Management Plan

South Water Caye Marine Reserve

2019 – 2023



SOUTH WATER CAYE MARINE RESERVE

GOAL

To manage the natural resources of South Water Caye Marine Reserve for its value to Belizeans, and global values as a World Heritage Site

OBJECTIVES

- Effectively manage the natural resources of South Water Caye Marine Reserve
- Develop and use sound data to inform management decisions
- Use South Water Caye Marine Reserve as an effective tool in promoting an understanding of the unique marine environment
- Engage stakeholders towards good stewardship of the marine environment for long term sustainable benefit
- Provide opportunities for recreation, interpretation, education, and appreciation for all visitors

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Acknowledgments

We would like to thank the many stakeholders of South Water Caye Marine Reserve (SWCMR), for providing the information in this report through participation in the discussions on the status of the reef and marine resource of SWCMR. Input into the recommended strategies for improved management, biodiversity baselines and threats, addressing climate change impacts, successful community engagement and improved benefits stratgies – thank you to all those who contributed to this output through sharing their knowledge and experiences. This Management Plan was funded by the German Development Bank (KfW) as part of the project: The Project "Conservation of Marine Resources in Central America," and implemented by the Fund for the Mesoamerican Reef System (the MAR Fund).

Wildtracks
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Contents

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Introduction

Background and Context

South Water Caye Marine Reserve was established in 1996 (SI 118 of 1996) as part of Belize's National Protected Areas System, in recognition of the exceptional integrity of the marine ecosystems, and the area's national, regional and international importance. The Marine Reserve covers 117,875 acres (approximately 47,700 hectares) of the shallow reef platform of Belize, and is part of the longest barrier reef in the Western Hemisphere stretching approximately 1,000km from the Yucatan to the Bay Islands in Honduras. Belizean fishermen have fished the area for many years, and are considered to have traditional rights to the fishing grounds, though this is regulated to some extent by the Marine Reserve zones, and is strengthened through the Managed Access program, with SWCMR being in Area 3. The area has also developed as a tourism destination, with a number of high end, caye-based resorts and a thriving seasonal tourism commuity based out of Tobacco Caye, and from resorts on other cayes.

The area is highlighted under ecoregional planning initiatives for its particularly rich biodiversity (Kramer and Kramer, 2002; updated in Arrivillaga et. al, 2008), the coral reef, oceanic mangrove and extensive seagrass meadows providing valuable habitats for commercial species – including queen conch *(Strombus gigas*) and Caribbean spiny lobster (*Panulirus argus*), the species that form the foundation of Belize's traditional fishing industry, supporting coastal communities from the north to the south of the country. The aesthetic beauty of the cayes and reef are essential to the support of the local and national tourism industry.

Mangrove cayes provide nesting sites for several nationally important bird species and include Man O' War Caye, protected in its own right as a Crown Reserve. The numerous sand bores adjacent to Wee Wee Caye include an established nesting beach for the rare roseate tern (*Sterna dougallii*), and the area is also utilized by marine turtles for nesting. The sheltered waters and mangrove systems of the Pelican Cayes in the southern area of the Marine Reserve have been identified as one of the most biodiverse marine systems within the western hemisphere, supporting a number of endemic species, and species new to science.

South Water Caye Marine Reserve is one of seven protected areas that form the Belize Barrier Reef Reserve System World Heritage Site, in recognition of its unique values, particularly its rhomboid reef structures.

The revision of the Statutory Instrument in 2009 (SI 51 of 2009) defines the Marine Reserve as the "Caribbean Sea, reef and cayes, excluding all private property" – an important distinction from

the previous SI (SI 118 of 1996), which only stipulated the Caribbean Sea, and excluded the cayes. The SI designates three different management zones: the General Use Zone, a Conservation Zone, and Preservation Zone, with each zone having regulations defining permitted activities. The Marine Reserve designation is considered to be equivalent to IUCN category IV – a Habitat/Species Management Area, with active management targeted at conservation through management intervention (IUCN, 1994).

Summary of Key Characteristics:

- Considered one of the most highly developed examples of barrier reef structure in the region, with extensive spur and groove formation
- sheltered waters and oceanic mangrove systems of the Pelican Cayes in the southern area of the Marine Reserve have been identified as one of the most biodiverse marine systems within the western hemisphere, supporting a number of endemic species, and species new to science
- Shallow northern back-reef lagoon between the reef crest and Tobacco Range supports nationally important nursery areas for the queen conch
- Mangroves of the Marine Reserve are considered particularly important for the sustainability of commercially important species for the entire Belize reef system
- Steep-sided faros in the Pelican Cayes area.
- Deep water channels
- High connectivity between littoral forest, mangrove, seagrass and reef
- Nesting beaches for hawksbill and green turtles
- Exposed reef and sand cayes provide nesting sites for several tern species
- Designated as part of Belize's World Heritage Site

Summary of Resilience Features

- Channels through reef barrier with strong flow and water exchange
- Deep water channels within reef lagoon bring cooler water
- Reef relief and environmental gradient - fore reef, reef crest, back reef and lagoon with reef patches – increasing potential for coral tolerance to different temperature regimes

National Protected Areas System Rationalization Report (Walker et al., 2012)

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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 the Fisheries Department (the management authority), and other partners to ensure South Water Caye Marine Reserve continues to support both biodiversity and livelihoods.

The management of the South Water Caye area 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 Fisheries Department to guide the management of the Marine Reserve through the next five years (2019 – 2023). 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 SWCMR, through focal group meetings, interviews with a wide variety of individuals (including key fishing and tourism stakeholders), SWCMR staff (both at management and field level), and the South Water Caye Marine Reserve 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, and defines 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 ecosystem functions and natural resource values. It outlines specific management programs, based on the best available data and scientific knowledge, integrating conservation planning strategies, as well as relevant strategies of national and regional plans. It also sets in place the means for measuring management effectiveness, and

recommends an implementation schedule. 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 – 2019 to 2023.

Section One

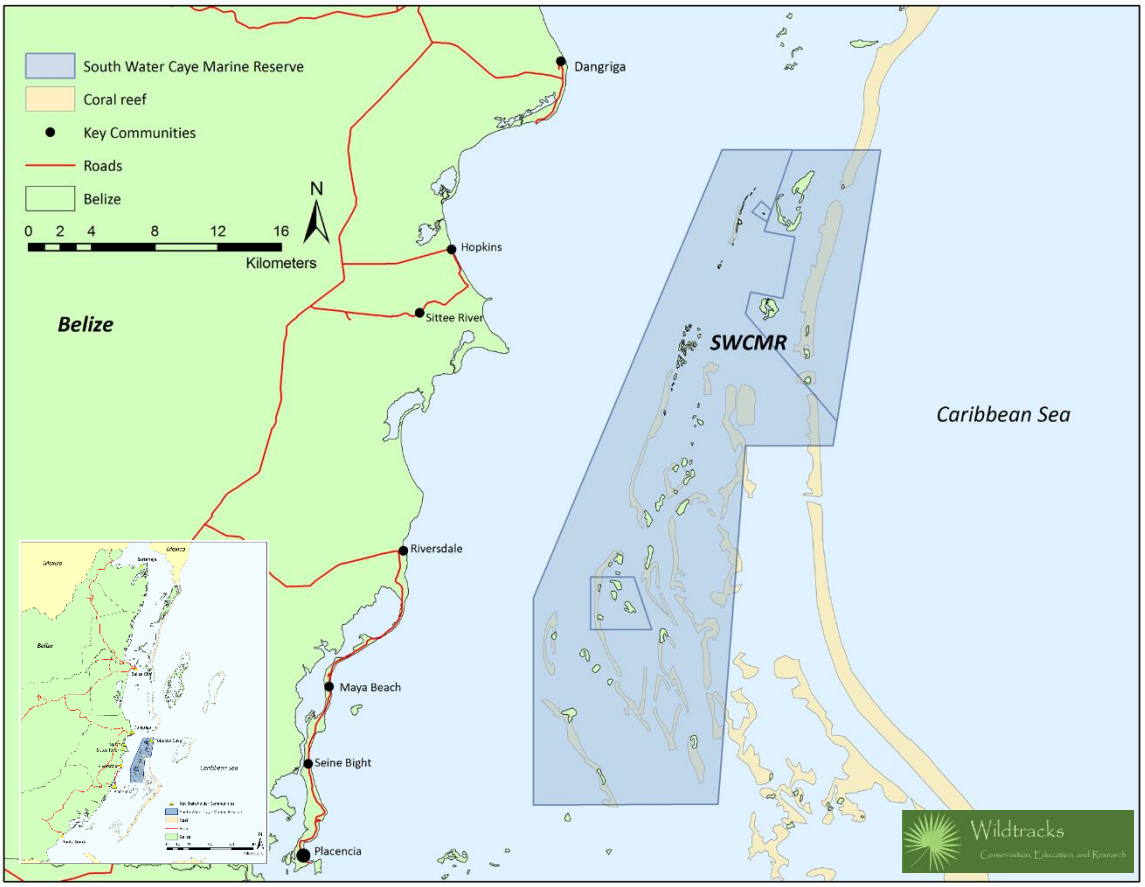
Current Status

1. CURRENT STATUS

1.1 Location

South Water Cay Marine Reserve is situated on the Belize Barrier Reef. It lies 18km east of the mainland, and west of the most southerly point of the Glover's Reef atoll (Maps 1 and 2). The Marine Reserve includes a portion of the barrier reef and a series of ecological important mangrove cayes – including the Pelican Cayes, Twin Cayes and the Tobacco and Blue Ground Ranges - many of them submerged (Map 1).

The Rangers Station is located on Twin Cayes, providing a base of operations for the Fisheries Department from which to manage South Water Caye Marine Reserve. The station contains accommodation for its rangers and reserve manager, and a recently constructed Visitor Centre.



SWCMR coordinates: 328187 E; 1792875 N

MAP 1: THE LOCATION OF SOUTH WATER CAYE MARINE RESERVE

Access

Access to the Marine Reserve is only by sea, with boats originating primarily from the mainland (Dangriga, Hopkins, Riversdale, Placencia, Sarteneja and Belize City,). South Water Caye Marine Reserve also attracts yachts and live-aboard dive boats from around the world. Boat access is restricted to three cuts on the western edge of the Reserve at the northern part of Blue Ground Range, south of Ragged Caye, and most commonly off the southern tip of Coco Plum Caye. Boat access from Sittee River is south of Blue Ground Range. Boats from Placencia enter the southern part of the Reserve through the main Victoria Channel or the more northerly deep channel entrance. Access from the east is restricted to cuts in the reef at Tobacco Caye, Carrie Bow and Curlew Caye, and Grand Channel (also called South Cut).

Communities Adjacent to South water Caye Marine Reserve

There are no permanent communities within the Marine Reserve - although Tobacco Caye supports a seasonal community of fishermen and hotel owners/staff. However, there has been a long history of use of the cayes as recreational retreats by local Belizeans as far back as the early 1900's. The majority of these cayes are now converted to tourism developments and resorts or private residences with local or international ownership.

A number of research/education facilities are located within South Water Caye Marine Reserve - Carrie Bow Caye has been leased since 1972 by the Smithsonian Institute, providing a research base for long term scientific studies of the reef within the protected area. International Zoological Expeditions (IZE) on South Water Caye has hosted student groups since 1970, Pelican Beach Resort also runs an eco-education facility. More recently, the Tobacco Caye Marine Station has been established on Tobacco Caye, catering for student study groups.

The primary stakeholders are the fishing, tourism and research sectors, based both from the mainland and from the cayes within the protected area. Fishing communities are located primarily on the mainland, with the majority of boats originating from Dangriga, Sittee River, Hopkins and Sarteneja.

1.2 Regional and International Context

> *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)**

South Water Caye Marine Reserve (SWCMR) protects a 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). With its unique coral faros, important inundated mangroves and rich biodiversity of SWCMR, is a component of Belize's World Heritage Site, (the Belize Barrier Reef Reserve World Heritage Site), a serial nomination of seven marine protected areas that showcase the high biodiversity and variety of reef types that result in the Belize reef being considered one of the best examples of this ecosystem in the world.

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 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).

The Marine Reserve encompasses a significant section of the barrier reef, with 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. SWCMR is important in its contribution towards the regional viability of important commercial species, including the queen conch (*Lobatus (Strombus) gigas*) and Caribbean spiny lobster (*Panulirus argus*). The mangroves of the cayes and coastal habitats are also important for sport fish species, and as

nursery areas for many commercial marine species of economic importance, contributing to local coastal economies.

Belize has signed a series of conventions and agreements designed to ensure continued viability of natural resources and biodiversity (Table 1). As a signatory of the **Convention on Biological Diversity (CBD) (1992),** Belize is committed to ensuring it has measures in place to protect biodiversity, with promotion of sustainable use, contributing to the 2011 – 2020 CBD strategic goals.

More specific targets of the CBD relevant to South Water Caye 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 the goal and objectives for the Marine Reserve, and in the wider goal, mission and activities of the Belize Fisheries Department.

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, which include South Water Caye Marine Reserve, comprise 12% of the entire Reef Complex and are seen as representative of the Belize Barrier Reef as the largest reef complex in the Atlantic-Caribbean region and second largest reef system in the world (UNESCO) under criteria (iii), in recognition of their global value and based on the classic examples of fringing, barrier and atoll reef types.

Recognition as the Site of Outstanding Universal Value

Cultural and/or natural significance that is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole.

Burgos et al., 2015

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 lifted at the recent sitting of the WHS Committee (2018), in recognition of the steps Belize has taken to address the identified issues and strengthen protection of the Belize Barrier Reef Reserve System.

Belize is a signatory to the **Convention on the International Trade in Species of Wild Fauna and Flora,** focused on ensuring that international trade in 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, with the season closing earlier than legislated once the quota is met, but is designed to ensure that in the long term, the fishery remains sustainable.

International Conventions and Agreements of Relevance to South Water Caye 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** *SWCMR 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, SWCMR provides sustainable 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 the protection of the reef. SWCMR, in protecting one of the largest, best formed portions of barrier reef has an important role in conservation of reef ecosystems in Belize.*
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 cayes of SWCMR provide important nesting beaches for marine turtles, including the critically endangered hawksbill turtle. SWCMR also provides a foraging area. The Fisheries Department is a member of the Belize Sea Turtle Conservation Network, one of a number of national biodiversity working groups in Belize that provides recommendations to inform national decisions.*
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.** *As part of Belize's World Heritage Site, SWCMR is important in protecting one of the largest, best formed portions of barrier reef.*
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.** *SWCMR 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 South Water Caye 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 land use planning and environmental impact assessments of large scale development projects in order to prevent or reduce harmful impacts within coastal waters. This is achieved primarily through the Integrated Coastal Zone Management Plan (South Central Region), the National Sustainable Tourism Master Plan, enforcement of relevant legislation and the EIA / ECP process.* *SWCMR 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.*

TABLE 1: INTERNATIONAL CONVENTIONS AND AGREEMENTS OF RELEVANCE TO SOUTH WATER CAYE 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, South Water Caye 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 south-central Belize.

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 SWCMR, 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 biodiversity resources within the NPAS. 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.*

SWCMR is a multiple use Marine Reserve, allowing for regulated fishery extraction and tourism use, and contributes towards a key goal of the NPAPSP - 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 coral faros, important inundated mangrove ranges and the rich biodiversity of SWCMR.

Under a national protected areas system rationalization exercise, a number of recommendations were made for SWCMR to improve representation or protection of specific national targets:

Priority Ecosystem / Species Protection

- Re-alignment with IUCN Category VI to allow for sustainable extraction
- Pelican Cayes merit serious investigation into the feasibility of incorporation into the Marine Reserve, with full protection – potential debt for Nature
- Include inundated mangrove ranges within the Marine Reserve
- Fully integrate Man O' War Caye into the Marine Reserve SI (it is already managed as part of the MR)
- Investigate potential to extend 5 nautical miles east to incorporate representative Caribbean Open Sea - Bathyal

National Protected Areas System Rationalization Recommendations (Walker et al., 2012)

South Water Caye Marine Reserve falls within the Southern Belize Reef Complex (SBRC) system level planning unit, which stretches from the coastline of Belize to the barrier reef and reef drop off.

SBRC Vision Statement

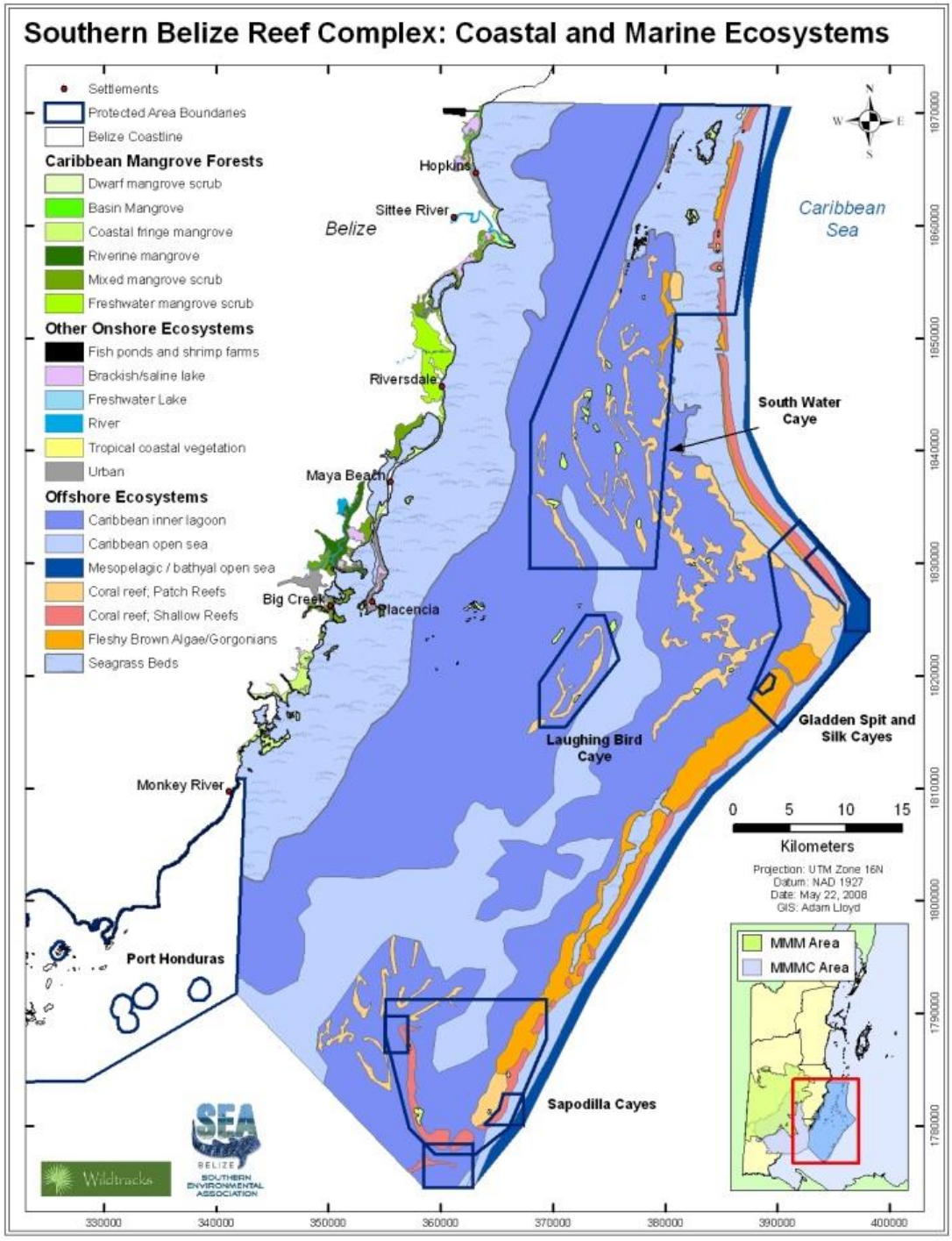
A collaborative stewardship of the internationally recognized Southern Belize Reef Complex, through strategic partnerships to conserve and improve the integrity of these socio-economically and biologically important ecosystems for the benefit of future generations

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

The SBRC 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. It encompasses five marine protected areas - South Water Caye Marine Reserve (SWCMR), Laughing Bird Caye National Park (LBCNP), Gladden Spit and Silk Cayes Marine Reserve GSSCMR), Sapodilla Cayes Marine Reserve (SCMR) and Port Honduras Marine Reserve (PHMR) (Map 3; Walker et al., 2013). Three of these (SWCMR, LBCNP, and SCMR) are 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.

Both the NBSAP and the NPAPSP support Belize's **Growth and Sustainable Development Strategy** (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 integrated and sustainable, but does not provide any enforcement capacity. Implementation and enforcement is therefore 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).



MAP 2: ORIGINAL SCOPE OF THE SOUTHERN BELIZE REEF COMPLEX (SBRC, WALKER ET AL., 2013). THIS HAS NOW BEEN EXTENDED TO THE SOUTHERN INTERNATIONAL BORDER, TO INCLUDE PHMR

SWCMR falls under the ICZMP South-Northern and South-Central Regions, with a number of overarching objectives identified under **the Integrated Coastal Zone Management Plan**. Whilst this development plan focuses on a larger scope than just South Water Caye Marine Reserve, it provides the context within which SWCMR operates:

1. *Encourage and promote the sustainable development of coastal and offshore areas within the South Northern and South Central Regions 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 South Northern and South Central Regions*

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 South Northern and South Central Regions need special protection and management because of their 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 regions by ensuring that proposed development activities do not exceed the carrying capacity*

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*

The national objective of the **Sustainable Tourism Master Plan** is to *"more than double overnight tourist arrivals while enhancing average length of stay and daily expenditure"***.** The qualities of the environment and the need to conserve these qualities are recognised in the MasterPlan, with the sustainable development program providing the framework that will *"ensure the NSTMP*

maintains a balance of the three pillars of sustainable development: social accountability, environmental conservation and economic prosperity." The NSTDP is primarily focused on destination development, financing and marketing, but does recognize the importance of conservation and environmental management in supporting Belize's tourism industry. Placencia has been a focus of the Sustainable Development Project investments, with the potential to increase visitor use of the area, and economic benefits to the communities, though with associated potential impacts on the natural resources. This, however, has little direct impact on the two most relevant stakeholder coastal communities – Dangriga and Hopkins.

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, revised 2000), 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 authorizes fishers to fish in designated fishing areas – in South Water Caye Marine Reserve, this is the General Use Zone. This is supported by Managed Access – a rights-based fisheries management tool being rolled out to better regulate fishing in Belize. The Subsidiary Laws were revised by the Law Revision Commissioner under the authority of the Law Revision Act, Chapter 3 of the Substantive Laws of Belize, Revised Edition 2000.

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 (1948, revised 2000)
Principal governing legislation regulating 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. This is achieved through the EIA / ECP process.

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 Fisheries Act is currently being revised and updated as the Fisheries Resource Bill, which will officially recognize the term managed access as a fisheries management tool. The Belize Fisheries Department, the authority responsible for SWCMR, enforces the fisheries regulations in the protected area and actively implements the Managed Access program.

The **Wildlife Protection Act (1981)** falls under the Forest Department, and provides protection for the endangered Antillean manatee, 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 2018/2019

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. The EPA also mandates DoE to carry out surveillance and response to environmental pollution. In the context of South Water Caye Marine Reserve, this is particularly important when ensuring that the impacts from development taking place on cayes – particularly dredging - within the marine reserve are minimized through the Environmental Impact Assessment (EIA) process. As a Marine Reserve, and with its proximity to the reef, any caye development is required to have an approved Environmental Impact Assessment and associated Environmental Compliance Plan before development can take place. This provides some measure of control over activities that have the potential to significantly impact the reef. A series of recommendations on lot size, housing density, solid and liquid waste disposal and dredging have been developed per caye, dependent on the height above sea level and ecosystems (Integrated Coastal Zone Management Authority, 2015). These recommendations guide the review process for Environmental impact Assessments.

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

The **Pesticides Control Act (1990)** provides a mechanism for the registration and regulation of pesticide importation and use through the Pesticide Control Board, important for improving pesticide management, and reducing contamination of the rivers feeding into the Mesoamerican Reef.

Tourism legislation in Belize falls under the mandate of the Ministry of Tourism through the **Belize Tourism Board.** This regulates tourism activities such as guide: visitor ratios, guide training and certification, and licensing of tour operators and accommodation and is focused on maintaining standards for tourism in Belize.

Whilst the above are the legislative acts most relevant to South Water Caye 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. Dredging activities have impacted the Marine Reserve in the past, even in the highly fragile Pelican Cayes area, and mechanisms are being developed to ensure stricter control of such activities within the protected area. The Belize Government has recently declared a policy-based moratorium on oil exploration in the marine environment, and a permanent ban on offshore oil exploration along the Belize Barrier Reef System and within the country's seven World Heritage Sites, including SWCMR. This is currently being inscribed into law.

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)

Also developed under the Forest Department is the **Forest (Protection of Mangrove) Regulations** (SI 52 of 1989, revised in 2018), which provides for the protection of mangroves, with restrictions on mangrove alteration and / or clearance. This has resulted in a number of stop orders for cayes within the Marine Reserve, including the Blue Ground Range area. 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.

Marine turtles and their nest sites have also 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. These three "Grand Slam" species 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.

Site Level Legislation

South Water Caye Marine Reserve is a national protected area, established in 1996 (SI 118 of 1996) under the Fisheries Act (1948 (1983 amendment)). The area is designated as a '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 directly by the Fisheries Department, 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 Instrument (SI 51 of 2009; Annex 1). There are a series of legislated 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

The seabed in South Water Caye Marine Reserve is national land, and permission is required from the Lands Department for the construction of over-water structures (including docks), seawalls and marinas, and from the Department of Mining for any dredging – as well as permission from the Fisheries Department. The protected area includes all overwashed mangrove areas and all cayes that are not private property, following the 2009 revision of the statutory instrument. Man O' War Caye is protected as one of seven bird sanctuaries gazette in 1977 under the Crown Lands Ordinance for protection of the frigatebird colony.

In the late 1990s a moratorium was placed on the sale of National Lands on the cayes, though since then, a number of cayes have been leased and surveyed within the Marine Reserve in contravention of this policy, often leading to subsequent granting as property, to then be re-sold to investors/ speculators and developers. Between 2004 and 2008, the Belize government issued at least 70 grants and 58 leases within the protected area (Jones, 2003; Table 2), despite the moratorium on sale of cayes, and the designation of this Marine Reserve as a World Heritage Site. An inventory of land tenureship within the marine protected areas of the WHS, including SWCMR, is currently being conducted, which will provide updated information on tenure status.

Name of Caye	Current Use (CZMAI, 2016)	Recommended Use (CZMAI, 2016)	Number of Grants (Jones, 2004)	Number of Leases (Jones, 2004)	Total Acreage (Jones, 2004)
Blue Ground Range		Conservation 1 (minimal development)	6	9	16.03
Coco Plum Caye	Resort	Commercial 1	1	3	30.99
Carrie Bow Caye	Research	Conservation 2 (low residential)	1	0	6.00*
Wee Wee Caye	Research	Conservation 2 (low residential)	0	2	0.84
Ragged Caye		Conservation 2 (low residential)	1	0	2.33
South Water Caye	Resorts	Commercial 1	15	0	13.27
Tobacco Caye	Guesthouses, resorts, residences	Commercial 1	27	0	5.87
Tobacco Range		Conservation 1 / 2	10	20	99.40
Twin Cayes / Twin Caye Range	HQ of SWCMR	HQ of SWCMR Conservation 2 (low residential)	3	10	20.96
Channel Caye	Fish camp, guesthouse	No expansion of development area	0	1	0.20
Peter Douglas	Resort (Little Peter Oasis), Fish camp	1 fishing camp, no disturbance of natural vegetation	0	1	2.00
Northeast Pelican	Resort, fish camp	Left in natural state where not already developed, with no impact on mangrove fringe	1	1	4.20
Northwest Pelican	Fish camp		0	1	1.50
Pelican (Cat) Caye	Fish camp, guesthouse	Development only on high north end	0	1	5.24
Lagoon Caye	Fish camp, guesthouse	No expansion of development area	0	2	2.50
Quamina Caye	Fish camp, guesthouse	No expansion of development area	0	1	1.00
Saddle Caye	Fish camp, guesthouse	1 fishing camp	1	1	1.00
Tarpon Caye	Resort, fish camp	No expansion of development area	0	1	1.00
Baker's Rendezvous North	Guesthouse, fish camp	No expansion of development area	0	1	0.22
Crawl Caye	Resort, residence	No expansion of development area	0	2	6.12
Bread and Butter Caye	Preservation, research	Conservation 1 (minimal development)	0	1	No data
Wiparri Caye	Resort, fish camp	No expansion of development area	0	1	1.02
Lark Caye	Resort, fish camp	No expansion of development area	3	0	No data

TABLE 2: LAND TENURE, SOUTH WATER CAYE MARINE RESERVE

UNESCO recommendations strongly suggest that the Belize Government consider setting a system in place to remove lands within the World Heritage Site completely from the jurisdiction of the Lands Department, thereby eliminating the chances of the issuing of leases or grants within the Barrier Reef System (UNESCO, 2009), and the recent revision of the Statutory Instruments now defines the Marine Reserve as the "Caribbean Sea, reef and cayes, excluding all private property" – an important distinction from the previous SI (SI 118 of 1996), which only stipulated the Caribbean Sea, and excluded the cayes. Man O' War Caye, which lies within the boundaries of the Marine Reserve, is protected in its own right as a crown reserve under SI 09 of 1977.

1.3.4 Evaluation of National Importance

South Water Caye Marine Reserve is highlighted as an area of national importance for its particularly high ecological and socio-economic value, and for protecting one of the best developed examples of barrier reef in the western hemisphere area. It 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.

Key Characteristics of National Importance: SWCMR:

- Considered one of the most highly developed examples of barrier reef structure in the region, with extensive spur and groove formation
- sheltered waters and oceanic mangrove systems of the Pelican Cayes in the southern area of the Marine Reserve have been identified as one of the most biodiverse marine systems within the western hemisphere, supporting a number of endemic species, and species new to science
- Shallow northern back-reef lagoon between the reef crest and Tobacco Range supports nationally important nursery areas for the queen conch
- Mangroves of the Marine Reserve are considered particularly important for the sustainability of commercially important species for the entire Belize reef system
- Steep-sided faros in the Pelican Cayes area.
- Deep water channels
- High connectivity between littoral forest, mangrove, seagrass and reef
- Nesting beaches for hawksbill and green turtles
- Exposed reef and sand cayes provide nesting sites for several tern species
- Designated as part of Belize's World Heritage Site

Rationalization Report (Walker, 2012)

South Water Caye Marine Reserve is also of economic importance to Belize as a lobster, conch and fin-fish resource for traditional fishermen from mainland fishing communities - particularly Sarteneja, Dangriga and Hopkins, and subsistence fishing resources for people living on Tobacco Caye, South Water Caye and other cayes within the protected area. The shallow northern backreef lagoon between the reef crest and Tobacco Range supports nationally important nursery areas for the queen conch. The mangroves and seagrass of Twin Cayes, Tobacco and Blue Ground ranges, and the Pelican Caye provide critical nursery and adult habitat for Caribbean spiny lobster and commercial finfish species, forming the foundation of Belize's national fishing industry. 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 the fisher stakeholders.

South Water Caye 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	
Green Turtle	*Chelonia mydas*
Social Wrasse	*Halichoeres socialis*
Nassau Grouper	*Epinephelus striatus*
Fire Coral	*Millipora striata*
Boulder Star Coral	*Orbicella annularis*
Star Coral	*Orbicella faveolata*
Whale Shark	*Rhincodon typus*
Splendid Toadfish	*Sanopus splendidus*
Great Hammerhead	*Sphyrna mokarran*
Antillean Manatee	*Trichechus manatus*
Vulnerable	
Lamarck's Sheet coral	*Agarica lamarcki*
Gray Triggerfish	*Balistes capriscus*
Dusky Shark	*Carcharhinus obscurus*
Loggerhead Turtle	*Caretta caretta*
Pallid Goby	*Coryphopterus eidolon*
Glass Goby	*Coryphopterus hyalinus*
Peppermint Goby	*Coryphopterus lipernes*
Masked Goby	*Coryphopterus personatus*
American Crocodile	*Crocodylus acutus*
Pillar Coral	*Dendrogyra cylindrus*
Leatherback Turtle	*Dermochelys coriacea*
Elliptical Star Coral	*Dichocoenia stokesii*
Seafan Blenny	*Emblemariopsis pricei*
Lined Seahorse	*Hippocampus erectus*
Maya Hamlet	*Hypoplectrus maya*
Hogfish	*Lachnolaimus maximus*
Cubera Snapper	*Lutjanus cyanopterus*
Mutton Snapper	*Lutjanus analis*
Manta Ray	*Manta birostris*
Boulder Star Coral	*Orbicella franksi*
Rough Cactus coral	*Mycetophyllia ferox*
Sperm Whale	*Physeter macrocephalus*
Whitelined Toadfish	*Sanopus greenfieldorum*
Cerulean Warbler	*Setophaga cerulea*
Glover's Reef Toadfish	*Vladichthys gloverensis*

IUCN, 2017

In 2017, 942 fishers were registered under the Managed Access program as users of Managed Access Area 3 as their primary or secondary fishing area (Fisheries Department, 2017) though only a portion of these will access the Marine Reserve. Boats also access the area from the northern fishing communities (FiD data, 2018). Twenty-nine fishing boats were recorded as using the area in 2017, of which six were sailboats, from the northern fishing communities, with crews of between 12 and 14 fishers. Twenty-three were skiffs, with crews of between 2 and 5, originating from the central coastal communities – primarily Dangriga and

Hopkins (SWCMR, 2017). 2017 CPUE data from SWCMR demonstrated that the northern fishers target predominantly lobster and conch, whilst the central fishers focus more on fin fish – over 90% of the lobster product, 85% of the conch and 90% of the crab recorded were extracted by northern fishers, whilst the majority of whole finfish (55%) were extracted by boats from the central communities (SWCMR, 2017).

In 2017, fishers represented only 2% of visitors to SWCMR. The remaining 98% were associated with tourism, generating over Bz$89,440 for the MPA through entrance fees (SWCMR, 2017). The Marine Reserve 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 resorts, hotels, guest houses, restaurants and a range of other assosciated local businesses in the coastal communities.

The Marine Reserve is recognized for supporting extraordinarily high biological diversity, particularly in the Pelican Cayes area. The protected waters provide nursery and feeding habitats for at least forty-one species of international concern (Critically Endangered, Endangered or Vulnerable; IUCN, 2017). These include ten species of coral, four species of turtle, twenty one species of fish, and the endangered Antillean manatee (a sub-species of the West Indian manatee).

The pristine mangrove vegetation and nesting bird congregations, the sheltered, clear waters and dazzling array of corals benefit Belize's growing number of tourism operations, based from both the cayes and the mainland, attracting snorkelers and divers from all over the world, as well as providing the perfect environment for kayaking packages. The area is also noted for specialized education and research value, with its own research and education facilities based on a number of the cayes within the Marine Reserve, bringing researchers and student groups to the area.

Ecosystem Services of South Water Caye Marine Reserve

The barrier reef and extensive mangrove cayes provide an important protective function, buffering the coastline from wave action, particularly during tropical storms and hurricanes, reducing coastal erosion and protecting property and life in the coastal zone. The presence of mangroves reduces storm surge inundation of seawater on land and reduces potential physical damage to houses and other infrastructure during storm events. The mangroves also limit the daily erosion that would otherwise occur as a result of the natural flow of the seawater and tides along the coastline and on the cayes, and reduce the flow of caye-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 the close connectivity of mangroves, seagrass and reef has been shown to significantly increase the survivorship of juvenile reef fish species (Mumby et al., 2004).

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 contribute towards global efforts to mitigate climate change, acting as an effective carbon sink.

