Management Plan

Port Honduras Marine Reserve

2017 - 2021

PORT HONDURAS MARINE RESERVE

GOAL

"the sustainable management of coastal ecosystem functions and natural resource values for the benefit of present and future generations of Southern Belize, within the wider ridge to reef landscape"

…promoting the sustainable use of the biological resources and the identification and development of integrated conservation and development activities related to the ecosystems and species associated with the reserve, and compatible with ecosystems functions and services for the buffer communities.

OBJECTIVES

- To promote sustainable marine resource use for the continued benefit of all users
- To ensure continued sustainable resource extraction through effective management mechanisms for the benefit of traditional fishing communities
- To promote community stewardship of the marine resources through effective communication, education and outreach
- To provide a sustainable recreational and tourism environment that will enhance the economic and social benefits of the area
- To engage in effective research and monitoring within PHMR to guide and inform management decisions

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Wildtracks, 2016

Contents

Plan Facilitated By:

Zoe Walker,
Wildtracks,
Belize

Introduction

Background and Context

Situated in Toledo District, in the south of Belize, Port Honduras Marine Reserve was established in 2000 as part of Belize's National Protected Areas System, to protect the physical and biological resources of the Port Honduras region. The 100,000 acres (40,468 ha) include mid-lagoonal reefs, unique in Belize, with characteristics of both inshore reef and offshore barrier reef environments. It also encompasses extensive seagrass beds and surrounds over 138 mangrove cayes, supporting an important fishery for the local traditional users, and growing tourism industry. This semi-enclosed bay lies within the larger Gulf of Honduras, which encompasses the waters of Southern Belize, Guatemala and Honduras.

SITE INFORMATION

Size: Total: 100,000 acres (40,468 ha)
Preservation Zone: 0.805km radius around Middle Snake Cayes
Conservation Zones I, II and III: 0.805km radius around West and South Snake Cayes, East Snake Caye and West Cane Caye
General Use Zone: 93,731, acres (37,932 ha)
Statutory Instrument: SI 9 of 2000 (Order)
SI 18 of 2000 (Regulations)
IUCN Category: IV
Management Authority: Fisheries Department
Co-Management Partner: Toledo Institute for Development and Environment
Contact Email: info@tidebelize.org
Website: www.tidebelize.org

Location: Port Honduras Marine Reserve is located directly offshore, in the coastal waters of southern Belize, extending from Monkey River at its northern extent, to beyond the Rio Grande in the south

Uses: Extractive and non-extractive – fishing, tourism, education and research
Visitor Facilities (2017): Ranger's Station / Visitors Centre (Abalone Caye), Tide Office (Punta Gorda)
On-site Staff (2017): 1 site manager, 5 rangers, 2 biologists

The boundaries of Port Honduras Marine Reserve are defined by Statutory Instrument 9 of 2000. The cayes within the Marine Reserve are not included within the protected area, which has implication on the ability to protect coastal and caye mangroves, important for the local tourism economy, for bird nesting sites, storm barriers and as protective nursery and feeding area for many fish species. 95% of the Marine Reserve is legislated as a General Use Zone, where commercial, subsistence and recreational fishing activities are permitted; 4% is designated as a Conservation Zone, where "no-take" recreational activities are allowed; and the remaining 1% is designated as a Preservation Zone where no activities are permitted. In addition, the use of gill nets, long lines and beach traps is prohibited anywhere within the Marine Reserve. The Marine Reserve status is equivalent to IUCN Category IV, designated for management mainly for conservation through management intervention.

As an integral part of the Maya Mountain Marine Corridor, Port Honduras Marine Reserve focuses on the conservation of marine biodiversity, with connectivity to the landscape through

the six watersheds that empty into it. This landscape includes the coastal wetlands, the matrix of private protected areas managed under TIDE and Ya'axché Conservation Trust, and the mosaic of mangrove, lagoon and savannas of Payne's Creek National Park.

The Toledo Institute for Development and Environment (TIDE) holds co-management responsibility for the Marine Reserve with the Government of Belize, under an agreement with the Fisheries Department. TIDE has grown from its inception as a local, grassroots response to manatee poaching and marine degradation, to a leading non-government organization in Belize. Monitoring of the key habitats and species within the Marine Reserve has taken place since 2003, with data collected, analyzed, and actively integrated into management decisions, increasing effective management of the marine protected area.

Purpose and Scope of Management Plan

This Management Plan provides the contextual background for informed management decision making, and a structured framework of activities to assist TIDE, the Fisheries Department (the legislated management authority), and other partners to ensure Port Honduras Marine Reserve continues to support both biodiversity and livelihoods.

The management of Port Honduras is guided by its categorization as a marine reserve, designated under the Fisheries Act, being set aside:

> *"To ensure, increase and sustain the productive service and integrity of the marine resources for the benefit of all Belizeans of present and future generations."*

This Management Plan has been developed by the Toledo Institute for Development and the Environment (TIDE), as the co-management partner, to guide the organization and its partners through the next five years (2017 – 2012). In line with the National Protected Areas Policy and System Plan, it reflects the participatory approach to management being adopted in Belize today, with the input of key stakeholders of PHMR, through focal group meetings, interviews with a wide variety of individuals (including key fishing and tourism stakeholders), PHMR staff (both at management and field level), and the Port Honduras Advisory Council.

The Plan includes information on the physical and biological attributes of the Marine Reserve, based on past and current research conducted in the area, and documents the legislative framework. It summarises current uses and management challenges, and integrates support for the traditional fishery of the stakeholder communities. It seeks to protect the resources of the area whilst implementing Managed Access as a mechanism for continued use, with improved

sustainability of harvest of local marine stocks by traditional fishermen, based on the national Managed Access framework. It also allows for the facilitation and promotion of diversification into other income-generating activities, compatible with the overall goals of the Marine Reserve, for increased socio-economic benefit for stakeholders.

The Management Plan summarises the outputs of the conservation planning processes - for the Marine Reserve itself, for the larger seascape, and for ridge to reef connectivity, and integrates climate change assessment outputs. It identifies the management challenges, as well as defining the goals and objectives of management.

The Plan provides a framework for both broad management strategies as well as more specific activities to achieve the goals of maintaining coastal ecosystem functions and natural resource values, from water quality to nursery habitats of the Port Honduras area. It also outlines specific management programs, sets in place the means for measuring management effectiveness, and recommends an implementation schedule.The management programmes are based on the best available data and scientific knowledge, with the integration of conservation planning strategies, as well as relevant strategies of national and regional plans. It is recommended that detailed annual operational plans be developed based on the framework provided by this management plan, with an annual review of implementation success, allowing for adaptive management over the five year period – 2017 to 2021.

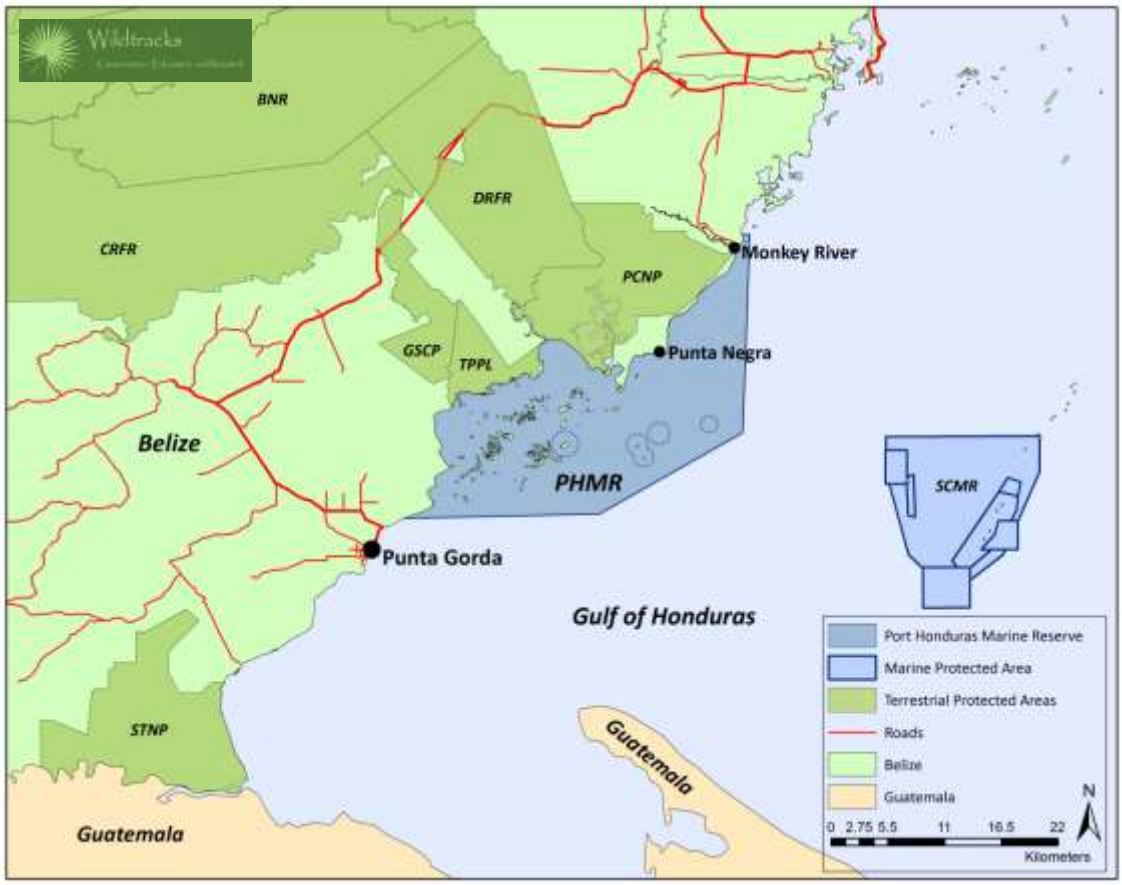
Section One

Current Status

1. Current Status

1.1 Location

Port Honduras Marine Reserve is situated in the southern coastal waters of Belize, in Toledo District (the most southerly of Belize's districts). It is a semi-estuarine system that stretches from Monkey River in the north to Rio Grande bar in the south, and extending approximately 8 kilometers out to sea, beyond the East Snake Cayes, encompassing 100,000 acres (40, 468 ha) of the marine environment (Map 1).



Map 1: *The Location of Port Honduras Marine Reserve*

PHMR: *Port Honduras Marine Reserve*
BNR: *Bladen Nature Reserve*
CRFR: *Columbia River Forest Reserve*
DRFR: *Deep River Forest Reserve*
PCNP: *Payne's Creek National Park*
GSCP: *Golden Stream Corridor Preserve*
TPPL: *TIDE Private Protected Lands*
STNP: *Sarstoon Temash National Park*
SCMR: *Sapodilla Cayes Marine Reserve*

PHMR coordinates: 328187 E; 1792875 N

Access

The Marine Reserve can be accessed by boat, either from Punta Gorda, Punta Negra or Monkey River. There is also direct access from the coastline through a series of seasonal footpaths and logging trails.

Communities Adjacent to Port Honduras Marine Reserve

Three communities lie near or adjacent to Port Honduras Marine Reserve:

- Punta Gorda (including Cattle Landing) (south of the MPA boundary)
- Monkey River (adjacent to the MPA boundary)
- Punta Negra (adjacent to the MPA boundary)

The Toledo Institute for Development and Environment (TIDE), the co-management partner with responsibility for day to day management of the Marine Reserve, has an office in Punta Gorda.

1.2 Regional and International Context

Port Honduras Marine Reserve (PHMR) is part of the Mesoamerican Reef (MAR), which stretches for more than 1,000 km (600 miles) parallel to 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 to more than a million people living in coastal areas in the three countries (Global Environment Facility, 2001).

> *The Belize Barrier Reef Reserve System contains an intact ecosystem gradient ranging from the terrestrial to the deep ocean: including, littoral, wetland, and mangrove ecosystems, to seagrass beds interspersed with lagoonal reefs, to the outer barrier reef platform and oceanic atolls. This ecological gradient provides for a full complement of life-cycle needs, supporting critical spawning, nesting, foraging, and nursery ecosystem functions. Maintaining these ecological and biological processes ensures robust and resilient reefs, which are themselves one of the world's most ancient and diverse ecosystems.*
>
> **From: Belize Statement of Outstanding Value, BBRRS World Heritage Site (2011)**

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 Barrier Reef, to the east of the Marine Reserve, and part of the southern Belize ridge to reef landscape / seascape, is included on a list of the 18 richest centers of endemism and has

been highlighted as one of the most threatened by human impacts (Roberts et al., 2002). Belize is one of the areas highlighted as having the lowest anthropogenic impacts on the marine environment, with its small population and relatively low coastal development rate. However pressures are increasing – particularly from the adjacent, more industrialized countries of Guatemala and Honduras.

The Marine Reserve contains assemblages of regionally important ecosystems and several species of global conservation concern, among them the critically endangered staghorn and elkhorn corals (*Acropora cervicornis* and *Acropora palmata*), hawksbill turtle (*Eretmochelys imbricata*) and goliath grouper (*Epinephelus itajara*) The area also protects the endangered green and loggerhead turtles (*Chelonia mydas* and *Caretta caretta*), and has regional importance in its maintenance of the endangered Antillean manatee (*Trichechus manatus manatus*), a sub-species of the West Indian manatee. PHMR contributes towards the regional viability of important commercial species, including the queen conch (*Lobatus gigas*) and spiny lobster (*Panulirus argus*). The mangroves of the cayes and coastal habitats are also important for sport fish species, (contributing to local coastal economies) and as nursery areas for many commercial marine species of economic importance.

Belize has signed a series of conventions and agreements designed to ensure continued viability of natural resources and biodiversity. As a signatory of the **Convention on Biological Diversity (CBD) (1992),** Belize has a commitment to ensuring it has measures in place to protect biodiversity, with promotion of sustainable use, contributing to the 2011 – 2020 CBD strategic goals.

The primary goals of the CBD are to promote the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising out of the utilization of genetic resources (CBD, 2010). More specific targets of the CDB relevant to Port Honduras Marine Reserve include:

- promoting the conservation of the biological diversity of ecosystems, habitats and biomes;
- promoting sustainable use and consumption, by encouraging use of products derived from sources that are sustainably managed;
- addressing threats to biodiversity related to the pressures of habitat loss, land use change and degradation, and unsustainable water use;
- addressing challenges to biodiversity from climate change, and pollution;
- maintaining the capacity of ecosystems to deliver goods and services that support sustainable livelihoods, local food security and health care, especially of poor people

CBD, 2010

All of these targets are reflected in TIDE's vision and mission statements, and in their active conservation and community outreach programmes.

Under the **Convention Concerning the Protection of the World Cultural and Natural Heritage,** Belize has a serial nomination of seven sites, designated in 1996 as components of the Belize Barrier Reef Reserve System - World Heritage Site. These seven sites are seen as representative of the Belize Barrier Reef under criteria (iii), in recognition of their global value and based on the classic examples of fringing, barrier and atoll reef types. One of these sites is the Sapodilla Cayes Marine Reserve, which lies to the east of PHMR, within both the larger Maya Mountain Marine Corridor ridge to reef landscape / seascape, and the Southern Belize Reef Complex seascape. Whilst Port Honduras Marine Reserve itself is not one of the seven protected areas that combine to form Belize's World Heritage Site, PHMR plays a critical role in the maintenance of the health of ecosystems of the Sapodilla Cayes, filtering land based sediments and contamination before waters reach the barrier reef, and providing an important nursery habitat for key reef species.

In 2009, Belize's World Heritage Site was placed on the List of World Heritage in Danger based on the sale and lease of public lands for development within the serial sites, leading to the destruction of mangroves and marine ecosystems. Also of concern was the issuing of past oil and gas leases within the WHS. Both are in contravention of the Convention commitment that "*No areas within the property and in its immediate vicinity are developed in ways that affect the property's natural outstanding beauty and status as a globally significant natural phenomenon of Outstanding Universal Value".* This "in Danger" status was upheld at the recent sitting of the WHS Committee (2016), as Belize is still to comply with the required actions for reducing these threats.

Belize is also a signatory to the **Ramsar Convention on Wetlands**, an international convention to protect the ecological character of important wetlands and to plan for sustainable use of these important ecosystems (Ramsar, 2006). Belize currently has two sites designated as Wetlands of International Importance, including Sarstoon Temash National Park, designated in 2005. Although Port Honduras Marine Reserve is not designated as a Ramsar site itself, it shares important estuarine connectivity with Sarstoon Temash National Park, which lies approximately 15 miles south of the southern boundary of the Marine Reserve.

Belize is a signatory of the **Convention on the International Trade in Species of Wild Fauna and Flora,** focused on ensuring that international trade in specimens of wild animals and plants does not threaten their survival. Belize CITES listed species include the queen conch, with annual quotas set to meet the commitments to the convention. This has impacts on the commercial fishery and local fisher income, but is designed to ensure that in the long term, the fishery remains sustainable. It is also illegal to take CITES species across international boundaries without valid permits – there is a current issue of illegal movement of harvested conch to Guatemala. The past illegal killing and smuggling of turtle and manatee products to Guatemala

was also in contravention of CITES (as well as being illegal in Belize). Transboundary smuggling is predicted to increase as economic pressures in all three countries increase (Guatemala, Honduras and Belize), increasing the effort needed by Belize to comply with this convention.

International Conventions and Agreements of Relevance to Port Honduras Marine Reserve

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** *PHMR is an important and integral part of Belize's 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.** *As a national protected area, PHMR provides benefits to local communities through fishing and tourism, whilst also protecting biodiversity and threatened species, as per Belize's commitment under ALIDES.*
Central American Commission for Environment and Development (CCAD) (1989)	**Regional organization of Heads of State formed under ALIDES, responsible for the environment of Central America. Initiated Mesoamerican Biological Corridors and Mesoamerican Barrier Reef Systems Programs.** *Belize is working with other ALIDES members towards the implementation of MAR2R, focusing on integrated watershed management for protection of the reef. PHMR has an important role in management of watershed impacts on the reef in the SBRC.*
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** *The beaches of PHMR provide important nesting areas for marine turtles, including the critically endangered hawksbill turtle. PHMR also provides a foraging area. TIDE is a member of the Belize Sea Turtle Conservation Network, one of a number of national biodiversity working groups.*
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.** *PHMR is important in maintaining the water quality of the larger seascape for healthy biodiversity of Sapodilla Cayes Marine Reserve, one of the protected areas that make up Belize's World Heritage Site.*
Convention on International Trade in Endangered Species of Wild Fauna and Flora	**CITES has been established to ensure that the international trade in specimens of wild animals and plants does not threaten their survival.** *PHMR is important for maintaining queen conch populations, harvested for export through the fishing cooperatives. CITES regulates the level of exportation, and therefore the level of harvest, to ensure sustainability.*

International Conventions and Agreements of Relevance to Port Honduras Marine Reserve

Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention Cartagena de Indias, Colombia, 1983) ▪ Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region (adopted in 1983 and entered into force on 11 October 1986. Ratified by Belize in 1999). ▪ Protocol Concerning Specially Protected Areas and Wildlife (SPAW) in the Wider Caribbean Region (adopted on 18 January 1990 and entered into force on 18 June 2000. Ratified by Belize in 2008). ▪ Protocol Concerning Pollution from Land-Based Sources and Activities (LBS) (adopted on 6 October 1999 and entered into force on 13 August 2010. Ratified by Belize in 2008).	**Regional convention with the objective of protecting the marine environment of the Wider Caribbean through promoting sustainable development and preventing pollution.** *Belize takes measures to prevent, reduce and control pollution in the marine environment. It also seeks to protect and preserve rare or fragile ecosystems, habitats of depleted, threatened or endangered species; and to develop technical and other guidelines for the planning and environmental impact assessments of important development projects in order to prevent or reduce harmful impacts within coastal waters. This is achieved through the Integrated Coastal Zone Management Plan (Southern Belize section), the National Sustainable Tourism Master Plan, enforcement of relevant legislation and the EIA / ECP process.* *PHMR provides an important and integral part of the national protected areas system, protecting biodiversity and threatened species, as per Belize's commitment under this Convention. It provides filtration of land based pollution and sediment before water reaches the barrier reef in the MMMC / SBRC*
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar, 1971)	**Global convention to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological function of wetlands and their economic, cultural, scientific and recreational value.** *PHMR shares important estuarine connectivity with Sarstoon Temash National Park one of Belize's two Ramsar sites, and therefore plays a role in the maintenance of coastal wetlands in southern Belize*

Table 1: *International Conventions and Agreements of Relevance to Port Honduras Marine Reserve*

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 of protecting the ecosystems of the marine environment, based on the regional

importance of the Mesoamerican Reef System, and consistent with the goals of the United Nation's Convention on Biological Diversity's International Coral Reef Initiative.

With the increasing threats to the overall health of the reef system, the Governments of Mexico, Belize, Guatemala and Honduras (the four countries bordering the Mesoamerican Barrier Reef System (MBRS)) committed to the development of a 15-year Action Plan – the **Mesoamerican Barrier Reef System Project** - through the **Tulum Declaration (1997),** for the conservation and sustainable use of this globally important ecosystem**.** This initiative, adopted by the Heads of State in June 1999, was supported by the **Central American Commission on Environment and Development (CCAD),** which seeks to harmonize environmental policies within the region. A second phase project is now underway – the Integrated Transboundary Ridges-to-Reef Management of the Mesoamerican Reef (MAR2R) - focused on enhancing regional collaboration for the ecological integrity of the Mesoamerican Reef, scaling up the ridge to reef approach to its management.

1.3 National Context

As well as the regional and global importance, Port Honduras Marine Reserve is also important at the national level. The marine resources of the protected area support traditional fishers and the young but growing tourism industry in southern Belize.

Port Honduras Marine Reserve is an important component of the **Maya Mountain Marine Corridor (MMMC)**, one of three primary national biodiversity corridors in Belize, which stretches from the Maya Mountains divide to the coast, linking the watersheds of the Toledo District to the Gulf of Honduras (including the Port Honduras Marine Reserve). The corridor itself is a mosaic of landscapes and cultures, an interdependent and biologically significant area that encompasses approximately 739,650 land acres and the 100,000 acres of Port Honduras Marine Reserve. This ridge-to-reef landscape / seascape includes more than forty-three distinct ecosystems that support threatened species, fulfill human needs, contribute to natural disaster mitigation and climate change adaptation, and are broadly classified as upland forests, coastal plain broadleaf forests, pine savannas, freshwater systems, near shore estuaries, seagrass beds, mangroves, and coral reefs.

PHMR is also linked to the **Southern Belize Reef Complex (SBRC),** which stretches northwards to the northern boundary of South Water Caye Marine Reserve and south-eastwards from the coastline of Belize to the Sapodilla Cayes and the outer reef. The SBRC encompasses four marine protected areas – Sapodilla

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

Cayes Marine Reserve, Gladden Spit and Silk Cayes Marine Reserve, South Water Caye Marine Reserve and Laughing Bird Caye National Park. 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.

Three of the Marine Reserves form part of the 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, such as Port Honduras Marine Reserve, 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 nationally and 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.

1.3.1 National Planning Strategies

The national goals and objectives for conservation revolve around the sustainable use, conservation and protection of Belize's natural resources within the context of sustainable human development. These objectives are implemented through the **National Biodiversity Strategy and Action Plan** (GoB, 2016), which recognizes the importance of protected areas such as PHMR, and the need to mainstream biodiversity across all sectors in Belize, improve integration of biodiversity and protected areas into national planning strategies, and build both human and institutional capacity to effectively manage the biodiversity resources. It provides a framework for strategies under five national goals:

> ***GOAL A. MAINSTREAMING:*** *Improved environmental stewardship is demonstrated across all society in Belize, as is an understanding and appreciation of marine, freshwater and terrestrial biodiversity, its benefits and values.*
>
> ***GOAL B. REDUCING PRESSURES:*** *Direct and indirect pressures on Belize's marine, freshwater and terrestrial ecosystems are reduced to sustain and enhance national biodiversity and ecosystem services*
>
> ***GOAL C. PROTECTION:*** *Functional ecosystems and viable populations of Belize's biodiversity are maintained and strengthened*

> ***GOAL D. BENEFITS:*** *Strengthened provision of ecosystem services, ecosystem-based management and the equitable sharing of benefits from biodiversity*
>
> ***GOAL E. IMPLEMENTATION:*** *Effective implementation of the NBSAP through capacity building, strategic decision making and integrated public participation*

The **National Protected Areas Policy and System Plan (NPAPSP**) (GoB, 2005; revised: 2015) guides system-level and individual protected area management efforts to support the national objectives of ecological and economic sustainability over the long term, with the development of human and institutional capacity to effectively manage the biodiversity resources. There is a strong focus on co-management partnerships, such as the one between the Fisheries Department and Toledo Institute for Development and Environment (TIDE). The NPAPSP centres on the following policy statement, which has been taken into consideration in the development of this plan:

> *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.*

A key goal of the NPAPSP is to ensure that the "*National Protected Areas System includes high quality examples of the full range of environment types within Belize, with balanced representation of the ecosystem types they represent*" (NPAPSP, 2005). These include the unique fringing coral reefs, important inundated mangroves and coastal fringing mangroves of PHMR.

Under a national protected areas system rationalization exercise, a number of recommendations were made for each protected area, to improve representation or protection of specific national targets. The following were highlighted for Port Honduras Marine Reserve:

Priority Ecosystem / Species Protection

- **Realignment of PCNP or PHMR:** to include at least 2 miles of Deep River from the river mouth, to improve representation of rivers as an ecosystem
- **PCNP / PHMR:** Strengthening protection of goliath grouper nursery areas
- **PHMR:** Prioritize management of lane snapper aggregations

Walker et al., 2012

Both the NBSAP and the NPAPSP support Belize's **Growth and Sustainable Development Plan** (GSDS), part of the 15 year national development framework under Horizon 2030. The GSDS recognizes effective implementation of both the NBSAP and NPAPSP as critical in achieving national development goals.

The **Coastal Zone Management Authority and Institute** was established under the Coastal Zone Management Act to ensure conservation of coastal resources, and the planning, management and sustainable development of resources within the coastal zone. The Act is focused on monitoring, planning and coordination to ensure that activities within the coastal zone are sustainable, but does not provide any enforcement capacity. Implementation and enforcement is achieved through more specific agencies – the Fisheries Dept. (Fisheries Act), the Forest Department (Wildlife Protection Act, Forest Act, Mangrove Regulations), Department of the Environment (Development regulations, EIAs and ECPs) and Geology and Petroleum Department (dredging and oil exploration).

A number of overarching objectives have been identified under **the Integrated Coastal Zone Management Plan** for the Southern Belize Region. Whilst this plan focuses on a larger scope than just Port Honduras Marine Reserve, it provides the context within which PHMR operates:

1. *Encourage and promote the sustainable development of coastal and offshore areas within the Southern Region that will promote economic growth while simultaneously ensuring ecosystem stability and the efficient delivery of ecosystem services.*

2. *Protect and preserve the traditional way of life of the stakeholders within the Southern Region*

3. *Ensure sustainability of coastal resources by identifying areas in need of conservation and reducing user conflicts*

A series of principles have also been identified under the Coastal Management Plan:

Principle 1: *Recognition that the Southern Region needs special protection and management because of its physical, economic, scientific, cultural and aesthetic attributes*

Principle 2: *Recognition of the need to avoid placing undue strain on the terrestrial and aquatic environment of the region by ensuring that proposed development activities do not exceed the carrying capacity of the region*

Principle 3: *Recognition of the rights and interests of traditional users and stakeholders while acknowledging the national development policy which promotes tourism and job creation*

Principle 4: *Recognition that environmental concerns are best handled with the participation of all concerned stakeholders at all levels and from all sectors*

Principle 5: *Recognition that planning guidelines represent a preventative and precautionary approach to environmental degradation and a tool for pursuing sustainable development of the region*

1.3.2 Legal Framework

Six key laws have been enacted to protect ecosystems, ecosystem services and biodiversity, contributing to the conservation framework of Belize. The Ministry of Agriculture, Fisheries, Forestry, Environment and Sustainable Development is the administrative agency for the **National Protected Areas System Act (2015), Fisheries Act (1948), Forest Act (1927),** and the **Wildlife Protection Act (1981).** The **Fisheries Act,** administered under the Fisheries Department, is the principal governing legislation regulating the fishing industry, and is directly concerned with maintaining sustainable fish stocks and protecting the marine and freshwater environments. The Fisheries Act requires that fishers and fishing vessels using Port Honduras Marine Reserve (Managed Access Area 5) are licensed. This is supported by Managed Access – a rights-based fisheries management regime. The Fisheries Act is currently being revised and updated as the Fisheries Resource Bill. The Belize Fisheries Department, the authority responsible for PHMR, provides support to the co-managers, especially in the enforcement of fisheries regulations in the protected area and taking an active role in implementation of the Managed Access program.

The Fisheries Act also provides protection for marine turtles which, along with their nest sites have been given some protection since the original Fisheries Ordinance in 1940. This was strengthened in 1993, when Belize revised its fisheries regulations to prohibit fishing, possession, or trade in products of all six species of marine turtle that might potentially be found in Belize's waters **(Fisheries (Amendment) Regulations, 1993 (S.I. No. 55 of 1993).** The **Sport Fishing Regulations (SI 114** and **115 of 2009**) have been developed to improve management and conservation of the economically important sport fishing species in Belize (particularly bonefish, tarpon and permit), which can only be caught using 'catch and release' best practices. These regulations, however, do not extend to protecting nursery areas or adult habitat – only to the sport fish species themselves.

The **Wildlife Protection Act (1982)** falls under the Forest Department, and provides protection for the endangered Antillean manatee (for which the area was originally protected), dolphins, whales, crocodiles and nesting bird colonies, with the prohibition of hunting and commercial extraction. This Act is scheduled for revision and significant strengthening in 2017.

Also developed under the Forest Department are the **Forest (Protection of Mangrove) Regulations** (SI 52 of 1989), 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 to consider whether the project will adversely affect the conservation of the area's wildlife, water flow, erosion and values of marine productivity.

The **Environmental Protection Act (1992)** was enacted under the Department of the Environment (DoE) with the aim of ensuring that development initiatives within Belize are planned and implemented with minimum environmental impact. In the context of Port Honduras Marine Reserve, this is particularly important when ensuring that the impacts from coastal and caye development adjacent and in the protected area are minimized, through the Environmental Impact Assessment (EIA) process, with privately owned / leased cayes located within the Marine Reserve. The EPA also mandates DoE to carry out surveillance and response to environmental pollution.

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.

KEY NATIONAL LEGISLATION PROTECTING FAUNA, FLORA, AND NATIONAL HERITAGE

The National Protected Areas Systems Act (2015)
Provides a framework for establishment and maintenance of the national protected areas system.

The Fisheries Act (1980)
Principal governing legislation to regulate the fishing industry, and is directly concerned with maintaining sustainable fish stocks and protecting the marine and freshwater environments.

The Wildlife Protection Act (1981)
Provides for the conservation, restoration and development of wildlife and regulation of its use.

The Forest Act (1927)
Promotes the forestry industry, with the implementation of conservation techniques, Responsible for forestry activities in all types of forest, including littoral forests and mangroves.

Environmental Protection Act (1992)
Promotes the preservation and improvement of the environment, the rational use of natural resources, the control of pollution, and associated actions.

The National Integrated Water Resources Act (2011)
Provides for management of water resources. Its role includes estimating water availability and value, and implementing measures to ensure wise use and long term sustainability of Belize's water resources

The **Pesticides Control Act (1990)** provides a mechanism for the registration and regulation of pesticide importation and use, important for improving pesticide management, reducing contamination of the rivers feeding into Port Honduras Marine Reserve.

Whilst the above are the legislative acts most relevant to Port Honduras Marine Reserve, there are others such as the **Mines and Minerals Act (1989)** and the **Petroleum Act (1991)**, which regulate the exploration and extraction of all non-renewable resources. These Acts regulate activities such as dredging of the seabed, as well as the exploration and extraction of all non-renewable resources, including oil.

Financial sustainability for protected area and natural resource management is partially addressed at Government level through the Protected Areas Conservation Trust (**PACT Act, 1996; revised 2015)**. A 'conservation tax' of Bz$7.50 is levied on non-residents as they leave the country providing a funding mechanism to assist in management and development activities within protected areas.

The functions of PACT are:

"…to contribute to the sustainable management and development of Belize's natural and cultural assets for the benefit of Belizeans and the global community, both now and for future generations."

Protected Areas Conservation Trust (Amendment) Act, 2015)

Site Level Legal Legislation

Port Honduras Marine Reserve is a national protected area, established in 2000 (SI 9 of 2000) under the Fisheries Act (1948 (1983 amendment)) with regulations established at the same time (SI 18 of 2000). The area is designated as 'Marine Reserve' under the mandate of the Fisheries Department to "....*afford special protection to the aquatic fauna and flora of such areas and to protect and preserve the natural breeding grounds and habitats of aquatic life to allow for the natural regeneration of aquatic life in areas where such life has been depleted*" (Fisheries Department, 1983).

The Marine Reserve is currently managed under a co-management regime shared between the Fisheries Department and Toledo Institute for Development and Environment, with zoned multiple use, incorporating areas open for extractive use and closed, no-take areas, regulated under a zoning system that is embedded within the Statutory Instruments (SI 9 and 18 of 2000). There are a series of rules and regulations within the statutory instruments that guide all activities within the protected area – both tourism-related and commercial fishing practices.

1.3.3 Land Tenure

Site Level Legal Legislation

Port Honduras Marine Reserve is a national protected area, established in 2000 (SI 9 of 2000) under the Fisheries Act (1948 (1983 amendment)) with regulations established at the same time (SI 18 of 2000). The area is designated as 'Marine Reserve' under the mandate of the Fisheries Department to "....*afford special protection to the aquatic fauna and flora of such areas and to protect and preserve the natural breeding grounds and habitats of aquatic life to allow for the natural regeneration of aquatic life in areas where such life has been depleted*" (Fisheries Department, 1983).

The seabed within the Marine Reserve is national land, as are the majority of the 138 cayes, though these cayes, whilst within PHMR boundaries, are not protected within the Marine Reserve (which protects only water). Abalone Caye, national land, is used as the operating base for the Marine Reserve. As PHMR is a national protected area, any construction, such as piers, marinas, and seawalls needs to be permitted by Fisheries Department and licensed by Lands Department. Any mining, including beach sand mining or dredging activities, and oil exploration / drilling activities, require permission from Fisheries Department and a license from the Geology & Petroleum Department.

The Integrated Coastal Zone Management Plan assessed land tenure of cayes (Table 2), recognizing that development would require specific building standards, with their close proximity to sensitive habitats such as coral reef, sea grass beds and mangroves, within a protected area. The Plan highlights the ecological sensitivity of the Snake Cayes and strongly recommends that no further developments be permitted in these areas.

Fourteen of the cayes in Port Honduras area have upland areas suitable for varying levels of on-land visitation. Attractive beach areas are accessible on West Snake Caye, Abalone Caye, South Snake Caye, and Moho Caye. West Snake Caye is the most frequently visited with over 190 feet of shifting beach and snorkeling on the fringing reefs around the northern and southern points. Three of these cayes, Moho Caye, Wild Cane Caye and South Snake Caye, include privately owned or leased property (CZMAI, 2015) – of these, only Moho Caye is fully privately owned and has been developed (and subsequently abandoned). Two cayes, West and South Snake Cayes, are currently being developed.

Name of Caye	National		Property		Total Acreage
	Size (Acres)	%	Size (Acres)	%	
Small Caye	6.61	100	0	0	6.61
Sickle Caye	13.55	100	0	0	13.55
Stuart Caye	16.88	100	0	0	60.0
#1 Inner Cross Caye	14.50	100	0	0	14.50
#2 Outer Cross Caye	5.70	100	0	0	5.70
#3 Caye	2.10	100	0	0	2.10
Moho Caye	0	0	2.8	100	1.80
Bird Caye	1.55	100	0	0	1.55
#4 Caye	4.10	100	0	0	4.10
#5 Caye	8.80	100	0	0	8.80
Bobby Caye		100	0	0	
Frenchman Lagoon Area	290.20	100	0	0	290.20
Long Caye	12.11	100	0	0	12.11
Frenchman Caye	38.38	100	0	0	38.38
Peter Caye	70.60	100	0	0	70.60
Outside Sheppard Caye	227.78	100	0	0	227.78
Inside Sheppard Caye	154.35	100	0	0	154.35
Wild Cane Caye	79.89	94.1	2.00	5.90	154.35
#6 Caye	0.50	100	0	0	0.50
Man of War Caye	5.00	100	0	0	5.00
#7 Caye	8.90	100	0	0	8.90
#8 Caye	2.40	100	0	0	2.40
Abalone Caye	0.50	100	0	0	0.50
Head Caye	3.00	100	0	0	3.00
McBride Caye	10.00	100	0	0	10.00
Wilson Caye	32.85	100	0	0	32.85
East Snake Caye	4.80	100	0	0	4.80
Middle snake Caye	10.00	100	0	0	10.00
West Snake Caye	9.70	100	0	0	9.70
South snake Caye	3.74	52	4.06	48	7.80
#9 - 29	171.40	100	0	0	171.40
TOTAL	**1209.89**	**2946.10**	**8.86**	**153.90**	**1333.33**

Table 2: *Tenure of Cayes of Port Honduras Marine Reserve (Data: CZMAI, 2015)*

The recommendations for the future of other cayes within the boundaries of Port Honduras Marine reserve are that:

> *"developments in these areas be consistent with existent management plans…. Most of the cayes of the Southern Region are situated within the Port Honduras Marine Reserve and are not suitable for development due to their small size, shoal environs, mangrove dominated vegetation and low lying and inundated character with no emergent land. In addition, some are within ecologically sensitive environments surrounded by coral patches and strands interspersed by sea grass beds. Consequently any development activity will require extensive dredging, sand mining and engineering applications."*
>
> ***Integrated Coastal Zone Management Authority, 2015***

The coastal area adjacent to the Marine Reserve is predominantly in the hands of private owners, and while a 1939 law reserved one-chain (20m / 66ft) of water frontage as public access, much of the land was privately titled before the law was passed.

1.3.4 Evaluation of National Importance

Key Characteristics of National Importance: PHMR:

- Mid-lagoonal reefs, with characteristics of both inshore reef and offshore barrier reef environments - unique in Belize
- Extensive sea-grass beds filter and settle out sediments and nutrients - critical for maintaining the health of the barrier reef further offshore
- Supports local traditional fishing industry
- Important goliath grouper habitat

Rationalization Report, 2012

Port Honduras Marine Reserve is of both local and national importance for the services it provides. Its location, at the foot of the Maya Mountain Marine Corridor (MMMC), results in it providing the vital link between the upland watersheds and terrestrial protected areas and the coastal and marine ecosystems of the Belize Barrier Reef. The extensive mangroves and seagrass beds remove land-based nutrients (especially agrochemicals), sediment and other pollutants from the water column, improving the quality of water that flows out to the reefs of the Snakes Cayes and the Sapodilla Cayes, as the most southerly portion of the barrier reef in Belize's reef system (Valiela et al. 2001). The fringing mangroves also provide an important protective function, buffering the coast and caye beaches from wave action, reducing coastal erosion. They also lift storm force winds, protecting property and life in the coastal zone.

Port Honduras Marine Reserve provides is on of the richest and most critically important habitats in Belize. It incorporates four distinct ecosystems: coastal and tidal wetlands, marine lagoonal habitats comprised of mangroves and seagrass beds, mangrove islands with associated

shallow banks, and the Snake Cayes fringing reef system (Sullivan et al. 1995). The extensive mangroves and seagrass beds act as nursery areas for commercially important marine species and as habitat and feeding areas for adults.

The mid-lagoonal reefs are unique in Belize, with characteristics of both inshore reef and offshore barrier reef environments. These reefs are thought to have some level of resilience to climate change, recovering well after the 1998 bleaching event. The protected area supports fifteen species of international concern, including four rated as Critically Endangered – staghorn and elkhorn corals (*Acropora cervicornis* and *A. palmata*), the goliath grouper *(Epinephelus itajara*), and the hawksbill turtle (*Eretmochelys imbricata*). The coastline of dense mangrove and the numerous small offshore mangrove cayes, some surrounded by fringing reefs, serve as critical nursery and feeding areas for a variety of species, including the globally endangered Antillean manatee.

Port Honduras Marine Reserve **Species of international Concern**	
Critically Endangered	
Staghorn Coral	*Acropora cervicornis*
Elkhorn Coral	*Acropora palmata*
Hawksbill Turtle	*Eretmochelys imbricata*
Goliath Grouper	*Epinephelus itajara*
Endangered	
Loggerhead Turtle	*Caretta caretta*
Green Turtle	*Chelonia mydas*
Nassau Grouper	*Epinephelus striatus*
Boudler Star Coral	*Montastraea annularis*
Star Coral	*Montastraea faveolata*
Great Hammerhead	*Sphyrna mokarran*
Vulnerable	
Rainbow Parrotfish	*Scarus guacamaia*
Queen Triggerfish	*Balistes vetula*
Hogfish	*Lachnolaimus maximus*
Cubera Snapper	*Lutjanus cyanopterus*
Mutton Snapper	*Lutjanus analis*
West Indian Manatee	*Trichechus manatus*
	IUCN, 2017

Ecosystem Services of Port Honduras Marine Reserve

Port Honduras Marine Reserve plays a critical role for the buffer communities of Punta Gorda, Punta Negra and Monkey River, and the Toledo District as a whole providing a range of ecosystem services (Table 3).

The overall value of the reef and mangroves in Belize was estimated at Bz$790 – $1,118 million a year (US$395 - $559 million a year), based on the coastal protection provided by the barrier reef, atolls and mangroves, the support of the fisheries industry and the contribution towards tourism income (Cooper et. al, 2008). Mangroves also protect coastal properties from erosion and wave-induced damage, providing an estimated US$231 to US$347 million in avoided damages per year at a national level. In total, reef- and mangrove-associated fisheries are estimated to have a direct economic impact of US$25.26 million in 2014 (SIB, 2015).

The intact mangroves along the coastline of PHMR provide protection against storms and hurricanes and reduce the impact of the waves on the coastal beaches. The presence of mangroves reduces storm surge inundation of seawater on land and reduces the potential

physical damage to houses and other infrastructure during storm events. The mangroves also limit the daily erosion that would otherwise occur due to the natural flow of the seawater and tides along the coastline and on the cayes, and reduce the flow of land-based nutrients, sediment and pollution into the sea (Valiela et al. 2001). The complex root systems of mangroves provide an ideal nursery habitat for juvenile fish and invertebrate species, and mangroves have been shown to significantly increase the survivorship of juvenile reef fish species (Mumby et al., 2004).

Ecosystem Services of Port Honduras Marine Reserve	
Regulation	Mangroves protect the coastline from wave action and storm surges
	Reduction of ongoing beach erosion on cayes and the coastline
	Coral forms a major component of beaches and cayes
	Seagrass and mangroves are important in filtering sediment and pollutants in runoff from the rivers
	Seagrass plays an important role in stabilizing the substrate and settling turbidity in the water before it reaches the reef
Recruitment	No-take zones within the protected area have been established to ensure viable populations of commercial species for subsistence, recreational, sport and commercial fishing
	Mangrove and seagrass provide important nursery areas for both commercial and non-commercial species
	Sand beaches provide nesting areas for marine turtles
Cultural and Socio-Economic	PHMR has been an important, traditional commercial fishing ground for the Belize capture fisheries industry in southern Belize
	Coral reefs are important resources for tourism and recreation
	Aesthetic appreciation and recreation opportunities for local communities
Support	Coral reefs and mangroves play an important role in the cycling of nutrients
	Coral reefs, seagrass beds and mangroves within the protected area provide ecosystems necessary for different life stages of commercial and non-commercial species
	Coral reefs are among the most productive habitats, producing 2,000 decagrams of carbon per square meter per year

Table 3: *Ecosystem Services of Port Honduras Marine Reserve (Adapted from UNEP-WCMC, 2006)*

Marine resources protected by Port Honduras Marine Reserve include commercially important finfish such as snook, snappers and groupers, in addition to the Caribbean spiny lobster and the

queen conch. These provide an important food and income source for the local communities, as well as direct revenue generation and provision of an important source of protein. The Replenishment (No-Take) Zones provides a refuge to enable species to reach maturity and reproduce, contributing to viable populations of commercial species. As the marine resources increase, 'spill-over' into the General Use Zone, where fishing is permitted, will help to sustain fisheries, and as such benefit local communities.

The Marine Reserve also supports a range of tourism uses - sport fishing, snorkelling, SCUBA diving, kayaking and bird watching, attracting visitors from all over the world, and benefiting not only local tour guides, but also helping to sustain the hotels, guest houses and restaurants and a range of other local businesses in the stakeholder communities. It is estimated that 28% of the population from the buffer communities was employed directly or indirectly in the tourism industry in 2010 (Padilla et al., 2010). TIDE operates a sister organization, TIDE Tours, that actively trains and employs local residents to guide marine and terrestrial tours within the Marine Reserve and the surrounding areas. Communities also benefit from recreational uses of the Marine Reserve, such as recreational and sport fishing, kayaking, swimming, snorkelling and trips to the beach.

In addition to the services coastal and marine ecosystems provide in terms of fisheries and pollution mitigation, the extensive mangrove and seagrass coverage protected within the Marine Reserve also play a significant role in building southern Belize's resilience to climate change, and contribute to global mitigation efforts. Marine ecosystems represent the largest long-term sink for carbon as well as storing and redistributing approximately 93% of the Earth's carbon dioxide (CO_2) (Nellemann et al., 2009). Mangroves, salt marshes and seagrasses account for more than 50%, possibly as much as 71%, of global carbon storage in ocean sediments (Nellemann et al. 2009).

1.3.5 Socio-Economic Context

National Context

Belize has a low population currently estimated at approximately 380,0300 (Table 4; SIB, 2016), with the lowest population density in Central America, at just over 14.6 persons per sq. km., concentrated primarily within the northern plain, southern coastal plain (including Toledo), Belize Valley and Stann Creek Valley. Much of the remaining country is less suited to habitation, with swampy lowlands and steep terrain in the Maya Mountains.

Belize Demographic Statistics (Average)	
Population (2016 est.)	380,000
Population density (2015)	14.6/sq. km.
Urban Population (2014)	44.1%
Annual growth rate (2014 est)	1.9%
Life expectancy (2014 est.)	68.5
Poverty Rate (2010)	41.3%
Literacy rate (2010)	79.7%
Unemployment rate (2016)	11.1%
GDP (per capita, 2013)	Bz$8,207.878 per capita

Table 4: *Belize Demographic Statistics, (SIB, 2017)*

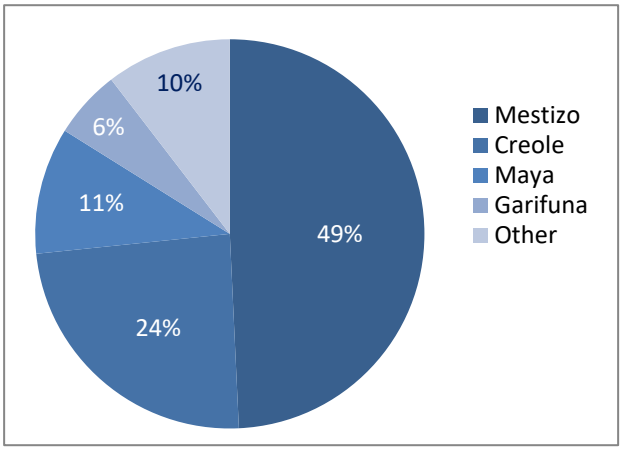


Figure 1: *Ethnic Composition of Belize (2010)*

Belize is a country of many cultures - the indigenous Maya of Belize are descendants of the original Central American civilization, at its height approximately 2,000 years ago, whilst Mestizo, Creole, Maya and Garifuna forming the major population groups (Figure 1).

Port Honduras Marine Reserve contributes towards support of the national fishing industry which provides direct employment for over 2,750 fishers and supports an estimated 12,500 Belizeans from 20 communities, with a further 1,000 people involved indirectly in processing and export (Belize Fisheries Department, 2013). In 2014, marine products (including farmed shrimp) provided the greatest contribution towards domestic exports (18.4%), exceeding petroleum products for the first time since 2007 (Table 5; SIB, 2014; Central Bank, 2015).

Marine Domestic Exports, 2014 Capture Fisheries	
Product	***Value (Bz$)***
Lobster Tail	13,998,780
Conch	8,534,180
Whole fish	558,190
Aquarium Fish	472,430
Lobster Meat	1,614,840
Crab	86,770
Total	***Bz$113,259,230***

Table 5: *National Marine Domestic Exports, 2014 (SIB, 2014)*

With its scenic beauty, vibrant reef and idyllic sand cayes, and the proximity of these resources to the mainland, Port Honduras Marine Reserve provides an important tourism service for Toledo District. Belize's tourism industry, one of the fastest growing sectors in Belize, is rapidly becoming the major foreign exchange earner, with over 1,390,000 tourists arriving in Belize in 2016. 385,580 of these were overnight visitors, the remaining approximately 1 million are day visitors through the cruise industry (Figure 2; BTB, 2017). Tourism is primarily natural- and cultural-resource based, with visitors focusing on the cayes, coastal communities and coral reef (particularly snorkelling, diving and sport fishing activities), and inland protected areas. Direct tourism expenditure in Belize exceeded Bz$510 million in 2015 – 14.7% of the total GDP. When indirect contributions are taken into account from related support industries, this rises to 38.6% of the GDP (WTTC, 2016). In 2015, the tourism industry supports over 18,000 direct jobs – 13.1% of total employment, expanding to 34.8% of total employment when related support industries are taken into account (WTTC, 2016).

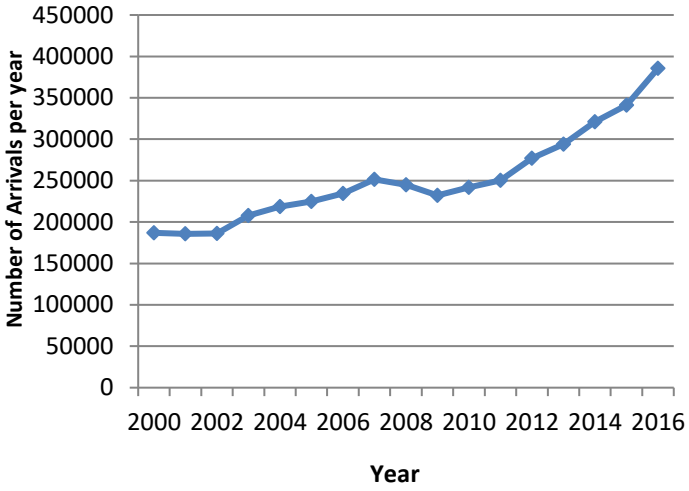


Figure 2: *Belize overnight tourism arrivals 2000 - 2016*

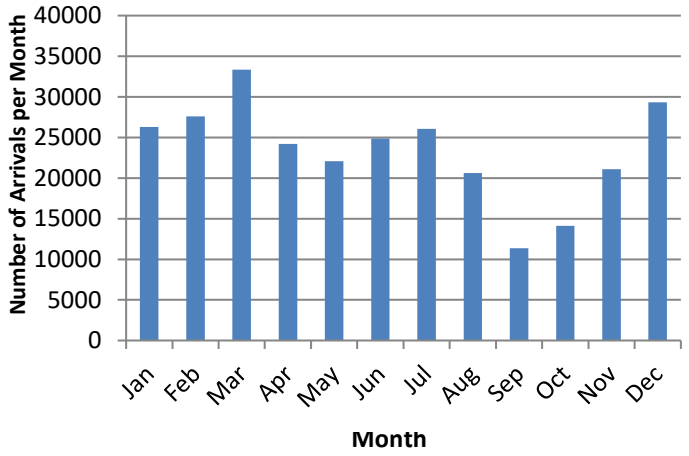
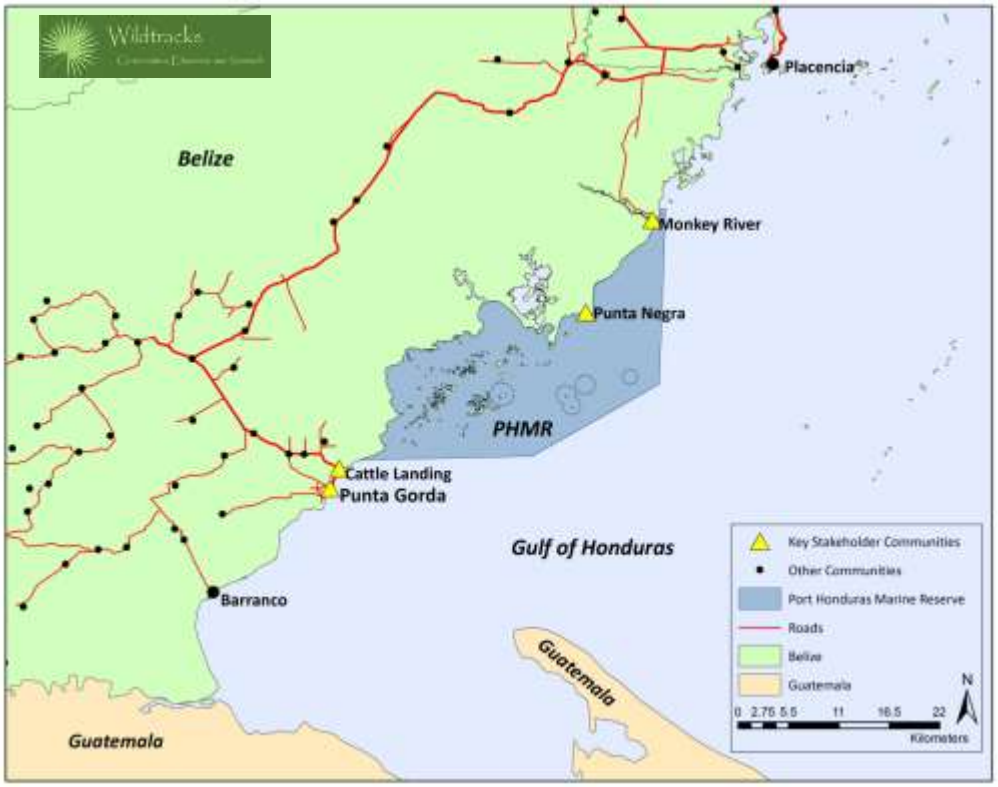


Figure 3: *Belize overnight tourism arrivals per month (Average: 2000 – 2016) (BTB, 2017)*

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 3). Toledo District has only a limited service-based economy, and many residents earn their income and livelihoods from subsistence agriculture, small-scale fisheries, ecotourism and agro-forestry. Other sources of income are derived from jobs within the public sector such as teaching, or with the high number of non-governmental organizations (NGOs) and foundations within the area. Despite the extensive natural resources of the Toledo District, the tourism industry has remained small with limited eco-tourism ventures, hotels and restaurants, and much of the infrastructure required to support large-scale tourism is still absent from the district.

