World Heritage Sites

Protected Areas and World Heritage

BELIZE BARRIER REEF RESERVE SYSTEM
BELIZE

The coastal waters of Belize have an outstanding part of the largest fringing barrier reef in both northern and western hemispheres. It has inshore, mid-shelf and shelf-edge coral reefs, offshore atolls, coastal lagoons, large seagrass meadows, mangrove forests and hundreds of sand cays. The seven sites illustrate the whole range of coral reef development and provide the habitat for a very large number of fish and for threatened animals such as marine turtles, manatees and the American marine crocodile.

Threats to the site: destruction of mangroves for coastal tourist development, pollution and overfishing.

COUNTRY
Belize

NAME
Belize Barrier Reef Reserve System

NATURAL WORLD HERITAGE SERIAL SITE IN DANGER
1996: Inscribed on the World Heritage List under Natural Criteria vii, ix and x.
2009: Declared endangered because of the destruction of mangroves for coastal development.

STATEMENT OF OUTSTANDING UNIVERSAL VALUE
The UNESCO World Heritage Committee issued the following statement at the time of inscription.

Justification for Inscription
The Committee inscribed the Belize Barrier Reef Reserve System under **natural criteria (vii), (ix)** and (**x**) as the largest barrier reef in the Northern hemisphere, as a serial nomination consisting of seven sites. The Reef illustrates a classic example of reefs through fringing, barrier and atoll reef types.

IUCN MANAGEMENT CATEGORY

Bacalar Chico National Park:	II National Park
and Marine Reserve:	IV Habitat/Species Management Area
Laughing Bird Caye National Park:	II National Park
Half Moon Caye Natural Monument:	III Natural Monument
Blue Hole Natural Monument:	III Natural Monument
Glovers Reef Marine Reserve:	IV Habitat/Species Management Area
South Water Caye Marine Reserve:	IV Habitat/Species Management Area
Sapodilla Cayes Marine Reserve:	V Habitat/Species Management Area

BIOGEOGRAPHICAL PROVINCE
Campechean (8.01.01)

GEOGRAPHICAL LOCATION

The Belize Barrier Reef lies off the Caribbean coast of Belize, extending 235 km between the Mexican and Guatemalan borders and between 0.5 to 80 km from the mainland. The sites lie between 16°04' to 18°11'N and 87°29' to 88°22'W:

Bacalar Chico National Park and Marine Reserve:	18°11' - 18°04' N by 87°48' - 87°55' W
Laughing Bird Caye National Park:	16°25' - 16°30' N by 88°09' - 88°13' W
Half Moon Caye Natural Monument:	17°14' - 17°14' N by 87°29' - 87°34' W
Glovers Reef Marine Reserve:	16°38' - 16°56' N by 87°39' - 87°53'W
South Water Caye Marine Reserve:	16°33' - 16°55' N by 88°03' - 88°15' W
Sapodilla Cayes Marine Reserve:	16°04' - 16°11' N by 88°13' - 88°22' W
Blue Hole Natural Monument:	17°19' N by 87°32' W

DATES AND HISTORY OF ESTABLISHMENT

1928: Part of Half Moon Caye gazetted as a Bird Sanctuary;

1977: Man O'War Caye, now in South Water Caye Marine Reserve, designated a Crown Reserve;

1979: Half Moon Caye reclassified as a Crown Reserve under the Crown Lands Ordinance of 1979;

1982: Half Moon Caye declared a Natural Monument under the National Parks System Act (Chap.181 of the Laws of Belize);

1983: All the marine areas designated protected areas under the Fisheries Act (Chap.174, Laws of Belize through the Fisheries (Amendment) Act, No.1);

1990: The Coastal Zone Management Unit established in the Fisheries Department

1991: Laughing Bird Caye designated a protected area;

1993: Glover's Reef Marine Reserve established by Statutory Instrument No.38;

1996: South Water and Sapodilla Cayes designated Marine Reserves; Bacalar Chico established partly as a National Park (on land) and partly as a Marine Reserve; the Blue Hole designated a Natural Monument; Laughing Bird National Park created by Statutory Instrument No.167 of 1991;

2009: Site declared endangered by the sale and lease of public lands for resort development at the cost of the destruction of mangroves and marine ecosystems and pollution.