South Water Caye Marine Reserve – Twin Cayes. The Marine Reserve has extensive mangrove ranges, protecting the shorelines from erosion, important in supporting the rich marine life of the area and providing sheltered harbour for boats during storms

Ecosystem Services of South Water Caye Marine Reserve	
Regulation	▪ Protection of the coastline from wave action and storm surges through structural barrier of the barrier reef and mangrove-cloaked cayes, reducing beach erosion on cayes and the coastline ▪ The reefs provide coral, a major component in the formation of beaches and cayes ▪ The prop roots of red mangroves protect the cayes from erosion ▪ Seagrass and mangroves are important in filtering sediment and pollutants in runoff from the caye and (to a lesser extent) mainland watersheds ▪ Seagrass plays an important role in stabilizing the substrate and settling turbidity in the water ▪ Coral fragments form a major component of beaches and cayes
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	▪ SWCMR is an important, traditional commercial fishing ground for the Belize capture fisheries industry in central and southern Belize ▪ Coral reefs are important resources for tourism and recreation - tourism-related income contributed 38.1% to the national GDP in 2016, much of it based on reef tourism. ▪ Coral reefs and the scenic vistas are important for aesthetic appreciation by both caye residents, local and international visitors ▪ Recreational opportunities for local and international visitors
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 ▪ Seagrass and mangroves are effective as a CO_2 sink ▪ Mangroves provide nesting structure for several bird nesting colonies, as well as the osprey, an important top predator ▪ Littoral forest and mangroves provide important stop-over habitat for migratory bird species

TABLE 3: ECOSYSTEM SERVICES OF SOUTH WATER CAYE MARINE RESERVE (ADAPTED FROM UNEP-WCMC, 2006)

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).

The faroes in the southern part of the marine reserve, and associated Pelican Cayes are recognized as particularly important, with a unique and fragile species assemblage and a species diversity unparalleled in the Caribbean. SWCMR provides habitat for fish that have restricted ranges, such as the vulnerable seafan blenny (*Emblemariopsis pricei*), which is only found from Belize to the Roatan Island, Honduras. The Maya hamlet (*Hypoplectrus maya*) is known only from Belize off Wee Wee Cay (South Water Marine Reserve), throughout the Pelican Cays, and the Sapodilla Cays (Lobel 2011), The area has also seen the discovery of a number of new species such as the endangered social wrasse (*Halichoeres socialis*), thought to be endemic to the Pelican Cayes. A number of species listed are transient, such as the vulnerable cerulean warbler (*Setophaga cerulea*) and sperm whale (*Physeter macrocephalus*).

Several coral sand cayes within SWCMR have provided historical nesting sites for hawksbill and green turtles, though the highly attractive nature of these cayes for tourism ventures has reduced much of the viability of these beaches for turtle nesting in the trend of caye development.

1.3.5 Socio-Economic Context

National Context

Belize has a population currently estimated at approximately 380,030 (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, Cayo District, Belize City and the district towns. 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.)	380,030
Population density (2015)	14.6/sq. km.
Urban Population (2015)	43.1%
Annual growth rate (20145 est)	2.1%
Life expectancy (2015 est.)	70.1
Below Poverty Level	33.5% (2002) 43% (2010)
Literacy rate (2015)	82.3%
Unemployment rate (2016)	10.1%
GDP (per capita, 2015)	Bz$9,813.88 per capita
Annual GDP Growth (2015)	1.9%

TABLE 4: BELIZE DEMOGRAPHIC STATISTICS, (SIB, 2016)

It is a country of many cultures, with Mestizo, Creole, Maya and Garifuna forming the major population groups. The indigenous Maya of Belize, the descendants of the Central American civilization, at its height approximately 2,000 years ago. Dangriga and Hopkins, the two key south central communities closest to South Water Caye Marine Reserve, were settled in the early 1800's, by the Garifuna people - immigrants of Amerindian and African ancestry who arrived from St. Vincent via the Roatan Islands, fleeing

persecution. The Creole also settled in Stann Creek in the 18th century, working in the logging industry in the area. They also established a thriving fishing community on Tobacco Caye before the focus of the caye switched to tourism. The northern coastal fishing communities, also important stakeholders of SWCMR, are predominantly Mestizo, being settled in the 1850's by refugees from Mexico, forced south by the Mexican Caste War.

Over the last 25 years, there has been a shift in the cultural demographic of the country as a whole, with a significant influx of Central American refugees – primarily from Guatemala and Honduras – in 2010, an estimated 20% of heads of households were born outside of Belize (SIB, 2010). There is also an ongoing emigration of Belizeans to the United States – generally those from urban areas who have completed secondary school or have professional training. There is also immigration of people to Hopkins and other coastal communities, predominantly from the USA, Canada and Europe, either as seasonal residents or as retirees.

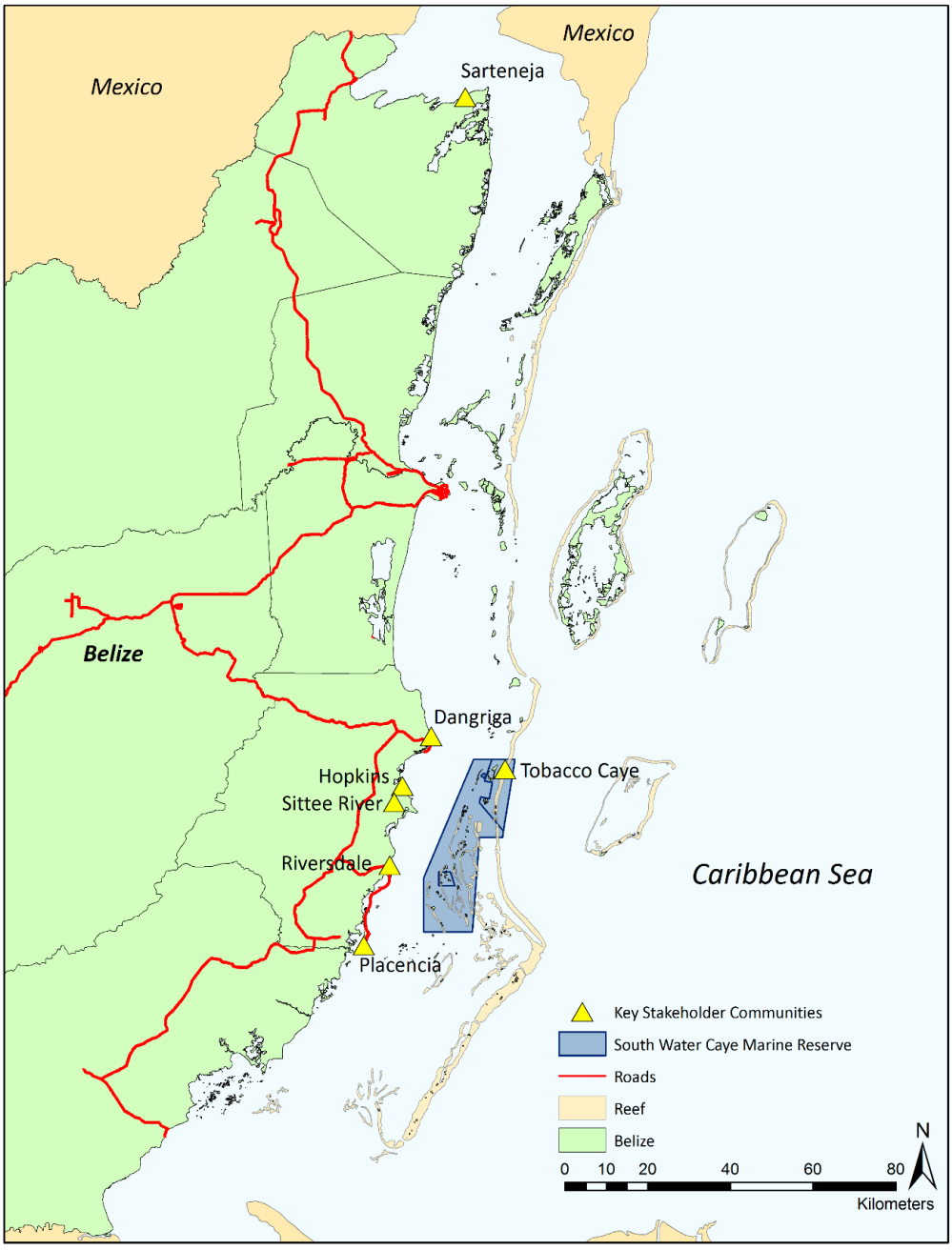
The economy of Belize has been based largely on agriculture, with fisheries, banana, sugar and citrus forming some of the key traditional exports that have contributed significantly towards the GDP. More recently, revenue from oil extraction has been significant in supporting the economy, but this has now declined. There is also an increasing reliance on the developing tourism industry, which is rapidly becoming the major foreign exchange earner.

South Water Caye Marine Reserve contributes towards support of the national fishing industry which provides direct employment for over 2,640 fishers (Belize Fisheries Department, 2017) and supports an estimated 15,000 Belizeans from 20 communities, with a further 1,000 people involved indirectly in processing and export (Belize Fisheries Department, 2013). In 2015, the capture fishery produced over 97,500 tonnes of product – primarily lobster and conch for the export market (FAO, 2017). In 2016, lobster exports (tail and meat) were approximately Bz$18,259,380. Conch and other mollusc exports were valued of Bz$10,522,230 (Table 4; SIB, 2017).

Product	***2016 (lbs)***	***2017 (lbs)***
Lobster Tail	432,013	546,788
Lobster Meat	40,367	47,841
Whole lobster	447,874	405,270
Conch	849,475	564,760
King Crab	1,713	3,919
Whole Fish	170,496	33,720
Fish Fillet	300	5,135
Sea cucumber	87,407	-
Shark	24,383	41,000
Total	***2,054,028***	***1,648,433***

The majority of the South Water Caye Marine Reserve traditional fishermen fish for fin-fish and free dive for lobster and conch, originating from the coastal communities of Sarteneja, Dangriga, Hopkins, Riversdale and Placencia (Map 3). These fishermen use hand lines for finfish and shades / traps for lobster (primarily the fishermen from Dangriga and Hopkins), and free-dive for spiny lobster (*Panulirus argus*) and Queen conch (*Lobatus (Strombus) gigas*) (primarily fishermen of Sarteneja), fishing throughout the shallow protected lagoon of the Belize Barrier Reef. Long lines

are also used in the deeper channels and on the fore-reef, especially near Tobacco Caye. Alternative job opportunities within many of these coastal communities are limited, though a number – Hopkins, Dangriga, Riversdale and Placencia in particular - are shifting to an increasing dependence on tourism.



MAP 3: KEY STAKEHOLDER COMMUNITIES OF SWCMR

Stakeholder Communities of South Water Caye Marine Reserve

Community	Location (UTM) Distance (km)	Population (approx.)	Population Components	Comments
Sarteneja	E16 0378750 N18 2029500 (158 km NW)	2,300	Mestizo	Largest fishing community, concentrating on lobster and conch throughout Belize waters using traditional sail boats. Largest number of fishermen utilizing natural resources of SWCMR.
Dangriga	E16 0370200 N18 1876300 (11.4km ESE)	11,600	Garifuna	Fishing skiffs utilizing SWCMR – hand lines, traps and shades for finfish, lobster and conch Tourism
Hopkins	E16 0363200 N 18 1864680 (13km E)	1,027	Garifuna	Small number of skiffs, focused on SWCMR - hand lines, traps and shades for finfish, lobster and conch Tourism developments (eg. Hamanasi)
Sittee River	E16 0363200 N 18 1864680 (13.3km E)	641	Garifuna	Fishing community gradually shifting to tourism
Placencia	E16 03653894 N18 26544 (14.3km NE)	1,200	Predominantly Creole	Historically a fishing community – now a primarily tourism-based economy
Riversdale / Seine Bight	E16 0363200 N 18 1864680 (8.3km E)	1,829	Garifuna	Historically a fishing community – now moving towards primarily tourism-based economies
Tobacco Caye	E16 0386986 N18 68397 (within SWCMR)	Seasonal pop. of 16	Creole	Small seasonal, caye-based community located in SWCMR mostly reliant on tourism based around snorkeling and diving. Small numbers of the community still depend on fishing for subsistence.

TABLE 5: STAKEHOLDER COMMUNITIES OF SOUTH WATER CAYE MARINE RESERVE

In 2009, Sarteneja, Dangriga and Placencia were identified as the primary fishing stakeholder communities. A total of 606 commercial fishers were identified as coming from five communities – Sarteneja, Dangriga, Placencia, Hopkins and Punta Gorda. The majority (approximately 49%) originated from Sarteneja, with 28% originating from Dangriga (Figure 1; Catzim, 2009).

More recently, in 2017, 942 fishers were registered under the Managed Access program as users of Managed Access Area 3 as their primary or secondary fishing area (Fisheries Department, 2017). 77% of MA Area 3 primary users originate in 9 communities, the majority (42%) originating in Dangriga and Sarteneja (21% from each of these two communities) (Figure 1). Managed Access Area 3 includes not only South Water Caye Marine Reseve, but also the coastal waters, Gladden Spit Silk Cayes Marine Reserve, and the waters around Laughing Bird Caye Marine Reserve. Many of the central coastal community fishers registered for ue of the area fish close to the coast, with only 30 fishers from Dangriga / Hopkins reported as using South Water Caye Marine Reserve on a regular basis (SWCMR staff, 2017).

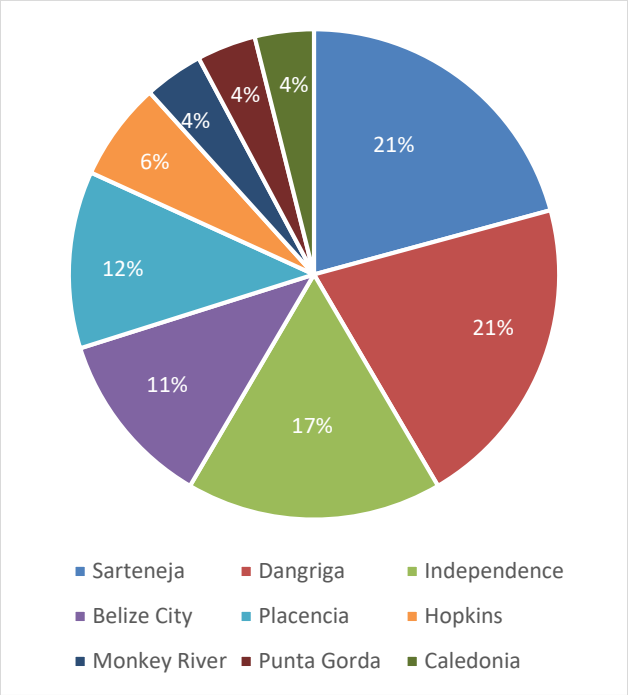


FIGURE 1: % ORIGIN OF KEY FISHERS REPRESENTING 77% OFMA AREA 3 USERS (DATA: FISHERIES DEPARTMENT, 2018)

The northern and southern communities represent two very different fishing sectors. Those from Sarteneja use larger traditional sailboats with between 7 and 13 fishers to reach the Marine Reserve, each fisher having a dug-out canoe, for daily fishing., with extracted product being stored on the sailboat. These fishermen camp on their boats or on adjacent cayes, spending up to 12 days at sea, free-diving primarily for lobster and conch, and some finfish (depending on the season). The Stann Creek / southern fishermen generally use smaller skiffs, and access the area on one day / two-day fishing trips, with an average of 2.5 fishermen per boat. Fishing methods include traps, shades and lines, as well as free diving for conch and lobster. There is also a subsistence fishery based primarily out of Tobacco Caye, and on other cayes in the Marine Reserve, wherever residents, watchmen and fishermen are present overnight. This, including dock fishing, is allowed as an unwritten policy for those people recognized as residents of the area.

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 (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.

Overnight tourism in Belize shows a distinct seasonality, with the majority of visitors arriving in the first quarter of the year (BTB, 2017). The lowest months are September and October, the main tropical storm season (Figures 2 and 3).

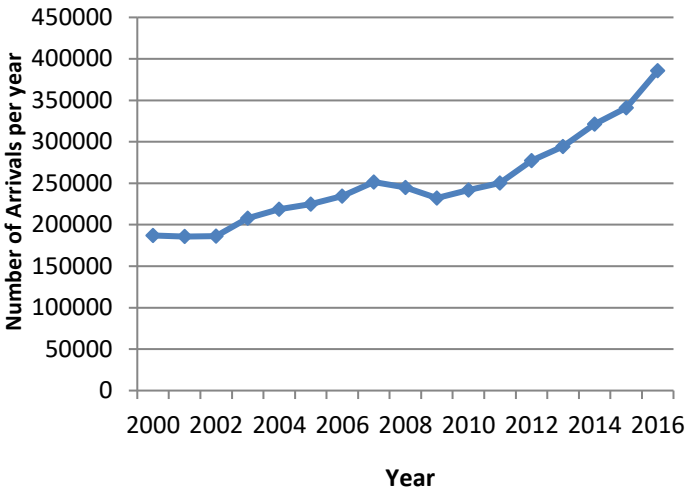


FIGURE 2: BELIZE OVERNIGHT TOURISM ARRIVALS 2000 - 2016

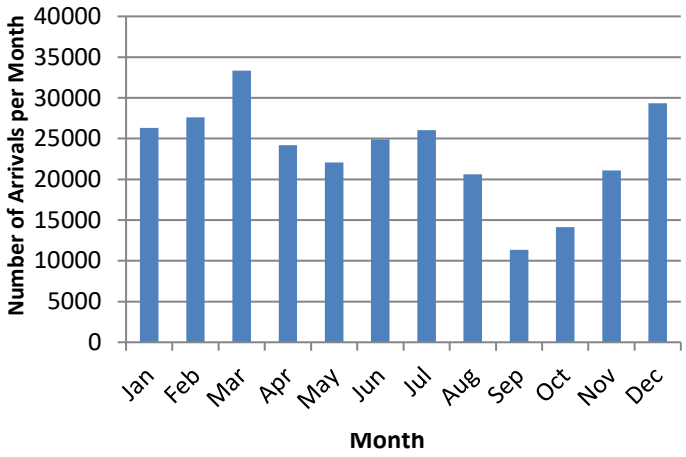


FIGURE 3: BELIZE OVERNIGHT TOURISM ARRIVALS PER MONTH (AVERAGE: 2000 – 2016) (BTB, 2017)

Direct tourism expenditure in Belize exceeded Bz$489.7 million in 2016 – 14.1% of the total GDP (WTTC, 2017). When indirect contributions are taken into account from related support industries, this rises to 38.1% of the GDP. In 2016, the tourism industry supported over 18,500 direct jobs – 12.6% of total employment, expanding to 34.3% of total employment when related support industries are taken into account (WTTC, 2017).

With its scenic beauty, vibrant reef and idyllic sand cayes, South Water Caye Marine Reserve provides an important tourism service for south-central Belize. From Dangriga soutwards, the coastline is rapidly changing as more resorts, retirement developments and other tourism developments, bringing employment to the coastal communities. Despite its touristic values, however, it is under-utilized, with only 11.8% of overnight visitors visiting Dangriga / Stann Creek during their stay in Belize in 2015 (BTB, 2016).

TOURISM STATISTICS FOR STANN CREEK DISTRICT, 2016

Average daily expenditure for guests in Dangriga / Stann Creek: Bz$335.16
Annual revenue generation (accommodation sector): Bz$17.17 million
Average hotel occupancy: 33.2%
Number of registered tour guides: 125
Number of registered tour operators: 38

BTB, 2017

The tourism sector is an important component of Belize's economy, providing employment for one out of seven people at the national level. In Stann Creek District, the tourism industry employs approximately 1,787 people (1,002 men and 785 women), only 9.2% of the national total (BTB / Social Security Board, 2017).

Considering the importance of tourism, the high potential for increasing visitation to the marine protected area, and the relative high use compared to the fishing sector, it is recommended that SWCMR seriously consider a significant shift to include a focus on engagement of the tourism sector in the targeted stakeholder communities.

DANGRIGA

Dangriga, once known as Stann Creek Town, is the largest community in the proximity of South Water Caye Marine Reserve. It is an expanding coastal town located at the mouth of the Stann Creek River. with a population estimated at 9,592 in 2010, growing to 10,328 in 2017, approximately 27.3% of the 42,230 people resident in Stann Creek District (SIB, 2017)). The town is predominantly Garifuna, with almost 60% of the population considering themselves as Garifuna in 2010 (Figure 4; SIB, 2010), 27% of the national Garifuna population. Dangriga is considered a vibrant cultural centre of the Garifuna people, with strong ties to the history, language and culture. This includes Garifuna Settlement Day, celebrated each year on November 19th with the re-enactment of the arrival of the Garinagu after being driven out of St. Vincent.

As the district center, Dangriga is the financial, commercial, medical and educational center for the district, with a daily transient population coming in to the town each day from the rural communities. Many of the district government offices are located here, as are the high schools.

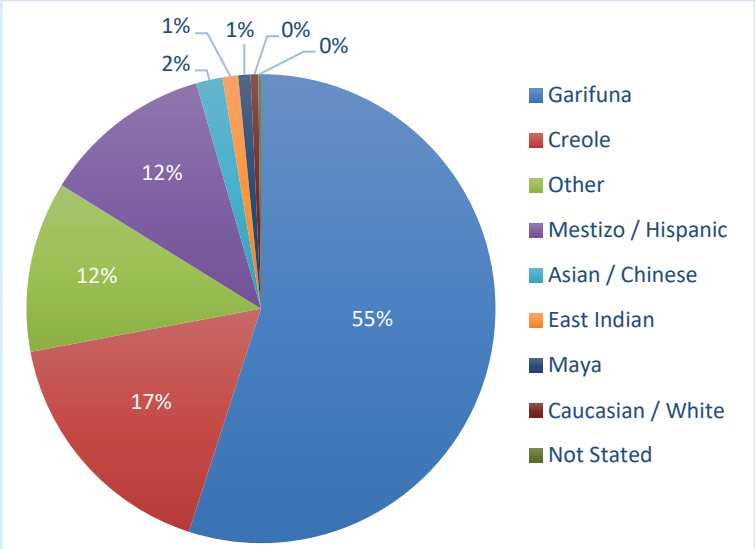


FIGURE 4: RELATIVE CULTURAL BREAKDOWN OF POPULATION, Dangriga (SIB, 2010)

Dangriga's economy is based on fishing, agriculture, tourism and farming, with citrus and cultivation being almost synonymous with the Stann Creek Valley. It has an increasing role to play in tourism as an access point to the cayes, though this is currently under-utilized. With the closure of the seaport in the mid-1980's, there has been an increasing unemployment rate, at 16.5% in 2014 (Belize Labor Force Survey, 2014), and a trend of 'working out', with young adults leaving the town for other areas in Belize with higher employment opportunities, or travelling to the United States to seek work. Many maintain strong links with Dangriga, sending funds back to support their families. This migration of young adults out of the town is of concern, with those that leave including the entrepreneurs – those that have the vision and innovation to be able to start businesses that provide local employment opportunities for others.

There has also been an increase in migrants into the community from Honduras, Guatemala and El Salvador, hired as seasonal workers on the citrus, banana and shrimp farms, and then remaining.

HOPKINS

Hopkins is a Garifuna community with an economy that was traditionally based on farming and fishing, located on the coastal strand of Stan Creek District, in central Belize. The Hopkins Fishermen Association has 30 members, of which 15 are active traditional fishers, though many are shifting to part- or full-time jobs associated with the growing tourism industry in and around the community

Recently, there has been an almost exponential growth of low-medium end tourism in the community, and an associated development of foreign-owned resorts catering to medium-high end tourism along the coastline. Tourism has enabled people in Hopkins to develop consistent incomes, with farming and fishing shifting to secondary importance, providing supplementary incomes in the low tourism season for those with only seasonal tourism employment (Morozova, 2016). The establishment of larger resorts has increased the availability of employment, opening up opportunities, particularly for women in the community, with a demand for service-related staff (housekeeping, cooking, reception etc.). It has also improved opportunities for employment as tour guides. Many of the larger resorts are willing to invest in capacity building for their staff, and retain them at the same rates during the low season, reducing their need to return to fishing. However, many also select their staff based on skills and experience, not necessarily through a wish to provide local employment (it is estimated that between 50 and 80% of employment is of local residents (Hopkins or Sittee River) (Morozova, 2016).

The increasing interest in Hopkins, not just a tourism destination but also for recreational and retirement homes for foreign investors, has led to sale of seafront properties, providing short-term economic gain for those selling, but reducing the potential for local community members to maximize long term development opportunities.

Small businesses identify marketing as one of their biggest barriers, with insufficient funds available for large scale promotion. Those wanting to enter the tourism industry as tour guides either fund themselves or are trained when working at one of the resorts.

A basic stakeholder analysis identifies stakeholder interests and impacts (Table 7; Table 8).

Stakeholder	Role
Fisheries Department	Government authority responsible for South Water Caye 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. Promote tourism development and regulation of tourism use of 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 – conch, lobster and finfish,
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 cayes of SWCMR, with the potential to impact the environment - including dredging, seawalls, and over-water constructions. May also be willing to use best environmental practices in their development
Tourism Services – hotels, resorts, restaurants	Rely on the aesthetic beauty of South Water Caye Marine Reserve for attracting guests to the area. Provide employment and training in the tourism industry, and the services to build capacity of Stann Creek communities as environmentally sound tourism destinations. Provide interpretation activities for visitors.
Research Organizations	The Smithsonian Institute, in particular, hosts long term, ongoing research studies in SWCMR, providing technical reports that increase knowledge of the MPA
Student Study Organizations	Use SWCMR as an educational study site, including the Tobacco Caye Marine Station (on Tobacco Caye) and Projects Abroad (based out of Placencia). Provide income generation in the communities, educational outreach, and can provide manpower for MPA surveys
Belize Coast Guard	Responsible for security to life and property

TABLE 7: KEY STAKEHOLDERS OF SOUTH WATER CAYE MARINE RESERVE

TABLE 8/1: STAKEHOLDER ANALYSIS FOR SOUTH WATER CAYE MARINE RESERVE

Stakeholder	Influence or Impact of South Water Caye Marine Reserve on Stakeholder		Influence or Impact of Stakeholder on South Water Caye Marine Reserve	
Community Stakeholder Sarteneja, Dangriga, Hopkins,	▪ Protection of fish, lobster and conch resources within the Conservation and Preservation Zones ensuring continued viability of fishery	+	▪ Some cooperating with Managed Access regime and improving stewardship	+
	▪ Protection of important mangrove nursery sites, ensuring continued viability of fishery	+	▪ Low level of cooperation or openly antagonistic towards protected areas	-
	▪ Protection of traditional fisher rights through Managed Access	+	▪ Illegal fishing within the replenishment zones	-
	▪ Exclusion from traditional fishing areas	-	▪ Unsustainable / illegal fishing practices (undersized / out of season / restricted species)	-
			▪ Fishing impacts within protected areas (including damage to coral)	-
			▪ Anchor damage to reef	-
Tour Guides (including tour boat captains)	▪ Benefit from having South Water Caye Marine Reserve as a major venue for snorkeling, dive- and kayak-associated tourism	+	▪ Support the conservation goals of South Water Caye Marine Reserve	+
	▪ Employment in reef-based tourism initiatives and related tourism sector businesses	+	▪ Provide interpretation for visitors, facilitating overall visitor appreciation	+
	▪ Income from using South Water Caye Marine Reserve for tourism	+	▪ If well trained, assist with visitor management within the protected areas through in-depth briefings	+
			▪ If poorly trained, can result in poor visitor management and increased impact on corals and associated fauna, anchor damage etc.	-
			▪ Impact behavior of fish through poor tourism practices such as chumming	-
Local / National Tour Operators	▪ Benefit from having South Water Caye Marine Reserve as a major venue for dive- and kayak-associated tourism	+	▪ Provide marketing at a national level, and send visitors to South Water Caye Marine Reserve, increasing sustainability	+
	▪ Income from using South Water Caye Marine Reserve as a tourism destination	+	▪ Support the conservation goals of South Water Caye Marine Reserve	+
			▪ Increase the potential for exceeding the carrying capacity of the protected area	-

TABLE 8/2: STAKEHOLDER ANALYSIS FOR SOUTH WATER CAYE MARINE RESERVE

Stakeholder	Influence or Impact of South Water Caye Marine Reserve on Stakeholder		Influence or Impact of Stakeholder on South Water Caye Marine Reserve	
Caye-based Tourism Initiatives	▪ Benefit from having South Water Caye Marine Reserve as a major venue for snorkeling, dive-, kayak- and fly-fishing associated tourism	+	▪ Support the conservation goals of South Water Caye Marine Reserve	+
	▪ Income from using South Water Caye Marine Reserve as a tourism destination	+	▪ Provide marketing of South Water Caye Marine Reserve at both national and international level	+
			▪ Provide interpretation for visitors, facilitating overall visitor appreciation.	+
			▪ Potential impacts from pesticide / herbicide use	-
			▪ Potential impacts from dredging activities	-
			▪ Potential impacts on fish populations through mangrove clearance	-
			▪ Potential impacts of run-off following caye clearance, and associated sedimentation impacts on seagrass and reef	-
			▪ Potential impacts of inadequate sewage disposal, grey water and detergents	-
			▪ Beach use impacts on turtle nesting	-
BTIA	▪ Benefit from having South Water Caye Marine Reserve as a tourism venue, and World Heritage Site, attracting visitors to the area	+	▪ Provide national and international marketing of South Water Caye Marine Reserve	+
			▪ Support the conservation goals of South Water Caye Marine Reserve	+
General Belize Public (excluding primary stakeholder communities)	▪ Maintenance of access to fish, lobster and conch as part of the Belize diet	+	▪ Support of the general public will strengthen the position of protected area	+
	▪ Environmental services	+	▪ Lack of support may increase chances of dereservation	-
	▪ Cultural and aesthetic appreciation	+		
	▪ Increased awareness of marine resources through education	+		

TABLE 8/3: STAKEHOLDER ANALYSIS FOR SOUTH WATER CAYE MARINE RESERVE

Stakeholder	Influence or Impact of South Water Caye Marine Reserve on Stakeholder	Influence or Impact of Stakeholder on South Water Caye Marine Reserve
Visitors: Tourists	▪ Enjoy South Water Caye Marine Reserve as a tourism destination + ▪ Benefit from education and awareness opportunities +	▪ Entrance fee contributes towards the goal of sustainability + ▪ Provide marketing nationally and internationally by word of mouth, if happy with level of product + ▪ Presence deters fishing (and other illegal activities) within protected area + ▪ Negatively impact marine and terrestrial environments through poor tourism practices -
Visitors: Researchers	▪ Benefit from being linked to South Water Caye Marine Reserve + ▪ Benefit from Smithsonian facilities on Carrie Bow Caye and other research bases within SWCMR + ▪ Benefit from access to a virtually pristine reef environment + ▪ Benefit from historic baseline information on past research activities within protected areas +	▪ Conservation management benefits from data gathered, greater knowledge of marine and terrestrial environments and species within area + ▪ Benefit from increased activity within area + ▪ Possible impact of research activities on marine environments -
Visitors: Student Groups	▪ Benefit from access to a virtually pristine reef environment at an affordable cost + ▪ Benefit from the presence of a number of field stations established within SWCMR +	▪ Provide revenue for the marine reserve + ▪ Large groups of young people have potential to increase the visitor impact on the reef, if poorly supervised - ▪ Possible impact of poorly supervised / vetted student research activities on marine environments -
Sailboat Charter Companies	▪ Benefit from protection of South Water Caye Marine Reserve as a major bareboat destination, and its value as tourist attractions + ▪ Benefit from tourism infrastructure – mooring buoys, restaurants, visitor center +	▪ Support the conservation goals of South Water Caye Marine Reserve + ▪ 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 -

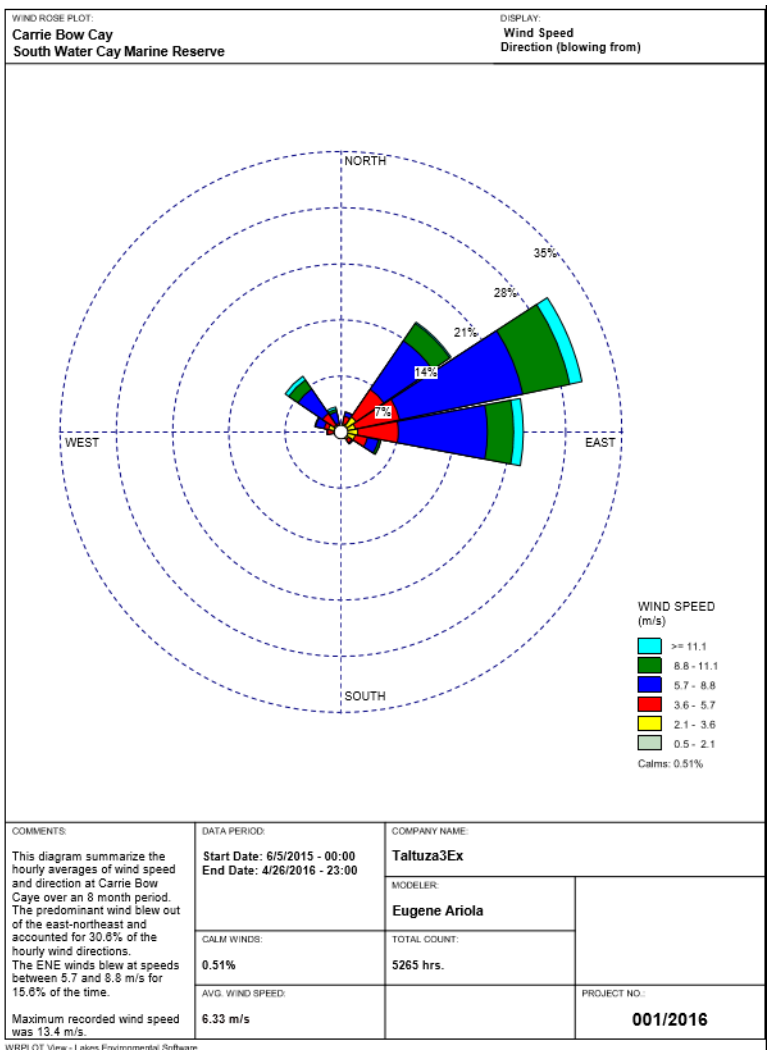
TABLE 8/4: STAKEHOLDER ANALYSIS FOR SOUTH WATER CAYE MARINE RESERVE

Stakeholder	Influence or Impact of South Water Caye Marine Reserve on Stakeholder	Influence or Impact of Stakeholder on South Water Caye Marine Reserve
International Tour Operators	▪ Benefit from having South Water Caye Marine Reserve as a major venue for dive-associated tourism + ▪ Benefit from having South Water Caye Marine Reserve as a World Heritage Site destination – global recognition + ▪ Income from using the Marine Reserve for tours +	▪ Provide marketing at an international level, and send visitors to the protected area, increasing sustainability + ▪ Support the conservation goals of South Water Caye Marine Reserve +
Government of Belize	▪ Provides fisheries management for fishing Industry + ▪ Provides environmental services + ▪ South Water Caye Marine Reserve is included within the National Protected Areas System Plan - Assists in fulfilling Belize Government's commitment to the conservation of natural resources, CCAD, CBD, MBRS, and national World Heritage sites + ▪ Income generation of significant foreign revenue + ▪ Provides employment opportunities in stakeholder communities +	▪ Political support (currently being strengthened through the NPAPSP) + ▪ Can commit to decisions to ban oil exploration and sale of national cayes + ▪ Can regulate caye development through the EIA process + ▪ Can regulate mangrove clearance through revision of the Mangrove regulations + ▪ Can overturn decisions on oil exploration and sale of national cayes -

1.4 Physical Characteristics

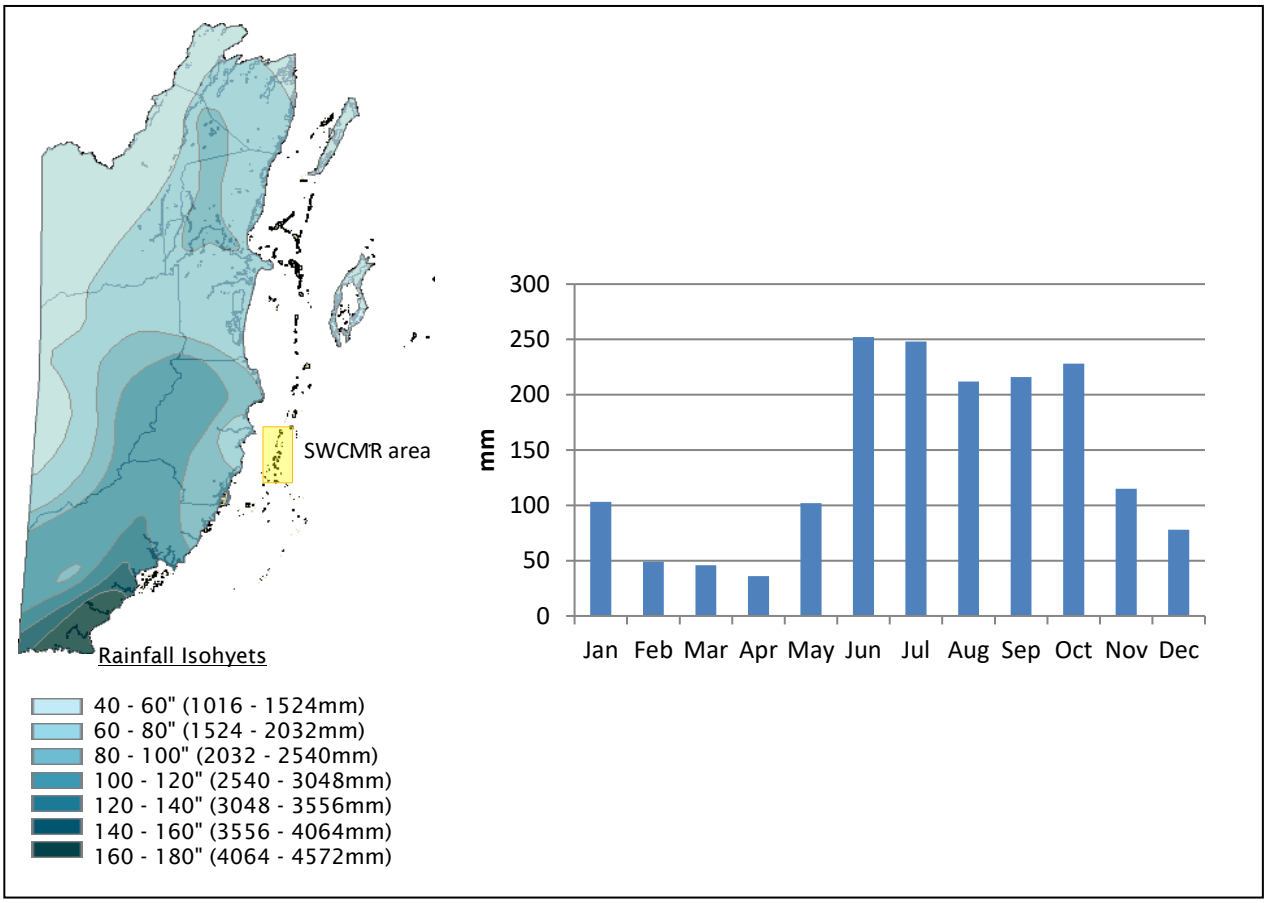
1.4.1 Climate

Wind 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 South Water Caye Marine Reserve. The predominant winds are the ***Trade Winds***, blowing from the east and north-east from April to October, and rarely exceeding 5 to 8 m/s. These are interspersed by tropical storms and hurricanes. The third wind system impacting the area is that of the ***Northers*** - high-pressure fronts moving down from the north, occuring between October and April, bringing cooler weather (Figure 5).