Local context

97% of users of PHMR have been identified as originating from three key stakeholder communities - Monkey River, Punta Negra and Punta Gorda (MMAS, 2010). All three communities use the Marine Reserve, either for fishing or tour guiding (Map 2; Table 6).



Map 2: *Key Stakeholder communities of PHMR*

Stakeholder Communities of Port Honduras Marine Reserve

Community	Location (UTM) Distance (km)	Proximity to PHMR	Population (approx.)	Comments
Monkey River	E16 341187 N18 09691	Directly borders reserve	200	**Fishers, farmers, tourism (including fly fishing**
Punta Negra	E16 334998 N17 99698	Directly borders reserve	18	**Fishers, farmers, guiding**
Punta Gorda	E16 306862 N18 80471	4km	5,255	**Fishers, guides. District administrative center**

Table 6: *Stakeholder Communities of Port Honduras Marine Reserve*

Key stakeholders include local fishers, tour guides, tour operators, hotel and restaurant owners, local residents, recreational users of the protected area, tourists, local and national politicians and large-scale investors. In addition, due to its location in relation to Belize, Guatemala and Honduras, a significant number of private tour groups and fishermen from the two neighboring countries also use the natural resources of the PHMR, both legally and illegally. A basic stakeholder analysis identifies stakeholder interests and impacts (Table 7).

Two of the communities (Monkey River and Punta Negra) lie directly on the boundary of the protected area and are heavily focused on marine resource use. As such, they have the greatest impact on the Marine Reserve and its resources, and will be the most impacted by the predicted climate change impacts. The third, Punta gorda (including Cattle Landing), is the larger, district centre, and less focused on use of the marine environment.

Of the three communities, Punta Negra has faced the most significant negative impacts since the establishment of PHMR. This is partially due to the presence of the community within the Marine Reserve. Though still able to fish in 95% of PHMR, the banning of gill nets severely limited income generation for the community (Padilla et al., 2010). The number of households has dropped from 20, before the establishment of PHMR, to 4 by 2012, with the migration of fishers to urban areas to seek alternative income.

In contrast, Port Honduras Marine Reserve has had a positive effect on many stakeholders' livelihoods in other communities. The Toledo District has seen an increase in tourism over the last few years, directly benefitting local tour guides, tour operators, hotels and restaurants within the area, some of which can be attributed to the existence of the Marine Reserve, with activities such as fly-fishing, snorkelling and SCUBA diving. It is estimated that 28% of the population from the buffer communities is employed directly or indirectly, in the tourism industry (Padilla Plaza et al., 2010).

TIDE has trained commercial fishers as licensed tour guides and sport fishers, in collaboration with the Belize Tourism Board. This has permitted diversification of income in the coastal communities, with trained tour guides shifting to marine based tours, or a combination of commercial and sport fishing. It is estimated that Bz$1 million a year is generated for stakeholder communities through snorkelling tours to the Snake Cayes (Garbutt, community consultation., 2016), contributing to the support of sustainable incomes. TIDE operates a sister organization, TIDE Tours, that actively trains and employs local residents to guide marine and terrestrial tours within the Marine Reserve, and the surrounding areas.

A rapid assessment was completed of community vulnerability (Walker et al., 2012). Of the three communities, Punta Gorda is considered the most resilient to climate change, with its location on higher land, the greater income diversification and the limited dependence on marine resources. Whilst the physical location of both Punta Negra and Monkey River on the

vulnerable, low lying coastline is similar, Punta Negra residents are more adaptable with in dealing with the issues facing them, diversifying their income base through opportunities offered by their proximity to Punta Gorda.The residents of the smaller community of Punta Negra show greater adaptability, with less resistance to the idea of relocation -

Monky River / Punta Negra Climate Change Asessement

Exposure to climate change: The extent to which Monkey River and Punta Negra come into contact with climate events or specific climate impacts

- Despite being in a lower risk hurricane belt, Monkey River and Punta Negra are exposed to hurricanes, and was badly impacted by Hurricane Iris in 2001
- Increasing intensity of storms threatens fishing infrastructure (boats, traps, nets)
- increased intensity of tropical storms with increased mechanical damage to reef, increased sediment load from watersheds and sediment impacts on reef
- Access is affected during and after storm events, and will become increasingly difficult with increasing sea level rise
- Increased sea temperature is leading to coral bleaching, increased disease and increased coral mortality, affecting the health of the reef ecosystem and fisher income

Sensitivity: The degree to which Monkey River and Punta Negra are negatively affected by changes in climate

- The communities are located on the coast on land less than 1m asl, with 100% of households facing inundation from sea level rise in the long term, with the high probability of the need for relocation
- Declining reef health as a result of ocean acidification and sea temperature rise will have future impacts on the fishing and tourism industries, the two primary income sources for the community
- Saltwater intrusion of ground water will reduce water security and affect current and future agricultural productivity
- Decreasing rainfall predictions will lead to reduced water security, and reduced ability to diversify from fishing into agricultural alternatives

Monkey River is located at the mouth of the river with the same name, and was once a thriving port with a population of over a thousand. It has declined to current population of approximately 200, with a heavy dependence on commercial fishing, sport fishing and natural history tourism. Many community members have more than one occupation to supplement the family income, with 63.3% of households engaged in commercial fishing, and 52% in tourism activities (MMAS, 2010). Part of the community's ability to diversify into tourism lies in its proximity to Placencia, one of Belize's primary tourism centers. However, the limited infrastructure and only recent establishment of 24 hour electricity and community water system have inhibited Monkey River itself from supporting larger-scale tourism within the community.

Monkey River was largely destroyed by Hurricane Iris in 2001, with up to 98% of the houses showing structural damage (NEMO, 2001). The village was then hit again in 2009 by an earthquake, with damage to 27 houses. With its location on the east-facing coastline, coastal erosion is reducing village land facing the sea, with a recent rate of erosion of 16 ft. of foreshore per year, thought to be partly as a result of altered river dynamics, with upstream water extraction for agriculture. Despite these pressures, there is a strong tie to the location, and the majority of people living there are reluctant to relocate.

Adaptive Capacity: The potential or capability of Monkey River to adjust to impacts of changing climate, and to minimize, cope with and recover from the consequences of changes

- Monkey River was identified as one of the coastal communities with a more diversified income base (MMAS, 2010), increasing the capacity of its inhabitants to adapt to climate change without relocating
- Income diversification into tourism still places a heavy reliance on the state of the marine resources
- Majority of adults (86%) have minimal education, leaving school on completion of primary level (MMAS, 2010), reducing options for diversification. However, many of the young adults are attending high school or college in Punta Gorda

Punta Negra is located directly on the coastline of PHMR, and is accessible only by water. It is not connected to the national road network or electricity system. Hurricane Iris affected the community in 2001, with an estimated 95% of the buildings suffering from structural damage (NEMO, 2001), reinforcing the exposed location and vulnerability of this community to tropical storm events. With the lack of amenities, educational opportunities and jobs, there has also been a migration of families to more accessible communities, and many people have established second homes in Punta Gorda. Punta Negra is a focal community of TIDE activities, receiving input in terms of skills training / capacity building, providing skills that have enabled community members to seek jobs outside the community. It has been building its potential for hosting tourism, with the installation of restaurant facilities, through assistance from TIDE.

Adaptive Capacity: The potential or capability of Punta Negra to adjust to impacts of changing climate, and to minimize, cope with and recover from the consequences of changes

- Punta Negra is a focal community of TIDE activities, receiving input in terms of skills training / capacity building.
- The majority of adults (over 70%) have minimal education, leaving school on completion of primary level (MMAS, 2010) reducing options for income diversification
- Those who are not fishermen generally are employed or have businesses and second residences in Punta Gorda
- Families in the community are slowly relocating to Punta Gorda or adjacent communities, for improved education opportunities, work and / or access to amenities (24hr electricity and water

Stakeholder	Role
Toledo Institute for Development and Environment	Site level management organization for Port Honduras Marine Reserve. Responsible for day to day management activities, including surveillance and enforcement, research and monitoring, and outreach
Fisheries Department	Government authority responsible for Port Honduras Marine Reserve. Responsible for enforcement of Fisheries legislation, implementation of Managed Access, towards achieving maximum sustainable yield. They are also responsible for protection of sea turtles
Forest Department	Government authority responsible for enforcement of mangrove legislation and protection of manatees, crocodiles, and dolphins
Department of the Environment	Government authority responsible for regulation of coastal and caye development activities, and of large scale agricultural and industrial activities in the watersheds
Geology and Petroleum Department	Government authority responsible for regulation of dredging and oil exploration / extraction activities
Belize Tourism Board	Provide training, certification and licensing framework for tour guides, tour operators and hotels. Potential to promote tourism that uses the protected area
Tour Guides	Have livelihoods based on the marine resources of the area. Provide interpretation for tourists, and guide visitor behaviour
Traditional Fishermen	Have livelihoods based on the marine resources of the area – finfish, conch and lobster.
Fishing Cooperatives	Promote and encourage increased extraction of marine product. Link fishermen with the export market
Coastal and Caye Developers	Clear terrestrial ecosystems and mangroves to build on coast and cayes of PHMR, with the potential to impact the environment - including dredging, seawalls, and over-water constructions. May also be willing to use best practices
Tourism Services – hotels, resorts, restaurants	Rely on the aesthetic beauty of Port Honduras Marine Reserve for attracting guests to the area. Provide employment and training in the tourism industry, and the services to build Toledo as an environmentally sound destination. Provide interpretation activities for visitors.
Belize Coast Guard	Responsible for security to life and property

Table 7: *Key Stakeholders of Port Honduras Marine Reserve*

Table 8: Stakeholder Analysis for Port Honduras Marine Reserve

Stakeholder	Influence or Impact of Port Honduras Marine Reserve on Stakeholder		Influence or Impact of Stakeholder on Port Honduras Marine Reserve	
Community Stakeholder Monkey River, Punta Negra, Punta Gorda (including Cattle Landing)	▪ Management of reef, other ecosystems and species of PHMR supports fisheries and tourism incomes	+	▪ Effective protected area management with the cooperation and collaboration of stakeholders	+
	▪ Facilitates a shift in the income base from fisheries dependency to tourism and associated opportunities, with increased economic benefits	+	▪ Greater stewardship by community stakeholders – particularly youth – based on knowledge of the importance of PHMR and environmental services it provides	+
	▪ Improved access to income diversification opportunities as a result of presence of TIDE	+	▪ Reduced impacts on reef through adoption of reef tourism Best Practices as a result of awareness and alternative livelihood training	+
	▪ Improved knowledge through TIDE education and awareness, associated with the protected area	+	▪ Illegal fishing within the No-Take zones	-
	▪ Long term investment in the protection of marine resources in perpetuity for future generations	+	▪ Anchor damage to coral and seagrass	-
	▪ Exclusion from traditional fishing areas	-	▪ Impacts from poorly planned coastal and caye development	-
			▪ Tourism impacts in heavy-use areas	-
Commercial Fishermen (Southern Belize)	▪ Protection of fish, lobster and conch resources within the Conservation and Preservation Zones ensuring continued viability of fishery	+	▪ Some support for effective management of MPA	+
	▪ Improved access to income diversification opportunities as a result of presence of TIDE, reducing fishing pressure	+	▪ In some areas, low level of cooperation and some open antagonism towards protected area	-
	▪ Exclusion from traditional fishing areas	-	▪ Illegal fishing within the Conservation and Preservation Zones / at night	-
			▪ Fishing impacts within protected areas (including damage to coral)	-
Transboundary Fishermen (Guatemala and Honduras)	▪ Protection of fish, lobster and conch resources within the Conservation and Preservation Zones ensuring continued viability of fishery	+	▪ No cooperation or openly antagonistic towards protected area	-
	▪ Exclusion from fishing (illegally) in Belize waters	-	▪ Illegal fishing within the No Take Zones / at night	-
			▪ Illegal harvest of non-fishery species (turtles, shells, coral etc.)	-
			▪ Illegal fishing impacts within protected areas (including damage to coral)	-

Table 8: Stakeholder Analysis for Port Honduras Marine Reserve (cont.)

Stakeholder	Influence or Impact of Port Honduras Marine Reserve on Stakeholder		Influence or Impact of Stakeholder on Port Honduras Marine Reserve	
Tour Guides (including sport fishing guides and tour boat captains) (Belize)	▪ Benefit from having PHMR as destination for snorkeling, dive and sports fishing related tourism	+	▪ Largely support the conservation goals of the Marine Reserve	+
	▪ Benefit from training opportunities associated with TIDE and Port Honduras Marine Reserve	+	▪ Provide interpretation for visitors, facilitating overall visitor appreciation	+
	▪ Employment in marine-based tourism initiatives	+	▪ If well trained, assist with visitor management within the protected area through in-depth briefings	+
	▪ Income from using Port Honduras Marine Reserve for tourism	+	▪ If poorly trained, can result in poor visitor management and increased impact on corals and associated fauna, anchor damage etc.	-
		-		
Local / National / International Tour Operators	▪ Benefit from having PHMR as a venue for marine-associated tourism	+	▪ Provide marketing at a local, national and international level, and send visitors to PHMR	+
	▪ Income from using Port Honduras Marine Reserve as a tourism destination	+	▪ Support the conservation goals of the Marine Reserve	+
			▪ Provide a financial sustainability mechanism for management of the protected area	+
			▪ Increase the potential for exceeding the carrying capacity of the protected area	-
Hotels / Resorts	▪ Benefit from having PHMR as a venue for guests	+	▪ Provide accommodation for visitors to PHMR	+
			▪ Increase awareness and knowledge of PHMR	+
			▪ Negative impacts to the environment if unregulated	-
BTIA	▪ Benefit from having PHMR as a tourism attraction	+	▪ Provide national and international marketing of PHMR	+
			▪ Support the conservation goals of the Marine Reserve	+
Local NGOs	▪ Provided capacity building opportunities through TIDE, linked to PHMR	+	▪ Support sustainable fishing practices	+
			▪ Facilitate sustainable employment opportunities	+
			▪ Promote improved stewardship of the environment by local communities	+
General Belize Public	▪ Maintenance of access to fish, lobster and conch	+	▪ Support of the general public will strengthen the position of protected area	+
	▪ Environmental services	+		
	▪ Cultural and aesthetic appreciation	+	▪ Lack of support may increase chances of dereservation	-
	▪ Increased awareness through education	+		

Table 8: Stakeholder Analysis for Port Honduras Marine Reserve (cont.)

Stakeholder	Influence or Impact of Port Honduras Marine Reserve on Stakeholder		Influence or Impact of Stakeholder on Port Honduras Marine Reserve	
Visitors: Tourists	▪ Enjoy Port Honduras Marine Reserve as a tourism destination	+	▪ Entrance fee contributes towards financial sustainability	+
	▪ Benefit from education and awareness opportunities	+	▪ Provide marketing nationally and internationally by word of mouth, if happy with level of product	+
			▪ Presence deters illegal fishing within the No Take zones	-
			▪ May negatively impact marine environment	-
Visitors: Researchers	▪ Benefit from being linked to PHMR and TIDE	+	▪ Conservation management benefits from data gathered	+
	▪ Benefit from access to a protected marine environment	+	▪ Greater knowledge of marine environments and species within area	+
	▪ Benefit from historic baseline information on past research activities within protected areas	+	▪ Presence deters illegal fishing within the No Take zones	+
			▪ Possible impact of research activities	-
Sailboat Charter Companies	▪ Benefit from maintenance of aesthetic beauty and biodiversity values of PHMR as a destination	+	▪ Support the conservation goals of PHMR	+
			▪ Impacts of sewage and detergent, bilge water. grey water and oil	-
			▪ Visual impact of non-traditional sailing boats	-
			▪ Anchor damage on mooring sites	-
			▪ Potential for grounding on the reef	-
			▪ Lack of compliance with rules and regulations due to limited awareness and knowledge of area	-
Belize Fisheries Department	▪ Part of Belize's marine protected areas system, for management of commercial species for benefit of fishing Industry	+	▪ Provides staff, fuel and training for surveillance and enforcement of PHMR	+
	▪ Generates revenue for the Fisheries Department	+		
Government of Belize	▪ Provides environmental services for Belize	+	▪ Provides finance for fisheries management for the fishing industry	+
	▪ PHMR included within the National Protected Areas System Plan - assists in fulfilling Belize Government's commitment to the conservation of natural resources, CCAD, CBD, and WHS	+	▪ Limited political support	-
			▪ Uncertainty of long term future commitment	-
	▪ Income generation of foreign revenue	+		
	▪ Provides employment opportunities in stakeholder communities	+		

1.4 Physical Characteristics

1.4.1 Climate

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 of Port Honduras Marine Reserve. The predominant winds are the ***Trade Winds***, blowing from the east and north-east from April to October, interspersed by tropical storms. ***Northers*** - high-pressure fronts moving down from the north - occur between October and April, bringing cooler weather (Figure 4).

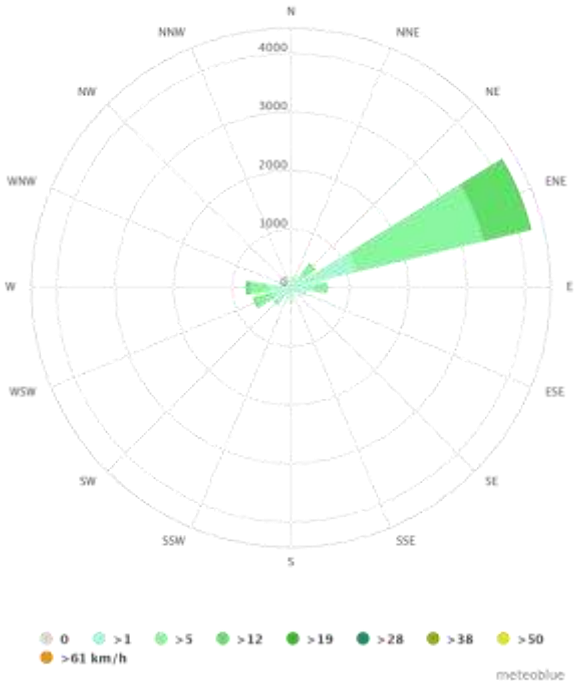


Figure 4: *Wind rose for Punta Gorda (*www.worldweatheronline.com, 2016)

Temperature

The annual mean temperature in the PHMR area is 28°C, fluctuating throughout the year from a minimum monthly average of 20°C in February, and maximum of 34°C in May (based on 2016 figures (Figure 5).

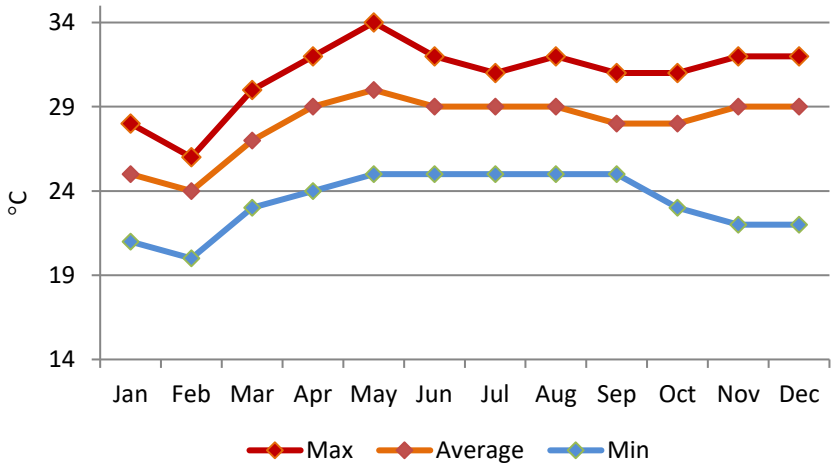
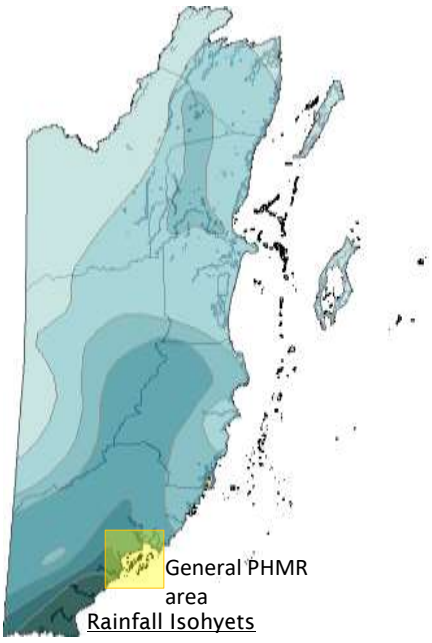
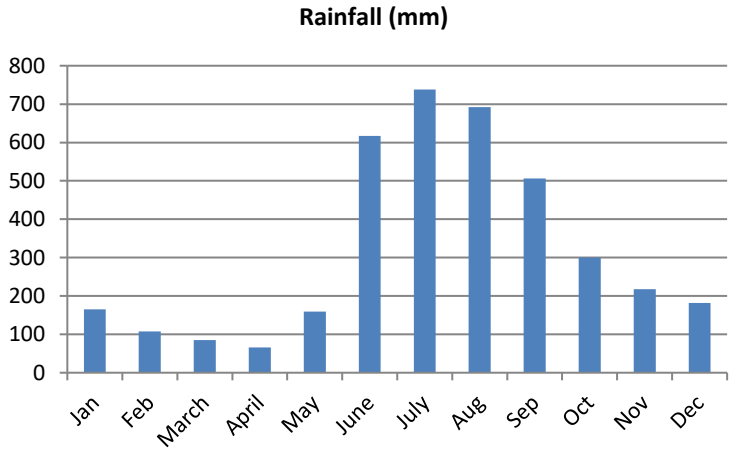


Figure 5:: *Maximum, minimum and mean temperature average per month – Punta Gorda (*www.worldweatheronline.com, 2016 data)

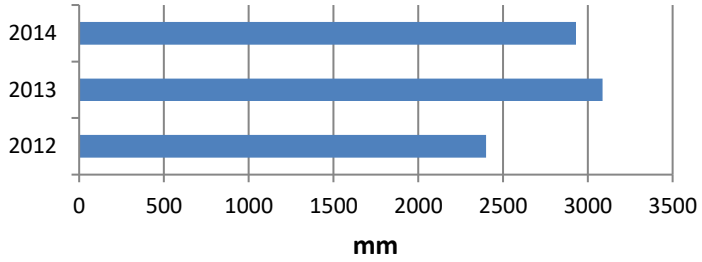
Rainfall

Port Honduras Marine Reserve lies within the highest rainfall belts in Belize, with between approximately 4000 and 4500 mm of rain per year (Figure 6). The driest months are from February to April with rainfall ranging from 40-70mm per month, whilst in the wettest months (June through to September) rainfall frequently exceeds 400mm per month and often in excess of 700mm (Heyman & Kjerfve, 1999).





Monthly precipitation data for Punta Gorda, Southern Belize for Belize during 2008 (www.climate-charts.com)



Annual precipitation data for Golden Stream Ranger Station Southern Belize, 2012 – 2014 (Ya'axche Conservation Trust)

Figure 6: *Rainfall*

Tropical storms affect Belize every year between June and November. 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 and Central American coastline, gathering strength until they hit land. They generally bring extreme weather conditions – heavy rains, destructive winds. Whilst many hurricanes have very focused paths of destruction, their effects are wide ranging, particularly in the marine and coastal environments. 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. All tropical storms, even tropical depressions, can bring increased rainfall, causing extensive flooding of the coastal savannas, and water flow from the rivers, decreasing the salinity of Port Honduras Marine Reserve and the Gulf of Honduras. 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.

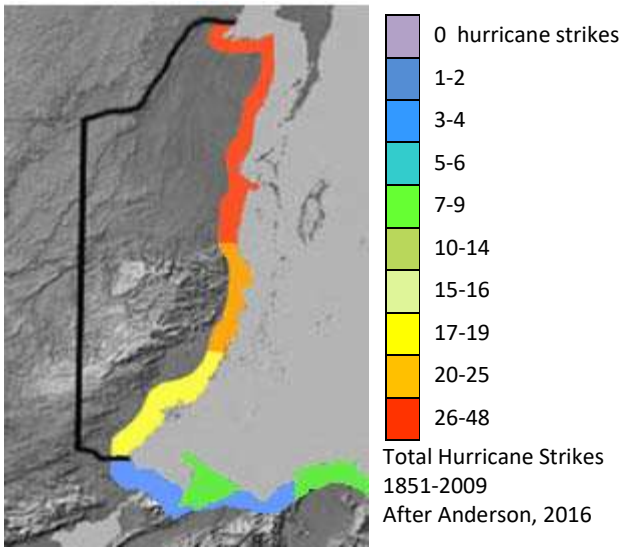


Figure 7: *Frequency of hurricane strikes in Belize, 1851 – 2009. After Anderson, 2016*

Figure 8: *Hurricane and Tropical Storm paths passing through or within 50km of PHMR (www.coast.noaa.gov, 2017)*

Southern Belize is sheltered from many of the tropical storms that spawn in the Caribbean when compared with the coastline in northern Belize (Figure 7), but nevertheless, PHMR has been affected on a regular basis, with some of the passing storms reaching hurricane strength. Stronger storms of most note have been Hurricane Iris (2001), Hurricane Fifi (1974), and Hurricane Francelia (1969).

Historical records identify 16 tropical storms / hurricanes that have impacted PHMR between 1918 and 2014, either passing directly across the Marine Reserve, or coming within a 50km radius of the area (Figure 8). This includes 10 tropical storms, 3 Category One hurricanes, 2

Category Two, and 1 Category Four. A further 9 tropical depressions were also reported (Table 9; NOAA, 2017).

Name	Cat.	Date Passed <50km of PHMR	Name	Cat.	Date Passed <50km of PHMR
Hanna	TD	Oct 29, 2014	Hattie	TS	Oct 31, 1961
Barry	TD	Jun 17, 2013	Abby	TS	Jul 15, 1960
Helene	TD	Aug 15, 2012	Gilda	TS	Sep 27, 1954
Harvey	TS	Aug 21, 2011	Francelia*	H2	Sep 4, 1969
Matthew	TS	Sep 25, 2010	Anna	H1	Jul 24, 1961
Felix*	TD	Sep 5, 2007	Unnamed*	H1	Oct 4, 1945
Iris*	H4	Oct 9, 2001	Unnamed	TD	Sep 21, 1942
Kyle	TD	Oct 12, 1996	Unnamed	TS	Sep 28, 1941
Unnamed	TD	Sep 25, 1994	Unnamed*	TS	Jun 8, 1934
Gert	TS	Sept 18, 1993	Unnamed	TS	Oct 1, 1932
Unnamed	TD	Oct 29, 1975	Unnamed	TD	Oct 5, 1926
Fifi	H2	Sept 19, 1974	Unnamed	H1	Aug 26, 1918
Laura*	TS	Nov 21, 1971	*Passed within the border of PHMR		

Table 9: *Hurricanes passing within 50km of PHMR (www.coast.noaa.gov)*

Hurricanes can also result in major changes to the shapes and sizes of cayes and sandbars within the marine reserve, as well as causing damage to infrastructure on the cayes. The most recent extreme hurricane impacts have been from Hurricane Mitch (1998) and Hurricane Iris (2001). In late October, 1998, shortly after peak bleaching temperatures, Hurricane Mitch swept across the Gulf of Honduras, to then stop 400km east of the southern coastline for 2 days, adjacent to the Bay Islands of Honduras. Even though it did not hit Belize directly, its proximity did significant damage to the reef. However, the mixing of the cooler and hotter waters by the passing storm is thought to have mitigated some of the impacts of coral bleaching experienced earlier in the year.

Hurricane Iris made landfall near Monkey River, slightly to the north of the Marine Reserve, on the 9th October, 2001. The area of impact was relatively small, with hurricane force winds extending out for only 30km. The 140mph winds and the associated storm surge of 14 feet, however, resulted in significant devastation in the coastal and caye areas.

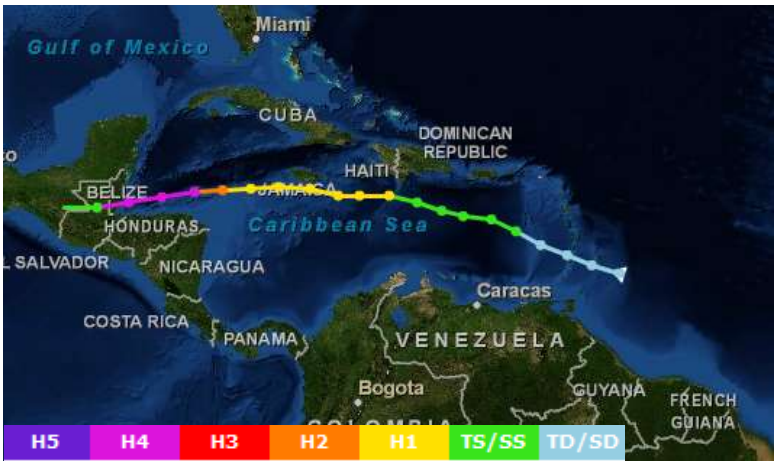


Figure 9: *Hurricane track: Hurricane Iris (www.csc.noaa.gov, 2011)*

Climate Change: Whilst these weather patterns have been relatively reliable over many years, they are now changing, with temperature patterns from January 2009 to December 2016 showing an increase in overall temperature, with maximum average monthly temperatures peaking in September 2015 at 36°C, whilst minimum termperatures in each year have steadily increased from 17°C in January 2009 to 20°C in February 2016 (Figure 10; www.worldweatheronline.com).

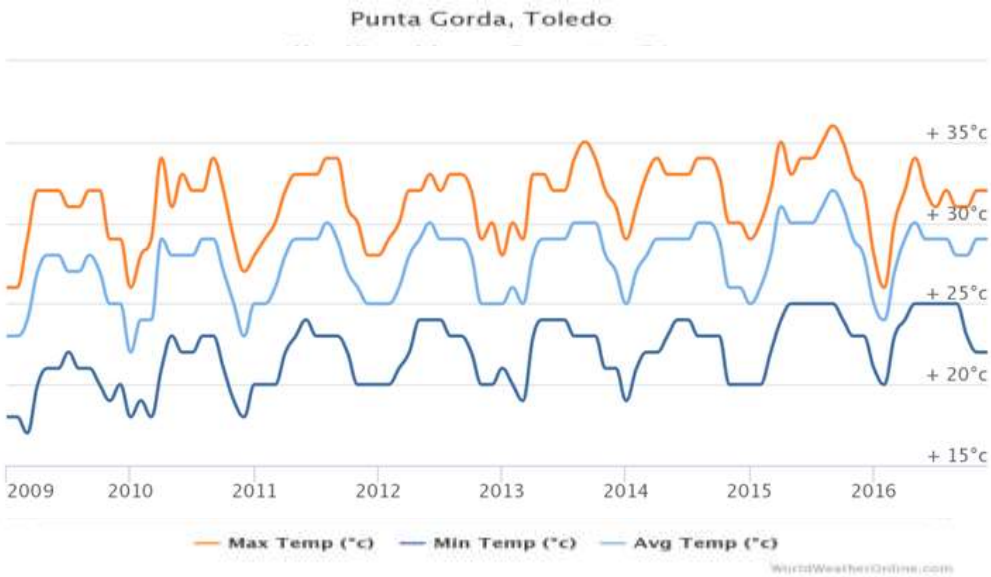


Figure 10: *Rainfall patterns, 2009 - 2016 (www.worldweatheronline.com)*

Climate change is having a very real impact on the health of the marine environment – with increasing sea temperatures resulting in reduced coral health and viability, ocean acidification, and increasing intensity of storms. An assessment of potential climate change impacts is included in Section Two: Conservation Planning.

1.4.2 Geology

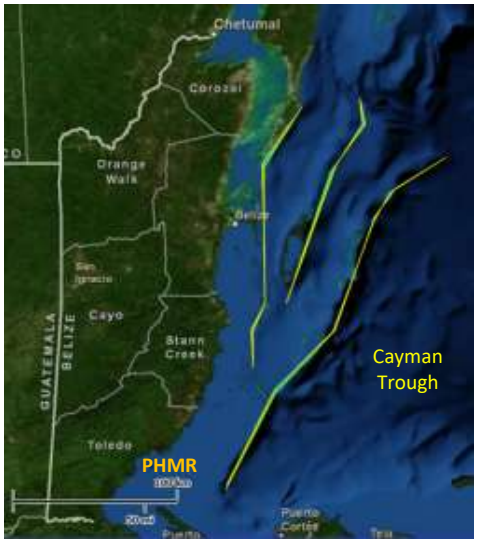


Figure 11: *Fault lines / escarpments running parallel to the Belize coastline, forming the base of the barrier reef and atolls (Based on Purdey et al.,*

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, in the southern seascape, on top of the third of three northeast-southwest escarpments that lie off the coastline (Figure 11). The first escarpment runs parallel to the coast, dropping off to the east to a depth of about 1 km, and supporting the largest and best develped section of the Belize barrier reef. In the southern portion, oceanic impacts on Port Honduras Marine Reserve are mitigated by the reefs of the Sapodilla Cayes. The barrier reef in this section follows the third escarpment, and is less well formed. The breaks between sections of reef crest allow the cooler waters of the Caribbean Sea to flow onto the coastal shelf, reducing water temperatures, and increasing seascape connectivity.

1.4.3 Bathymetry

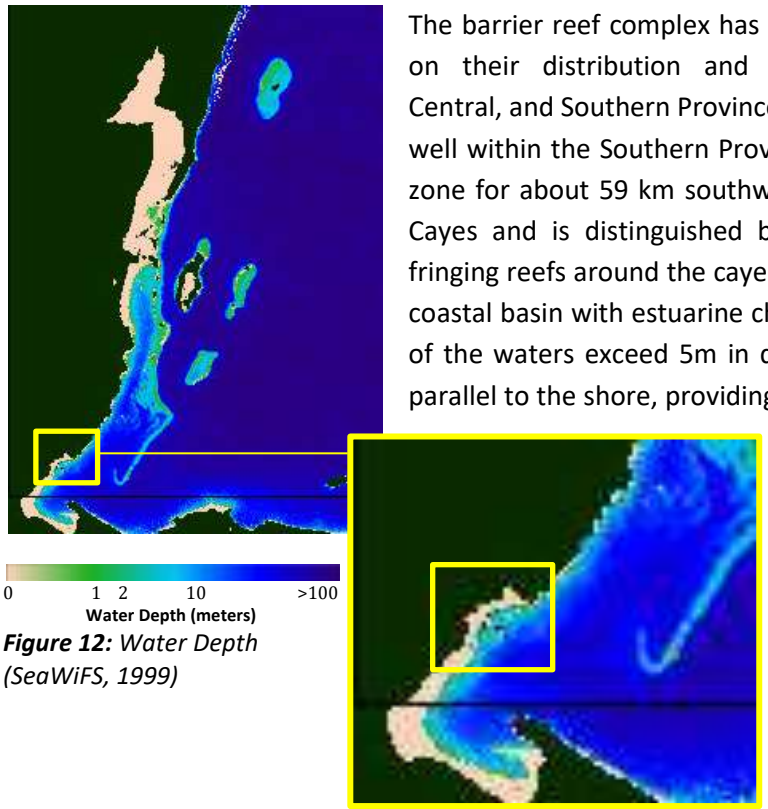


Figure 12: *Water Depth (SeaWiFS, 1999)*

The barrier reef complex has been divided into three provinces based on their distribution and geomorphic characteristics: Northern, Central, and Southern Provinces (Burke, 1982). The Marine Reserve lies well within the Southern Province, which extends through the coastal zone for about 59 km southwards from Gladden Spit to the Sapodilla Cayes and is distinguished by shallow-water reefs, which occur as fringing reefs around the cayes. Port Honduras Marine Reserve lies in a coastal basin with estuarine characteristics (Figure 12). Although much of the waters exceed 5m in depth, two shallow carbonate banks run parallel to the shore, providing a base for many of the cayes and acting as sediment traps, preventing much of the riverine sediment from reaching the coral reefs (Sullivan et. al., 1995). These banks are separated by deep channels (Heyman et al., 1999).

1.4.4 Tides and Water Movement

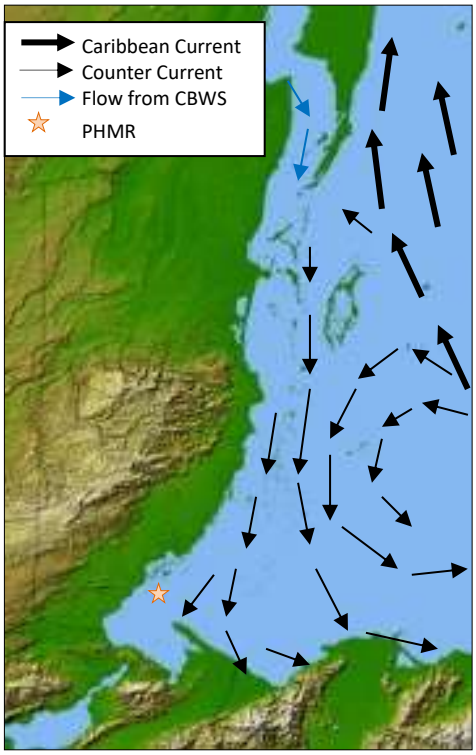


Figure 13: *Currents of the Belize coast*

The mixed, primarily semidiurnal tide is of limited importance in southern Belize with a range of only 20 cm (Kjerfve, 1981).

On a regional scale, the oceanic, warm-water Caribbean (or Cayman) Current forms the main surface circulation in the Caribbean Sea, flowing westwards from the Lesser Antilles towards southern Belize. The current then travels northwards offshore, beyond the atolls, and eventually through the Yucatan Channel. This results in a counter clockwise gyre in the Gulf of Honduras area, including much of the coastal waters of Belize, which flows south / southwest, at a rate of 1 to 2 knots, past the Belize coastline and Barrier Reef (Figure 13; Heyman et al., 2000; Stoddart, 1962), through the shelf lagoon and offshore basins (Purdy et al., 1975), with strong currents up to 5 knots in the reef channels especially during low tides.

The high precipitation in the watersheds leads to significant runoff of freshwater, with a high sediment load, between June and September, which drives gravitational currents and lowers water transparency. The resulting surface current flows east between Punta Manabique and the Sapodilla Cayes. Deep, clear, nutrient-rich oceanic waters occasionally enter the Gulf of Honduras from the Caribbean Sea, with deep currents flowing contrary to prevailing surface current (Heyman et al., 1999).

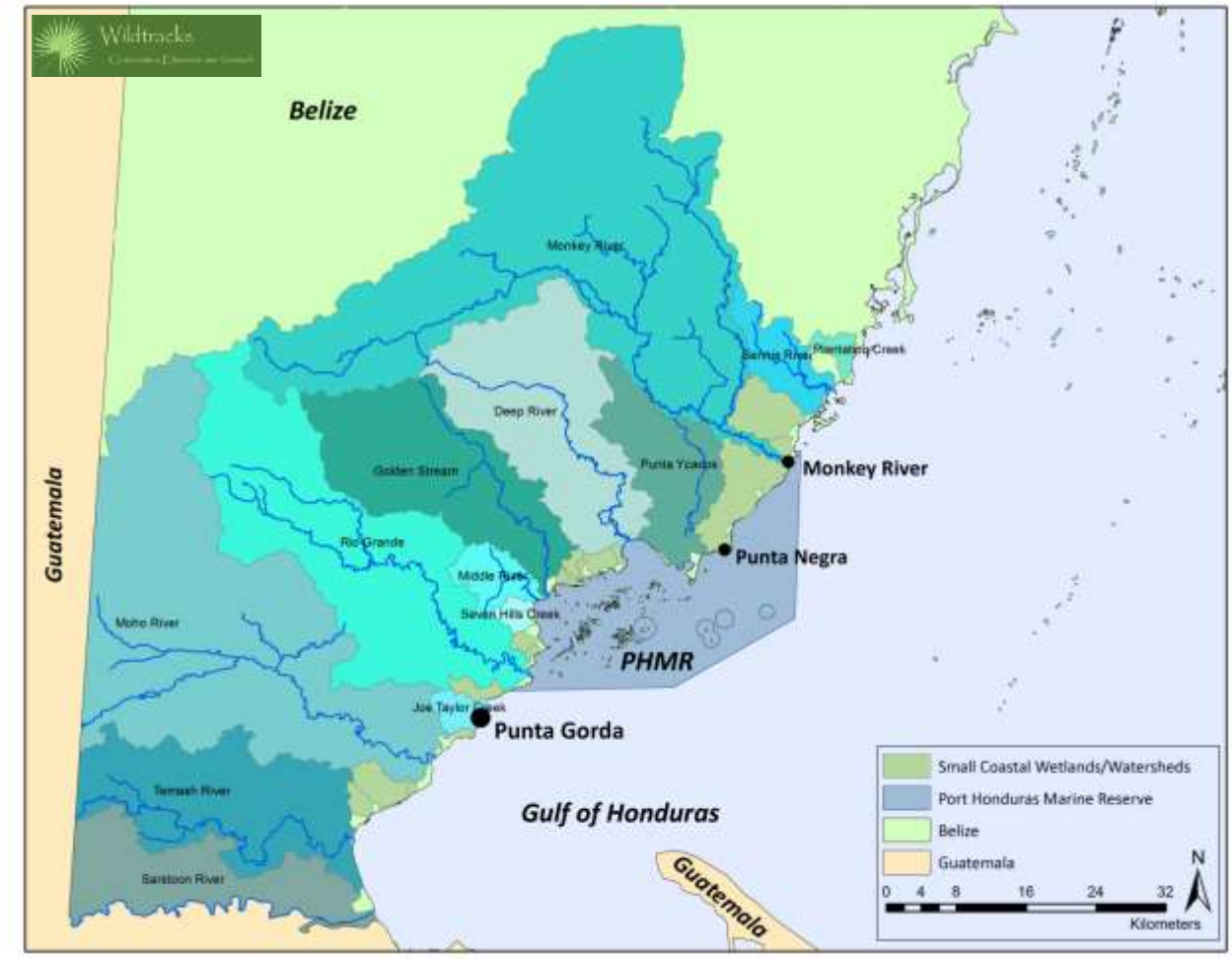
Knowledge of oceanic and coastal currents is essential in determining the transport of larvae, nutrients and pollutants, as well as abetting the spread of disease and invasions (demonstrated by the rapid spread of disease in *Diadema antillarum* throughout the Caribbean region in the 1980s). Connectivity through currents has also resulted in the rapid invasion of Belize by the lionfish (*Pterois volitans*), which has been increasing exponentially at Port Honduras Marine Reserve, as part of a larger, regional invasion.

1.4.5 Hydrology and Water Quality

Hydrology

Hydrologic process are critical in the characterisation of the estuarine environment of Port Honduras Marine Reserve. As part of a larger seascape – the Gulf of Honduras – the estuarine condition os PHMR are influenced not only by the rivers and watersheds of southern Belize, but also those of Guatemala

and Honduras. At the site level, six major watersheds empty directly into Port Honduras Marine Reserve, with a further 6 flowing into the adjacent seascape (Map 3). A series of small coastal wetlands / watersheds also flow into the sea from the southern Belize. coastline.



Map 3: *Watersheds flowing into Port Honduras Marine Reserve*

Port Honduras Marine Reserve is seasonally brackish, and highly sensitive to upland activities that alter sedimentation rates and surface water flow (Heyman et al., 1999). During the rainy season, the water column becomes highly stratified, with fresh, often very turbid water at the surface, and freshwater plumes frequently extending as far as the Snake Cayes (Foster, 2010a). River plumes from these watersheds have a significant impact on the Marine Reserve, which are turned southwards along the coast by the prevailing southward-directed winds and currents (Heyman et al., 1999).

Monkey River: During the rainy season, when easterly trade winds are light, the red–orange surface plume of Monkey River extends 1 km to the north, 3–5 km to the east, and more than 15 km to the south and southeast, approaching the Snake Cayes. The river carries a high load of granitic sands, which form a submarine fan and historically contribute to the maintenance of the siliceous sand beach, which

extends south to Punta Ycacos (Heyman et al., 1999). More recent activities in the watershed have altered water flow and sedimentation patterns, leading to reduced beach deposition, and increased beach erosion – and issue for the Monkey River community.

Deep River: The plume from Deep River extends seaward 2–5 km during the wet season and usually veers south into the large bight formed at the southern end of the river mouth (Heyman et al., 1999). During the dry season, however, surface plumes from Deep River and Ycacos generally extend less than 0.5 km, with higher salinities ranging between 29‰ and 36‰ (Heyman et al., 1999).

Ycacos Lagoon: The Ycacos Lagoon drains the Punta Ycacos watershed, and is bound to the east by a thin strip of sand between Punta Negra and Monkey River. During the rainy season, a hydrologic head develops in the lagoon, pushing 10–15 intermittent canals through the granitic sand berm and releasing dark brown, tannin-stained fresh water to PHMR (Heyman et al., 1999).

Golden Stream / Middle River: The river plumes from Golden Stream and Middle River extend eastward but are difficult to distinguish from each other and the turbid inshore coastal waters of southern Port Honduras (Heyman et al., 1999).

Rio Grande: The plume from Rio Grande is characteristically reddish brown and more distinct from slate-coloured turbid inshore waters than the other rivers. During the rainy season, the plume can extend 4–6 km due east (Heymanet al., 1999).

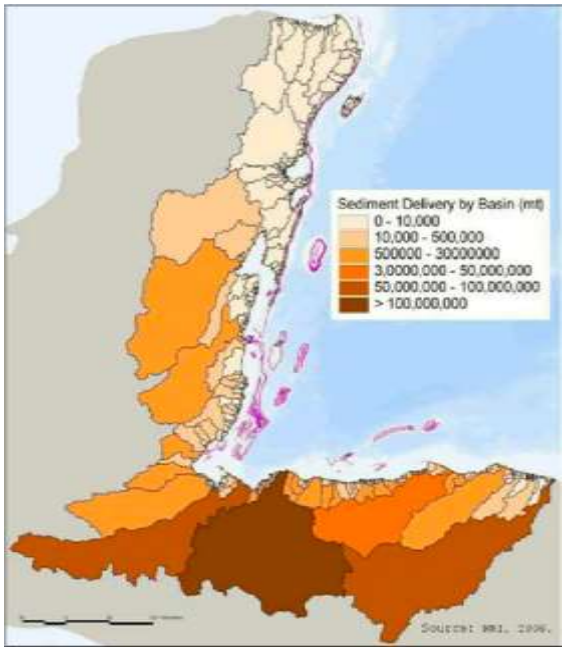


Figure 14: *Sediment Delivery by Watershed Basin (Burke et al. 2006)*

Sedimentation and agrochemical contamination from mainland watersheds have been highlighted as perhaps one of the greatest impacts on the Belize reef, after climate change. Port Honduras Marine Reserve lies east of six watersheds, which drain some of the principal banana growing areas of southern Belize (Figure 14). 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. This is overshadowed by the watersheds emptying into the Gulf of Honduras from Guatemala and Honduras (particularly the Ulua, Motagua, Patuca and Aguan) where land use change has removed much of the natural vegetation from the formerly forested slopes (Burke et al., 2006).

Sediment core analysis of two sites within the Belize reef system (Turneffe Atoll and Sapodilla Cayes), indicate that watershed 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, with greater urgency for action to reduce runoff impacts (Carilli et al., 2009).

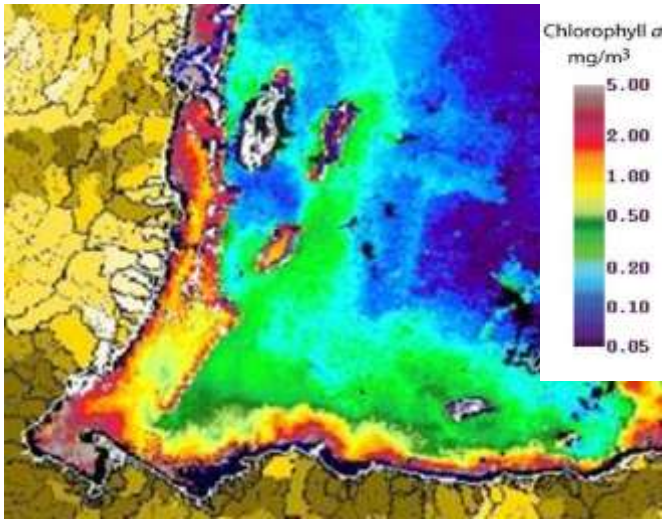


Figure 15: *SeaWifs Chlorophyll α. After Shank et al. 2010/ Soto et al. 2009*

- 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 modeled 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 as far north as Gladden Spit, and even out as far as Glover's Reef Atoll, during these storm events (Figure 15; 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).

Water Quality

Primary threats on water quality in Port Honduras Marine Reserve originate primarily in the watersheds, and have been identified as domestic pollution (particularly detergents), and pollution from agricultural, aquaculture and fire-impacted landscapes in the watersheds. There is also the continuous threat of oil exploration, extraction and associated impacts. As water quality, with the variations in temperature, salinity, dissolved oxygen, turbidity and pH, impacts the viability and health of all conservation targets, it is an important part of the biological monitoring program. Water quality has been monitored in PHMR since 1998, the program being expanded and strengthened in 2011 to include new sites, multiple depths, new parameters and revised and standardised methods. More recently, TIDE has integrated the

water quality monitoring activities in PHMR with those of the parallel freshwater program, with the addition of nitrates and phosphates, to inform "ridge-to-reef" management of marine and terrestrial protected areas under TIDE.

Water quality has been assessed at 43 sites on a monthly basis, with 27 in PHMR (marine), 8 in Monkey River and 8 in Rio Grande (freshwater). Eight parameters are measured (Table 10) and, where possible, data is collected at 1m, 5m, 10m and 15m depths at each monitoring site in PHMR.

TIDE Water Quality Parameters
Marine
Temperature
Salinity
Dissolved Oxygen
pH
Turbidity (vertical visibility)
Nitrate-nitrogen
Orthophosphate-Phosphorus
Sedimentation

Table 10: *TIDE Marine Water Quality Parameters*

Temperature: Within Port Honduras Marine Reserve, water temperature varies seasonally and across years (Figure 16; Figure 17). Increased water temperature of even 1°C can initiate a bleaching response in hard and soft corals and may affect the metabolism of many fish and invertebrates, especially during their early life stages (Munday et al., 2008). In the estuarine environment, hotter waters, and the associated reduced oxygen availability, can also result in fish kills, particularly of bottom dwelling species such as catfish and pufferfish. Despite the variations between sites, a clear pattern can be seen in water temperature over the years. Between October and February, water temperatures are cooler, when winds are frequently from the north, while water temperatures from May to September are warmer (Figure 16).