LAND TENURE

State owned except for the following: The six cays of Glover's Reef Marine Reserve are privately owned. South Water Caye Marine Reserve includes a number of privately owned cays not part of the protected area, and in Sapodilla Cayes Reserve three of the eight cays are not included in the protected area. Marine areas are managed by the Fisheries Department of the Ministry of Agriculture and Fisheries and terrestrial areas by the Forest Department of the Ministry of Natural Resources.

AREA

The site totals 96,300 ha. The areas are cited from a) the 1996 nomination, b) Meerman, c) WDPA records. Meerman's 2005 study gives authoritative figures which may include extended marine areas:

	Nom. Doc.	Meerman	WDPA
Glover's Reef Marine Reserve	30,800 ha	35,067.5 ha	32,876 ha
South Water Caye Marine Reserve	29,800 ha	47,702.5 ha	47,803 ha
Sapodilla Cayes Marine Reserve	12,700 ha	15,618.5 ha	13,517 ha
Bacalar Chico National Park and	10,700 ha	4,510.3 ha	5,115 ha
Marine Reserve	6,319.6 ha	6,303.0 ha	
Laughing Bird Caye National Park	4,300 ha	4,095.3 ha	4,095.ha
Half Moon Caye Natural Monument	3,900 ha	3,954.0 ha	3,954 ha
Blue Hole Natural Monument	4,100 ha*	424.0 ha	414 ha

* the Blue Hole site is small; this figure is in error, but is part of the total cited in the nomination.

ALTITUDE
Below sea level to 5m.

PHYSICAL FEATURES
This serial property combines seven of the biologically most valuable sites of the Belize shelf, from the northern tip of Ambergris Caye to the terminus of the barrier reef in the Sapodilla Cayes, plus offshore atolls but excluding the mainland coast. Four sites lie along 235 km of the 1,200 km Mesoamerican barrier reef, the second largest in the world, between 0.5 and 35 km from the coast, and three isolated on the continental shelf beyond it as far as 80 km from the mainland. The barrier reef is typically a rubble-strewn reef flat with numerous mangrove cays on its central and landward side, fronted by a reef crest and split by a series of channels (Spalding *et al.*, 2001). The sites are listed here from north to south. Bacalar Chico is on the northern end of Ambergris Caye where the barrier reef is almost part of the mainland, separated by a channel. South Water Caye, over 40 km long and 8-25 km from the mainland includes a maze of small cays of many types. Laughing Bird Caye, a *faro* or shelf atoll, lies immediately south of it. Sapodilla Cayes, the southernmost atoll in Belize with good shingle cays, is 35 km offshore. Glover's Reef, 45 km from the mainland, is the best developed atoll in the Caribbean, 12 by 32 km with a deep lagoon with 700 coral patches encircled by a reef. Half Moon Caye on the southeastern edge of Lighthouse Reef is an oceanic atoll of six cays 80 km from land. The Blue Hole is a deep drowned sinkhole in the middle of this reef. The existence of atolls outside the Pacific is rare.

The Belize shelf is a submarine extension of the Yucatan Platform, a drowned low-relief karst surface with drowned river channels and sinkholes such as the Blue Hole *(Boca Ciega)* which is 0.4 km across, 144m deep and intensely blue. Its speleothems preserve a record of past climatic conditions. The limestone ranges in age from 135 million to less than 2 million years old and has been laid down in shelf-like layers, a process which is still taking place. Offshore the sea floor is a series of north-northeast trending fault blocks which form submarine escarpments. The northern part of the reef and Ambergris Caye, the largest and northernmost cay, lie on one block; the Turneffe Islands and the central reef lie on a second; and the outer shelf atolls of Lighthouse Reef and Glover's Reef, on a third (Hartshorn *et al.*, 1984). The reef is only a few hundred metres offshore in northern Ambergris Caye, where it merges with the shoreline at Rocky Point, one of the few places in the world where a major barrier reef meets a coast (Dotherow *et al.*, 1995). There are approximately 450 sand and mangrove cays within the barrier which range in size from small ephemeral sand spits to large settled islands. Cays typically develop in gaps between stretches of linear reef, on more arched reef segments, or at prominent bends in the reef.