Rainfall

South Water Caye Marine Reserve lies within the second lowest rainfall belt, with between approximately 1,500 and 2,000 mm of rain per year (Figure 6). There is a pronounced dry season stretching from January through to May, with only 36 mm recorded in April, the driest month. This is followed by a wetter season (June to October) with total rainfalls in the region of 212 to 228 mm, associated with passing tropical storms, particularly between October and November.



Temperature

The annual mean temperature in the SWCMR area is 25.9°C, fluctuating throughout the year from a minimum monthly average of 21°C in January, during the cold fronts, and a maximum in June of 29.0°C (Figure 7).

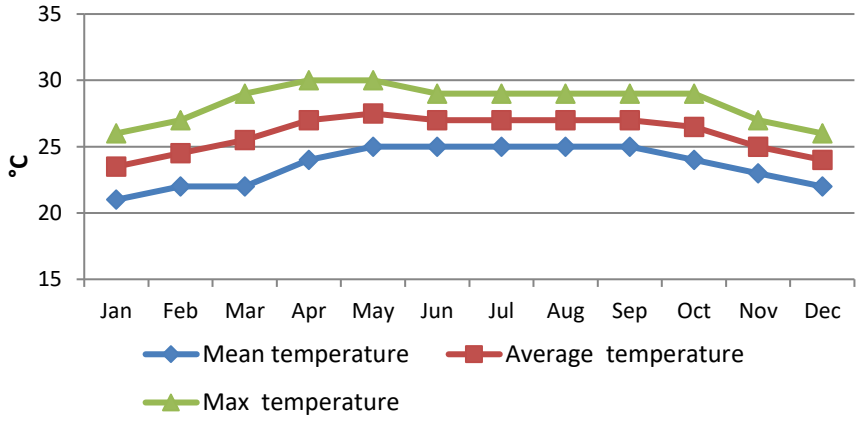
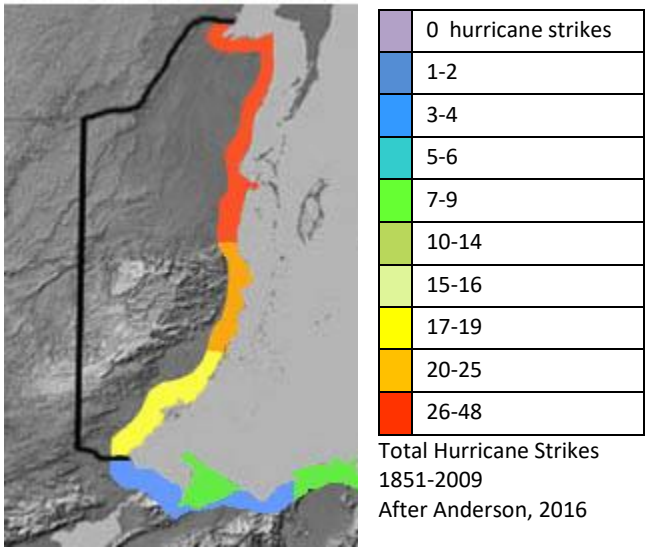


FIGURE 7: MAXIMUM, MINIMUM AND MEAN TEMPERATURE AVERAGE PER MONTH

Tropical storms affect Belize every year between the beginning of June and end of November, with potential for landfall being particularly high in northern Belize. 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.



Total Hurricane Strikes
1851-2009
After Anderson, 2016

Whilst many hurricanes have very focused paths of destruction, their effects are wide ranging, particularly in the marine and coastal environments. SWCMR has been affected on an almost annual basis by tropical storms, some of these reaching hurricane strength. Tropical storm impacts include mechanical damage to the reef and siltation of the corals, affecting habitat quality for reef organisms. Mangroves, whilst known for their resilience to hurricane damage to a large extent, will lose their leaves and suffer from increased mortality in major hurricanes. The storm surge, a local rise in sea level of several feet that washes over the coastline, has the potential to remove vegetation cover, with salt contamination of ground water and soils. The severity of the impacts from tidal surges depends on the strength of the surge, and the duration of inundation under water. Tropical storms and hurricanes also have the potential to impact life and property in the SWCMR caye and on the mainland to the east. All tropical storms, even tropical depressions, can bring increased rainfall, causing extensive flooding of the mainland, and increased water flow into the rivers and coastal waters, increasing the turbidity of the water as far out as SWCMR.

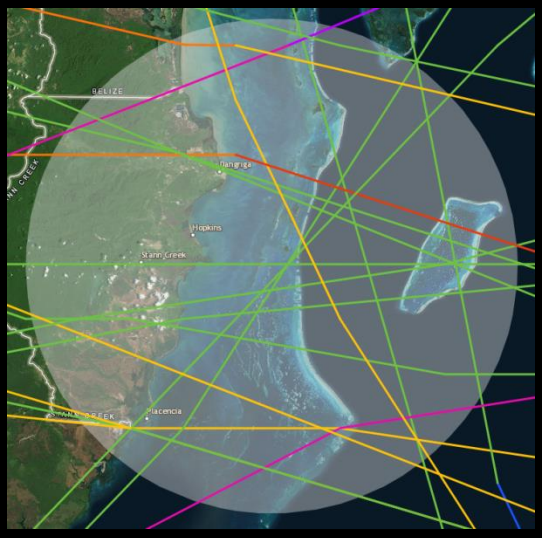


FIGURE 9: HURRICANES AND TROPICAL STORM PATHS PASSING THROUGH OR WITHIN 50KM OF SWCMR (WWW.COAST.NOAA.GOV, 2017)

FIGURE 8: TOTAL HURRICANE STRIKES 1851-2009 (AFTER ANDERSON, 2016)

Hurricanes can also bring cooler water to the reef shelf, stirred up from deeper Caribbean Sea, reducing the surface water temperatures, and therefore the potential for coral bleaching. Historical records identify 23 tropical storms / hurricanes that have impacted SWCMR between 1900 and 2016, either passing directly across the Marine Reserve, or coming within a 50 km radius of the area (Figure 8; Table 9). This

includes 11 tropical storms, 7 Category One hurricanes, 2 Category Two, 1 Category Three, and 2 Category Four. Two additional major hurricanes (Hurricane Earl (H1, 2016), and an unnamed storm (H4, 1931) passed beyond the 50km used to define storm influence, but were still strong enough to impact the area.

Name	Cat.	Date Passed <50km of SWCMR	Name	Cat.	Date Passed <50km of SWCMR
Harvey	TS	Aug 20 2011	Gilda	TS	Sep 27, 1954
Richard	H1	Oct 25, 2010	Unnamed	H1	Oct 4,1945
Matthew	TS	Sep 25, 2010	Unnamed	TS	Aug 3,1942
Iris	H4	Oct 9, 2001	Unnamed	TS	Sep 22, 1942
Gert	TS	Sept 17, 1993	Unnamed	H1	Sep 28, 1941
Greta	H3	Sep 19, 1978	Unnamed	TS	Oct 11, 1938
Fifi	H2	Sep 19, 1974	Unnamed	TS	Jun 5 and 8, 1934
Laura	TS	Nov 21, 1971	Unnamed	TS	Sep 25, 1932
Francelia	H2	Sep 3, 1969	Unnamed	TS	Aug 15, 1931
Anna	H1	Jul 24, 1961	Unnamed	H1	Aug 26, 1918
Hattie	H4	Oct 31, 1961	Unnamed	H1	Oct 31, 1906
Abby	H1	Jul 15, 1960			
Other large storms affecting the area (>50km)					
Earl	H1	Aug 4, 2016			
Unnamed	H4	Sep 10, 1931			

TABLE 9: HURRICANES PASSING WITHIN 50KM OF SWCMR (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. Whilst many hurricanes have very focused paths of destruction, their effects are wide ranging, particularly at sea. As well as the physical and mechanical damage to the coral, hurricanes also stir up the water, increasing turbidity and can reduce water clarity for a significant time after the storm event itself. Water clarity can be further reduced following tropical storms by the associated heavy rainfall, which can exacerbate erosion and increase sediment transport from the mainland via the rivers.

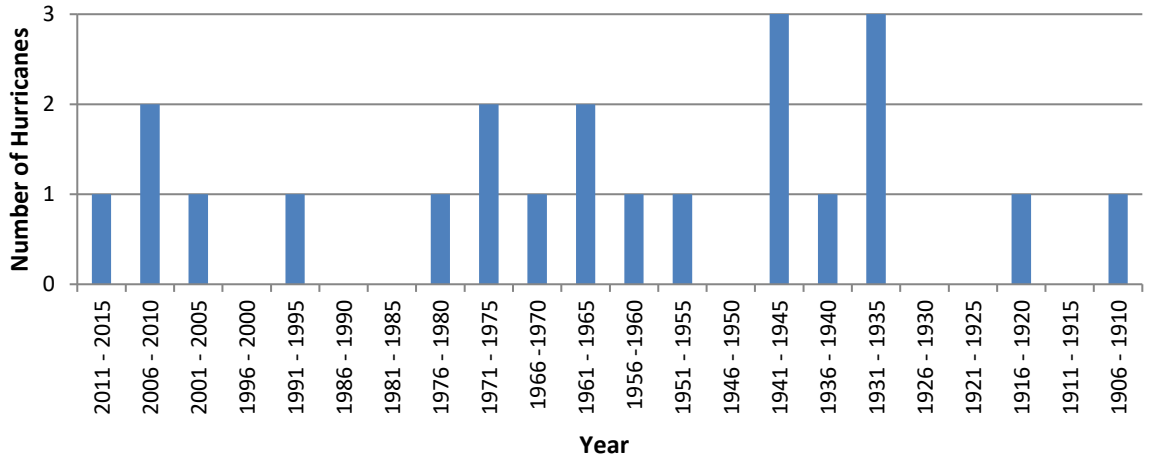


FIGURE 10: FREQUENCY OF HURRICANE EVENTS PASSING WITHIN 50KM OF SWCMR (TROPICAL STORMS / HURRICANES; WWW.COAST.NOAA.GOV)

1.4.2 Geology

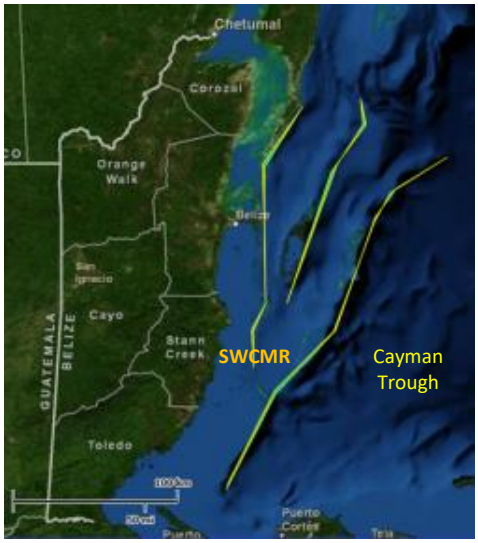


FIGURE 11: FAULT LINES / ESCARPMENTS RUNNING PARALLEL TO THE BELIZE COASTLINE, FORMING THE BASE OF THE BARRIER REEF AND ATOLLS (BASED ON PURDEY ET AL., 2003)

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 developed section of the Belize barrier reef.

The Marine Reserve includes a 9km unbroken stretch of the barrier reef, running from Tobacco Caye to South Water Caye, and considered to be one of the most highly developed examples of barrier reef structure, with extensive spur and groove formation. The underlying reef structure consists of at least 16m of unlithified late Holocene sediments in the back reef and more than 18m of a mixed coral and deeper water coral-head facies in the shallow and deep forereef, with a maximum age of 7,175 ± 100 years BP (Koltes et. al. 1998).

Cayes dot the platform, some formed on mangrove peat, others from coral outcrops and sand deposition. Tobacco and Blue Ground ranges both have areas of over-washed mangrove, whereas other cayes are above sea level. Moving south of Carrie Bow Caye, and east of Wee Wee Caye, lie hundreds of sand bores, some of which break the surface. These mounds rise from water depths of 15 m and are generally separated by narrow, deep channels 20 to 30 meters across. Coral rubble and debris are piled on top of the islets, and the surrounding ecosystems are extremely complex and varied, ranging from algal-dominated to gorgonian dominated (Jones, 2003).

South of Blue Ground Range, shelf topography reaches its maximum complexity with a narrow outer platform and a maze of patch reefs, faros, and pinnacles. This complexity is driven by karstic processes of the underlying limestone, originating from erosion impacts when the area was exposed by lower sea levels, which have resulted in unusually steep coral reefs known as faros or rhomboid reefs, averaging 2-3 m depth in the Pelican Cayes area.

Soils / Sediments: The sediments from reef and fore reef are comprised of fragments of coral, red algae and Halimeda. In contrast, sediments of the back reef area contain more mollusk fragments and have lower percentages of Halimeda (Gischler 1994). Sediments associated with the patch reefs are poorly sorted coarse-grained carbonates, composed primarily of Halimeda, coral, coralline algae, mollusc and other skeletal particles.

The lagoon floor is muddy, composed of fine-grained carbonate sand, with the sand fraction rich in Halimeda, mollusc and foraminifer grains (James & Ginsburg 1979). Mud dominates sediments of the channel flooring - generally 80-90%. Sand forms less than 10% of seabed sediment in deep areas. Gravel is a very minor component (Nunny et al. 2002).

Submerged mangrove peat banks have been identified adjacent to a number of the mangrove peat islands. Those on the northern margin of Tobacco Range differ, however, in that they show significant slumping, with a unique formation of peat fractures in the ocean floor. In this area, the sea bottom is composed of a 1 to 7m thick consolidated fossil mangrove peat bank of tilted, slumping blocks, stretching 2km in length and 0.5km wide. The area is interspersed with fractures ranging from 0.1m to >30m in width, with steep, vertical walls (Littler et. al., 1995), and exposing small caves in the ocean floor that provide shelter for large numbers of schooling fish (Jones, 2003).

1.4.3 Bathymetry

The barrier reef complex has been divided into three provinces based on their distribution and geomorphic characteristics: Northern, Central, and Southern Provinces (Burke, 1982). An inner channel separates the reef platform from the mainland, and is shaped like a featureless, gently sloping valley deepening toward the south, with water depth maintaining a fairly constant descent ranging from 40 to 60 feet in the north to 60 to 90 feet in the south. This is flanked on the seaward side by the barrier reef platform, which is relatively flat in this area and about 8 km wide (Figure 12.

Depths in the main part of the barrier reef platform average 3-5 m. with much of the reef platform being covered with sea grass meadows studded with patch reefs (Figure 13).

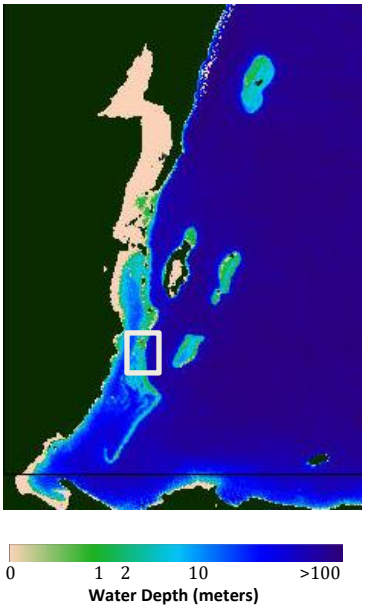


FIGURE 12: WATER DEPTH (SEAWIFS, 1999)

In the southern portion of the reef, south of Blue Ground Range, a series of complex, diverse reef structures - faros, pinnacles and patch reefs - become evident, tied in with the karstic geology. This maze is intersected by deep-water channels averaging between 25-45m that can rise steeply, as around Crawl and Channel Caye. The most extensive surface-breaking reef of the inner cayes stretches from Crawl Caye to Baker's Rendezvous. Several of the cayes in this area have lagoon formations of considerable depth, mostly surrounded by reef. The Victoria Channel, in the south, with depths of between 30 to 44m, is essentially a large lagoon that connects to the Inner Channel in the vicinity of Crawl Caye, and extends fingers north around the Pelican Cayes. The channel also gives deep-water frontage to a number of the inner cayes on the windward side (Elbow, Channel, Crawl, and Baker's Rendezvous), some of which are high and sandy, others low and dominated by mangrove.

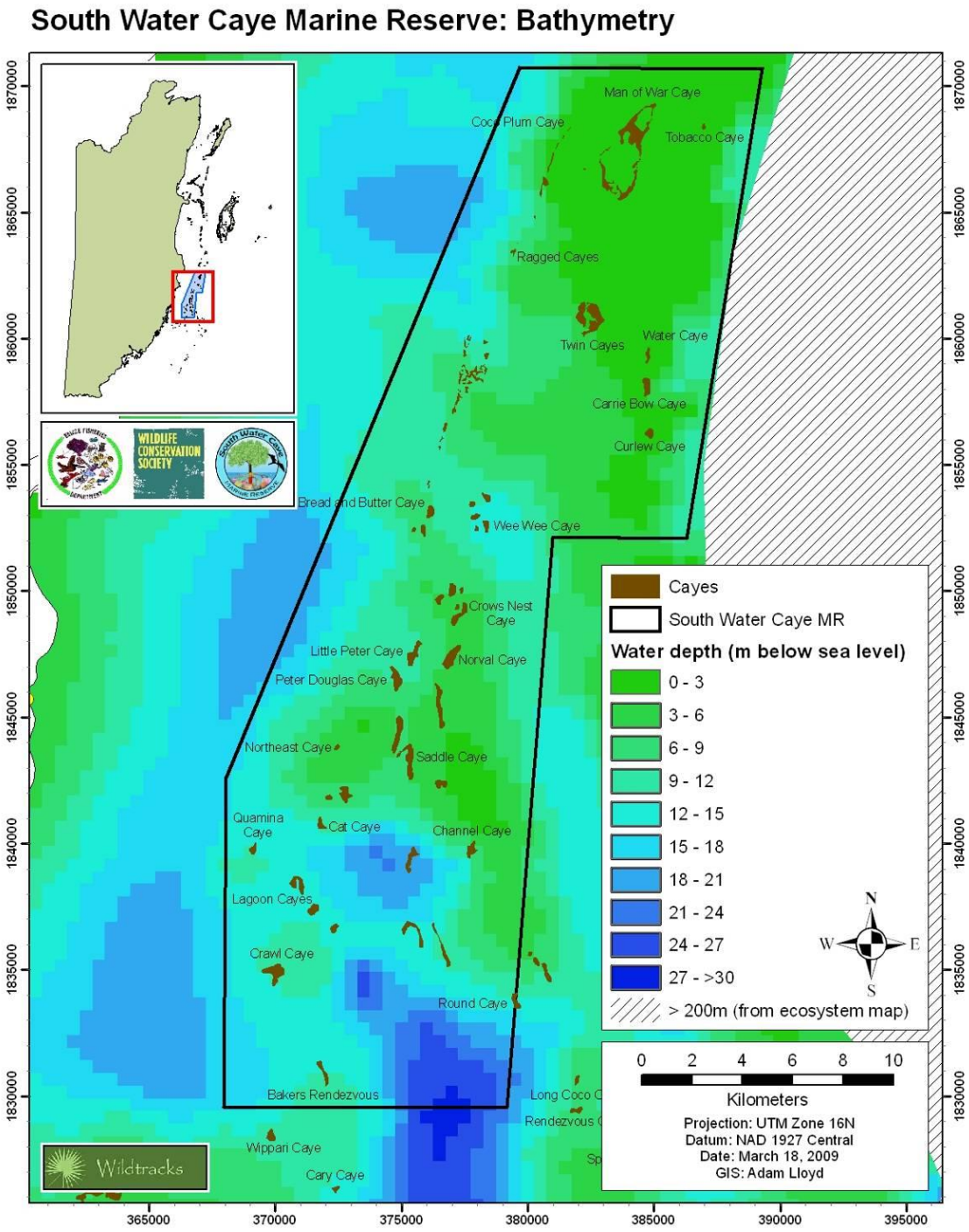


FIGURE 13: WATER DEPTH (SEAWIFS, 1999)

1.4.4 Tides and Water Movement

The mixed, primarily semidiurnal tide is of limited importance in southern Belize with a range of only 20 cm (FigureS 14 AND 15; Kjerfve, 1981). Tides in the South Water Caye Marine Reserve region of the Belize reef system are considered to be micro tidal, with a mean range of 15 cm at Carrie Bow Cay (Kjerfve *et al*., 1982) and 21 cm at Twin Cays (Wright *et al*., 1991), averaging an estimated 30 cm throughout the area (Stoddart, 1962; Caribbean Coral Ecosystems Program, 2005). The currents generated by these tides through reef cuts and at river mouths are thought to play a significant role in the spatial dispersion of sediment, nutrients, and larvae along the shallow reef flats and back reef (Heyman & Kjerfve, 2001). Local currents within the lagoon and platform are mainly wind driven whilst velocity measurements at Carrie Bow Caye indicate that currents near the cuts and barrier reef crest are considered to be strongly influenced by the tides and often reach speeds of 1.0 to 1.5 kts (Rath, 1996). Incoming currents greatly exceed ebb currents, indicating a slow continual in-filling of the lagoon with oceanic waters.

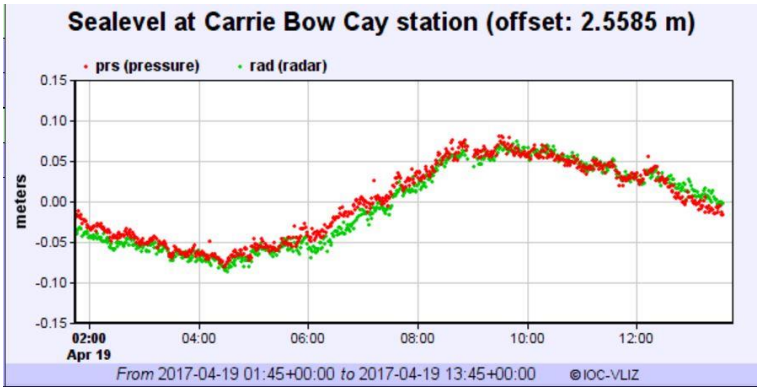


FIGURE 14: SEALEVEL AT CARRIE BOW CAYE http://www.ioc-sealevelmonitoring.org, 2017

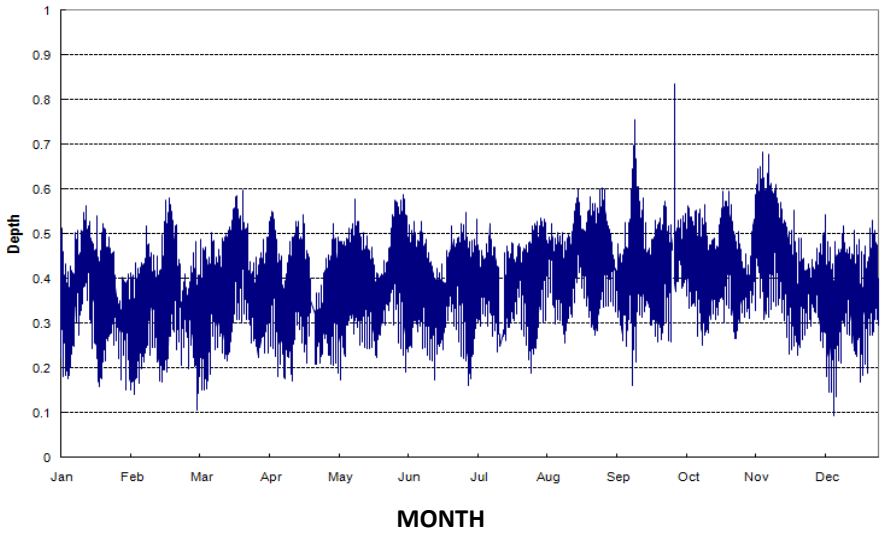


FIGURE 15: TIDAL RANGE FOR CARRIE BOW CAYE (HTTP://CBC.RIOCEAN.COM)

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

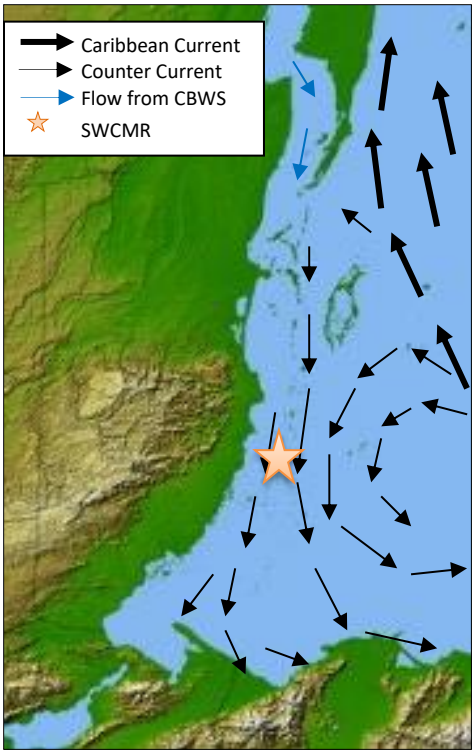


FIGURE 16: OCEANIC CURRENTS OF MESOAMERICAN REEF THAT INFLUENCE BELIZE

Knowledge of currents is essential in determining the transport of larvae, nutrients and pollutants. Water currents can also result in the spread of diseases, as was demonstrated by the rapid spread of disease in *Diadema antillarum* throughout the Caribbean region.

On a more regional scale, the main oceanic current, the warm-water Caribbean Current, flows westwards from the Lesser Antilles then northwards through the Yucatan Channel, with an average flow rate of between 38 to 43 cm (15 to 17 inches) per second, and with localized gyres and counter-currents. One such counter current is created within the Yucatan Basin / Gulf of Honduras area, throughout Belizean coastal waters, where a counter-current is created, influenced by the Caribbean Current, flowing southwards past the Belize coastline (Figure 16; Stoddart, 1962). This creates a low-flow area between the atolls and the shore, with circulation being predominantly wind-driven by the easterly trade winds for much of the year, resulting in a south west / south circulation in the shelf lagoon and offshore basins (Purdy et al., 1975). Strong northerly winds frequently occur during the winter months, and are associated with cold air masses from the north, shifting currents to a more southerly direction.

1.4.5 Water Parameters

Salinity of normal seawater is 36 parts per thousand (ppt). Throughout the Belize continental shelf, normal salinity persists except very close to the mainland (Rath, 1996). The Inner Channel is dominated by marine conditions throughout the year. Salinity rarely drops below 25 ppt (Nunny *et al.* 2001).

The Smithsonian Institute Field Station has been monitoring basic water parameters within South Water Caye Marine reserve since 1994 / 1995. Measurements in 1994 - 1996 show that mean monthly water temperatures ranged between 25.4°C – 30.3°C on the reef, and 26.2°C to 30.3°C over the drop-off, with salinity varying from 33.0‰ to 37.4‰.

Data Set	Visibility (m) (Range)	Salinity (ppt) (Mean Monthly Range)	Temperature (°C) Mean Monthly Range
Seagrass	7.0m – 15.8m	33.3‰ – 37.3‰	23.6°C – 31.3°C
Reef	-	-	25.4°C – 30.3°C
Reef Drop-off	11m – 35.5m	33.0‰ – 37.4‰	26.2°C – 30.3°C

TABLE 10: MEAN AND RANGE VALUES OF VISIBILITY, SALINITY, CONDUCTIVITY, AND TEMPERATURE (FROM: CARICOMP DATA)

Increasing water temperature has been linked with coral bleaching - during September, 1995, for example, sea surface temperatures reached a 12-year high of 29.9°C to the east, at Glovers Reef. Surface water temperatures over the drop-off at Carrie Bow Cay were the highest recorded since CARICOMP monitoring began in January 1993, reaching a peak of 30.4°C during the first two weeks of June 1995 (Jones, 2003). Bottom water temperatures at CARICOMP Coral Reef Site I (13m water depth) averaged 29.8°C (±0.16) during the last week of August. This coincided with the first widespread coral bleaching event within Belize reef waters. By December 1995, temperatures had fallen to a monthly average of 27.7°C, due partly to the passages of Hurricanes Opal and Roxanne across the Yucatan Peninsula in late September and early October, respectively. Follow-up surveys of coral bleaching in August 1996 and January 1997 indicated that most of the coral had recovered, but as the impacts of climate change become more pronounced, it is expected that bleaching episodes will become more frequent, with only more resilient corals surviving (Aronson et. al., 2000). These high temperature peaks are becoming more frequent as a result of climate change.

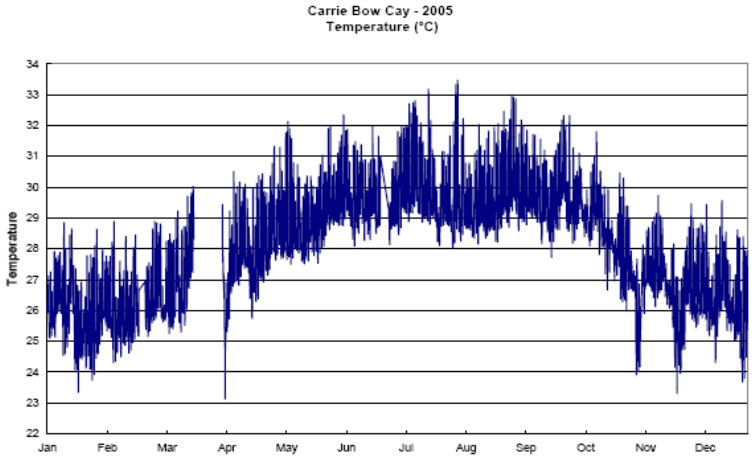


FIGURE 17: WATER TEMPERATURE AT CARRIE BOW CAYE (HTTP://CBC.RIOCEAN.COM, ACCESSED 2009)

There has been a steady decline in the water clarity at SWCMR - episodes of low visibility (<6 m) have always occurred, but appear to be more frequent in recent years, while very clear water with visibility exceeding 18m has not been observed since 2004. Since monitoring of water clarity started in 1993, horizontally sighted Secchi distance outside a shallow seagrass bed near Twin Cays has declined at a rate of 0.29 m•y-1, while the vertically sighted Secchi depth at a deep station on the fore-reef has declined at a rate of 0.52 m•y-1. (Gallegos et al., CCRE, 2012). Storm events also impact water turbidity and quality within the protected area. Following the passage of Hurricane Mitch in October 1998, Seawifs ocean colour images showed that large river plumes from Honduras extended out as far as Glover's Reef Atoll (Andrefouet *et al.* 2002). A significant increase in turbidity was also reported after Hurricane Mitch, with impacts from both Honduras and the Belize mainland. More recently, in 2016 and 2017, reports have increased of algal blooms in the SBRC.

The increased sediment load is also accompanied by an increased pesticide load, as rain washes agrochemicals from the watersheds into the rivers, and from there, into the sea. South Water Caye lies directly east of twelve primary watersheds (Map 18), including the North Stann Creek, which includes the principal citrus growing valley in Belize, and South Stann Creek, within which some of the largest banana farms are situated.

Sedimentation and agrochemical contamination from mainland watersheds have been highlighted as perhaps one of the greatest impacts on the Belize reef, after climate change. South Water Caye Marine Reserve lies east of six watersheds, which drain some of the principal banana growing areas of southern Belize (Map 4). 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 (Figure 18; Burke et al., 2006).