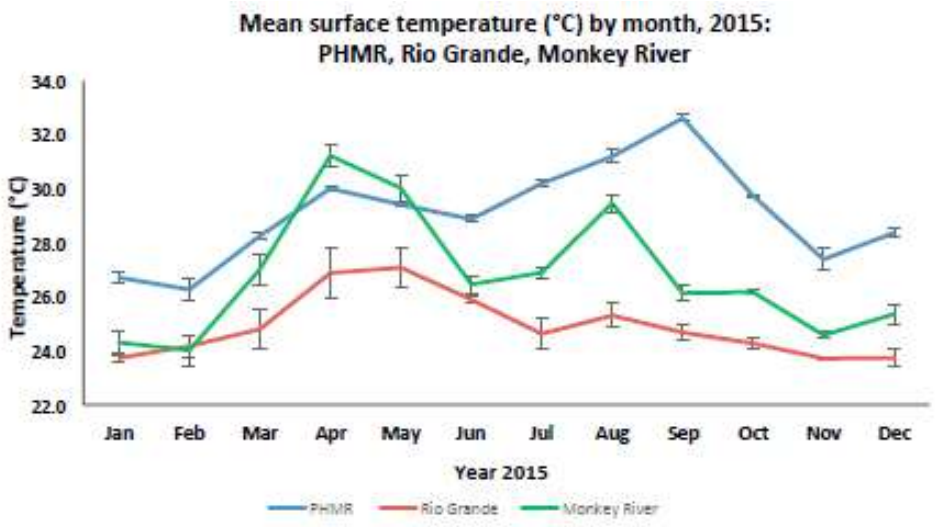


Figure 16: *The mean sea surface temperature by month in PHMR, Rio Grande and Monkey River in 2015 (TIDE)*

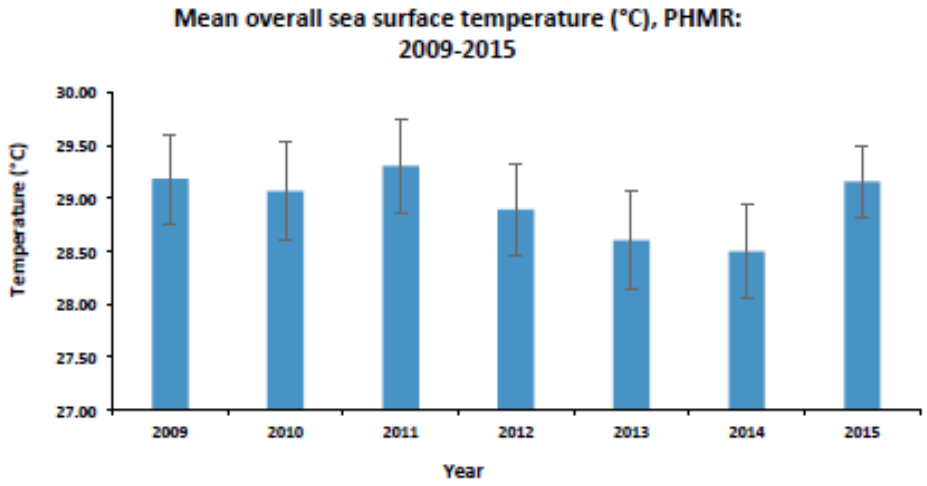
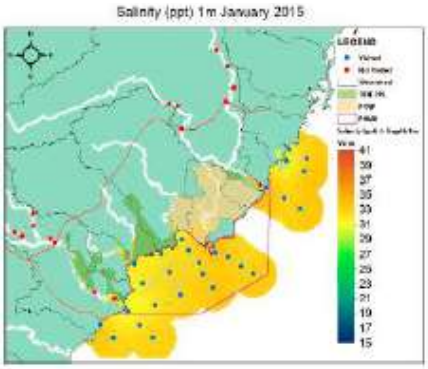


Figure 17: *Mean surface temperature by month 2009 – 2015.*

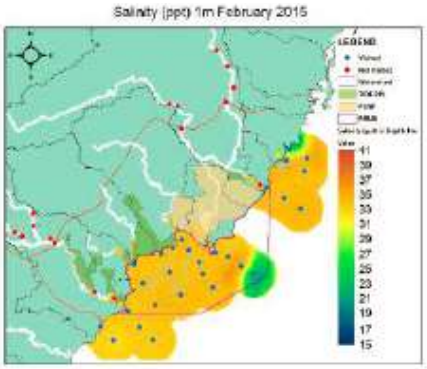
From 2009 to 2014, there was a trend of declining mean sea surface temperature in PHMR, which ended in 2015 with a noticeable increase. Whilst 2015 demonstrated the highest recorded temperatures, the cool temperatures in the early and late part of 2015 offset this, bringing the mean overall sea surface temperature below that of the 2011 level (Figure 17).

Salinity: The freshwater influxes from the six watersheds that flow into PHMR have a strong, seasonal influence on the salinity in PHMR. Changes in salinity can affect reproduction and physiological responses in many organisms including fish and corals (Vermeij et al., 2006; Koenig et al., 2007). Variation in salinity in PHMR is evident over the year with June to August / September having the lowest salinity values, coinciding with the rainy season. Greatest seasonal variation occurs at the river mouths (Figure 18).

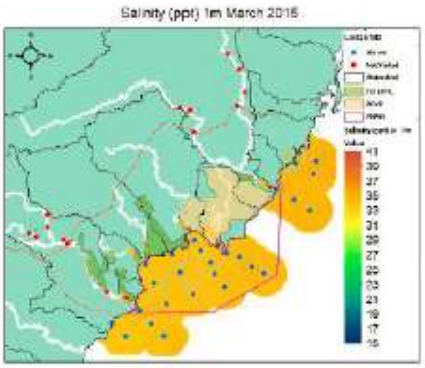
January 2015



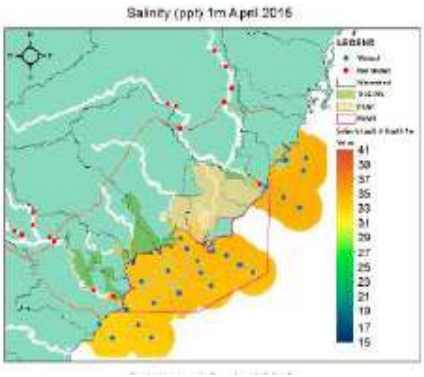
February 2015



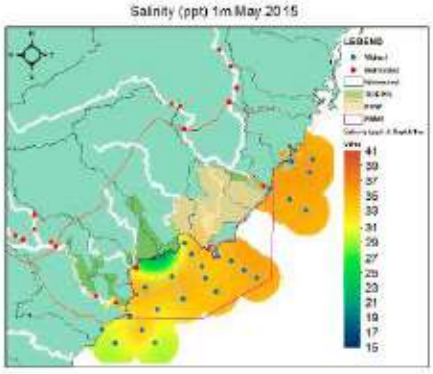
March 2015



April 2015



May 2015



June 2015

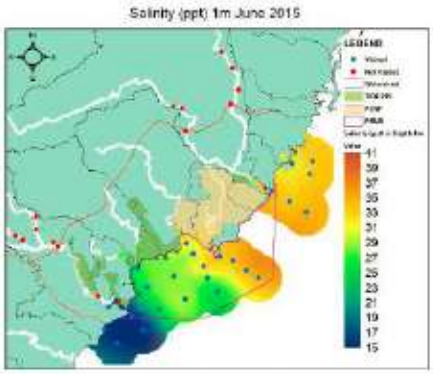
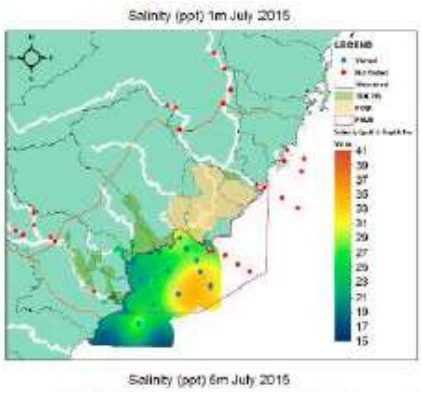
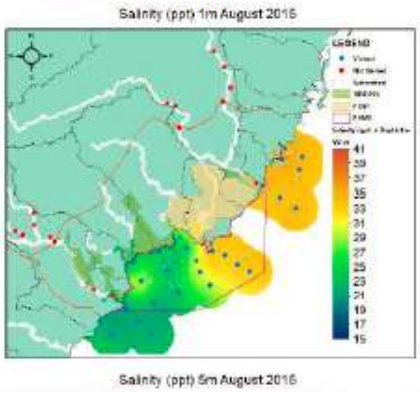


Figure 18a: *Salinity maps from January to December 2015 at 1m depth – PHMR, Rio Grande, Monkey*

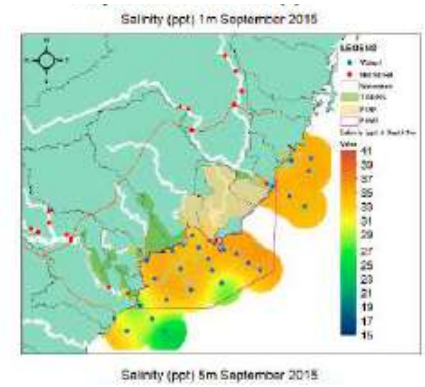
July 2015



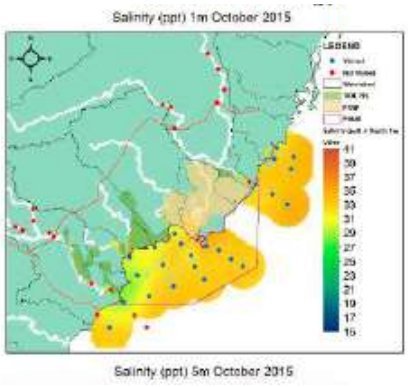
August 2015



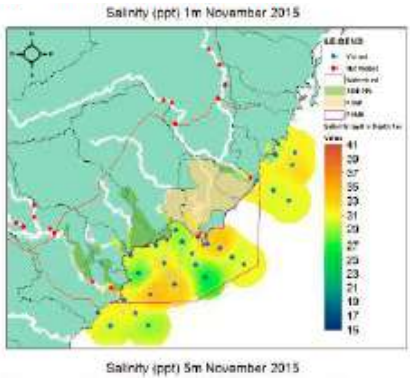
September 2015



October 2015



November 2015



December 2015

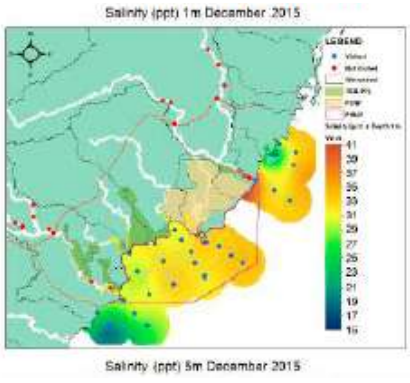


Figure 18b: *Salinity maps from January to December 2015 at 1m depth – PHMR, Rio Grande, Monkey*

The waters of the Marine Reserve exhibit pronounced haloclines – layering of waters with different concentrations of salinity, particularly during the rainy season and particularly pronounced in areas where the rivers enter the estuary. The less dense surface waters from the rivers lying on top of the denser seawater. Mixing of these layers is limited by the shallow banks, protecting the inshore waters from significant offshore wave-action, and salinity can vary from freshwater to over 30 ppt. As a result, the greatest variability over time occurred at the water surface (1m), while there was significantly less variation in the 5-15m depth range, especially between January and May (Figure 19; TIDE, 2015).

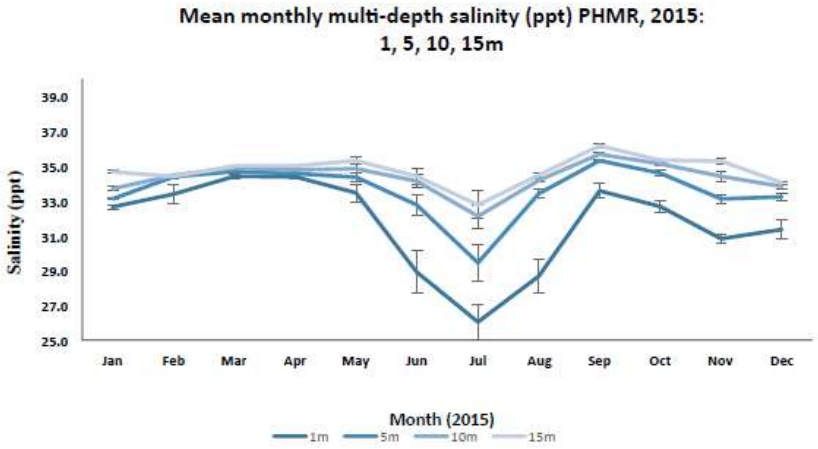


Figure 19: *Mean salinity in PHMR at different depths (TIDE data, 2015)*

Dissolved Oxygen: The productivity of PHMR is tightly linked to the level of dissolved oxygen in the water column, determining the abundance and diversity of organisms that can be supported. Dissolved oxygen concentrations within PHMR vary between years. Overall there is a similar trend in both rivers and the sea of higher mean surface dissolved oxygen levels in the early and late part of the year (Figure 20). Average, mean surface dissolved oxygen has increased from 2012 to 2015.

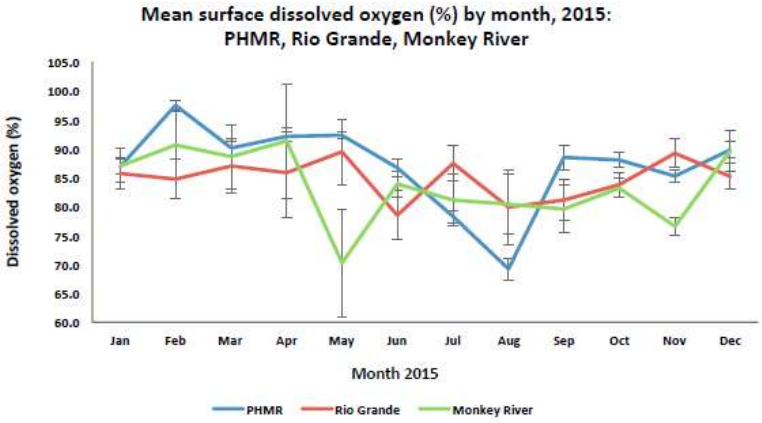


Figure 20: *Mean salinity in PHMR at different depths (TIDE data, 2015)*

pH: The acidity of water can have serious implications on coral health and formation, especially with the global increase in ocean acidification. In general, pH levels in Port Honduras Marine Reserve are alkaline (Figure 21), readings ranging between 8.00 to 8.4,

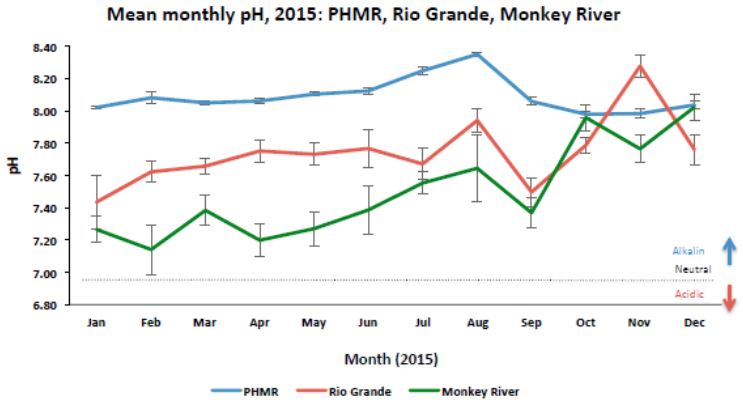


Figure 21: *Mean pH in PHMR at different depths (TIDE data, 2015)*

as a result of the influence of the calcium carbonate from the karst limestone bedrock in the watersheds. While pH levels should decrease when salinity decreases (as salt water is naturally more alkaline), the pH levels in PHMR actually increased whilst salinity decreased, suggesting the calcium carbonate-rich water influx from the rivers may be a stronger driver of the pH trends in PHMR than the neutralizing effect of dilution of salt water.

Turbidity (Vertical Visibility): Visibility is linked to rainfall, with heavy storms during the wet season carrying sediment into PHMR frm the watersheds. The turbidity, along with depth, determines the amount of sunlight that can penetrate the water and can influence the health of seagrass growth and other aquatic vegetation. Port Honduras Marine Reserve is known for its turbid environment. Visibility generally increases with distance from shore, with the lowest visibility trends near the mouths of the Rio Grande and Middle River/Golden Stream, whereas beyond the shallow banks the water has far greater clarity.

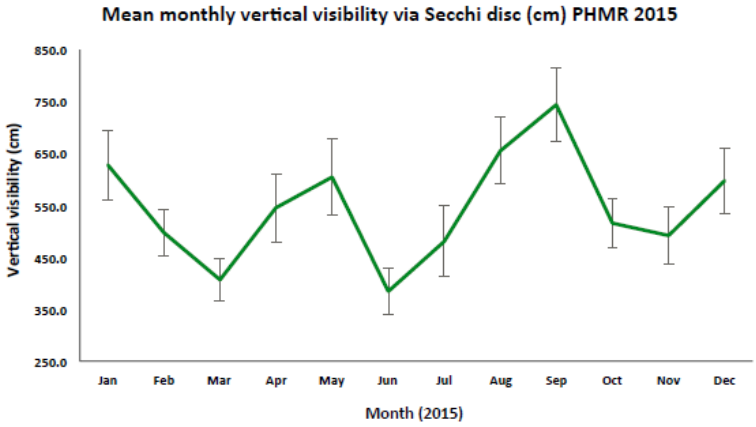
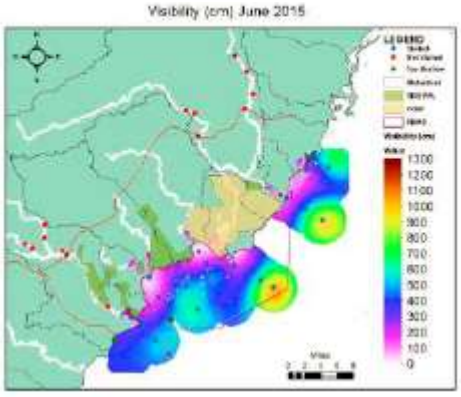


Figure 22: *Mean visibility in PHMR at different depths (TIDE data, 2015)*

June 2015



September 2015

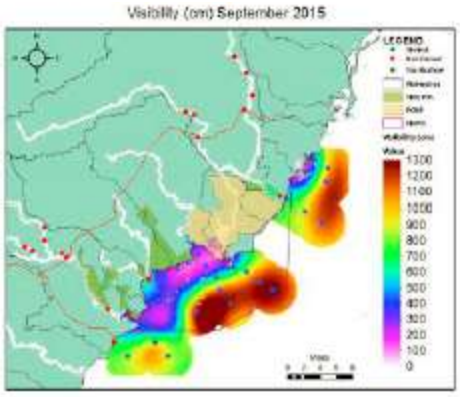


Figure 23: *Visibility in PHMR in June and September, 2015 (TIDE data, 2015)*

Sedimentation: Sedimentation data is collected for Port Honduras Marine Reserve, with highest mean sedimentation rates recorded from May to November. Sedimentation rates are driven by two different processes. When the sedimentation rates are negatively correlated with visibility

(March to May), the likely cause of higher sedimentation is introduction of land sediments by runoff, with sedimentation rates generally decreasing with increasing distance from shore. However, in June, July and December, a high rate of sedimentation is positively correlated with a high visibility rate, indicating the level of sedimentation is result of precipitation of oceanic particulate organic matter (Figure 24).

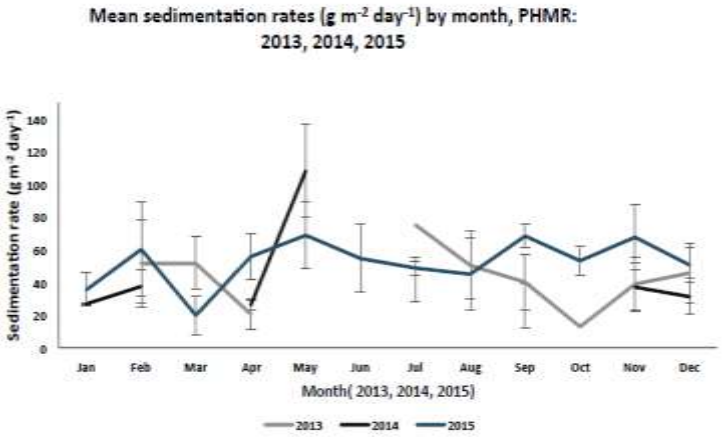


Figure 24: *Mean sedimentation rate in PHMR 2013 – 2015 (TIDE data, 2015)*

Nitrates and Phosphates: Water contamination is derived primarily from land-based sources. An assessment of risks from land-based sources of pollution highlighted the fringing reefs of Port Honduras Marine Reserve as at high risk from runoff from mainland agricultural areas (Figure 25; WRI, 2005). This is manifested in the form of sediment-laden river plumes rich in nutrients (effluents) that extend throughout the Marine Reserve, with the potential to cause algal blooms and coral death (WRI, 2005).

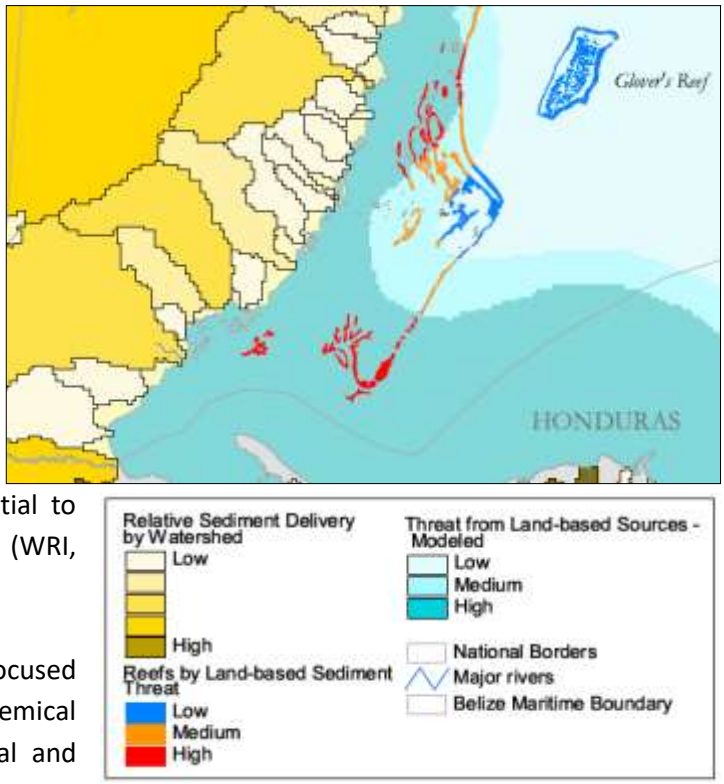


Figure 25: *Modeled threats to coral reefs from watershed-based sources of sediment and pollution. From: Reefs at Risk in Belize analysis, World Resources Institute (WRI, 2005).*

The World Wildlife Fund (WWF) has focused on identifying and mitigating agrochemical impacts in Belize, both for terrestrial and marine ecosystems, with concerns associated with the use of agrochemicals on the banana and citrus plantations and shrimp farms in the Toledo area, due west of the Marine Reserve. 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.

Excess levels of nitrates and phosphates can cause significant water quality issues for human and environmental health, with high levels leading to eutrophication. Nitrates can come from runoff from various sources, including agricultural fertilizer, livestock, animal wastes, industrial waste, etc. (Cushion 2004; TIDE 2015). Phosphates can be introduced from fertilizers, pesticides, waste water from laundries and river-based clothes washing, human and animal waste, etc. (TIDE, 2015). TIDE has identified human use of both the rivers and landscapes within the watersheds, as well as possible sources of nitrates and phosphates, reflecting the near shore levels (TIDE, 2015).

Whilst there are not clear trends for nitrates or phosphates in PHMR, the concentrations in rivers tended to be highest at the start of the rainy season, as would be expected. This would suggest terrigenous nutrients accumulate and are stored on land during the dry season and are washed into the rivers when the wet season begins. However, results also show that at times, nitrate and phosphate concentrations increase with distance from the shore (near the Snake Cayes), suggesting an oceanic source for higher nutrient levels offshore (Figure 26).

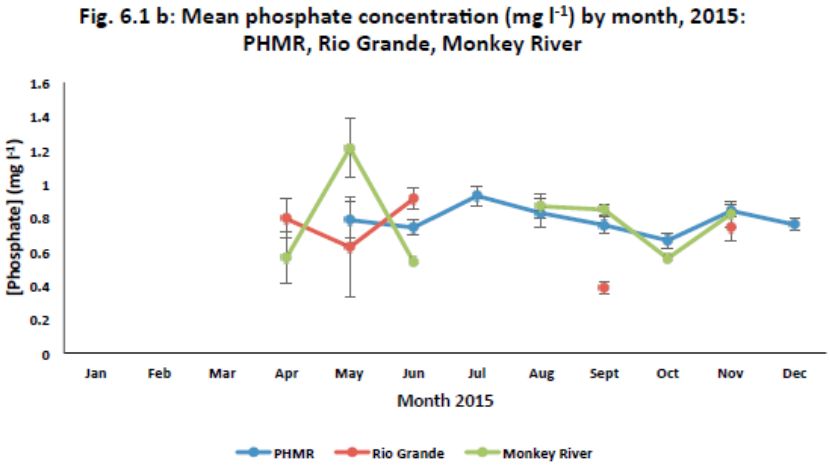


Figure 26: *Mean phosphate levels in PHMR by month, 2015 (TIDE data, 2015)*

1.5 Biodiversity

Port Honduras Marine Reserve is primarily estuarine in character, the result of the six major watersheds that flow into it (Heyman et al., 1999), resulting in one of the most biodiverse areas in southern Belize. The coastline of dense fringing mangroves and 138 small offshore mangrove cayes surrounded by fringing reefs serve as critical nursery and feeding areas for a variety of species of both national and international importance. These include commercially important Caribbean spiny lobster and queen conch, and globally threatened species such as the Antillean Manatee, Goliath Grouper and hawksbill turtle.

1.5.1 Ecosystems

The Marine Reserve incorporates five distinct broad ecosystems:

- Mangroves
- Littoral forest and Herbaceous beach communities (including sandy beaches)
- Seagrass
- Coral reef system
- Open Sea

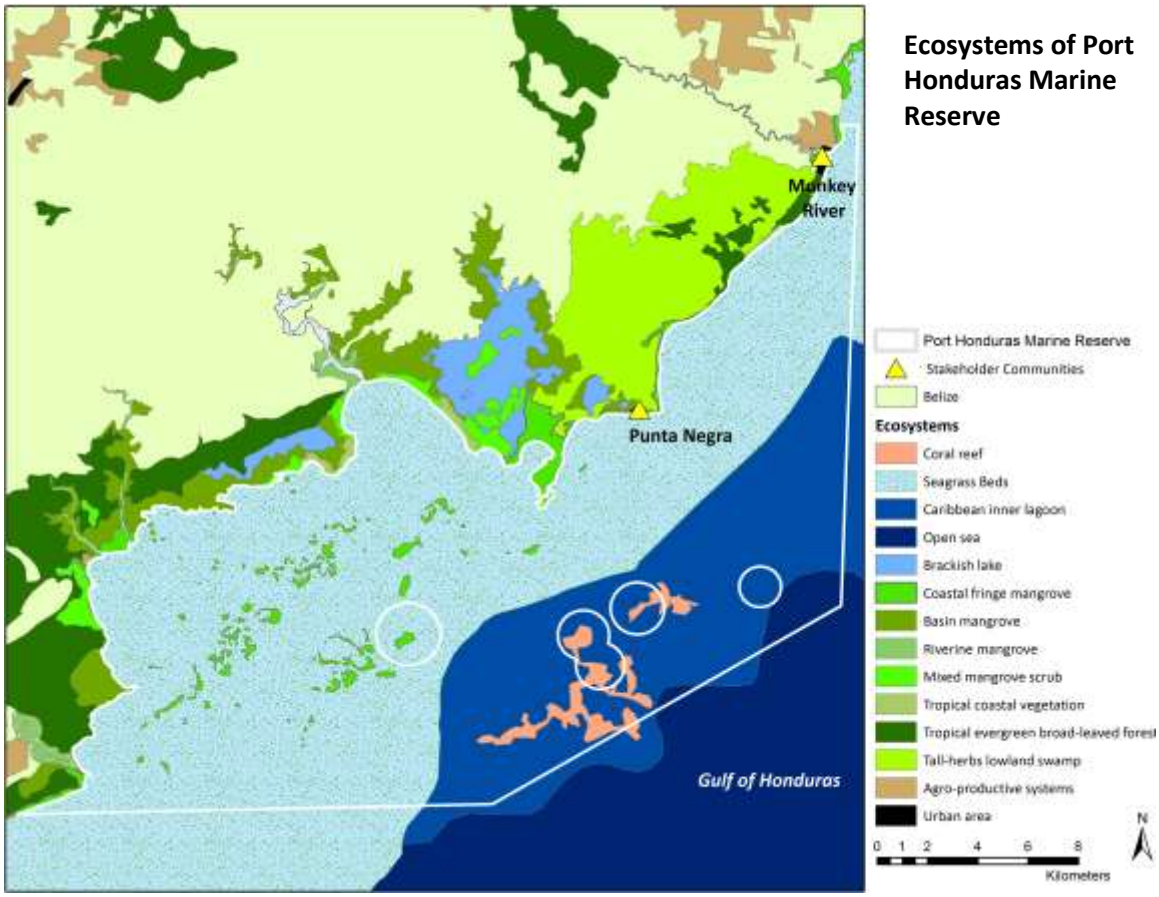
Coastal / Caye Ecosystems

The statutory instrument for Port Honduras Marine Reserve describes the protected area as "*All that portion of the Caribbean Sea…"*. As a result, there is very little terrestrial vegetation within the boundaries, unless it is inundated mangrove. However, the coastal and caye ecosystems, whilst not within the protected area, are an important component of the landscape / seascape transition.

Coastal / Caye Ecosystems
Caribbean mangrove forest: Coastal fringe mangroves
Caribbean mangrove forest: Basin mangrove
Caribbean mangrove forest: Riverine mangrove
Caribbean mangrove forest: Mixed mangrove scrub
Tropical coastal vegetation on very recent sediments
Tropical evergreen broadleaf lowland swamp forest
Tall herbs lowland swamp
Brackish lake of the Caribbean plain
Anthropogenic Ecosystems
Agroproductive systems
Urban Areas

Table 11: *Coastal / Caye Ecosystems*

Eight natural terrestrial ecosystems are present either on the coast or on the cayes (Table 11). Four of these are mangroves, ranging from the tall riverine mangroves associated with the river mouths to the salt tolerant mixed mangrove scrub. Coastal fringing mangroves line both the cayes and the majority of the coastline. Two anthropogenically altered ecosystems, agriculture and urban areas, are also identified (Map 4).



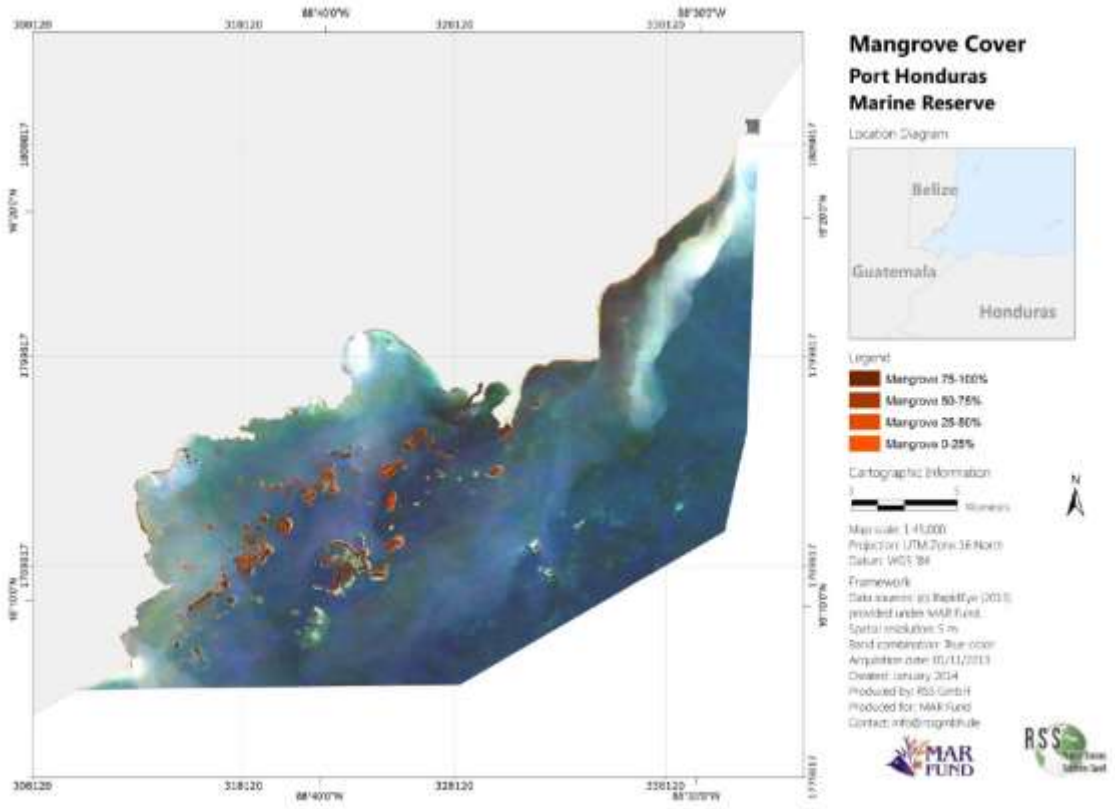
Map 4: *Ecosystems of Port Honduras Marine Reserve*

Mangroves are salt tolerant species found within the intertidal zone, bordering the coastal lagoons and estuaries, and on the cayes. Mangroves are a critical component of the coastal habitat, providing important ecosystem functions such as nursery and feeding areas for commercial and non-commercial fish species, and shoreline protection from storms and erosion. There are 1,770 acres of mangroves in the marine reserve, with another 13,000 mangroves along the coastal boundary (TIDE, 2015). Red Mangrove (*Rhizophora mangle*) is the dominant mangrove species, often found with White Mangrove (*Laguncularia racemosa*) and Black Mangrove (*Avicennia*

Mangrove Type	Acreage	Hectares	Proportion
In Port Honduras Marine Reserve			
Dwarf	1,693	*685*	***95.8%***
Medium height	73	*30*	***4.2%***
Tall	-	-	-
Total	***1,767***	***715***	
In the larger Port Honduras Marine Reserve area			
Dwarf	12,962	*5,245*	***88.5%***
Medium height	1,115	*451*	***7.6%***
Tall	569	*230*	***3.9%***
Total	***14,646***	***5,927***	

Table 12: *Mangrove composition in PHMR, CATHALAC / TIDE, 2012*

germinans)), the other two mangrove species in Belize, and Buttonwood (*Conocarpus erectus*), a mangrove associate. Where beaches occur, the low beach vegetation is classified as Tropical coastal vegetation on very recent sediments, and is important in maintaining the beaches. This low herbaceous beach vegetation is important for stabilizing the coastal ridges, and provides the optimal conditions for successful turtle nesting.



Map 5: *Mangroves of the cayes of PHMR (RSS, 2014; MARFund)*

Coastal fringing mangroves *(UNESCO Ecosystem Code: I.A.5.b.(1).(d))*: Found along the coastline and cayes, the best examples of this ecosystem can be seen on the coast west of the entrance to Ycacos Lagoon. Taller red mangroves stand as high as 10m or more, despite past storm damage. The stilt roots of coastal fringe red mangrove extend out into the shallow waters, and play a critical role in breaking the force of storm surge and waves during tropical storm events. They also trap sediments and reduce erosion run-off. In slightly deeper water, they also provide nursery

grounds for a broad variety of fish species. The health of this ecosystem is being impacted by increased hurricane damage and wave action, resulting in coastal erosion, undermining the stability of the trees with the potential failing in their protective functionality.

Basin Mangrove *(UNESCO Ecosystem Code: I.A.5.b.(1).(f))***:** Generally occurring on waterlogged peaty soils, this ecosystem is dominated by tall red mangroves (*Rhizophora mangle*), varying in height depending on inundation cycles and nutrient availability. Where water depth is lower, tidal flushing, amplitude and kinetic energy of floodwaters decreases, other mangrove species and associates become established. With increasing salinity, dominant species include all three types of mangroves. Where salinity is at its highest, black mangrove (*Avicennia germinans*) dominates. With its pneumatophores, an adaptation for life in the waterlogged soil, this species has an ecological advantage in these areas where, in addition to being highly saline, the oxygen content of the soils may be much reduced (anaerobic soils).

Riverine Mangrove (*UNESCO Ecosystem Code: I.A.5.b.(1).(e)*)***:*** In Port Honduras Marine Reserve, riverine mangroves are found at the river mouths, growing on nutrient-rich sediments from the deposition of riparian alluvium, and benefitting from deeper dead leaf and branch humus layer. This ecosystem is dominated by tall red mangroves (*Rhizophora mangle*)*,* and can attain an impressive stature, often standing 10m-20m tall. Riverine mangrove forest typically stretches 5-10m back from the watercourse, and then grades into lower mixed mangrove scrub. Whilst it can be structurally very similar to coastal fringing mangroves, the stilt roots rarely project far out into the river.

Mixed Mangrove Scrub (*UNESCO Ecosystem Code: I.A.5.b.(1).(c)*)***:*** Generally found on waterlogged and seasonally inundated, saline coastal mudflats, this ecosystem is dominated by stunted red mangrove (*Rhizophora mangle*), generally standing no more than 1.5m tall. Mangroves can be densely packed in some areas, or thinly scattered in others, dependent largely on salinity, seasonal inundation and nutrient levels. A few herbaceous plants and grasses may be found in association with the mangroves, along with the mangrove vine (*Rhabdadenia biflora*). Whilst the mudflats are generally hypersaline, where conditions are less saline, all three mangrove species occur, along with buttonwood, the mangrove associate, with a canopy height reaching 3-4m.

Tropical Littoral Forest and Beach Communities *(UNESCO Ecosystem Code: VIB3a: Tropical coastal vegetation on very recent sediments).* Littoral forest is found both on the cayes and in small patches on the coast between Deep River and Golden Stream, growing on the higher beach ridge. This forest type plays an important role in stabilizing the beach ridge and provides an important habitat for migratory birds. It includes plant species such as yellow sapote (*Pouteria campechiana*)*,* sapote (*Manilkara zapota*), black poisonwood (*Metopium brownei*) and palmetto (*Acoelorraphe wrightii*), with understory species such as cocoplum (*Chrysobalanus icaco*), spider lily (*Hymenocallis littoralis*)*,* and wax myrtle (*Myrica cerifera*), and epiphytes such

as the cow horn orchid (*Myrmecophila tibicinis*). This ecosystem is considered the most threatened in Belize as the beach ridges are targeted for coastal development.

On the cayes, vegetation is generally composed of mangroves (*Rhizophora mangle, Avicennia germinans, Conocarpus erectus*) with saltwater palmetto (*Thrinax radiata*) and seagrape (*Coccoloba uvifera*). The understory of salt tolerant ground cover includes species such as saltwort (*Batis maritima*) and beach bean (*Canavalia rosea*). The presence of several species (e.g. coconut palms (*Cocos nucifera)* and noni *(Morinda citrifolia)* are indicative of previous anthropogenic use. The herbaceous beach communities are only found on the beach from Monkey River to Punta Ycacos and on a few of the cayes. These beach communities, consisting of low, wind and salt-resistant shrubs and vines, are also important for stabilizing the beaches, and provide conditions that promote successful turtle nesting.

Tropical evergreen broadleaf lowland swamp forest *(UNESCO Ecosystem Code: IA1g(1))* is an inland ecosystem found adjacent to the coastal ridge. The ground is generally waterlogged, supporting species tolerant of seasonal or permanent freshwater inundation, with a forest canopy that can reach 25m or more. ***Tall herbs lowland swamp*** is also found behind the coastal ridge. It is a seasonally inundated system dominated by tall graminoids and *Thalia geniculate,* with a largely unbroken canopy up to 2m in height. These two ecosystems are found in low-lying areas that are not connected to the coastal waters, except during wet season, when flow out of the inundated basins contributes to freshwater runoff into the Marine Reserve.

Brackish lake of the Caribbean plain *(UNESCO Ecosystem Code: SA1b(5))* is represented by the Punta Ycacos Lagoon system, embedded within Payne's Creek National Park, and flowing into Port Honduras Marine Reserve.

Estuarine / Marine Ecosystems

Four estuarine / marine ecosystems are identified in Port Honduras Marine Reserve (Table 13). All lie within the Epipelagic (sunlit) Zone with ecosystems that are defined by their species composition, formation and substrate characteristics. Each has evolved in response to the degree of exposure and impact of wave action, current direction and strength, light intensity and spectra. The predominant ecosystems are seagrass and coral reef.

Marine Ecosystems
Seagrass
Coral reef
Caribbean inner lagoon
Open sea

Table 13: *Marine Ecosystems*

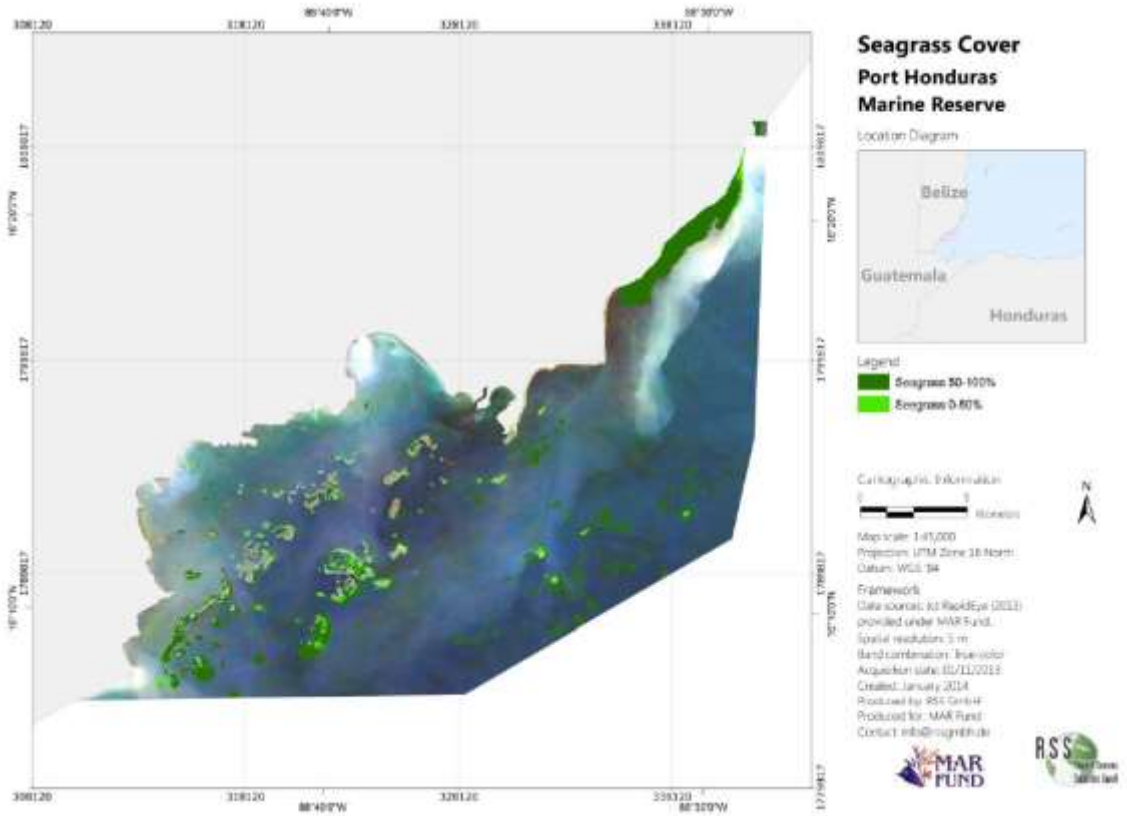
Seagrass *(UNESCO Ecosystem Code: VIIIA)**:*** TIDE has mapped 7,380 acres of seagrass in Port Honduras Marine Reserve, with seagrass beds located in shallow water areas close to the

coastline and surrounding many of the cayes. 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 - an acre of seagrass can support up to 40,000 fish and 50 million small invertebrates (Seagrass Ecosystems Research Laboratory, 2005). In Port Honduras Marine Reserve the most common seagrass species are turtle grass (*Thalassia testudinum*) and manatee grass (*Syringodium filiforme*), which act as nursery grounds for the commercial important species in PHMR – including lobster, conch and finfish. It is also important for supporting the conch fishing industry of the area (Table 14).

Marine Plant Species of Port Honduras Marine Reserve

Family	Species	Common name
Hydrocharitaceae	*Thalassia testudinum*	Turtle grass
Cymodoceaceae	*Syringodium filiforme*	Manatee grass
	Halodule wrightii	Shoal grass

Table 14: *Marine Plant Species of Port Honduras Marine Reserve*



***Map* 6:** *Seagrass of PHMR (RSS, 2014; MarFund)*

Coral Reef *(UNESCO Ecosystem Code: SA1d(2))*

PHMR encompasses an estimated 936 acres (380 hectares) of coral reef (TIDE, 2016). The coral composition changes with increasing distance from the coast. The reefs found in the inner lagoon consist of patch reef or algal-dominated hard-bottom communities. Around the Snake Cayes, however, a more diverse assemblage of coral species is found (Foley, 2016). Four threatened coral species have been identified in the area (Table 15).

Port Honduras Marine Reserve Species of International Concern	
Critically Endangered	
Staghorn Coral	*Acropora cervicornis*
Elkhorn Coral	*Acropora palmata*
Endangered	
Star Coral	*Montastraea annularis*
Star Coral	*Montastraea faveolata*

IUCN, 2017

Table 15: *Coral species of international concern of PHMR*

Whilst the ecological and structural differences amongst reef sites in PHMR do not allow for comparison between sites, they do allow for comparison of sites from year to year. The fringing reef sites at the Snake Cayes are thought to be unique in Belize, with characteristics of both shallow near-shore reefs and offshore barrier reefs. The reefs in the Snake Cayes support a diverse assemblage of marine life, are locally valued for their tourism benefits, and provide rich habitat for commercial species (lobster, conch and finfish), corals, sponges and tropical fish (Robinson et al., 2004).

The patch reef sites closest to the shore, Frenchmen and Wilson caye, are more heavily influence by the freshwater input and the health of the watersheds. The sites were showing signs of stress in 2003, with increased amounts of algal growth, a possible indicator of high turbidity from river input, upstream agricultural development, leading to excess nutrients (Robinson et al., 2004). These inner lagoon sites are considered to be relatively resilient, with corals surviving despite the elevated pressures. Between the patch reefs of the in-shore lagoon and the fringing reefs of the Snake Cayes a series of banks support reefs that are not associated with cayes. With similar depth, composition and its close proximity to Middle Snake Caye, Bank 2 is most similar to the fringing reefs, providing the best comparison between reef sites in a General Use Zone and a No Take Zone. Bank 3 is different from all sites, with the greatest depth and differences in the geology, slope, hard coral community, and possibly hydrology (Robinson et al., 2004).

Coral Health

On a regional level, more than 75% of Caribbean coral reefs are considered threatened, a figure expected to increase to 90% by 2030, and 100% by 2050 (Burke et al., 2011). Port Honduras Marine Reserve is no exception. It has experienced the same large-scale threats as other reefs in the region, including hurricanes, loss of herbivorous urchins and parrotfish, unsustainable fishing, coral disease and mass coral bleaching triggered by prolonged high sea surface temperatures. All of these impacts have contributed towards the extensive loss of key reef-building *Acropora* species, as well as *Agaricia tenuifolia, Millepora complanata, Diploria spp.* and *Montastrea spp* (Kramer et al., 2001).

As a result, over the last four decades, the structurally complex *Acropora* has been replaced as the dominant coral species throughout the region, following widespread mortality associated with white band disease, with significant declines also observed in *Agaricia*. These structural corals are particularly important in the maintenance of reef structure, the function as a protective barrier to storms, and as a habitat for commercial species such as lobster and snapper, as well as the touristic reef fish. Extensive surveys of these habitats n PHMR have identified over 118 finfish species, six of which were observed only at sites around the Snake Cayes (Sullivan et al. 1995, Harborne 2000, Robinson et al. 2004).

Coral Bleaching: Anthropogenically-induced global warming is widely believed to be responsible for increases in global sea surface temperature. Corals are highly sensitive to changes in water temperature - increases of only 1°C can have potentially lethal effects. High water temperature events in the MAR region have resulted in several large-scale bleaching events (e.g., in 1995, 1998 and 2005) causing significant coral mortality in some areas.

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

Diseases have also been linked to elevated nutrients (especially from sewage), sedimentation and runoff. Corals seem to be more prone to disease when affected by other stressors.

Healthy Reefs for Healthy People Initiative, 2007

Global climate change (with increasing sea temperatures, UV levels, and associated ocean acidification), has been identified as the biggest contributing factor in reef health decline (Aronson et al., 2006). The increasing sea surface temperatures result in coral bleaching, and the breakdown of the partnership between corals and zooxanthellae. This reduces the resilience of corals, leaving them more vulnerable to disease and infection until sea temperatures fall, and the symbiotic relationship can be re-established (Marshall et al., 2006). As high sea temperature events increase, bleaching is predicted to rise significantly (Westmacott et al., 2000), with an associated increase in coral mortality and macroalgal growth. This has significant economic implications for the fisheries and tourism sectors, and overlies and adds to other stressors, including coral diseases (black, white and yellow band diseases and white plague), unsustainable fishing of herbivorous fish, 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).

Event	Year	Scale of Event
Coral bleaching event	2008	Some coral bleaching
Coral bleaching event	2005	Significant bleaching
Hurricane Iris	2001	Category 5 hurricane – mechanical damage to corals, increased sedimentation on reef
Hurricane Keith	2000	Localized coral mortality
Hurricane Mitch	1998	Category 5 hurricane – mechanical damage to corals, increased sedimentation on reef
Coral bleaching event	1998	Catastrophic bleaching – approximately 50% decline in coral cover
Coral bleaching event	1995	Small scale bleaching
White band disease on Acroporid corals	Since late 1980s	Major Caribbean wide die-off Acroporid corals
Viral epidemic in urchin *Diadema antillarum* population	1983	Major Caribbean wide die-off of *Diadema antillarum*

Table 16: *Bleaching Events affecting the Belize reef*

The Belize Barrier Reef experienced mass coral bleaching for first time in 1995 (McField, 1999; McField et al., 2007), affecting hard corals throughout Belize (including Port Honduras Marine Reserve), impacting *Montastraea annularis, Agaricia agaricites, Agaricia tenuifolia, Madracis* spp., and *Porites porites* (McField, 2000). A second, more severe bleaching episode took place in 1998, followed closely by Hurricane Mitch in the same year, further stressing the corals, with increased coral mortality in key structural species. Since then, bleaching events have been recorded in Belize with increasing frequency, and are thought to be exacerbated by increased acidification resulting from higher CO_2 levels (Table 16; Anthony et al., 2008). 68% of Belize's coral reefs are currently rated as in Poor or Critical health, only 4% considered in Good health, and 0% in Very Good health, based on a survey of 94 sites across the country (HRI, 2015). In 2015, Port Honduras Marine Reserve sites rated between Critical and Poor.

The reefs of Port Honduras Marine Reserve are in an area heavily influenced by anthropogenic influence in the watersheds from not only Belize, but also Guatemala. Water quality is affected by the sediment load and contaminants carried by the rivers, and the shallow depths of the water near the cayes result in higher water temperatures than in reef areas closer to the barrier reef, where the oceanic influence in greater. Despite these pressures, the coral reefs of PHMR have shown greater resilience than many other areas. In the 1998 bleaching event, PHMR coral reefs underwent extensive bleaching, losing up to 40% of coral cover, but recovered fast, suggesting some level of resilience to climate change. A similar pattern was seen in 2008 / 2010.

The monitoring of coral communities in the three management zones has been ongoing at eight sites in PHMR since 2003. A further two monitoring sites were added in 2011, outside of PHMR. Diversity increases with distance from shore (linked to improved water clarity and increased salinity, two of the pre-requisites for healthy reefs). The PHMR fringing reef sites of the Snake Cayes have the highest hard coral cover and complexity when compared with the patch reefs found closer to the coastline.