The reef complex, though far smaller, has a wider range of geological features and reef types than the Great Barrier reef and has benefited from relatively low use in the past. It is divided into three regions, each with its distinctive reef communities and geomorphic characteristics: the north, which contains 46 km of shallow-water reefs; the centre, with 91 km of shallow-water reefs which are the best developed; and the south, which includes 10 km of shallow-water reefs. A detailed transect study from the lagoon to the open ocean revealed a distinct zonation of substrates and organisms, governed primarily by water depth and the prevailing wave and current regime (Rutzler & Macintyre, 1982; McCorry *et al.*, 1993). The reef growth is most active on the windward side to the east which absorbs the energy of the storm winds, and is less active and discontinuous on the west side towards the lagoon. At various places on the shelf are patch reefs and occasional *faros*, rhomboidal atoll-like reefs. Between the barrier reef and Glover's Reef, and between Lighthouse and Glover's Reefs, depths range from 300m to 400m. East of Glover's Reef and Half Moon Caye the sea floor falls sharply between 1,000-3,000m (Gibson, 1988).

Between the mainland and the barrier reef the very long lagoon increases in width and depth from north to south. In the north, the lagoon is 20-25 km wide, with a flat, featureless bottom averaging 2-3m deep to a maximum of 6m. Bottom sediments are land-derived muds dominated by foraminiferal tests. South of Belize City, the shelf gradually widens to 40 km and deepens, in a channel between the mainland and the outer platform, reaching a depth of 65m in the Gulf of Honduras. Numerous patch reefs are found throughout the coastal lagoon. Offshore water currents are dominated by the south-westerly Caribbean current. Salinity patterns on the north and south shelves differ during the rainy season. In the

north, the shallow water is well mixed and there is no surface fresh water lens. In the deeper southern lagoon, a fresh water lens spreads out from the Punta Gorda area where the influence of coastal river discharge is greatest. Offshore salinities are typically oceanic (35 ppt). The tidal range averages 0.5m, and its influence on coastal current patterns is small but becomes noticeable in the channels between reef segments and cays (Hartshorn *et al*., 1984).

CLIMATE

The Belize coast lies in the subtropics, characterised by higher extreme and mean temperatures than in more tropical latitudes. Mean annual temperatures on the oceanic Glover's Reef range from 16-17°C in winter to 24-25°C in summer, and in Bacalar Chico near the mainland from 23-26°C in winter to 28-31°C in summer, Mean annual precipitation ranges between 1,500mm in the north to 4,000mm in the south. A dry season with strong easterly winds runs from January/February to May/June. Strong winter storms blow from October to February, often as 'northers' which bring strong winds, cool temperatures, heavy rains and rough seas. Until May, winds tend to be strong and fairly constant, averaging 16-24kph. In the summer there are occasional strong squalls with winds up to 48kph. The hurricane season is between August and October. Hurricanes Dean in 2007 in the north, Wilma in 2005 and Iris in 2001 in the south caused much damage especially on the mainland (Dotherow *et al*., 1995). Coral cover in South Water Caye declined from 22-25% to 3-15% following bleaching and Hurricane Mitch in 1998 (Kramer & Kramer, 2002).