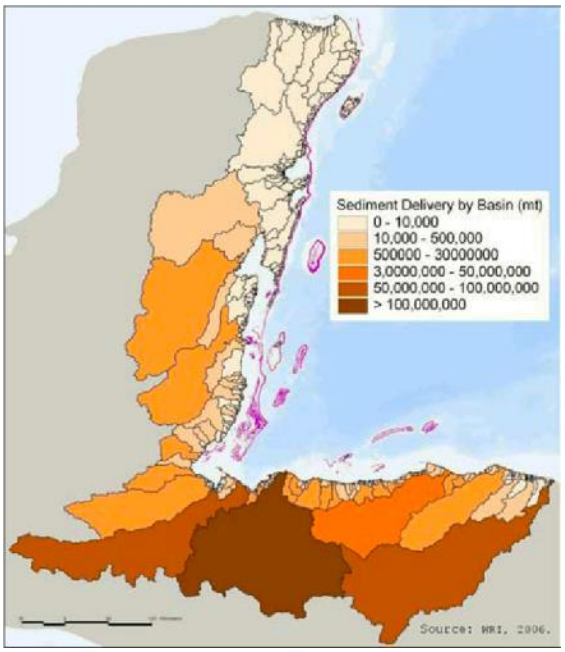
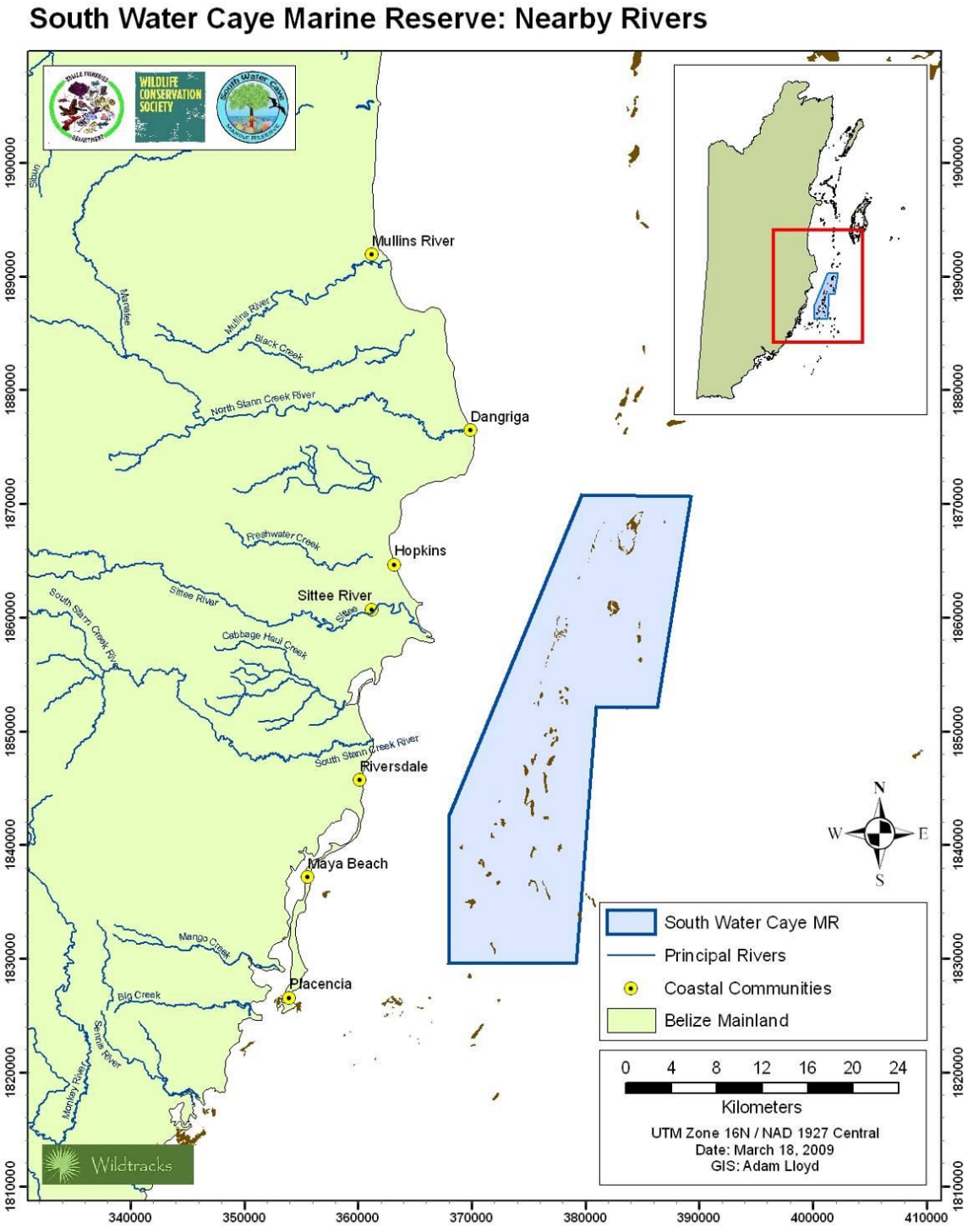


FIGURE 18: SEDIMENT DELIVERY BY WATERSHED BASIN (BURKE ET AL. 2006)

Sediment core analysis of two sites within the Belize reef system (Turneffe Atoll and Sapodilla Cayes), indicate that watershed



MAP 4: RIVERS DRAINING INTO THE BARRIER REEF LAGOON IN THE VICINITY OF SOUTH WATER CAYE MARINE RESERVE

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).

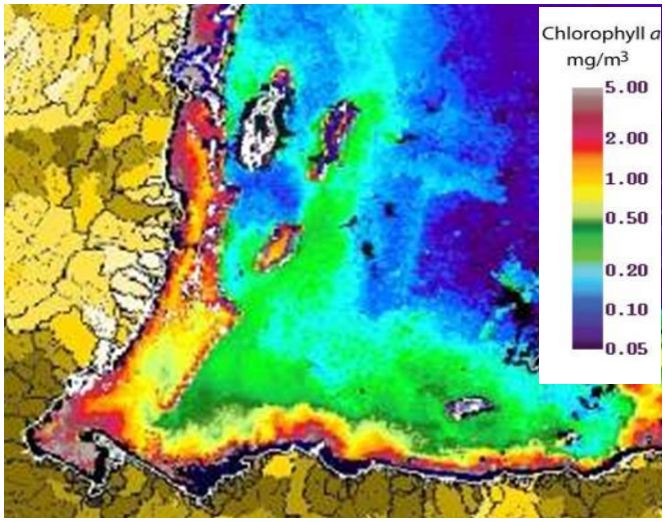


FIGURE 19: SEAWIFS CHLOROPHYLL A. AFTER SHANK ET AL. 2010/ SOTO ET AL. 2009

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 19; 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).

Salinity varies dependent on the time of year, with lower salinity during the wet season (Figure 20).

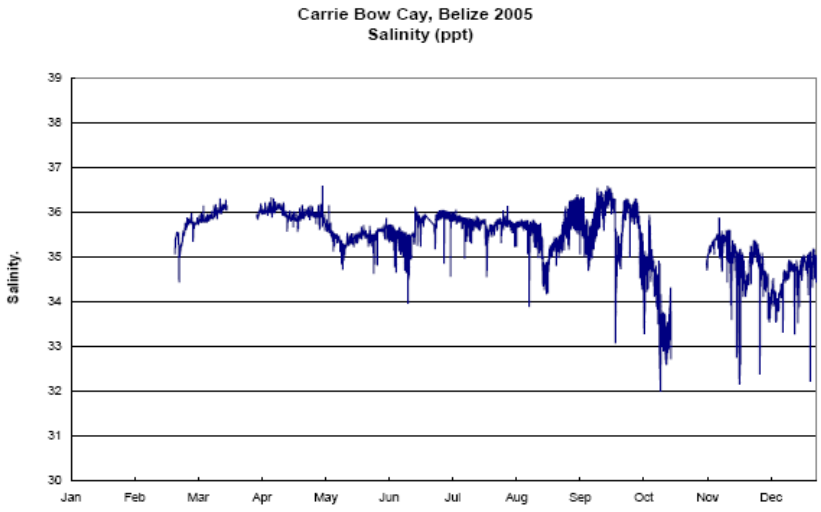


FIGURE 20: ANNUAL SALINITY PATTERNS AT CARRIE BOW CAYE (http://cbc.riocean.com)

1.5. Biodiversity of Management Area

A significant amount of biological information about South Water Caye Marine Reserve has been accumulated since the establishment of the Smithsonian Institute Field Station at Carrie Bow Caye in 1972. With over 900 scientific papers published on the biodiversity of the area, this section can only touch on the information available. Much of the following has been adapted from the previous draft Management Plan (Jones, 2003), from Koltes *et. al*. (1998), from Atoll Bulletins over the years, and from Caribbean Coral Reef Ecosystem reports (1996 - 1998, 2002, 2003, 2005, 2007 – 2008) which have provided in-depth descriptions of the marine protected area. A full list of reports is presented in Annex 5.

1.5.1 Ecosystems

National ecosystem mapping gives a broad overview of the ecosystems to be found in the South Water Caye Marine Reserve (Meerman, 2004) – the area is highlighted as one of the most biodiverse within the Mesoamerican Barrier Reef, an ecoregion that is, itself, recognized for its biodiversity and representational values, which are considered outstanding on a global scale, leading to recommendations for this to be recognized as a priority area for conservation (Olson & Dinerstein, 1998; Roberts, 2001; Kramer and Kramer, 2002).

South Water Caye Marine Reserve encompasses a range of ecosystems stretching from the bathypelagic zone of the open sea to the shallow epipelagic waters of the continental shelf:

Terrestrial	Mangrove Herbaceous Beach Community
Epipelagic	Reef Seagrass Caribbean inner lagoon / Sparse Algae
Mesopelagic / Bathypelagic	Open Sea

Ecosystems of South Water Caye Marine Reserve				
	Meerman (2004)		**Mumby and Harborne (1999)**	
Terrestrial	Mangrove	Coastal Fringe Mangrove		
	Herbaceous Beach Community	Sandy Beaches		
		Littoral Forest		
Epipelagic	Reef	Shallow Coral Reef	Fore Reef	With sparse massive and encrusting corals With dense massive and encrusting corals
		Patch Reef	Patch Reef	Dense patch reef Diffuse patch reef
		Shallow Coral Reef	Other Reef	Reef crest Low relief spur and groove
	Seagrass	Seagrass beds	Shallow Lagoon Floor – Seagrass dominated	Sparse seagrass Medium density seagrass Dense seagrass Seagrass with distinct coral patches
	Caribbean inner lagoon / Sparse Algae	Fleshy brown Algae / Gorgonians	Algal dominated	Fleshy brown Algae and sparse Gorgonians
		Sparse Algae / sand		Green algae *Lobophora* *Euchmea* and *Amphiroa* Bedrock / rubble and dense gorgonians Bedrock / rubble and sparse gorgonians
			Bare substratum dominated	Rubble and sparse algae Sand with sparse algae Mud / bedrock
Mesopelagic / Bathypelagic	Open Sea	Caribbean Open Sea	Caribbean Open Sea	Bathyal Mesopelagic

TABLE 11: ECOSYSTEMS OF SOUTH WATER CAYE MARINE RESERVE

Mesopelagic / Bathypelagic Zone (200m to 2000m)

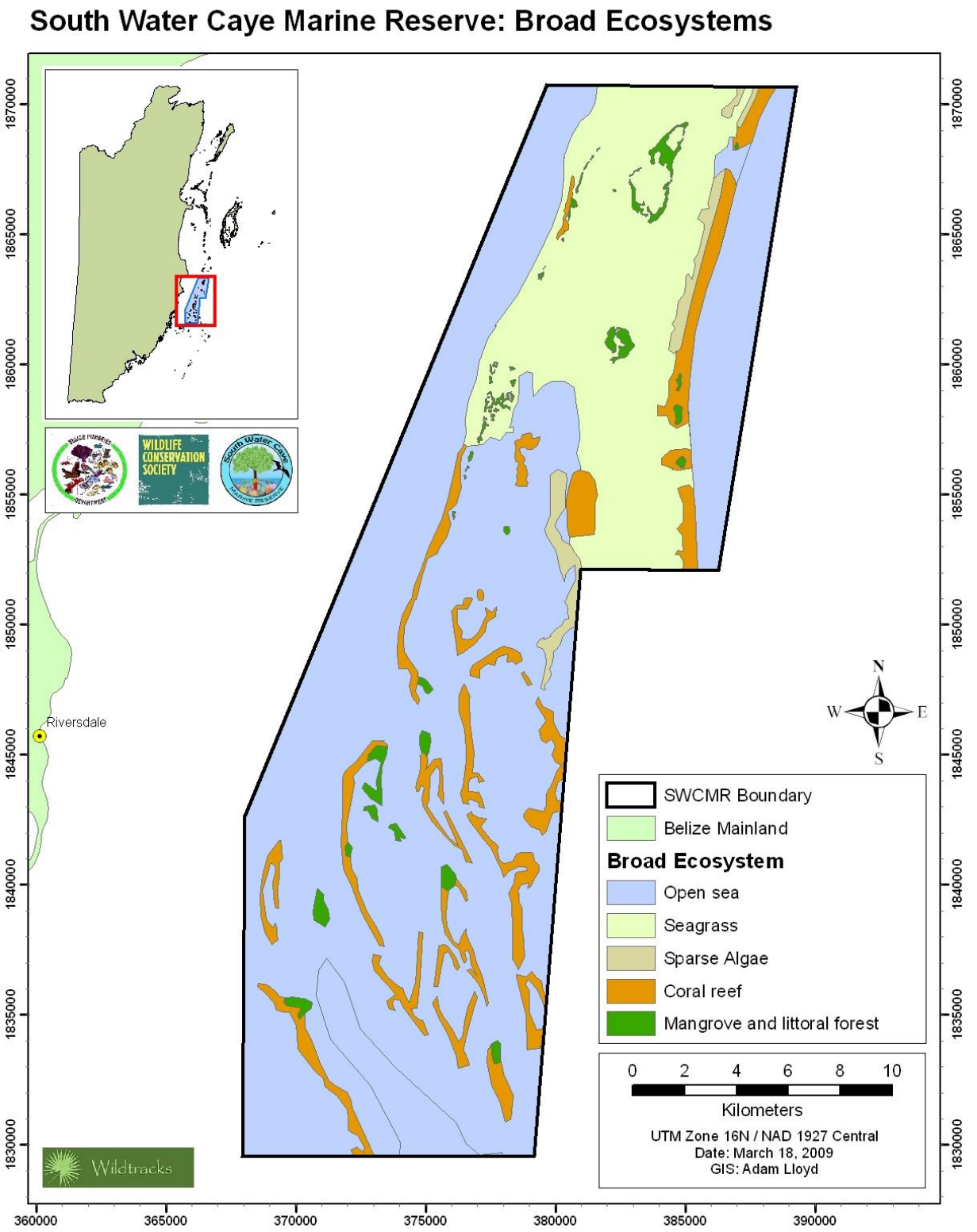
The Mesopelagic and Bathypelagic Zones include the deeper waters to the east of the barrier reef. The mesopelagic zone extends from a depth of 200m downwards, merging into the bathypelagic zone (which begins at the edge of the continental slope and extends beyond into the deeper water). Whilst little is known of the marine life that exists here, whale sharks and other deep-water species are known to travel up and down parallel to the reef, passing inside the eastern boundaries of South Water Caye Marine Reserve.

Epipelagic Zone (0m – 200m)

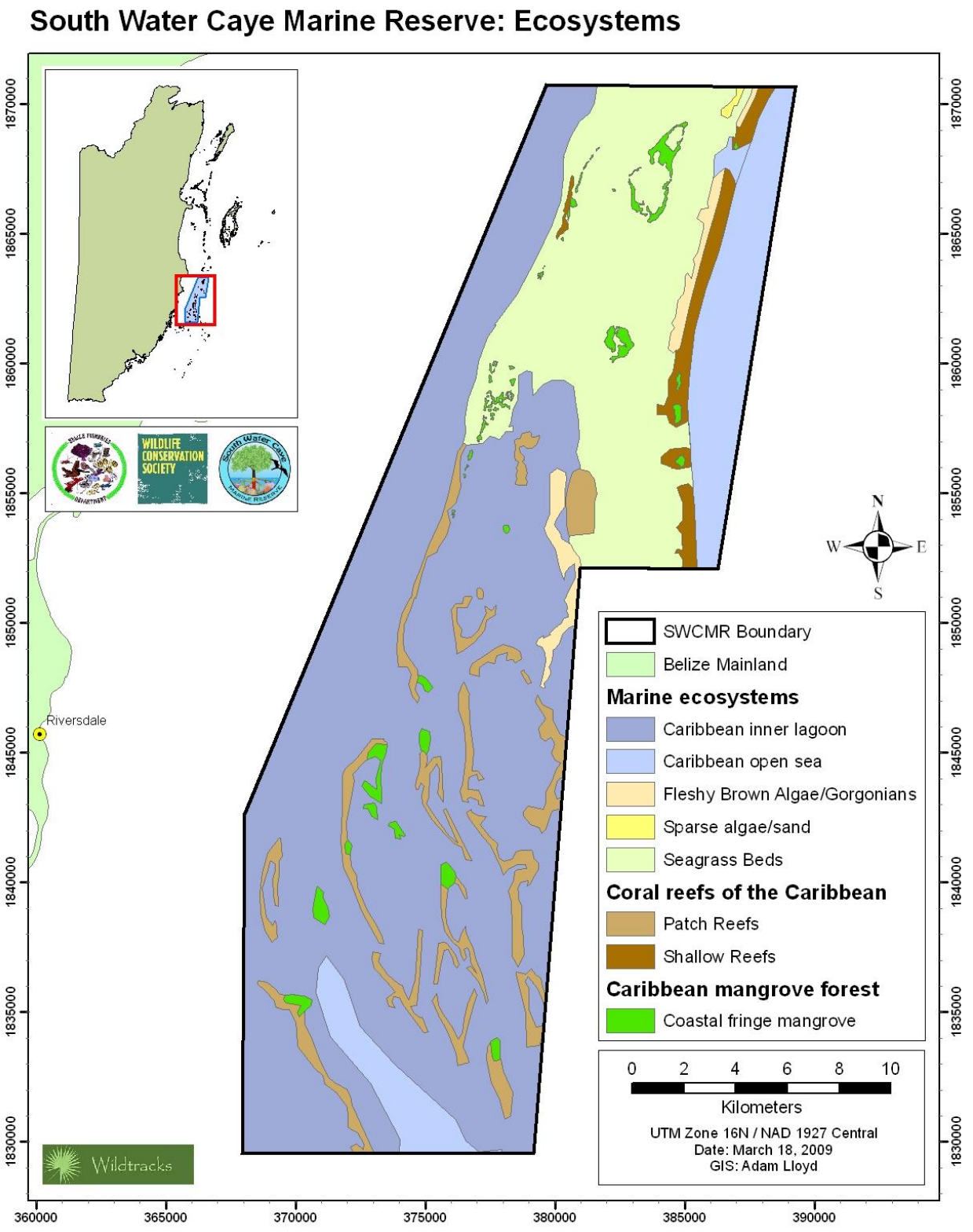
The Epipelagic Zone ranges from 0 to 200m, and includes the shallow waters of the inner lagoon and the deeper waters of the fore reef. Within this zone there are an array of ecosystems that have evolved in response to the degree of exposure and impact of wave action, current direction and intensity, light intensity and light spectra, and are defined by their species composition, formation and substrate characteristics. Six broad ecosystems have been identified and mapped (Maps 5 and 6; Meerman, 2004):

- Fore-reef (upper and lower reef slopes, including spur and grove topography)
- Reef crest and reef flats
- Back reef (with patch reefs)
- Seagrass
- Sparse algae / sand
- Mangrove and littoral forest

The marine components are further categorized by into seven primary categories and twenty-one sub-categories (Mumby and Harborne,1999).



MAP 5: BROAD ECOSYSTEMS OF THE SOUTH WATER CAYE MARINE RESERVE (BASED ON MEERMAN, 2001, REVISED 2004)



MAP 6: ECOSYSTEMS OF THE SOUTH WATER CAYE MARINE RESERVE (BASED ON MEERMAN, 2001, REVISED 2004)

CORAL REEF

The Barrier Reef

Located in the central region of the Belize Barrier Reef, the reef runs northwest to south east and, within South Water Caye Marine Reserve, is considered to be one of the most highly developed examples of barrier reef formation in the Western Hemisphere. The core components, Fore Reef, Reef Crest, and Back Reef are all present.

Fore-reef

The fore-reef lies on the outer side of the reef crest, facing the open sea, and includes the upper and lower reef slopes. The upper fore reef begins at the outer edge of the reef crest, and extends out to a depth of 14-22m. This zone is characterized by impressive spur and groove formations, with many theories to explain how these formations have evolved, including differential erosion, differential growth of corals, a combination of these actions, or as features resulting from underlying karst morphology. The fore reef is a major tourism resource, attracting divers from all parts of the world to Belize.

UPPER SLOPE SPUR AND GROOVE FORMATIONS
2009 © TOBACCO CAYE MARINE STATION: IMAGE AND PHOTOGRAPHS BY MATTHEW JASINSKI & MICHELLE SMITH

The tops of these spurs are carpeted with a variety of corals and other invertebrates, with the large surface area provided by the canyon sides and currents that pass through the 'grooves' (or surge channels) providing ideal living conditions for a multitude of marine organisms. The strong currents that occur in the deep grooves sweep the floor of fine sediments, the grooves providing the most obvious pathways for sediment movement into the deep water to the east.

One hundred meters seaward of the reef crest the water drops to between 50 and 100m – the lower reef slope. Here, coral diversity and density decreases in correlation with decreasing light intensity.

Moving southward, the inner reef spur-and-groove and the outer fore reef (characterized by a sand trough and coral ridge) gradually disappear.

Reef Crest and Reef Flats

The reef crest and reef flats lie behind the fore-reef, and are considered typical of high energy surf zones around the Caribbean. Coral species inhabiting these areas are hardy enough to be able to withstand the breaking waves, constant strong current, exposure at low tide, and high light intensity.

In much of the South Water Caye Marine Reserve, the reef crest forms a relatively unbroken barrier, protecting the back reef waters to the west. This protective formation, however, can be exacerbated at times by the piling of coral rubble in this zone by tropical storm and hurricane events, preventing the cooler oceanic waters from entering the back reef and lagoon. With much of the rubble being bio-cemented together to form an impenetrable barrier, this is currently causing concern for traditional fishermen, who correlate the decreasing coral health of the back reef north of Tobacco Caye with increasing water temperatures, following restrictions of water movement with the deposition of rubble on the reef crest by recent hurricane events.

Concerns have also been expressed over the tourism impacts caused by sport fishermen and others walking in the shallow waters of the reef crest, particularly in the vicinity of Tobacco Caye, with the recommendation by some stakeholders that this is not considered a good practice, and should not be allowed.

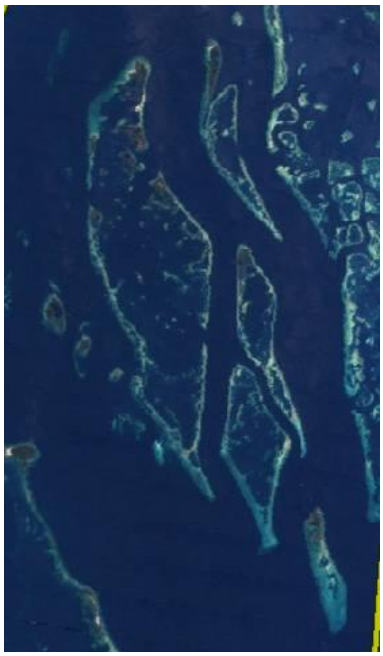
Back Reef

The Back Reef includes a continuum of habitats from the algae-encrusted coral rubble near the reef crest to the sandy muds of the *Thalassia* meadows and scattered patch reefs, in waters ranging from 0.3 to 6m deep, and sheltered by the presence of the barrier reef. This is intersected in the south by deeper channels, such as the Victoria Channel, which drop to depths of 40m or more.

The sheltered waters promote the growth of spectacular coral formations and impressive sponges, with numerous patch reefs varying in size and orientation, interspersed among the seagrass meadows of the back reef. They rise from different depths off the southern platform, with crests at varying depths below sea level. A distinct lateral zonation of corals from the windward to the leeward margins of these reefs has been identified, the windward margins generally supporting a higher diversity of marine organisms, and typically include such hardy corals as elkhorn coral (*Acropora palmate*) and boulder star coral (*Orbicella annularis*). The more sheltered leeward margins support less robust corals such as staghorn coral (*Acropora cervicornis*) and *Porites spp*. (Jones, 2003).

Rhomboid Reefs of the Pelican Cayes Area

In the Pelican Cayes area lie a series of unique faro formations - unusual ring-shaped rhomboid reefs formed by differential coral accumulation on the underlying polygonal limestone karst features (Map 10).



FAROS - RHOMBOID REEFS OF SOUTH WATER CAYE MARINE RESERVE (NASA)

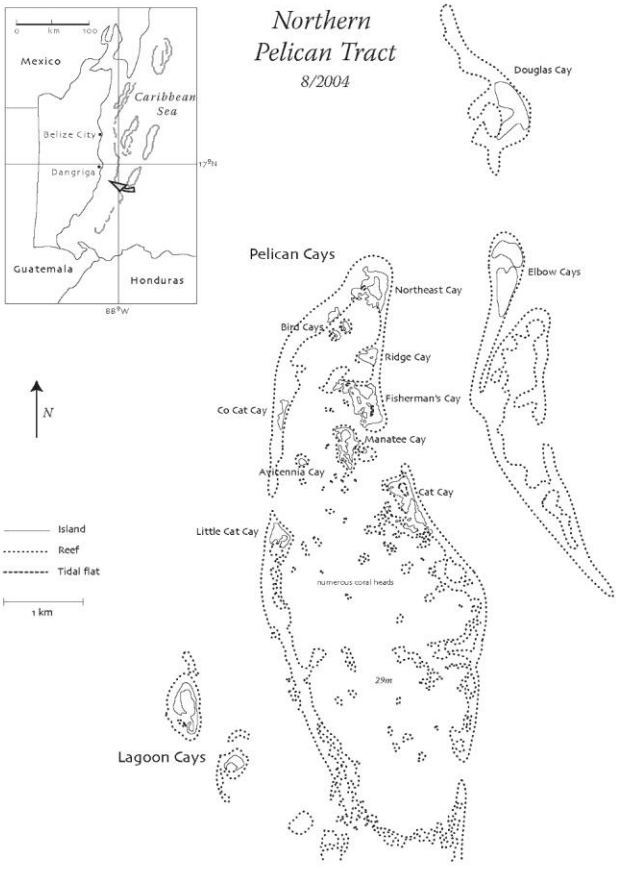
Species richness and live surface cover of the Pelican Cayes are unparalleled in the Caribbean - layers of brilliantly colored organisms including sponges, ascidians, seaweeds, and corals cover reef, mangrove root and peat substrates. The cause of this high diversity in such a small geographic area is not well understood, but may be attributed to the unique juxtaposition of mangrove, coral, sea grass, and algal biomes under stable oligotrophic conditions (Jones, 2003).

These reefs enclose ponds that are striking in their roundness, and support cayes with some of the richest mangrove ecosystems known in the Caribbean. The Pelican Cayes ponds have a number of characteristics in common, with each having at least one opening to the surrounding seas, restricted to various degrees by coral ridges, and originally formed from *Acropora cervicornis*. Each is surrounded in part by mangrove forests composed of red mangroves and sporadic stands of black mangrove, which have formed an underlying peat substrate, usually eroded around the perimeter of the ponds and undercut to expose some of the root system of the forest above. Bank roots, hanging roots, the back rim base, and the exposed peat bank provide substrates for sessile organisms, supporting flourishing communities of sponges, ascidians, algae, corals, and other organisms (MacIntyre et al. 2000). The limited presence of the ephemeral sheet-like and filamentous green algae indicative of eutrophic bird cayes or polluted systems (Jones, 2003) confirms the pristine nature of this area.

Fine organic sediments derived from the adjacent mangrove forest floor lie at the base of most pond rims, and are easily disturbed by any movement of the water, resulting in a cloud of suspended material that eventually settles on sessile organisms on the mangrove roots or the peat bank, (MacIntyre et al. 2000), in an ecosystem particularly sensitive to any external impacts. Mangrove clearance, dredging and other increasing human impacts have been affecting these unique ecosystems, with 30% of the mangroves of the Pelican Cayes having been cleared for caye development by April 2007 (McField, 2007), causing extensive erosion and sedimentation.

MANATEE CAYE (PELICAN CAYES) – SOUTH WATER CAYE MARINE RESERVE (M. MCFIELD)

As with many of the reefs of the Western Caribbean, the reef communities of the Pelican Cayes area have suffered a drastic change in composition since 1986, when White Band Disease destroyed the original staghorn coral (*Acropora cervicornis*) (CCRE Report 1996-98). Throughout much of Belize, populations of this species have declined by up to 98% as a result of this disease, compounded locally by hurricanes, increased sedimentation and predation, bleaching, and other factors. Lettuce coral (*Agaricia tenuifolia*) took its place, but was itself badly affected by the bleaching event of 1998, which affected 100% of the population, with virtually all other coral species in the Pelican Cayes area also showing symptoms of coral bleaching to differing degrees. Following several months of prolonged bleaching resulting from elevated sea temperatures and increased UV light, almost all the *A. tenuifolia* was dead (Aronson *et. al.*, 2000; CCRE 2002). Following this mortality, coral recruitment at Channel and Cat Cayes was depressed for more than two years. Persistently high densities of the sea urchin *Echinometra viridis* have kept the cover of fleshy and filamentous algae to low levels, but the cover of the encrusting sponge *Chondrilla cf. nucula* has been increasing - from 14% to 43% between October 1998 and March 2001 (Aronson *et. al.* 2000; Jones, 2003).



MAP 7: THE PELICAN CAYES (HTTP://CBC.RIOCEAN.COM, ACCESSED 2009)

Reef Health

Regional Reef Health: Reef health across the region has experienced a massive decline over the last five decades. From having a vibrant reef with a mean percentage coral reef cover of 38.9% before 1984 (and some areas as high as 70% live cover in some fore reef areas before the decline of *Acropora cervicornis*) (GCRMN, 2012), the regional average is now 16 to 18% live coral cover (HRI, 2015). 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). 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). Reef health in 2015 was rated as Poor, with a Reef Health Index (RHI) score of 2.5 out of a possible 5.0.

The Belize Barrier Reef experienced mass coral bleaching for the first time in 1995 (McField, 1999; McField et al., 2007), affecting hard corals throughout Belize (including South Water Caye Marine Reserve), impacting *Orbicella annularis, Agaricia agaricites, Agaricia tenuifolia, Madracis* spp., and *Porites porites* (McField, 2000). Extensive bleaching of *Agaricia lamarcki*, *A. grahamae*, *Siderastrea siderea*, and *Diploria labyrinthiformis* was also reported. In South Water Caye Marine Reserve, this bleaching event was observed on CARICOMP transects in August of that year. By October, up to 90% of *O. annularis* colonies were bleached, particularly those on the shallow forereef in less than 10m water depth, where water temperature is highest. This resulted in the eventual loss of 50% of mound and boulder corals (including *O. annularis*). Recovery after this initial bleaching episode was considered to be good. Based on an analysis of reef cores, this is the first mass coral mortality in the central lagoon in at least the last 3,000 years (Aronson et al., 2002).

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

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 12; Anthony et al., 2008). In 2006, regional coral coverage was reported at 10%, but has improved since then. In the last five years,

regional coral cover has stabilized at approximately 16-18% (HRI, 2015). Whilst this is encouraging, the parallel increases in fleshy macroalgal cover, the limited *Diadema* urchin recovery, continued fishing pressure on parrotfish, and poor water quality are thought to be limiting coral recovery (HRI, 2015).

Event	Year	Scale of Event
Hurricane Earl	2016	Mechanical damage to corals, reduced water clarity
Coral bleaching event	2015	Significant bleaching
Phytoplankton bloom	2011	Southern and central Belize coastal waters
Ban on fishing for herbivorous fish	2009	
Earthquake	2009	Catastrophic slope failure in 50% of surveyed reef sites in SWCMR
Lionfish first reported in Belize	2008	Impacting juvenile reef fish
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 12: EVENTS AFFECTING THE BELIZE REEF

Reef Health in SWCMR: Four RHI survey sites are in South Water Caye Marine Reserve, with an overall 2015 rating of POOR (two sites rated as FAIR, one as POOR and one as CRITICAL, based on relative levels of coral reef cover, fleshy macroalgal cover, commercial fish species and herbivorous fish species. No site rated as VERY GOOD for any of these four indicators. (Figure 21; Table 13; Healthy Reefs, 2015).

Live Coral Cover (%) is indicative of healthy reef, and ranged from GOOD (1 site; 20.0 – 39.9%) to FAIR (2 sites; 10 – 19.9%) to POOR (1 site; 5.00 – 9.99). No sites rated as either VERY GOOD or CRITICAL.

Fleshy Macroalgae Cover (%) As fleshy macroalgae compete for space on the reef with coral, the higher the cover of algae, the poorer the health of the reef. Sites ranged from GOOD (1 site; 1.0 – 5.0) to POOR (1 site; 12.1 – 25), with two sites rating as FAIR (5.1 – 12.0). No sites rated as either VERY GOOD, or CRITICAL.

Commercial Fish (g/100m^2): The 2015 average for SWCMR was rated as POOR. One site rated as GOOD (1,260 – 1,679 g/100m^2), one as POOR (420 – 839 g/100m^2), and two as CRITICAL (<420 g/100m^2).

FIGURE 21: REEF HEALTH INDEX SITES, SWCMR, 2014 (HEALTHY REEFS, 2015)

Herbivorous Fish (g/100m^2): As herbivorous fish are important in keeping the reef recruitment sites clean of macroalgae, a healthy reef needs herbivorous species. The average rating for SWCMR was FAIR, with three sites rated as POOR (960 – 1,919 g/100m^2) and one as CRITICAL (<960 g/100m^2). No site rated as VERY GOOD, GOOD or FAIR.

Site	Coral Cover	Fleshy Macroalgae	Commercial Fish	Herbivorous Fish	Overall RHI
Site One	Good	Poor	Critical	Poor	**POOR**
Site Two	Fair	Good	Poor	Poor	**FAIR**
Site Three	Fair	Fair	Good	Poor	**FAIR**
Site Four	Poor	Poor	Critical	Critical	**CRITICAL**
National Average	Fair	Poor	Poor	Fair	**POOR**

TABLE 13: 2014 HEALTHY REEFS SURVEY OUTPUTS FOR SWCMR (HEALTHY REEFS, 2015)

A more recent survey in 2017 focused on the four Fisheries Department sites (two back reef and two fore reef sites in the Tobacco Caye and South Water Caye areas). This identified the reef adjacent to Tobacco Caye as relatively healthly, with both the Fore Reef and the Back Reef demonstrating good live coral cover (24.2% and 28.5% respectively), with very minimal disease. The second sites, near South Water Caye, whilst lower, are still above or near the national average (SWFR: 18.5% and SWBR: 16.3%) (Table 14; Projects Abroad, 2017).

Despite the relatively high coral cover on the Tobacco Caye Fore Reef, however, the overall SIRHI rating was Poor, with no *Diadema* presence and very low commercial species biomass (362.5g/100m^2). The Tobacco Caye Back Reef, however, rated significantly higher (Very Good) for commercial species biomass (2,950.3g/100m^2). Herbivorous fish biomass was also higher, and Diadema density was Fair, at 0.85/m^2.

	SITE			
	TCFR	**TCBR**	**SWFR**	**SWBR**
Live Coral Cover (%)	Good	Good	Fair	Fair
Macro Algal Cover (%)	Poor	Fair	Poor	Poor
Diadema (m^2)	Critical	Fair	Critical	Poor
Disease prevalence	Fair	Very Good	Critical	Very Good
Herbivores (g/100m^2)	Poor	Good	Poor	Critical
Commercial Species (g/100m^2)	Critical	Very Good	Critical	Fair
	2.2	3.7	1.7	2.7
Site Rating	**POOR**	**GOOD**	**CRITICAL**	**FAIR**

TABLE 14: SIRHI RATINGS FOR SWCMR (PROJECTS ABROAD, 2017)

The history of change in South Water Caye Marine Reserve is similar to other reef in the region. It has experienced the same large-scale threats, including hurricanes, loss of herbivorous urchins and parrotfish, unsustainable fishing, coral disease and mass coral bleaching triggered by prolonged high sea surface temperatures, as well as more localized earthquake damage. All of these impacts have contributed towards the extensive loss of key reef-building *Acropora* species, as well as *Agaricia, Millepora, Diploria spp.* and *Orbicella spp* (Kramer et al., 2001).

Baseline studies from the 1980's at Channel Caye and other rhomboid shoals demonstrated a reef dominated by *Acropora cervicornis* in waters between 3 and 15m deep, with a percentage coral cover of over 70% in some places. Subdominant species included *Agaricia tenuifolia* and other species of lettuce coral of the family, which dominated the reef community below 15m (Aronson et al., 2002). White band disease resulted in the collapse of the *A. cervicornis* population, and its replacement by the fast growing *Agaricia tenuifolia* and similar lettuce coral species, which reached a coral cover of 56% at Channel Caye and up to 85% at Cat Caye by the mid 1990's. The combined cover of other coral species remained low – below 9% from 1986 to 1998.

Surveys of the forereef in December 1995 showed that bleaching was still widespread, varying with species and water depth / temperature. Heavily affected species included *Orbicella annularis, Agaricia lamarcki*, *A. grahamae*, *Siderastrea siderea*, and *Diploria labyrinthiformis*. Recovery after this initial bleaching episode was considered to be good. This transition from *Acropora* to *Agaricia* occurred throughout the central and southern shelf lagoon in the 3- to 15-m depth range.