Resilience Characteristics of PHMR corals

- Corals thriving close to shore, in shallow, turbid water conditions with rapidly changing salinity
- Rapid and widespread recovery from coral bleaching, with increasing coral cover

In 2009 / 2010, six sites in PHMR were assessed for signs of bleaching (Frenchman Caye, Middle Snake Caye, South Snake Caye, West Snake Caye and two sites at East Snake Caye) following bleaching events in 2008. For the assessment, the level of bleaching was rated on a scale of "pale, partial and whole bleach" for each coral. When the data is averaged per site, the patch reefs of the Frenchman Caye site were the most severely impacted in 2008, with mean coral bleaching estimated at 31.6%, and consistently showed higher % bleaching over the three years. Between October 2009 and February 2010, the majority of sites recovered from bleaching, with an overall decrease from 18% to 11% in the number of surveyed colonies affected. Middle Snake Caye and Frenchmen Caye were the only two sites that showed an increase in the number of affected colonies with pale or partial bleaching during that timeframe (Foster, 2010). All the reefs showed good recovery by 2009, with mean coral bleaching levels below 4%.

Coral Bleaching Survey Sites		2008	2009	2010
Frenchman	*Patch Reef*	31.63%	3	5.25
South snake Caye	*Shallow fore reef*	14.29%	3.5	4.5
West Snake Caye	*Shallow fore reef*	29%	3.5	3
Middle Snake Caye	*Shallow fore reef*	16.33%	3.5	3.49
East Snake Caye 1	*Shallow fore reef*	16.16%	1	3.48
East Snake Caye 2	*Shallow fore reef*	22.45%	2	1.75

Figure 27: *Live coral cover: Status of coral bleaching sites in PHMR 2008 - 2010 (TIDE / ERI, http://datahost.uberibz.org/coralmap)*

Elevated water temperatures and associated bleaching generally occur during August – October, with coral recovering as cooler weather reduces sea temperatures in December. Tropical storms may help to reduce or prevent bleaching, as increased wave action draws cooler, deeper water to the surface, and pushes oceanic waters towards the mainland, reducing sea temperatures.

Benthic cover assessment over eleven years demonstrates that there have been oscillations in benthic composition in Port Honduras Marine Reserve, but with little significant overall change. Between 2013 and 2014, however, there was a significant decrease in the % cover of gorgonians, with their virtual disappearance in 2014 (Figure 28). There was a corresponding significant increase in sand from a maximum of 24% between 2003-2012, to 47.3% in 2014. An increase in bare substrate was also observed in 2014 – a maximum of 11.0% in past years to 14.5% in 2014 (Foley, 2016). There are concerns that increased wind and wave action are causing part of the declining reef health – possible as a result of declining outer barrier reef health, reducing its function as a barrier to oceanic waves (Foley, pers. com.).

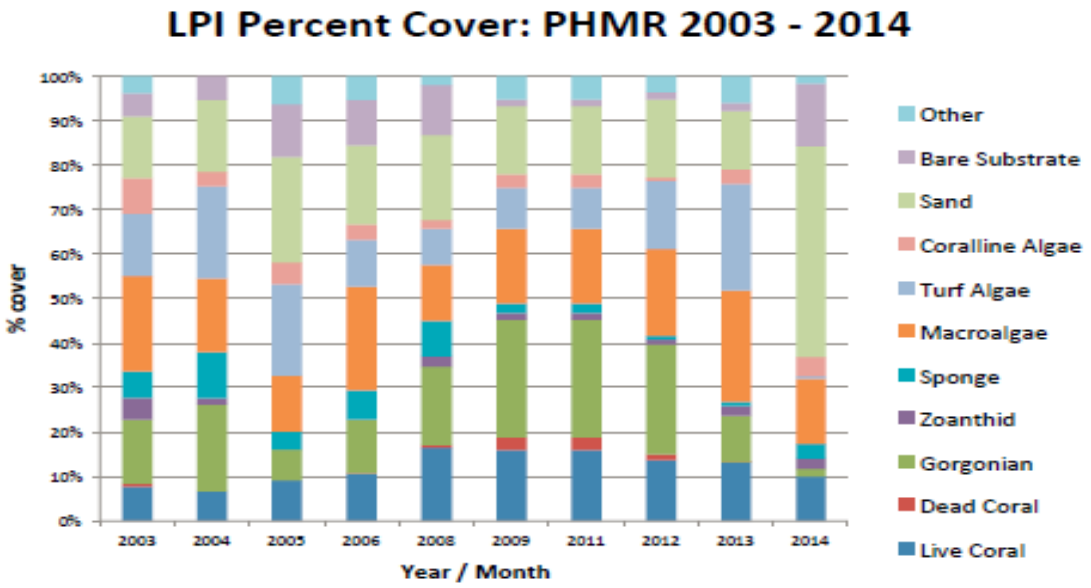


Figure 28: *Percentage benthic cover in PHMR monitoring sites, 2003 – 2014 (TIDE data)*

Species	WS	ES	SS	MS	WN	FR	B2	B3	No Take	GUZ	Total
Acropora cervicornis								2		2	***2***
Acropora palmata		1							1		***1***
Agaricia agricites		3			2				3	2	***5***
Agaricia humilis			3					6	3	8	***11***
Agaricia lamarcki							2	2		2	***2***
Agaricia tenufolia	6	10	8	1	3			1	25	4	***29***
Colpophyllia natans	3	3	4	5		1		6	15	7	***22***
Dichocoenia stokesii	4	6	4	5	1	2	6		19	9	***28***
Diploria clivosa	7	8	2	1	1		9	4	18	14	***32***
Diploria labyrinthiformis	3	1		3				2	7	2	***9***
Diploria strigosa	10	10	10	10		2			4	2	***42***
Eusililia fastigiata								4		4	***4***
Favia fragum	4	2	2	2		4	3	1	8	8	***16***
Isophyllia sinuosa		6	5	5		1	6		16	7	***23***
Leptoseris cucullata			1	1				6	1	6	***7***
Madracis mirablis		2							2		***2***
Manicina areolata								6		6	***6***
Meandrina meandrites	2	1						3	3	3	***6***
Millepora alcicornis	6	8	10	10	8	2	10	4	34	24	***58***
Millepora complanata	10	3	5	5	4	2	9	1	23	16	***39***
Montastraea annularis	1	2	3		2	1	6	2	6	11	***17***
Montastraea cavernosa	6	8	9	10	2	2	7	6	33	17	***5***
Montastraea faveolata	6	7	9	5	2	2	5	6	27	15	***42***
Montastraea franksi	6	2		1				4	9	4	***13***
Mussa angulosa			1	1				2	2	2	***4***
Mycetophyllia aliciae								1		1	***1***
Mycetophyllia danaana				2				1	2	1	***3***
Mycetophyllia ferox			1					1	1	1	***2***
Mycetophyllia lamarckiana		3		1				3	4	3	***7***
Oculina sp.	2		3	6					11		***11***
Porites asteroides	9	10	9	10	8	7	10	6	38	31	***69***
Porites divaricata					2		3	1		6	***6***
Porites furcata			6						6		***6***
Porites porites	3	2	7						12		***12***
Scolymia lacera								1		1	***1***
Scolymia cubensis								3		3	***3***
Siderastrea radians	6	1	3	7	10	10	6	1	17	27	***44***
Siderastrea siderea	9	8	10	10	10	10	10	6	37	36	***73***
Solenastrea bournoni				6	1	3	2	1	6	7	***13***
Stephanocoenia michelinii	7	9	8	9	8	5	7	6	33	26	***59***
Species Abundance	***20***	***24***	***23***	***21***	***15***	***15***	***16***	***31***	***32***	***35***	***40***

Table 17: *Baselilne coral species and abundance at monitoring sites, PHME (Robinson et al., 2004)*

1.5.2 Species

Fish

Port Honduras Marine Reserve supports two different finfish populations, near-shore estuarine species more tolerant of brackish / fresh water, and those associated with the clearer, more saline waters of the more eastern coral reef and banks. With the large expanses of intact seagrass beds, extensive mangrove areas and vibrant coral reefs found in and around Port Honduras Marine Reserve, and the high connectivity between these ecosystems, the area is an important habitat for fish species and supports a strong traditional artisanal fishery. Of the species recorded in PHMR, the goliath grouper is considered to be Critically Endangered and the Nassau grouper, Endangered (Table 18). A further seven species found in PHMR are considered Vulnerable at the global scale.

Fish Species of International Concern of PHMR	
Critically Endangered	
Goliath Grouper	*Epinephelus itajara*
Endangered	
Nassau Grouper	*Epinephelus striatus*
Hammerhead Shark	*Sphyrna mokarran*
Vulnerable	
Queen Triggerfish	*Balistes vetula*
Hogfish	*Lachnolaimus maximus*
Mutton Snapper	*Lutjanus analis*
Cubera Snapper	*Lutjanus cyanopterus*
Tarpon	*Megalops atlanticus*
Yellowmouth Grouper	*Myctoperca interstitialis*
Rainbow Parrotfish	*Scarus guacamaia*

Table 18: *Fish Species of International Concern (IUCN, 2017)*

In the near shore estuarine environment, the most abundant fish families identified are the snappers (Lutjanidae), mojarras (Gerreidae), parrotfishes (Scaridae), croakers (Sciaenidae), and grunts (Haemulidae) (TIDE, 2008). It has been identified as an important fish nursery ground (Sullivan *et al*., 1995), supporting an estimated 70 species, including the critically endangered goliath grouper. This species utilizes the Punta Ycacos Lagoon/Deep River estuary, located in the shallow waters of Port Honduras Marine Reserve and Payne's Creek National Park (PCNP), thought to be one of only three key nursery areas for this species in the world (Graham, 2009; Graham et al., 2010).

These shallow estuarine areas are also important for baitfish, supporting the trophic integrity of the ecosystem. There are increasing concerns, however, of a growing local industry based on the netting of large numbers of baitfish for commercial sale to fishers, with a significant decline in the populations. Local sport fishers point to this as the reason for the decline in a number of the sport fishing species.

118 species of fish were identified at the Snake Cayes (Harborne, 2000), with a significantly different community composition from that of the near-shore environment. In the shallow reef areas, the most abundant fish families are also the parrotfishes (Scaridae), grunts (Haemulidae) and snappers (Lutjanidae), though the species diversity is much higher, with many brightly coloured reef fish important for supporting the tourism industry in southern Belize. The snappers, groupers and hogfish are targeted by fishermen and, like other large predatory fish species, also have high tourism appeal, being very popular with recreational divers. Reef fish communities have been monitored at eight sites

since 2003, in all three management zones, with two additional sites outside of PHMR added in 2011, to provide comparisons between protected, managed use and non-protected areas.

Fish % Frequency observations:

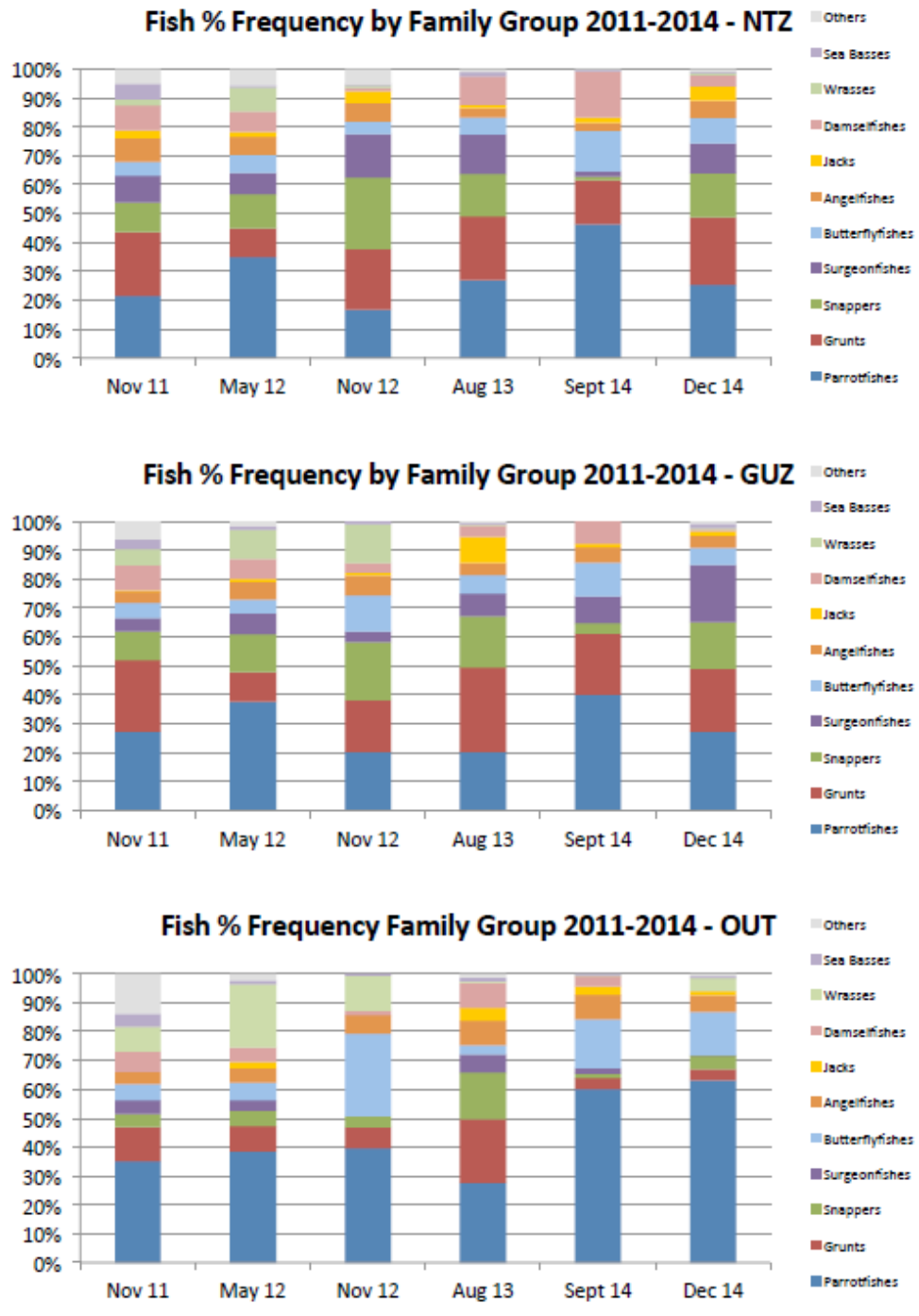


Figure 29: *Fish % Frequency by Family Group 2011 – 2014 (TIDE data)*

The three most important commercial finfish in the PHMR area are identified as lane snapper (*Lutjanus synagris*); mackerel (*Scomberomerus maculatu* and *S. regalis*), and jacks (Carangidae) (Sommerville, 2001). Goliath grouper is also targeted, though this species is on the threshold of disappearing.

Direct threats to the viability of commercial species, and therefore the fishing industry, have been identified as the low income in local stakeholder fishing communities, and the traditional dependence on fishing, coupled with the increase in number of fishermen. Poor fishing practices and illegal fishing (fishing out of season, harvesting of undersized product, use of gill nets, and nocturnal fishing within no-take zones), both as local incursions and trans-boundary incursions into the protected area, reduce the viability of the fish stocks, and the small size of the no take zones for spill-over effect reduces the effectiveness in their function as a replenishment tool for the fisheries industry. This is exacerbated by increasing fishing pressure and market demand from Jamaica and other CARICOM nations, and Guatemala and Honduras, as well as ecosystem impacts - the reduced coral reef health (partially as a result of reduced herbivorous fish populations), and regime shifts and disruption of the trophic structure.

Herbivorous fish populations, such as the parrotfish (Scaridae) and surgeonfish (Acanthuridae) are the dominant grazers of the reef ecosystem, and considered important for the maintenance of the health of the reef. These species keep algal growth under control and effectively reduce algal cover, increasing substrate availability for coral recruitment (Mumby et al., 2006). Assessments show that parrotfish are one of the most abundant types of reef fish, both in PHMR and at sites outside the reserve.

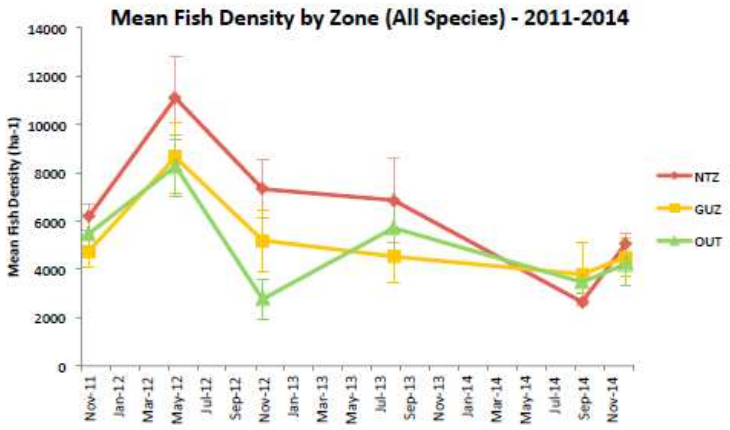


Figure 30: *Mean Fish Density by Zone (TIDE data)*

Sharks are an important part of the ecosystem at Port Honduras Marine Reserve, though numbers nationally and regionally have declined significantly due to heavy fishing pressure. Three species of sharks are reported for PHMR – nurse sharks (*Ginglymostoma cirratum*), bull sharks (*Carcharhinus leucas* (Near Threatened, IUCN, 2017)) and hammerheads (*Sphyrna mokarran* (Endangered, IUCN, 2017)). Whilst the nurse shark is protected under Belize legislation for its tourism value, the endangered great hammerhead is still fished in Belize, despite its globally threatened status. A further ten shark species have also been confirmed as present within the larger seascape (SEA / SCMR data; R. Graham, pers. com.). Whilst these are deeper water sharks, they have the potential to pass through the deeper

waters of PHMR. The combination of having a close stock-recruitment relationship, complicated patterns of size/sex segregation, seasonal migration, and long recovery times in response to over-fishing (with few offspring and late sexual maturity), result in low biological productivity. These factors have raised concerns at the national level about the sustainability of the shark fishery.

Shark fishing in Belize was assessed in 2005 during the initial drafting of the National Plan of Action – Sharks (Fisheries Department, 2005). At that time, an estimated twenty-five fishermen were identified as being involved nationally, originating from coastal communities, with the greatest activity concentrated between December and March (R. Graham, pers. com., 2010).

Sharks in the PHMR Seascape

Bull shark
Lemon shark
Caribbean reef shark
Tiger shark
Caribbean sharpnose shark
Whale shark
Nurse shark
Black tip shark
Silky shark
Scalloped hammerhead
Great hammerhead
Bonnethead
Blacknose shark

SEA / SCMR MP, 2010

The fish density in PHMR has decreased across all zones. In general, the mean fish density is higher in the No Take Zone compared to the General Use Zone and the waters outside PHMR. This decline is of concern, and indicative of the need for increased effectiveness of the replenishment zones, either through extension of the zones, improved enforcement, or both.

The invasive lionfish (*Pterois volitans*) has been rapidly colonizing many areas of the Western Atlantic and Caribbean in the past 20 years. They are known to be voracious predators, able to expand their stomach volumes over thirty times to accommodate large prey (Fishelson, 1997), and have a broad diet that includes a large range of juvenile fish, shrimps and crabs (Morris and Akins 2009). Their extremely fast growth and reproduction rate allow them to quickly overwhelm ecosystems, and their efficient hunting techniques and venomous spines mean they have very few predators in the Caribbean waters.

Lionfish are found in small, but growing numbers in PHMR, although the lionfish abundance still remains low compared to adjacent areas. Surveys were conducted in PHMR from 2012-2014, to characterize the population size, density and information on the diet of the lionfish in the protected area. Over the three years (2012-2014), the total catch of lionfish increased, with 15, 21, and 41 lionfish respectively. Juvenile lionfish were found in all years, but 2014 showed the greatest number of individuals, with 23 recorded (Holah, H. and J. Foley, 2015).

Fish Species of Port Honduras Marine Reserve

Family	Species	Common name
CARCHARHINIFORMES		
Carcharhinidae	*Carcharhinus leucas*	Bull Shark (NT)
Sphyrnidae	*Sphyrna mokarran*	Great Hammerhead (EN)
Triakidae	*Mustelus canis*	Smooth dogfish (NT)
ORECTOLOBIFORMES		
Ginglymostomatidae	*Ginglymostoma cirratum*	Nurse shark
MYLIOBATIFORMES		
Dasyatidae	*Dasyatis americana*	Southern stingray
	Himantura schmardae	Caribbean whiptail stingray
Myliobatidae	*Aetobatus narinari*	Spotted eagle ray (NT)
Urolophidae	*Urobatis jamaicensis*	Yellow stingray
ACTINOPTERYGII (Ray-finned fish)		
ALBULIFORMES		
Albulidae	*Albula vulpes*	Bonefish
Congridae	*Heteroconger halis*	Brown garden eel
Muraenidae	*Gymnothorax funebris*	Green moray
	Gymnothorax miliaris	Goldentail moray
	Gymnothorax moringa	Spotted moray
	Myrichthys breviceps	Sharptail eel
AULOPIFORMES		
Synodontidea	*Synodus intermedius*	Sand diver
BELONIFORMES		
Belonidae	*Ablennes hians*	Flat needlefish
BERYCIFORMES		
Holocentridae	*Holocentrus adscensionis*	Squirrelfish
	Holocentrus coruscus	
	Holocentrus rufus	Longspine squirrelfish
	Myripristis jacobus	Blackbar soldierfish
	Sargocentron vexillarium	Dusky squirrelfish
ELOPIFORMES		
Elopidae	*Megalops atlanticus*	Tarpon
GASTEROSTEIFORMES		
Aulostomidae	*Aulostomus maculatus*	Trumpetfish
PERCIFORMES		
Apogonidae	*Apogon binotatus*	Barred cardinalfish
	Apogon lachneri	Whitestar cardinalfish
	Apogon townsendi	Belted cardinalfish
	Phaeoptyx pigmentaria	Dusky cardinalfish
Blennidae	*Ophioblennius atlanticus*	Redlip blenny
	Parablennius maramoreus	Seaweed blenny
Carangidae	*Carangoides bartholomaei*	Yellow jack
	Carangoides ruber	Bar jack
	Caranx crysos	Blue runner
	Caranx hippos	Crevalle jack

	Caranx latus	Horse-eye jack
	Caranx lugubris	Black jack
	Trachinotus falcatus	Permit
Centropomidae	*Centropomus undecimalis*	Common snook
Chaenopsidae	*Acanthemblemaria aspera*	Roughhead blenny
	Acanthemblemaria spinosa	Spinyhead blenny
	Chenopsis ocellata	Bluethroat pikeblenny
	Emblemaria pandionis	Sailfin blenny
	Lucayablennius zingaro	Arrow blenny
	Malacoctenus macropus	Rosy blenny
Chaetodontidae	*Chaetodon capistratus*	Foureye butterflyfish
	Chaetodon ocellatus	Spotfin butterflyfish
	Chaetodon sedentarius	Reef butterflyfish
	Chaetodon striatus	Banded butterflyfish
	Prognathodes aculeatus	Longsnout butterflyfish
Cirrhitidae	*Amblycirrhitus pinos*	Redspotted hawkfish
Echeneidae	*Echeneis naucrates*	Sharksucker
	Echeneis neucratoides	Whitefin sharksucker
Epinephelidae	*Cephalopholis cruentata*	Graysby
	Cephalopholis fulvus	Coney
	Epinephelus adscensionis	Rock hind
	Epinephelus fulvus	Coney
	Epinephelus guttatus	Red hind
	Epinephelus morio	Red
	Epinephelus itajara	Goliath grouper (CR)
	Epinephelus striatus	Nassau grouper (EN)
	Mycteroperca bonaci	Black grouper
	Mycteroperca interstitialis	Yellowmouth grouper
	Mycteroperca tigris	Tiger grouper
	Mycteroperca venenosa	Yellowfin grouper
Ephippidae	*Chaetodipterus faber*	Atlantic spadefish
Gerreidae	*Gerres cinereus*	Yellowfin mojarra
Gobiidae	*Bathygobius soporator*	Frillfin goby
	Coryphopterus dicrus	Colon goby
	Coryphopterus eidolon	Pallid goby
	Coryphopterus galucofraenum	Bridled goby
	Coryphopterus lipernes	Peppermint goby
	Coryphopterus personatus	Masked / glass goby
	Ctenogobius saepepallens	Dash goby
	Elacatinus dilepis	Orangesided goby
	Elacatinus oceanops	Neon goby
	Elacatinus randalli	Yellownose goby
	Gnatholepis thompsoni	Goldspot goby
	Tigrigobius saucrus	Leopard goby
Grammatidae	*Gramma loreto*	Fairy basslet
	Gramma melacara	Blackcap 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 mactostomum	Spanish grunt
	Haemulon parra	Sailors choice
	Haemulon plumieri	White grunt
	Haemulon sciurus	Bluestriped grunt
	Haemulon striatum	Striped grunt
Inermiidae	*Emmelichthyops atlanticus*	Bonnetmouth
	Inermia vittata	Boga
Istiophoridae	*Makaira nigricans*	Atlantic blue marlin
Kyphosidae	*Kyphosus sectator*	Chub
	Kyphosus sectatrix	Bermuda Chub
Labridae	*Bodianus rufus*	Spanish hogfish
	Cryptotomus roseus	Bluelip parrotfish
	Halichoeres bivittatus	Slippery Dick
	Halichoeres garnoti	Yellowhead wrasse
	Halichoeres maculipinna	Clown wrasse
	Halichoeres pictus	Rainbow wrasse
	Halichoeres radiatus	Puddingwife
	Halichoeres socialis	Social wrasse
	Lachnolaimus maximus	Hogfish
	Scarus coelestinus	Midnight parrotfish
	Scarus coeruleus	Blue parrotfish
	Scarus iserti	Striped parrotfish
	Scarus guacamaia	Rainbow parrotfish (VU)
	Scarus taeniopterus	Princess parrotfish
	Scarus vetula	Queen parrotfish
	Sparisoma atomarium	Greenblotch parrotfish
	Sparisoma aurofrenatum	Redband parrotfish
	Sparisoma chrysopterum	Redtail parrotfish
	Sparisoma radians	Bucktooth parrotfish
	Sparisoma rubripinne	Redfin parrotfish
	Sparisoma viridae	Stoplight parrotfish
	Thalassoma bifasciatum	Bluehead wrasse
	Xyrichtys martinicensis	Rosy razorfish
	Xyrichtys splendens	Green razorfish
Labrisomidae	*Malacoctenus boehlkei*	Diamond blenny
	Malacoctenus triangulatus	Saddled blenny
Lutjanidae	*Lutjanus analis*	Mutton snapper
	Lutjanus apodus	Schoolmaster
	Lutjanus buccanella	Blackfin snapper
	Lutjanus cyanopterus	Cubera snapper
	Lutjanus griseus	Gray snapper
	Lutjanus jocu	Dog snapper
	Lutjanus mahogani	Mahogany snapper
	Lutjanus synagris	Lane snapper
	Ocyurus chrysurus	Yellowtail snapper

Malacanthidae	*Malacanthus plumieri*	Sand tilefish
Mullidae	*Mulloidichthys martinicus*	Yellow goatfish
	Pseudupeneus maculatus	Spotted goatfish
Opistognathidae	*Opistognathus aurifrons*	Yellowhead jawfish
Pomacanthidae	*Centropyge argi*	Cherubfish
	Chromis cyanea	Blue chromis
	Chromis multilineata	Brown chromis
	Holacanthus ciliaris	Queen angelfish
	Holacanthus tricolor	Rock beauty
	Pomacanthus arcuatus	Grey angelfish
	Pomacanthus paru	French angelfish
Pomacentridae	*Abudefduf saxatilis*	Sergeant major
	Microspathodon chrysurus	Yellowtail damselfish
	Stegastes adustus	Dusky damselfish
	Stegastes diencaeus	Longfin damselfish
	Stegastes leucostictus	Beaugregory
	Stegastes partitus	Bicolor damselfish
	Stegastes planifrons	Threespot damselfish
	Stegastes variabilis	Cocoa damselfish
Priancanthidae	*Heteropriacanthus cruentatus*	Glasseye snapper
	Priacanthus arenatus	Bigeye
Sciaenidae	*Equetus acuminatus*	Highhat
	Equetus punctatus	Spotted drum
	Odontoscion dentex	Reef croaker
Scombridae	*Acanthocybium solandri*	Wahoo
	Scomberomorus cavalla	King mackerel
	Scomberomorus regalis	Cero
	Scomberomorus maculatus	Atlantic Spanish mackerel
	Thunnus albacares	Yellowfin tuna
Serranidae	*Hypoplectrus guttavarius*	Shy hamlet
	Hypoplectrus indigo	Indigo hamlet
	Hypoplectrus nigricans	Black hamlet
	Hypoplectrus puella	Barred hamlet
	Hypoplectrus gemma	Blue hamlet
	Hypoplectrus randallorum	Tan hamlet
	Hypoplectrus unicolor	Butter hamlet
	Liopropoma mowbrayi	Cave bass
	Rypticus saponaceus	Greater soapfish
	Serranus tabacarius	Tobaccofish
	Serranus flaviventris	Twinspot bass
	Serranus tigrinus	Harlequin bass
Sparidae	*Calamus bajonado*	Jolthead porgy
	Calamus calamus	Saucereye porgy
Sphyraenidae	*Sphyraena barracuda*	Great barracuda
PLEURONECTIFORMES		
Bothiidae	*Bothus lunatus*	Peacock flounder
SCORPAENIFORMES		
Scorpaenidae	*Scorpaena plumieri*	Spotted scorpionfish
TETRAODONTIFORMES		

Acanthuridae	*Acanthurus bahianus*	Ocean surgeonfish
	Acanthurus chirurgus	Doctorfish
	Acanthurus coerulus	Blue tang
Balistidae	*Balistes vetula*	Queen triggerfish
	Balistes capriscus	Grey triggerfish
	Canthidermis sufflamen	Ocean triggerfish
	Melichthys niger	Black durgon
Diodontidae	*Diodon hystrix*	Porcupinefish
Monacanthidae	*Aluterus scriptus*	Scrawled filefish
	Cantherhines macrocerus	Whitespotted filefish
	Cantherhines pullus	Orangespotted filefish
	Monacanthus tuckeri	Slender filefish
Ostraciidae	*Acanthostracion quadricornis*	Scrawled cowfish
	Lactophrys bicaudalis	Spotted trunkfish
	Lactophrys trigonus	Trunkfish
	Lactophrys triqueter	Smooth trunkfish
Tetraodontidae	*Canthigaster rostrata*	Sharpnose puffer
	Chilomycterius antennatus	Bridled burrfish
	Sphoeroides spengleri	Bandtail puffer

Table 19: *Fish of Port Honduras Marine reserve (TIDE / Blue Ventures data)*

Birds

Port Honduras Marine Reserve provides nesting, roosting and foraging areas for coastal and wetland birds of southern Belize, such as brown pelicans, magnificent frigatebirds, terns, gulls and cormorants (Table 20). The Caribbean subspecies of Osprey (*Pandion haliaetus ridgwayi*), an important predator of the marine environment and indicative of the health of the trophic structure, also nests on the cayes. This subspecies has a limited global distribution, with Belize representing the southern extent of its range (Jones, pers. com.). The same is true for the Yucatan Vireo, confined to southeast Mexico and adjacent Belize, with reports from the cayes of Port Honduras Marine Reserve representing the southern-most reports for this species.

Middle Snake Caye has been known historically for its mixed species colony of terns, with both sooty and bridled terns (*Onychoprion fuscatus* and *O. anaethetus*) reported to be nesting there in relatively large numbers (Jones et al., 2011). It is thought that disturbance from research activity led to the relocation of the colony outside of PHMR. Have they returned?

Apart from the resident bird species of the southern Belize coast, the area is also a stopover point for migrants as they move south in autumn and north in spring between North American breeding grounds and Central and South American wintering grounds. Thousands of migrant songbirds, notably wood warblers, tanagers, thrushes, and tyrant flycatchers, pass through the outer cayes and atolls each spring and fall. Some of these also find their way to the cayes of Port Honduras Marine Reserve. These cayes provide stop-off points with critical forage and shelter for these migrants as they pass through. Following the songbirds are the predators, including peregrine falcons, which support themselves by feeding on the migrating songbirds as they too migrate between northern and southern latitudes. The peregrine and its smaller relative, the merlin, migrate almost exclusively through the cayes of Belize and Honduras, for the most part avoiding the mainland in order to take advantage of this abundant prey resource.

Bird Species of Port Honduras Marine Reserve

Species		Status
Brown Pelican	*Pelecanus occidentalis*	cV
Magnificent Frigatebird	*Fregata magnificens*	vP
Neotropic Cormorant	*Phalacrocorax brasilianus*	cP
Anhinga	*Anhinga anhinga*	cP
Great Blue Heron	*Ardea herodias*	uV
Great Egret	*Ardea alba*	uV
Little Blue Heron	*Egretta caerulea*	uV
Tricolored Heron	*Egretta tricolor*	oV
Cattle Egret	*Bubulcus ibis*	fT
Green Heron	*Butorides virescens*	fV
Yellow-crowned Night-Heron	*Nyctanassa violacea*	uT
White Ibis	*Eudocimus albus*	P
Red-breasted Merganser	*Mergus serrator*	T
Blue-winged Teal	*Anas discors*	oT
Black-bellied Whistling Duck	*Dendrocygna autumnalis*	cV
Black Skimmer	*Rynchops niger*	oT
Turkey Vulture	*Cathartes aura*	cP
Black Vulture	*Coragyps atratus*	cP
Osprey	*Pandion haliaetus*	fP
Common Black-Hawk	*Buteogallus anthracinus*	fP
Peregrine Falcon	*Falco peregrinus*	fT
Spotted Sandpiper	*Actitis macularia*	cW
Least Sandpiper	*Calidris minutilla*	cW
Laughing Gull	*Larus atricilla*	uV
Royal Tern	*Sterna maxima*	cV
Sandwich Tern	*Sterna sandvicensis*	uV
Sooty Tern	*Onychoprion fuscatus*	S
Bridled Tern	*Sterna anaethetus*	oV
White-crowned Pigeon	*Columba leucocephala*	fS
Pale-vented Pigeon	*Patagioenas cayennensis*	cP
Green-breasted Mango	*Anthracothorax prevostii*	fS?
Cinnamon Hummingbird	*Amazilia rutila*	fP
Ruby-throated Hummingbird	*Archilochus colubris*	uT
Lesser Nighthawk	*Chordeiles acutipennis*	uT

Status

Legend

v = very common	**P** = permanent resident
c = common	**S** = seasonal resident
f = fairly common	**V** = visitor
u = uncommon	**T** = transient (migrant)
o = occasional	**W** = winter resident
l = local	**F** = former resident
X = one or two records only	

Bird Species of Port Honduras Marine Reserve /2

Belted Kingfisher	*Ceryle alcyon*	fW
Eastern Wood-Pewee	*Contopus virens*	vT
Willow Flycatcher	*Empidonax traillii*	fT
Great Crested Flycatcher	*Myiarchus crinitus*	cT
Eastern Kingbird	*Tyrannus tyrannus*	cT
Philadelphia Vireo	*Vireo philadelphicus*	uT
Red-eyed Vireo	*Vireo olivaceus*	cT
Yucatan Vireo	*Vireo magister*	?
Purple Martin	*Progne subis*	cT
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	uT
Cliff Swallow	*Petrochelidon pyrrhonota*	uT
Barn Swallow	*Hirundo rustica*	cT
Gray Catbird	*Dumetella carolinensis*	vT
Tennessee Warbler	*Vermivora peregrina*	vT
Northern Parula	*Parula americana*	cW
Yellow Warbler	*Dendroica petechia*	cW
Chestnut-sided Warbler	*Dendroica pensylvanica*	cT
Magnolia Warbler	*Dendroica magnolia*	cT
Yellow-rumped Warbler	*Dendroica coronata*	uT
Yellow-throated Warbler	*Dendroica dominica*	cW
Black-and-white Warbler	*Mniotilta varia*	cW
American Redstart	*Setophaga ruticilla*	vW
Prothonotary Warbler	*Protonotaria citrea*	fT
Worm-eating Warbler	*Helmitheros vermivorus*	fT
Northern Waterthrush	*Seiurus noveboracensis*	cT
Kentucky Warbler	*Oporornis formosus*	uT
Mourning Warbler	*Oporornis philadelphia*	uT
Hooded Warbler	*Wilsonia citrine*	cW
Summer Tanager	*Piranga rubra*	cW
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	cT
Indigo Bunting	*Passerina cyanea*	vT
Great-tailed Grackle	*Quiscalus mexicanus*	vP
Orchard Oriole	*Icterus spurious*	uT
Baltimore Oriole	*Icterus galbula*	cT

Status	
v = **very common**	**P** = permanent resident
c = **common**	**S** = seasonal resident
f = **fairly common**	**V** = visitor
u = **uncommon**	**T** = transient (migrant)
o = **occasional**	**W** = winter resident
l = **local**	**F** = former resident
X = **one or two records only**	

Table 20: *Birds of Port Honduras Marine Reserve*

Reptiles

The conservation priorities for the herpetofauna of Port Honduras Marine Reserve 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*). The Port Honduras area was highlighted as important for sea turtles in the Sea Turtle Recovery Action Plan (Smith, G et al., 1992). In 1982, landing data reported that 250 turtles of all three secies were fished and landed in Punta Gorda, with a total weight of 46,750kg (an average weight of 187kg). It should be noted that the Punta Gorda landings were the highest for Belize – approximately 25%. When the survey was repeated in 1987, with Punta Gorda still showed similar landings (250), but with reduced total and average weight of catch (Total: 18,181kg; Average: 72.7kg) (Smith et al. 1992).

Reptile Species of the Port Honduras Marine Reserve	
Hawksbill Turtle	*Eretmochelys imbricata*
Loggerhead Turtle	*Caretta caretta*
Green Turtle	*Chelonia mydas*
St. George Island Gecko	*Aristelliger georgeensis*
Yellowbelly Gecko	*Phyllodactylus tuberculosus*
Brown Anole	*Norops sagrei*
Boa	*Boa constrictor*
Morelet's Crocodile	*Crocodylus moreleti*
American Crocodile	*Crocodylus acutus*

Table 21: *Reptile Species of Port Honduras Marine Reserve*

In 1990, before the moratorium on hunting turtles, green turtles were reported as commonly fished in the Monkey River area, along with a smaller numbers of loggerheads and very small number of hawksbill (one Monkey River fisherman reported catching 50 – 60 green and loggerhead turtles per year, with only five hawksbills; a Punta Negra fisher reported an annual catch of 60 turtles, with equal numbers of green, loggerhead and hawksbills; and a Punta Gorda fisher reported a catch of 60 – 100 turtles…predominantly green. A nesting survey in 1990 highlighted Punta Negra as an important nesting beach for all three species, and Punta Ycacos for hawksbill turtles (with 8 hawksbill nests identified)

As elsewhere, sea turtle numbers have plummeted in recent decades, having been exposed to intense 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). 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 cayes increasing the critical importance of maintaining those characteristic of the cayes of Punta

Negra and Punta Ycacos that increase nesting success, and balancing this with land ownership conflicts, tourism activities and development in the area.

TIDE has been collecting data on the number and location of nests,

A recent initiaitive inpartnership with Marymount University also looks at the use of the larger seascape by nesting females, using satellite tagging and tracking. Two turtles have been tagged to date, enabling TIDE to highlight the importance of the coastal beaches and foraging areas for endangered sea turtles in and around PHMR, and determine connectivity with other areas in the region. The first, TIDE of Hope, moved from the nesting site in PHMR to Honduras. TIDE of Hope II, however, moved northwards to

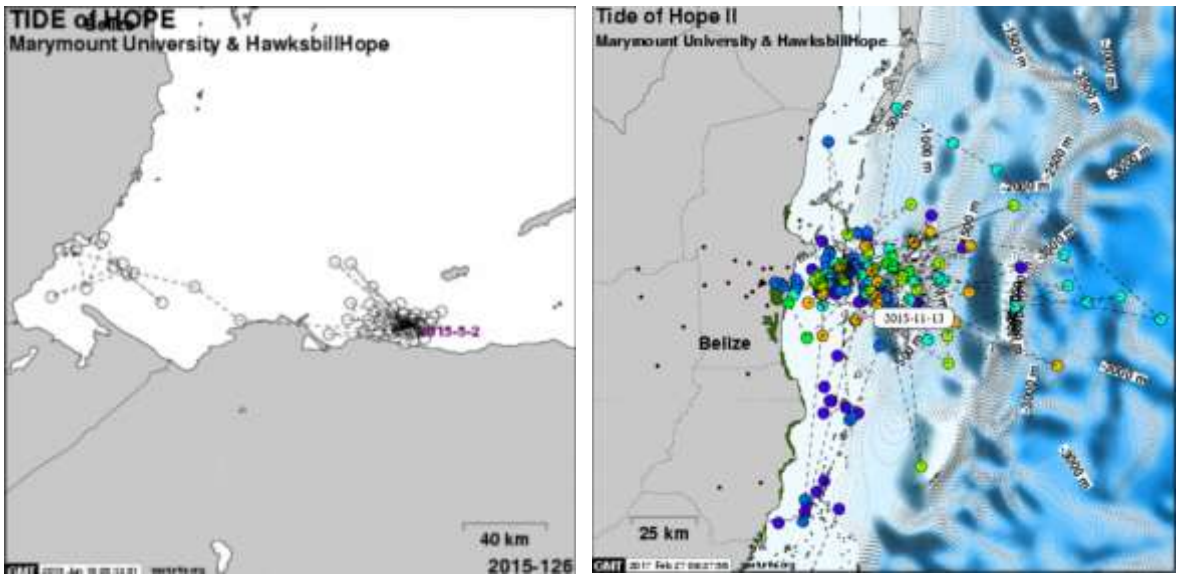


Figure …: *Tracking of TIDE of Hope and TIDE of Hope II (TIDE / Marymount University)*

Three terrestrial reptile species have been recorded on the PHMR cayes – the brown anolis (*Anolis sagreil),* St. George's island gecko (*Aristelliger georgeensis*), and the boa (*Boa constrictor*). All three are species frequently found on cayes – both the St. George's island gecko and the brown anole are considered to be human commensals, and can generally be found wherever humans have settled, though the brown anole also occurs naturally throughout the littoral forest patches and on uninhabited coastal islands.

Information on crocodiles?

Morelets crocodile (*Crocodylus moreleti*) is present in the area, though there is little information on distribution and abundance (Tellez survey?)

Crocodile populations in southern Belize are considered to be reduced due to poaching, particularly as a result of transboundary incursions (Tellez, pers. Com.)

Marine Mammals

Port Honduras Marine Reserve has three species of marine mammal recorded within its boundaries – the bottle-nosed dolphin, Atlantic spotted dolphin and the Antillean manatee (Table 22).

Mammal Species of the Port Honduras Marine Reserve	
Bottle-nosed Dolphin	*Tursiops truncatus*
Atlantic spotted Dolphin	*Stenella frontalis*
Antillean Manatee	*Trichechus manatus*

Table 22: *Mammals of Port Honduras Marine Reserve*

The Belizean coast is home to the largest population of ***Antillean manatee*** (*Trichechus manatus manatus*) in the Caribbean (Morales-Vela *et al*, 2000) and PHMR is one of 6 key areas with critical habitat for manatees. A baseline study was conducted by TIDE in 2014 to obtain information on the distribution and behaviour of manatees in PHMR. In total, during the 78 surveys conducted across five selected zones, 121 manatees were observed with 12 of these being calves, (Gonzalez et al., 2014). However, as individual manatees could not be identified, these sighting represent multiple counts of individual manatees during the survey period. The manatee sightings were generally closer to the coastline, with higher sighting frequency in the Deep River mouth (Zone 1), followed by the adjacent Payne's Creek National Park (Zone3) and Golden Stream (Zone 4) (Gonzalez et al., 2014).

Historically, manatees have been hunted for meat by the ancient Maya, with bone middens discovered on archaeological sites. This was continued into the 17th century by privateers and explorers (Self-Sullivan et al., 2004). At the national level, the first legislation for the protection of manatees was the Manatee Protection Ordinance (1933-1936) (Quintana-Rizzo and Reynolds, 2007), which stemmed from over-hunting pressures (Auil, 1998). The manatee is also included as a threatened species in the Wildlife Protection Act No. 4 of the Forest Department in 1981, which prohibits the killing, taking or molesting of manatees (Auil, 1998), though despite this, hunting is still occurring illegally in some areas of Belize. Today, Belize's Antillean manatee (a sub species of the West Indian manatee (globally 'Vulnerable', IUCN, 2017)) is considered threatened across its range, and listed as 'Endangered', based on the higher threats and lower population (IUCN, 2017).

Although Belize is considered to be the population stronghold for the Antillean manatee (Quintana-Rizzo et al., 2010), threats to the population have increased

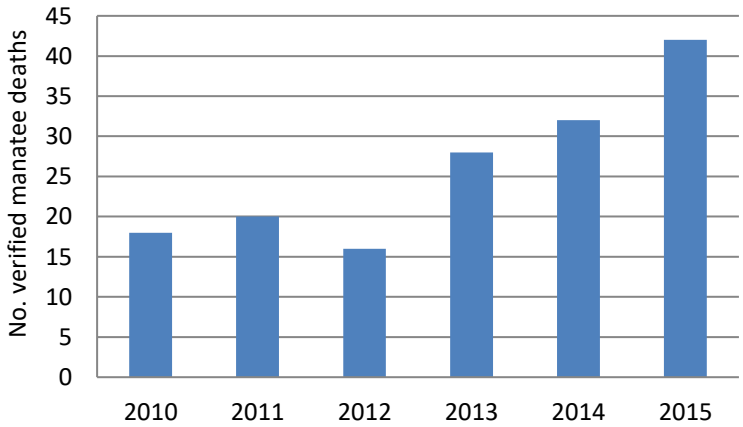


Figure 31: *Number of stranding reported per year (Galves, pers.com., 2016)*

significantly in recent years – primarily from increasing boat-based tourism in the Belize City / Belize River area. Belize has witnessed more than a two-fold increase in manatee mortalities over the last 5 years (Galves, 2015), with confirmed mortalities in 2015 of 42 animals. At the lower population estimate of 700 individuals, the 2015 mortality represents a 5.7% mortality rate of the national population - already higher than the 5% that population modelling indicates to be sustainable (Castelbanco et al., 2012). Best available science demonstrates that Belize's population of manatees will crash unless current trends in mortality are reversed (NMWG, 2015). The highest verified cause of stranding is due to collision with watercraft (Figure 31), though in PHMR, there has also been indications of hunting, presumed to be by transboundary fishers / hunters.

The manatees of PHMR use a larger seascape, stretching north to the mouth of Placencia lagoon, one of the preferred freshwater sources in the southern Belize region. With the opening of another cruise ship port in November 2016, all land-based tours are scheduled to be accessed by boat through this high density manatee area, conservation planning based on best available data indicates the potential for a significant increased additional mortality (Walker et al., 2015). Even if only half of that at the Belize River, it would bring national annual mortality to as much as 8.6% - substantially higher than levels considered sustainable for the population. It would also have the potential to significantly impact the manatee population of PHMR. With increasing coastal development and tourism-related boat traffic in key manatee areas, the current increasing trend of mortality in this species is not going to stop unless effective measures can be put in place.

Effective protection of PHMR contributes to ensuring that Belize maintains a viable population of the species, with the potential to serve as a source for recovering populations in adjacent countries such as Honduras and Mexico (Quintana-Rizzo & Reynolds, 2007). Despite this, the current regional sub-species population is expected to decrease by over 20% in the next 40 years if effective conservation actions are not put in place (Self-Sullivan et al., 2008). The current total regional population of manatees is estimated at 2,500 mature individuals, with between 700 and 1,000 in Belizean waters (Auil, pers. com.), though this estimate is based on an extrapolation from the total count of 507 individuals, and may not be an accurate representation of the current population. Accuracy of aerial surveys is heavily dependent on season, weather and water turbidity conditions, and it is accepted that population estimates may have a large margin of error (Auil, 2004).

Two species of dolphin have been identified in PHMR – the ***bottle-nosed dolphin*** *(Tursiops truncates)* and the ***Atlantic spotted dolphin*** (*Stenella frontalis*) The global conservation status for bottle-nosed dolphins is listed as of low concern, identifying the main threats as hunting, entanglement in fishing nets, and habitat destruction and degradation (IUCN 2012). The loss of these marine mammals, however, can have a cascading effect on the rest of the trophic levels, destabilizing the food chain and marine ecosystems, and having ecological and economic effects that may be irreversible.

Although the bottle-nosed dolphin is one of the most studied cetaceans in the world (Wells and Scott, 1999), little is known about the status across Belize. However, research is increasing, principally around Turneffe Atoll. Until 2013, there has been only anecdotal information about dolphins in PHMR. In 2013, 1,202 photos of dorsal fins were used to create a photo ID catalogue, identifying a total of twenty nine *T. truncatus* and twenty four *S. frontalis* in PHMR (Rojas, 2013).

1.5.3 Past and Present Research

Past Research

A number of studies have been conducted in and around the Port Honduras area since the 1960's (Stoddart, 1960; High, 1966; Wetland et al., 1971; Perkins, 1983; Zisman, 1992). A "rapid ecological assessment" (REA) was conducted for the PHMR area in 1994, addressing, to varying extent, oceanography and coastal hydrology, fisheries, benthic community ecology, and mangroves. The results are documented in the report "Site Characterization for Integrated Coastal Management: Ecology, Oceanography, and Geography of Port Honduras, Belize - a proposed marine protected area" (Sullivan et al. 1995). The assessment of the Gulf of Honduras benthos was assisted by Coral Caye Conservation (CCC) who led the expedition for the area surrounding the Snake Cayes.

Research has also been conducted within PHMR by a variety of national and international researchers. Will Heyman spent an extended time in the area, working on seagrass and mangrove productivity (Heyman, 1996); an assessment of climate and hydrology of Port Honduras (Heyman & Kjerfve 1999), and a survey of the perceptions of fishers who use Port Honduras (Heyman and Hyatt, 1996). Rachel Graham has also focused on the shark and goliath grouper populations of the area. More than a decade of research on the archaeology of Port Honduras has been conducted under Heather McKillop, focused on Wild Cane Caye and its position as part of the trading routes used by the ancient Maya.

The area has also been used by a number of universities, including and students from Texas A&M University (Dr. Will Heyman), South Carolina University (Dr. John Bruno), and students from Boston University (Les Kaufman and Dr Burton Shank).

A number of studies have also been completed by TIDE, as ouputs of the Research and Monitoring Program:

Alvarez M. and J. Foley (2015). Lionfish awareness study: tracking changes in public perceptions – 3 year summary report 2011-2014, TIDE

Arias J. (2013). *Establishement of a Baseline Information for Tursiops truncatus for a Monitoring Program in the Marine Reserve of Port Honduras, Belize*. Master Thesis for El Colegio de la Frontera Sur Universidad de Sherbrooke

Cherrington, E. A. (2013). Baseline Assessment of Seagrass and Mangrove Cover and Dynamics in the Port Honduras Marine Reserve, Belize. Technical Report, Water Center for the Humid Tropics of Latin America & the Caribbean (CATHALAC), Panama City, Panama.

Cushion, N. (2004). Port Honduras Marine Reserve: Manual for Biological Monitoring, Management Effectiveness Indicators and GIS Applications

Foley J. (2011). Status of the Caribbean Spiny Lobster Population Port Honduras Marine Reserve – 2011, TIDE

Foley J. (2011). Donkey Dung Sea Cucumber Monitoring Report: September – December 2011, TIDE

Foley J. (2011). Queen Conch Report: June 2010 – Sept 2011, TIDE

Foley J., M. Alvarez and T. Barona (2014). *Status of Goliath Grouper in Port Honduras Marine Reserve, Payne's Creek National Park, Deep River 2014,* TIDE

Foley J., T. Barona and T. Irvine (2015). Port Honduras Marine Reserve Commercial Benthic Species Update: 2009-2014, TIDE

Foley J., M. Alvarez, T. Barona, R. Moore, E. Requena and D. Warns (2015). Ridge to Reef Water Quality Port Honduras Marine Reserve, Monkey River, Rio Grande, TIDE

Foley J. (2016). Port Honduras Marine Reserve Coral and Reef Fish Health: 2011-2014, TIDE

Foley J., T. Barona, T. Irvine and M. Alvarez (2016). Port Honduras Marine Reserve Commercial Benthic Species Update: 2009-2015, TIDE

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1.6 Cultural and Socio-Economic Values of Management Area

1.6.1 Archaeological Sites

Port Honduras Marine Reserve and the surrounding area has been the subject of archaeological investigation for over 30 years, with several archaeological sites identified (McKillop 1984, Jackson & , 1987, McKillop 2005, Seidemann & McKillop 2007). These include a trading post at Wild Cane Caye, settlements at Frenchman's Caye, salt production ponds at Stingray Lagoon (Punta Ycacos), and underwater sites of Green Vine Snake Caye and Pork-and-Doughboy Point.