VEGETATION

Stoddart *et al*. (1982) recorded 178 species of vascular plants, including 32 non-native species, in coastal Belize. Many of the South Water cayes are mangrove dominated although some have sand with shrub and coconut vegetation. Half Moon Caye has a well developed forest with species of 40 trees. There are three major types of mangrove forest: a buttonwood-red mangrove-white mangrove association, *Conocarpus erectus-Rhizophora mangle - Laguncularia racemosa* on land periodically inundated with sea water; permanently inundated *R. mangle*; and a *R. mangle - L. racemosa* association with occasional black mangrove *Avicennia germinans* where salt water intrudes infrequently (Wright *et al*., 1959). Mangroves may form a narrow coastal fringe, a concentric ring around small mainland lagoons, or colonize the lagoon side of offshore cays as in South Water Caye which has several mangrove cays (Hartshorn *et al*., 1984).

Several cayes have stands of littoral forest with scarlet cordia *Cordia sebestena*, teabox *Myrica cerifera*, gumbo limbo *Bursera simaruba* and coco plum *Chrysobalanus icaco*. These are fringed by shrubby sea grape *Coccoloba uvifera*, *Heliotropium gnaphalodes*, bay cedar *Suriana maritima* sea ox-eye *Borrichia arborescens*, also introduced coconut trees *Cocos nucifera*. Other vegetation types include: herbaceous marsh and swamp seasonally inundated depressions, dominated by rushes, sedges, calabash *Amphitecna breedlovei*, black olive *Bucida buceras* and *Jacquinia aurantiaca;* grass savannas with scattered medium-tall (3-10m) calabash and logwood *Haematoxylon campechianum*; low semi-deciduous forest with a 8-15m canopy and formed by gumbo limbo, white poison wood *Cameraria latifolia,* logwood *Haematoxylon campechianum*; and medium semi- deciduous forest with a multi-level canopy 8-25m in height.

A total of 247 species of marine flora has been described from the barrier reef (Gibson, 1993). This vegetation consists mainly of widespread seagrass beds, particularly of turtle seagrass *Thalassia testudinum,* shoalgrass *Halodule wrightii* and manatee grass *Syringodium filiforme*, which host many other organisms: seaweeds, crustaceans, mollusks, shoals of grass and alga-eating fish, forage for turtles and manatees and huge schools of juvenile fish. They trap sediment and nutrients and stabilize the sea floor. The high diversity of algae include *Halimeda incrassata*. *H. monile*, *Rhipocephalus phoenix*, and *Udotea flabellum*. *Sargassum* species and red algae *Laurencia* spp. are also common.

FAUNA

The wide Belize shelf contains an impressive assemblage of habitats: inshore, mid-shelf, shelf-edge, and offshore coral reefs, lagoons, seagrass meadows and mangrove swamps. This structural diversity supports a very complex and productive trophic chain based on abundant micro- and macroinvertebrate life, and three thriving fisheries, commercial artisanal and recreational. Over 500 species of fish are

recorded, nearly 290 at Glover's Reef alone. Many juvenile fish, reef, estuarine and pelagic, including several sharks, depend on the sheltered seagrass beds and mangroves as nurseries, and estuarine fish like tarpon *Megalops atlanticus,* stonebass *Ambloplites rupestris* and mullet *Mugil* spp.use the inshore waters. The seagrass beds provide critical habitat for the the world's largest population of West Indian manatee *Trichechus manatus* (VU: 300-700 individuals). The grass and lagoon of South Water Caye attract huge schools of bonefish *Albula nemoptera*, permit *Trachinotus falcatus* and snook *Centropomus undecimalis*. The larger secondary consumers of the deep slopes and banks such as the snappers, hogfish *Lutjanus analis* (VU) and mutton snapper *Lachnolaimus maximus* (VU), and groupers, Nassau grouper *Epinephelus striatus* (EN) and black grouper *Mycteroperca bonaci,* red porgy *Pagrus pagrus* (EN) and striped grunt *Haemulon striatum* support the economically important commercial fishery and sport fishing. Goliath grouper *Epinephelus itajara* (CR) and wide sawfish *Pristis pectinata* (CR), queen triggerfish *Balistes vetula* (VU) and whitelined toadfish *Sanopus greenfieldorum* (VU) are all found. Further out are blackfin and yellowfin tuna, *Thunnus atlanticus* and *T. albacares*, great barracuda *Sphyraena barracuda*, wahoo *Acanthocybium solandri*, king mackerel *Scomberomorus cavalla* and a variety of jacks *Caranx* spp. Pelagic fish include rays, nurse shark *Ginglymostoma cirratum,* Caribbean reef shark *Carcharhinus perezi,* bull shark *Carcharhinus leucas,* whale shark *Rhincodon typus* (VU) and great and scallopped hammerhead sharks *Sphyrna lewinii* (EN) and *Sphyrna mokarran* (EN). Large populations of spiny lobster *Panulirus argus* and queen conch *Strombus gigas* support important fisheries (Kramer & Kramer, 2002).