In 1998, sea temperatures rose again to cause complete bleaching of *Agaricia tenuifolia* and many of the other large coral species, with more or less 100% mortality of *A. tenuifolia* between October 1998 and January 1999, and total cover of living hard corals dropping to nearly 0% (Aronsen et al., 2002). These structural corals were 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, and their loss results in reduced resistance to climate change impacts such as increased storm intensity and increased sea level rise. By May 1999, the majority of *Diploria spp*. and *Siderastrea siderea* were reported to have recovered. However, *O. annularis* still showed widespread bleaching, with nearly 50% of the surveyed colonies still bleached 9 months after the warming event. The percentage of coral colonies showing signs of disease tripled during the same time interval, thought to be related to the stress of bleaching.

During this period, there was also a rapid increase in crustose coralline algae and a moderate increase in sponges which became the dominant benthic communities. Crustose coralline algae cover fell to pre-bleaching levels by 2001, though sponge cover remained high, and increased from 25% to 43%, with the encrusting *Chondrilla nucula* as the dominant species.

During 1998, the same year as the catastrophic coral bleaching episode, Hurricane Mitch, one of the most powerful hurricanes on record within the Atlantic Basin, had a significant physical impact on the reef of the Marine Reserve, especially on the shallow coral spurs. Producing waves of 5-6m high, major hurricane storms cause physical damage - coral breakage and rolling of large boulder corals, whilst the heavy rains add to sediment run off from the main land and cleared cayes. Although these negative effects resulted from the impacts of Hurricane Mitch, the hurricane also lessened the impact of previous coral bleaching through cooling the shallow waters, with the mixing of the warm shallow waters with the cooler deep waters. Hurricane Mitch was followed by Hurricane Iris in 2001, which impacted some of the southern areas of SWCMR, in the region of the rhomboid reefs. This southern area was also impacted by significant earthquake damage in 2009.

Tourism and fishing have also had their effect on the health of the reef. In the past 17 – 25 years the health of the reef has severely degraded, with indigenous corals being over grown by invasive species such as blue- green algae, brown algae and sponges. Fishing of the herbivorous fish species – particularly the parrotfish, reduced the reef's natural ability to maintain algal growth within acceptable levels. Seasonal out-breaks of Black Band disease (first discovered in the South Water Caye Marine Reserve area (Antonius, 1973), caused by blue green algae, have also contributed to the complete degradation of a number of reef species within South Water Caye Marine Reserve, along with impacts from other diseases.

Most recently, in 2017, a prolonged period of high water temperatures exceeding 32˚C led to another widespread bleaching episode, with SWCMR forereef sites surveyed in November 2017 demonstrating differing levels of bleaching, with the percentage of corals affected ranging from 27.4% to 58.2%. The percentage reported as partially / wholly bleached ranged from 18.9% to 42.3% (Cawich, pers. com.). Surveys associated with the Fragments of Hope programme reported a similar pattern of bleaching on shallow reef, with 46% bleaching in mid-October, dropping to 23% at the start of December, with some partial mortality (FoH, 2017).

Fragments of Hope has been contracted through the MCCAP project to outplant more resistant elkhorn and pillar coral fragments in key areas of SWCMR, to strengthen reef resilience in the Marine Reserve. The coral fragments planted out on the reef show greater resilence to the increasing water temperatures, improving the resistance of corals to bleaching as water temperatured increase.

FRAGMENTS OF HOPE OUTPLANTS IN SWCMR (FoH, 2018)

Sponges, too, have been impacted by drastic mortality events between June 2006 and July 2012. In late summer 2011, a dense phytoplankton bloom on the southern portions of the Belize Barrier Reef in August 2011 was thought to have caused an extreme sponge mortality event. 30% of the sponge biomass had been lost between 2010 and 2011, and a loss of 70% of the sponge biomass four months later (Wulff, 2013). This has resulted in changes in community structure, with some species being affected more than others. This is also considered to be equivalent to 70% loss of water filtration (Wulff, 2013) - a critical function for removing contaminants from the water and maintaining the water clarity required for a healthy reef.

Resilience Characteristics of SWCMR corals

- Channels through reef barrier with strong flow and water exchange
- Deep water channels within reef lagoon bring cooler water
- Reef relief and environmental gradient - fore reef, reef crest, back reef and lagoon with reef patches – increasing potential for coral tolerance to different temperature regimes

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 results 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).

All these shifts – in fish populations, in coral species dominance, algal growth and water parameters - lead to concerns for the future viability of the coral reef ecosystem, from a biodiversity point of view, as an economically important fishing and tourism resource in Belize and as a protective barrier to increasingly intense tropical storm events.

The shallow waters of the back reef of South Water Caye Marine Reserve are demonstrating increasing stress from increasing water temperature, with conch die-off. The well-structured barrier reef prevents exchange of water with the cooler fore reef, though there are some resilience characteristics in the presence of channels through the barrier reef, and in the deep water channels within the reef lagoon.

Seagrass

Much of the reef platform north of Wee Wee Caye is shallow (<6.5m in depth), with a soft bottom supporting extensive meadows of seagrass. These seagrass meadows stretch from the Barrier Reef westwards across the back reef, interspersed with rubble, patch reefs, and large sponges (Rützler and Macintyre, 1982). Three species of seagrass have been identified to date within the seagrass ecosystem of South Water Caye Marine Reserve, though two are predominant: turtle grass (*Thalassia testudinum*), interspersed with sparse strands of manatee grass (*Syringodium filiforme*)), along with algae such as *Halimeda* spp, also considered important components of this ecosystem, and distributed throughout the seagrass beds. The extensive seagrass bed cover 14.2% of the protected area – an estimated 6,739 hectares. The majority of this (71.9%) is classified as ≥ 50% cover (Figure 22; Table 15; Balhorn et al. / MARFund, 2016).

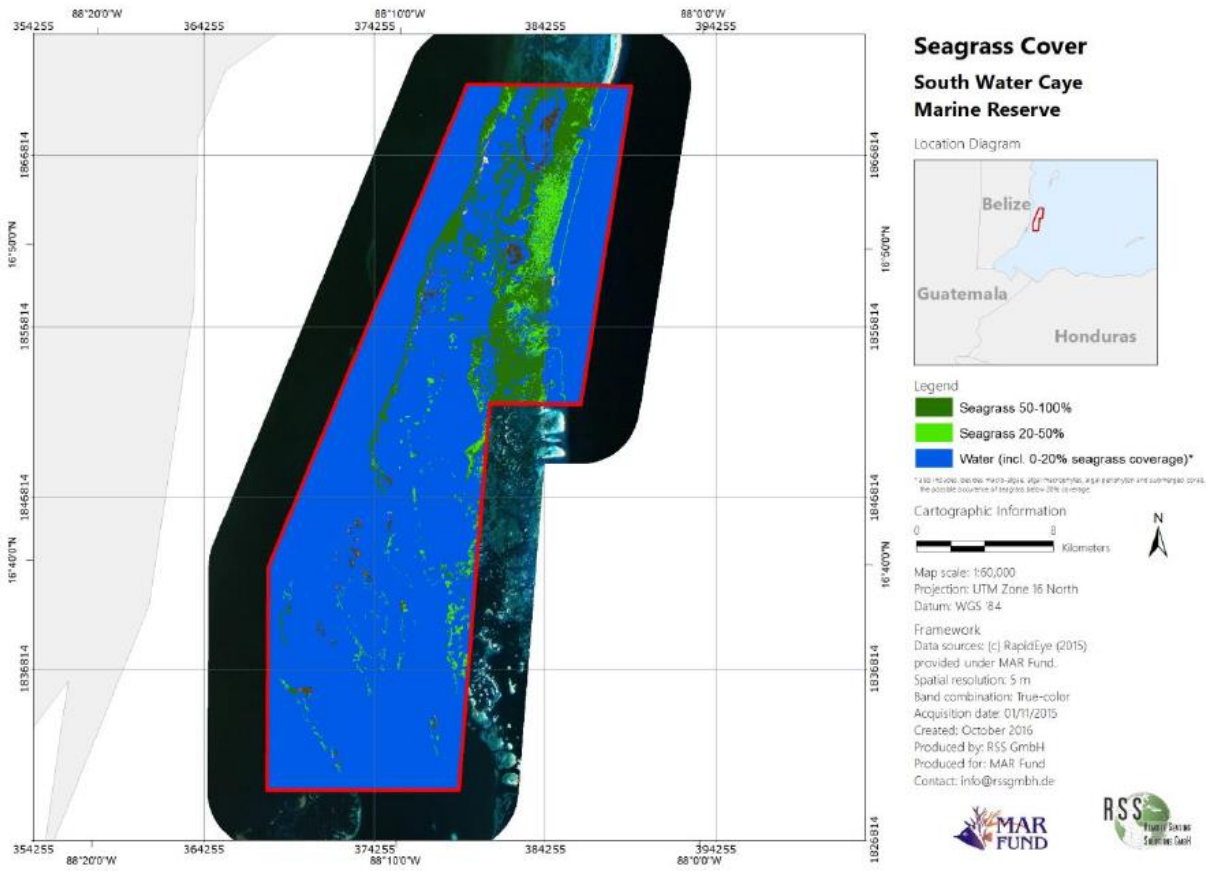


FIGURE 22: SEAGRASS COVER IN SOUTH WATER CAYE MARINE RESERVE (BALHORN ET AL. / MARFUND, 2016)

Ecological Class	Area (ha)	% of total segrass cover in SWCMR	% of total SWCMR (47,703 ha)
50 – 100% Seagrass	4,848	71.9	10.2
0 – 50% Seagrass	1,892	28.1	4.0
Total	**6,739**	**100**	**14.2**

TABLE 15: SPATIAL EXTENT OF SEAGRASS OF SOUTH WATER CAYE MARINE RESERVE (BALHORN ET AL. / MARFUND, 2016)

Seagrass meadows are essential for maintaining the ecological health of the shallow marine ecosystems, with an important role in nutrient cycling, filtration and sediment stabilization. Seagrass is also a critical ecosystem for many fish and invertebrate species - an acre of seagrass has been shown to support up to 40,000 fish and 50 million small invertebrates (Seagrass Ecosystems Research Laboratory, 2005). The highest richness and diversity within South Water Caye Marine Reserve has been identified in the Carrie Bow Caye area, whilst the beds near the Pelican Cayes have been shown to be less biodiverse (CCRE,

2002). The long-term, Caribbean Coastal Marine Productivity (CARICOMP) program (1993–2007) included two sites established in SWCMR under the Smithsonian. Of 52 sites across the Caribbean, the highest total (above- and below-ground) biomass of *T. testudinum* was registered at Twin Cayes (1960 g dry m^{-2} (van Tussenbroek et al., 2014). Despite this, both sites were reported to have been subjected to loss of water clarity due to increased input of sediments and nutrients from coastal development and agriculture. T. testudinum shoot density has declined at the Twin Cays over the sampling period, possibly due to increased sedimentation. The Carrie Bow Cay monitoring site was scoured by Hurricane Mitch (1998) but was recovering (van Tussenbroek et al., 2014).

These seagrass beds fill a critical role as a nursery area for the commercially important conch, many reef fish (including commercial species such as tarpon, hogfish, yellowtail snapper and great barracuda), and for the key herbivore guild species assemblages - the parrotfish. The seagrass beds also provide corridors for juvenile lobsters between habitats and, close to cuts in the Barrier Reef, important settlement areas for post-larval stages of commercial species (Acosta, 2001). Epiphytic coralline algae and foraminifera form heavy encrustations of the *Thalassia* blades (Koltes *et. al.,* 1998; Young and Young, 1982), though where there is heavy nutrient loading (such as the natural eutrophication in the waters around Man O' War Caye, or in human impacted areas adjacent to poorly designed caye developments), the diversity and density of epiphytic formanifera has been shown to be higher, with suggestions that this may form a useful indicator for reduced water quality (Richardson, 2006).

Whilst generally considered in good condition, the seagrass beds are crisscrossed by a series of uncolonized sand holes from seismic surveys for petroleum exploration during the 1960s. Recolonization of disturbed areas by *Thalassia* is slow, often taking years (Zieman and Zieman, 1989; Williams, 1988), possibly due to nutrient accumulation in the sediments (Koltes et. al., 1998; Williams, 1990). Scarring of the seagrass beds is also found in areas where dredging has occurred, and in shallow areas of high boat activity. A long term CARICOMP study of seagrass plots in SWCMR demonstrated that more than half (58%) of the seagrass communities showed changes consistent with degradation of the environment during the CARICOMP monitoring period (1994 to 2013). This included decreases in the density of short shoots in response to declines in light levels and/or nutrient enrichment.

Mangroves

An estimated 418 hectares of mangrove cover (0.9% of the total area of SWCMR) was mapped by remote sensing (Figure 23; Table 16; Balhorn et al. / MARFund, 2016). Mangroves occur on both isolated islands and elliptical groups of predominantly inundated islands (ranges) within the Marine Reserve, several hundred meters leeward of the reef crest. The best studied are the Twin Cayes complex which, like the majority of the mangrove communities in the South Water Caye Marine Reserve, are built on a limestone platform (fossil patch reef) that was topographically high during the Late Pleistocene (Koltes *et. al*., 1998, citing Rützler and Feller, 1988; Littler *et al*., 1995; Woodroffe, 1995). Unlike the terrestrially-derived sediments that underlie mangrove forests of the mainland, many of the mangrove forests of South Water Caye Marine Reserve are growing on mangrove-derived peat, which has accumulated to thicknesses of as

much as 10m above the limestone bedrock, during the rising seas during the Holocene period (Koltes *et. al*., 1998, citing Woodroffe, 1995; Macintyre *et al*., 1995).

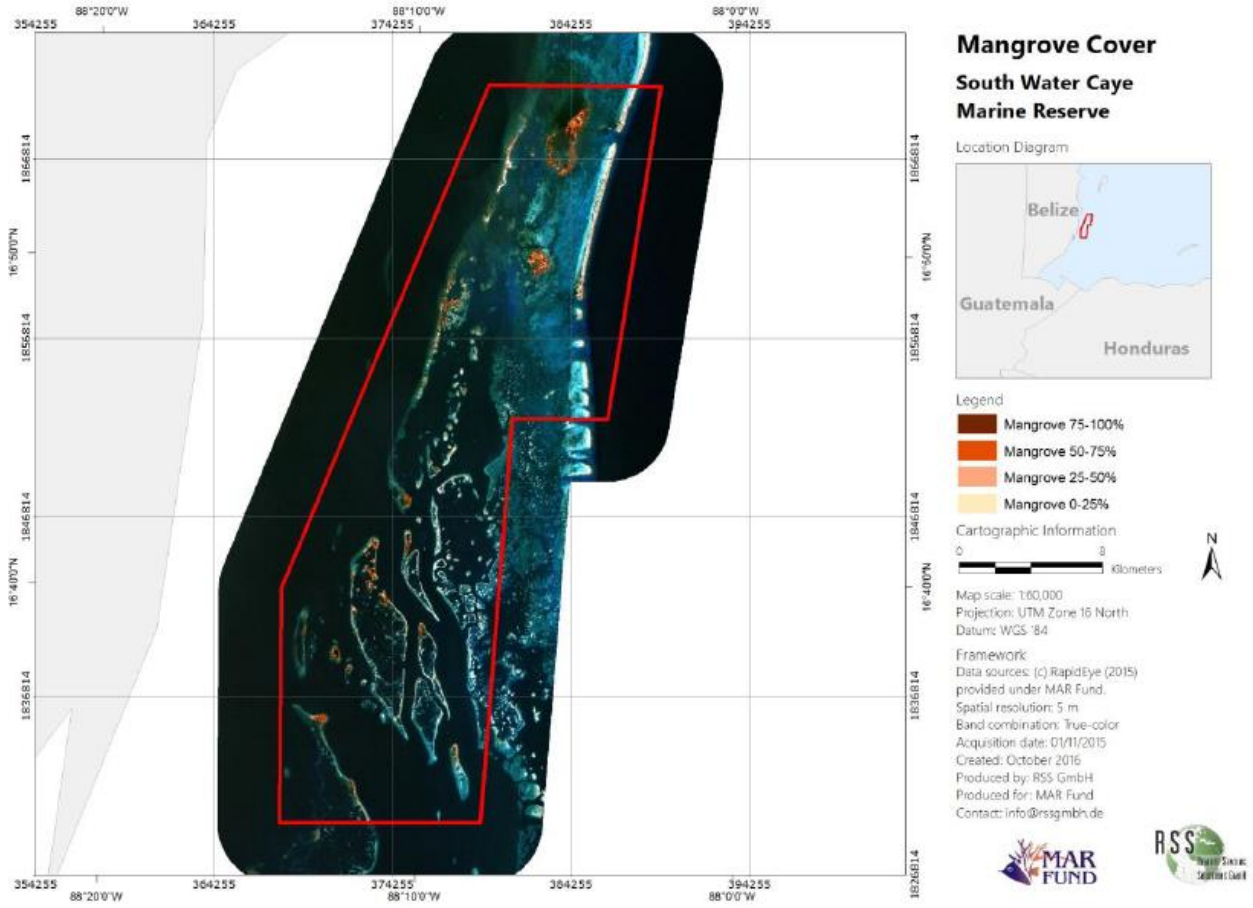


FIGURE 23: MANGROVE COVER IN SOUTH WATER CAYE MARINE RESERVE (BALHORN ET AL. / MARFUND, 2016)

Ecological Class	Area (ha)	% of total mangrove SWCMR cover	% of total SWCMR
75 – 100% Mangrove	155	37.0	0.3
50 – 75% Mangrove	158	37.8	0.3
25 – 50% Mangrove	73	17.5	0.2
0 – 25% Mangrove	32	7.7	0.1
Total	**418**	**100**	**0.9**

TABLE 16: SPATIAL EXTENT OF MANGROVE OF SOUTH WATER CAYE MARINE RESERVE

Red mangrove (*Rhiophora mangle*) is the dominant species, forming a fringe around the periphery of many of the cayes. The caye interiors have extensive stands of black mangroves (*Avicennia germinans*), exposed on the shore in some areas, such as Tobacco Range, as a result of shoreline erosion (Woodroffe, 1995). Scattered individuals of white mangrove (*Laguncularia racemosa*) are also present in the interior areas (Woodroffe, 1995), along with dwarf red mangroves, which dominate the low potassium hypersaline ponded areas found in the center of the cayes. Rodriguez and Feller identified seven different communities within the Twin Cayes (Rodriguez and Feller, 2004):

- *Avicennia germinans* forest
- *Rhizophora mangle* forest
- Mixed Forest
- Agriculture (coconut)
- Water (ponds, algal mats)
- Barren (beach, clear cuts, die back)

Tobacco and Blue Ground Ranges appear to be undergoing disintegration, with extensive unvegetated flats in the interiors and dead mangrove stumps throughout the range, indicating that the pattern of mangrove distribution is changing. It is suggested that shoreline erosion and the anomalous mangrove distribution patterns on Twin Cays, as well as on other nearby mangrove ranges, may be the result of abiotic stresses in the environment, including hurricane damage, reduced tidal flushing, salinity, and soil chemistry, exacerbated by anthropogenic clearance of mangroves (Woodroffe, 1995).

Historically, fishermen used Twin Cays and the Ranges as bases for seasonal fishing camps, for bait collecting, and for storm shelter. Since the early 1980s, local developers have tried repeatedly to establish resorts and vacation homes in the area, and several stands of mangrove have been clear-cut, followed in some cases by land fill, with sediment dredged from the sub-tidal area adjacent to the development site. The majority are later abandoned.

MAP 8: TWIN CAYES, BELIZE 2005 (HTTP://CBC.RIOCEAN.COM, ACCESSED 2009)

The Twin Cays, a 91.5-ha range of two large and four small intertidal islands separated by a 0.5-2.0 m deep, S-shaped navigable channel, lies within the intertidal zone and is overwashed by spring tides. These cayes have been the focus of long-term ecological studies on mangrove communities by Smithsonian Institution scientists and their collaborators at Carrie Bow Cay.

The mangrove ecosystem is fragile, and once clear-cut, it is fundamentally disturbed and has trouble recovering. Clear cut areas can become overrun by saltwort, more tolerant of the hyper-salinity, which crowds out the slower-growing black mangroves, reducing recolonization, and where fringing red mangroves on the edge of the sea are disturbed, currents and tides rapidly erode the peat and leave a bottom that seedlings can't penetrate. Although Belize's regulations regarding mangrove protection should protect the Twin Cayes complex and the other mangrove-dominated cayes from future threats of development, attempts by the Forest Department to enforce these regulations have been only moderately successful. Protection, however, is currently being strengthened the recently revised regulations outlined in the Statutory Instrument. Mangroves contribute directly to soil formation and their elimination removes a major source of material critical in the maintenance of surface elevation in the coastal zone. Clearance of the mangroves will decrease the resilience of these cayes to sea level rise, negatively impacting all organisms that use mangroves for substrate, nursery, refuge, and food (CCRE 1998).

Much of the mangrove clearance is driven by the demand for properties on the cayes, and tourism facilities, with the proposed establishment of resorts and marinas, and increases the susceptibility of the cayes to storm event impacts – particularly erosion and sedimentation of adjacent reef and seagrass areas. Other threats are also increasing, particularly from the rapidly expanding tourism industry, with the dumping of substantial quantities of trash by operators of nearby resorts and sailing yachts.

Boat traffic – both the number of boats and the speed - has increased significantly since the 1980's, primarily with the increasing tourism interest in the area. Wakes created from boats driven at high speed through the Main Channel of the Twin Cayes complex and through the Ranges result in broken mangrove roots and dislodged sessile organisms. Unfortunately, rapidly rising rates of inadequately managed tourism will likely exert increasing pressure on this and other mangrove communities in Belize (Jones, 2003).

Submerged, subtidal mangrove prop roots and mangrove island margins of Twin Cayes (Map 11), Tobacco and Blue Ground Ranges are important habitats for spiny lobster, and also provide structure for many endemic and new species of tunicates and sponges, with as many as 20%-30% of microbes, algae, sponges and worms possibly being currently undiscovered. Microbes and Teredinads (shipworms) native to the Belize mangrove system help cycle nutrients (Rutzler and Feller 1996).

In the Pelican Cayes area, red mangroves are anchored directly on the live coral reef, as opposed to the mangrove peat of the ranges, and on several of the cayes, sheltered, circular ponds are encircled by steep lush coral ridges, with red mangrove roots reaching into the water, providing a structure for colonization by sessile marine organisms. Analysis undertaken to reconstruct the history of the vegetation at Pelican Cayes has revealed a successional sequence ultimately driven by changes in sea level, but with mangrove vegetation clearly playing a major role in soil formation and vertical growth of these islands through root production and decomposition processes (McKee & Faulkner 2000).

1.5.2 Fauna

Invertebrates

South Water Caye Marine Reserve has long been recognized for its rich and diverse fauna. Species richness and live surface cover in the Pelican Cayes, for example, are thought to be unparalleled in the Western Caribbean - layers of brilliantly colored organisms including sponges, ascidians, seaweeds, and corals, cover reef, mangrove root and peat substrates, with ponds sheltered from currents and predators. The extensive barrier reef, with its spur and groove formations, is also known for its high diversity, attracting increasing numbers of tourists each year. With water depths ranging from the shallow reef flats and reef crest to the open sea, and a series of interconnected complex ecosystems - mangrove, seagrass, sand and reef - the Marine Reserve has the heterogeneity for high biodiversity. Five species of coral present within the Marine Reserve are considered to be critically endangered or endangered on the global scale (IUCN, 2018; Table 17).

South Water Caye Marine Reserve Species of international Concern	
Critically Endangered	
Staghorn Coral	*Acropora cervicornis*
Elkhorn Coral	*Acropora palmata*
Endangered	
Fire Coral	*Millipora striata*
Boulder Star Coral	*Orbicella annularis*
Star Coral	*Orbicella faveolata*
Vulnerable	
Lamarck's Sheet coral	*Agarica lamarcki*
Pillar Coral	*Dendrogyra cylindrus*
Elliptical Star Coral	*Dichocoenia stokesii*
Boulder Star Coral	*Orbicella franksi*
Rough Cactus coral	*Mycetophyllia ferox*
	IUCN, 2018

TABLE 17: CORAL SPECIES OF INTERNATIONAL CONCERN

Two areas of the Marine Reserve have been particularly well studied – the Pelican Cayes, and the Carrie Bow Caye / Twin Cayes area. The cause of the high diversity in the Pelican Cayes area is not well understood, but the principal factors are thought to be the abundance of solid substrates (mangrove stilt roots, extended peat banks), low turbidity, and proximity of sponge-rich coral reefs. Such high biodiversity in a small geographic area may also be attributed to the unique juxtaposition of mangrove, coral, sea grass, and algal biomes under stable oligotrophic conditions (Jones, 2003). The topography of deep ponds alternating with steep coral ridges helps contain fine sediments and prevents re-suspension and silting during storms without blocking the water exchange that is necessary for importing nutrients and flushing waste (Rutzler *et al*. 2000).

70 species of Ascidians, of 30 genera have been recorded, including a new endemic – representing 60% of all known Caribbean Ascidian species. Many of these sea squirts occur as solitary individuals, but others live in colonies of varying forms - as bushy clusters, forming cushions, or growing as flat encrusting sheets, primarily inhabiting the mangrove ponds and coral ridges (Goodbody, 2002). 31 species of Bryozoans (Wilson, 2007) have been identified during preliminary surveys of 13 sites around the Pelican Cayes, as well as 52 species of Echinoderm - including 10 species not previously reported from Belizean waters. (Hendler and Pawson, 2000). 7 species of Foraminifera have also been identified - including 2 new species

(Richardson, 2000). The mangrove-fringed ponds in the Pelican Cayes also support an uncommonly diverse population of 147 species of sponge, many large and colorful, and 45% of which are new species or variants (Rutzler et. al, 2000).

One hundred and fifty-two species of marine macrophytes have been identified from the area - 148 species of algae and 4 vascular plants (Littler *et. al.,* 2000; McField, 2007). Of these, 64 are Rhodophytes, 59 Chlorophytes, 16 Phaeophytes, and 9 Cyanophytes; 4 Magnoiaphytes were also present (Littler et al. 2000). Commercially valuable red algal agar-producers (*Gracilaria* and *Hydropuntia*) and carigeenan-producers (*Meristiella*) flourish near the entrances to several of the ponds. An unusual number of macro algal species attained record sizes in these ponds (Littler *et al*. 2000).

The Pelican Cayes area is thought to offer suitable substrates, calm waters, and possibly a refuge from predation for some species that are cryptic on, or completely excluded from, reef habitats (Hendler & Pawson 2002). This area has also been highlighted for the high number of endemic species identified. However, it appears that significant negative changes have occurred in the biodiversity over recent history, as identified for the Ascidian populations at Cat Caye (CCRE, 1998). These changes have accelerated as anthropogenic impacts from mangrove clearance and dredging have increased (McField, 2007).

Fish

Whilst there have been a number of researchers studying the fish of South Water Caye Marine Reserve, much of this is focused on the identification of new species or species-specific complexes and relationships, with little focus on long term monitoring of larger-scale fish populations and the impacts of anthropogenic pressure.

South Water Caye Marine Reserve Species of international Concern	
Critically Endangered	
Goliath Grouper	*Epinephelus itajara*
Endangered	
Social Wrasse	*Halichoeres socialis*
Nassau Grouper	*Epinephelus striatus*
Whale Shark	*Rhincodon typus*
Splendid Toadfish	*Sanopus splendidus*
Great Hammerhead	*Sphyrna mokarran*
Vulnerable	
Gray Triggerfish	*Balistes capriscus*
Dusky Shark	*Carcharhinus obscurus*
Pallid Goby	*Coryphopterus eidolon*
Glass Goby	*Coryphopterus hyalinus*

TABLE 18: FISH SPECIES OF INTERNATIONAL CONCERN (IUCN, 2018)

Of the over 125 species included in the current species list (Annex Six), three are considered to be Critically Endangered or Endangered at global scale, including the critically endangered goliath grouper (*Epinephelus itajara*) and endangered Nassau grouper (*Epinephelus striatus*) (Table 18). Both of these species have been targeted commercially in the past, with the Nassau grouper declining nationally by more than 80% since the late 1970s, attributed primarily to fishing pressure, particularly at the spawning aggregation sites where it is most vulnerable. It is thought that one-third of all known Nassau grouper spawning aggregation sites in

the Caribbean region have disappeared, with estimates that, under present management conditions, Nassau grouper (once the second most commonly caught fish in Belize) will disappear from Belize waters by the year 2013 (Paz and Grimshaw, 2001). Recent amendments to the regulations now impose size regulations, and make it illegal to take Nassau grouper during the peak spawning months - December to March.

The third species, the endangered great hammerhead (*Sphyrna mokarran*) is also still fished within Belize, despite its global status. However, the threatened whale shark (*Rhincodon typus*) is protected under the Fisheries Act, with no fishing, or even touching, permitted. This species is an important tourism resource, especially within the spawning aggregation area of the adjacent Gladden Spit and Silk Cayes Marine Reserve, and has been reported passing through the deeper waters of the outer reef of South Water Caye Marine Reserve. A further eleven shark species have been confirmed as present within the Marine Reserve, with a further four thought to be present but yet to be confirmed (R. Graham, pers. com.).

Shark Species of South Water Caye Marine Reserve	
Documented	
Bull shark	*Carcharhinus leucas*
Blacktip shark	*Carcharhinus limbatus*
Caribbean reef shark	*Carcharhinus perezi*
Tiger shark	*Galeocerdo cuvier*
Lemon Shark	*Negaprion brevirostris*
Great hammerhead	*Sphyrna mokarran*
Caribbean sharpnose shark	*Rhizoprionodon porosus*
Nurse shark	*Ginglymostoma cirratum*
Bonnethead	*Sphyrna tiburo*
Silky shark	*Carcharhinus falciformis*
Blacknose shark	*Carcharhinus acronotus*
Probable but undocumented	
Scalloped hammerhead	*Sphyrna lewini*
Spinner shark	*Carcharhinus brevipinna*
Galapagos shark	*Carcharhinus galapagensis*
Dusky smooth hound	*Mustelus canis insularis*

TABLE 19: SHARK SPECIES OF SOUTH WATER CAYE MARINE RESERVE

Anecdotal reports from fishermen, researchers and tour guides suggest declining populations of key species of fish within South Water Caye Marine Reserve. Quantitative data on fish populations comparing 2002 and 2008 probabilities of encounter support visual observations, indicating a significant decline in populations of larger reef fish such as grouper, snapper, and triggerfish (Mumby, 2009), with a shift in targeted species towards harvesting of the herbivorous Scarids as the other more favored species decline, reducing the numbers and impacts of this important reef-maintaining guild, with a linked increase in algal growth. This was addressed in 2009, with legislative protection for these species.

More recent permanent transects by the Smithsonian Institute stationed at Carrie Bow Caye showed fish populations to be relatively stable from 2010 to 2015. However significant declines were observed in 2016, particularly of Nassau grouper and, to a lesser extent, black grouper. Similar patterns were also reported from Tobacco Caye Marine Station, with declines in reef health and reduced diversity in the patch reefs of the back reef during the same time period.

In 2008, the Belize reef faced new pressures from the arrival of the invasive lionfish. Analysis of gut contents of 51 lionfish in the Pelican Cayes and surrounding areas demonstrated that lionfish were consuming large numbers of juvenile fish and crustacean species - lionfish are voracious predators and are known to consume up to 20 reef fishes in 30 minutes. 46% of the prey items were identified as the social wrasse (*Halichoeres socialis*), a critically endangered species that falls within the preferred size range of lionfish prey as both juveniles and adults (Rocha et al., 2012). Lionfish tournaments are held several times a year to remove this fish from the reef.

Mammals

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

Antillean (or West Indian) manatees (*Trichechus manatus manatus*) use the Tobacco Range and Twin Cayes area, and have been reported from the Pelican Cayes area. The Belize coast is home to the largest population of Antillean manatee in the Caribbean (Morales-Vela *et al*, 2000), with a population estimated at between 700 and 1,000 individuals (NMWG, draft, 2017). Historically the manatee has been hunted for meat, with bone middens discovered on archaeological sites, and in the 17th century, it was taken to provide food for privateers and explorers (Self-Sullivan and LaCommare, 2004). Today, the Antillean manatee is considered threatened throughout its range, and this sub-species is listed as 'Endangered' (IUCN, 2018, Table 20).

South Water Caye Marine Reserve Mammal Species of international Concern	
Endangered	
Antillean Manatee	*Trichechus manatus*
Vulnerable	
Sperm Whale	*Physeter macrocephalus*
	IUCN, 2018

TABLE 20: MAMMAL SPECIES OF INTERNATIONAL CONCERN (IUCN, 2018)

Birds

64 species of birds have been reported from the Marine Reserve (Mitten et. al, 2004, Balderamos, pers. com. 2009, E-bird, 2018). Brown pelicans (*Pelecanus occidentalis*) and a number of egret species are reported to nest in great numbers on the southern cayes of Blue Ground Range, and osprey (*Pandion haliaetus*) have been recorded nesting on Carrie Bow and Tobacco Cayes and on Tobacco Range. A single record of scarlet ibis (*Eudocimus ruber*) exists for Wee Wee Caye (BERDS, 2009) – this species has only been recorded in Belize three times, and is considered an 'accidental' transient (Jones, 2003).

Man O' War Caye, a mangrove caye designated as a bird sanctuary in its own right, is considered one of the ten largest nesting sites for magnificent frigatebird (*Fregata magnificens*) in the Caribbean, and also supports nesting brown boobies (*Sula leucogaster*). This Crown Reserve is an important tourism resource for local tour guides utilizing South Water Caye Marine Reserve, and a regular stop on the way to or from Tobacco Caye. There is significant concern as to the long term viability of the nesting colony, with tropical storm and erosion gradually reducing the caye size, vegetation structure and nesting site availability.

MAN O' WAR CAYE in 2009 (LEFT) AND 2018 (RIGHT)

Past records have shown that the exposed reef lying off Tobacco Caye has been an important colony nesting site for terns, with more than 200 breeding adult roseate terns (*Sterna dougallii*), over 50 sandwich terns (*Sterna sandvicensis*), and a number of bridled terns (*Sterna anaethetus*) reported (Balderamos, 2003). With the constant change in the availability of such sites as exposed reef and sand bores change with the tides and tropical storms, nesting aggregations may be opportunistic, and change location each year. The sand bores adjacent to Wee Wee Caye have also

BROWN NODDY, MAN O' WAR CAYE

been highlighted as important breeding site for terns, with reports of nesting bridled terns (*Onychoprion anaethetus*).

The mangrove cayes are important as stepping stones for migratory species during southbound and northbound migrations, including the globally vulnerable cerulean warbler (Table 21). Many thousands of migrants follow the mainland coast southwards and meander off course each year, ending up on the cayes every spring and fall after being blown offshore by shifting winds. Others may use the cayes and ranges of South Water Caye Marine Reserve as part of a straight line migration path down the Yucatan Peninsula coastline, through Ambergris Caye and southwards, and from there to Guatemala and Honduras, where they again hook up with the mainland and its "infinite" food resources.

South Water Caye Marine Reserve *Bird Species of International and National Concern*	
Vulnerable	
Cerulean Warbler	*Setophaga cerulea*
	IUCN, 2018
Species of National Concern	
Colony Nesting Birds	
Magnificent frigatebird	*Fregata magnificens*
Brown boobies	*Sula leucogaster*
Brown pelicans	*Pelecanus occidentalis*

TABLE 21: BIRD SPECIES OF INTERNATIONAL AND NATIONAL CONCERN (IUCN, 2018)

Reptiles

A total of twelve reptile species have been documented to date from South Water Caye Marine Reserve.

The herpetofauna of South Water Caye Marine Reserve is comprised entirely of reptile species. No amphibians have been recorded there, as the saline conditions, absence of freshwater sources, and distance from the mainland are the main determinants precluding their presence, and includes the critically endangered hawksbill turtle (*Eretmochelys imbricata*) and endangered loggerhead and green turtle (*Caretta caretta* and *Chelonia midas*) (Table 22).