With the advantages of a natural harbour and a strategic location at the mouth of Deep River, Wild Cane Caye has been identified as a prehistoric coastal Maya trading station in southern Belize. Six artificial coral mounds are located on the low lying, 62 ha caye, indicative of past habitation, and the presence of obsidian artifacts from seven sources located from origins ranging from Central Mexico to the Hhighlands of Honduras suggests that the caye was part of important coastal and inland trade routes and regional trade networks (McKillop et al., 1988).

1.6.2 Recreation and Tourism Use

Swimming, sunbathing and general relaxation are common activities enjoyed by locals and tourists alike within PHMR, with the majority of activities taking place on or near the cayes. Despite its high touristic value, however, only a small percentage of international tourism visitation reaches Toledo District. In 2016, approximately 13,800 visitors included Toledo in their trip – just over 3.5% of the total annual international visitors to Belize (BTB, 2017). These visitors tend to stay in the Toledo District for an average of 13 days – far longer than other locations in Belize, focusing on local history, culture, arts and crafts, and archaeological sites as their top interests, with only 18% listing Port Honduras Marine Reserve as an activity (BTB, 2015). As a result, national investment in marine-based tourism through the current Sustainable Tourism Development project is considered a low priority (BTB, 2015).

Visitors that use Port Honduras Marine Reserve provide employment opportunities for local guides and tourism developments on the mainland – it is estimated that 12 tour guides use the Marine Reserve from both the Toledo and Monkey River Tour Guide Associations (TIDE, pers. com.). There are also a small number of visitors accessing PHMR through “barefoot” boat charters, and from Belcampo, the high end tourism resort near Punta Gorda. Present tourism and recreation use of Port Honduras Marine Reserve is low impact compared with similar nearby locations such as Laughing Bird Caye National Park, which is used extensively for tourism purposes.

Attractive beach areas are accessible on West Snake Caye, Abalone Caye, South Snake Caye, and Moho Caye. West Snake Caye is the most frequently visited with over 190 feet of shifting beach, with the vibrant colours and life of the fringing reefs of this caye, Frenchman’s Range to Moho Caye and South Snake Caye attracting divers and snorkelers (Avila et al., 2005). Kayaking and sailing are also popular within the Marine Reserve, around the Snake Cayes, with private sailboat charters originating from

Placencia. The close proximity to Guatemala and Honduras also makes the area a popular sailing destination, particularly during the Easter holidays. Day sailing activity has high potential but is currently limited.

Two cruise ships carrying between 20 to 85 passengers currently visit the cayes within Port Honduras Marine Reserve on a regular basis with landings off West Snake Caye and Punta Gorda Town. One Company markets its cruise as an eco-tourism tour and offers natural history educational lectures on board.

Sport fishing in PHMR is defined as catch and release or tag and release fishing of target species (primarily tarpon, bonefish, permit and snook), whereas recreational fishing is extractive fishing for enjoyment and consumption but not subsistence. Sport fishing is an important resource for the area, and has gained in popularity in Belize since the establishment of PHMR in 2000. PHMR and the larger southern Belize region are now regarded as one of the prime fly fishing sites in the world – an area where the coveted 'grand slam' can be achieved (when an angler is able to catch a bonefish, tarpon and permit during one day of fishing). Healthy stocks of targeted sport fish species are prevalent in PHMR, with the majority of tours in PHMR being guided by the Toledo Sport Fishing Association.

Tourists are also able to participate in research and monitoring activities in PHMR through TIDE's partnership with Discovery Corps, an international travel company that connects travellers with opportunities to immerse themselves in local cultures and assist in volunteer work. In PHMR, volunteers conduct manatee surveys by boat, learning how to measure environmental conditions that affect the manatees' habitat and record behavioral data. This cross linkage of tourism / volunteer use of PHMR provides valuable support for ongoing TIDE monitoring activities.

1.6.3 Educational Use

TIDE considers the Environmental Education Program to be a cross-cutting organizational priority, engaging stakeholders and stakeholder communities through education and outreach activities. It seeks to create awareness and knowledge of critical ecosystems to reduce and minimise the threats to the marine resources of PHMR and surrounding areas. It encourages people to become active stewards of the natural resources in and around their communities through provision of information, active engagement and participation in TIDE activities. The Program is highly interactive and promotes activities that connect leaders, teachers and the wider community to a variety of learning experiences such as classroom presentations, team sports, community outreach and field trips.

Program activities in PHMR are implemented under three key areas:

- **Schools Education and Training Program**
- **Fisheries Education Program**
- **Public Education Program**

In 2015, TIDE initiated a partnership with the Ministry of Education and schools to raise standards in environmental education, with lesson plans and teaching materials tailored to the national curriculum and teachers involved in field-testing and refining them for national dissemination. TIDE also implemented the pilot phase of the Reef Guardian Schools Program in three schools in Punta Gorda, to improve standards in coral reef education. This is being strengthened in 2017, with the integration of conservation targets into the middle school curriculum over the next five years.

It also implements specific educational campaigns designed to address specific issues. The "Extinction makes me grumpy" campaign implemented in 2016 targeted schools in the stakeholder communities to raise awareness of the issues facing the critically endangered Goliath grouper in PHMR, and the concepts of sustainable fishing, linked to the research outputs for this species. TIDE has been running an annual Summer Camp for the last ten years, including visits to PHMR to ensure as many youths as possible have an opportunity to experience, know and understand the marine environment in their backyard.

1.6.4 Commercial, Recreational and Subsistence Fishing

Since 2011, TIDE and its partners (the Fisheries Department, Environmental Defense Fund, Wildlife Conservation Society and other partners) have piloted Managed Access fisheries in Port Honduras Marine Reserve, as one of two pilot sites in Belize. Managed Access provides exclusive commercial fishing rights to local, traditional fishers, ending the open access fishery that has been operating to date in Belize, improving the security of fishing livelihoods, and fostering a sense of stewardship. In 2015, the Belize Government approved the roll-out of Managed Access to all 3,000 square miles of Belize's near-shore fishery - a major milestone on the way to fisheries recovery in the Mesoamerican Reef. Managed Access in Belize is the first nationwide rights-based fishing program in a lower income country, creating a model for restoration of tropical developing world near-shore fisheries.

Managed Access recognizes 86 commercial fishers as traditional users of PHMR, based primarily from the coastal communities of Punta Gorda, Monkey River and Punta Negra. The non-mechanized, traditional capture fishery of PHMR is focused on Caribbean spiny lobster (*Panulirus argus*), queen conch (*Strombus gigas*), sea cucumber (*Holothuria mexicana*) and finfish - primarily lane snapper (*Lutjanus synagris*), Historically, lane snapper (*Lutjanus synagris*) has been, and still is, the most abundant fish species extracted, and is targeted using fish traps and hand lines (and previously gill nets, before they were banned within the protected area). Mutton, silk and dog snapper, snook and goliath grouper are also listed among the top ten targeted species.

A small number of subsistence fishers are reliant on PHMR to access fish for consumption, but the majority of non-commercial fishers access the area for recreational fishing. This is considered a traditional activity in PHMR stakeholder communities, with families and friends travelling to the Marine Reserve to fish, targeting many of the same species as the commercial fishermen. There is, however, an issue of recreational fishers using this loop hole to catch fish for sale, whilst not holding Managed Access licenses, causing ongoing conflicts, and challenges for TIDE as the management body.

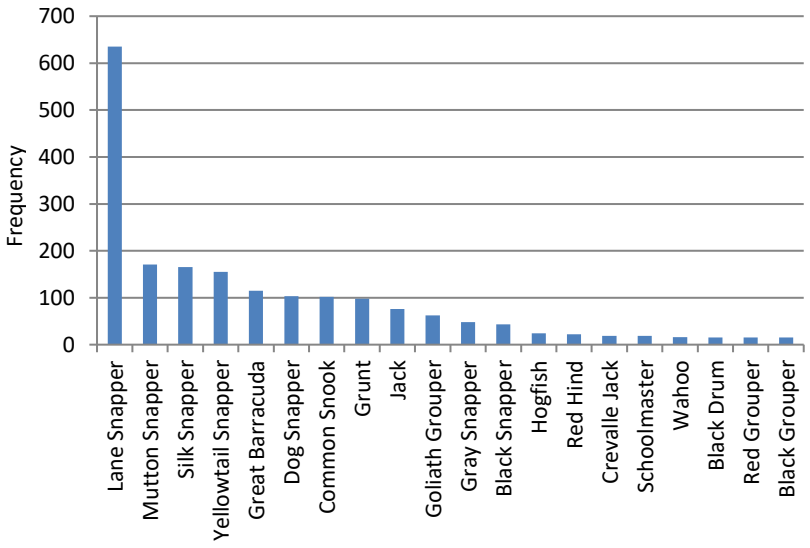


Figure 32: *Frequency of preferred finfish species landed by fishers from the Port Honduras Marine Reserve, March 2009 to June 2010 (TIDE data).*

Conch is fished by free diving, with effort generally concentrated at the start of the conch season. Conch surveys in PHMR are carried out twice a year, with twenty sites monitored since 2011 – five in the Replenishment Zones, eleven in the General Use Zone and four outside the reserve. Since 2009 the mean density of conch has decreased across all zones, and is now considered critically low (Figure 33). Whilst the closed seasons are designed to protect conch during their reproductive season, they have not been successful in increasing abundance. This is likely to have serious impacts on the reproductive success of the conch, as such low densities make finding a mate unlikely (TIDE, 2015).

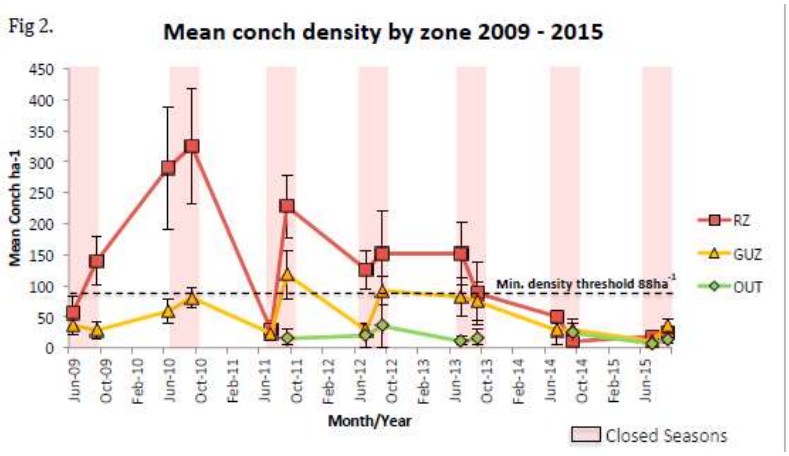


Figure 33: *Mean conch density by zone, Port Honduras Marine Reserve, 2009 to June 2015 (TIDE data).*

In 2012 / 2013, surveys demonstrated that almost 100% of conch caught was of legal size, indicating compliance with the law by fishers. Size limits are intended to allow all individuals to grow to maturity before they can be caught, ensuring reproduction. However, shell length may not be the best measure

to set size limits. Despite being within the legal size limits, as much as 90% of conch in fishers' catches in PHMR is actually juvenile, as fast-growing individuals can reach legal shell length before they are sexually mature. Shell lip thickness is therefore probably a much better indicator of maturity.

TIDE is exploring new measures to protect conch in PHMR. New replenishment zone boundaries have been agreed upon with fishers, and will increase the size of these zones by 60%. In 2016, TIDE also worked with fishers towards further harvest control rules based on an "Adaptive Management Framework" developed by University of California at Santa Barbara, and other partners. Preliminary findings of conch size-at-maturity suggest a more effective size limit can be set, with a potential output being a shift in size regulations for conch.

The lobster fishery is the most economically productive within PHMR, with lobster caught using traps, shades and by free diving, primarily on the deep-water banks associated with the Snake Cayes. There has been a recent shift to live lobster, caught with lobster shade, a technique considered to be more selective against undersized lobster than use of the lobster hook. The Caribbean spiny lobster is surveyed twice a year at eighteen sites, with eight in the Replenishment Zones, seven in the General Use Zone and three outside the marine protected area (TIDE, 2015). There has been a major decline in mean lobster abundance across zones between 2011 and 2013, with a small indication of the trend reversing in 2014 (Figure 34). An increase in numbers and mean carapace length in both zones was reported in the 2015 closed season survey for both the Replenishment Zones and the General Use Zone. This suggests that the introduction of Managed Access, the current management zones and improved enforcement are successful in increasing sustainability of this species. However, it is important to ensure that this trend continues over the next five years.

Fig 5.

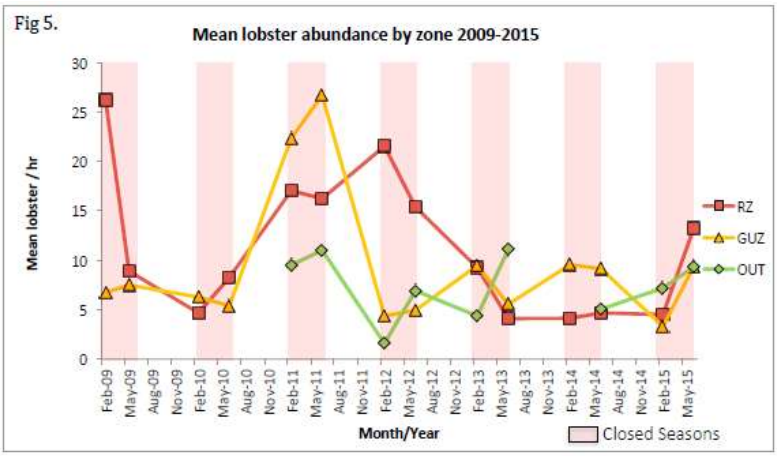


Fig 6.

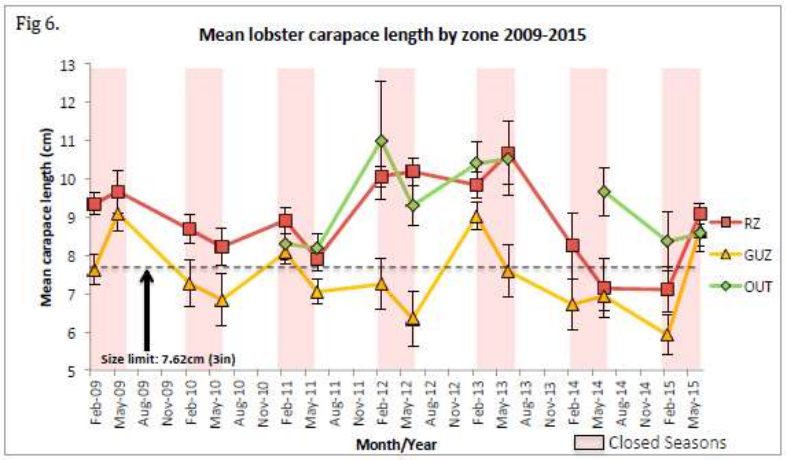


Figure 34: *Mean lobster abundance and carapace length by zone, Port Honduras Marine Reserve, 2009 to 2015 (TIDE data).*

As important detritus feeders, sea cucumbers are important to the health of the reef and marine ecosystem, removing detritus and preventing anaerobic build-up of biological matter. The sea cucumber, the most recently established commercial species for PHMR, was the most profitable species in terms of catch per unit effort (CPUE) in 2014 (TIDE, 2015). This species is monitored twice a year, at the start and end of the open season – July 1st – December 31st. Six monitoring sites have been selected across the Replenishment Zone and General Use Zone, based on habitat assessment. It should be noted, however, that the current Replenishment Zones may not be suitable for protection of the sea cucumber population in PHMR, with habitats in the General Use Zone considered more favourable. Replenishment Zone designation was based on requirements for lobster, conch and finfish, and occurred long before the sea cucumber became an important commercial species (TIDE, 2015).

Monitoring of sea cucumbers has been ongoing since 2011, when populations appeared to be relatively stable. However from 2012, mean density decreased in the General Use Zone to critically low levels, a trend that has continued to 2015 (Figure 35). Whilst a trend of increasing net weight and mean length was observed in the replenishment zones, surveys of density show a trend similar to that of the General Use Zone, with no signs of recovery in either between 2014 and 2015. The combination of a declining mean length, mean weight and densities in the general use Zone since 2014 indicates poor recruitment and unsustainable fishing pressure, with a lack of juveniles and only a few large adults, keeping the population low. Overfishing is considered to be a significant threat to the sustainability sea cucumbers and data suggest management interventions, such as a much reduced quota and new replenishment zones in prime sea cucumber habitat, are urgently needed to reverse this declining trend.

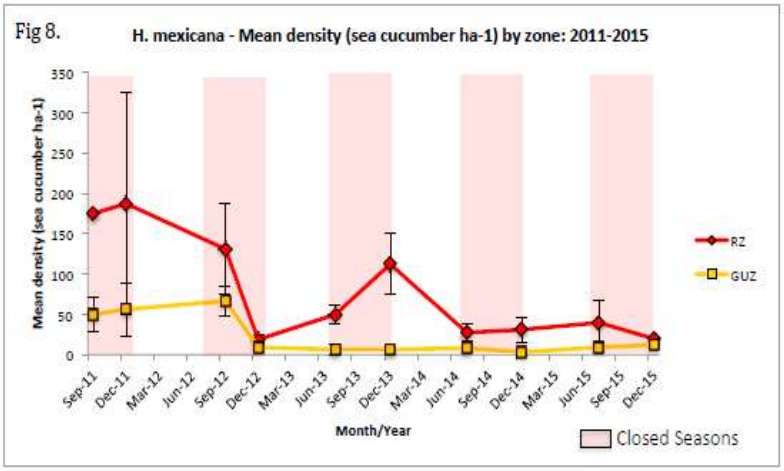


Figure 35: *Mean sea cucumber density by zone, Port Honduras Marine Reserve, 200911 to 2015 (TIDE data).*

Goliath grouper, as a key finfish species targeted preferentially by PHMR fishers, also has a declining population – particularly concerning with its status as a globally critically endangered species. Goliath grouper abundance in the Punta Ycacos / Deep River / PHMR estuary has shown a steady trend of decline – over a five year period, from 2006 to 2010, Goliath grouper catch per unit effort in the area declined by 50% (Graham et al. 2009). Market landing surveys in Punta Gorda over a two year period from 2005 to 2007 found that 99% of all landings had not reached the size of sexual maturity (Graham, 2009). This trend has continued over more recent years, with PHMR fishers reporting declines in both size and abundance. Similar landing surveys conducted by TIDE also found an average Goliath grouper length of 66.3 cm, far below the minimum size of sexual maturity, and of the 209 individuals measured

over the four year period (2009 to 2012), only one was considered to be above the minimum reproductive adult length of 110cm to 115cm for males and 120cm to 135cm for females (Bullock et al. 1992).

Preliminary discussions with fishers suggest that size limits may be the most acceptable mechanism for future implementation of species management and recovery regulations. In 2014, TIDE assessed the goliath grouper population in PHMR, to provide information for effective lobbying for greater protection of this species. The results highlighted the importance of the area for its nursery functionality for the goliath grouper, and the critical need for increased management of this species, and increased awareness.

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 in the management of the area to mitigate these threats. Conservation has been conducted at two different levels – the first is at the system level, during the Management Action Planning process for the Maya Mountain Marine Corridor, which identified the targets and threats over the larger, ridge to reef landscape / seascape. The second is at the site level – for the protected area. As part of the larger seascape, it is important that Port Honduras Marine Reserve is managed for maintenance of seascape targets – not just those of the site, and particularly for its role in maintaining water quality for the reef as part of the ridge to reef, its support of local commercial species, and as an important nursery area for species.

2.1 Conservation Targets

Conservation Targets (or Management Targets) are species, species assemblages or ecosystems that have been selected as representing the biodiversity of the marine protected area – such that strategic actions, taken to ensure their continued viability and reduce the pressures impacting them, will adequately address the conservation management needs of the protected area as a whole, and thosenested species they represent (Table 23).

2.1.1 Identification of Conservation Targets

As part of TIDE's adaptive management strategies, the PHMR conservation targets were reviewed and revised during the management plan revision process, with a list of seven revised targets selected to form the basis for conservation planning for 2017 – 2021 management period:

Ecosystem Level Targets: Assemblages of ecological communities that occur together, share common ecological processes, and have similar characteristics. One coastal and two marine ecosystems have been selected:

- ***Coral reef ecosystem***
- ***Coastal Ecosystems (littoral forest, sandy beaches, mangroves)***
- ***Seagrass and mudflats***

Species Assemblages: Three targets were selected that represent a group of species that share common natural process or have similar conservation requirements:

- ***Commercial marine species***
- ***Sport fishing species***

- ***Large marine vertebrates***

Two more targets were identified during the revision process to represent the physio-chemical health of the estuarine / marine environment and cultural heritage

- ***Water Quality***
- ***Archaeological Sites***

Target Justification	Nested Species, Communities or Ecological Systems
Coral reef communities	
Coral reef communities are an important ecosystem within PHMR, providing habitat, biodiversity, feeding areas, shoreline protection, enhancing tourism, and support many endangered species. PHMR corals are considered to have some resilience to climate change, and are therefore important at a national level for climate change adaptation	Coral reef communities and all associated reef species (reef fish, gorgonians, sponges, etc.)
Seagrass beds and mudflats	
Seagrass beds are an important habitat within PHMR, providing feeding and nursery areas that support turtles, manatees, and many fish and invertebrate species. This ecosystem supports the commercially important queen conch. In addition, seagrass beds play a crucial role in filtering sediment from the waterbody before it reaches the reef.	Seagrass beds, manatees, turtles, juvenile fish and invertebrate species. Queen conch.
Coastal Ecosystems (Littoral forests/sandy beaches/Mangroves)	
Mangroves are important nursery, nesting and feeding areas, providing critical coastal functions (e.g. erosion and storm damage prevention, filtering sediment from rivers). Littoral forests are the most threatened ecosystems in Belize. They are important for stabilizing the coastal ridge, and provide shelter and foraging habitat for migratory birds. Beaches and beach vegetation are important nesting areas for turtles and an important tourism attraction and recreational area for southern Belize.	Littoral forest tress, mangroves trees, sandy beaches, turtles (nesting), migratory bird species.
Commercial Marine Species	
Commercial species, particularly conch, lobster and sea cucumber, are important in supporting local fishers. Species fished include the critically endangered Goliath grouper.	Conch, lobster, commercial finfish (grouper, snapper, snook, etc.), sea cucumber, sharks
Sport Fishing Species	
Sport fishing species are very important in bringing tourism to southern Belize, and provide alternative income opportunities for local fishers	Recreational sport fishing species (permit, bonefish, tarpon),
Large marine vertebrates	
Large marine vertebrates are important in maintaining trophic integrity in their roles as top predators or important herbivores. As charismatic species, they are also important in attracting tourism.	Dolphins, whales, sharks, turtles, manatees, crocodiles
Water Quality	
Water quality is perhaps the most important factor in the health of both ecosystems and species in PHMR. Increasing pressures are resulting in declining water quality, with increased sediment and contaminant load from the watersheds.	

Table 23: *Conservation Target selection and justification for Port Honduras Marine Reserve*

Origin of the targets 2011 targets:

In the previous management plan (2011 – 2016) four conservation targets were selected from the Maya Mountain Marine Corridor Conservation Action Strategy, all of which are directly related to Port Honduras Marine Reserve:

- Coral reef communities
- Near shore estuaries
- Seagrass beds
- Large marine vertebrates

An additional target was selected for its importance in supporting the livelihoods of key

- Commercial and recreational species

2.1.2 Assessment of Conservation Target Viability

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

- A means for determining changes in the status of each focal target over time, to measure success of conservation strategies, compare the status of a specific conservation target with future conditions, and 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 mitigation actions

- A basis for strategy design and the baseline for monitoring

In order to assess the status of conservation targets over time and to determine if the management strategies and actions are working, each target is assigned a viability rating based on a number of criteria (Walker et al., 2005).

- Size: a measure of the target's area or abundance, based on the minimum requirement needed to ensure survival after natural disturbance.

- Condition: an integrated measure of community composition, structure and biotic interactions (e.g., population structure, population components etc.).

- Landscape context: an integrated measure of two factors – key elemental processes that sustain the species or ecosystem, and connectivity.

Each Conservation Target was assessed using the following viability criteria:

- **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

Conservation Target	Size	Condition	Landscape Context	Overall Viability Rating
Coral Reef Communities	Fair	Fair	Poor	**Fair**
Coastal Ecosystems	Good	Good	Good	**Good**
Seagrass Beds and Mudflats	Good	Very Good	Good	**Good**
Commercial Marine Species	Fair	Poor	Fair	**Fair**
Sport Fishing Species	Good	Good	Fair	**Good**
Large Marine Vertebrates	Fair	Fair	Fair	**Fair**
Water Quality	Good	Fair	Fair	**Fair**

Table 24*: *Matrix for Viability Ranking for Selected Conservation Targets, 2016 (based on TNC CAP)

Archaeological sites on the cayes were added as an additional target in 2016, but will not be rated until they are assessed.

Conservation Target	2011	2016	Goal

Coral reef communities	**Fair**	**Fair**	**Good**
Justification for current rating: In 2012, PHMR was one of the healthiest reefs in the MAR region based on coral cover. Since then there has been a loss of some live coral (including gorgonians, particularly in 2015) and an increase in % sand and bare substrate. This may be due to increased wind and wave action impacts, potentially as a result of a decline in functionality of the outer barrier reef. Regional Healthy Reef data suggests that in the Landscape Context, the Healthy Reef sub region is considered to rate as Poor in terms of reef health. **Goal**: To return coral reef ecosystems in PHMR to a healthy state, providing the full range of functions and services.			
Coastal Ecosystems	**Good**	**Good**	**Good**
Justification for current rating: Still good, but slightly lower than 2011. Old growth mangroves are increasingly inundated and dying as a result of coastal and caye erosion. Whilst normal shifts in sandy beaches are expected, reports of increased wave action and erosion, and increased loss of turtle nests suggest that the condition is declining. It is possible that this is linked to a decline in functionality of the outer barrier reef. **Goal**: To maintain littoral forests and mangroves in a healthy state to ensure they perform critical functions by preventing illegal deforestation and clearing along the coastline and cayes within PHMR. To maintain healthy beaches, free of debris, for turtle nesting and tourists in PHMR.			
Seagrass Beds and Mudflats	**Very Good**	**Good**	**Very good**
Justification for current rating: A relatively large area of seagrass has been lost (assessments show a reduction in seagrass and increase in sand) thought to be because of shifts in sand and changing climate conditions, though local fishers think that this may also be partly due to movement and impacts of the fish traps. **Goal**: To maintain healthy seagrass beds throughout PHMR to ensure they perform critical functions as nursery areas and feeding grounds.			
Commercial Fishing Species	**Fair**	**Fair**	**Good**
Justification for current rating: Commercial species are declining, with increasingly similar populations within the protected area and outside. Different species are being impacted to differing extents - lobster and lane snapper (the primary finfish species harvested) are considered to rate as Fair, while both conch and sea cucumber are considered to have reached critically low levels. There have been shifts in the trophic structure, with overfishing of both baitfish (at the lower end of the food chain) and sharks (at the top of the food chain). **Goal**: To return abundance of commercial fish species to a sustainable level by reducing pressures in PHMR.			
Sport Fishing Species	**Originally merged with Commercial Species**	**Good**	**Good**
Justification for current rating: Within PHMR, sport fish species are considered to be doing well, though there is fishing pressure outside the protected area, in the larger seascape. **Goal**: To return abundance of sport fish species to optimum by reducing pressures in PHMR.			

Conservation Target	2011	2016	Goal
Large marine vertebrates	**Fair**	**Fair**	**Good**
Justification for current rating: Justification is based on the current status for a number of nested targets: *Antillean* Manatee: Population is considered stable, though the reported 3 to 5 boat strikes per year is cause for concern. *Dolphins:* Population is considered to be stable to good. There is thought to be some level of disease within the dolphin population, though it is not known how this affects the individual animals or population viability (note: not linked to PHMR – thought to be throughout Belize). It Is possibly linked to declining water quality. *Turtles:* Tuttle populations are thought to be good. Turtles are known to come from the northern and eastern reef to nest. Two tagged individuals moved outside the protected area (one to Honduras and one to the Drowned Cayes). Whilst the population size is considered to be good, the condition is thought to be declining as turtle nest survivorship is impacted by the increased number of animals on beaches (dogs, coatis and raccoons), and from increased wave action. *Sharks:* There is no specific monitoring of sharks within PHMR, but anecdotal information from fishermen suggest that numbers of nurse sharks and bull sharks are increasing. It is possible that the mudflats of PHMR may act as a nursery area for bull sharks. However at the national and regional level, populations are decreasing, with heavy national and transboundary fishing pressure, and overall, this target is rated as Poor. *Crocodiles:* There has been an increase in the number of crocodiles (both Morelet's and American) in both the rivers and PHMR itself. However, there is also an emerging market for meat. Overall, crocodile populations are considered to rate as Good. **Goal**: To return numbers of large marine vertebrates to optimal levels by reducing fishing and hunting pressure, and habitat loss within PHMR.			
Water Quality	**New Target (2016)**	**Fair**	**Fair**
Justification for current rating: Water flow is reduced by water diversion from the rivers during dry season. Water is diverted from Monkey River through banana plantations, then into the sea outside of PHMR. Land use change (including copper mining) results in an increased level of sediment, with increased nitrates and phosphates, particularly after the first rains of the year. Condition is considered to be fair to good…at the upper end of fair. The changing conditions are resulting in changing quantity and types of ephiplants growing on seagrass, increasing mortality, but juvenile fish feed on this ephiflora and fauna. ***Goal:*** Maintain and improve water quality in PHMR and the ridge to reef systems			
Archaeological Sites	**New Target (2016)**	**Unknown**	**Unknown**
Justification for current rating: Archaeological sites (Maya sites) on the cayes are considered to be an important information gap needing to be addressed as the focus on caye development increases. Information can assist in prioritizing reaction to threats of caye development, and inform input into NEAC decision making for EIAs ***Goal:*** Improve knowledge of archaeological sites on cayes within PHMR			

2.1.3 Threats Identification and Assessment

Anthropogenic issues such as unsustainable fishing and development are common to all marine protected areas in Belize, and can be addressed through management actions. Port Honduras Marine Reserve also faces a number of impacts outside the control of the site-level and management body. The

greatest external impact is climate change, a major overarching threat facing all marine protected areas of the Caribbean today.

TIDE identified the four highest threats for Port Honduras Marine Reserve as:

- Climate Change
- Transboundary Fishing Incursions
- Overfishing / Unsustainable fishing practices
- Inappropriate land use / Unsustainable development

Rating Critical Threats

The critical threats are assessed by Area, Severity and Urgency, using the following criteria (adapted from WCS):

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

Proportion of Area Affected		
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		
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		
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	Won't happen in > 10 years

<table>
<tr><th colspan="5">Threats to biodiversity of Port Honduras Marine Reserve / 1</th></tr>
<tr><td rowspan="8">Climate Change</td><td colspan="2">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 littoral forest, beach vegetation and mangrove
Ecological shifts in benthic communities
Reduced biodiversity
Reduced coral growth rates and live coral cover</td></tr>
<tr><td colspan="4">Source (Indirect Threat):
Increased water temperatures
Increased storm events / hurricanes
Sea level rise
Increased wave action – potentially as outer barrier reef loses some of its functionality – and changes in currents
Ocean acidification</td></tr>
<tr><td>Area</td><td>4</td><td colspan="3">Climate change is a global phenomenon, and is affecting biodiversity throughout PHMR</td></tr>
<tr><td>Severity</td><td>3</td><td colspan="3">The impacts of climate change are currently being felt at PHMR through increased bleaching and storm events. It is predicted that the severity and frequency of these events will increase over the coming years. Biodiversity, including live coral cover, is declining.</td></tr>
<tr><td>Urgency</td><td>3</td><td colspan="3">Although the impacts of climate change are occurring over an extended time period, the cumulative effects of this stressor pose 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 focus on building and maintaining resilient ecosystems

Management Strategies:
Strategy 1: Identify and map resilient coral species and areas within PHMR and increase targeted enforcement

Strategy 2: Identify mechanisms to ensure coral recruitment sources for PHMR are adequately protected

Strategy 3: Strengthen understanding of oceanic currents and physio-chemical characteristics of water critical for coral and fish recruitment

Strategy 4: Ensure adequate protection of key herbivores to maintain live coral cover and ecological functions

Strategy 5: Reduce local anthropogenic threats through effective enforcement and community engagement and awareness programmes

Strategy 6: Work closely with national and international partners to monitor climate change impacts and identify appropriate national and regional management strategies</td></tr>
</table>

<table>
<tr><th colspan="4">Threats to biodiversity of Port Honduras Marine Reserve / 2</th></tr>
<tr><td rowspan="8">Unsustainable Fishing Pressure</td><td>Status:</td><td>Historical</td><td>Active</td><td>Potential</td></tr>
<tr><td colspan="4">Conservation Target(s): Coral Reef Communities, Commercial and Recreational Species, Large Marine Vertebrates</td></tr>
<tr><td colspan="4">Threats (Direct):
▪ Reduced commercial / recreational fish / lobster / conch populations
▪ Reduced coral reef health (reduced herbivorous fish population,)
▪ Regime shifts and disruption of the trophic structure</td></tr>
<tr><td colspan="4">Source (Indirect Threat):
▪ Low income in local stakeholder fishing communities
▪ Increase in the number of fishermen
▪ Traditional occupation
▪ Poor fishing practices (fishing out of season, harvesting of undersized product, use of gill nets)
▪ Market for illegal product (out of season / undersized) in Belize and transboundary
▪ Replenishment Zones too small for effective spill-over effect
▪ Increasing fishing pressure and market demand from Jamaica and other CARICOM nations</td></tr>
<tr><td>Area</td><td>3</td><td colspan="2">Across the General Use Zone. There is also thought to be illegal fishing in the Conservation Zones at night</td></tr>
<tr><td>Severity</td><td>2</td><td colspan="2">Populations are in decline</td></tr>
<tr><td>Urgency</td><td>3</td><td colspan="2">Illegal fishing is happening now</td></tr>
<tr><td colspan="4">Management Goal: Improve sustainability of the commercial, recreational, sport and subsistence species

Management Strategies:

Strategy 1: Ensure PHMR has the human resources, equipment and training for effective surveillance and enforcement

Strategy 2: Continue effective development and implementation of managed access and other mechanisms (species specific regulations/quotas etc.) for increasing benefit for traditional users

Strategy 3: Continue collaborative enforcement (fishermen, TIDE, Fisheries Dept., SEA Coastguard, BDF, Police Dept. Customs etc.) against transboundary incursions both within and outside the MPA

Strategy 4: Increase capacity of staff for arrest procedures and handling of evidence

Strategy 5: Continue to demonstrate positive effects on maturity of commercial species as a result of good management of GUZ and reduction of illegal fishing</td></tr>
</table>

Threats to biodiversity of Port Honduras Marine Reserve / 2	
Unsustainable Fishing Pressure	**Strategy 6:** Continue monitoring of commercial species populations and trends (prioritizing conch, lobster, sea cucumber), in collaboration with Fisheries Department **Strategy 7:** Improve understanding of the importance of PHMR for all stages of the life cycles of commercial species (e.g. spawning areas for queen conch) **Strategy 8:** Improve appropriate sustainable diversification opportunities for PHMR fishermen and their families **Strategy 9:** Support initiatives to strengthen the judiciary system, towards an increased conviction rate and increased penalties for infractions **Strategy 10:** Continue to work closely and lobby with Government at the national level to develop and implement effective mechanisms towards a sustainable fishing industry

<table>
<tr><th colspan="5">Threats to biodiversity of Port Honduras Marine Reserve / 3</th></tr>
<tr><td rowspan="8">Transboundary Fishing Incursion</td><td>Status:</td><td>Historical</td><td>Active</td><td>Potential</td></tr>
<tr><td colspan="4">Conservation Target(s): Coral Reef Communities, Commercial and Recreational Species; Large Marine Vertebrates</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</td></tr>
<tr><td colspan="4">Source (Indirect Threat):
▪ Proximity to Honduras and Guatemala
▪ Political interference and lack of political support to address transboundary issues
▪ Low income in fishing communities of neighboring countries
▪ Low marine productivity in neighboring countries
▪ Increase in the number of transboundary fishermen
▪ Transboundary market for illegal product (out of season / undersized / nontraditional)</td></tr>
<tr><td>Area</td><td>3</td><td colspan="2">Avoid some areas, as rangers are active, so across less than 50%</td></tr>
<tr><td>Severity</td><td>3</td><td colspan="2">Populations are in decline, thought to be primarily as a result of transboundary fishing impacts</td></tr>
<tr><td>Urgency</td><td>3</td><td colspan="2">Illegal transboundary fishing is happening now</td></tr>
<tr><td colspan="4">Management Goal: Prioritize addressing of transboundary fishing incursions, to improve sustainability of the commercial and recreational species

Management Strategies:

Strategy 1: Strengthen collaborative enforcement (fishermen, TIDE, SEA, Fisheries Dept., Coastguard, BDF, Police Dept. Immigration Department, etc.) against transboundary incursions both within and outside the MPA

Strategy 2: Strengthen collaboration with Immigration Department towards more effective control of transboundary incursions

Strategy 3: Engage NGOs and Government agencies in Guatemala and Honduras through TRIGOH to seek assistance in addressing transboundary issues

Strategy 4: Support initiatives to strengthen the judiciary system and increase penalties for transboundary infractions</td></tr>
</table>

<table>
<tr><th colspan="5">Threats to biodiversity of Port Honduras Marine Reserve / 4</th></tr>
<tr><td rowspan="7">Inappropriate land use / Unsustainable development (including coastal and cayes)</td><td>Status:</td><td colspan="2">Historical</td><td>Active</td><td>Potential</td></tr>
<tr><td colspan="5">Conservation Target(s): All targets</td></tr>
<tr><td colspan="5">Threats (Direct):
▪ Reduced extent of littoral forest, mangroves and herbaceous beach vegetation
▪ Erosion of sandy beaches
▪ Reduced viability of nesting turtles populations
▪ Reduced viability of nesting bird populations
▪ Reduced viability of coral reef
▪ Reduced populations of commercial and non-commercial marine species
▪ Increased nutrients, sediment and pollutants in marine environment
▪ Potential destruction of seagrass beds</td></tr>
<tr><td colspan="5">Source (Indirect Threat):
▪ Agricultural development
▪ Clearance of riverbanks / riparian vegetation
▪ Infrastructure development (residential tourism, research, etc.)
▪ Inadequate / unplanned water management practices
▪ Increased pollutants (fertilizer, herbicide, insecticides, sewage etc.)
▪ Dredging
▪ Sedimentation
▪ Financial and political incentives
▪ Lack of direct management control over cayes
▪ Lack of current integrated land use planning for southern Belize</td></tr>
<tr><td colspan="5"><table>
<tr><td>Area</td><td>4</td><td>All PHMR is impacted - water quality impacts (including sediment)</td></tr>
<tr><td>Severity</td><td>3</td><td>Coastal caye vegetation / sandy beach clearance for development removes a significant portion, if not all, of ecosystem</td></tr>
<tr><td>Urgency</td><td>3</td><td>There are development plans for cayes in the planning stage</td></tr>
</table></td></tr>
<tr><td colspan="5">Management Goal: To maintain water quality, coastal and marine ecosystems and aesthetic beauty in the Port Honduras Marine Reserve

Strategy 1: Improve information on the ecological and archaeological components of the cayes to inform and better address threats of caye development

Strategy 2: Engage land owners, agricultural/caye developers, residents and users in riverine, littoral forest, mangrove, caye and beach vegetation areas in legislation, best management practices, protection and restoration

Strategy 3: Lobby for inclusion of national cayes within the Marine Reserve

Strategy 4: Empower local resource users with the background information and contact details for reporting environmental crimes</td></tr>
</table>

Threats to biodiversity of Port Honduras Marine Reserve / 4	
Inappropriate land use / Unsustainable development (including coastal and cayes)	**Strategy 5:** Work closely with developers, DOE, Fisheries and Forest Department, etc. to ensure effective monitoring of environmental impacts and enforcement of all relevant policies and regulations for development activities and compliance with guidelines and ECPs within and adjacent to the Marine Reserve and the wider MMMC (e.g. dredging of sand, mangrove clearance, water quality impacts) **Strategy 6:** Lobby for implementation of recommendations of the Coastal Zone Plan for the southern region **Strategy 7:** Strengthen the water quality monitoring program for PHMR to include effects from larger seascape (oceanic influence, river outflow from Guatemala etc.)

Threats to biodiversity of Port Honduras Marine Reserve / 5

Invasive Species
Lionfish

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

Conservation Target(s): Commercial and Recreational Species; Coral Reef Communities; Large Marine Vertebrates

Threats (*Direct*):

- Reduced viability of fish populations
- Reduced abundance of herbivores
- Reduced coral reef health
- Increased algal growth

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

- Invasive species (lionfish)

Area	***4***	Lionfish numbers have are starting to increase since first being reported in PHMR in 2011, and present at 10 of the 14 sites surveyed in 2014
Severity	***1***	Whilst it is not completely known the extent of impact that could be caused by lionfish it is thought that they could have a significant impact on local fish populations
Urgency	***3***	Lionfish have increased from a single report in 2010 to current densities. Still lower than elsewhere in Belize

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

Management Strategies:

Strategy 1: Work with national partners in the updating and implementation of the national plan for lionfish management

Strategy 2: Develop and implement a site-specific monitoring plan for lionfish within the Marine Reserve

Strategy 3: Strengthen stakeholder awareness, support and involvement in consistent, ongoing lionfish removal and management, especially at key target areas such as sites with high juvenile fish abundance

Strategy 4: Strengthen the local market for lionfish, in collaboration with local stakeholders

2.1.4 Prioritizing Threats

The assessment results for the priority threats are then compared and ranked in terms of their impact.

Threat	Area	Severity	Urgency	Total AxSxU	Rank
Climate Change	4	3	3	**36**	**1**
Transboundary Fishing Incursions	4	3	3	**36**	**1**
Unsustainable Fishing Pressure	3	2	3	**18**	**2**
Inappropriate Land Use /Unsustainable Development	4	3	3	**36**	**1**
Invasive Species - Lionfish	4	1	3	**12**	**3**

Table 25: *Prioritised treats for Port Honduras Marine Reserve*

This identifies three threat impacts as equally high – Transboundary Fishing Incursions, Unsustainable Fishing Pressure and Inappropriate Land Use / Unsustainable Development (of the cayes, coast and / or watersheds) (Table 25).

Based on these outputs, a number of key, cross-cutting strategies were identified and developed to reduce these impacts (Table 26).

Key Cross-Cutting Strategies	**Coral Reefs**	**Near Shore Ecosystems**	**Seagrass and Mudflats**	**Commercial Species**	**Sport Fish Species**	**Large Marine Vertebrates**	**Water Quality**
Ensure PHMR has the human resources, equipment and training for effective surveillance and enforcement and data management							
Reduce local anthropogenic threats through effective enforcement, community engagement and awareness programmes							
Work closely with national and international partners to identify appropriate national and regional management strategies for building resilience to climate change							
Lobby for inclusion of national cayes within the PHMR							
Engage land owners, agricultural/caye developers, residents and users in riverine, littoral forest, mangrove, caye and beach vegetation areas in best management practices, protection and restoration							
Work closely with developers, DOE, Fisheries and Forest Department, etc. to ensure effective monitoring of environmental impacts and enforcement of all relevant policies and regulations for development activities and compliance with guidelines and ECPs within and adjacent to the Marine Reserve and the wider MMMC							
Collaborative enforcement (fishermen, TIDE, Fisheries Dept., SEA Coastguard, BDF, Police Dept. Customs etc.) against transboundary incursions both within and outside the MPA							
Streamline and strengthen the water quality monitoring program for PHMR and include the larger seascape							
Engage NGOs and Government agencies in Guatemala and Honduras through TRIGOH to seek assistance in addressing transboundary issues							
Identify and map resilient coral species and areas within PHMR and integrate in prioritised enforcement areas							
Improve information on the ecological and archaeological components of the cayes to inform and better address threats of caye development							
Ensure adequate protection of key herbivores to maintain live coral cover and ecological functions							
Strengthen collaborative enforcement (fishermen, TIDE, SEA, Fisheries Dept., Coastguard, BDF, Police Dept. Immigration Department, etc.) against transboundary incursions both within and outside the MPA							
Continue effective implementation of managed access and other mechanisms for increasing benefit for traditional users							
Continue working to demonstrate positive effects on maturity of commercial species as a result of good management of GUZ and reduction of illegal fishing							

Table 26: *Key Cross-cutting Strategies*

2.1.5 Monitoring of Success of Conservation Strategies

The series of indicators allocated to each conservation target during the planning process provides a measure of success framework for site level monitoring, which have been incorporated into the Science Program. Monitoring the success of conservation strategies is an integrated component of the Management Action Planning process (Table …).

2.2 Planning for Climate Change

2.2.1 Site Resilience Assessment

When planning management strategies for climate change, it is important to determine areas of resilience and vulnerability. It is also important to identify adaptive strategies that can assist in maintaining the viability of biodiversity whilst increasing resilience at both site and stakeholder community level. This assessment of the predicted implications of climate change has been conducted for Port Honduras Marine Reserve, based on the ***conservation targets*** identified during conservation planning, and on the ***environmental services*** provided by the protected area in question.

Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems. Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.

IPCC, 2014

The following assessment has been based on Belize's "*Guidelines for Integrating Climate Change Adaptation Strategies into Protected Areas Management Plans*" management planning framework, and provides a mechanism for assessing the implications of climate change through a series of steps:

1. Understanding the resources of PHMR
2. Understanding climate change projections for PHMR
3. Identifying vulnerability factors and resilience features
4. Identifying focal targets threatened by climate change
5. Assessing, rating and prioritizing the threat of climate change for each focal target
6. Situation Analysis and baseline
7. Development of adaptation objectives and strategies

2.2.2 Identified Resources of Port Honduras Marine Reserve

The following resources have been identified as important for Port Honduras Marine Reserve:

The Fisheries Sector consists primarily of a traditional capture fisheries focused on lobster, conch and finfish. PHMR is important in supporting local artisanal fishermen from the adjacent coastal communities.

Resource	Comment
▪ Conch, Lobster, Sea cucumber	PHMR contributes to both national conch and lobster production, providing an important income for traditional fishermen from the southern fishing communities. A relatively recent market has also emerged for sea cucumbers
▪ Snapper / Grouper	The lane snapper continues to be important in supporting local fishermen and supplying local markets

The Tourism Sector. Port Honduras Marine Reserve is considered important locally as a tourism resource, generating significant income for the local economy and foreign exchange for the national economy.

Resource	Comment
▪ Healthy reef	The reefs of PHMR are some of the most accessible in Belize, with corals thriving close to shore, in shallow water. The vibrant colours and marine life associated with the corals are one of the key attractions for visitors to the area.
▪ Sandy beaches	PHMR is known for its scenic sandy beaches and turtle nesting, adding to the touristic appeal of the protected area.
▪ Sport fishing	PHMR is a key sport fishing destination, contributing to tourism income, and supporting tourism operations in Punta Gorda, Monkey River and Punta Negra.
▪ Large Marine Vertebrates (Antillean manatee, crocodiles, sharks, turtles)	As well as being key for maintaining ecosystem health, charismatic large marine vertebrates are also an important tourism resource, contributing towards high visitor satisfaction.

Ecosystem Service: The ecosystem services provided by PHMR are considered of national importance, particularly as the key link between the terrestrial protected areas and upland watersheds and the coastal and marine ecosystems of the landscape / seascape of the Maya Mountain Marine Corridor (MMMC). The Marine Reserve supports the commercial and sport fishing industries by enhancing finfish, conch and lobster populations, contributing towards the long-term sustainability of these activities. Additionally, these coastal ecosystems provide

protective filtration services for the Southern Belize Reef Complex (including the Sapodilla Cayes Marine Reserve) by settling out sediment and agrochemicals from terrestrial sources.

Ecosystem	Ecosystem Services
▪ Mangroves	The mangrove ecosystem provides a highly productive protected nursery habitat for juvenile commercial species (both extractive species supporting fishermen livelihoods and reef species of touristic appeal). It buffers and protects life and property on the cayes and coastal areas, reducing shore erosion, filtering land based pollutants and breaking the strength of storm force winds.
▪ Seagrass	PHMR has extensive seagrass beds, with high connectivity to reef and mangrove, providing productive nursery habitat for juvenile commercial species, as well as foraging sites for threatened species such as marine turtles, and commercial species such as conch. Seagrass is also recognized for its value in CO_2 absorbing qualities.
▪ Corals	The coral reefs of PHMR are thought to have some resilience to climate change impacts, with high tolerance to rapidly changing salinity, temperature and turbid water conditions. Corals show rapid and widespread recovery from coral bleaching.
▪ Littoral forest	The cayes of PHMR support some of the last remnants of littoral forest, considered the most threatened ecosystem in Belize. The coastal strand vegetation is important for stabilizing turtle nesting beaches, and maintaining the cayes.

2.2.3 Identification of the Primary Climate Change Elements

The primary climate change elements associated with Port Honduras Marine Reserve are identified as:

- Sea level rise
- Increased sea surface temperature
- Increased intensity of storms
- Ocean acidification
- Decreased precipitation
- Increased air temperature

Current, short term and long term predictions for climate change impacts are identified (Table …). For each target, the impacts of the identified primary climate change elements were rated on a scale of 1 to 4 (Table ..). Ratings took into consideration factors such as the severity, scope, contribution and irreversibility of each climate change element.

Table 27: Climate Change Predictions (B2 Scenario) for Port Honduras Marine Reserve

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 (IPCC, 2007). Current average increase in sea level rise in the Mesoamerican region is estimated at 3.1mm per year (IPCC, 2007).	The Hadley Centre's Unified Global Climate Model (GCM), HadGEM2-ES provides additional data to the IPCC reports (IPCC 2007, 2013) for the three Representative Pathways Projection scenarios[1]. In all three, the coastal sea level is projected to exceed 10 cm by the 2030s; 22, 23, and 38 cm respectively are projected for the low, medium and high emission scenarios by 2050 (NCCPSAP 2015).	By the end of the Century, the Hadley Centre's Unified GCM, HadGEM2-ES projects coastal seal level to rise by 34, 56, 120 cm respectively for the low, medium and high emission scenarios (NCCPSAP 2015).
Sea surface temperature rise	Water temperature has increased by 0.74˚C between 1906 and 2005 Current levels of increase are estimated at 0.4˚C per decade (Simpson et al., 2009)		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 intensity and frequency of storms	Increased storms from 1999 onwards, with annual fluctuations. More storms during El Nina, fewer during El Nino. Stronger storms >Cat 4 / 5	Extreme precipitation events over most of the mid-latitude land masses and over wet tropical regions predicted to become more intense and more frequent.	Extreme precipitation events over most of the mid-latitude land masses and over wet tropical regions predicted to become more intense and more frequent.
Increased 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).	Warming is occurring throughout Central America; up to 1°C since the mid-1970s (IPCC, 2014). Both seasonal and annual air temperatures are predicted to increase by approximately 2°C.	Temperatures are expected to increase between 1.6°C to 4.0°C by 2100 (IPCC, 2014).