The reef system is luxuriant and diverse: 66 scleratinian corals (90% of the Caribbean total), 36 soft corals, 45 hydroids, 350 molluscs and a great diversity of algae, crustaceans, echinoderms, sponges, marine worms, ascidians and copepods are recorded from the sites. Prominent coral species on the somewhat exposed Glover's Reef include the massive lobed star corals *Monastrea annularis* and brain coral *Diploria* spp., starlet coral *Siderastrea* spp. and finger coral *Porites* spp. with less dense patches of lettuce coral *Agaricia tenuifolia* and staghorn coral *Acropora cervicornis.* Nearer inshore fire coras *Millepora complanata* occur. The rare endemic Belize atoll gecko *Phyllodactylus insularis* occurs on Lighthouse Reef. Besides the manatee (VU), there are bottlenosed dolphins *Tursiops truncatus* and three other dolphin species. Three species of sea turtles nest on the islands and a few mainland sites: hawksbill *Eretmochelys imbricata* (CR), loggerhead *Caretta caretta* (EN), and green *Chelonia mydas* (EN). They are routinely seen between the coast and the reef, and on offshore cays and atolls. Leatherback turtle *Dermochelys coriacea* (CR) also occurs. The American crocodile *Crocodylus acutus* (VU) nests at several sites (Platt, 1994).

About 260 (66%) of the approximately 392 resident birds of Belize species were recorded in 1996, and thousands of birds visit the lagoons during migrations. A later figure of 574 species for the total avifauna of the country was given in Meerman (2005) and at Bacalar Chico alone 260 species have been seen (Kramer & Kramer, 2002). Cays with littoral forest and mangroves are important habitat for species endemic to the Yucatan Peninsula, as well as migrant staging areas. Major seabird colonies include those of red-footed booby *Sula sula* (3,000-4,000 individuals) on Half-Moon Caye, brown booby *Sula leucogaster* on Man O'War Caye, and common noddy *Anous stolidus* on Glover's Reef. Other notable breeding birds are brown pelican *Pelecanus occidentalis* and magnificent frigate bird *Fregata magnificens*. Laughing gull *Larus artricilla* used to breed on Laughing Bird Caye but visitors have driven it to other islands.

CONSERVATION VALUE

The Belize shelf and its reef is part of the largest fringing barrier reef in the northern hemisphere and the best-developed example of the type in the western Atlantic. It is an ecosystem of great biological diversity and beauty, of great scientific value and a major habitat for threatened species. The Reserve lies within a Conservation International-designated Conservation Hotspot and a WWF Marine Global 200 Eco-region.

CULTURAL HERITAGE

Shell middens at Mayan sites along the coast and on many of the cays show that the reefs were used for fishing for conch, finfish, turtle eggs and manatees some 2,500 years ago. Evidence of pre-historic effects of fishing on marine ecosystems in the Caribbean have been documented. Between 300 B.C.and 900 A.D. the coastal waters were probably extensively used by the Mayans for fishing, and

trading posts, ceremonial centres and burial grounds were established on the islands. There are at least seven Mayan sites in the Bacalar Chico area, some of which, such as San Juan on the west coast, are of particular cultural and historical value. The Bacalar Chico channel was dug by Mayan traders between 700 and 900 A.D. when the northwestern side of Ambergris Caye was a trans-shipment point for the large Mayan city-state of Santa Rita in Corozal district. Some important Mayan sites have been found in South Water Caye reserve, Sapodilla Cayes and Glovers Reef.