South Water Caye Marine Reserve Species of international Concern	
Critically Endangered	
Hawksbill Turtle	*Eretmochelys imbricata*
Endangered	
Green Turtle	*Chelonia mydas*
Vulnerable	
Loggerhead Turtle	*Caretta caretta*
American Crocodile	*Crocodylus acutus*
Leatherback Turtle	*Dermochelys coriacea*
	IUCN, 2018

TABLE 22: REPTILE SPECIES OF INTERNATIONAL CONCERN (IUCN, 2018)

The conservation priorities for the herpetofauna of the South Water Caye Marine Reserve relate to the three species of sea turtle known to use the area: the critically endangered hawksbill (*Eretmochelys imbricata*) and the endangered loggerhead (*Caretta caretta)* and green (*Chelonia mydas)* turtles. As elsewhere, sea turtle numbers have plummeted in recent decades, having been exposed to enormous exploitation for over 250 years in Belize and adjacent countries. As relatively recently as 1925, their

numbers were considered inexhaustible (Smith, *et. al.* 1992) – a far cry from the current situation with only the hawksbill still nesting within the Reserve, and in only very small numbers. Whilst now afforded full legal protection against harvesting in Belize, turtle populations remain highly threatened by loss or degradation of nesting habitat, disturbance by beach-facing lights, and by dogs. 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.

Hawksbill turtles tend to be more confined to shallow waters than loggerhead and green turtles, and are known to venture into coastal lagoon and estuaries, where it feeds primarily upon sponges and marine invertebrates. It has a protracted nesting season of 6 months or more – peaking in June and July, with the period between nesting seasons generally being 2-4 years, sometimes longer. Nesting occurs at night, generally at high tide, with a clutch size of 50-200 eggs. Nests tend to be concealed in beach vegetation quite high on the beach and, except for a faint asymmetrical crawl leading to and from the sea, there is seldom any obvious evidence of the visiting female. In the early 1900s, the size of the turtle industry, harvesting hawksbills for their shells, supported two or more schooners at Tobacco Caye. Records indicate that there are now fewer than 25 nests per year on Tobacco Caye and Carrie Bow Caye, and only marginally more on South Water Caye (records for 2002-2006, Fisheries Department; 2006). With a regional average of 4.5 nests per female in the years they breed, 25 nests in all probability represent only 5-6 females coming ashore to breed.

Loggerhead and green turtles still frequent the waters of South Water Caye Marine Reserve, though there are no confirmed records of nesting in recent years – the last reports of nesting being for loggerheads on Tobacco Caye in 1990, and on South Water Caye in 1989 (Smith *et. al*. 1992). Undoubtedly it is the level of human encroachment onto turtle-nesting beaches that has reduced numbers of this species. There appear to be no confirmed records of greens nesting in this area, though there can be little doubt that they did so prior to the over-exploitation of the nineteenth and twentieth centuries. Whilst the green turtle is primarily herbivorous, feeding mostly upon sea grasses and seaweeds, the loggerhead is more omnivorous, feeding on a wide range of marine invertebrates, seaweeds and turtle grass.

There are reports of the critically endangered leatherback turtles (*Dermochelys coriacea*) swimming off the Pelican Cayes (Coral Caye Conservation Expedition Report, 1993), though this species is not known to nest in Belize. Like the loggerhead, it is omnivorous, feeding on seaweeds and a variety of marine invertebrates – primarily tunicates and jellyfish.

The small raised sand-based islands and low-lying mangrove cayes dotted across the South Water Caye Marine Reserve also present potentially very good habitat for adult American crocodiles (*Crocodylus acutus*), but the absence of extensive brackish lagoons within the islands make them less than ideal in terms of juvenile nursery grounds. Whilst Tobacco Range was identified in 1990 as a nesting and feeding site for American crocodiles (CCC, 1993), a national survey of this vulnerable species, did not locate any specimens or nests within the Marine Reserve (Platt, 1997), although Coral Caye Conservation had previously reported a nest on Tobacco Caye.

A population of the morphologically distinct island boas (*Boa constrictor*) exists on Crawl Caye, Peter Douglas Caye, Lagoon and Wee Wee cayes, but has shown a steady population decline over the last 30+ years, attributed to over-collection (reportedly for the pet trade). From site visits and past collection records, it was estimated that the boa population on Crawl Caye had decreased to only 8 individuals by 2003 (Boback, 2005). Recent reports suggest that American crocodiles are still occasionally seen in the Marine Reserve with Fisheries staff reporting a relatively recent sighting adjacent to Coco Plum Caye (SWCMR staff, 2017).

The St. George Island gecko *(Aristelliger georgeensis),* tuberculate leaf-toed gecko (*Phyllodactylus tuberculosus),* and brown anole (*Norops sagrei)* have also been recorded on these cayes (Boback, 2005). Whereas the brown anole is a human commensal, occurring on or close to human buildings along the Belize coast and cayes, formal records of the St. George Island gecko and the tuberculate leaf-toed gecko are far more limited. The Central American skink (*Mabuya unimarginata*), whilst not yet recorded for the protected area, may also occur on a number of the cayes – this species has been recorded on Caye Bokel, north of South Water Caye Marine Reserve. Black iguana (*Ctenosuara similis*) are found on the cayes within the South Water Caye Marine Reserve, generally transport there by residents in the past.

Two non-native reptile species occur on the cayes of South Water Caye Marine Reserve. The South East Asian House Gecko (*Hemidactylus frenatus*), an introduced species that has been spreading through mainland Belize since the early 1990's, has been recorded from South Water Caye (Meerman and Garel, 2002) and is likely to occur on the majority of the other human inhabited cayes within the protected area. The Asian tokay gecko (*Gekko gecko)* is thought to have been introduced onto South Water Caye in the early 1990's, with the first confirmed report in 1994. This aggressive and voracious exotic has the potential to not only eradicate native lizards on South Water Caye, but also to disperse across island chains and on the mainland, causing irreparable damage to native herpetofauna. It is considered a conservation management priority to instigate a programme to capture and remove or euthanize all observed specimens on South Water Caye, in an attempt to eradicate this potentially very invasive species before it is able to disperse further. A survey in 2013 reported this species from five cayes in SWCMR – the original South Water Caye and the additional Crawl Caye, North East Caye, White Sand Caye and Billy Hawk Caye (Cockney Range) (Maaz, 2014).

1.5.3 Economically Important Species

The fishery at South Water Caye Marine Reserve focuses on Caribbean spiny lobster (*Panulirus argus*), Queen conch (*Lobatus (Strombus) gigas*), two invertebrate species of commercial importance, and a variety of fin fish – particularly snapper and grouper. Nationally, the annual economic benefits from reef and mangrove-dependent fisheries is estimated at between US$14–16 million (Cooper et. al, 2008).

TRADITIONAL CONCH FISHING

Conch and lobster have both declined since the early 1980's, when the industry was at its peak. It is significant to note that the general trend of total national lobster production over the period from 1981 to 2008 is a decline of almost 77%. National lobster landings peaked in 1981 at 2,204,622 lbs, but fell to 457,680 lbs in 2006, when it stabilized, with 511,389 lbs exported in 2009 (tails and head meat combined - with a market value of Bz$13.8 million (Ministry of Agriculture and Fisheries, 2009)). 90% of the lobster and conch is exported through the two fishing cooperatives, the remaining 10%, and the majority of the finfish, are sold for local consumption.

The Queen Conch fishery has been considered as near collapse in Belize and in the wider region, with national conch landings peaking at 1,239,000 lbs in 1972, and subsequently declining significantly, by 54% to 574,756 lbs in 2008 (Ministry of Agriculture and Fisheries, 2008). As a result of regional concerns on the state of the Queen conch, this has been addressed through listing of the species in Appendix II by the Convention on International Trade in Endangered Species (CITES) in 1992. Belize has been placed in the Category (ii) list of countries, as an expression of concern as to the viability of the national conch fishery, and instigating a rigid requirement for implementation of an assessment and monitoring procedure. Each year, pre and post season surveys are conducted to assess the conch population, and to set a national quota – 884,092 pounds for market clean conch meat for the 2017 – 2018 conch season (BFD, 2017).

Inside the Barrier Reef just south of Tobacco Cut, the lagoon is a relatively flat grassy bed sloping slowly inland away from the reef. This area has traditionally been a fishing ground for conch, with fishermen congregating here at the start of the conch fishing season. In 1996, the area was assessed as having the highest density of conch relative to the other sections of the reef (CFRAMP, 1996). In 2007, in the backreef of South Water Caye Marine Reserve, densities were reported as approximately 99 adult conch per hectare, and 1,419 juveniles (based on ten transects of 30m x 3m; SWCMR Annual Report, 2007). However, this has declined to between 9.4 and 11.5 adult individuals per ha in 2015 (WCS, 2015).

The importance of South Water Caye Marine Reserve to the conch industry is well documented - the high density of juvenile conch reported in 2006 and 2007 reflecting the extensive conch nursery areas in the shallow northern back reef areas of the protected area from Tobacco Caye to Grand Channel. These lie within the Conservation Zone (as defined through the recent revision of the Statutory Instrument). Because the current fishery contains few adults and reproduction in conch is almost never reported by fishermen, it is assumed that the adults must be occupying areas that are not currently fished - possibly on the outer shelf to the east of the reef crest, in waters deeper than 50 feet.

FISHERMEN OF SOUTH WATER CAYE MARINE RESERVE

Finfish are also extracted from the marine protected area, and in general provide an important component of the commercial catch – most are fished using spear guns and hand lines. Much of this catch is sold in local markets and directly to hotels rather than through the co-operatives, though some is marketed for export. The targeted export species include groupers (*Epinephelus* sp. and *Mycteroperca* sp.), snappers (*Lutjanus* sp. and *Ocyurus* sp.), the hogfish (*Lachnolaimus maximus*), king mackerel (*Scomberomorus cavalla*), great barracuda (*Syhyraena barracuda*), and jacks (*Alectis* sp., *Caranx* sp. and *Trachinotus* sp.) (www.fao.org/fishery/countrysector/FI-CP_BZ/en). 163,870 lbs of whole fish and 11,252 lbs of fish fillet were reported as landed in 2015 (Fisheries Department, 2018). Species harvested for local consumption include snapper (also the major export species), grunts (Haemulidae), snooks (Centropomidae), mullets (Mugilidae), porgies (Sparidae), triggerfish (Balistidae), and tarpon (Megalopidae).

Shark fishing is also conducted in the South Water Caye Marine Reserve, utilizing gill nets and long lines, particularly in the drop off to the east of the reef crest. Eleven (11) shark species have been reported from South Water Caye Marine Reserve - the common species caught include bull, hammerhead, nurse, reef and lemon sharks, with the dried shark fins and salted or frozen shark meat being exported by individual permitted fishermen. Shark fishing in Belize was assessed in 2005 during the initial drafting of the National Plan of Action – Sharks (Fisheries Department, 2005), when an estimated twenty-five fishermen were identified as being involved, originating from various communities along the coastline, with the greatest activity concentrated between December and March. In 2001, about 9,500 lbs of shark products were exported (Belize Fisheries Dept. 2002) – in 2017, this had riden to 41,000 lbs (Fisheries Department data, 2108). However, this is thought to be an under-estimation of the fishing level, as the largest market is the illegal trade with Guatemala and Honduras.

Except for the whale and nurse sharks (for which there is a complete ban on fishing under the Fisheries Act), there is the recognition in Belize that sharks, in general, are under pressure from over-fishing, having a close stock-recruitment relationship, long recovery times in response to over-fishing, with few offspring and late sexual maturity, resulting in low biological productivity. This, in combination with complicated patterns of size/sex segregation and seasonal migration, raise concerns at the national levels about the sustainability of the shark fishery, particularly under the current unregulated fishing levels. SI 78 of 2011 regulates shark fishing, with the licensing of fishers, prohibition on finning, open and closed seasons, exportation, fines and penalties. The Belize Fisheries Department has developed the National Plan of Action for the the Conservation and management of Sharks 2017 to 2022. The NPOA is designed to achieve the conservation and sustainable use of shark species with the minimization of by-catch, waste and discard, and through the adoption of selective and environmentally safe fishing practices.

1.5.4 Past and Present Research

There has been a long history of research activities within the South Water Caye Marine Reserve area, as well as a number of facilities that provide logistical support for student groups and field study courses. Scientific work started with the establishment of the Smithsonian Institute Field Station on Carrie Bow Caye in 1972, and during the first decade, resulted in the production of "The Atlantic Barrier Reef Ecosystems at Carrie Bow Cay, Belize, I: Structure and Communities" (Rützler and Macintyre, 1982), and providing baseline information on the marine life and physical processes of the reef. Over the decades, the station has provided a logistical base for many scientists and graduate students, with more than 900 research papers being produced on the fauna, flora, and geology of the Carrie Bow reef tract, and Pelican Cayes area.

Research Facilities	
Carrie Bow Caye	Carrie Bow Caye Field Station
Student Study Facilities	
Wee Wee Caye	Wee Wee Caye Marine Lab
Tobacco Caye	Tobacco Caye Marine Station
South Water Caye	The Pelican's University

TABLE 23: RESEARCH FACILITIES BASED IN SOUTH WATER CAYE MARINE RESERVE

In the early 1980s, emphases shifted to an ecological study of Caribbean mangrove swamp communities - the Smithsonian Western Atlantic Mangrove Program (SWAMP), with the nearby Twin Cays chosen as the model mangrove system, (Rützler and Feller, 1996).

Beginning in 1985, the Caribbean Coral Reef Ecosystems (CCRE) programme was established, growing out of the previous two programmes, encompassing reef, mangrove, seagrass meadow, and plankton community studies. This was further strengthened in 2000 with the establishment of the Marine Science Network. Under this network, the CCRE programme became a component of a more regional focus, with comparative studies in Belize, Panama and the United State, focused at solving problems of coastal and marine environments from the U.S. to Central America.

Meteorological and oceanographic conditions have been monitored at the Smithsonian Field Station at Carrie Bow Cay, Belize, since 1993 through the Caribbean Coastal Marine Productivity (CARICOMP) program, and since 1997 through an automated monitoring system operated by CCRE.

Despite the extensive information documented throughout the many years during which the Carrie Bow Caye Field Station has been functioning, much of the information has been focused on 'pure science' - taxonomic or species specific information, and does not address the primary management gaps in knowledge for conservation management, nor does it provide long term information on the status of the reef biodiversity. Access to and use of this information by the Belize Fisheries Department for the management and development of strategies towards the conservation of the Marine Reserve is limited, with little networking between the two.

Intensive surveys of several proposed marine protected areas, including South Water Caye, were conducted between 1986 and 1998 by Coral Caye Conservation, utilizing international volunteer expeditions, providing baseline information on fish species present within each of the protected areas.

In 2008, Conservation International established the Marine Management Area Science Program, established to fill the current information gap by providing information for more effective management, through six program areas: management effectiveness, connectivity, resiliency, economic and cultural valuation, conservation and economic development, and enforcement. This program is currently ongoing.

A list of research outputs from South Water Caye Marine Reserve is included in Annex Five – whilst this covers the majority of papers produced over the years, it is accepted that there will be further work by independent researchers that it has not been possible to locate for inclusion in this list.

A number of facilities for student groups and independent researchers are also available within the Marine Reserve. The Pelican Pouch (the University of South Water Caye) on South Water Caye was established in 1977, and is designed to house self-catering groups of up to 23 people, with the option of tuition in marine ecology. International Zoological Expeditions also host researchers and students on the Caye. Wee Wee Caye Marine Lab is located within the more southerly portion of South Water Caye Marine Reserve, approximately nine miles off the coast, and was established in 1988 as a more dedicated support facility for researchers and students.

The Tobacco Caye Marine Station was established to cater for student study groups. Whilst this facility does not include accommodation (this being provided by guest houses on the caye), it provides structured courses on marine ecology, and also seeks to work with Fisheries Department and the local fishermen towards more effective conservation management of the reef.

1.6 Cultural and Stakeholder Use of South Water Caye Marine Reserve

1.6.1 Community and Stakeholder Use

The Belize coast and cayes have been used by local populations since the times of the early Maya. Fishing stations, trading posts, ceremonial centers, and burial grounds are found throughout coastal Belize, dating from as early as approximately 300 B.C. Maya artifacts have been found on Tobacco Range, Wee Wee Caye, and South Water Caye, indicating that the cayes of South Water Caye Marine Reserve were used during the height of the Maya civilization.

The cayes within the marine protected area also have a long tradition of more recent use - Tobacco Caye, for example, is thought to have been settled by the Puritans in the 1600's, who provided a trading outpost for the exchange of goods – including tobacco. The complex systems of cayes also provided safe havens for pirates, privateers and buccaneers during the 17th and 18th centuries.

In the early 19th century, the Garifuna arrived from the West Indies, settling in Commerce Bight and establishing "New Town" in the general vicinity of Sittee River. Hurricane Hattie, however, removed the settlement in 1961, forcing the inhabitants to move inland to Georgetown, or south to Hopkins. The Garifuna of both New Town and Hopkins have traditionally been subsistence fishermen, paddling in dories close to shore and rarely venturing beyond Blue Ground Range and Ragged Caye. With the arrival of outboard motors and fiberglass skiffs, however, many of today's fishing descendants are able to travel further, better utilizing the resources of the Marine Reserve. In the 1960's, the expanding footprint of the Sarteneja free-diving lobster and conch fishermen, with their traditional wooden sail boats, extended to include the Marine Reserve – this use continues today.

Tobacco Caye and South Water Caye, in particular, have been used as vacation destinations for the older established Belize families, with many of the vacation houses being adapted as tourism facilities in more recent years. The area is also still used extensively for recreational activities at a national level, particularly over Easter.

TOBACCO CAYE

1.6.2 Recreation and Tourism Use

Belize is a well-known tourism destination for those seeking the reef, coral sand beaches and laid-back Caribbean culture. South Water Caye Marine Reserve provides an excellent resource for marine based activities - the proximity of vibrant reef, dive sites and world class sport fishing gives this marine protected area the potential to become a world-renowned destination, though it is currently under-promoted. Snorkeling and diving tours originate from both the mainland (principally Dangriga, Placencia, Sittee River, and Hopkins), and from the cayes located within the protected area itself. Many of the larger coastal resorts, such as Hamanasi and Pelican Beach Hotel, also provide day tour packages.

Overnight tourism facilities within South Water Caye Marine Reserve are concentrated primarily on Tobacco Caye and South Water Caye, though a small number of self-contained, higher-end resorts are also established on other cayes within the protected area (eg. Thatch Caye Resort and Coco Plum Island Resort). The cheaper facilities on Tobacco Caye attract backpackers and other budget travelers, though there are concerns for the ecological sustainability of the caye at the current and predicted future levels of tourism development and use.

OVERNIGHT TOURISM FACILITIE OF SWCMR RANGE FROM BASIC TO THE HIGH END MARKET

Private yachts and charters also utilize the area on a frequent basis, with a number of companies providing charter services, based primarily in Placencia and San Pedro.

Tourism to the Marine Reserve has increased over the years, with ticket sales reaching over Bz$89,440 in 2017. Accurate visitor numbers, however, are not easy to assess, as many avoid paying the entrance fees, and the size of the marine protected area and limited staff prohibits effective fee collection. Visitation fluctuates over the year, too, peaking in Marchl, when traditional local tourism to the cayes is at its highest, and when international tourism season is at its peak (Figure 24). Minimal tourism occurs between October and November - the peak tropical storm season – and many facilities on Tobacco Caye close down for that period.

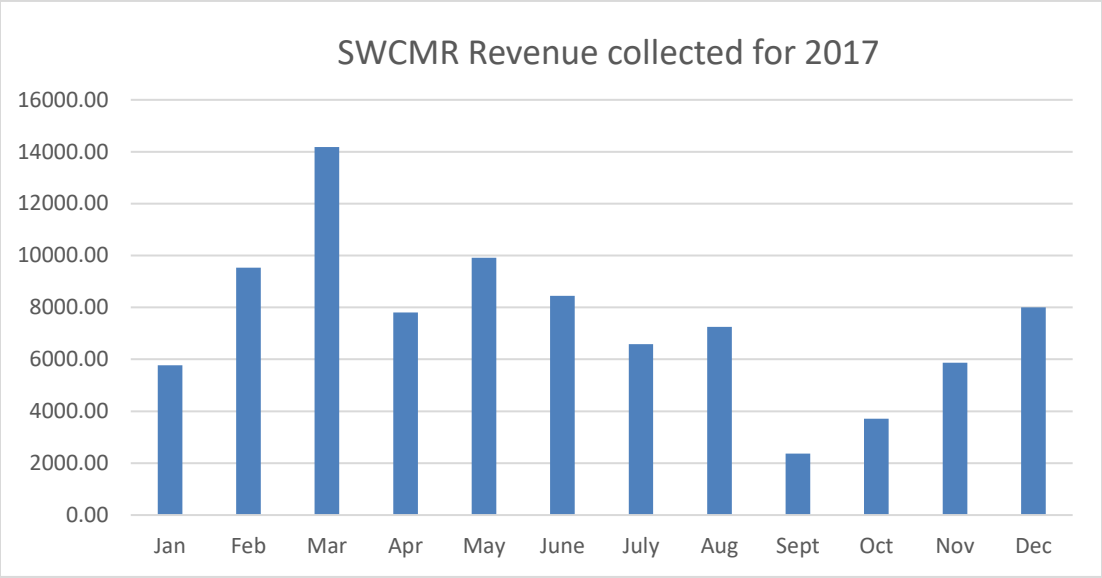


FIGURE 24: MONTHLY TOURISM LEVELS IN 2017 (ASSESSED BY ENTRANCE FEES – Bz$)

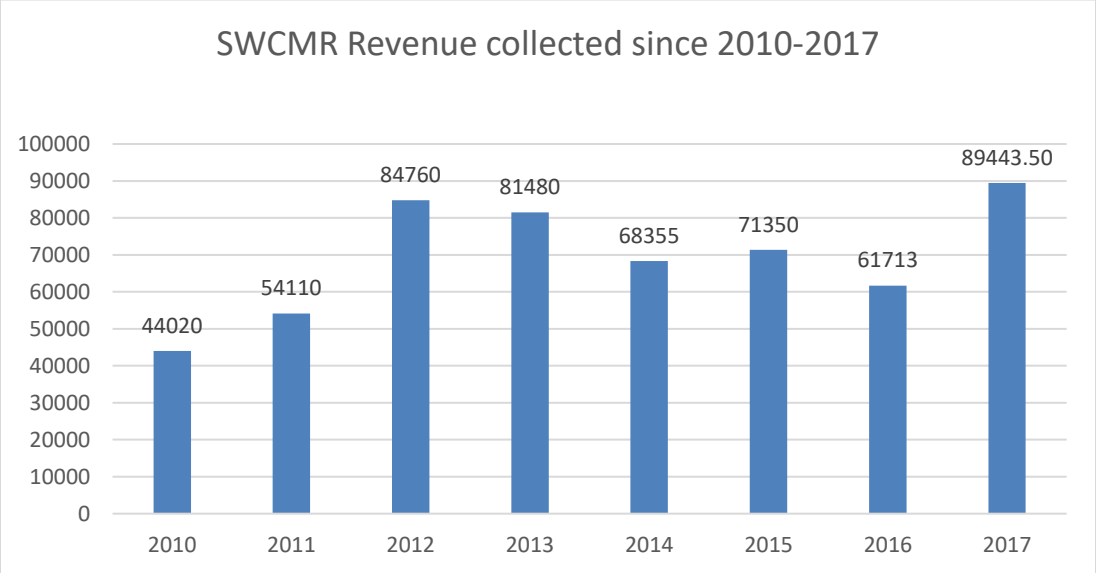


FIGURE 25: TOURISM REVENUE 2010 - 2017 (ASSESSED BY ENTRANCE FEES – Bz$)

1.6.3 Educational Use

South Water Caye Marine Reserve has a number of facilities that offer cheaper options for international student study groups, and forms a component of their educational visit to Belize. With the ease of accessibility, relatively pristine coral and rich biodiversity, the reefs, seagrass meadows and mangroves adjacent to these facilities offer an excellent resource for these groups. The majority of the facilities available offer logistical support, with the option of interpretation and tuition. Some also provide accommodation, whilst others, such as Tobacco Caye Marine Station, rely on guest house accommodation on the cayes.

Education use by local communities is more restricted, with the costs involved in transporting students to the Marine Reserve. In 2017, a draft one year SWCMR Communication, Education and Awareness Strategy was developed (Moore, 2017), providing a sound foundation for a structured, cohesive framework designed to reach a wide cross-section of local stakeholders for improved understanding of the key concepts and role of South Water Caye Marine Reserve, and mechanisms for meaningful participation in management activities. This identified communication tools that can be used depending on the sector, that have been integrated into the SWCMR Community Engagement Strategy (Wildtracks, 2018).

LESSONS LEARNT

Multi-year outreach strengthens student engagement and understanding

Field activities and outdoor experiences are critical

Outreach should also focus on creating conservation leaders

Outreach by multiple organizations will be more successful if it is co-ordinated, with unified messaging

The importance of engaging youths through education activities in schools cannot be over-emphasized, but to date, efforts have been project-based, resulting in limited continuity of presence in the schools, with stops and starts to engagement activities, duplication of effort by organizations and limited cohesive structure or messaging. As a result, the majority of students in Dangriga have a low level of understanding and engagement – not only for support of SWCMR, but for the marine environment and conservation generally (A. Moore, pers. com.). Marine ecosystem values and good stewardship are not being successfully transferred to youths through the education system. The only exceptions are seen in two private schools, where there has been significant input over multiple years from the local NGO, Reef Keepers Belize, resulting in a cohort of students that understand the importance of the reef and are inspired and engaged in marine conservation. This has been achieved through a successful combination of classroom activities and field trips (A. Moore, pers. com.). The challenge is now how to scale up these activities to have the same impact in the remaining eight schools in the town, and in the schools in Hopkins.

In 2017, a partnership between SWCMR and Reef Keepers brought this model to eight more schools in Dangriga through the MARFund KfW project, increasing the reach of education and awareness activities. However, this initiative has been short-term (one year) and project based, and not well coordinated with other education activities by other organizations such as SEA, Oceana and Mar Alliance. To be effective in changing perceptions and behaviour, experience has shown that activities need to be consistent over time (not short-term, project-based), and delivered according to a strategic framework that provides opportunities for improving communication, collaboration and coordinated activities by all organizations involved in marine conservation education in the two communities.

The limited continuity in the schools, in particular, and the lack of a structured plan, is considered a significant barrier to the long-term achievement of outreach and engagement goals and objectives. To overcome this, the key school-based strategy is focused on the development of a structured, collaborative, long-term programme that interacts with students at key stages in primary and high school, building knowledge and understanding of the key concepts and identified pre-conditions, engaging students throughout their schooling, and developing conservation leadership skills to improve outcomes. It also integrates a focus on 'learning by doing' through outdoor experience, considered critical as experience has shown that exposure to the marine environment is the most effective way to engage youths and develop a long-term interest in the marine environment and conservation, building a future culture of conservation stewardship in the communities.

Section Two

Conservation Planning

2. Conservation Planning

Conservation Action Planning (CAP) is a structured approach to planning, implementing and measuring success for conservation projects at system and site level. The Nature Conservancy (TNC) CAP processes used are based on the outputs of the 2008 conservation action plan developed for the Southern Belize Reef Complex (SBRC), of which South Water Caye Marine Reserve is a component. It integrates broad scale participation from a wide range of stakeholders – community, NGO, government agency, conservation field staff, private sector business and academic, to produce a plan for the future effective management of the marine protected area, as part of the Southern Belize Reef Complex, at both system level and site level.

Focal Conservation Targets for the South Water Caye Marine Reserve

- Turtle Nesting Beaches
- Commercial and Recreational Species
- Coral Reef Communities
- Mangroves
- Wide Ranging Large Marine Vertebrates
- Seagrass

2.1 Identification of Conservation Targets

Six **Conservation Targets** were identified from the SBRC targets to represent and encompass the biodiversity values of the South Water Caye Marine Reserve. These have been selected to assist in guiding conservation strategies at site level, and are the focus of the threats that are faced by the protected area. The TNC CAP criteria were adopted in target identification – that:

- **Targets should represent the biodiversity and cultural heritage of the site.** The focal targets should represent or capture the array of ecological systems, communities and species of importance of South Water Caye Marine Reserve, and the multiple scales at which they occur

- **Targets reflect ecoregion or other existing conservation goals**. Focal targets are grounded in the reasons for protection – South Water Caye Marine Reserve's current status of protection as part of the National Protected Areas System Plan, and as one of seven protected areas within Belize's World Heritage Site. Focal targets also reflect conservation efforts at the regional and national level, as well as system-level planning for the Southern Belize Reef Complex, national level initiatives including the National Protected Areas Policy and System Plan, and at regional level, the TNC, CI and WWF ecoregional assessments, which identify the Belize Barrier Reef as one of the region's key marine areas of ecological, biological and social importance.

- **Targets are viable or at least feasibly restorable**. Viability (or integrity) is a measure of a target's ability to persist for many generations. If a target is on the threshold of collapse, or conserving a target requires extraordinary human intervention, it may not represent the best use of limited conservation resources

- **Targets are highly threatened**. All else being equal, targets should focus on highly threatened species or ecosystems, ensuring that critical threats are identified and addressed through conservation actions.

All conservation targets selected to represent South Water Caye Marine Reserve are ecosystem and species assemblages, and have guided the conservation strategies at site level, being indicative of the threats faced by the protected area.

2.2 Assessing Biodiversity Viability

The Viability Assessment provides an objective, consistent means for determining changes in the status of each focal conservation target over time, providing baseline for the measuring of success of conservation action planning strategies.

The Conservation Action Planning process has assisted the Southern Belize Reef Complex project team in building an informed structure to guide monitoring and research in each of the marine protected areas of the SBRC. The CAP has been developed using available information on the biology and ecology of the conservation targets selected, with input from technical and field experts through a series of workshops in 2008. The results have been further adapted to be relevant at site-level for South Water Caye Marine Reserve.

The Assessment provides:

- An objective, consistent means for determining changes in the status of each focal conservation target over time, allowing the management partners to measure success of conservation action planning strategies

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

- A basis for strategy design and the foundation for monitoring

- Guidance in summarizing and documenting knowledge and assumptions about the biology and ecology of each target, with identification of critical information gaps and research questions.

Conservation Target: Turtle Nesting Beaches		
Conservation Target	**Justification for Target Selection**	**Species, Communities or Ecological Systems represented by Target**
Turtle Nesting Beaches **Viability Indicators:** ▪ **% of identified turtle nesting cayes without human development** ▪ **Abundance of turtle nests** Data for indicators are not yet comprehensive	A number of the cayes have historically provided nesting sites for critically endangered hawksbill and endangered green turtles, important to the survival of these species within the region. However tourism developments have significantly reduced the size and suitability of beaches used by turtles. Limited nesting activity is, however, still seen to occur on Carrie Bow Caye and Tobacco Caye. On the latter, increased tourism, light pollution and dogs have had a major negative impact on the nesting success of turtles. The endangered loggerhead turtle is also reported to nest irregularly on Carrie Bow Caye. Data collection on patterns and success of nesting have been sporadic, and little information is available on how viable the remaining nesting sites are. Turtle nesting beaches and the associated herbaceous beach communities are classified within the Belize Ecosystem Map as ***Tropical Coastal Vegetation on recent sediments*** (Meerman and Sabido, 2001). This ecosystem is found in isolated patches on the cayes within SWCMR, and is very resilient to hurricane damage, and can become established on small, isolated cayes, with long distances between patches. The herbaceous beach community is considered very important for the stabilization of the turtle and crocodile nesting beaches. However, this ecosystem is found in areas targeted for residential and tourism development, where it is often subjected to extensive clearance to expose the sandy beaches.	All three species of turtle commonly found within the waters of South Water Caye Marine Reserve (green, loggerhead and hawksbill turtles) have used the cayes for nesting in the past, but nesting success has been reduced significantly by human impacts – beach clearance, introduction of predators, light pollution, tourism development etc., and the number of nest has declined significantly when compared with historical records (State of the Protected Areas Assessment, 2009). American Crocodile and a range of bird species may also be nesting on some of the sandy cayes – least, roseate and bridled terns among them. 2008 and updated 2014 (Maaz / WCS) data suggests that hawksbill and green turtle nesting is occurring on Carrie Bow Caye, South Water Caye, and Tobacco Caye, though in all sites, nesting success in uncertain.

Conservation Target: Commercial / Recreational Species		
Conservation Target	**Justification for Target Selection**	**Species, Communities or Ecological Systems represented by Target**
Commercial / Recreational Species **Viability Indicators:** ▪ **Biomass of commercial fish** ▪ **Conch density** ▪ **Lobster density**	The two invertebrate species of highest commercial importance extracted from the SWCMR are the **Caribbean Spiny Lobster** (*Panulirus argus*) and **Queen conch** (*Lobatus (Strombus) gigas*), both of which are fished extensively throughout the area. The lobster fishery is the largest capture fishery in Belize, with production representing over 40% of total capture fisheries production in 2006, and an export value of US$7.37 million (Fisheries Department, 2007). Lobster landings peaked in 1981 at 2,204,622 lbs, but have fallen to 457,680 lbs in 2006 (Fisheries Department, 2007). It is significant to note that the total national lobster production over this period has declined by almost 25%, and there are concerns for the continued sustainability of the lobster fishing industry. Conch, too, have declined significantly, though strict regulations and quotas are being implemented towards more sustainable use of this resource. SWCMR is highlighted for its importance in recruitment, with the presence of a critical nursery area. The role of many of the target fin-fish species as top predators is essential in reef community structure. Most commercially important marine species have complicated life cycles that rely on the health of the entire marine ecosystem – utilizing not just the reef, but also the seagrass beds and the mangroves at some point during their life cycles.	This target, commercial marine species, covers fin fish, lobster and conch – fished primarily by artisanal fishermen of the northern fishing communities (Sarteneja, Chunox and Copper Bank) and of the more adjacent coastal communities such as Dangriga, Placencia, and Hopkins, who are reliant on lobster, conch and finfish resources for their livelihoods. **Caribbean Spiny Lobster** (*Panulirus argus*) and **Queen conch** (*Lobatus (Strombus) gigas*), are fished extensively throughout the area. Figures show that conch density averages 44/ha in open fishing areas, and 255/ha in no take zones. The Healthy Reef target is 300 – 400 adults per hectare. The high diversity of fish species recorded within the SBRC includes **Snapper** (Lutjanidae) (*Lutjanus cyanopterus*, *L. jocu*, *L. apodus*, and *L. mahogany,*), **Grouper** (Serranidae – *Myctoperca bonaci, M. venenosa* and *M. tigris*), the **Great Barracuda** (*Sphyraena barracuda*), **Grunt** (Haemulidae); **Goatfish** (Mullidae), and **Parrotfish** (Scaridae – *Scarus coelestinus, Sparisoma chrysopterum* and *S. virida)* Sport fishing is an increasing activity within the SWCMR, focusing on permit, barracuda, bonefish, tarpon, mullet, crevalle and horse-eye jacks. Trolling and line fishing is also prevalent frm Tobacco Caye and South Water Caye, for consumption.

Commercial / Recreational Species Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Condition Population Structure and Recruitment	Biomass of commercial fish ▪ ***SBRC Indicator*** ▪ ***Healthy Reef Indicator***	420 – 839g/ m^2	*840 – 1,259g/ m^2*	1,260 – 1,679/ **m^2**	>1,680g / **m^2**	**Current Status:** HRI 2015: One site rated as, one as POOR, and two as CRITICAL. Average: FAIR Projects Abroad 2017: SIRHI: One site rated as VERY GOOD, one as FAIR, and two sites as POOR, with an average biomass of 1154.2g/100 m^2 (FAIR) **Healthy Reef Goal:** A 20% increase regionally in commercial fish biomass to 1300g/100 m^2 **Healthy Reef Red Flag Warning:** Levels below < 1000g/100m^2 **SBRC Monitoring Priority:** High **SBRC Monitoring Status:** Ongoing **Methods:** AGRRA/ LAMP /MBRS protocols **Baseline:** GOOD: Based on adjacent Gladden Spit / LBC Rapid Assessment 2006 - 1400g/100 m^2 **Trend:** Declining
Condition Population structure and recruitment	Adult Conch density ▪ ***SBRC Indicator*** ▪ ***Healthy Reef Indicator***	**Current Status**		*Desired Status*		**Current Status:** WCS 2015: Adult conch densities were between 9.4 and 11.5 individuals per ha. A minimum of 50 – 100 mature individuals for long term viability. **Healthy Reef Goal:** Adult conch populations of 300 – 800 individuals per hectare within the next 20-25 years **Healthy Reef Red Flag Warning:** Any consistent reduction in average density, correlated with a drop in production **SBRC Monitoring Priority:** Very High **SBRC Monitoring Status:** Ongoing **Methods:** Modified LAMP protocol **Baseline:** POOR: 2008 National Conch Survey data for SWCMR.