[1] RCP 2.6 (low emission), RCP 4.5 (medium emission), and RCP 8.5 (high emission) scenarios

Climate Change Predictions (B2 Scenario) for Port Honduras Marine Reserve / 2			
Climate Change Impacts	**Current Status**	**25 - 50 yrs**	**100 yrs**
Changes in rainfall regime	Mean annual rainfall over Belize has decreased at an average rate of 3.1mm per month per decade since 1960 (NCSP/UNDP)	Predictions suggest that 2020/2030 may show a slight increase in the early and late parts of the wet season (May and Oct-Nov). The dry season and the mid-wet season decreases in rainfall (June), on the other hand, will be characterized by further decreases. Between 2030/2040, the entire country will be characterized by reduced precipitation, with exceptions only in early and late parts of the wet season (May and Nov). 2050/2060 projections are for an enhancement of the 2030s pattern of reduced rainfall (-1 to -4 mm/day) in the dry season (December – April). Increased precipitation of 2-7 mm/day is projected during the early and late (Oct May - Nov) parts of the wet season (NCCPSAP 2015). These predictions are based on predictions for the mainland – Stann Creek District. Predicted ecological shifts may alter the catchment functionality important for maintaining rivers in dry season in the south of Belize, and providing nutrients to the reef environment. Increased concentration and seasonality of agrochemical delivery	During the 2070s and 2090s predictions suggest that the Belize landscape is marked by reduced rainfall from December through to September. The largest reduction of up to -7 mm/day is projected in the Stann Creek District during the mid-wet season dip in June. The end of the wet season (Oct - Nov) maintains increased rainfall of 2 – 5 mm/day in the western Toledo, Stann Creek, Orange Walk and Corozal Districts (NCCPSAP 2015)

Climate Change Predictions (B2 Scenario) for Port Honduras Marine Reserve / 3			
Climate Change Impacts	**Current Status**	**25 - 50 yrs**	**100 yrs**
Ocean acidification	Atmospheric CO_2 concentration has increased from 280 parts per million (ppm) in 1880 to 385 ppm in 2008 - 35% increase in hydrogen (Simpson et al., 2009). 48% of all atmospheric CO_2 resulting from burning of fossil fuels has been taken up by the ocean (Hartley, 2010)	Predicted atmospheric CO_2 levels of 450 ppm by 2040 (Simpson et al., 2009). Predicted 30% decrease in pH. Predicted decrease in calcification rate by 20 - 50% by 2050	Some experts predict a 35% reduction in coral growth by 2100 (Simpson et al., 2009) Decrease of between 0.3 and 0.5 units by 2100 (Hartley et. al. 2010).

Table 27: *Climate Change Predictions (B2 Scenario) for Port Honduras Marine Reserve*

2.2.4 Hypotheses of Change

Hypotheses of Change	Ecosystems		
	Coral Reefs	**Seagrass**	**Coastal Ecosystems**
Sea level rise	▪ Coral reefs may be able to keep up with sea level rise, barring other impacts and dependent on rate of sea level rise. ▪ Change in dispersal / recruitment routes / sources. ▪ Potential loss of deeper corals, shift in distribution, as light availability decreases. ▪ Increased sedimentation and reduced light availability due to shore erosion.	▪ Increases in water depths above present meadows will reduce light availability ▪ Changes in currents may cause erosion and increased turbidity of water column. ▪ Shifts in distribution and extent of seagrass beds. ▪ Over the medium term, seagrass should be able to survive in increased water depth	▪ The cayes may become inundated ▪ Salt intrusion of water table may alter terrestrial vegetation cover, with changes in species presence / diversity, favoring more salt resilient species. ▪ Potential loss of low-lying crocodile and turtle nesting beaches ▪ Reduction of functional, available fish nursery mangrove habitat
Sea surface temperature rise	▪ Increased coral bleaching and eventual loss of ecosystem functionality. ▪ Increased coral disease. ▪ Possible impacts from new invasive species and algal blooms. ▪ A shift towards more tolerant species and symbiont types, and more opportunistic species, with reduced diversity. ▪ May alter localized current patterns and therefore coral larval dispersion. ▪ Impact on tourism as a result of reduced coral health	▪ Temperature stress on seagrass will result in distribution shifts, changes in patterns of sexual reproduction, altered seagrass growth rates, metabolism, and changes in 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, reducing available sunlight.	▪ Reduced oxygen content in water in mangrove areas. ▪ Loss of barrier reef functionality may reduce protection from erosion and storm events, increasing risk to mangroves.

Hypotheses of Change	Ecosystems		
	Coral Reefs	**Seagrass**	**Near-shore Ecosystems**
Increased frequency and intensity of storms	▪ Increased mechanical damage to corals. ▪ Increased sedimentation, particularly from watersheds following high rainfall and storm damage to riparian belts. ▪ Removal of macro algae, resulting in more available substrate for recruitment. ▪ Fragmentation of coral – dispersal and colonization	▪ Massive sediment movements that can uproot or bury seagrass. It may also become harder for seagrasses to become re-established. ▪ Would be exacerbated by anthropogenic impacts – primarily dredging and landfill	▪ Removal of some or all natural vegetation with less time for regeneration between storms - change in forest structure / reduced species diversity. ▪ Increased erosion, loss of part or entire cayes, changes in beaches. ▪ Arrival of opportunistic species. ▪ Impacts on bird colonies (nesting / roosting) ▪ Reduction of functional, available mangrove fish nursery habitat
Ocean acidification (corals, lobster / conch)	▪ Decreases in coral calcification rates, growth rates and structural strength. Also impacts other invertebrates. ▪ Weakening of reef matrix. ▪ If there are areas of localised calcification, acidification will have a drastic impact on the localized environment. ▪ Change in ratio of accretion / dissolution	▪ Possible positive effect on photosynthesis and growth, as seagrass is carbon limited in some situations ▪ Higher CO_2 levels may increase the production and biomass of epiphytic algae on leaves, adversely impacting seagrasses by causing shading.	▪ Positive increase in growth. ▪ However, damage to coral reefs may adversely impact mangrove systems that depend on the reefs to provide shelter from wave action. ▪ May affect mangrove root communities – especially invertebrates, such as molluscs.

Hypotheses of Change	Ecosystems		
	Coral Reefs	**Seagrass**	**Near-shore Ecosystems**
Decreased Precipitation	▪ There is a hypothesis that increased algal blooms may be attributed to reduced precipitation, resulting in decreased visibility – with potential to be positive, by shading corals from intense UV, or negative by blocking sunlight, depending on light penetration		▪ Reduction of freshwater lens, affecting carbon uptake and photosynthesis. ▪ Potential change in species composition favouring more heat / saline tolerant species ▪ Decreased precipitation, with a decrease in productivity, growth, and seedling survival
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, there may be thermal stress affecting mangrove root structures and establishment of mangrove seedlings. ▪ At leaf temperatures of 38-40°C, almost no photosynthesis occurs (IUCN, 2006). ▪ Possible localized changes in distribution.

Hypotheses of Change	Resources		
	Commercial Species	**Sport Fishing Species**	**Large Marine Vertebrates**
Sea level rise	▪ Conch / sea cucumber: May experience shift in range or habitat loss linked to changes in critical habitat ▪ Snapper / grouper / lobster: Shift in range / habitat loss of both adult and juvenile finfish and lobster – linked to inundation of mangrove, shift in seagrass distribution, changes in coral reef	▪ Tarpon / bonefish / permit: Shift in range / habitat loss of both adult and juvenile sport fish ▪ Shift in seagrass distribution, changes in coral reef ▪ Inundation of low-lying areas – potential reduction in mangrove extent, and related reduction in key nursery areas for sport fishing species	▪ Adults are able to adapt to changing water depth – highly mobile ▪ Shifts in foraging areas ▪ Turtle and crocodile nesting beaches may become inundated
Sea surface temperature rise	▪ Reduction in accessibility to commercial marine resources – lobster, conch, snapper, as they move into deeper cooler water, and associated reduction in income for commercial fishing industry ▪ Conch: Temperature may affect spawning (spawning has been shown to increase as a linear function of bottom water temperature, but decline once a temperature threshold is reached) ▪ Lobster: Possible effects on larval and adult lobsters and reproduction. ▪ Loss of critical habitat ▪ May affect physiological processes, and disease may become more prevalent. ▪ Possible impacts from new invasive species and algal blooms.	▪ Sport fish may move into deeper cooler water ▪ Shifts / habitat loss of critical ecosystems	▪ Manatees and sharks are able to adapt to changing water temperatures by moving to cooler areas – highly mobile – as long as other resources are still available (e.g. seagrass / manatees) ▪ Shifts / habitat loss of critical ecosystems

Hypotheses of Change	Resources		
	Commercial Species / Fishing	**Sport Fishing Species**	**Large Marine Vertebrates**
Increased frequency and intensity of storms	▪ Reef, seagrass and mangrove destruction, increased sedimentation - reduced availability of habitats ▪ Possible impacts on larval dispersal / survival (potential for wider dispersal of larvae) ▪ Increased frequency of damage / destruction of fishing infrastructure (boats, fish traps) negatively impacting the fishing industry	▪ Increased mechanical damage to sport fish habitats, reducing tourism potential ▪ Increased sedimentation and associated agrochemical contamination impacts on reef, reducing reef health ▪ Increased frequency of damage / destruction of tourism infrastructure (hotels, mooring buoys, signage etc.) and boats, negatively impacting sport fishing incomes	▪ Able to move away from storm areas, but can be impacted if caught up in the storms ▪ Small number of manatee deaths / strandings have been reported after large hurricanes ▪ Increased potential for inundation of turtle and crocodile nests during storm events ▪ Removal or erosion of turtle and crocodile nesting beaches, deposition of corals and boulders over existing beaches, by storm events ▪ Impacts on dispersal / survival of both adults and nestling turtles
Ocean acidification	▪ Habitat loss (impacts on reef). ▪ Impacts on larval viability and adult growth rates ▪ Weakening shell structures - a decrease in the calcification process by species that build an exoskeleton of $CaCO_3$ (e.g. conch)	▪ Impacts on larval viability and adult growth rates ▪ Changes in larval fish behaviour, based on reduced ability to distinguish chemical cues	▪ Elevated CO_2 may have detrimental effects on sharks by increasing energetic demands, decreasing metabolic efficiency, and reducing their ability to locate food through olfaction. ▪ Sea turtle olfaction may also be impacted reducing their ability to locate food and nesting sites.
Decreased Precipitation	▪ Possible changes in salinity impacting larval dispersal. ▪ There is an hypothesis that increased algal bloom may be attributed to first runoff after increased droughty periods	▪ Possible changes in salinity impacting larval dispersal	▪ Manatees require access to relatively freshwater (< 10ppt) every 10 days or so… decreased precipitation may encourage their use of river mouths and the mouth of Placencia Lagoon, increasing risk of injury / mortality from boat collisions

Hypotheses of Change	Resources		
	Commercial Species / Fishing	**Sport Fishing Species**	**Large Marine Vertebrates**
Air Temperature	▪ Potential impacts on mangroves as a nursery habitat	▪ Potential impacts on mangroves as a nursery habitat	▪ Turtles may have a female biased sex ratio >31˚C females; 29 -- 30˚C 50:50; <29˚C males. ▪ Warming of turtle and crocodile nesting beaches, resulting in increased egg mortality, shorter hatching time with smaller average hatching size, reducing survival potential. ▪ Increased disease risk to eggs

Table 28: *Hypothesis of Change for Port Honduras Marine Reserve*

2.2.5 Prioritization of Targets

Each target is assessed for the impacts of the identified primary climate change elements (increased intensity of storms, decreased precipitation, increased air temperature and increased water temperature), each element being rated on a scale of 0 to 4 (Table 29). Ratings took into consideration factors such as the severity, scope, contribution and irreversibility of each climate change element (Table 30).

As a non-biodiversity target, the Blue Hole was not included in this part of the assessment.

Rating		Description
Very High	**4**	The climate change element is (or is predicted to be) the major contributing factor to the reduced viability, or possible local extinction, of the target over the majority of its extent within the project area over the next 50 years, and cannot be reversed
High	**3**	The climate change element is (or is predicted to be) a significant contributing factor to the reduced viability of the target over a significant part of its extent within the project area over the next 50 years, but can be reversed at high cost or over a long time period
Medium	**2**	The climate change element is (or is predicted to be) a moderate contributing factor to the reduced viability of the target over part of its extent within the project area over the next 50 years, and can be reversed at moderate cost
Low	**1**	The climate change element is (or is predicted to be) a minor contributing factor to the reduced viability of the target in localized areas within the project area over the next 50 years, and will reverse naturally or at limited cost
Positive	**0**	The climate change element is (or is predicted to be) a positive impact on target viability

Table 29: *Ratings for Selection of Priority Conservation Targets*

Predicted climate change element	*Conservation Targets*					
	Coral Reef	*Seagrass*	*Coastal Ecosystems*	*Commercial Species*	*Sport Fishing Species*	*Large Marine Vertebrates*
Increased sea level	High (3)	Low (1)	High (3)	Medium (2)	Medium (2)	High (3)*
Increased sea temperature	Very High (4)	Low (1)	Low (1)	Medium (2)	Medium (2)	Low (1)
Decreased Precipitation	Low (1)	-	Medium (2)	Low (1)	Low (1)	Medium (2)
Increased frequency of storms	Medium (2)	High (3)	Very High (4)	High (3)	Medium (2)	Medium (2)
Ocean acidification	Very High (4)	Positive (0)	-	High (3)	Medium (2)	Medium (2)
Increased air temperature	-	-	Medium (2)	Low (1)	-	High (3)
Averaged Rating	**2.80**	**1.25**	**2.40**	**2.00**	**1.80**	**2.17**
	Selected		**Selected**	**Selected**		**Selected**

** based on loss of turtle and crocodile nesting beaches and reduced nest viability*

Table 30: *Ratings for Prioritization of Conservation Targets*

Prioritized Targets:

- ***Coral Reef***
- ***Coastal Ecosystems***
- ***Large Marine Vertebrates (based on impacts to nesting turtles and crocodiles)***
- ***Commercial Species***

Vulnerable Communities was also selected as a target, based on the community assessment output (Walker, 2014)

2.5.8 Prioritised Strategies per Target and Objective

Target	Objective	Strategy	Priority	Priority Threat
Coral Reef Communities	By 2020, effectively managed, sustainable fisheries diversification initiatives are in place that target both traditional and new target species	Monitor each identified species using both fisheries dependent and independent surveys	1	Diversification resulting in increased fishing pressure across a wider range of species that impact coral reef health.
	By 2020, 100% of tourism activities and services follow well defined and accepted best practices standards	Educate tour operators and tourists regarding best practices and impacts of malpractice to encourage responsible tourism	1	Tourism increasing to unsustainable levels in the PHMR as a result of degradation in other popular tourist areas
		Provide incentives for tour operators to abide by established best practices regulations	2	
	By 2016, a sustainable tourism plan has been developed for Port Honduras Marine Reserve, integrating climate change adaptations	Establish a grassroots tourism program to increase community involvement in the management of tourism in PHMR by 2015	2	Tourism developments on the cayes and coastline will potentially face the need to reinforce shorelines and create landfill, or relocate, as sea level rises
Littoral Forest / Sandy Beaches / Mangroves	By 2018, mangrove coverage in PHMR will be increased by 10% based on 2011 mangrove baseline results, and maintains viable littoral forest and sandy beaches.	Enforce existing mangrove legislation by 2015 to decrease mangrove loss along coastline	1	Tourism developments on the cayes and coastline will potentially face the need to reinforce shorelines and create landfill, or relocate, as sea level rises
		Develop an on-going education and outreach program to promote stewardship for mangroves, sandy beaches and littoral forest	1	
		By 2016 establish reforestation program to increase mangrove by 10% of existing coverage and maintain littoral forest and sandy beaches	2	
	By 2028, sea turtle sex ratio will have increased by 30% from the 2013 baseline results in PHMR	Develop a turtle monitoring program by 2015 to protect nesting areas	2	Increase in air temperature will affect the sex ratio of sea turtles

Target	Objective	Strategy	Priority	Threat
Commercial Species	By 2020, Fisheries Department and TIDE will identify and improve at least three responsible and effective fishing techniques, in collaboration with PHMR fishers	Establish regulations to discontinue the use of destructive fishing techniques within PHMR.	1	Using different fishing techniques (e.g. deep sea fishing) without informed guidelines in place
		Assess present fishing techniques used by PHMR fishers and identify both sustainable and destructive fishing techniques	2	
		Consult with stakeholders (fishers, TIDE, FiD) to share information on findings about the assessment of fishing techniques.	2	
	By 2018, at least 75% of fishermen consider they have ownership of PHMR and are integrated into decision making, stewardship and surveillance and enforcement	Strengthen representation with at least one fishermen, elected by fishing stakeholders, to both TIDE Board of Directors and PHMR Board	2	Climate change impacts and adaptation measures are exacerbated by limited enforcement effectiveness
		Build capacity of PHMR stakeholders for management and staff positions for PHMR and TIDE	2	
		Strengthen managed access committee to the point where it can give the final approval on resource management decisions e.g. research permits, licenses	2	
		Involve fishermen in activities at all levels – boat drivers, community researchers	2	
	By 2014, 50% of fishermen will have access to training and funding opportunities to diversify into or improve sustainable alternatives, with integration in project planning and implementation	Strengthen initiatives assisting fisherman and farmers in Toledo for diversification and improved marketing	2	
		Support return to traditional small-scale, family support agricultural schemes for fishermen for supplementing fishing income	2	
		Assist fishermen in strengthening marketing of marine products and mechanisms of increasing market value	2	
		Reduced availability of marine resources with increased sea surface temperature	2	

Target	Objective	Strategy	Priority	Threat
Commercial Fishing	By 2014, 50% of fishermen will have access to training and funding opportunities to diversify into or improve sustainable alternatives, with integration in project planning and implementation	Invest in education of fisher's children, to ensure they have employment opportunities beyond fishing	2	
	By 2015, collaboration between fishermen of Port Honduras Marine Reserve will have been strengthened to be able to lobby successfully at local and national level	Develop a public relations / communication program to be implemented by fisherman group leaders, to increase awareness and collaboration among fishermen	2	Local, national and international climate adaptation politics
Vulnerable Communities	By 2013, 100% of villagers from Punta Negra and Monkey River have a sustainable water supply considered resilient for at least 25yrs	Implementation and reinforcement of water conservation and awareness campaign in Punta Negra and Monkey River by 2014.	2	Reduced availability of fresh water
	By 2012, mechanisms will be in place to ensure maintenance of the shoreline in its current (2012) position for the community of Monkey River.	Complete an assessment of impacts and causes of erosion in Monkey River by July 2015	1	Erosion of beaches in Monkey river

3. Management Planning

3.1 Management Goals

The overall goal for management of the Port Honduras Marine Reserve is:

> ***"the sustainable management of coastal ecosystem functions and natural resource values for the benefit of present and future generations of Southern Belize, within the wider ridge to reef landscape"***
>
> ***TIDE Advisory Board, 2011***

A number of objectives have been identified to meet the PHMR goal:

- To promote sustainable marine resource use for the continued benefit of all users
- To ensure continued sustainable resource extraction through effective management mechanisms for the benefit of traditional fishing communities
- To promote community stewardship of the marine resources through effective communication, education and outreach
- To provide a sustainable recreational and tourism environment that will enhance the economic and social benefits of the area
- To engage in effective research and monitoring within PHMR to guide and inform management decisions

TIDE Advisory Board, 2011

The goal and objectives are aligned with other relevant planning outputs. As a Marine Reserve, Port Honduras Marine Reserve was established under the Fisheries Act of 1948 (amended 1987) which states that the purpose of the marine protected area is to:

> "*afford special protection to the aquatic flora and fauna …and to protect and preserve the natural breeding grounds and habitats of aquatic life*".

The management goal of the marine protected area is also aligned with the wider vision for the Maya Mountains Marine Corridor:

> *For the Maya Mountain Marine Corridor to continue to be a place of national importance to Belize and international importance to the greater Gulf of Honduras because of its environmental, economic and geopolitical significance.*
>
> ***A Collective Vision for the Maya Mountain Marine Corridor, Belize CAP Workshop, 2008***

A series of goals were developed for the entire Maya Mountain Marine Corridor in 2008, through a fully participatory Conservation Action Planning process. A number of these goals are both directly related to the PHMR action plan as well as general goals for TIDE and its increasing success in environmental conservation.

Whilst this management plan is specifically for the Port Honduras Marine Reserve, compatibility with plans for the larger coastal basin (including Payne's Creek National Park, Sapodilla Cayes Marine Reserve and the wider Southern Belize Reef Complex) have also been considered in the development of management strategies to ensure holistic management of the area, in line with the National Protected Area System objectives.

3.2 Management and Organizational Background

Regulatory authority for Port Honduras Marine Reserve lies with the Fisheries Department (Ministry of Agriculture, Foresty, Fisheries and Sustainable Development). As with many national protected areas in Belize, Government has a co-management agreement with the Toleo Institute for Development and Environment (TIDE) for on-site management activities.

Toledo Institute for Development and Environment

TIDE was established in 1997, and has grown from its grassroots as a local, community-based response to manatee poaching and marine degradation, to one of Belize's leading non-government conservation organizations. It is respected nationally and internationally for its landscape/seascape conservation initiatives and its promotion of sustainable resource use. It is governed by a multi-sectoral Board of Directors with seven members, with implementation led by the Executive Director. The organization currently has 26 full time and 10 part time employees, including rangers, administrative, outreach, and science staff

Management decisions are made with the input of the Port Honduras Marine Reserve Advisory Committee composed of local stakeholders and resource users. Day to day management of Port Honduras Marine Reserve is led by the TIDE Marine Manager, who is supported by an on-site Head Marine Ranger based from Abalone Caye for daily operations, and reports to the TIDE Program Manager. The PHMR staff also includes four full-time and one temporary ranger. These personnel are responsible for the day-to-day management of the Marine Reserve, and the implementation of the management plan, supported by staff of the other TIDE Program areas - Research and Monitoring and Environmental Education and Outreach.

Toledo Institute for Development and Environment

Vision

Toledo's healthy ecosystems support biodiversity, communities and sustainable development

Mission

To engage stakeholders in the sustainable management of natural resources within the Maya Mountain Marine Corridor of southern Belize for the benefit of all

Long Term Goal

Toledo has healthy ecosystems and functioning ecosystem services supporting biodiversity and providing benefits to local communities

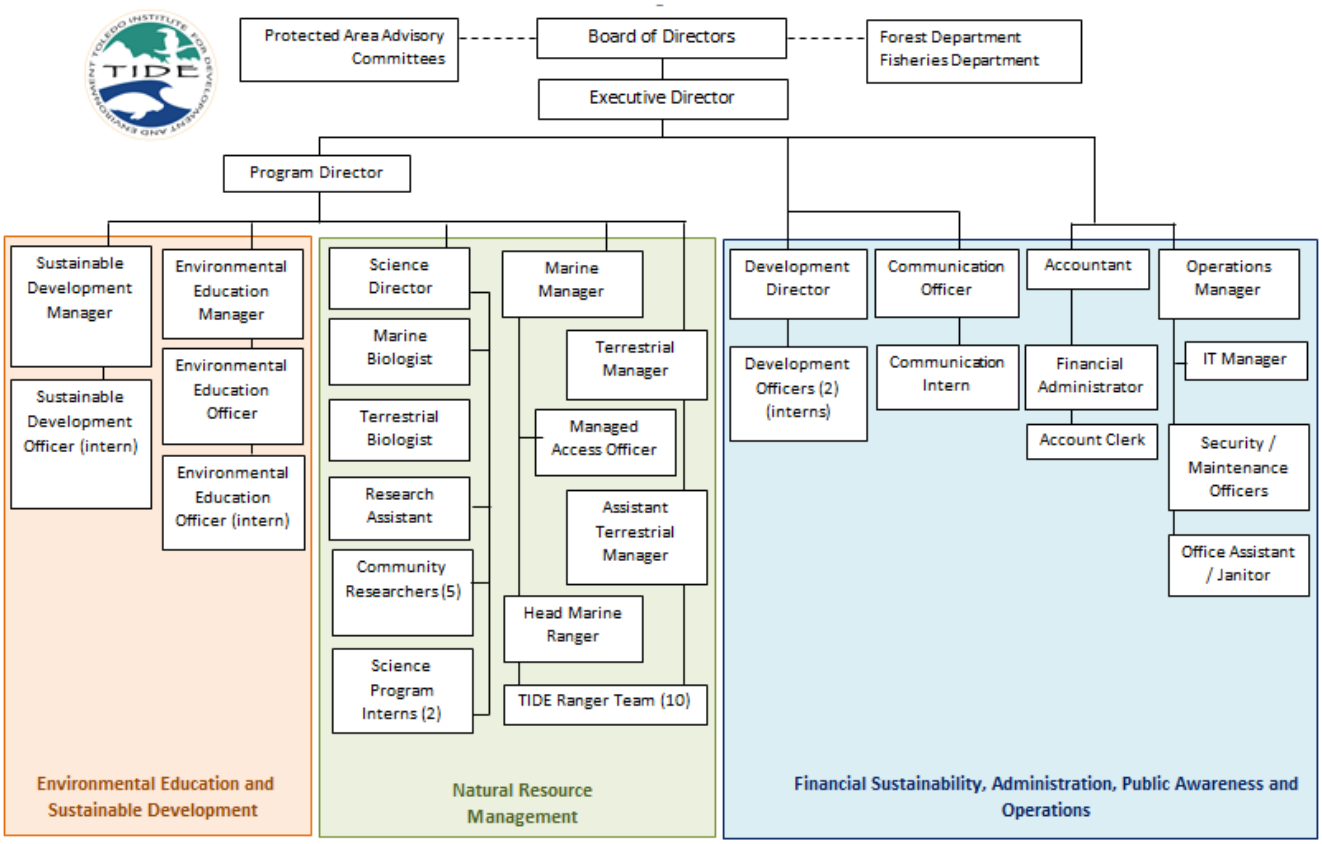


Figure 36: *TIDE Organizational Structure*

TIDE's Strategic Framework

TIDE's Strategic Plan runs from 2014 to 2019, setting the framework for management activities for Port Honduras Marine Reserve. It takes into consideration other TIDE planning outputs, with the integration of strategies from the 2007 Business Plan, the MMMC Conservation Action Strategy, PHMR Climate Change Adaptation Plan, 2013 Institutional Assessment and the site level management plans (Table 31).

TIDE Strategic Areas (2014 – 2019)

TIDE implements its activities through four key strategic areas (Table 32):

- **Natural Resource Management**
- **Community Stewardship**
- **Influencing Policy**
- **Institutional Capacity**

Using five key strategies:

- *Management informed by science and local knowledge*
- *Natural resource management*
- *Building willingness and capacity of stakeholders to sustainably manage natural resources*
- *Creating opportunities for economic development that reduces pressure on natural resources*
- *Providing scientific evidence to inform environmental policies*

TIDE manages two national protected areas within the southern Belize landscape / seascape: Port Honduras Marine Reserve (PHMR) (through a co-management agreement with Fisheries Department) and Payne's Creek National Park (PCNP), under agreement with the Forest Department. It also owns and manages 21,598 acres of private lands within the MMMC – the TIDE Private Protected Lands (TPPL). These form the TIDE integrated Management Area (TIMA). All three are important components of the 830,000-acre Maya Mountain Marine Corridor (MMMC), a central focus of TIDE's planning since the development of the MMMC Conservation Action Strategy in 2008. TIDE undertakes a wide range of tasks associated with the Marine Reserve, from law enforcement to community outreach and biodiversity monitoring. It works closely with the three stakeholder communities of Monkey River, Punta Negra and Punta Gorda.

TIDE's Role in Southern Belize

In implementing the 2014 – 2019 strategic plan, TIDE is expanding its role in sustainable economic development within Toledo, and within the MMMC in particular. There is recognition of the need to create further opportunities for sustainable economic development to reduce poverty while protecting natural resources. Key strategic points for consideration during the management planning included:

Natural Resource Management

- Continued effective management of TIDE protected areas, as an integrated management system within the larger MMMC
- Integrated landscape / seascape strategies for holistic management of the ecosystems and biodiversity of the MMMC. Site level protected area management is guided by individual management plans, within this framework
- Effective environmental monitoring and research strategy, with ongoing, first class monitoring outputs informing management and policy. In particular, continued monitoring of commercial fisheries, sports fish and critically endangered species.
- Effective engagement of government and non-government partners in natural resource management in Toledo
- Community participation in fisheries management (Managed Access / catch shares / replenishment zone expansion / economic diversification) toward sustainability of Port Honduras Marine Reserve
- Providing communities living around protected areas with opportunities for economic development that reduces pressure on natural resources (both economic diversification and optimisation of resource extraction)

Community Engagement and Partnership

- Promoting a balance between environment and humans in Toledo
- Promoting strengthened partnership and communication with stakeholder communities
- Supporting communities to manage natural resources sustainably, including greater involvement in planning and decision making.
- Shifting the focus of the environmental education program from teaching children directly to building the capacity of Toledo's teachers in environmental education
- Focusing on behavioural change for good stewardship of natural resources
- Providing opportunities and training for sustainable livelihood projects geared towards improving human welfare and reducing pressure on natural resources
- Building the capacity of communities to adapt to climate change

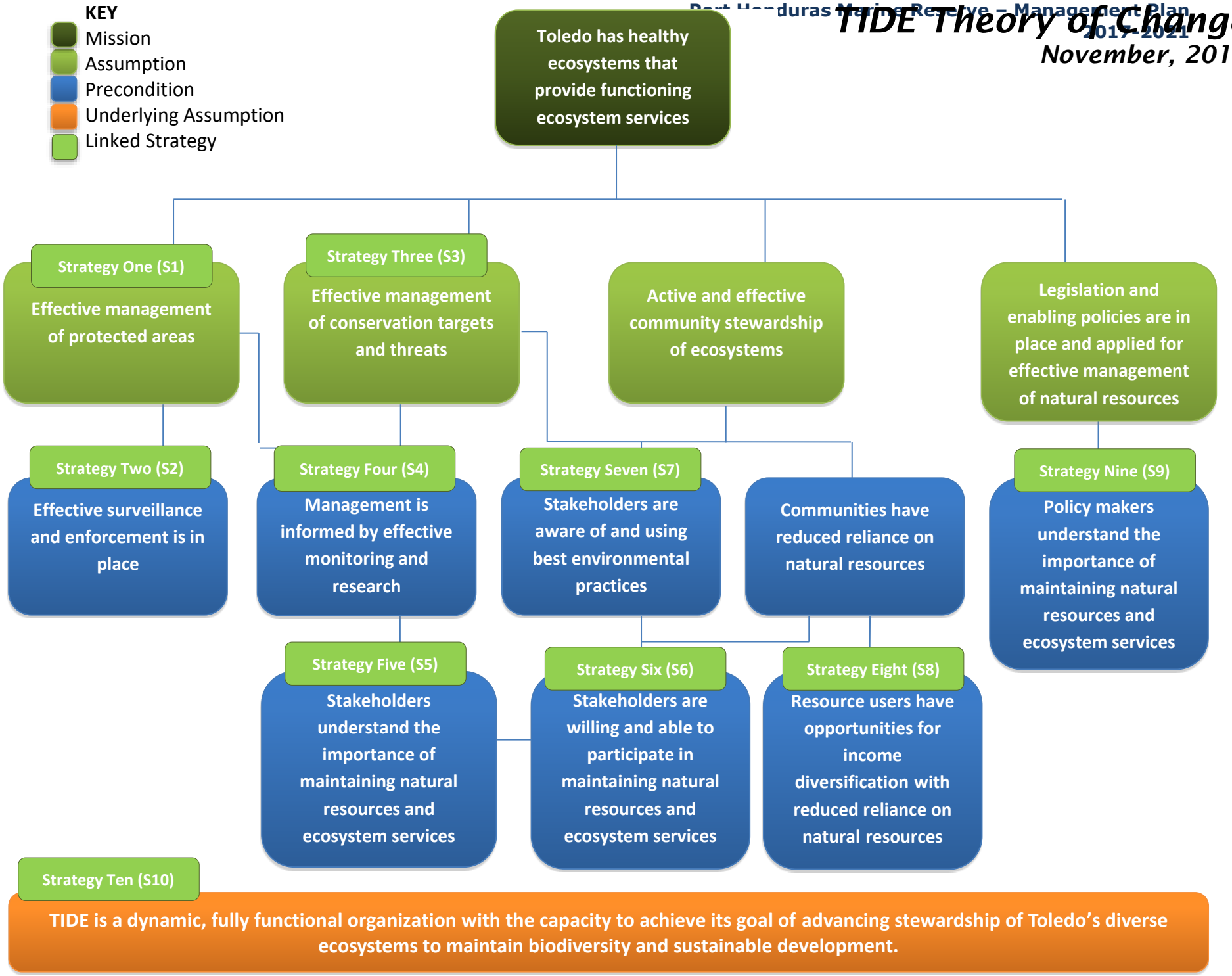
Advocacy / Negotiation / Collaboration

- Negotiation and partnership with Government in areas of TIDE's interest, such as:
  - Sustainable management of fisheries resources
  - Effective enforcement tied to national security
- Support of national system level planning units and structure (NPAPSP), promoting active implementation and clear definition of roles and responsibilities
- Strengthened communication and collaboration with relevant key organizations with similar roles and responsibilities within the MMMC and the Southern Barrier Reef Complex
- Mentoring of environmental CBOs in Toledo, strengthening them as institutions so that they can achieve their missions

- Supporting organizations of resource-users toward sustainable economic development
- Participating in regional networks such as TriGoH to enhance sustainable management of natural resources in the Gulf of Honduras
- Building the capacity of communities to participate in decision making regarding large development projects that may affect them (e.g. oil exploration and development, hydro-dams, oil palm, etc.)

TIDE Theory of Change

November, 2013



Organizational Program Guiding Frameworks

Natural Resource Management	Research and Monitoring	Environmental Education	Sustainable Development	Administration and Operations
Guiding Frameworks:	***Guiding Frameworks***	***Guiding Frameworks***	***Guiding Frameworks***	***Guiding Frameworks***
▪ MMMC CAS ▪ Site management plans ▪ Climate Change Adaptation Plan (PHMR) ▪ Surveillance and Enforcement Plan ▪ Managed Access Framework ▪ National Wildland Fire Management Strategy and Policy ▪ Fire Management Plan ▪ National Protected Areas System Plan (NPAPSP) ▪ National Land Use Policy ▪ Coastal Zone Plan ▪ National legislation	▪ MMMC CAS ▪ Site management plans ▪ Climate Change Adaptation Plan (PHMR) ▪ National Research Agenda ▪ Research and Monitoring Strategy	▪ MMMC CAS ▪ Environmental Education and Outreach Strategy ▪ National Primary School Curriculum ▪ Site management plans ▪ Climate Change Adaptation Plan (PHMR) ▪ Communications Plan	▪ MMMC CAS ▪ Sustainable Development Strategy ▪ Managed Access Framework ▪ National economic alternatives and fisheries diversification strategy ▪ Community Development Plan ▪ Tourism Development Strategy for southern coastal communities ▪ Site management plans ▪ Climate Change Adaptation Plan ▪ Communications Plan	▪ Articles of Association ▪ Policy and Procedures Manual ▪ Financial Plan ▪ FIU Regulations ▪ Communications Plan ▪ Site management plans ▪ Annual institutional assessment recommendations ▪ TIDE 3 year Workplan

Table 31: *Organizational Guiding Frameworks (TIDE Strategic Plan, 2014 – 2019)*

Organizational Program Areas

Natural Resource Management	Research and Monitoring	Environmental Education	Sustainable Development	Administration and Operations
Protected area management: ▪ Payne's Creek NP ▪ Port Honduras MR ▪ TIDE Private Lands ***Conservation Targets:*** ▪ Upland Forests ▪ Coastal Plain Broadleaf Forests ▪ Pine Savanna ▪ Near Shore Ecosystems ▪ Seagrass Beds ▪ Freshwater Systems ▪ Large Marine Vertebrates ▪ Archaeological Sites ***Focal Areas:*** ▪ Reduction of hunting and fishing pressure ▪ Functional ecosystem connectivity ▪ Restoration of species and ecosystems ▪ Fire management ▪ Cultural Sites Conservation ▪ Pesticide Control ▪ Policy Development	***Established Biodiversity Monitoring*** ***Marine*** ▪ Fisheries Assessment ▪ Water Quality ▪ Coral Reef (Healthy Reef Indicators) ▪ Sea grass ▪ Sediments ▪ Mangrove ▪ Turtle ▪ Manatee ▪ Dolphins ▪ Sea birds ***Terrestrial*** ▪ Central American River Turtle ▪ Yellow headed Parrots ▪ Birds ▪ Mammals ▪ Amphibians ▪ Fire effects ▪ Socioeconomic attitude ▪ Economic wellbeing	***Environmental Education in the Schools*** ***Training the teachers - building capacity for teaching environmental science*** ***Annual Environmental Activities*** ▪ TIDE Freshwater Cup ▪ TIDE FishFest ▪ Youth conservation competition ▪ TIDE Summer Camps ▪ Special environmental events ▪ Climate change awareness ▪ International Days – Earth Day, World Water Day	***Community Engagement*** ***Community Outreach*** ***Community Participation*** ▪ Community Stewards ▪ Community Researchers ***Community Natural Resource Management in Buffer Areas*** ***Leadership Training*** ***Alternative Supplemental Livelihoods*** ***Climate change adaption***	***Organizational Administration*** ***Human Resources*** ***Communications / Public Awareness*** ***Institutional Strengthening*** ***Financial Sustainability***

Table 32: *Organizational Program Areas (TIDE Strategic Plan, 2014 – 2019)*

3.3 Review of Previous Management Plan

3.4 Management Strategies

Management strategies are guided by national protected area legislation and objectives, the goals and objectives of the Maya Mountain Marine Corridor, the TIDE strategic framework and climate change adaptation planning for the protected area. The legislation sets out the framework for use of management zones to regulate use – both extractive and non-extractive. It also sets out the requirements for fishing licenses and dive boats, fees, mechanisms for monitoring of fish catches, and offences and penalties. In addition, TIDE has a number of PHMR-specific rules that apply across all management zones.

3.4.1 Fisheries Regulations

Port Honduras Marine Reserve functions as a national fisheries management tool, providing an area of management focus in southern Belize to improve sustainable use of marine resources. The Fisheries Department regulations for species, size and seasons are implemented in the General Use Zone, where fishing is permitted (Figure 38). Extraction of marine resources is not permitted in the Conservation and Preservation Zones.

Under SI 18 of 2000, the following definitions apply:

- "Sport fishing" means catch and release;
- "recreational fishing" means fishing for fun with the intention to eat the fish caught but not for the purpose of selling;
- "subsistence fishing" means fishing conducted by those who reside within the Reserve for the purpose of consuming the fish caught but not for selling such fish.

The regulations also set entrance fees:

- For all water recreational activities, excluding sports and recreational fishing, fees shall be as follows:
  (a) Swimmers/Snorkelers $8.00 per person per day;
  (b) Scuba $20.00 per person per week
- No fees shall be payable by Belizeans and foreign children below twelve years of age

Legislated Management Strategies (SI 18 of 2000)

ESTABLISHMENT OF ZONES AND RULES FOR ZONES

- Establishment of zones.
- Rules for General Use Zone.
- Rules for Conservation I Zone.
- Rules for Conservation II Zone.
- Rules for Preservation Zone.
- Rules for Special Management Area.

COMMERCIAL FISHING, RESEARCH, SPORT FISHINGLICENSES AND REGISTRATION OF DIVE BOATS

- Commercial Fishing Licenses.
- Research Licenses.
- Sport fishing Licenses.
- Registration of dive boats.

GENERAL

- Licenses not transferable.
- Duration and renewal of licenses.
- Cancellation of licenses.
- Condition of licenses.
- Duty to report accidents or damage to property.
- Non-liability of Government.
- Application of Fisheries Regulations.
- Opening days of Reserve.
- Admission fees.
- Prohibition of certain acts.
- Fisheries Administrator may designate certain areas.
- Rendering fish catch information to rangers.
- Establishment of fishery officers.
- Offences and Penalties.

SI 18 of 2000

Fisheries Regulations

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 using compressed air or scuba gear
- No fishing shall be conducted using explosives or chemicals

CONCH (*Lobatus gigas* - once *Strombus gigas*)

- Shell length should exceed 7 inches (17.8 cm)
- Market clean weight and fillet weight should exceed 3 ounces (85 g) and 2.75 ounces (78 g) respectively
- No person or establishment shall buy, sell or have in possession diced conch meat except under a special permit issued by the Fisheries Administrator.
- Closed Season: July 1st to September 30th, or when the catch quota has been met

LOBSTER (*Panulirus argus*):

- No person or establishment should have in possession fillet or diced lobster tail.
- It is illegal to have in possession any soft shell (molting) lobster or females with eggs (berried)
- It is illegal to remove from any female lobster any eggs or spawn or the setae or fibre to which any eggs or spawn are or have been attached.
- Minimum carapace length is 3 inches
- Minimum tail weight is 4 ounces
- Closed season: 15th February to 14th June

FISH FILLET

- Every fish, other than Nassau groupers and grazers, caught in Belizean waters and landed as fillet fish should have a skin patch of 2 inches by 1 inch

SEA CUCUMBER

- No person shall engage or attempt to engage or assist a person to engage or attempt to engage in fishing, of any kind, for sea cucumber without a special license from the Fisheries Administrator
- Individuals applying for special license for sea cucumber must have a valid fisherman's license
- No person shall fish for, or harvest, at any time in the waters of Belize, or buy, sell, have in possession, export or attempt to export any sea cucumber between July 1st and Dec 31st (Special license required)

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

Figure 38: *Fisheries Legislation Regulations*

SHARKS

- No person shall take, buy, sell, possess, and export shark meat or fins during the period 1st August to 31st October
- No person shall take or kill any shark of Nurse shark (Ginglymostoma cirratum) and Whale shark (Rhincodon typus) in the waters of Belize
- No person shall engage in shark finning
- Fishing for any other non-protected shark species requires a special license issued by the Fisheries Administrator
- All sharks are to be landed with the fins attached

TARPON, BONEFISH, PERMIT

- These species of fish are designated for the purpose of sport fishing
- Bonefish commonly known as "macabi" Scientific name: *Albula vulpes*
- Permit Scientific name: *Trachinotus falcatus*
- Tarpon: Scientific name: *Megalops atlanticus*
- No person shall have in possession any bonefish, permit fish or tarpon or any of its product forms, save and except in the act of catch and release.
- No establishment shall have in its possession any bonefish, permit fish or tarpon or any of its product forms

NOTE: Catch and Release means the act of catching fish and then releasing them back immediately into the waters of Belize in the same state in which the fish was landed

GRAZERS:

- No person shall take in the waters of Belize, buy, sell, or have in his possession any grazers. Grazers refer to any fish of the parrotfish , angel fish and tangs (Scaridae and Acanthuridae)

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 - this may only be bought, sold or exported with a licence from the Fisheries Administrator

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

TRAWLING

- No person shall engage in trawling

RESEARCH

- Every person who applies for a research permit needs to submit a proposal for vetting and approval
- Bio-prospecting also requires special permission

Figure 38: *Fisheries Regulations (continued)*

GEAR RESTRICTIONS

NETS AND LONG LINES

- No gill net, or series of joined gill nets, can exceed 300m in length
- Gill, seine and stop nets, and long lines cannot block a river, creek or stream. No net or long line can stretch more than a quarter of the distance across that river, creek or stream and must not exceed 200m in total length
- No gill net, seine net, stop net, or long line can be set in a lagoon, that is more than one-tenth of the distance across the lagoon, and can not exceed 200m in total length
- No nets or beach traps can be set within half a mile of any city, town, or village

WITHIN A MARINE RESERVE

- Valid licences are required for commercial fishing, sport fishing and recreational fishing in a Marine Reserve
- Fishing activities conducted in Marine Reserves can only be those permitted in accordance to the specific zone regulations.
- The use of beach traps and fish traps is prohibited in Conservation and Preservation Zones
- A license is required for the use of beach traps and fish traps in the General Use Zone.
- Fishing in a Conservation Zone is prohibited without a license
- Fishing, snorkelling and diving are prohibited in a Preservation Zone
- Spearfishing is prohibited in Marine Reserves
- Use of long lines, seine nets and gill nets is not permitted within Marine Reserves
- It will be assumed that anyone with a speargun, polespear, Hawaiian sling, spearfishing mask or powered speargun or sling is attempting to engage in spearfishing

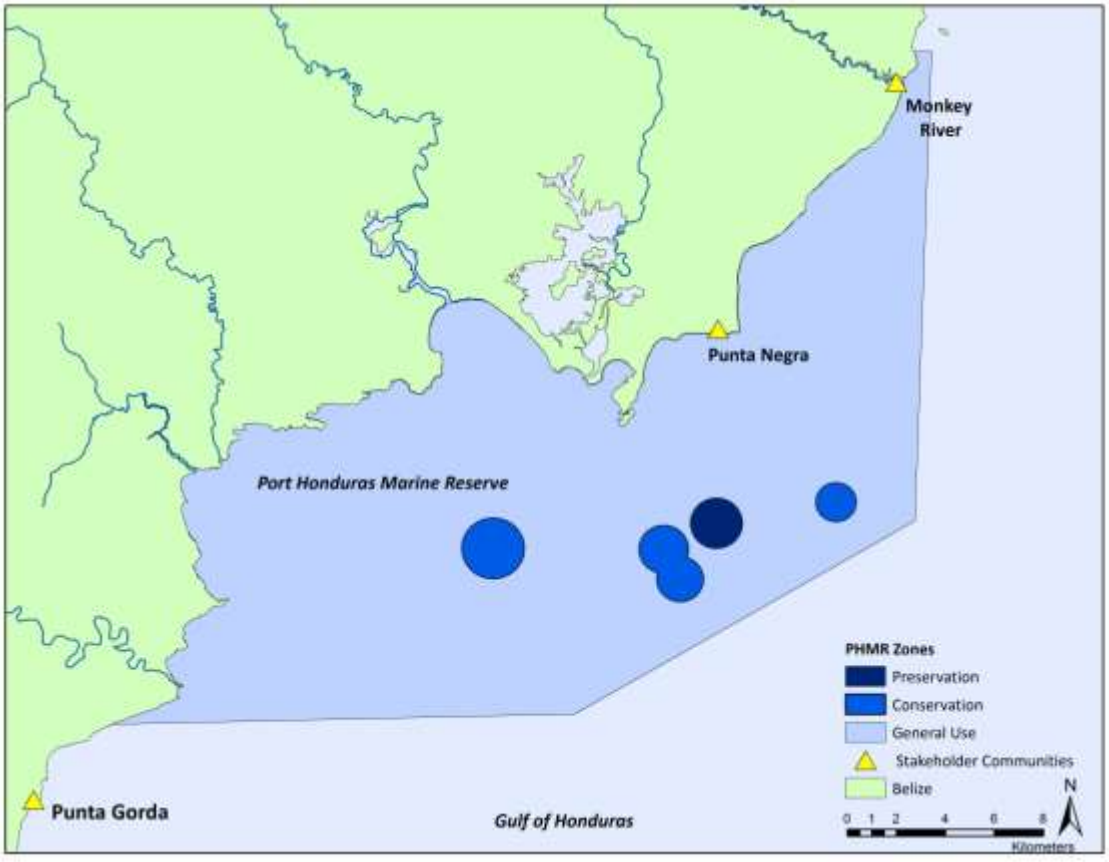
Figure 38: *Fisheries Regulations (continued)*

3.4.2 Management Zones

PHMR is divided into three zones for management purposes (Map 5). The General Use Zone, covering 95% of the marine protected area, provides opportunities for established traditional uses and activities under stringent regulations based on the Fisheries legislation and site specific regulations and guidelines. Regulated activities such as commercial, sport, recreational and subsistence fishing, are permitted within this area, if fishers have the required valid license and follow zone, and gear restrictions. The Conservation Zone covers 4% of the reserve area and incorporates the marine environment extending half a mile out from East Snake Caye, West Snake Caye, South Snake Caye and Wild Cane Caye. The Conservation Zone provides an area free from commercial fishing, preventing over-exploitation of fishery

stocks, providing an undisturbed area for recruitment of species, and enhancing the value of the area for recreational and tourism activities. No-take recreational activities, such as SCUBA diving, snorkelling and kayaking, are permitted within this zone. “Catch and release” sport fishing is also allowed within the Conservation Zone, but only with a valid license. The third zone is the Preservation Zone which covers approximately 1% of the reserve and incorporates Middle Snake Caye, extending half a mile out from the island. Entry in to the Preservation Zone is strictly prohibited except in an emergency or with prior written permission from the Fisheries Administrator, providing an area within the marine reserve that maintained in an entirely natural state and protecting areas of particularly fragile habitat and threatened or rare species. There is also provision fo establishment of a Special Management Zone.

The zones support the effective management of the commercial fish stocks, and also play a role in ecosystem conservation. They are an important tool in the Managed Access framework, protecting key nursery and foraging areas, as well as important recreational areas.



Map 5: *PHMR Zones*

General Use Zone (GUZ)

The General Use Zone allows for the sustainable management of existing traditional uses, with the focus on commercial fishing and recreational activities. This zone lies outside the more critical protection zones, and is relatively accessible to local fishers, who use part of the area for commercial fishing. The existence of a number of fishing banks and nearby replenishment areas makes the GUZ a valuable fishing ground for local communities, for commercial, recreational and subsistence fishing.

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

The **General Use Zone** shall be restricted to those with the appropriate fishing license for any of the following, namely a commercial, sport, subsistence and recreational fishing license. Fishermen shall apply for a license to fish in accordance with these Regulations.

Rules for General Use Zone.

- Only residents of Port Honduras who have special licences to fish shall be allowed to fish in this zone solely for subsistence purposes, and such fishing shall be determined by the terms and conditions of each resident's license.
- No person shall be permitted to use long lines or gill nets in the Port Honduras Marine Reserve.
- No person shall be permitted to use or erect beach traps.
- No person shall, within the Port Honduras Marine Reserve, cast or drag any anchor in any manner that may damage coral reef formation.
- Fishermen catching lobster shall preserve such lobster while in the Marine Reserve within its carapace but not as fillet.

SI 18 of 2000

Additional Regulations for the General Use Zone:

- Spear fishing is not permitted within the marine protected area.
- Mangroves clearance is not permitted without the approval of, and a permit from, the Forest Department.
- No collection of flora and fauna except with permission from the relevant permitting authority.
- All proposed tourism development must go through the EIA process and follow any ECP conditions.

Key Enforcement and Monitoring Needs: Effective patrols are required to check for fisher compliance, specifically on licenses, fishing gear, catch sizes etc. These patrols will also deter potential incursions into the other zones, and transboundary incursions.

Many cayes lie within this Zone, and many have some degree of clearing and development, mostly to accommodate temporary fishing camps or seasonal / temporary occupation. The

majority of these cayes have no legal status. The development trend is predicted to continue, as the area has high recreational potential, as demonstrated by the proposed development of West Snake Caye. TIDE uses the EIA process as a tool to assist in guiding sound development in this zone. The clearing of mangroves can be addressed through the existing permit system from the Forest Department, in coordination with the Department of Environment.

Conservation Zones (CIZ and CIIZ)

The Conservation Zones I and II encompass examples of all representative habitats of the protected area. These are non-extractive zones, maintained to provide baseline conditions to allow monitoring, research, education and limited recreational activities. The Conservation Zones that include the Snake Cayes were determined based on the value of their fringing reef system, whilst the Conservation Zone around Wild Cane Caye was based on its archeological value as a Maya site. The conservation zones serve as replenishing and nursery areas for commercial species with spillover to the General Use Zone, and provides habitats for threatened species such as the Morelet's Crocodile, Antillean manatee, sea turtles and many bird species.

Objectives: To provide undisturbed areas free from all fishing and collecting, to enable recruitment of commercial species, for spillover to adjacent areas. They also provide representative examples of habitats within the protected area, and allow access for research and education.

Additional Regulations for Conservation I and II Zones:

- All educational activities require approval and coordination of TIDE, as the site-manager.
- No disturbance of the natural habitat is allowed.
- Mangroves clearance is not permitted without the approval of, and a permit from, the Forest Department.
- No collection of flora and fauna except with permission from the relevant permitting body.
- All proposed tourism development must go through the EIA process.
- Visitors/tourists should steer clear of the main boat access routes.

Rules for Conservation I and II Zone.

- No person shall engage in water-skiing and jet skiing within this zone.
- Sport fishing in the Conservation II Zone shall only be carried out under a license issued in accordance with these Regulations and such fishing shall only be carried out on a catch-and-release basis.
- No person shall engage in spear fishing with the Conservation II Zone.
- No person shall engage in commercial, recreational and subsistence fishing within the Conservation II Zone.
- No person shall engage in trawling, setting nets or traps within the Conservation II zone.
- No person shall engage in water-skiing and jet skiing within the Conservation II zone.
- No person shall secure a boat to the seabed of the Conservation I and II zones except by means of a mooring that is officially designated for this purpose, (save in the case of an emergency where life and property are endangered), or with the prior, written permission of the Reserve Manager.
- All divers in the Conservation I and II zones shall adhere to the following rules:
  - divers shall register with the Reserve Manager prior to entering the Conservation zones
  - charter dives shall first obtain a licence in the form prescribed as Form VI of the Schedule before operating in the Conservation zones and all dive boats shall fly the "divers down flag" when they have divers in the water;
  - Only certified scuba divers, or divers undergoing a training course conducted by a recognized instructor shall be allowed to use scuba equipment in areas of the Reserve where diving is permitted.
  - Dive guides shall be required to explain the rules of the Reserve to all divers within the Reserve.
  - All boats which need to operate in these zones shall first obtain registration from the Fisheries Administrator in accordance with these Regulations.
- For the purpose of this Regulation "divers down flag" means a flag with a white diagonal stripe upon a red background.
- All motor boats are to observe the low-wake-boat-way when approaching snorkelers or divers.