With the decline of the Maya civilisation, these resources were probably little used for centuries. However, early Spanish explorers used the area to repair their boats and collect freshwater and by the early 17th century, the coastal waters of Belize had become a refuge for pirates and buccaneers, largely from Britain, who looted Spanish and British trading ships. Subsequently, with Puritan traders from the Mosquito Coast of Nicaragua, they settled in the cayes, becoming fishermen and plantation owners. British occupancy between 1854 and 1981 left Belize the one English-speaking central American country. The name may derive from the Mayan *beliz* named from the muddy water of the Belize river.

LOCAL HUMAN POPULATION

Since the 18th century, there have been several waves of immigration to the coast and seven languages are still spoken by their descendants. The population is 50% mestizo, 25% Creole, about 11% Maya and 6% Garifuna. Fishing records kept by coastal communities since the early 1840s show that commercial fishing began to develop in the mid 19th century (Price, 1984). Since early in the 20th century the economic importance of the reef increased with the growth of the coastal population. Initially, a wide range of species was harvested, from turtles, sharks, finfish and crabs to sponges and seaweeds. But between 1920 and 1960, the industry changed from a small scale domestic fishery, with periodic incursions into the Mexican market, to wholesale commercial marketing by foreign purchasing and marketing companies of spiny lobster, conch and fin-fish products to the lucrative U.S. and Caribbean markets. This fishery then devolved during the 1950s and 1960s to the local cooperatives which now dominate the export market.

There were in 1998 according to Spalding *et al.* some 2,000 fishers with a fleet of approximately 350 boats, two-thirds of which was owned, operated, and managed by 13 registered fishing cooperatives (www.caricom.org). Spiny lobster and queen conch contribute most of the value of exported seafood, estimated at US$10.4 million in 1995. There is a domestic fishery for shallow reef fish and a commercial fishery for deep slope and bank fish. Currently the main use of the barrier reef is for tourism, which is the country's largest source of foreign exchange (Ministry of Agriculture & Fisheries, 1995). More recently, North Americans and other foreigners drawn by the beauty of the reef and its surroundings have come to live in the cayes (Ministry of Agriculture & Fisheries, 1995).

VISITORS AND VISITOR FACILITIES

An estimated 128,000 tourists visited the Barrier Reef Complex in 1994 generating an income of about US$75 million (McField *et al.*, 1996) and increasing the demand for coastal hotels. The figure is said to have tripled between 1995 and 2005 (Addison, 2007). The most popular site, Hol Chan Marine Reserve near San Pedro Town, now receives over 30,000 visitors a year. The major attraction to foreign tourists is diving and snorkelling, centred on San Pedro on the south end of Ambergris Caye, the main headquarters of the tourist industry. Caye Caulker and Placencia are also important centres. Other activities include bird-watching, sightseeing, sportfishing from chartered yachts and boats, kayaking, camping and picnicking. Boats generally come from Ambergris Caye, Belize City and Caye Caulker. Access to Lighthouse Reef is only by boat or amphibious plane. South Water Caye had 8 hotels in 1996 with rooms for 200, and 20 tour guides. Laughing Bird Caye is only accessible by boat mainly from the nearby Placencia Village. Sapodillo Caye is heavily used by local people. There are many camps and resorts in the surrounding cays and areas, and hotels in the mainland towns. Belize City has an international airport. Cruise ships bring increasing numbers of transient visitors, and their garbage.