Commercial / Recreational Species Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Condition Population Structure and Recruitment	Lobster density ▪ ***Healthy Reef Indicator***		**Current Status**	*Desired Status*		**Current Status:** 40 – 47 individuals / ha
						Healthy Reef Goal: Increased average spiny lobster abundance by 30% by 2025 **Healthy Reef Red Flag Warning:** Any consistent reduction in average density, correlated with a drop in production
						Methods: MBRS / LAMP protocol **Baseline:** Laughingbird Caye National Park (a no take mpa in the SBRC) had a density of 200/ha in 2002

Conservation Target: Mangroves		
Conservation Target	**Justification for Target Selection**	**Species, Communities or Ecological Systems represented by Target**
Mangroves **Viability Indicators:** ▪ **Total extent of mangrove ecosystem** ▪ **Abundance of juvenile fish**	The prop roots of red mangroves are important in their role as a critical fisheries nursery area for commercially valuable species, and considered important in the maintenance of commercial fish and lobster stocks. They also play a key role in the maintenance of caye integrity through erosion control. The trees themselves serve as nesting structure, as seen at Man-o-War Caye, which supports a nesting colony of magnificent frigatebirds and brown boobies. The leaves provide nutrients for plankton, which serve as the basis of the detrital food chain. Some of the cayes – particularly Twin Cayes, Pelican Cayes and Tobacco and Blue Ground Ranges - have important oceanic red mangrove (*Rhizophora mangle*), as well as the more terrestrial white mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), and buttonwood (*Conocarpus erectus*). Whilst the important roles of mangroves are widely recognized, there is extensive clearance of these species within South Water Caye Marine Reserve for caye development, with the associated reduction in the essential ecosystem services they provide. The Pelican Cayes, in particular, have been highlighted for their importance and fragility, yet 29% of the mangroves have been lost since 1996, when South Water Caye Marine Reserve was first declared part of Belize's World Heritage Site.	The diversity of marine organisms in the South Water Caye Marine Reserve – particularly the Pelican Cayes area - is considered unparalleled in the Caribbean, primarily due to the prop roots of the red mangrove, which provide a substrate for the mangrove oyster, shrimp, sponges and many other invertebrates – 62 species of sponge, for example, have been recorded in association with the Twin Cayes mangrove system (Fiaz and Rutzler, CCRE, 2008). The structure also provides shelter for many commercial and non-commercial fish species such as permit, lobster, snappers, and goliath grouper. Studies of mangrove root systems within SWCMR (primarily Twin Cayes) have shown a total of 142 taxa from 55 families – among the highest reported for oceanic mangroves in this biogeographic region (Taylor et. al. CCRE, 2008), and including endemics and new species. Species associated with the mangrove ecosystem include those marine birds that use the mangrove structure for nesting – for example, boobies and noddies, magnificent frigatebirds, brown pelicans, and double-crested cormorants. The mangroves are also important as waypoints for migrating birds. The mangrove-lined creeks of Tobacco Range provide sheltered protection for the West Indian Manatee and American crocodile.

Mangrove Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Size Size / extent of characteristic communities / ecosystems	Total extent of mangrove ecosystems ▪ ***Healthy Reef Indicator*** ▪ ***SBRC Indicator***		2009 status	**Current Status**	*Desired Status*	**Current Status:** 418 ha mangrove cover (0.9% of SWCMR). MARFund assessment, RSS 2016. There is no extensive mangrove clearance in SWCMR, and much of the 2009 clearance is regenerating. **Healthy Reef Goal:** Restore mangrove cover to 1990 levels **Healthy Reef Red Flag Warning:** Any decrease in current mangrove extent **SBRC Monitoring Priority:** High **SBRC Monitoring Status:** Planned **Data Requirements:** Baseline for South Water Caye Marine Reserve of 1990 mangrove extent (if feasible) **Method:** Aerial photography – interpretation. Spectral analysis of satellite mapping – if done correctly Field reports / inspections (site level) from ongoing MPA patrols **Baseline:** 2009: Clearance of mangroves for caye development is observed throughout South Water Caye Marine Reserve – even in critical areas such as Blue Ground Range and Pelican Cayes. The system is still thought to be sufficient to retain functionality and viability if active management and protection is put in place over remaining key mangrove areas.
Condition Population structure & recruitment	Abundance of juvenile fish (nursery functionality) ▪ ***SBRC Indicator***		**Current Status**	*Desired Status*		**Current Status:** No data **SBRC Monitoring Priority:** High **SBRC Monitoring Status:** Planned **Method:** 3 seine net trawls per site, identification to general type (not species) **Baseline:** 2009: No current status / baseline. Patchy, thought to be varied across the Marine Reserve.

Conservation Target: Coral Reef Communities		
Conservation Target	**Justification for Target Selection**	**Species, Communities or Ecological Systems represented by Target**
Coral Reef Communities **Viability Indicators:** ▪ **Number of coral recruits** ▪ **% survey sites showing coral bleaching** ▪ **% live coral cover** ▪ **Parrotfish density** ▪ **Biomass of adult fish (see commercial fish species)** ▪ **Water Quality (see seagrass)**	The reef building corals of the South Water Caye Marine Reserve, and the larger scale Southern Belize Reef Complex in general, are critical to the maintenance of local biodiversity, and considered a conservation priority in ecoregional planning initiatives. Coral reefs are one of most diverse ecosystems on this planet, essential to the viability of the majority of fish and marine invertebrates living in the shallow tropical waters of Belize, providing basic structure for shelter, foraging, and reproduction. The coral reef is critical to the maintenance of the artisanal fishing industry, particularly for spiny lobster and finfish populations. It is also one of the most important tourism resources Belize has to offer, and supports a significant percentage of employment in coastal communities. Coral reef ecosystems throughout the region, including the SWCMR, are also being impacted by warming seas and increasing acidity, causing coral bleaching and lowering resistance to disease.	The reef ecosystems of the SWCMR, including fore-reef, back-reef, reef slope, patch reef, are composed of many scleractinian coral species, providing a diverse range of habitats for a multitude of fish species and invertebrates, including commercially important species such as the spiny lobster, snapper and grouper. MBRS monitoring by Fisheries Department shows that *Orbicella annularis* is the most abundant species found in the four sites surveyed followed by *Porites astreoides*, *Sidesrastrea siderea*, and *Agaricia tenufolia,* accounting for 72.50% of the species surveyed (SWCMR Annual Report, 2008). The SWCMR has exceptionally high biodiversity, with at least eighteen IUCN redlist species ranked Critically Endangered, Endangered, or Vulnerable, including the critically endangered staghorn and elkhorn corals: **Staghorn Coral** (*Acropora cervicornis*) **CR** **Elkhorn Coral** (*Acropora palmata*) **CR** **Goliath Grouper** (*Epinephelus itajara*) **CR** **Hawksbill Turtle** (*Eretmochelys imbricata*) **CR** **Loggerhead Turtle** (*Caretta caretta*) **EN** **Green Turtle** (*Chelonia mydas*) **EN** **Nassau Grouper** (*Epinephelus striatus*) **EN** ***Millepora striata*** **EN** ***Orbicella annularis*** **EN** ***Orbicella faveolata*** **EN** **Great Hammerhead** (*Sphyrna mokarran*) **EN**

Coral Reef Communities Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Condition Population Structure and Recruitment	Number of coral recruits ▪ ***SBRC Indicator*** ▪ ***Healthy Reef Indicator***	< 2 recruits/ m2 - 10/m^2	2 – 4.9 recruits/ m^2 - 15/m^2	**5 – 9.9 recruits/ m^2 - 20/m^2**	*>10 recruits/ m^2*	**Current Status:** No recent data **Healthy Reef Goal:** On par with ~2000 Caribbean average: At least 4.5 recruits per m^2 (for recruit size < 2 cm). **Healthy Reef Red Flag Warning:** A regional average of less than 3 recruits per m2 (for recruit size < 2 cm).. **Methods:** Most recruitment data for the MAR region are based on AGRRA / modified MBRS methods, quantifying stony coral recruits up to 2 cm maximum diameter within a 25 cm x 25 cm quadrat, every 2m along a 10m transect **Baseline:** 5.9 recruits / m^2 SBRC data for 2008
Condition Coral Bleaching Indicator	% survey sites showing coral bleaching ▪ ***SBRC Indicator*** ▪ ***Healthy Reef Indicator***		**Current Status**	***2009 status***		**Current Status:** A major bleaching event occurred in 2017, with between **Healthy Reef Goal:** Corals adapt to changing temperatures, and frequency of bleaching events is not more than 3 per 10 years **Healthy Reef Red Flag Warning:** Coral bleaching prevalence > 10%, with limited post bleaching impacts **SBRC Monitoring Priority:** Low (but considered High for SWCMR) **SBRC Monitoring Status:** Ongoing **Methods:** MBRS **Baseline:** WWF data, 2006 **SBRC Monitoring Priority:** High **SBRC Monitoring Status:** Ongoing **Methods:** MBRS **Baseline:** 2009: In the adjacent Laughing Bird Caye National park, averages fall between 8 and 18% (FAIR).

Coral Reef Community Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Condition Successional Dynamics	% live coral cover ▪ ***SBRC Indicator***	<10%	10 – 19% 2009 rating	**20-39%**	>39%	**Current Status:** Overall GOOD (HR, 2015). ranged from GOOD (1 site; 20.0 – 39.9%) to FAIR (2 sites; 10 – 19.9%) to POOR (1 site; 5.00 – 9.99). **SBRC Monitoring Priority:** High **SBRC Monitoring Status:** Ongoing **Methods:** MBRS **Baseline:** 2009. In the adjacent Laughing Bird Caye National park, averages fall between 8 and 18% (FAIR).
Condition Present / abundance of key functional guilds	Parrotfish density ▪ ***SBRC Indicator*** ▪ ***Healthy Reef Indicator***	≤1250 g-100m^2	**1250 - 2400 g-100m^2**	*2399 – 4800* g-100m^2	≥*4800* g-100m^2	**Current Status:** Overall rating of FAIR (HR, 2015). Three sites rated as POOR (960 – 1,919 g/100m2) and one as CRITICAL (<960 g/100m2). **Healthy Reef Goal:** Maintain current levels of parrotfish **Healthy Reef Red Flag Warning:** Any reduction in parrotfish density **SBRC Monitoring Priority:** High **SBRC Monitoring Status:** Ongoing **Method:** Modified MBRS protocol / LAMP/ AGGRA **Baseline:** P. Mumby, 2009..no data, but estimate from graph that range from 200 to 1200g 120m^{-2} with a mean of (very approximately) 750g 120m^{-2}

Viability of Conservation Targets: Wide Ranging Large Marine Vertebrates		
Conservation Target	**Justification for Target Selection**	**Species, Communities or Ecological Systems represented by Target**
Wide Ranging Large Marine Vertebrates **Viability Indicators:** ▪ **Average travel distance recorded per wide ranging sharks (including whale sharks) and turtles** ▪ **Number of feeding areas / sources for whale sharks** ▪ **Number of shark species (diversity)** ▪ **Number of whale sharks sighting per year within SWCMR** ▪ **Population size by species** Data for indicators are not yet comprehensive	This target includes those species that require larger areas than the SWCMR, with connectivity to the open oceans. The world's largest fish, the whale shark (*Rincodon typus*), whilst thought to be primarily pelagic feeders, congregate at Gladden Spit each year to feed at the aggregation site, and are known to pass through SWCMR. This vulnerable species (IUCN, 2008) is considered highly migratory, travelling 1000's of kilometers, and occurs throughout tropical and warm temperate waters around the globe. A number of other sharks have been recorded from the Marine Reserve, and Shark Cave, north of the Marine Reserve, have also been highlighted by tour guides of Tobacco Caye as an important shark area. *Carcharinus* and *Sphyrna* genus. Three species of marine turtles - green, hawksbill and loggerhead turtles (all highlighted as endangered or critically endangered by IUCN), frequent the waters of the SWCMR for feeding. These species are known to migrate between temperate and tropical zones, and are therefore also within this target.	**Sharks:** **Bull Shark** *Carcharhinus leucas* **Blacktip Shark** *Carcharhinus limbatus* **Whitetip Shark** *Carcharhinus longimanus* **Caribbean Reef Shark** *Carcharhinus perezi* **Sandbar Shark** *Carcharhinus plumbeus* **Smalltail Shark** *Carcharhinus porosus* **Tiger Shark** *Galeocerdo cuvier* **Lemon Shark** *Negaprion brevirostris* **Blue Shark** *Prionace glauca* **Scalloped Hammerhead** *Sphyrna lewini* **Great Hammerhead** *Sphyrna mokarran* **Smooth Hammerhead** *Sphyrna zygaena* **Whale Shark** *Rincodon typus* **Dolphins** **Fraser's Dolphin** *Lagenodelphis hosei* **Bottle-nosed Dolphin** *Tursiops truncatus* **Atlantic Spotted Dolphin** *Stenella frontalis* **Rough-toothed Dolphin** *Steno bredanensis* **Green Turtle** *Caretta caretta* **Hawksbill Turtle** *Eretmochelys imbricata* **Loggerhead Turtle** *Chelonia mydas*

Conservation Target: Seagrass		
Conservation Target	**Justification for Target Selection**	**Species, Communities or Ecological Systems represented by Target**
Seagrass **Viability Indicators:** ▪ **% sea grass cover** ▪ **Seagrass density** ▪ **Water quality**	Seagrass meadows are essential for maintaining the ecological health of the shallow marine ecosystems, with an important role in nutrient cycling, sediment stabilization and maintenance of water clarity. Seagrass is also a critical ecosystem for many fish and invertebrate species, with an acre of sea grass being shown to support up to 40,000 fish and 50 million small invertebrates (Seagrass Ecosystems Research Laboratory, 2005). In the shallow waters of the SWCMR, these beds are dominated by *Thalassia testudinum,* interspersed with sparse stands of *Syringodium filiforme* and *Halimeda* spp. CARICOMP sites have been established within SWCMR, and show an estimated total biomass varying seasonally from approximately 3,766 to 4,159 g m-2 dry weight - among the highest reported for the Caribbean (Koltes et. al. UNESCO)**.** Over 90% of the seagrass beds of SWCMR are considered to be intact, with only marginal impacts around the cayes, primarily from dredging activities associated with caye development, and from seismic testing activities in the 1960's. However, recolonization of cleared seagrass patches is considered to be slow (Koltes et. al. UNESCO). Other impacts on the condition and	Nested targets include the West Indian Manatee (*Trichechus manatus)*, the largest of Belize's herbivorous marine mammals, as well as marine turtles. These species play a role in the maintenance of the seagrass and increase the productivity of this ecosystem through grazing. Seagrass beds are also essential for the Queen Conch *(Lobatus (Strombus) gigas)*, one of the most important commercial species extracted from the sea, and for the juveniles of many commercial fish species. Parrotfish, herbivores that play a critical role in maintaining the reef, also rely on the seagrass beds as juveniles.

	extent of seagrass within SWCMR include poor water quality from agrochemical pollution, and increased sediment loads from both Belize and Guatemala.	

Seagrass Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Size Size / extent of characteristic communities / ecosystems	% seagrass cover ▪ ***Healthy Reef Indicator*** ▪ ***SBRC Indicator***	< 50%	50% - 75%	75% - 90%	***90%-100%***	**Current Status:** 2017: Seagrass covers 6,739 hectares (14.2%) of SWCMR (MAR Fund / R.S.S., 2016) **Healthy Reef Goal:** No decrease in extent from 1990 levels **Healthy Reef Red Flag Warning:** More than a 5% reduction in area in any subregion's annual or biennial assessment, compared to that subregion's previous survey. **SBRC Monitoring Priority:** High **SBRC Monitoring Status:** Some ongoing, some planned. No data or initiatives within SWCMR under FD **Methods:** Seagrass monitoring protocol: % cover of sea grass in shallow marine areas **Baseline:** Accurate mapping of seagrass extent through satellite imagery and groundtruthing – 1990 data from CZMAI landsat data. >95% - minimal impacted area to date, primarily from dredging activities
Condition Primary Productivity	Seagrass density ▪ ***SBRC Indicator***	0 - 29%	30-49%	50-79%	***80 - 100%***	**Current Status:** The condition of the seagrass is considered Very Good (80 – 100%) **SBRC Monitoring Priority:** Low **SBRC Monitoring Status:** Some ongoing, some planned. No data or initiatives within SWCMR under FD **Methods:** SeagrassNet protocol s for % cover and biomass 4 times a year, at Pelican Cayes (identified under SBRC planning) **Baseline:** Two permanent monitoring plots have been established in the seagrass beds approximately 100 and 150m east of the CARICOMP mangrove plot at Twin Cays.

Seagrass Indicators						
Category / Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Indicator Status**
Landscape Context Water Quality	Water Quality ▪ ***Healthy Reef Indicator*** ▪ ***SBRC Indicator***			***Current / Desired Status***		**Current Status:** 2017: No data. However there are concerns of increasing sedimentation and pollution from the mainland watersheds, and algal blooms. Also some question re. pollution from passing ships **Healthy Reef Goal:** Monthly average temperature values no greater than 0.5°C above historical monthly average for that month. Salinity values not in excess of 34-37. For water clarity: No net decrease in "baseline" water transparency (to be determined after more data are available). **Healthy Reef Red Flag Warning:** To be developed **SBRC Monitoring Priority:** Very High **SBRC Monitoring Status:** Some ongoing under Smithsonian Institute (raw data available on-line), some planned under SBRC. **Method:** MBRS protocols. Identified monitoring sites under SBRC: Pelican Cayes, Blueground Range. Other suggested monitoring site: Tobacco Caye Smithsonian Institute monitoring by Twin Cayes **Data Baseline: 2009:** The water quality is currently considered to be Good, with only localized impacts from the caye developments scattered throughout the Marine Reserve. However, the Marine Reserve is close enough to the mainland for agrochemical pollution to be a concern. With climate change, water temperature is also a concern, and the increasing potential for associated coral bleaching.

Conservation targets have been assessed based on three criteria:

- **Size -** a measure of the area or abundance of the conservation target's occurrence.
- **Condition** - a measure of the biological composition, structure and biotic interactions that characterize the occurrence.
- **Landscape context** - an assessment of the target's environment including ecological processes and regimes that maintain the target occurrence such as water temperature and natural disturbances, and connectivity, allowing access to habitats and resources or the ability to respond to environmental change through dispersal or migration.

These define the critical requirements for each conservation target, and **indicators** have been developed to provide a means of measuring the viability status. An effort has been made throughout the viability assessment to use indicators that are measureable, precise, consistent, sensitive and technically and financially feasible, and where possible, use the outputs of current ongoing monitoring programmes within the project area.[1] Healthy Reefs indicators have also been taken into consideration.

A viability rating has been developed for each target, based on the following scale:

- **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

The current status and goals for each indicator were developed during the system-level SBRC workshop, and have been reviewed and revised for applicability at site level for this management plan (Annex Three).

[1] AGGRA, MBRS Synoptic Monitoring Programme, WWF, WCS etc.

At the site level, the South Water Caye Marine Reserve was rated as FAIR - outside its range of acceptable variation, and vulnerable to serious degradation if left unchecked - requiring human intervention.

50% of the targets have an overall viability rank of **FAIR,** suggesting that there needs to be significant intervention if they are to improve. Two targets were rated as **GOOD** (Mangroves and Wide-Ranging Large Vertebrates). Seagrass was one exception, being rated as **VERY GOOD**, with few widespread human impacts (Table 24).

Summary of Conservation Target Viability for South Water Caye Marine Reserve (2017)				
Conservation Targets	*Landscape Context*	*Condition*	*Size*	*Viability Rank*
	Rating	*Rating*	*Rating*	
Nesting Bird Sites	*Fair*	*Poor*	*Poor*	*Poor*
Turtle nesting beaches	*Fair*	*Fair*	*Poor*	*Fair*
Commercial / Recreational Species	*Fair*	*Fair*	*Fair*	*Fair*
Coral Reef Communities	*Good*	*Poor*	*Fair*	*Fair*
Wide Ranging Large Marine Vertebrates	*Good*	*Good*	*Fair*	*Good*
Mangroves	*Good*	*Fair*	*Good*	*Good*
Seagrass	*Very Good*	*Very Good*	*Good*	*Very Good*
Biodiversity Health Rank for South Water Caye Marine Reserve				*Fair*

TABLE 24: SUMMARY OF CONSERVATION TARGET VIABILITY (2018)

2.3 Threats to Biodiversity

The SBRC CAP workshop in 2008 focused on the Southern Belize Reef Complex as a whole, and assessed stresses and threats at both the technical and site management levels, with representation from researchers, Fisheries Dept, the tourism and fishing sectors, and both protected area management and field staff. The summary results from the planning process have been adapted to site level, providing each conservation target with a threat status rating (Table 28). This has provided the baseline for SWCMR.

This was re-evaluated in 2017, specifically for SWCMR, with the following key threats highlighted: Caye Development, Fishing Pressure and Agricultural Runoff (Table 25). For the first two, it is recognized that there is an awareness gap that needs to be addressed, with improved engagement of stakeholders, and enabling of their participation in the reduction of these threats. Climate Change was also identified as an over-arching threat.

Threats Across Targets	Seagrass	Mangroves	Coral Reef Communities	Wide Ranging Marine Vertebrates	Commercial / Recreational Species	Sandy Beaches	Overall Threat Rank
Caye Development	Medium	Very High	Very High	High	High	Very High	**Very High**
Fishing Pressure	Medium	-	High	High	Very High	-	**High**
Climate Change	-	Medium	High	Medium	High	Very High	**High**
Poor Fishing Practices	-	**Low**	**Low**	High	High	-	**High**
Agricultural Runoff	Medium	-	Medium	Medium	Medium	-	**Medium**
Oil Spills		-	**Low**	Medium	-	Medium	**Medium**
Visitor Impacts (tourists, researchers etc.)	-	-	**Low**	**Low**	-	-	**Low**
Oil Exploration and Drilling	Low	-	**Low**	-	-	-	**Low**
Overall Threat Status for Targets	**Medium**	**High**	**High**	**High**	**Very High**	**Very High**	**Very High**

TABLE 25: THREAT ASSESSMENT FOR SOUTH WATER CAYE MARINE RESERVE

2.3.1 Caye Development

Historical habitat loss through caye development for tourism has resulted in the removal of mangroves, littoral forest and coastal strand communities throughout the South Water Caye Marine Reserve. In addition, shoreline structures such as piers, dredged access routes, marinas and seawalls have led to loss and/or alteration of habitats.

Whilst the privately owned cayes are not, strictly speaking, part of the Marine Reserve, they do lie within the boundaries, and human activities on the cayes will impact the viability of the adjacent marine ecosystems.

CAYE DEVELOPMENT	
Clearance of Mangrove	Removal of important marine nursery areas Removal of important habitat for migrating birds Erosion of caye soils Removal of important habitat for lizards with limited distribution (Island leaf-toed gecko) Removal of important nutrient source within the marine system
Destruction of Coral	Live and dead coral used as land fill in poorly planned caye development Destruction of coral to provide boat access, and impacts of boat access on corals within seagrass beds
Human Impacts on Sandy Beaches	Removal of coastal strand vegetation – an ecosystem that is under-represented within the national protected areas system, and which is essential for good turtle nesting success Removal of critical turtle nesting habitats Light pollution – impacting turtle nesting and hatching success rates Presence of introduced predators - dogs and cats, reducing hatching success
General Human Impacts	Use of insecticides and herbicides and associated impacts on natural biodiversity and water quality Increased nutrient and sediment runoff into water, with associated accelerated algal growth and coral loss Reduction and pollution of freshwater lenses beneath cayes Increased impacts from human activity immediately adjacent to caye Introduction of exotics – *Casuarina,* the tokay gecko

Red mangrove, littoral forest and herbaceous beach communities play a critical role in stabilizing island structure, reducing coastal erosion, beach loss and sedimentation as well as providing nursery functionality for many marine species. Among the most threatened ecosystems within the protected area system of Belize, their loss has stabilized since 2009, with little new development. The sandy beaches are

critical for nesting sea turtles and American Crocodiles, and the littoral forest for the Island leaf-toed gecko, a species with extremely disjointed distributions, as well as for numerous migratory bird species. Clearance on the cayes greatly reduces connectivity within an already seriously fragmented ecosystem, reducing the scope for gene-flow and recolonization after natural and anthropogenic impacts. It also greatly undermines the stability of the islands themselves, making them, and any associated infrastructure, a great deal more susceptible to the impacts of hurricanes and sea level rise. The long-term sustainability of caye-based tourism and residential developments can be made significantly more financially viable through the maintenance of these natural ecosystem.

Resort managers are aware of and implementing best-practices for water conservation, solid and septic waste management and prevention of water contamination. The exception is Tobacco Caye, where greater efforts are needed to improve best practices.

Recommendations:

- Ensure development follows the CZMP guidelines for the area
- Ensure input into the EIA process, to highlight and resolve any development conflicts
- Engage caye / resort owners and managers for continued use of environmental best practices
- Work with Tobacco Caye to develop improved environmental sustainability measures

2.3.2 Fishing Pressure

OVERFISHING	
Overfishing / Illegal Fishing	Overfishing for lobster, conch and commercial species of fin-fish
	Illegal fishing within conservation zones (need for greater enforcement of Marine Reserve regulations)
	Perceived biased in enforcement targets, leading to reduced engagement and compliance by fishers
	Reduction in coral-grazers and key predatory fish species, particularly the sharks and grouper, reducing reef resilience
	Damage to coral from fishing activities Fishing by boats from Honduras

South Water Caye Marine Reserve is an important resource for a number of the coastal communities – primarily Sarteneja, Hopkins and Dangriga, with 180 or more fishermen using the area. The pressure on marine stocks within the protected area is high, and overfishing of commercial marine species has resulted in reduced catch per unit effort and a shift in the community and population structures of both fish and invertebrates harvested.

Whilst the majority of extractors are traditional fisherman, free diving primarily for lobster and conch, and spear fishing or long lining for fin-fish, the impact on the commercial marine species of the Marine Reserve has been immense, with the majority of fishermen and tour guides reporting reduced numbers of lobster and conch and commercial species (SWCMR Consultations, 2017). There is also subsistence extraction from people resident on the cayes, and fishing for tourism (catch and eat) – particularly around Tobacco Caye. A comprehensive study of fish populations, focusing on grouper and comparing numbers between 2002 and 2008/9 at 6 sites within SWCMR demonstrates a drop from an average encounter probability of 21% in 2002 to 3% in 2008 (Mumby et. al., 2009).

More recent consultations report a significant drop in shark encounters, and in large grouper. The large coastal sharks present in the waters around to the east of South Water Caye Marine Reserve (such as black tip, bull, tiger and hammerhead) are also considered to be overfished, both nationally and regionally.

Recommendations:

- Implement Managed Access in SWCMR, with engagement of fishermen in fisheries management activities
- Ensure clear zone demarcation and dissemination of zones and zone regulations to all fishermen using the Marine Reserve and fair enforcement of zone regulations across all fishermen
- Target fishing communities for awareness activities to highlight critical state of the fisheries

2.3.3 Coral Bleaching/Warming sea temperatures

Global climate change is predicted to have increasing impacts on the coral reef, with a greater frequency and severity of coral bleaching events, hurricane impacts, coral disease outbreaks higher ultraviolet radiation, rise in sea level and increased acidification.

Studies of *Orbicella faveolata* have shown that following a major bleaching event, coral growth rates at sites with higher local anthropogenic stressors such as overfishing, pollution and sedimentation have been shown to remain suppressed for up to four times as long as rates at sites with lower stress, which recover within 2 to 3 years (Carilli et. al., 2009). Healthy reefs are normally resilient to the past stress levels, but the current increasing levels of human impacts are reducing coral resilience to increasing sea temperatures, frequency of storm events and increasing acidity of the seas. It is thought that background stress reduces coral fitness and resilience to coral bleaching events. Reducing chronic stress through local coral reef management efforts may therefore increase coral resilience to global climate change, providing an opportunity for the coral to recover between bleaching events.

Recommendations

- Identification and targeted protection of resilient reef areas
- Reduce anthropogenic impacts on coral in at least 20% of the marine reserve (particularly the Conservation Zones)
- Participate in the Mesoamerican Coral reef Watch Programme / Belize Coral Watch Programme (Ecomar) for early reporting of coral bleaching episodes
- Regular monitoring of coral reef indicators
- Continued coral replenishment in partnership with Fragments of Hope

2.3.4 Agricultural runoff

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

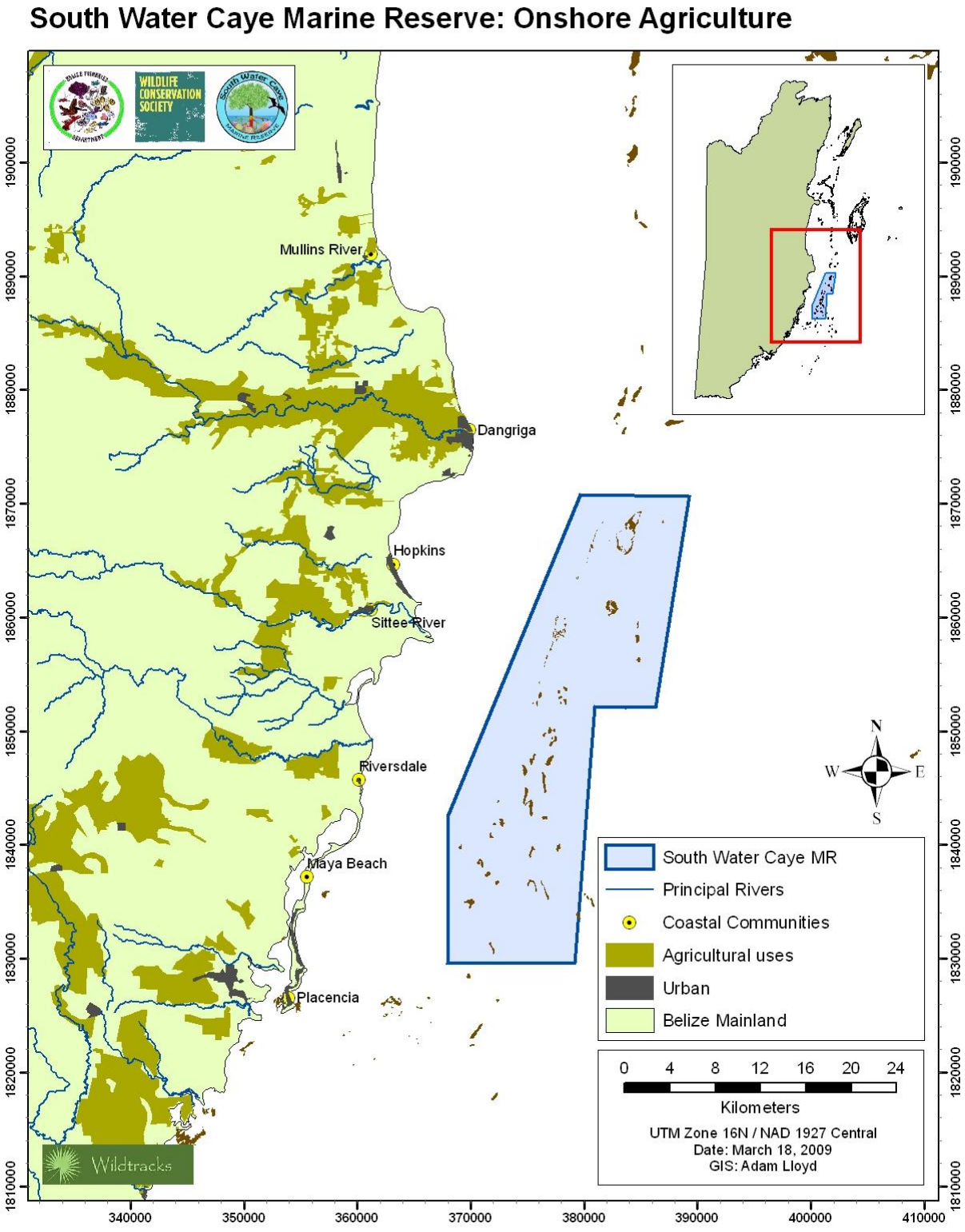
"*…there is no evidence to suggest that changed sedimentary processes resulting from farming activity to date in the Stann Creek area are having a negative impact on the Barrier Reef. The natural coastal system would appear to be effective in dealing with the impact of increased sediment yield and sediment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

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

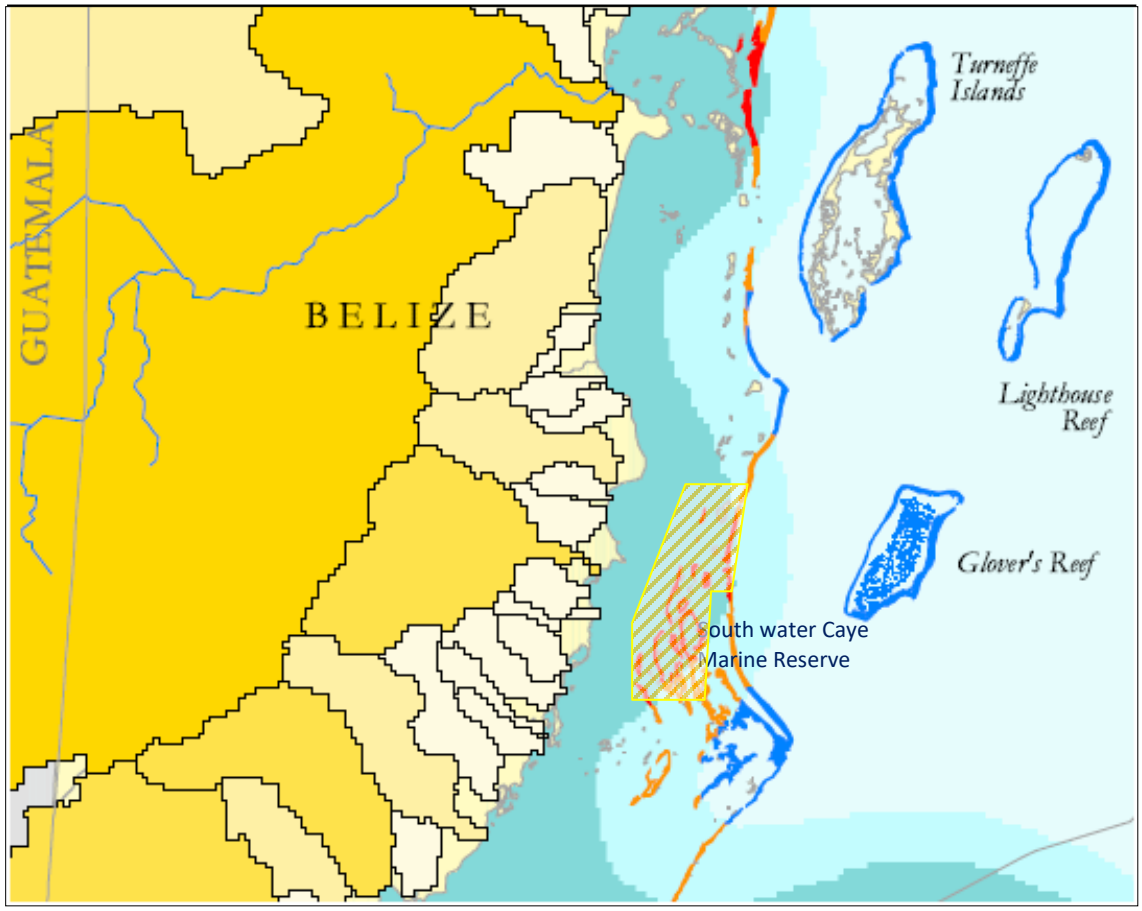
A more recent assessment of risks from land based sources of pollution highlighted the reefs of South Water Caye Marine Reserve as at high risk from runoff from mainland agricultural areas, manifested in the form of sediment-laden river plumes rich in nutrients (effluents) that at times extend to the Marine Reserve, causing algal blooms and coral death. Definitive research to characterize the effects of pesticides and nitrate and phosphate nutrients from agriculture and aquaculture is in its early stages, but initiatives under WWF, YCT and Wildtracks are focusing on identifying and mitigating agrochemical impacts Belize, both on terrestrial and marine ecosystems, with concerns associated with the use of agrochemicals on the banana and citrus plantations and shrimp farms in the Stann Creek area, due west of South Water Caye 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 (Maps 9 and 10, WRI, 2005).