Additional Rules for Conservation I Zone.

- There shall only be non-extractive recreational activities in the Conservation I Zone.
- No person shall engage in water-skiing and jet skiing within this zone.

SI 18 of 2000

Key Enforcement and Monitoring Needs: Enforcement against illegal fishing and fishing camps, and transboundary incursions, with both day and night patrols. Enforcement of recreational and tourism regulations in collaboration with the Belize Tourism Board, and monitoring of tourism impacts. Coordination with residents and resource users (fishers and tour guides) within the marine protected area for assistance in surveillance.

Preservation Zone (PZ)

The Preservation Zone provides the strictest protection. This area is closed to all visitors and extractive users, including researchers, except under special permission. The establishment of the Preservation Zone around Middle Snake Caye was based on the fact that it is one of the few know colony nesting sites for migratory sooty terns in Belize.

Objectives: To provide areas within the Marine Reserve that are preserved in an entirely natural state; to protect particularly fragile habitats and threatened or rare species.

Regulations

- Subject to subregulation (2) below, no person shall engage in commercial fishing, sport fishing, diving or any other water activity within the Preservation zone.
- No vessel shall be permitted within the Preservation Zone except in cases of emergency or where written permission has first been obtained from the Fisheries Administrator.
- This area is reserved for special projects. Fishing and other activities may or may not be allowed depending on the status of the area in the management plan.

SI 18 of 2000

Regulations:

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

Key Enforcement and Monitoring Needs: The primary potential impact will be from tourism boat traffic accessing the nearby Deep River area.

3.4.3 Managed Access

Overview: Until recently, Belize has had an open access fishery with a steady rise in the number of fishermen, increasing fishing pressure and making it harder for each fisherman to make a living - too many fishermen chasing too few fish.

To address these concerns, the Managed Access framework was developed and implemented in Port Honduras Marine Reserve in 2011, as one of two pilot sites. Following successful implementation of the pilot phase, Managed Access is now being rolled out across Belize, providing traditional users with preferential access and participation in management of their resources. Under Managed Access, fishermen are expected to benefit directly from compliance with regulations and improved stewardship through commitment to better management of their fishery, adopting measures that will give them higher net profits for their effort.

Managed Access also creates an opportunity for fishermen to be full partners in making management decisions for the fishery. The long-term benefits are healthy sustainable stocks, a healthy ecosystem, and economically viable fisheries.

WHY MANAGED ACCESS?

Managed Access benefits the traditional fishermen. It…

- recognises those fishermen with a long term interest in specific fishing areas
- protects their rights to fish in that area
- protects these areas against incursions by fishermen who are not long-term customary users, and against illegal trans-boundary incursions
- improves fisher compliance through self-enforcement of the rules
- improves collaboration between fishers and area managers, reducing violations
- improves compliance with management interventions that will increase the performance and productivity of the fishing areas
- improves cooperation with managers and scientists to gather and report catch data
- takes advantage of market opportunities to increase revenue
- provides Belize with increased food security - fish are a local, reliable source of protein

3.5 Management Programs and Objectives

Management Programmes are a means of grouping management objectives within related areas – for example, those related to natural resource management, or to environmental education. 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. The inclusion of strategies is also important to strengthen communication and collaboration between Program areas, with inter-Program collaboration mechanisms for greater adaptive management effectiveness.

Five general Management Programmes are identified under the TIDE Strategic Plan, which follows the National Protected Areas Policy and System Plan framework (TIDE, 2013).

A. Resource Protection
B. Research and Monitoring
C. Environmental Education
D. Sustainable Development
E. Administration and Operations

The conservation strategies outlined for Port Honduras Marine Reserve in the conservation planning section of this management plan are integrated into the management Programmes, contributing towards the adaptive management process.

Port Honduras Marine Reserve Management Programs

Natural Resource Management		Environmental Education and Sustainable Development		Administration and Operations
Resource Protection	**Research and Monitoring**	**Environmental Education**	**Sustainable Development**	
Surveillance and enforcement ▪ Patrols ▪ Zoning, boundaries and regulations ▪ Staff ▪ Collaboration ▪ Reporting ***Marine Resource Management*** ▪ Management of Conservation Targets ▪ Addressing threats	***Research and Monitoring*** ***Human Resources*** ***Communication and Collaboration*** ***Dissemination of Information***	***Environmental Education in the Schools*** ***Training the teachers - building capacity for teaching environmental science*** ***Annual Environmental Activities*** ▪ TIDE Freshwater Cup ▪ TIDE Fish Fest ▪ Youth conservation competition ▪ TIDE Summer Camps ▪ Special environmental events ▪ Climate change awareness ▪ International Days – Earth Day, World Water Day	***Community Engagement*** ***Community Outreach*** ***Community Participation*** ▪ Community Stewards ▪ Community Researchers ***Community Natural Resource Management in Buffer Areas*** ***Leadership Training*** ***Alternative Supplemental Livelihoods*** ***Climate change adaption***	***Organizational Administration*** ▪ Financial Management ▪ Annual planning ***Human Resource Management*** ***Communications / Public Awareness*** ***Advocacy*** ***Infrastructure*** ▪ Staff facilities and maintenance ▪ Visitor facilities and maintenance ▪ Transportation ***Institutional Strengthening*** ***Financial Sustainability***

Table 33: *Management Programs of Port Honduras Marine Reserve*

3.5.1 Resource Protection Program

The Resource Protection Program focuses on ensuring the maintenance of healthy, functional ecosystems, through direct management of the marine environment, surveillance and enforcement and direct biodiversity management interventions. This Program falls under the responsibility of the Marine Manager and rangers. Two sub-programmes have been identified under this Program:

- **Surveillance and Enforcement**
- **Marine Resource Management**

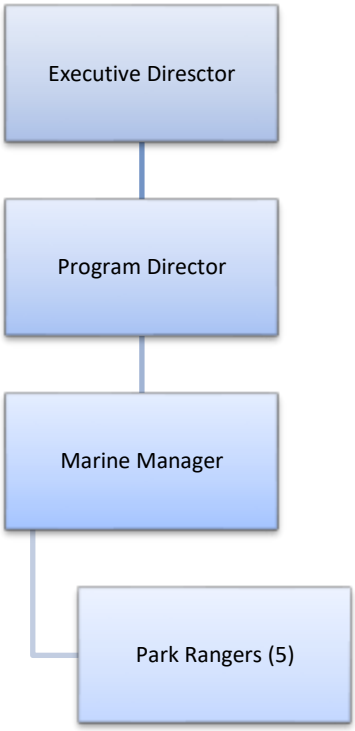


Figure 39: *TIDE Resource Protection Program staff structure*

Over the last five years, the Resource Protection Program has been strengthened in several ways:

- implementation of Managed Access
- use of technology such as SMART, (Spatial Monitoring and Reporting Tool), allowing park rangers and managers to plan and implement more intelligence-based patrols through collection and analysis of georeferenced data to assist in identification of hotspots and peak times for illegal activities, for more strategic surveillance and enforcement.
- partnering with the Belize Coast Guard, providing security for the fishers and staff of PHMR, increasing respect for the patrol team, and enabling increased night patrols.
- improving staff motivation and professionalism in the ranger team through exchanges and trainings at local, national and regional levels.

The improved surveillance and enforcement is seen in an increased rate of successful convictions for illegal fishing from an average of 0.25 convictions per month from 2012 to 2014, to 0.67 per month in 2015 (TIDE, 2016)

Surveillance and enforcement is complicated by the constant presence of illegal transboundary fishers from Guatemala and Honduras. These fishers are drawn to the better fish stocks in Belize, particularly with in the marine protected areas, but bring with them less sustainable fishing practices and, as illegal fishers, have no incentives for compliance with regulations or good stewardship. This leads to the taking of undersized product, fishing in restricted areas and with restricted gear, and in closed seasons. This is compounded by traditionally different fishing seasons (and therefore available markets) for lobster and conch.

Managed access has also improved the management environment for protection of the resources in PHMR, resulting in measurable increases in catches of lobster and finfish, compliance with regulations, sense of ownership and participation. At a Fishers Forum in 2015, fishers stated they were pleased with the improved protection of Port Honduras Marine Reserve through TIDE's partnership with the Belize Coast Guard and that they are seeing fewer non-Belizean fishers in PHMR.

The **Surveillance and Enforcement** sub-program for Port Honduras Marine Reserve is focused on supporting and upholding the Marine Reserve legislation, regulations and Managed Access fishing regime, ensuring fishing and tourism regulations are enforced. This is achieved through a number of Program areas:

- **Patrols**
- **Zoning, boundaries and Regulations**
- **Staff**
- **Collaboration**
- **Reporting**

Priority strategies for 2017 – 2021 include:

- Ensure PHMR has the human resources, equipment and training for effective surveillance and enforcement
- Revise and strengthen the Surveillance and Enforcement Plan for PHMR
- Strengthen collaborative enforcement (fishermen, TIDE, SEA, Fisheries Dept., Coastguard, BDF, Police Dept. Immigration Department, etc.) against transboundary incursions both within and outside the MPA
- Strengthen reporting on enforcement actions to improve prosecution success
- Strengthen collaboration with Immigration Department towards more effective control of transboundary incursions
- Strengthen implementation of tourism regulations through collaboration with BTB and tourism police

The **Marine Resource Management** sub-program has two strategic areas:

- **Management of Conservation Targets**
- **Addressing threats**

This addresses strategies such as mechanisms for management of the traditional fishery and specific activities for the management of conservation targets, as highlighted under the Conservation Planning section. It also addresses threats to the viability of biodiversity generally within the Marine Reserve.

Priority strategies for for 2017 – 2021 include:

- Continue and strengthen work with fishermen to strengthen implementation of Managed Access in PHMR, with the integration of the Adaptive Management Framework
- Strengthen management actions to address the future impacts of climate change and build resilience, based on the Climate Change Adaptation outputs
- Develop and implement a clear framework for fish trap and pot regulations for PHMR
- Continue to address the increasing numbers of lionfish in PHMR
- Participate actively in assessment of EIAs and ECPS to ensure sustainable development in coastal areas and on the cayes
- Develop collaboration strategies with other organizations with similar agendas, specifically for strengthening coordinated assistance to communities towards improved natural resource stewardship
- Provide visitor education and interpretation
- Develop and implement a Sustainable Tourism Plan for Port Honduras Marine Reserve, integrating climate change adaptations
- Review and update the Limits of Acceptable Change framework for PHMR, to guide management of tourism activities
- Work with tour guides and tour operators to improve tourism best practices in PHMR

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Surveillance and Enforcement			1	2	3	4	5		
Review, revise and implement the Surveillance and Enforcement Plan for PHMR	A surveillance and enforcement plan exists but needs to be updated	An effective surveillance and enforcement plan is being implemented for PHMR						Program Manager Marine Managers	
Ensure PHMR has the human resources and equipment for effective surveillance and enforcement	Have 4 rangers, are seeking a Marine Manager	Adequate human resources and equipment for effective surveillance and enforcement						Program and Marine Managers	A faster boat is required for addressing night surveillance of transboundary fishers in fast boats
Strengthen intelligence-based enforcement, with input from the enforcement team and integration of analyzed SMART data	Ongoing	Patrols are effective, targeted, strategic and intelligence-based, with improved integration of knowledge of the Enforcement Team and SMART data						Marine Manager	Need to build mechanisms to ensure enforcement team knowledge is integrated with SMART data
Conduct daily patrols and surveillance to enforce rules and regulations of PHMR to prevent illegal activities	Ongoing Need to evaluate patrol strategies	Scheduled and random daily patrols of PHMR to prevent illegal activities						Marine Manager	Based on revised surveillance and enforcement plan, and on SMART outputs and feedback from enforcement team
Ensure the Enforcement Team is trained and proficient in use of SMART data collection	Ongoing	Enforcement Team is trained to ensure proficient, well-structured use of SMART data collection						Marine Manager	Staff turnover would require training of new rangers – not assuming that they will be able to learn these skills in the field. Annual refresher course
Strengthen night patrols and implement more effectively	Ongoing. Need a faster boat and the night equipment	Night patrol are more targeted and strategic, with a faster boat and the required equipment for improved surveillance and enforcement						Marine Manager	Transboundary incursions at night are normally with fast boats that are able to outrun the patrol vessel. Participation of coastguard to ensure safety of rangers on night patrols

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Surveillance and Enforcement									
Continue to disseminate rules and regulations to key user groups on a regular basis	A need for clarification and dissemination of regulations for use of shades and pots in PHMR	Users are adhering to all rules and regulations of PHMR						Marine Manager	Boat to boat and fisher forums and meetings, radio messages
Collaborative enforcement (fishermen, TIDE, Fisheries Dept., Tourism Police, SEA, Coastguard, Immigration Dept., BDF, Police Dept. Customs etc.) against transboundary incursions both inside and outside the MPA	Ongoing	Effective surveillance and enforcement is achieved through collaboration with stakeholders and enforcement agencies						Program and Marine Managers	Collaborating agencies may not be able to work to TIDE's schedules. Need to improve stakeholder willingness to report illegal activity
Ensure effective surveillance and reporting of illegal development activities within the Marine Reserve	Ongoing	Effective surveillance and reporting of illegal development activities within the Marine Reserve						Marine Manager	Collaboration with DoE, Fisheries and Forest Department. Need to improve stakeholder willingness to report illegal activity
Strengthen reporting on enforcement actions to improve prosecution success	Ongoing	Effective enforcement outcomes, with improved prosecution success						Marine Manager	In collaboration with Fisheries Department Ensure new rangers are trained in effective reporting. Annual refresher course.
Sensitize the judicial system to impacts of illegal fishing and coastal / caye development within PHMR and the wider MMMC	Not started. Fines are often low, and unless requested, fishing equipment will not be confiscated	Judicial sector sensitized to impacts of illegal fishing and coastal/ caye development, more willing to give effective fines						Executive Director	Meeting with magistrates , site visits to PHMR

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Surveillance and Enforcement									
Support initiatives to strengthen the judiciary system and increase penalties for transboundary infractions	Not started.	Penalties and fines for transboundary incursions are set at a high enough level to deter illegal activities						Executive Director	Lobby for passing of the Fisheries Bill
Strengthen visitor management, and enforcement of visitor rules and tourism regulations	Not all visitors report to the ranger station in PHMR and so they are not aware of regulations	Effective visitor management, with enforcement of tourism rules and regulations						Marine Manager	In collaboration with BTB / tourism police. Capture 100% of visitation to the park Ensuring tourism operators are collecting fees and educating guests correctly about rules and regulations
Increase surveillance and enforcement of fishing, tourism and immigration regulations over Easter period	Influx of transboundary tourists during Easter – transboundary visitors are not as aware of the PHMR regulations and zones	Effective management of transboundary visitation						Program Manager Marine Manager	Challenging to stop every boat coming into PHMR
Strengthen enforcement of boating regulations through collaboration with the Belize Port Authority	Boating regulations are not fully enforced	Boating regulations are fully enforced						Marine Manager	In collaboration with the Belize Port Authority
Investigate feasibility of implementing color coding for recreational boats using PHMR	There is a conflict with recreational use of PHMR by non-traditional fishers	Management of recreational fishing is improved, with reduced conflict						Program Manager Marine Manager	How to ensure boats that are painted are officially PHMR recreational boats, issue over boats that are also used for commercial fishing in other Managed Access areas

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Surveillance and Enforcement			1	2	3	4	5		
Ensure effective surveillance and enforcement of research guidelines and regulations	No such agreement exists Ensure	All research in PHMR is conducted in accordance to the regulations, guidelines and agreed research protocols						Marine Manager PHMR Rangers	In collaboration with Fisheries Department. Training of rangers in rules and regulations Also covers research conducted by TIDE and research partners
Sensitize the retailers / restaurants to impacts of illegal fishing within PHMR and the wider MMMC	Not started	Retail / restaurant sectors sensitized to impacts of illegal fishing and not buying undersized / out of season products						Executive Director Program Manager	Meeting retail / restaurant owners, site visits to PHMR
Conduct restaurant / retail checks with Fisheries Department	Not started	Effective enforcement of size limits / seasons for retail / restaurant market						Executive Director Program Manager	Effective fines for contravention of legislated size limits / seasons
Provide PHMR users with emergency contact numbers on laminated cards for report on illegal fishing boats, and in case of emergency	Not started, but requested by fishers	PHMR fishers are fully engaged in reporting illegal fishing within the Marine Reserve						Marine Manager	Need to improve anonymity for tip-offs, and speed of follow-up and response to calls and reports
Ensure that staff and collaborating agencies do not contravene PHMR fishing regulations	Recreational fishing by staff and collaborating agencies occurs within PHMR and questioned by users	PHMR staff and collaborating agencies know, understand, respect and abide by all PHMR fishing regulations						Program Manager Marine Manager	Difficult for rangers to report other rangers and / or collaborating agencies. Challenging workplace dynamics
Zoning, Boundaries and Regulations									
Ensure effective demarcation of PHMR boundaries, for visual recognition of boundaries at all points by fishermen	Ongoing	PHMR boundaries are effectively demarcated with buoys and signs						Marine Manager	Buoys and signs are maintained on a regular basis and replaced when necessary

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Surveillance and Enforcement			1	2	3	4	5		
Zoning, Boundaries and Regulations									
Lobbying for amending the boundaries and zones of the PHMR	Conservation Zones are through to be too small to be functional	Conservation Zone is functional, providing spill over benefits for fishers						Executive Director, Project Manager, Marine Manager	Stakeholder engagement, support and participation is key in this process
Improve awareness of fishers and tour guides of location of international boundary	Whilst not of immediate concern to PHMR, fishers are unsure of the exact location of the international boundary with Guatemala, and have requested clarification	Belize fishers know accurately where the international boundary is						Marine Manager	Guatemalan navy vessels have stopped Belize fishers in what they believe to be Belize waters
Staff									
Strengthen capacity of all TIDE rangers to be able to operate effectively in PHMR	Ongoing. Training in key areas -Special constable training, law enforcement and chain of custody training, boat handling and engine maint., navigation skills, boarding procedures, public relations, first aid, tourism regulations	Rangers have the capacity for effective surveillance and enforcement						Marine Manager	One area highlighted for improvement was boarding procedures and public relations
Provide incentives to maintain qualified, committed and experienced rangers	Ongoing - Need to improve staff motivation to reduce staff turnover	Reduced staff turnover, with retention of skilled rangers						Executive Director, Project Manager, Marine Manager	Need to identify incentives and performance criteria for incentive delivery
Conduct a detailed review and revise policies and procedures to ensure rangers are hired based on skills	Not started	PHMR staff are hired based on their skills						Executive Director, Project Manager, Marine Manager	

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Surveillance and Enforcement									
Staff			1	2	3	4	5		
Ensure all PHMR staff are aware of and compliant with the rules and regulations of the MPA	Ongoing	All PHMR staff are aware of and compliant with the rules and regulations of the MPA						Marine Manager	
Collaboration			1	2	3	4	5		
Maintain strong collaborative partnership between TIDE and Fisheries Department towards effective enforcement – application of laws and regulations	Ongoing	TIDE and Fisheries Department collaborating effectively in areas of enforcement – application of laws and regulations						Executive Director, Project Manager, Marine Manager	
Continue working with fishermen to strengthen implementation of Managed Access in PHMR, with the integration of the Adaptive Management Framework	Ongoing	Increasing benefit for traditional users of PHMR as a result of effective implementation of Managed Access						Executive Director, Project Manager, Marine Manager	Issues have arisen with PHMR MA licenses being issued without due process; ensure Guatemalans living in Guatemala are excluded from MA licenses
Increase collaboration between rangers and resource users (communities, fishers and tour guides) for more effective surveillance	Ongoing	Natural resource users are collaborating to strengthen effective surveillance						Marine Manager	Willingness of resource users to collaborate for effective surveillance
Strengthen collaborative enforcement against transboundary incursions, both within and outside the MPA	Ongoing	TIDE collaborating effectively with partners to reduce incursions						Marine Manager	Fishermen, TIDE, Fisheries Dept., SEA Coastguard, BDF, Police Dept. etc. Focused primarily on transboundary incursions

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Surveillance and Enforcement									
Collaboration			1	2	3	4	5		
Engage NGOs and Government agencies in Guatemala and Honduras through TRIGOH to seek assistance in addressing transboundary issues	Ongoing	Regional solutions and collaboration for addressing transboundary fishing						Executive Director, Project Manager,	Inclusion of issues with marine life used as tourism curios (dried seahorses, sea shells, coral, turtle shells etc.)
Strengthen collaboration with Belize Tourism Board for effective enforcement of tourism legislation within PHMR	Not started	Effective enforcement of tourism Legislation within PHMR with reduced tourism impacts						Executive Director, Marine Manager	Limited tourism police in Toledo and schedule conflicts for tourism police
Strengthen partnership with Immigration Department, with more effective integration into patrols, to address transboundary incursions	Not started	TIDE has increased reduced transboundary incursions through its partnership with Immigration Department						Executive Director, Marine Manager	Willingness of the Immigration Department to participate,
Reporting			1	2	3	4	5		
Ensure SMART data is analyzed and integrated into reports	Ongoing	SMART data is analyzed and integrated into reports						Project Manager, Marine Manager	In collaboration with Fisheries Department / WCS. Need to ensure that the Head Ranger is trained to produce reports from SMART data
Maintain patrol log book for PHMR	Ongoing	Patrol log book for PHMR is up to date						Head Ranger	
Produce required reports, and submit to Fisheries Department	Ongoing	Required reports are produced and submitted to Fisheries Department						Marine Manager	

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Marine Resource Management									
Management of Conservation Targets: Commercial and Recreational Species			1	2	3	4	5		
Continue effective implementation of Managed Access and other mechanisms for effective management of marine resources in PHMR	Ongoing	TIDE is effectively implementing Managed Access in PHMR						Executive Director Marine Manager	Other mechanisms: E.g. Species specific regulations /quotas etc.) for increasing benefit for traditional users
Continue working with Managed Access fishers to demonstrate positive effects on maturity of commercial species as a result of good management of GUZ and reduction of illegal fishing	Ongoing	Fishers understand the benefits of Managed Access and continue to be advocates						Marine Manager, Marine Biologist	May also require expansion of replenishment zone
Investigate the feasibility of a Managed Access framework for sport fishers in PHMR, with agreed standardized catch and release protocols	No framework for management of sport fishing activities in PHMR	Improved monitoring and management of local sport fishing industry and implement standards						Executive Director, Marine Manager	Agreement on standards may be an issue
Identify and implement sustainable fisheries diversification initiatives that target both traditional and new target species	Ongoing – investigating potential for seaweed and sea cucumbers	Reduced pressure on traditionally harvested species, increased sustainability						TIDE Executive Director, Marine Manager	Diversification into polyculture system based on seaweed, conch and sea cucumber farming Potential issue of theft if not within sight of Abalone Caye
Identify and implement mechanisms to reduce local dependence on marine resources	Not continuous	Mechanisms are identified under the Sustainable Development Program						Executive Director, Project Manager,	In collaboration with relevant Government departments

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Marine Resource Management									
Management of Conservation Targets: Commercial and Recreational Species			1	2	3	4	5		
Investigate feasibility of implementation of size limits for lane snapper	Not started	Increased sustainability of lane snapper						Executive Director, Marine Manager	Would need consensus from the fishers
Investigate feasibility of implementation of size limits for Goliath grouper	Not started	Increased sustainability of Goliath grouper						Executive Director, Marine Manager	Would need consensus from the fishers
Develop and implement strategies to better manage baitfish	Not started	Effective management of baitfish for sustainability						Marine Manager	Overfishing for sale to fishers is thought to be impacting trophic structure and reducing ability of PHMR to support predatory fish
Continue to increase awareness of non-consumptive value of sharks (tourism and ecosystem) – targeted at fishermen in stakeholder communities	Ongoing	Shark fishing reduced within PHMR						Marine Manager, Environmental Education Manager	
Investigate possible interventions to improve lobster populations	Not started. There are concerns that lobster shades outside the conservation zone are attracting juvenile lobsters, in preference to habitat inside the zone	Improved functionality of the Conservation Zone as a replenishment zone for lobster						Marine Manager Marine Biologist	Potentially through: Restriction of trap sites in buffer around Conservation Zone Use of lobster shades or artificial reef in the Conservation Zone, to Increase habitat availability for juveniles
Phase out fish pot use in PHMR	Fish pots are illegal in PHMR	Fish pots are not used in PHMR						Marine Manager	Based on review Push back from fishermen

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Marine Resource Management									
Management of Conservation Targets: Commercial and Recreational Species			1	2	3	4	5		
Investigate the feasibility of site specific quotas and species specific zoning for sea cucumber recovery in PHMR	Sea cucumber density has decreased dramatically in PHMR since 2012 and there are no signs of recovery	Sea cucumber extraction is sustainable						Marine Manager Marine Biologist	Need for species specific zoning to protect sea cucumber recruitment sites and effective surveillance and enforcement
Investigate potential for farming sea cucumbers to reduce pressure on wild populations	Sea cucumber population density has decreased dramatically in PHMR since 2012 and there are no signs of recovery	Sea cucumber extraction is sustainable in PHMR						Marine Manager Marine Biologist	Would need to be in a Special Management Area in the GUZ
Improve knowledge of use of PHMR by key sport fish species	Some information, but there is not yet a full picture of sport fish use of PHMR for informing management decisions	TIDE is able to effectively manage sport fish through knowledge of nursery and foraging areas						Science Director, Marine Manager	In collaboration with sport fishers
Management of Conservation Targets: Coral			1	2	3	4	5		
Designate and enforce specific mooring sites and boat access channels to reduce mechanical impacts on corals by tourism / recreational boats	Ongoing	Specific mooring sites and boat access channel markers are installed, with reduced physical damage to reef						Marine Manager	Need additional mooring sites, maintenance of buoys
Ensure effective surveillance and enforcement of resilient coral sites to improve resilience of PHMR reefs	Ongoing	Resilient coral sites are identified and integrated into surveillance activities						Marine Manager Marine Biologist	Identifying sites

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Marine Resource Management									
Management of Conservation Targets: Coral Reef			1	2	3	4	5		
Ensure adequate protection of key herbivores to maintain live coral cover and ecological functions	Ongoing	Herbivorous fish populations are stable / improving as a result of effective surveillance and enforcement						Marine Manager	Tied to increased awareness and addressing of transboundary incursions
Management of Conservation Targets: Mangroves / Littoral Forest / Sandy Beaches			1	2	3	4	5		
Continue replanting of mangroves on Abalone Caye and coastline	Ongoing	PHMR maintains and increases its mangrove cover						Marine Manager, Science Director	
Lobby for inclusion of nationally-owned cayes in PHMR	Not started, but supported by communities	Key littoral forest / mangrove are included within PHMR						Executive Director	Public consultation meeting voiced local opinion that the four snake cayes should be nationally owned and managed as part of PHMR
Protect key bird nesting and roosting sites through engagement of caye owners / developers, control of visitor access and effective surveillance and enforcement	Not started	Nesting and roosting bird populations have greater protection						Executive Director, Marine Manager,	Engagement of caye owners
Management of Conservation Targets: Sea Turtles			1	2	3	4	5		
Identify and implement mechanisms to ensure continued viability of turtle nesting sites	Turtle nests have been identified and are monitored	Turtle nest sites continue to be viable						Executive Director Science Director,	Targeted surveillance; Use of EIA process to protect key beaches; Engagement of residents for surveillance and protection of nest sites Movement of “at risk” nests

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Marine Resource Management									
Management of Conservation Targets: Sea Turtles			1	2	3	4	5		
Increase capacity of land owners / communities for turtle nest protection	Limited active protection of turtle nests, some are on private land	Protection of critical nests for increased viability through engagement of land owners / communities						Science Director, Education and Outreach Coordinator	Conflict between conservation and tourism development
A Turtle nest area is created in Punta Negra ***if*** active movement of "at risk" nests is considered necessary	Limited active management of turtle nests. Requires a feasibility study and cost benefit analysis	Turtle nest area is created in Punta Negra ***if*** active movement of "at risk" nests is considered necessary						Science Director, Environmental Education Manager	Engagement of Punta Negra for collaborative management and monitoring of nest translocation area. Project activity for Ridge to Reef Expedition
Continue satellite tagging of sea turtles to provide improved information on their use of the wider seascape	Ongoing	Improved information on use of the wider seascape by sea turtles nesting in PHMR						Science Director	
Management of Conservation Targets: Large Marine Megafauna			1	2	3	4	5		
Continue to patrol against illegal nets to reduced threats to large marine megafauna	Ongoing	Reduced risk to Antillean manatees, dolphins, sharks and crocodiles in PHMR						Marine Manager	Night patrols

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Addressing Threats									
Development			1	2	3	4	5		
Develop and promote guidelines and best development and facility management practices among resort and caye owners / leaseholders and residents in PHMR (including Abalone Caye)	Started, needs additional information	TIDE, resort and caye owners / leaseholders and residents reduce their pressures on PHMR through adopting best development and facility management practices						Marine Manager, Environmental Education Manager	Willingness of developers / communities to adopt guidelines. Targeting areas such as wastewater management, chemical use and storage, etc. Targeting use of, and impacts on, littoral forest, mangrove, caye and beaches
Engage land owners, residents and agricultural/ in best management practices, protection and restoration in the watershed	TIDE has engaged communities in riparian restoration	Stakeholders are more informed and engaged in using best management practices to reduce their impact on PHMR						Executive Director, Environmental Education Manager	Targeting use of, and impacts on, riparian forest, and mangrove. Focusing on riparian functionality, agrochemical use
Effectively use the EIA process of consultations to address potential coastal / caye development threats	TIDE is a member of NEAC and is able to inform decision making	TIDE is influential in addressing caye development threats						Executive Director,	TIDE active and vocal in the EIA process and advocates for reduced impacts on marine resources
Ensure development within and adjacent to PHMR is compliant with all relevant policies, regulations and ECP agreements, in collaboration with DoE	Ongoing	TIDE includes surveillance of development activities in its revised Surveillance and Enforcement Plan						Marine Manager	Including dredging of sand/coral, clearance of mangroves, water quality In collaboration with developers, Fisheries and Forest Department, etc.
Tourism			1	2	3	4	5		
Revise and implement Limits of Acceptable Change Program	Needs review and revision	Effective implementation of Limits of Acceptable Change integrated into adaptive management and informed by research						Marine Manager Science Director	Particularly important if cruise visitation increases

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Addressing Threats									
Tourism			1	2	3	4	5		
Ensure tour guides know the rules and regulations of PHMR		All tour guides know the rules and regulations of PHMR						Marine Manager Environmental Education Manager	
Ensure tour guides are trained in Tourism Best Practices	Ongoing	All tour guides are using Tourism Best Practices						Marine Manager Environmental Education Manager	Including waste disposal
Ensure information is available for visitors at Abalone Caye to inform them of Tourism Best Practices		Visitors to PHMR area aware of Tourism Best Practices						Marine Manager Environmental Education Manager	
Provide access to interpretive information for visitors		Visitors learn about PHMR, its ecosystems and species						Marine Manager Environmental Education Manager	
Improve tourism signage in PHMR in both English and Spanish	Ongoing	Tourism signage provides effective management of visitors to reduce tourism impacts						Marine Manager	Signage includes the identification, rules and regulations of zones
Increase the percentage of visitors that receive a presentation upon entering PHMR	Currently, approximately 85% receive a presentation	All visitors receive a briefing on entry to the protected area						Marine Manager	In collaboration with BTB. For some visitors, this would mean a detour / increased fuel use, which may cause some conflict
Provide an annual refresher course for tour guides focused on implementation of best practices in PHMR	BTB is initiating a series of mandatory national refresher courses	Tour guides reduce tourism impacts on PHMR by using best practices						Marine Manager	Collaborate with BTB

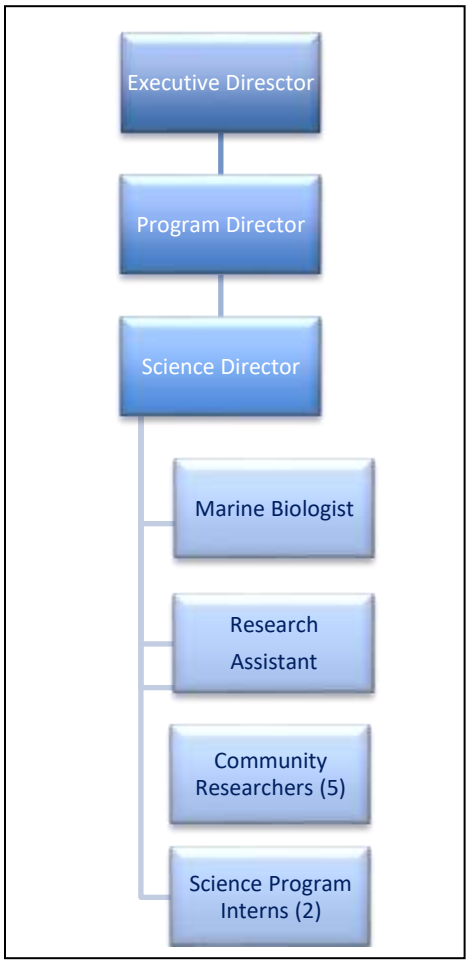
A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Addressing Threats									
Tourism			1	2	3	4	5		
Increase awareness of PHMR regulations for transboundary visitors, at their points of origin, before each Easter holiday	Not started. BAS contacts this sector before Easter to ensure knowledge of HMCNM / NHNM regulations	All transboundary visitors are aware and compliant with national tourism and site specific PHMR regulations						Executive Director, Marine Manager	Collaborate with BAS and BTB E.g. ratio of tour guides, use of local tour guides etc.)
Oil exploration / extraction / transport			1	2	3	4	5		
Lobby for exclusion of marine protected areas – including PHMR - from oil exploration concession areas	TIDE is a member of APAMO, lobbying for no oil exploration in MPAs	PHMR excluded from oil exploration areas						Executive Director	Political will of GOB
Lobby for creation / adoption of navigation and oil exploration / extraction standards as needed, and enforce all such regulations	Not started; Revisit the MarPol convention	Oil exploration / extraction and transshipment standards are in place and enforced						Executive Director	Working with Geology and Petroleum Dept. and Belize Port Authority
Work with local and national partners to develop an oil spill response plan for mitigation of oil /chemical spills within the PHMR wider southern reef area, and train staff in response	An oil spill plan already exists for Belize	An oil spill response plan is in place for PHMR, and staff trained in implementation						Executive Director	GOB needs the resources to implement the plan
Waste Management			1	2	3	4	5		
Implement effective waste management plan for Abalone Caye rangers station	Not started	Waste management is effective for Abalone Caye						Executive Director, Project Manager,	Need safe, environmentally sound waste management system - act as model

A. Resource Protection Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Addressing Threats									
Invasive Species			1	2	3	4	5		
Work with national partners in updating and implementation of the comprehensive action plan for lionfish management	First lionfish action plan is being revised	PHMR is implementing an updated national lionfish management plan						Marine Manager	Willingness of partners to network, develop and implement plan.
Work with national partners in updating and implementation of the comprehensive action plan for lionfish management	First lionfish action plan is being revised	PHMR is implementing an updated national lionfish management plan						Marine Manager	Willingness of partners to network, develop and implement plan.
Develop and implement a site specific monitoring and management plan for lionfish within the Marine Reserve	Not started	PHMR is implementing a site specific lionfish management plan for PHMR, reducing lionfish numbers						Marine Biologist	Ensure monitoring protocols are comparable to national monitoring efforts
Strengthen stakeholder awareness, support and involvement in consistent, ongoing lionfish removal	Ongoing	Lionfish density in PHMR is reduced with increased involvement of stakeholders in lionfish management						Project Manager, Marine Manager	Investigate potential for regular lionfish removal by local eradication teams especially at key target areas such as sites with high juvenile fish abundance and identified resilient reefs
Strengthen the local market for lionfish, in collaboration with local stakeholders	Not started. Some local market for lionfish but not sufficient to motivate fishers to preferentially take lionfish	Fishers are preferentially culling lionfish to supply market demand. Stakeholders develop a preference for eating lionfish						Project Manager, Marine Manager	

3.5.2 Research and Monitoring Program

The Research and Monitoring Program provides ongoing information on the state of the marine resources, informing adaptive management decisions and assisting in prioritising management activities. This Program falls under the responsibility of the Science Director, and consists of four sub programmes:

- **Research and Monitoring**
- **Human Resources and Capacity Building**
- **Communication and Collaboration**
- **Dissemination of Information**



TIDE has a strong and comprehensive Research and Monitoring Program, with effective data collection, data management, and dissemination of reports. It is focused on providing an integrated approach to the management of Port Honduras Marine Reserve. From intermittent data sets extending as far back as 1995, to the more complete data sets being collected today, a detailed picture is being constructed of the changes in the ecosystems and marine resources of the Marine Reserve. The Program provides information for effective implementation of an ecosystem-based approach to management of the natural resources of PHMR, towards improving conservation target viability.

Research and monitoring activities rely heavily on the assistance of community researchers, with training provided in the skills required to participate in monitoring activities.

Program Goal

To implement a Research and Monitoring Program that supports ecosystems planning and management in the Port Honduras Marine Reserve.

Key Objectives

- To monitor the conservation targets of PHMR
- To provide information on the ridge to reef connectivity of the Maya Mountain Marine Corridor
- To effectively assess success of no take areas, Managed Access and PHMR as a whole in maintaining viable populations of key conservation species and ecosystems
- To identify sites/coral species resilience for targeted protection, and develop strategies for climate change
- To establish comprehensive datasets and effective data management and analysis for informing adaptive management strategies and decisions
- To assess management effectiveness of PHMR
- To improve engagement of PHMR stakeholders through involvement in research and monitoring activities, to build capacity and improve support for conservation activities.
- To improve capacity and ability of staff, rangers and community researchers to conduct research and monitoring within PHMR

The **Research and Monitoring Program** incorporates the following key activities to achieve its objectives:

- Maintain revised water quality monitoring protocols for the next five years, with increased cost effectiveness through use of in-water data loggers, to monitor trends for climate change adaptation planning
- Continue ongoing monitoring of commercial species – conch, lobster, sea cucumber populations contributing towards adaptive management, and informing Managed Access, and potential expansion of replenishment zones
- Continue catch survey monitoring of Goliath grouper
- Investigation of recruitment (lobster / conch) and links to water quality and habitat
- Complete habitat mapping of critical areas
- Continued assessment of benthic cover, coral health and reef fish populations.
- In-water and nest monitoring of sea turtles
- Monitoring of Antillean manatee

Adaptive Management Framework (AMF)

The AMF evolved as part of discussions by the Belize Fisheries Science Team (UB, Fisheries Department, TNC, WCS, TIDE).

It assesses the types of data being collected, with the development of a decision making matrix that can accept multiple types of data collected using different methods.

This will enable use of data that has been collected differently in different areas, to facilitate integration into management decisions, with implemention, monitoring and review of the effectiveness of the techniques implemented.

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
General									
Ensure resources are allocated for on-going critical marine baseline and monitoring activities, with equipment for effective biodiversity monitoring	Program is limited by equipment	The Research and Monitoring Program is equipped for effective program management and strategy implementation						Science Director	
Ensure adequate baseline data is available for management decisions	Adequate baseline data is available for the majority of monitoring targets. New targets still require baselines.	Adequate baseline information is available and easily accessed for input into management decisions						Science Director	Prioritizing areas such as water quality (upriver pollution sources, wider seascape currents / salinity), climate change adaptation, limits of acceptable change, conch and sea cucumber
Review and revise the Research and Monitoring Plan	Currently under revision	Effective research and monitoring outputs are guided by the revised Research and Monitoring Plan, and provide input into adaptive management decisions						Science Director	Continued monitoring of site specific conservation targets and national indicators
Continue monitoring of sites providing comparison between inside and outside the PHMR boundary	PHMR has established monitoring sites inside and outside the MPA boundaries for comparison, to measure effectiveness in conserving marine resources	A clear understanding of the links between marine resources, protection, MPA effectiveness and zones						Science Director	Ensure monitoring sites inside and outside PHMR are comparable

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
General			1	2	3	4	5		
Continue strengthening data collection on extractive use of the area (legal and illegal)	Some data available on legal extractive use from log books	TIDE has an effective data collection system that provides accurate data on extractive use of the area (legal and illegal)						Science Director	Fishermen may need further capacity building to be able to complete the log book accurately. Use surveillance and enforcement information to extrapolate illegal use.
Continue and strengthen integration of research and monitoring outputs into the adaptive management process	Ongoing	The adaptive management process is informed by research and monitoring outputs						Project Manager Science Director	
Research			1	2	3	4	5		
Identify priority research activities and partners / locate funding for implementation	Ongoing	Priority research activities have been identified for PHMR, and being implemented						Science Director	Engaging partners and locating funders
Strengthen mechanisms to ensure effective communication between Fisheries Department and TIDE during the research permits application process	TIDE is not always included within the permitting process	TIDE is fully aware of and has input into the research permit process for projects targeting PHMR						Executive Director	In collaboration with Fisheries Department
Develop a written agreement between TIDE and researchers wishing to use PHMR, that covers regulations and guidelines, to be signed by all researchers before starting work	No such agreement exists	Researchers are aware of and compliant with regulations and guidelines set out in the agreement.						Science Director	To include the current data sharing agreement. To avoid situations such as past research on Sooty Terns, which resulted in the sooty terns abandoning the nesting caye.

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Research			1	2	3	4	5		
Investigate the feasibility and mechanisms for effective hosting of student research groups	Hosting University groups and individual Masters students from ECOSUR as a model for hosting student research opportunities	TIDE is effectively hosting student research groups and has increased its income as a result						Science Director	Cost effectiveness assessment of time / personnel availability and value of outputs
Continue to update baseline species lists for PHMR	Some work has been completed, but it is not easily accessible or updated	TIDE has baseline species lists for PHMR, that are maintained and updated as necessary						Science Director	E.g. Fish, corals, birds, mammals and other vertebrates and invertebrates
Assess the diversity and abundance of shark species within PHMR	No current baseline	TIDE has baseline knowledge of the diversity and abundance of shark species within PHMR						Science Director	In collaboration with SEA / SBRC / MarAlliance / WCS collaborating towards knowledge at seascape level
Increase knowledge of resource use and occupancy – status of coastal and caye properties adjacent to PHMR	Some data is available for the cayes from the Integrated Coastal Zone Management Plan, but this needs to be updated	TIDE has accurate knowledge of resource use and occupancy of coastal and caye properties adjacent to PHMR						Program Manager	Collaboration with Lands Department
Improve information on the ecological and archaeological components of the cayes to inform and better address threats of caye development	Not started	TIDE has more information from which to effectively address issues of caye development						Executive Director Science Director	Archaeological research partners

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Research			1	2	3	4	5		
Map extent of coastal and caye critical littoral forests adjacent to PHMR	No capacity to map – only ground truth	Mapping of coastal and caye critical littoral forests adjacent to PHMR						Science Director	Information to assist where procurement and protection are identified as necessary, and for addressing EIAs Linked to mapping of archaeological information on cayes
Update habitat map of PHMR and surrounding areas (within 4km of PHMR boundary) to include critical resilient areas/nursery grounds	Ongoing – being implemented in stages	Habitat map of PHMR and surrounding areas is updated, and includes critical areas/nursery grounds						Science Director	Including mapping of buffer area within 4km of reserve boundary
Identify and map coral reefs demonstrating some resilience to climate change within PHMR in the context of the wider seascape	TIDE is in the process of identifying resilient reefs within PHMR	TIDE has identified areas resilient to climate change in PHMR, in the context of the wider seascape						Science Director	Use identified sites to guide targeted surveillance and enforcement activities
Identify coral recruitment sources for PHMR, and mechanisms to ensure that these are adequately protected, if necessary	Coral recruitment sources are better known	TIDE has identified coral recruitment sources for PHMR, and mechanisms to ensure that these are adequately protected, if feasible						Science Director	Regional collaboration
Characterize seascape water currents critical for larval dispersal (for coral and fish recruitment) for PHMR	Not yet implemented	TIDE has knowledge of seascape water currents critical for larval dispersal for PHMR, on which to base its management decisions						Science Director	There is limited information on water parameters and currents in the larger seascape

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Monitoring									
Water Quality Monitoring			1	2	3	4	5		
Conduct a cost-benefit review of use of lobster shades and pots in PHMR – positives and negatives of both	There is concern about the impact of lobster shades and pots on seagrass health	Informed decision making on management of lobster shades and pots in PHMR						Marine Manager Science Director	
Revise basic water quality monitoring protocols to integrate deployment of in-water data loggers	Being revised.	Water quality monitoring is cost effective, consistent, and with results informing management decisions						Science Director	Barrier may be cost of equipment and technical issues with in-water loggers
Implement effective water quality monitoring of agro-contaminants at key points and times	No targeted sampling framework for monitoring water quality after storm events	Better understanding of the impacts of watershed contamination on water quality of PHMR						Science Director	Especially at the river mouths after storm events
Remote sensing monitoring run-off from the central and southern coastal plain, and northern Honduras / Guatemala during extreme storm events	Not started	TIDE is informed of the watershed and seascape influences on PHMR during extreme storm events						Science Director	Using remote sensing information (NOAA website / SERVIR, ICRAN-MAR to assess impacts on PHMR
Monitor Limits of Acceptable Change indicators for water quality in high visitor use areas	Limits of Acceptable Change framework is still to be established / revised	In-water nutrient levels and relative algal growth are monitored on a regular basis in high visitor-use areas, and results inform management decisions and actions						Science Director	To be incorporated into Limits of Acceptable Change framework. To include water by Abalone Caye i

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Monitoring									
Coral and Reef Fish									
Monitor coral and reef fish in GUZ, CZ / PZ, and outside PHMR - 10 sites in total	Ongoing since 2011, with 8 sites in PHMR, and 2 sites outside	Coral and reef fish are monitored accurately and consistently, and outputs are used to inform management decisions						Science Director	Monitoring team is fully trained for accurate identification of corals and reef fish Include data on bleaching levels
Conduct bleaching surveys during critical periods	Ongoing	Bleaching surveys are conducted during critical periods						Science Director	
Commercial Species									
Continue in-water monitoring of conch, lobster sea cucumber, and fin fish (lane snapper, snook, jack, grouper)	Ongoing	TIDE has data on population trends of key commercial species, feeding into the Adaptive Management Framework						Science Director	
Catch monitoring of Goliath grouper at landing or point of sale	Ongoing	TIDE has data on population health and trends of Goliath grouper						Science Director	Habitat used by Goliath grouper are too turbid for in water monitoring
Monitor fish landings through log book data	Fishers are required to log their catch as part of Managed Access	Data is recorded accurately and consistently by fishermen, feeding into the Adaptive Management Framework						Science Director	Need to strengthen capacity of fishers for accurately completing log books
Map and assess identified fish nursery habitats within PHMR	To be started	Fish nursery habitats within PHMR are mapped and assessed						Science Director	Incorporate information from the habitat mapping assessment

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Monitoring Program									
Sport Fish Species									
Establish an effective catch monitoring program for sport fish species, in collaboration with sport fishers	Need to better engage sport fishers for improved data sharing	TIDE is effectively managing sport fishing for the benefit of local sport fishers and sport fish species, towards adaptive management						Science Director	Would like to standardize. (Note: The majority of the sport fishermen in PHMR use BTT standards).
Marine Turtles									
Continue mapping and monitoring of nesting beaches (species, number of nests, reproductive success)	Nests have been monitored (locations, time hatched, percentage nest success), but no monitoring of sex ratio of hatchlings	Nesting beaches have been mapped and nesting / reproductive success data collected on an annual basis to inform management decisions						Science Director	Ensure existing nesting sites remain viable through increased vigilance and increased capacity for turtle nest management. A Ridge to Reef Expedition project
Conduct in-water turtle surveys monthly within PHMR	Monitoring is planned	In-water turtle surveys are conducted monthly in PHMR						Science Director	Share data with ECOMAR Volunteer program
Antillean Manatee									
Continue working with Marymount University for tagging and tracking of sea turtles	Two hawksbill turtles tagged and tracked (2014 / 2015)	Information on seascape use by tagged sea turtles is informing collaborative sea turtle conservation and management						Science Director	National and transboundary collaboration. E.g. Prolansate in Honduras
Conduct manatee surveys within PHMR	Current monitoring is opportunistic	Improved knowledge and management of status of manatee populations and use of PHMR						Science Director	Volunteer Program. Share data with the National Manatee Working Group

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Monitoring									
Antillean Manatee									
Respond to manatee stranding reports as an active member of the Marine Mammal Stranding Network	Ongoing	TIDE participates as an active member of the Marine Mammal Stranding Network, responding to reports in southern Belize						Science Director	Activities include calf rescue and necropsies Share data with the BMMSN
Sea Cucumbers									
Continue to monitor sea cucumber populations within PHMR	TIDE has a baseline assessment, Monitoring is ongoing	TIDE is using the data to effectively manage sea cucumbers within PHMR						Science Director	Information for replenishment zoning
Monitoring of Impacts									
Revise and strengthen Limits of Acceptable Change monitoring framework and integrate into monitoring activities	Needs review and revision	Effective monitoring of Limits of Acceptable Change indicators, fully integrated into monitoring activities						Science Director	Where feasible indicators should align with current monitoring effort Particularly important if cruise visitation increases
Develop and implement rapid assessment mechanisms for impacts such as ship groundings, hurricane / earthquake damage, disease outbreaks, oil spills etc.	Ongoing	Rapid assessment mechanisms are in place and implemented when required						Science Director	With engagement of staff and stakeholders, training of staff and community Stewards / Researchers for specific responses
Ensure post impact assessments are conducted and reports produced and disseminated for all impact events – e.g. earthquakes, hurricanes, boat groundings	Ongoing	Post impact assessments are conducted and reports disseminated						Science Director	

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Monitoring									
Impacts									
Monitor presence and density of lionfish population	Opportunistic	TIDE has the information on abundance and density of lionfish and diet to be able to engage stakeholders in active management strategies						Science Director	Ensure protocols are aligned with national monitoring
Human Resources and Capacity Building									
Staff									
Ensure sufficient, trained staff for effective implementation of the Program activities	Ongoing capacity building	TIDE has sufficient, trained staff for effective implementation of the Research and Monitoring Program activities						Science Director	Training in Open Water, Advanced Rescue and Dive Master SCUBA, Oxygen Provider, EFR (CPR & First Aid), Dive Incident Emergency Response/ Evacuation. Training in coral, sea fan, algae fish and sponge ID, seagrass, conch and lobster and mangrove monitoring
Ensure all staff (particularly rangers) are fully engaged, and understand the reasons behind research and monitoring, and can articulate major research and monitoring outputs (state of reef, state of fish resources etc.)	Needs to be improved	PHMR staff (particularly rangers) are fully engaged and have a good understanding of the reasons behind research and monitoring						Science Director Marine Manager	Should also include the Community Researchers and Community Stewards

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Human Resources and Capacity Building									
Staff									
Provide incentives for maintaining good staff	Ongoing	Research and Monitoring Program staff remain committed for the long term, with low turnover						Executive Director	DAN Insurance
Community Researchers									
Continue to strengthen the research and monitoring program through engaging and training community researchers	Ongoing	TIDE's Community Researchers provide the human resources required for effective research and monitoring activities						Science Director	Strengthening of the Community Researcher Program is covered under Community Participation
Data Management and Reporting									
Ensure mechanisms are in place for easy access to monitoring data and quarterly and annual data summaries	Ongoing	Monitoring data and quarterly and annual data summaries are easily accessible						Science Director	Data is on central server, organized and accessible to those who need it
Research and monitoring reports are produced and distributed as required	Ongoing	Monitoring reports are available on the TIDE website and accessible to stakeholders						Science Director	Ensure reports include clear conclusions and recommendations in non-technical terms for stakeholders
Produce Annual State of the Park monitoring output report for submission to Fisheries Department	Ongoing	An Annual Report summarizing Research and Monitoring outputs of PHMR is submitted to the Fisheries Department						Science Director	
Produce biennial report for stakeholders that integrates key research outputs	Ongoing (2013, 2015)	Biennial report disseminates key research and monitoring results to stakeholders						Science Director	

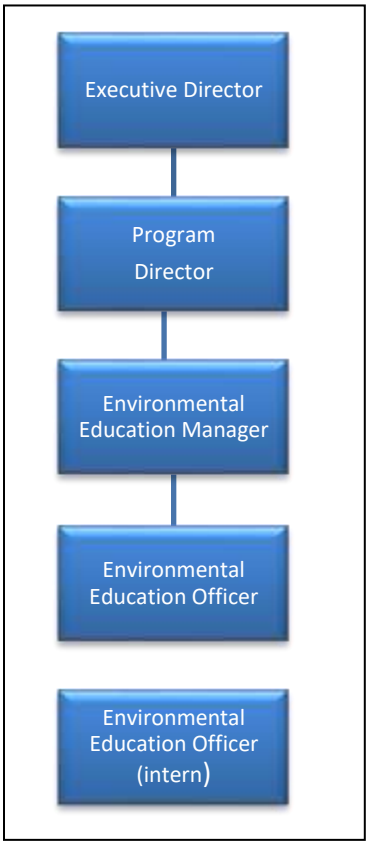
B. Research and Monitoring Program										
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Communication and Collaboration										
Ensure results of monitoring and research outputs are available to staff of PHMR and to other Directors / Managers	Ongoing	Data is shared effectively between all areas of TIDE for strategy integration and strengthened adaptive management						Science Director	
Ensure continued communication and collaboration with Fisheries Department for effective coordination of monitoring activities that feed into national data sets	Ongoing	Monitoring activities are conducted in close liaison with Fisheries Department and feed into national data sets to inform national management of fishery resources						Executive Director Science Director	Belize Fisheries Science Team
Effective communication, collaboration and information sharing with other marine management / research partners	Ongoing	TIDE has effective communication, collaboration and information sharing with other marine management / research partners						Executive Director Science Director	SEA, Fisheries Department, other MPA co-management agencies
Collaboration with local users to integrate local knowledge into the development of research strategies and hypotheses	Ongoing	TIDE integrates local knowledge and the participation of local users into its research and monitoring program development						Science Director	

B. Research and Monitoring Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Communication and Collaboration									
Ensure relevant monitoring outputs are communicated effectively to local stakeholders	Ongoing	TIDE effectively disseminates its results to a wide range of stakeholders						Executive Director Science Director	Stakeholder visits, fisher forums, workshops, symposia, conferences, school visits, tour guide meetings etc.
Ensure relevant monitoring outputs are communicated effectively to improve management and policy locally and nationally	Ongoing	TIDE uses its outputs to improve management and inform policy locally and nationally						Executive Director Science Director	
Participate in Coral Monitoring Network Meetings and Spawning Aggregation Working Group Meetings	Ongoing	TIDE actively participates in Coral Monitoring Network Meetings and Spawning Aggregation Working Group Meetings						Science Director	
Participate in Belize Sea Turtle Monitoring Network and National Manatee Working Group / Marine Mammal Stranding Network meetings	Ongoing	TIDE actively participates in Belize Sea Turtle Monitoring Network and National Manatee Working Group / Marine Mammal Stranding Network meetings						Science Director	
Attend national and international conferences and workshops	Ongoing	TIDE is able to disseminate results and best practices to peers at relevant national and international conferences and workshops						Executive Director Science Director	

3.5.3 Environmental Education Program

The Environmental Education Program guides TIDE in its work as an environmental educator in the stakeholder communities, and addressing a number of areas highlighted as barriers or in need of strengthening (TIDE Strategic Plan, 2014 – 2019):

- Engaging and building capacity of youths in the community
- Addressing misconceptions about the environment, sustainable development, the role and responsibility of TIDE in Toledo, and TIDE's mission
- The need to address the standard of education in southern Belize



This is achieved through a number of important sub-programmes:

- **Training the teachers - building capacity for teaching environmental science**
- **Environmental Education in the Schools**
- **Annual Environmental Activities**

Program Goal

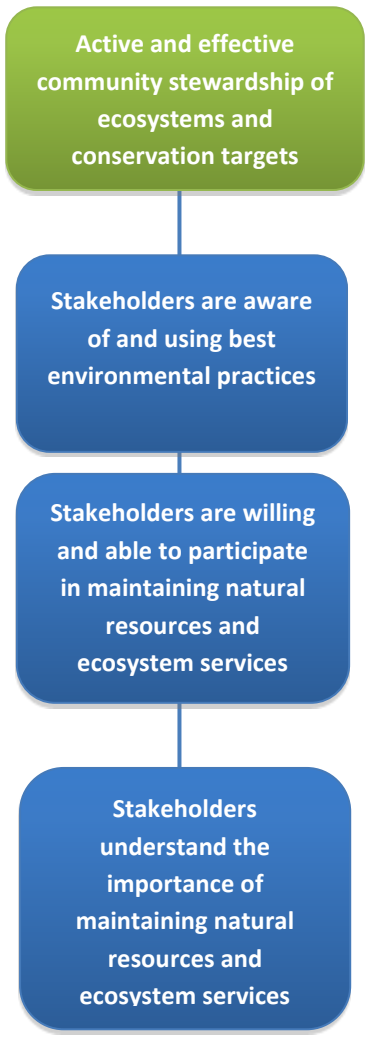
Students understand the importance of maintaining natural resources and ecosystem services

Objectives

- Ensure that the Environmental Education Program is guided by a strategy, linked to specific objectives, designed to deliver specific targeted messages.
- Ensure the Environmental Education program has the human resources, equipment and logistical support for effective implementation.
- Strengthen the TIDE annual activities – Freshwater Cup, FishFest and Summer Camps – for increased effectiveness in transmitting targeted conservation messages, identified in the Environmental Education strategy.
- Ensure targeted education for youths.