SCIENTIFIC RESEARCH AND FACILITIES

The reef complex is a natural laboratory area with intense ongoing research. The first major study on the reefs and cays of Belize was made by the Cambridge Expedition to British Honduras between 1959 and 1960. In the 1960s, a series of studies focusing primarily on the geology of the reef complex, was carried out (Wantland & Pusey, 1975). Since then, the area has become a major subject of study and expeditions, especially by universities from the United States, adding to scientific knowledge of the barrier reef (Perkins & Carr, 1985), and by the University of Belize. In 1969 the Belize Audubon Society was established and in 1982 began managing Half Moon Cay on Lighthouse Reef. In 1970 International Zoological Expeditions established a Marine Biology station on Weewee Caye in South Water Caye and in 1972 the Smithsonian Institute established a field station, a now classic location for marine biology, on Carrie Bow also in South Water Caye, as a centre for the study of Caribbean coral reef ecosystems. This started with a detailed transect study from the lagoon to the open ocean, followed by a mangrove swamp study and many others, investigated by hundreds of scientists from over 80 world institutions including the U.S. National Museum of Natural History. A comprehensive range of publications on the physical and biological characteristics of the reef and its environment by visiting scientists before 1982 was collected in a volume by Rützler & Macintyre.

The Centro de Investigaciones de Quintana Roo (CIQRO) in Mexico carried out survey work in the area in 1990-1 and produced a four-volume set of studies. In 1993, the Belize Centre for Environmental Studies made an environmental review on a country-wide scale, carrying out in Bacalar Chico protected area a Rapid Ecologic Assessment for northern Ambergris Caye (McCorry *et al.*, 1993). The Wildlife Conservation Society's Marine Research station and lodge on Glover's Reef set up in 1997 has hosted hundreds of expeditions and over 400 researchers and students. The Bacalar Chico headquarters building has room for two scientists. The Biodiversity & Environmental Resource Data System of Belize website, launched in 2005, gives 31 up-to-date species lists including freshwater and marine fish, corals, mammals, amphibians, reptiles, birds, 13 insect families and 10 plant families.

MANAGEMENT

In 1990, the Government of Belize created the Coastal Zone Management Unit (CZMU) within the Fisheries Department, and a Coastal Zone Management Plan was approved as part of the country's National Development Plan. This Plan developed the capabilities of the unit and assisted in the management and conservation of the country's coastal resources through development of monitoring and planning techniques, implementation of applied research and enhancement of public awareness. Although the property preserves seven separate sites, the sustainable management principles apply to the whole archipelago. The first phase was carried out with assistance from IUCN, and involved the collection and compilation of data relevant to the coastal zone (Gibson *et al.*, 1993). The second and third phases involved the preparation of plans, policies and legislation, and their implementation. These activities were carried out with the assistance of a UNDP/GEF Coastal Zone Management Project, initiated in 1993.

The three main ministries involved in coastal management are the Fisheries Department of the Ministry of Agriculture and Fisheries, responsible for marine reserves and fisheries management, the Forest Department of the Ministry of Natural Resources, responsible for national parks and natural monuments, and the Ministry of Tourism and Environment. Activities are coordinated through the CZMU and the CZM Technical Committee, an arrangement developed with the assistance of the UNDP/GEF Coastal Zone Management Project to oversee management of the World Heritage site in the context of a policy of national sustainability. The Government of Belize developed a National Protected Areas System Plan and the sites form part of this system. Draft management plans have been prepared for all seven sites of the World Heritage property (BAS, 1986; Bevier, 1994; Dotherow *et al.*, 1995, Gibson, 1986, 1988; McCorry *et al.*, 1993; Young, 1994). These plans include zoning of each area; descriptions of the types of activities permitted or not permitted; descriptions of programmes of research, surveillance and enforcement, environment education, recreation and tourism; staffing and training needs; and budget. The Fisheries and Forestry Departments are in charge of the day-to-day management of the sites. In some cases, management is delegated to NGOs and local communities, the government agencies providing support and assistance as required: Half Moon Caye is managed by the Belize Audubon Society and Laughing Bird National Park is managed by a committee of local representatives. There is a need for a legal framework to coordinate the many co-managements

With the creation of marine reserves, fishing pressure on some areas is much reduced and is restricted to the low level allowed under the regulations. A policy of establishing no-take zones has begun to revive areas formerly overfished though these may prove too small to sustain populations of the larger species. The lobster fishery is just at or above its sustainable level though conch fishing is in decline. The inshore artisanal fishery is seasonal and small scale. The deep slope and bank fishery is the traditional base of the profitable finfish export industry where over-exploitation remains a threat. The inshore pelagic and shark fishery is seasonal and largely for the Mexican, Honduran and Guatemalan markets. An inshore commercial trawl fishery thrived in the 1980s but the catch is declining. The marine aquarium fishery for the U.S. fish hobbyist in the U.S. and Europe is still valuable.