This is achieved through a series of activities:

- Teacher training for local educators in collaboration with Ministry of Education, towards the successful development and implementation of the Reef Guardians School Program.
- Educator package of information material about PHMR.
- Marine and coastal ecology workshops and resource materials.
- Outreach presentations.
- Educational field trips for local schools.
- Distribution of posters, booklets etc.
- Annual educational activities (e.g. tide Summer Camp, Salt Water Cup, Fish Fest)
- Network with national academic institutions to promote field studies and workshops.



TIDE Strategic Plan 2014 – 2019

TIDE has a number of ongoing initiatives that have developed over the years to engage youths, working directly with the schools and through activities such as the award winning Freshwater Cup. There has been a shift in more recent years from conducting activities in schools to training the teachers and improving environmental education standards in schools. In 2015, TIDE established the ***Reef Guardians School Program*** to improve standards in coral reef education to reduce impact on the reef. TIDE has worked with the Ministry of Education and teachers to ensure that teaching materials and activities for this program are aligned with the school curriculum.

Local environmental stewardship can be one of the most important ingredients in conservation success. The ***Freshwater Cup*** is an innovative program that uses school sporting competitions to engage local communities in environmental issues, building their awareness about climate change risks and the role they can play in helping coral reefs. It is an annual event that has been ongoing for many years, and links conservation activities with football, putting children "in the driving seat as the agents of change". It involves the students in the planning and execution of mini-projects to protect freshwater resources and downstream ecosystems, as a first step to being able to compete in the Freshwater football marathon. Since 2004, over 3,000 people have undertaken more than 170 mini-projects, resulting in the planting of over 6,700 trees along waterways, the removal of over 34,000 lb of trash, the creation of 16 green spaces or organic gardens, the painting of numerous environmental murals, removal of three illegal dumpsites, and the exposure of more than 4,000 people to environmental messages from their peers. This

initiative has received three global awards for innovation and success as a model for other conservation organizations, and in 2015, had the participation of almost 1,000 children.

On a smaller scale, the ***Saltwater Cup*** volleyball tournament was started in 2013, and modelled on the freshwater Cup. It was established specifically to engage the small coastal communities of Monkey River, Punta Negra, and Cattle Landing.

Another important annual event in the TIDE / Punta Gorda calendar of the TIDE Fish Festival, a weekend of community awareness activities that targeted all sectors of the community, from youths (through a youth conservation competition for associate degree scholarships) to adults participating in the Weekend Warriors Cycling Club race and the annual "***Fish Fest***" fishing tournament, all activities being designed to encourage environmental stewardship.

C. Environmental Education and Outreach Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
General									
Review and strengthen the Education and Outreach Strategy and align with the TIDE Strategic Plan	To be completed	The Environmental Education Program is guided by a strategy, linked to specific objectives, designed to deliver specific targeted messages that are linked to each other.						Environmental Education Manager	Aligned with the Strategic Plan, with links to education / awareness needs identified by the Resource Protection Program and Research and Monitoring Program
Continue implementing the Education and Outreach Strategy	Ongoing	Students have access to education opportunities through TIDE, increasing awareness and support for management of PHMR						Environmental Education Manager	
Ensure TIDE has the staff to support Environmental Education to PHMR communities	Ongoing	TIDE has qualified and experienced staff to support Environmental Education to PHMR communities						Executive Director Environmental Education Manager	
Ensure TIDE has the necessary tools and equipment to support Environmental Education Outreach to PHMR communities	Ongoing	TIDE has the necessary tools and equipment to support Environmental Education Outreach to PHMR communities						Executive Director Environmental Education Manager	

C. Environmental Education Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Training the Teachers									
Strengthen partnership with the Ministry of Education and schools to assist in raising standards in environmental education	TIDE is developing and field testing lesson plans and teaching materials tailored to the national curriculum	TIDE lesson plans are adopted by the Ministry of Education and disseminated nationally						Executive Director Environmental Education Manager	Reef Guardian Schools Program
Engage and train teachers in marine resources and management principles	Ongoing	Teachers are advocates for sustainable marine resource and management, and have the tools and training to pass these concepts on to their students						Executive Director Environmental Education Manager	Based on the Reef Guardian Schools Program
Educational field trips to PHMR to engage and inspire teachers through an understanding of the need to reduce impacts on the reef.	Ongoing	Teachers are engaged and inspired to become advocates of sustainable use of the marine environment through field trips to PHMR						Environmental Education Manager	Based on the Reef Guardian Schools Program Teachers need to be willing to be engaged – can it count as part of an accredited course?
Environmental Education in Schools									
Assess the pilot Reef Guardian Schools Program in improving standards in coral reef education	Pilot Reef Guardian Schools Program has been implemented – is to be assessed	TIDE has assessed the pilot Reef Guardians Schools Program, and decided whether to roll it out to all PHMR schools						Executive Director Environmental Education Manager	In collaboration with the Ministry of Education

C. Environmental Education Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Environmental Education in Schools									
Roll out the Reef Guardian Schools Program to all PHMR schools	Pilot Reef Guardian Schools Program has been implemented. Decision needs to be made whether to roll out to all PHMR schools	TIDE has engaged schools through improved standards in coral reef Education, with a reduced impact on the reef.						Environmental Education Manager	If the program is assessed as successful and cost effective
TIDE Annual Activities									
Strengthen and implement TIDE annual activities, with increased effectiveness in transmitting targeted conservation messages	Ongoing	Improved engagement of participants in understanding and being engaged by the targeted conservation messages						Environmental Education Manager	
Strengthen the Salt Water Cup volleyball tournament as a mechanism for engaging the smaller fishing communities	Ongoing	Small fishing communities are actively participating in the Salt Water Cup						Environmental Education Manager	Monkey River, Punta Negra and Cattle Landing
Continue to participate in national and international environmental awareness events	Ongoing	TIDE is actively participating in national / international environmental awareness events						Environmental Education Manager	Earth day, Biodiversity Day, World Water Day, etc.

3.5.4 Sustainable Development Program

The Sustainable Development Program guides TIDE in engagement of its stakeholder communities and addressing a number of areas highlighted as barriers or in need of strengthening (TIDE Strategic Plan, 2014 – 2019):

- Building trust between TIDE and stakeholders
- Engaging and building capacity in leaders, women and youths in the community
- Improving baseline information on community assets, socio-economic status and economic opportunities
- Finalizing and implementing community development plans
- Improving sustainable use of natural resources, with improved marketing / value added outputs
- Improving demand for ecotourism as an income diversification strategy
- Addressing misconceptions about the environment, sustainable development, the role and responsibility of TIDE in Toledo, grant funding cycles, and TIDE's mission (why TIDE promotes sustainable management)

This is achieved through six sub-programmes:

- ***Community Engagement and Outreach***
- ***Community Participation***
- ***Community Natural Resource Management in Buffer Areas***
- ***Leadership Training***
- ***Diversification of Livelihoods***
- ***Climate Change Adaption***

The Sustainable Development Program was established to provide an increased focus on facilitation of opportunities for sustainable economic development for primary stakeholders, both of PHMR and in the Maya Mountain Marine Corridor. This will require expanded resources to meet the increasing need for community engagement and skills training to achieve sustainable development in the PHMR communities.

Community Engagement and Outreach: TIDE uses a number of mechanisms to reach out to and engage its key stakeholders – the fishers and tour guides that use PHMR. Over the past five years, the primary focus has been on the engagement of fishers for piloting of Managed Access, providing a platform for increasing fisher stewardship of the commercial species of PHMR. TIDE also ensures that it keeps its fishers informed, using opportunities such as the Fisher Forums to increase awareness, and for open dialogue between TIDE, Fisheries Department and the PHMR fishers. Fisher forums have been particularly successful at bringing fishers to the table, with a combination of outreach presentations to improve awareness concepts such as sustainability, backed by science, and open discussions on issues and concerns associated with PHMR. Fisher exchanges have also been very successful, encouraging fishers to take pride in PHMR when hosting visiting fishers.

Whilst the fishers have been the primary focus of engagement and outreach strategies, full engagement of sport fishers and tour guides is an area that can still be improved.

Community Participation: Environmental monitoring and compliance with MPA rules are among the most challenging aspects of coral reef management. In order to address this, TIDE has ensured that communities have the opportunity to participate in management of PHMR and its marine resources. This has been achieved through strategies ranging from the formal PHMR Advisory Council, composed of representatives of the different sectors and communities, to the more open Fisher Forums where fishers are able to voice their concerns and participate in activities such as revision of the PHMR management plan.

Perhaps the most successful mechanism for community engagement is the ***Community Researcher*** program, integrating community researchers into the research and monitoring activities, and building capacity to ensure reliable data collection. TIDE has, to date, trained twenty-five Community Researchers, building their skills to participate. From dive training to coral identification, the training addresses the critical gap in skills and human resources for data collection, for supporting management. More importantly for the communities, it also assists the participants through personal development and networking opportunities, and experience in working in a professional environment, towards improving access to employment opportunities with TIDE, other similar organizations and the tourism sector.

In 2015, TIDE trained five existing community researchers in more advanced laboratory and data analysis, through the creation of a new Level 2 training component. During the next five years, TIDE will be partnering with professional educators to revise and strengthen the course to provide a long term, structured framework for training of community researchers. The course will focus on the concepts of marine conservation, monitoring protocols and analysis, both for TIDE and for other organizations in Belize.

Drawn from the fishing communities, these Community Researchers have proved to be good ambassadors for conservation and sustainable management, communicating with resource

users about human impacts on ecosystems in a way they can understand. This has resulted in improved community trust in the science behind management decisions for PHMR, with fishers proving more open to understanding the research and monitoring outputs when their family members are involved in collection and analysis of the data. This leads to increased environmental stewardship among local communities and strengthening support for MPA regulations.

The ***Community Stewards Program*** focuses on fishermen and tour guides. It has been a successful mechanism for engaging and involving community participants in management activities in PHMR. TIDE focuses on integrating participation in TIDE management activities through the blend of classroom-based learning with field-based practical learning experiences, site visits, and cross-border exchanges with other fishers enriched the learning experience. This ensures the participants have a good understanding about the relevant legislations, ecology, whys and wherefores of protected area management, and facilitates greater understanding of the concepts of marine protected areas, sustainability and conservation. TIDE has used this model to develop the Junior Stewards Program, engaging high school students from Punta Gorda in similar activities.

A review of the program demonstrated that participants, drawn from the fishers of PHMR gained a deep appreciation and sense of ownership of PHMR. As a result of the training, community stewards reported that benefits included:

- Increased knowledge, awareness and skills
- Growth in personal confidence and responsibility
- Positive impact on the resources
- Improved and positive relations between TIDE and community

Both the community Researcher and Community Stewards programs provide models nationally and regionally for stakeholder engagement.

Strengthening Community Livelihood Diversification Options and Climate Change Adaptation:
TIDE strengthens community livelihood option through targeted projects that fall within its remit that will reduce pressures on the natural resources, strengthen sustainable development and/or contribute towards livelihood diversification. It works with the key stakeholder communities to identify specific, community-driven projects that fill identified needs, locating funding and engaging partners (other NGOs, government ministries working in the same field) for these community efforts. Punta Negra and Monkey River have been identified as not only the key fisher stakeholder communities that would most benefit from income diversification, but also the highest at risk from Climate Change. In 2015, Local Early Action Plans (LEAPs) were created for these two communities, with implementation of the outputs as a core component of activities during the five years of this management plan.

In Punta Negra, TIDE has assisted in establishing a restaurant for visitor groups. TIDE projects builds on this, with use of the restaurant in TIDE activities such as the Ridge to Reef Expeditions, ensuring that income flows into the community where possible. The women in the community have been engaged in developing vegetable gardens to provide supplementary support for their families, reducing food costs and dependence on fishing in PHMR.

Punta Negra is also the potential location of a turtle hatchery, if it becomes necessary to relocate at-risk turtle nests as beaches become less viable. This would open opportunities for training and employment in management of the facility.

TIDE supports local students through its ***Scholarship Program*** - for many students, education is the barrier to being able to seek alternatives to fishing. TIDE, in identifying this, focuses on providing opportunities for continuing education beyond primary school, increasing options for non-resource use related employment opportunities through access to further education. Since 2001, TIDE has supported 192 students through their high school education providing tuition and book scholarships. It also holds an annual Youth Conservation Competition, awarding an associate degree scholarship to the winner.

D. Sustainable Development Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
General									
Develop a strategy for the Sustainable Development Program, in collaboration with communities	Ongoing	Sustainable Development activities are guided by the Sustainable Development Strategy						Sustainable Development Manager	
Ensure the Sustainable Development Program is equipped and has the human resources for effective strategy implementation	Ongoing	The sustainable development Program is not restricted by equipment or human resource limitations						Executive Director Sustainable Development Manager	
Build in-house capacity of TIDE to be able to strengthen CBOs, community leaders and communities	Ongoing	TIDE is effective at providing mentoring and support for CBOs, community leaders and communities						Sustainable Development Manager	
Conduct a stakeholder analysis to better understand stakeholders, their impacts and their scope of influence	Not started	TIDE has easily accessible, updated information on its stakeholder communities						Sustainable Development Manager	A Strategic Plan activity
Develop and implement strategies for collaboration with other organizations with similar agendas, for coordinated assistance to communities towards improved natural resource stewardship	Ongoing	TIDE is effective in its collaboration with other organizations with similar agendas						Executive Director Sustainable Development Manager	

D. Sustainable Development Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Community Engagement and Outreach									
Provide opportunities for community leaders to meet to identify areas for improved collaboration	Ongoing	TIDE is able to engage community leaders and improve collaborative actions						Sustainable Development Manager	Use issues of interest to community leaders – e.g. water contamination, solid waste
Build capacity of stakeholder communities for effective participation in sustainable resource use and management	Ongoing	Stakeholder communities are engaged and supportive of sustainable resource use and management and demonstrating best practices						Sustainable Development Manager	Stakeholder buy-in
Conduct annual meetings in the PHMR communities to increase understanding of key users of PHMR on the impacts of unsustainable resource use.	Ongoing	Community meetings are held in PHMR communities on an annual basis, and increase understanding of the impacts of unsustainable resource use						Sustainable Development Manager	
Increase the capacity of women within the community to be able to effectively participate in sustainable development activities	Ongoing	Women are engaged, supportive of, and demonstrate, sustainable resource use and management						Sustainable Development Manager	

D. Sustainable Development Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Community Engagement and Outreach									
Continue to use exchanges as a mechanism for engagement of fishers, tour guides, women	Ongoing for fishers – has proved very successful for engaging fishers	Increased engagement of stakeholders and support of PHMR management activities						Sustainable Development Manager	
Continue to engage sport fishing guides	Ongoing	TIDE and sport fishing guides are collaborating to improve sport fish management						Sustainable Development Manager	
Expand role of Community Researchers to outreach activities - giving presentations in schools to encourage protection of the environment.	Ongoing	Community Researchers are actively engaging students in natural resource protection						Science Director Environmental Education Manager	Including information about the Community Researcher Program
Improve tour guide understanding of coral reefs and best practices	Ongoing	Increased engagement of tour guides and reduced tourism impacts on coral reefs						Sustainable Development Manager	Particularly important if cruise visitation increases
Encourage communities and other stakeholders to effectively integrate best practices into their work and lives	Ongoing	Stakeholder communities are aware of best practices and incorporating these into their daily lives						Sustainable Development Manager	Use posters, workshops, videos and other tools Targets would include best fishing practices, solid waste disposal / plastic bags / straws

D. Sustainable Development Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Community Engagement and Outreach									
Host 24 local radio shows annually	Ongoing	24 local radio shows hosted annually by TIDE						Sustainable Development Manager	
Community Participation									
Continue the Community Stewards Program in PHMR communities	The Community Stewardship Program is effective and ongoing	Community participants are engaged in biodiversity management through the Community Stewards Program						Marine Manager Environmental Education Manager Science Director	
Continue the Community Researcher Program in PHMR	The Community Researcher Program is effective and ongoing	TIDE research and monitoring activities are supported by active, committed and trained Community Researchers						Science Director	
Strengthen the Community Researcher Program through development of a structured, certified course	The Community Researcher Program is ongoing, with the recent development of Level 2 training	A well-structured course is providing more effective training for Community Researchers						Science Director Environmental Education Manager	Bring expertise of educators into the design process

D. Sustainable Development Program											
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Community Participation											
Provide opportunities for Belize and regional students to participate in the Community Researcher course and assist with research activities	Ongoing	TIDE is building capacity and improving standards in the region for community participation in research and monitoring activities						Science Director Environmental Education Manager	With a focus on standardized protocols and accuracy. May require a cost-benefit analysis to assess feasibility
Build specific capacity of committed Community Researchers towards personal development goals and improved job opportunities	To be started	Community Researchers have increased capacity and improved job opportunities						Science Director Environmental Education Manager	
Community Natural Resource Management in Buffer Areas											
Strengthen partnerships with stakeholder community towards sustainable natural resource management	Ongoing	TIDE is collaborating with its community partners towards sustainable natural resource management						Sustainable Development Manager	E.g. for maintenance of riparian vegetation in watersheds
Assist in establishing organized environmental groups in stakeholder communities to increase stewardship of natural resources	Ongoing	Organized community groups demonstrating increased community stewardship of natural resources						Sustainable Development Manager	Capacity building in enforcement of hunting, fishing, riparian reforestation, solid waste management etc.

D. Sustainable Development Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Community Participation									
Collaborate with established groups/ organizations to conduct natural resource stewardship planning, and support communities to implement plans.	Ongoing – could be strengthened	TIDE strengthens collaboration within the MMMC for natural resource stewardship planning, and supports communities to implement plans.						Executive Director	With identification of key natural resources and environmental services,
Leadership Training									
Provide capacity building for community leaders and CBO's focused on strengthening community planning	Ongoing	Community leaders and CBOs have improved capacity for management of their communities and implementation of climate change adaptation strategies						Sustainable Development Manager	Basic accounting, proposal development, project management, and effective lobbying skills
Provide mentoring and support for the fishing associations linked to PHMR	Ongoing	Fishing associations are engaged and promoting sustainable resource use						Sustainable Development Manager	Rio Grande Fishing Cooperative Monkey River fishermen Association
Livelihood Diversification									
Support supplemental livelihood projects identified by PHMR buffer communities during Climate Change assessments and LEAP	Ongoing	TIDE partners with communities to support specific supplemental livelihood projects						Sustainable Development Manager	

D. Sustainable Development Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Livelihood Diversification									
Assess potential for ad implement identified diversification through polyculture – seaweed, conch and sea cucumber	Ongoing	PHMR fishers have diversified into mariculture, with a reduced dependency on the traditional marine resources						Marine Manager Science Director	
Improve engagement of and collaboration with Toledo Tour Guide Association and Monkey River Tour Guide Association for the development of tourism use of PHMR	Ongoing	PHMR is providing increased earning opportunities for tour guides from the stakeholder communities						Sustainable Development Manager	In collaboration with BTIA and BTB
Support tourism development in Monkey River and Punta Negra	Ongoing	Monkey River and Punta Negra have increased capacity and infrastructure for increased tourism						Sustainable Development Manager	In collaboration with Ministry of Tourism. Tour guide training for youths, improvement of trails – Money River. Continue to provide support for restaurant
Assess success of income diversification projects at end of project, 1 year and 3 years after end	Ongoing	TIDE uses lessons learnt to strengthen future project planning						Sustainable Development Manager	
Climate Change Adaptation									
Support communities in the implementation of priority strategies identified under the LEAP assessments	Ongoing	The priority LEAP strategies are being implement in Monkey River and Punta Negra						Sustainable Development Manager	

3.5.5 Administrative and Operations Program

Administration for Port Honduras Marine Reserve is at two levels. The Belize Fisheries Department is the authority with the mandate for management of Marine Reserves, with its administrative headquarters in Belize City. The Fisheries Department is responsible for oversight, with input for training and support to ensure that surveillance and enforcement and research and monitoring are effective.

PHMR is managed at site-level by the Toledo Institute for Development and Environment (TIDE), which implements day-to-day administration and operations activities through its program areas.

AAdministrative and Operations activities fall under seven sub-programmes:

- ***Institutional Strengthening***
- ***Organization Administration***
- ***Human Resources***
- ***Communications / Public Awareness***
- ***Advocacy***
- ***Infrastructure***
- ***Financial Sustainability***

TIDE is one of Belize's foremost conservation management NGOs, with a team of dedicated staff who believe strongly and passionately in what they are doing. It has a functional organizational structure and is achieving significant outcomes, particularly in the marine environment.

TIDE's governance structure has been strengthened, facilitating an effective and participatory decision-making process. Capacity building of the new Board has been ongoing, with the implementation of improved documentation of meetings and resolutions. Briefings from program managers and the financial administrator ensure that the Board members are fully informed when making decisions.

TIDE's Administration Program is centralized in Punta Gorda, and focuses on the management of the ridge-to-reef MMMC land/seascape, including Port Honduras Marine Reserve. A number of specific actions were identified to increase institutional strengthening over the past five years – the development and strengthening of program strategies in the areas of science,

environmental education, communication and sustainable development; restructuring of the financial system to align with the program areas presented in the strategic plan, linking cost to outputs/outcomes, and improvement of monitoring and evaluation. Also considered a priority is the continued strengthening of long term partnerships with key funders, cultivation of partnerships with new funders, and further diversification into non-grant-based financial sustainability mechanisms. These are all critical over the period 2015 - 2019.

TIDE's relationship with the Fisheries Department is one of collaboration and partnership, with a co-management agreement signed for Port Honduras Marine Reserve. There is also collaboration with the Belize Coastguard, Belize Defence Force, Police Department and Tourism Police to strengthen surveillance and enforcement activities.

E. Administrative and Operations Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Institutional Strengthening									
Restructure the TIDE accounting system to reflect income and expenditure by program area, to facilitate monitoring of organizational cost effectiveness	Completed	Organizational cost effectiveness is monitored through TIDE's accounting system, to include reporting income and expenditure by program area						Executive Director	
Review and strengthen administrative policies and procedures, and operating processes	TIDE has good administrative policies and procedures, and operating processes	Administrative policies and procedures, and operating processes are relevant for the operational context						Executive Director	A review should be conducted once every three to five years
Review volunteer policy, with strengthened orientation and exit procedures for interns, volunteers	Ongoing	TIDE's volunteer policy has strong orientation and exit procedures for interns, volunteers						Development Officer Marine Manager	
Continue to build the capacity of the Board of Directors in NGO governance through training and exchange visits to international NGO's	Ongoing	The Board of Directors have the capacity to effectively provide guidance to management of PHMR						Executive Director	Will be strengthened through the development of the Board Policy and Procedures Manual
Ensure structured Board meetings are held on a regular basis	Ongoing	Board meetings are well structured, achieve their objectives, and are held on a regular basis						Executive Director	

E. Administrative and Operations Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Institutional Strengthening									
Build the capacity of the Advisory Council for its role in management of PHMR	Ongoing	The Advisory Committee represents the local stakeholders, and has the capacity to effectively provide input into management of PHMR						Executive Director	
Ensure structured Advisory Council meetings are held on a regular basis	Ongoing	Advisory Council meetings are well structured, achieve their objectives, and are held on a regular basis						Executive Director	
Hold 2 BOD/Advisory Council meetings each year	Ongoing	2 BOD/Advisory Council meetings held every year						Executive Director	
Build capacity of Managed Access Committee and Advisory Councils	Ongoing	Managed Access Committee and Advisory Councils have the capacity to effectively guide management of PHMR						Marine Manager Sustainable Development Manager	
Review and evaluate program strategies relevant to PHMR annually	Ongoing	Program strategies are reviewed and evaluated annually, and strengthened when necessary						Marine Manager	
Continue to strengthen information sharing within the organization	Ongoing	Information is available and shared on a regular basis between programs						Executive director Marine Manager	
Improve monitoring and evaluation of the impacts TIDE is having on PHMR, resource users and key stakeholder communities	Ongoing	TIDE understands the impact it has on PHMR, resource users and key stakeholders						Marine Manager Science Director	

E. Administrative and Operations Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Institutional Strengthening									
Conduct annual management effectiveness assessments for PHMR and integrate into single report for the TIDE Integrated Management Area	Ongoing	Management effectiveness for PHMR is evaluated annually and integrated into the TIDE Integrated Management Area report						Executive Director Program Director	
Review and revise the Strategic Plan	Current strategic Plan runs from 2014 – 2019.	The Strategic Plan has been reviewed and revised						Executive Director	Review and revision process is implemented In 2018 / 2019
Organization Administration									
Maintain co-management agreement between Fisheries Department and TIDE for PHMR	Ongoing	TIDE has an effective, ongoing co-management agreement with Fisheries Department for PHMR						Executive Director Program Director	
Preparation of annual workplan and operational plan budget for PHMR	Ongoing	Annual workplan, operational plan and budgets are prepared and submitted by the Marine Manager						Executive Director Program Director Marine Manager	Linked to the management plan and the 3-year organizational workplan
Ensure monitoring and evaluation of operational plans / workplans on a quarterly basis	Ongoing	Operational plans / workplans are monitored and evaluated on a quarterly basis						Program Director Marine Manager	
Ensure monitoring and evaluation of management plan on an annual / biennial basis	Ongoing	Monitoring and evaluation of management plan takes place on an annual / biennial basis						Program Director Marine Manager	

E. Administrative and Operations Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Organizational Administration									
Implement Surveillance and Enforcement strategies relevant to PHMR from the TIMA Surveillance and Enforcement Plan	Ongoing	Surveillance and Enforcement strategies relevant for PHMR are implemented						Marine Manager	
Implement strategies relevant to PHMR from the Science strategy for the Research and Monitoring program	Ongoing	Implementation of science strategies relevant for PHMR						Science Director	
Implement strategies relevant to PHMR from the Environmental Education strategy	Ongoing	Implementation of Environmental Education strategies, relevant for PHMR						Environmental Education Manager	
Prepare a summary report on outputs per program, every 5 years	2003 – 2008 report. Summary is presented in biannual "annual" report	A summary report on outputs per program is produced every 5 years						Science Director	
Ensure TIDE is compliant with all reporting requirements for Fisheries Department	Ongoing	Quarterly and annual reports are produced for and submitted to Fisheries Department						Marine Manager Science Director	
Prepare Annual TIDE report for dissemination to stakeholders (biennial?)	Ongoing	Annual TIDE report is produced for dissemination to stakeholders (biennial?)						Development Director	
Finance									
Prepare timely financial and management accounts and submit monthly to the Financial Administrator	Ongoing	Financial and management accounts are prepared and submitted monthly to the Financial Administrator						Marine Manager	

E. Administration Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Organizational Administration									
Finance									
Prepare project budgets and financial reports as necessary for Executive Director and funding agencies	Ongoing	Project budgets and financial reports are prepared for Executive Director and funding agencies as necessary						Financial Administrator	
Prepare quarterly report on use of annual budget, for submission to Executive Director and BoD	Ongoing	Quarterly reports on annual budget use are prepared and submitted to the Executive Director						Financial Administrator	
Ensure auditing of annual accounts and production of an annual audit report	Ongoing	Annual accounts are audited and reports are produced						Accountant	
Continue maintaining accurate staff payment records	Ongoing	Staff payment records are accurately maintained						Financial Administrator	
Assess and plan for potential liability issues	Ongoing	TIDE has identified potential liability issues and has plans in place						Executive Director Marine Manager	
Human Resources									
Ensure there are sufficient staff for the effective management of PHMR	Ongoing	There are sufficient staff for the effective management of PHMR						Executive Director Program Director	
Ensure all positions are filled by people qualified for their roles, or have had relevant training to equip them for their roles	Ongoing	Staff have the qualifications, experience and skill sets for their positions						Executive Director Program Director	

E. Administration Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Human Resources									
Develop formal Orientation Package for all permanent staff, specific to PHMR	Ongoing	All staff are given an Orientation Package specific to PHMR upon hiring						Marine Manager	
Ensure all TIDE employees are familiar with TIDE documents, including the organizational policies and procedures and strategic plan	Ongoing	All TIDE employees are familiar with TIDE documents, organizational policies and procedures and the strategic plan						Executive Director Program Director	
Hold staff meetings, across all programs, three times a year	Ongoing	Staff meetings across all programs are held three times a year						Executive Director Program Director	
Hold Administration Meetings every two weeks	Ongoing	Administration Meetings are held every two weeks						Executive Director Program Director	
Conduct an annual evaluation of staff performance and ensure that recommendations are implemented	Ongoing	An evaluation of staff performance is conducted annually and recommendations are implemented						Executive Director Program Director	
Strengthen staff exit procedures	Ongoing	Staff exit procedures are well established and effective						Executive Director Program Director	

E. Administration Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Human Resources									
Develop and implement site level PHMR Human Resource Development / Capacity Building plan to maximize on present staff skills and interests, identifying key training needs	Ongoing	Staff participate in Human Resource Development/ Capacity Building, with key training needs identified						Executive Director Program Director	Link to Human Resource Development / Capacity Building Plan. E.g. Hospitality training, simple administrative and accounting procedures, and use of computer, Fisheries Act and Green Laws training, presentation skills etc.
Ensure Marine Manager has sufficient training for effective general management, fundamental accounting, budget and proposal / workplan preparation and implementation	Ongoing	Marine Manager is an effective general manager, and has the capacity to prepare and implement the budget and proposal / workplan, and project management / accounting skills to implement projects successfully						Program Director	
Staff training in: conducting positive public (fisher – boat to boat) engagement, visitor and volunteer management, basic biodiversity monitoring	Ongoing	Staff is has improved positive public engagement, visitor and volunteer management and trained in basic biodiversity monitoring						Marine Manager	
Develop conflict resolution mechanisms and in-house skills for dealing with public use conflicts	Ongoing	Staff have conflict resolution mechanisms and in-house skills for dealing with public use conflict situations						Executive Director	

E. Administration Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Human Resources									
Ensure staff are familiar with health and safety and emergency plans		Staff are familiar with health and safety and emergency plans						Program Director	Including adequate insurance
Continue encouraging participation of local stakeholders through Community Stewardship and Community Research programmes	Ongoing	Local stakeholders assist TIDE in implementation of activities through Community Stewardship and Community Research programmes						Science Director Marine Manager	
Communication, Collaboration and Public Awareness									
Strengthen communication with Fisheries Department	Ongoing	Communication with Fisheries Department is ongoing and effective						Executive Director	
Ensure fishermen and tour guides operating in the PHMR, and key stakeholder communities, are kept informed of PHMR activities and management decisions affecting them	Ongoing	Fishermen and tour guides operating in PHMR, and key stakeholder communities, are kept informed of PHMR activities and management decisions affecting them						Marine Manager	Fisher Forums, Fish Fest, radio show, community meetings
Strengthen links with other organizations and Government agencies involved in marine protected areas management	Ongoing	TIDE is communicating effectively with other organizations and Government agencies involved in marine protected areas management						Executive Director Science Director	

E. Administration Program								
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Communication, Collaboration and Public Awareness									
Implement strategies from the TIDE Communication Plan relevant to PHMR	Ongoing	TIDE has improved its communication through implementation of relevant strategies from the Communication Plan						Communications Officer	
Maintain and update TIDE website and social media outputs on an ongoing basis	Ongoing	TIDE website and social media outputs are maintained and updated on an ongoing basis						Communications Officer	
Advocacy									
Lobby for exclusion of marine protected areas from oil exploration concessions	Ongoing	TIDE effectively lobbies for the exclusion of marine protected areas (particularly PHMR) from oil exploration concessions						Executive Director	In collaboration with the BOD and Advisory Council
Lobby for exclusion of Belize's marine territory from oil exploration concessions	Ongoing	TIDE effectively lobbies for exclusion of Belize's marine territory from oil exploration concessions						Executive Director	In collaboration with the BOD and Advisory Council
Lobby for improved protection of Goliath grouper	Ongoing	TIDE effectively lobbies for improved protection of Goliath grouper						Executive Director	In collaboration with the BOD and Advisory Council
Lobby for implementation of Southern Belize Integrated Coastal Zone Plan recommendations	Ongoing	TIDE effectively lobbies for implementation of Southern Belize Integrated Coastal Zone Plan recommendations						Executive Director	Through the EIA process In collaboration with the BOD and Advisory Council

E. Administration Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Infrastructure									
Identify and address additional resource and infrastructure requirements required to achieve the objectives of PHMR	Ongoing	Adequate resources and infrastructure are in place to achieve the objectives of PHMR						Executive Director Program Director	Equipment, logistics etc.
On-site facilities and equipment are maintained	Ongoing	PHMR has working equipment and maintained facilities and equipment to support effective protected areas management and increased staff satisfaction						Program Director Marine Manager	
Ensure visitor facilities are adequate for visitation levels and for maintaining high visitor satisfaction	Ongoing	Visitor facilities are adequate for visitation levels and for maintaining high visitor satisfaction						Program Director Marine Manager	
Ensure sufficient mooring buoys are installed for visitation requirements	Ongoing	Sufficient mooring buoys are installed for visitation requirements, and maintained						Program Director Marine Manager	
Expand facilities at Abalone Caye to accommodate the Coastguard and Ridge to Reef classroom facility	Ongoing	Facilities are sufficient for supporting effective operations on Abalone Caye						Program Director Marine Manager	

E. Administration Program									
Management Actions	**Present Status**	**Desired Status**	**Year**					**Responsible Party**	**Limitations/Requirements**
Financial Sustainability									
Implement strategies relevant to PHMR from the Financial Sustainability Plan	Ongoing	PHMR has increased its financial sustainability through implementation of Financial sustainability strategies, relevant to PHMR						Program Director Marine Manager	Ridge to Reef, Discovery Corps, hosting of university groups

3.5.6 Management Policies

The organization's operations are guided by the administrative Policies and Procedures Manual, a living document that is updated as policies and procedures are developed and / or amended, and approved by the Board. Organizational planning has been significantly strengthened, with use of functional planning frameworks (the Business Plan (2006), Strategic Plan (2014 - 2019), the Maya Mountain Marine Corridor Conservation Action Strategy (2008), the PHMR Climate Change Adaptation Plan (2012), and program strategies: Surveillance and Enforcement, Research and Monitoring, Environmental Education, and Sustainable Development. These inform project development and protected area management plans, and feed into the development of annual work plans.

Implementation of the Strategic Plan includes integration of these multiple planning outputs, improving cohesiveness of TIDE's activities, and strengthening links between the Strategic Plan, management programmes and financial management. The Strategic Plan itself is due for revision in 2019 and is used by the Board of Directors and Executive Director to guide the organization, and by managers to inform the development of annual work plans.

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

An Emergency Plan is in place, including a Hurricane Preparedness Plan to ensure protection of life and property during hurricane events, particularly with the exposed nature of Abalone Caye to oncoming storms.

3.6 Timeline, Evaluation and Review

The Management Program matrices form the basis of an implementation plan, 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.

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 Fisheries Department, and by the TIDE Board members and management staff of the Toledo Institute of Development and Environment.

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.

3.7 Monitoring and Review

Monitoring and review of the management plan and the Annual Work Plans is essential in order to ensure that management is effective in achieving its objectives. This can be achieved through use of a 'measures of success' framework:

- measuring success in implementing the management actions
- measuring success of the conservation strategies in addressing threats and increasing target viability.

Two matrices have been developed to facilitate this process, forming the basis for the annual review of the management plan. Time should be taken to complete each one fully and as accurately as possible at the end of each year, to track using data from the monitoring program. If this is maintained on an annual basis, then this will greatly facilitate any management staff transition handover.

Included is an example of the suggested structure for both Measures of Success matrices (Table 34 and Table 35).

Table 34: Natural Resource Management Program - Implementation							
Measure of Success of Implementation							
N.B. It is important to note that the numerical values ascribed to the measures of success are not scores, but indicators of the stage of implementation	**1** No improvement on present status						
	2 Planning has started, but no implementation						
	3 Planning is completed, but no implementation						
	4 Implementation is started, but not yet completed						
	5 Implementation is completed or ongoing (continuous activities), activity has succeeded						
Management Activities	**Measure of Success**						**Comments:** Justification for Measure of Success score. Problems, concerns. Notes for inclusion in updated Management Plan
	Year						
Activity	**1**	**2**	**3**	**4**	**5**	**Desired Status**	
Surveillance and Enforcement							
Review, revise and implement the Surveillance and Enforcement Plan for PHMR						An effective surveillance and enforcement plan is being implemented for PHMR	***Current Status:*** A surveillance and enforcement plan exists but needs to be updated
Ensure PHMR has the human resources and equipment for effective surveillance and enforcement						Adequate human resources and equipment for effective surveillance and enforcement	***Current Status:*** Have 4 rangers, are seeking a Marine Manager
Strengthen intelligence-based enforcement, with input from the enforcement team and integration of analysed SMART data						Patrols are effective, targeted, strategic and intelligence-based, with improved integration of knowledge of the Enforcement Team and SMART data	***Current Status:*** SMART is being used to collect surveillance data for intelligence-based surveillance and enforcement
Conduct daily patrols and surveillance to enforce rules and regulations of PHMR to prevent illegal activities						Scheduled and random daily patrols of PHMR to prevent illegal activities	***Current Status:*** Ongoing Need to evaluate patrol strategies

Table 35: Example: Natural Resource Management Program - Status							
Measure of Success - Status							
It is important to document clearly the status of each Activity whilst developing Annual Operation Plans, as this allows highlighting of areas that need prioritization							
Management Activities **Activity**	**Present Status (2016)**	**Status (2017)**	**Status (2018)**	**Status (2019)**	**Status (2020)**	**Status (2021)**	**Desired Status**
Surveillance and Enforcement							
Review, revise and implement the Surveillance and Enforcement Plan for PHMR	A surveillance and enforcement plan exists but needs to be updated						An effective surveillance and enforcement plan is being implemented for PHMR
Ensure PHMR has the human resources and equipment for effective surveillance and enforcement	Have 4 rangers, are seeking a Marine Manager						Adequate human resources and equipment for effective surveillance and enforcement
Strengthen intelligence-based enforcement, with input from the enforcement team and integration of analyzed SMART data	SMART is being used to collect surveillance data for intelligence-based surveillance and enforcement						Patrols are effective, targeted, strategic and intelligence-based, with improved integration of knowledge of the Enforcement Team and SMART data
Conduct daily patrols and surveillance to enforce rules and regulations of PHMR to prevent illegal activities	Ongoing Need to evaluate patrol strategies						Scheduled and random daily patrols of PHMR to prevent illegal activities

3.8 Timeline

The five year timeline provides guidance for implementation of the management plan, but should be considered adaptable, as the management context changes over the years. The timeline also provides a framework against which implementation effectiveness can be measured, to ensure orderly and planned implementation of activities throughout the management plan period (Table 36).

The annual work plan and budget is developed from the timeline by the Marine Manager at the end of each year, a process that should be in collaboration with the PHMR staff and otherprogram managers, to ensure that cross-cutting strategies such as Environmental Education and Sustainable Development are aligned with and support the site-specific management activities for PHMR.

Table 36: Example: Resource Protection Program							
Management Activity	**Notes**	**Year**					
		1st	**2nd**	**3rd**	**4th**	**5th**
Surveillance and Enforcement							
Review, revise and implement the Surveillance and Enforcement Plan for PHMR	**Responsible:** Program Manager Marine Manager					
Ensure PHMR has the human resources and equipment for effective surveillance and enforcement	**Responsible:** Program Manager Marine Managers					
Strengthen intelligence-based enforcement, with input from the enforcement team and integration of analyzed SMART data	**Responsible:** Marine Manager					
Conduct daily patrols and surveillance to enforce rules and regulations of PHMR to prevent illegal activities	**Responsible:** Marine Manager					
Ensure the Enforcement Team is trained and proficient in use of SMART data collection	**Responsible:** Marine Manager					
Strengthen night patrols and implement more effectively	**Responsible:** Marine Manager					
Continue to disseminate rules and regulations to key user groups on a regular basis	**Responsible:** Marine Manager					
Continue collaborative enforcement (fishermen, TIDE, Fisheries Dept., Tourism Police, SEA, Coastguard, Immigration Dept., BDF, Police Dept. Customs etc.) against transboundary incursions both inside and outside the MPA	**Responsible:** Program Manager, Marine Manager					

3.9 Financing

TIDE has strong policies and procedures in place that guide effective financial management within the organization. The organization is working on increasing its financial sustainability through diversification of its income base, reducing its reliance on donor / grant agencies. The 2016 statement of income and expenditure provides a snapshot of the current status of the organization.

Income: The total 2015 income was US$964,000 and came from private grants (49%), public grants (42%), and individuals, and events and earned income (9%).

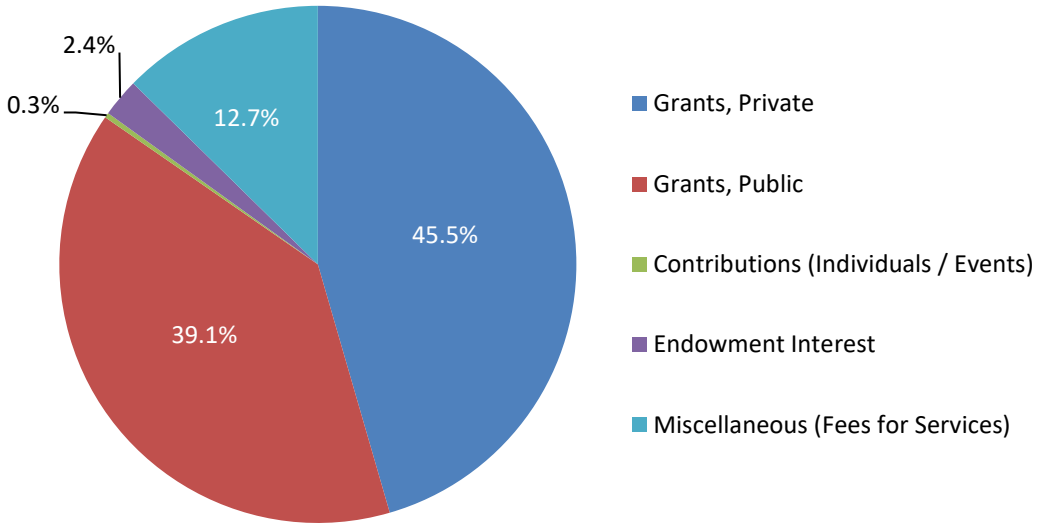


Figure 40: *Breakdown of Income for TIDE, 2015 (TIDE data, 2016)*

Expenditures: 2015 orgnizational expenses totalled US$904,000, with 67% of these being allocated to Port Honduras Marine Reserve.

SEE TIDE

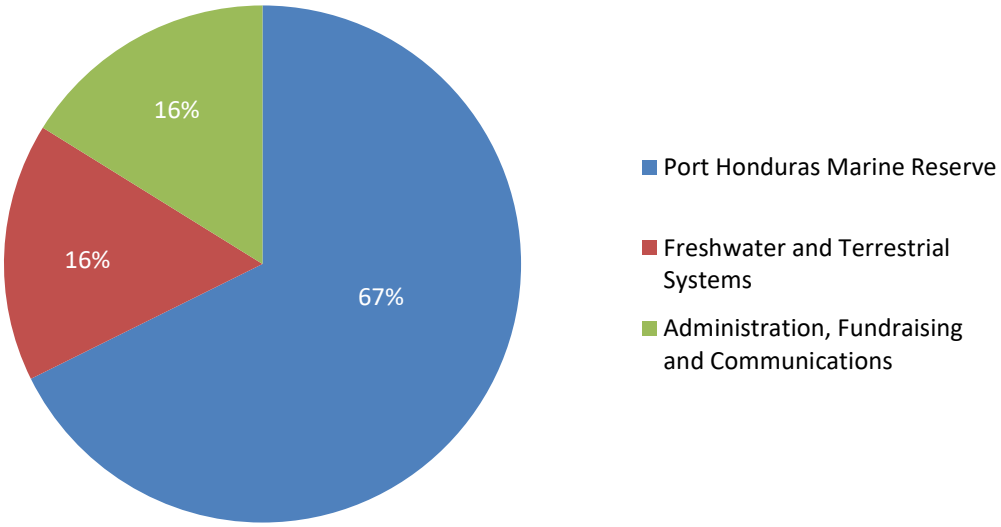


Figure 41: *Breakdown of Expenditures for TIDE, 2015 (TIDE data, 2016)*

4. Implementing the Plan

The following outline presents the first steps torward implementing the management plan.

At the Start of the Management Plan Period

1. Develop the timeline for all program areas and activities (Table 36)

2. Develop the two Measures of Success tables for all program areas and activities, defining the current and desired status, and developing implementation and outcome indicators (Tables 34 and 35)

3. Identify those activities scheduled for implementation in the first year and develop the first annual workplan

4. Develop the baseline for the indicators (Table …), and for information gaps, identify which year this baseline information will be gathered in

5. Implement the Annual Workplan

At the End of the First Year…

1. Update the two Measures of Success tables for all program areas and activities, and measure the success of implementation (Table …)

2. Define the current status, and status of implementation and outcome indicators (Table ..)

3. Review the workplan, and identify challenges and adaptive strategies, for inclusion in the next workplan (this should be a participatory exercise)

4. Update the status of the indicators and develop a report on the outputs, to be integrated into the Annual Report

3. Identify those activities scheduled for implementation in the second year and develop the second annual workplan, incorporating adaptive strategies from the workplan review

5. Implement the second Annual Workplan

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Annex

PORT HONDURAS MARINE RESERVE

SI 9 of 2000

ALL THAT PORTION of the Caribbean Sea comprising of General Zones, Conservation Zones and Preservation Zones and more fully described as follows:

A. GENERAL USE ZONE

Commencing at a Point A lying South East of Monkey River Village having scaled UTM coordinates 341 784 East 1 810 803 North; thence in a general easterly direction to a Point B having scaled UTM coordinates 342 573 East 1810 803 North; thence in a general southerly direction to a Point C having scaled UTM coordinates 341 784 East 1 791 754 North; thence in a general south-westerly direction to a Point D having scaled UTM coordinates 328 384 East 1 784 002 North; thence in a westerly direction to a Point E south of the Rio Grande River Mouth having scaled UTM coordinates 3 10 122 East 1 783 740 North; thence in the direction of the coastline contour back to the point of commencement.

B. CONSERVATION ZONES

(i) East Snake Caye 0.805-kilometers (half a mile) radius around the Caye scaling UTM coordinates:

Northern point	338 588.85 East 1 793 101.35 North
Eastern point	339 545.54 East 1 792 120.74 North
Southern point	338 517.10 East 1 791 140.13 North
Western point	337 632.16 East 1 792 096 82 North

(ii) West and South Snake Cayes 0.805-kilometers (half a mile) radius around the Cayes having an overlap and scaling at UTM coordinates:

Northern point	331 868.09 East 1 791 666.31 North
North-eastern point	332 489.94 East 1 791 164.04 North
Eastern point	332 705.19 East 1 789 944.26 North
South-eastern point	332 800.00 East 1 788 533.14 North
Southern point	331 915.92 East 1 788 270.05 North
South-western point	331 389.74 East 1 788 628.81 North
Western point	330 767.89 East 1 789 968.18 North
North-western point	330 983.15 East 1 791 331.47 North

(iii) Wild Cane Caye 0.88805 kilometers (half a mile) radius around the **Caye scaling UTM coordinates:**

Northern point	325 984.43 East 1 796 019.26 North
Eastern point	326 582.36 East 1 795 445.24 North
Southern point	325 888.76 East 1 795 134.32 North
Western point	325 410.42 East 1 795 397.41 North

C. PRESERVATION ZONES

Middle Snake Cayes 0.805 kilometers (half a mile) radius around the Cayes scaling UTM coordinates:

Northern point	333 709.72 East 1 792 599.08
North Eastern poin	334 809.91 East 1 791 498.89 North
Southern point	333 709.72 East 1 790 398.69 North
Western point	332 633.44 East 1 791 498.89 North