MANAGEMENT CONSTRAINTS

Despite its enormous economic value to the overall economy of Belize, the Barrier Reef ecosystem is threatened by over-exploitation of reef resources by the fishing and tourist industries, especially by the sale and lease of public lands for private developments. The lucrative fisheries are in danger of decline. The reefs of Hol Chan Marine Reserve receive over 30,000 visitors a year and show signs of stress caused by over-collecting and boat anchor damage. Pressures are mounting from a whole range of other impacts. There is increasing shoreline erosion through the removal of vegetation, nutrient enrichment by fertilizer run-off from citrus and banana plantations, sewage pollution from tourist resorts and housing, coral-choking sediments from dredging, sand mining and the escalating residential, hotel and marina construction on many cays, Much of the native cay vegetation, including mangroves, has been disturbed or eliminated for coconut plantations and urban developments. There is growing pressure from shipping and recreational boat traffic and pollution in the reef-strewn shallow waters, increasing collisions with manatees, and a steady increase in divers and snorkelers. Exploratory offshore oil drilling made no significant finds but bleaching, climatic warming and hurricanes have begun to degrade the high quality of the coral reef. And in 2008 mangroves with coral reefs and sea bed were seen from aerial photographs to have been cleared and filled for development on two islands of Pelican Cays in the South Water Caye Marine Reserve. No explanation was given by the State Party whose definition of acceptable development does not meet WHC requirements for site integrity (UNESCO, 2009; IUCN, 2008).

Birds are at particular risk from tree destruction as much critical forest habitat lies on privately owned land. Species commensal with humans, such as great-tailed grackle *Quiscalus mexicanus* and bronzed cowbird *Molothrus aeneus*, increase in number around settlements and reduce nesting success in other birds (Dotherow *et al*., 1995). Recreational pressure has caused laughing gull *Larus artricilla* to desert Laughing Bird Caye. Similar pressures may be threatening the breeding colonies of red-footed booby of Half-Moon Caye, and of the common noddy on Glover's Reef (Gibson, 1988). For decades, the Sapodilla Cayes and Glover's Reef areas have been illegally fished by Guatemalan and Honduran fishermen. Since there are no closed seasons or size limits for conch and lobster in those countries, much of the area's populations of these species have been depleted (Gibson, 1988; Young, 1994). And those using the Bacalar Chico area for a number of years are concerned over the general decline in the fish catch, much of lost to poaching by Mexican fishermen. Incursions by three invasive species are noted: the Australian pine *Casuarina* spp., the lionfish *Pterois volitans* and rats *Rattus norvegicus*.

STAFF

In 1996, each protected area had a staff of 3-5 people, including a manager, rangers, researchers and volunteers (BAS, 1986; Bevier, 1994; Dotherow *et al*., 1995, Gibson, 1986, 1988; McCorry *et al*., 1993; Young, 1994).

BUDGET

A total of US$3 million funding, through the five year UNDP/GEF Coastal Zone Management Project, was available for the period 1993-1998 (Ministry of Agriculture & Fisheries, 1995). In 2008 three UNESCO grants totalled US$140,000 were noted: US$30,000 from the Rapid Response Facility for monitoring of unauthorized activities in the Bladen Nature Reserves, impacting the property; US$30,000 for emergency conservation of the wide sawfish (CR); and US$80,000 for planning and financing strategy development for the Blue Hole Natural Monument (UNESCO,2009).

LOCAL ADDRESS

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