Recommendations:

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



MAP 9: AGRICULTURAL AREAS OF THE SOUTHERN COASTAL PLAIN THAT HAVE THE POTENTIAL TO AFFECT SOUTH WATER CAYE MARINE RESERVE



MAP 10: MODELLED THREATS TO CORAL REEFS FROM WATERSHED-BASED SOURCES OF SEDIMENT AND POLLUTION. FROM: REEFS AT RISK IN BELIZE ANALYSIS, WORLD RESOURCES INSTITUTE (WRI), 2005.

2.3.5 Direct Physical Damage to Coral

Direct physical damage to corals is generally caused by boats and anchors, divers or snorkelers. Boats that visit South Water Caye Marine Reserve can be divided into two categories – those associated with the tourism industry (dive boats, live-aboards, independent sail boats, small cruise ships and supply boats for the tourism developments), and those associated with the fishing industry - fishing skiffs from Dangriga and Hopkins and the traditional Sarteneja sail boats.

Both categories have similar impacts with mechanical damage from anchors. Lack of sufficient mooring buoys in the more heavily used dive and snorkeling sites and areas of safe harbor, is a major concern. Creation of new mooring buoy sites and enforcement of their use would reduce damage to reefs from anchors and anchor chains.

The increasing impact of divers and snorkelers is also of concern, particularly around the Tobacco Caye and other high-traffic visitation areas. The popular dive sites are also increasingly impacted by diver activity – particularly mechanical damage from standing on or touching corals and sediment kicked up by flippers.

Recommendations:

- Install sufficient mooring buoys in critical locations – key dive sites, safe harbors
- Enforce diver and snorkeler / guide ratios
- Increase awareness of best practices for boats entering the marine reserve
- Increase awareness of best dive and snorkeling practices for divers, snorkelers and guides using the marine reserve
- Ensure navigational routes through reef areas are adequately marked

2.3.6 Introduced Species

South Water Caye Marine Reserve has already been impacted by introduced species, some of which may be invasive, others less so. Many of these arrive in the bilge water of cargo vessels using Big Creek and passing through South Water Caye Marine Reserve. Within the last few years, for example, native populations of large *Mithrax, Menippe, Callinectes* and *Panulirus* have been reported as being replaced by the non-indigenous portunid crab, *Charybdis helleri* (CCRE, 2008). The Asian tokay gecko has been introduced to South Water Caye, where it has established a breeding population, thought to be replacing the endemic island geckos (Meerman and Garel). A recent survey suggests it is now present on five cayes in SWCMR – the original South Water Caye, Crawl Caye, North East Caye, White Sand Caye and Billy Hawk Caye (Cockney Range) (Maaz, 2014).

The invasive lionfish (*Pterois volitans* and *Pterois miles*), native to the Indian and Pacific Oceans, was first recorded in Belize in 2008. This voracious predator is able to expand its stomach volumes over thirty times to accommodate large prey (Fishelson, 1997), and has a broad diet that includes a large range of juvenile fish, shrimps and crabs (Morris and Akins 2009). The extremely fast growth and reproduction rate allows it to quickly overwhelm ecosystems, and its efficient hunting techniques and venomous spines means it has very few predators in the Caribbean waters. With no natural predators to keep numbers of this species in balance, the population has expanded, with highest densities recorded at South Water Caye Marine Reserve (Chapman et al., 2016). Densities in Belize are currently considered below tipping point

(Chapman, pers. com.)

On the cayes, introduced coconuts have already replaced the natural vegetation on significant portions of some of the cayes of South Water Caye Marine Reserve. As an invasive species, it is able to gradually out-compete natural vegetation through direct competition for light, nutrients and water, as well as smothering the regenerating herbaceous and shrub layers with heavy leaf debris. Natural vegetation has a far more extensive root system than do coconut groves, and is therefore far more effective in stabilizing the sandy soils of islands against the impacts of tropical storms and hurricanes – invasive coconuts therefore increase the likely impacts from such storms.

Casuarina (C. equisetifolia) is also invasive in the coastal strand vegetation. This fast-growing (1.5 to 3 metres per year) tree produces dense shade and a thick blanket of leaves that completely cover the ground beneath it. Dense thickets displace native dune and beach vegetation, including mangroves and many other resident, beach-adapted species. Once established, it radically alters the light, temperature, and soil chemistry regimes of beach habitats as it outcompetes and displaces native plant species and destroys habitat for native insects and other wildlife. Chemicals in its leaves may inhibit the growth of other plants underneath it. The ground below the tree becomes ecologically sterile, reducing the food value for native wildlife. Unlike native shrubbery, the thick, shallow roots make it much more susceptible to blow-over during high wind events, leading to increased beach and dune erosion and interference with the nesting activities of sea turtles and American crocodiles (Swearingen (1997)).

Recommendations:

- Increase awareness in residents and tour guides of potential impacts of lionfish
- Encourage use of lionfish as a protein source and sale to restaurants
- Provide opportunities for stakeholders to actively participate in removal of lionfish from the reef
- Increase awareness in residents and tour guides of the problems caused by releasing non-caye fauna and flora onto the cayes

2.3.7 Pollution

POLLUTION	
Pollution	Contamination of waters near cayes and throughout South Water Caye Marine Reserve due to inappropriate sewage and grey water treatment on cayes, leading to eutrophication
	Inappropriate solid waste disposal, particularly in the Tobacco Range area
	Contamination of waters with runoff containing herbicides, insecticides or detergents from both the cayes and the mainland
	Contamination from international shipping
	Garbage from the mainland and from international shipping

Solid Waste: Some types of garbage have been shown to be very detrimental to marine wildlife, such as plastics to sea turtles. Solid waste originating from the cayes is a concern, with dumping of household refuse from Tobacco Caye on Tobacco Range. There is also concern voiced by participants over the increasing levels of solid waste accumulating on the reef crest and caye beaches, and shredded plastics in the water, thought to originate from international shipping, particularly with the increase in cruise shipping and freight shipping destined for, and departing from, Belize.

Liquid Waste & Sewage: A more insidious impact is the leaching of nutrients and chemicals into the ground water or fresh water lenses of the cayes, which then percolate through the sandy soil into the sea. Groundwater is an important source of freshwater on the cayes for maintaining natural vegetation, and is important for supplying the mangrove areas and coral reefs with fresh water. If the groundwater becomes polluted, these ecosystems are affected. The leakage of sewage from island resorts can cause algal blooms, visible as a ring around the cayes or patches of increased algal growth near the highest impacted areas, due to nutrient enrichment. Currently, this impact is considered to be relatively low due to the current small scale of operations and low level of visitation, as well as the general adoption of closed sewage systems. The exceptions are the areas adjacent to Tobacco and South Water Caye, where heavy algal growth indicates increased nutrient availability.

Development activities are growing in the area, but there is currently little guidance given in areas such as herbicides and pesticides, wood preservatives etc. Contamination of waters by biocides and detergents is likely to become an increasing problem as more tourism accommodation is developed on the cayes, affecting not only the waters adjacent to these cayes, but potentially all the fragile ecosystems of the Marine Reserve. Very few resorts in Belize have adequate training in chemical storage, use, and spill response, or attempt to find environmentally friendly alternatives to more toxic options - availability of alternatives in Belize is also a limiting factor. Little thought, too, is generally given to problems of chemical contamination following flooding through storm events…such as pre-empting the problem by storing bulk chemicals on the mainland, ensuring only minimal amounts are kept on the cayes.

Recommendations

- Develop baseline, monitor and address environmental impacts of Tobacco Caye and South Water Caye on the adjacent ecosystems
- Develop an Environmental Sustainability Plan for Tobacco Caye to mitigate current impacts, and look at synergies for reducing ecological footprint
- Encourage caye based operations to adopt WCS best practices guidelines
- Develop closer links with Department of the Environment for rapid response to pollution events
- Ensure all EIAs are adequately vetted and approved, and that Fisheries Department plays a vocal part in NEAC in relation to environmental sustainability of development within South Water Caye Marine Reserve

- Monitor development activities on the cayes and ensure they are compliant with ECPs

2.3.8 Dredging

DREDGING	
Dredging and Associated Sedimentation	Destruction of seagrass habitat, supporting many vertebrate and invertebrate species
	Sedimentation of coral, reducing coral viability
	Sedimentation of seagrass, reducing seagrass viability
	Re-suspension of pollutants

Dredging and mining of sand for use in construction and landfill associated with development on the cayes has resulted in the removal of seagrass beds, siltation on the reef, water quality degradation and smothering of benthic flora and fauna by excessive sedimentation within South Water Caye Marine Reserve. It continues to be an impact. If inappropriately managed, dredging activities within the Marine Reserve will impact areas of conservation importance such as the particularly fragile Pelican Cayes, where dredging has had a huge impact on the health of the biodiversity of the area. There are concerns that dredging may also be one of the factors influencing the erosion of Man-O-War Caye.

Recommendations

- Ensure adequate surveillance of caye developments
- Develop closer links with Department of the Environment for rapid response to illegal dredging
- Ensure all EIAs are adequately vetted and approved, and that Fisheries Department plays a vocal part in NEAC in relation to environmental sustainability of development within South Water Caye Marine Reserve

2.3.9 Threats from adjacent Shipping Lanes

Threats from adjacent shipping lanes cannot be ignored. The shipping lane between Belize and Honduras passes close to South Water Caye Marine Reserve, with an ever-increasing flow of cargo and passenger vessels, from oil tankers to cruise ships. The latter are a component of the passenger vessel category, which make up 13% of the world shipping fleet - with the rapid rate of increase of cruise ship visitation to Belize, and with cruise ship fleets predicted to grow by 50% in the next ten years, this sector has started to receive far more attention in terms of the threats they pose to the environment. The grounding in 2009 of the Westerhaven on the reef crest just off Emil Caye, not far to the north of South Water Caye Marine Reserve, highlights this problem. The cargo vessel was passing through the English Caye Channel, the

shipping route from Belize City to Guatemala, and went off course, with the destruction of an estimated 10,000 square meters of healthy reef, resulting in an estimated US $20 million in damages to the reef, based on an internationally accepted average of US$2,000 per square meter.

MARPOL
(International Convention for the Prevention of Pollution from Ships, 1973/1978)

The prevention of pollution from oil, bulk chemicals, dangerous goods, sewage, garbage and atmospheric pollution, and includes provisions such as requiring certain oil tankers to have double hulls.

The mechanical and physical impacts of groundings are not the only threats faced from vessels passing by in the shipping lane. During a typical one-week voyage, a large cruise ship (3,000 passengers and crew) is estimated to generate 210,000 gallons of sewage, 1 million gallons of greywater (wastewater from sinks, showers and laundries); more than 130 gallons of hazardous waste; 8 tons of solid waste; and 25,000 gallons of oily bilge water (Copeland, 2005). Whilst there are international laws in place to regulate pollution of the open seas by vessels such as these (principally the 1973 International Convention for the Prevention of Pollution from Ships – MARPOL), there are also known infringements of these regulations that suggest that ships will dump waste at sea – for example, 2013, Princess Cruises were fined $40 million for illegally dumping 4,227 gallons of oily waste and then trying to cover it up. Incidents such as this, whether through human error, mechanical failure, negligence or deliberate, lead to skepticism about the waste handling of large ocean-going vessels. Cruise ships are self-regulated to a certain extent by the expectations of the passengers to be able to sail in unpolluted waters. Other components of international shipping have no such internal controls. Impacts can be from a variety of recognized sources from regular operations, and are normally characterized as blackwater, greywater, hazardous waste, solid waste and bilge water.

Blackwater: Sewage, waste water from toilets and medical facilities). Release of untreated or inadequately treated sewage close to the reef can cause bacterial and viral contamination of fisheries and shellfish, and excess nitrogen and phosphorus can promote excessive algal growth, leading to eutrophication and great algal cover, reducing coral colonization.

BLACKWATER

A larger cruise ship (3,000 passengers and crew) generates an estimated 15,000 to 30,000 gallons per day of blackwater waste

Graywater: Waste water from sinks, showers, galleys, laundry and cleaning activities, containing a variety of contaminants such as detergents, oil, grease, metals petroleum hydrocarbons, nutrients etc. As with blackwater, this can cause excessive algal growth and eutrophication.

GREYWATER

A larger cruise ship (3,000 passengers and crew) generates an estimated 90,000 to 255,000 gallons per day of grey water waste

Hazardous Waste: A wide range of substances produced by on-board activities are included within this category – hydrocarbons, heavy metals, solvents, fluorescent and mercury vapor light bulbs, and batteries, which whilst small in volume can be extremely toxic to marine organisms if they find their way into greywater, bilge water or solid waste.

Solid Waste: This category includes glass, paper, cardboard, aluminum, steel cans and plastics, much of which is incinerated on board, and the ash discharged at sea - it is estimated that 24% of solid waste generated by vessels worldwide comes from cruise ships. Inadequate incineration can lead to entanglement of marine mammals, fish sea turtles and birds with plastics and other solid waste.

SOLID WASTE

A larger cruise ship (3,000 passengers and crew) generates an estimated 8 tons of solid waste during a one-week cruise.

Bilge Water: A frequent problem on a ship is oil leakage, or oil byproducts from engines or from engine maintenance activities which, even in minute quantities, can kill fish or cause chronic effects. Much of this ends up in the bilge water, which may also contain other chemical contaminants. The bilge space, where this contaminated water accumulates, needs to be flushed out at regular intervals to maintain the vessels stability and eliminate potentially dangerous flammable vapors. To do so, the oil needs to be extracted, and then reused, offloaded at port or incinerated, using a separator or similar mechanism – failure to do so, negligent bad practices, or mechanical faults can result in untreated bilge water being emptied directly into the sea.

BILGE WATER

A larger cruise ship (3,000 passengers and crew) generates an estimated 25,000 gallons of oily bilge water every week of operation

Ballast Water: Ballast water, used to stabilize vessels during transport, is often taken on in coastal waters in one region, then released in another, as cargo or passengers are loaded or unloaded, resulting in changes in the amount of compensating ballast required. This has resulted in the transport of plants, animals, viruses and bacteria into areas they would not normally occur, and is considered to be the major source of invasive species in US waters (Copeland, 2005), and is also considered a problem in Belize.

Recommendations

- Develop an emergency response plan with the input of DoE, in case a major shipping incident should occur
- Work closely with Port Authority, Coast Guard and DoE towards mitigation of potential groundings

2.4 Cross-cutting Strategies to Reduce Threats

A series of strategies have been developed to address concerns, threats and stresses raised during the SBRC management planning process, conservation planning review, and through consultations with stakeholders throughout the management planning process. These strategies are incorporated into the management programmes.

Key Cross-Cutting Strategies	**Coral Reefs**	**Seagrass**	**Commercial Species**	**Turtle Nesting Beaches**	**Large Marine Vertebrates**	**Mangroves**	**Nesting Bird Species**
Ensure SWCMR 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							
Engage land owners, caye developers, residents and users in 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 in the wider SBRC							
Continue strengthening collaborative enforcement (fishermen, Fisheries Dept., Coastguard, BDF, Police Dept. Customs etc.) against transboundary incursions both within and outside the MPA							
Establish a water quality monitoring program for SWCMR aligned with and contributing towards the NBMP							
Identify and map resilient coral species and areas within SWCMR and integrate in prioritised enforcement areas							
Ensure adequate protection of key herbivores to maintain live coral cover and ecological functions							
Continue effective implementation of managed access and other mechanisms for increasing benefit for traditional users							

TABLE 26: KEY CROSS-CUTTING STRATEGIES

2.5 Monitoring of Success of Conservation Strategies

The series of indicators allocated to each conservation target provides a framework for site level monitoring. A system level monitoring programme has also been developed under the SBRC to measure the success of conservation strategies, as an integrated component of the conservation planning process.

2.6 Planning for Climate Change

2.6.1 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 South Water Caye 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 SWCMR
2. Understanding climate change projections for SWCMR
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

2.6.2 Identified Resources of South Water Caye Marine Reserve

The following resources have been identified as important for South Water Caye Marine Reserve:

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

Resource	Comment
▪ Conch, Lobster	SWCMR contributes to both national conch and lobster production, providing an important income for traditional fishermen from the southern fishing communities.
▪ Snapper / Grouper	The snapper and grouper continue to be important in supporting local fishermen and supplying local markets

The Tourism Sector. South Water Caye Marine Reserve is considered important locally as a tourism resource, generating income and employment for the local economy and foreign exchange for the national economy.

Resource	Comment
▪ Healthy reef	The caye-based resorts and Tobacco Caye, located right on the barrier reef, make the reefs of SWCMR among 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	The sandy beaches of the cayes have led to the development of a number of popular resorts, and add to the touristic appeal of the protected area.
▪ Sport fishing	SWCMR is a growing sport fishing destination, contributing to tourism income, and supporting sport fishing lodges on the cayes, in Dangriga and Hopkins.
▪ Large Marine Vertebrates (Antillean manatee, 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 SWCMR are considered of national importance, the well-defined barrier reef, mangrove ranges and complex rhomboid reefs providing significant protection to the coastline from storm surges during hurricanes. They support an important tourism sector that is based on the health of the reef, with associated snorkelling and diving activities. The Marine Reserve also supports the commercial and sport

fishing industries by protecting key nursery areas, enhancing finfish, conch and lobster populations, and contributing towards the long-term sustainability of these activities.

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, reducing shore erosion and breaking the strength of storm force winds. The oceanic mangroves of the Pelican Cayes are considered particularly rich, though have been impacted by past clearance.
Seagrass	SWCMR 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 SWCMR are some of the most complex in Belize, with a well formed barrier formation that protects the reef lagoon, and supports high biodiversity, as well as economic opportunities for the coastal communities. Extensive coral reef formations exist within the reef lagoon, including rhomboid reefs.
Coastal vegetation and littoral forest	The cayes of SWCMR support small remnants of littoral forest, considered the most threatened ecosystem in Belize. The forest is important for the endemic migratory birds, as well as nesting birds as seen on Man-O-War Caye. The coastal strand vegetation is important for stabilizing turtle nesting beaches, and maintaining the cayes.

2.6.3 Identification of the Primary Climate Change Elements

The primary climate change elements associated with South Water Caye 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 27). For each target, the impacts of the identified primary climate change elements were rated on a scale of 1 to 4 (Table 28). Ratings took into consideration factors such as the severity, scope, contribution and irreversibility of each climate change element.

TABLE 27/1: CLIMATE CHANGE PREDICTIONS (B2 SCENARIO) FOR SOUTH WATER CAYE 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[2]. 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).

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

Climate Change Predictions (B2 Scenario) for South Water Caye 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 South Water Caye 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 SOUTH WATER CAYE MARINE RESERVE

2.6.4 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 caye and coastal 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.	▪ The lowest lying cayes will 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 coral larval dispersion through localized current patterns ▪ 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, exacerbated by anthropogenic clearance of the riparian belt. ▪ 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**	**Mangroves / Littoral Forest**
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	**Turtle Nesting Beaches**	**Large Marine Vertebrates**
Sea level rise	▪ Conch: 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 ▪ Individuals moving to deeper, cooler waters when temperatures increase – harder to extract	▪ Turtle and crocodile nesting beaches may become inundated	▪ Adults are able to adapt to changing water depth – highly mobile ▪ Shifts in foraging areas
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.		▪ 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	**Turtle Nesting Beaches**	**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 potential for inundation of turtle and crocodile nests during storm events, deposition of corals and boulders over existing beaches, by storm events ▪ Removal or erosion of turtle and crocodile nesting beaches, ▪ Impacts on dispersal / survival of both adults and nestling turtles	▪ 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
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) ▪ Changes in larval fish behaviour, based on reduced ability to distinguish chemical cues	▪ Sea turtle olfaction may also be impacted reducing their ability to locate food and nesting sites.	▪ 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.
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		▪ 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	Turtle Nesting Beaches	Large Marine Vertebrates
Air Temperature	▪ 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 SOUTH WATER CAYE MARINE RESERVE

2.6.5 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*	*Mangroves / Littoral Forest*	*Commercial Species*	*Turtle Nesting Beaches*	*Large Marine Vertebrates*	*Nesting Bird Species*
Increased sea level	High (3)	Low (1)	High (3)	Medium (2)	Very High (4)	Low (1)	Very High (4)
Increased sea temperature	Very High (4)	Low (1)	Low (1)	Medium (2)	Medium (2)	Low (1)	Low (1)
Decreased Precipitation	Low (1)	-	Medium (2)	Low (1)	Low (1)	Medium (2)	Low (1)
Increased frequency of storms	Medium (2)	High (3)	Very High (4)	High (3)	High (3)	Medium (2)	Very High (4)
Ocean acidification	Very High (4)	Positive (0)	-	High (3)	Low (1)	Medium (2)	Low (1)
Increased air temperature	-	-	Medium (2)	Low (1)	High (3)	Low (1)	Low (1)
Averaged Rating	**2.80**	**1.25**	**2.40**	**2.00**	**2.33**	**1.50**	**2.00**
	Selected		**Selected**	**Selected**	**Selected**		

TABLE 30: RATINGS FOR PRIORITIZATION OF CONSERVATION TARGETS

Prioritized Targets:

- ***Coral Reef***
- ***Mangroves / Littoral Forest***
- ***Commercial Species***
- ***Turtle Nesting Beaches***

2.6.6 Prioritised Strategies per Target and Objective

Target	Objective	Strategy	Threat
Commercial Species	By 2020, Fisheries Department, in collaboration with fishers, will identify and improve at least three responsible and effective new fishing techniques	Ensure diversification into new fisheries is guided by sustainable fishery plans	Using different fishing techniques (e.g. deep sea fishing) without informed guidelines in place
	By 2020, at least 75% of fishermen consider they have ownership of SWCMR and are integrated into decision making	Strengthen managed access committee, addressing identified capacity building needs	Climate change impacts are exacerbated by limited enforcement effectiveness, partially as a result of limited engagement of fishers and adaptation measures
		Involve fishermen in activities at all levels – boat drivers, community researchers	
	By 2020, 25% of fishermen will have access to training and funding opportunities to diversify into or improve sustainable alternatives, with integration in project planning and implementation	Assist fishermen in strengthening marketing of marine products and mechanisms of increasing market value	Barriers to international climate adaptation agreements
		Identify income diversification opportunities for fishers	
		Invest in education of fisher's children, to ensure they have employment opportunities beyond fishing	
Turtle Nesting Sites	By 2022, sea turtle monitoring of sex ratio and nest success is ongoing at SWCMR	Implement turtle monitoring program, with capacity building of staff and community researchers	Increase in air temperature will affect the sex ratio of sea turtles
	By 2020 there is improved stewardship of turtle nests by caye owners and developers of SWCMR	Ensure those caye owners and developers that can influence turtle nesting success have access to best practices and are engaged in nest protection	Clearance of beach vegetation may lead to an increase in erosion of turtle nesting beaches, reducing turtle nest success
	Between 2018 and 2022, no new impacts are identified on key turtle nesting beaches	Ensure targeted surveillance of key nesting beaches to monitor potential harmful development activities	

2.6.6 Prioritised Strategies per Target and Objective

Target	Objective	Strategy	Priority Threat
Coral Reef Communities	By 2022, 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	Diversification results in increased fishing pressure across a wider range of species, increasing impact to 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	Tourism increasing to unsustainable levels in SWCMR as a result of degradation in other popular tourist areas
		Provide incentives for tour operators to abide by established best practices regulations	
		Effective management of tourism vessels through installation of sufficient mooring and marker buoys in relevant areas.	Mechanical impacts on the reef from poorly anchored boats
	By 2020, a sustainable tourism plan has been developed for Tobacco Caye, integrating climate change adaptations	A participatory sustainability plan has been developed for Tobacco Caye, focusing on promotion of best tourism and environmentally sustainable development and management practices	Tobacco Caye has an increasing tourism impact on nearby reefs, with poor solid and liquid waste management
	Strengthen resilience of coral reefs in SWCMR through continued planting out of resilient coral fragments	Continue partnering with Fragments of Hope for outplanting of resilient coral strains in SWCMR	Sea temperature rise causing increased bleaching and mortality in corals
Mangroves / Littoral Forest	Between 2018 and 2022, there will be no reduction of mangrove coverage in SWCMR based on 2016 MARFund mangrove baseline	Continue surveillance of development activities to ensure no non-permitted mangrove loss occurs	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 of mangroves on the cayes and ranges of SWCMR	

Section Three

Management Planning

3. Management Planning

3.1 Management Goals

The overall goal for the management of South Water Caye Marine Reserve is:

> ***To manage the natural resources of South Water Caye Marine Reserve for its value to Belizeans, and global values as a World Heritage Site***

This goal is supported by five objectives:

- Effectively manage the natural resources of South Water Caye Marine Reserve
- Develop and use sound data to inform management decisions
- Use South Water Caye Marine Reserve as an effective tool in promoting an understanding of the unique marine environment
- Engage stakeholders towards good stewardship of the marine environment for long term sustainable benefit
- Provide opportunities for recreation, interpretation, education, and appreciation for all visitors

3.2 Management and Organizational Background

Regulatory authority for South Water Caye Marine Reserve lies with the Fisheries Department (Ministry of Agriculture, Foresty, Fisheries and Sustainable Development), which administers the policies and laws that govern the Marine Reserve. The Fisheries Department manages the Marine Reserves in Belize (including South Water Caye) under the Protected Area Management (Marine Reserve) programme of the Ecosystems Management Unit, as part of its Mission…

> *"To provide the country and the people of Belize with the best possible management of aquatic and fisheries resources with a view to optimize the present and future benefits through efficient and sustainable management".*
>
> ***Mission Statement, Fisheries Department***

…with the specific goal of:

> *"holistic ecosystems management of the aquatic resources through a marine reserve network and international commitments".*

Implementation of the management plan is the responsibility of the Ecosystem Management Unit, managed under the Marine Protected Areas Coordinator, and the site management team, under the Reserve Manager (Officer in Command). Site level management at South Water Caye Marine Reserve is conducted from the staffed Fisheries Base, established on Twin Cayes. The Reserve Manager is supported by a Head Ranger (Officer in Charge of Enforcement) a ranger, a marine biologist and a caretaker. These personnel are responsible for the on-site, day-to-day management of the reserve, and for the implementation of the management plan, through effective use of funds, staff and equipment, and supported by centralized activities such as environmental education and outreach, from Belize City. Each staff position is described by a general terms of reference.

An Advisory Committee assists Fisheries Department with management recommendations, and is composed of representatives from the major stakeholder sectors (Figure 26), with the following Terms of Reference:

- Ensure regular revision and review of management plan;
- Comment on and recommend legislation and regulations (e.g. regarding extension of geographic boundaries of reserve and zoning);
- Provide advice on all applications for permits (eg dredging, mangrove clearance and leases/subdivisions) within the general boundaries of the reserve;
- Report on activities impacting the reserve and liaise with government enforcement agencies
- Assist in the development of sustainable financing mechanisms for the reserve;

- Advise on and, where appropriate, assist with administrative matters, publicity, education and interpretive programmes and
- Review and advise on research proposals and research permit applications related to the reserve.

Composition of the South Water Caye Marine Reserve Advisory Committee (SWCMRAC) Representation…

1. Fisheries Department
2. Forest Department
3. Coastal Zone Management Authority and Institute
4. Belize Tourism Industry Association
5. Dangriga Town Council
6. Hopkins Village Council
7. Tobacco Caye representative
8. Sarteneja Fisherman Association
9. Hopkins Fishermen Association
10. Riversdale Fishermen Association
11. Wabafu Fishermen Association
12. Placencia Producers Cooperative Society Ltd.
13. Southern Environmental Association
14. Wildlife Conservation Society
15. Healthy Reef Initiative
16. SWCMR Manager

FIGURE 26: COMPOSITION OF ADVISORY COMMITTEE (2018)

3.3 Review of Previous Management Plan

The first draft management plan was prepared for South Water Caye in 1993, and revised in 2007 (Jones, 2007). It was then revised a second time (Walker, 2009) to ensure the management plan complied with the updated objectives of the National Protected Area System Plan and National Management Planning frameworks. An assessment of management implementation success was conducted in 2017, focusing on the success of implementation of management activities and programmes of the 2009 Management Plan (Table 31).

Programme Area	*Total no. actions*	*Succeeded*	*Improved*	*No Change*	*Worse*
Marine Resource Management	*65*	*18.5%*	*40.0%*	*37.0%*	*4.6%*
Research and Monitoring	*57*	*21.1%*	*24.6%*	*54.4%*	*0.0%*
Community Participation	*14*	*14.3%*	*42.9%*	*42.9%*	*0.0%*
Public Use Programme	*25*	*0.0%*	*32.0%*	*68.0%*	*0.0%*
Education and Outreach	*32*	*25.0%*	*25.0%*	*50.0%*	*0.0%*
Administration	*14*	*28.6%*	*42.9%*	*28.6%*	*0.0%*
Average	***207***	***17.9%***	***34.6%***	***46.8%***	***0.8%***

TABLE 31: % STATUS OF ACTIVITY IMPLEMENTATION PER PROGRAMME AREA OF 2009 MANAGEMENT PLAN

It should be noted that the assessment only provides a 2017 snapshot of implementation success from the viewpoint of 2017 – so, for example, the relative success of the Education and Outreach Programme reflects the hiring of an Outreach Officer in 2017 / 2018, not the status of the programme across the 8 years (2009 – 2017). The results demonstrate a need for significant strengthening, with 52.5% of activities rating as 'No Change' or 'Worse'. Only 17.9% of activities are considered to have

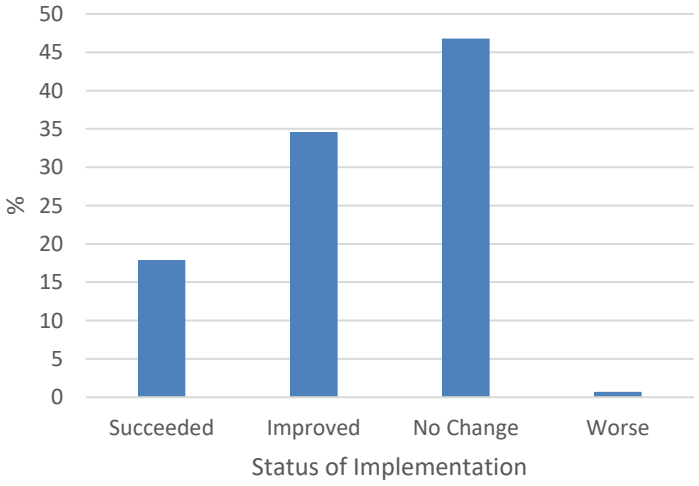


FIGURE 27: STATUS OF ACTIVITY IMPLEMENTATION OF 2009 MANAGEMENT PLAN

been implemented successfully, though 34.6% are considered to have been implemented with partial success.

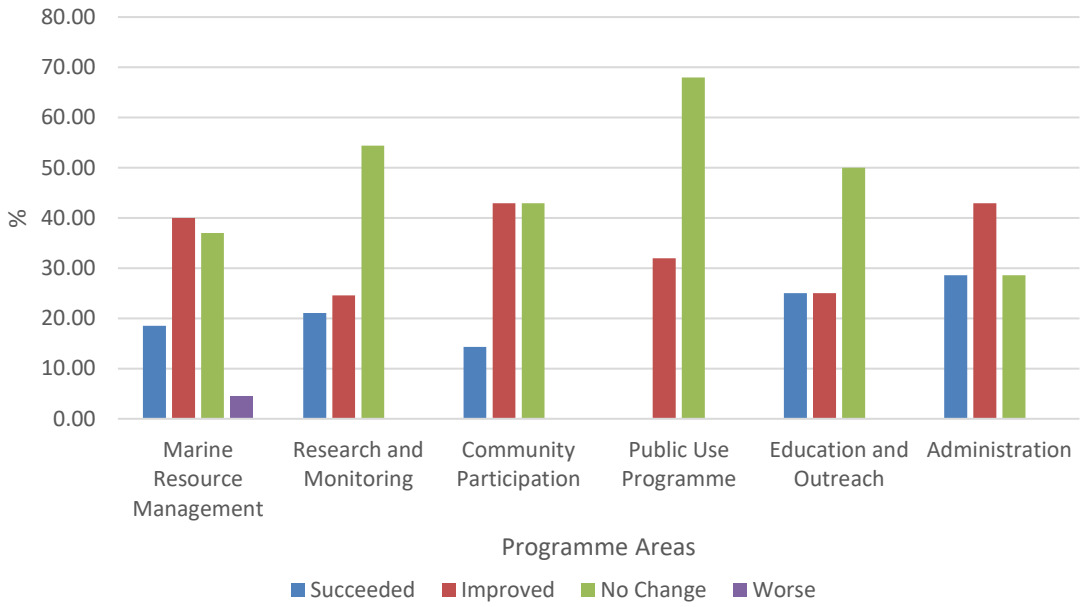


FIGURE 28: RELATIVE STATUS OF PROGRAMME IMPLEMENTATION OF 2009 MANAGEMENT PLAN

The weakest area is the Public Use Programme – management has been firmly focused on the fishing sector, with very little active management of tourism. Education and Outreach and Research and Monitoring are also flagged as benefitting from strengthening. Stronger areas are the management of the natural resources, with surveillance and enforcement in place, and administration, with clear financial and reporting protocols in place.

3.4 Management Strategies

Management strategies are guided by national protected area legislation and objectives, and the goals and objectives of the Fisheries Department. Whilst this management plan is specifically for South Water Caye Marine Reserve, compatibility with seascape objectives 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.

Management objectives and strategies are therefore also aligned with the wider vision for the Southern Belize Reef Complex:

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

Five key strategies provide guidance for effective management of the Marine Reserve:

- Regulations under the Fisheries Act and SWCMR Statutory Instrument
- Management Zones
- Managed Access – management of the fishery
- Management as a World Heritage Site
- Caye development guidelines (ICZMP)
- Community Engagement and Investment Strategy

3.4.1 Fisheries Regulations

South Water Caye Marine Reserve functions as a component of the 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. Extraction of marine resources is not permitted in the Conservation and Preservation Zones.

Under SI 74 of 2009, the following definitions apply:

- "Sport fishing" means catch and release;
- "recreational fishing" means fishing for enjoyment with the intention to eat the fish caught but not for the purpose of selling;
- "subsistence fishing" means fishing conducted by persons who reside within the Reserve for the purpose of consuming 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) $10.00 per person per day;
  (b) $30.00 per person per week

- No fees shall be payable by Belizeans and children below twelve years of age

Legislated Management Regulations

ESTABLISHMENT OF ZONES AND RULES FOR ZONES

- Establishment of zones.
- Rules for establishment of zones
- Rules for General Use Zone.
- Rules for Conservation I Zone.
- Rules for Conservation II Zone.

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

- Commercial Fishing Licenses.
- Research 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.
- Officers to uphold Regulations.
- Offences and Penalties.
- Negative Resolution

SI 74 of 2009

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 29 / 1: FISHERIES LEGISLATION REGULATIONS

FISHERIES 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 29 / 2: 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 29/3: FISHERIES REGULATIONS

3.4.2 Management Zones

The South Water Caye Marine Reserve encompasses a total area of 117,875 acres, though maintaining ongoing boundary demarcation is a constant challenge. Boundary demarcation of the Conservation Zone is considered a priority.

South Water Caye Marine Reserve is currently divided into three zones to allow for the management of resources for sustainability, and to provide the flexibility needed to accommodate many users:

- General Use Zone
- Conservation Zone
- Preservation Zone

NOTE: The following are the current zones. However there is an ongoing project to realign the zones for improved management. The proposed new zones are not yet validated, but are presented after the current zones.

General Use Zone (GUZ)

The General Use Zone covers 95,597 acres (38,687 hectares) – 81.1% of the protected area.

Fishing is permitted in this Zone by licensed fishermen, though there are gear restrictions, including a ban on gillnets, long lines and spear fishing. There is also provision for residents of the Marine Reserve to fish for subsistence purposes, under Special License.

Sport fishing is permitted within this Zone, (excluding spear fishing), but is generally catch and release, unless fish are being caught for subsistence purposes during the tour.

GUZ REGULATIONS

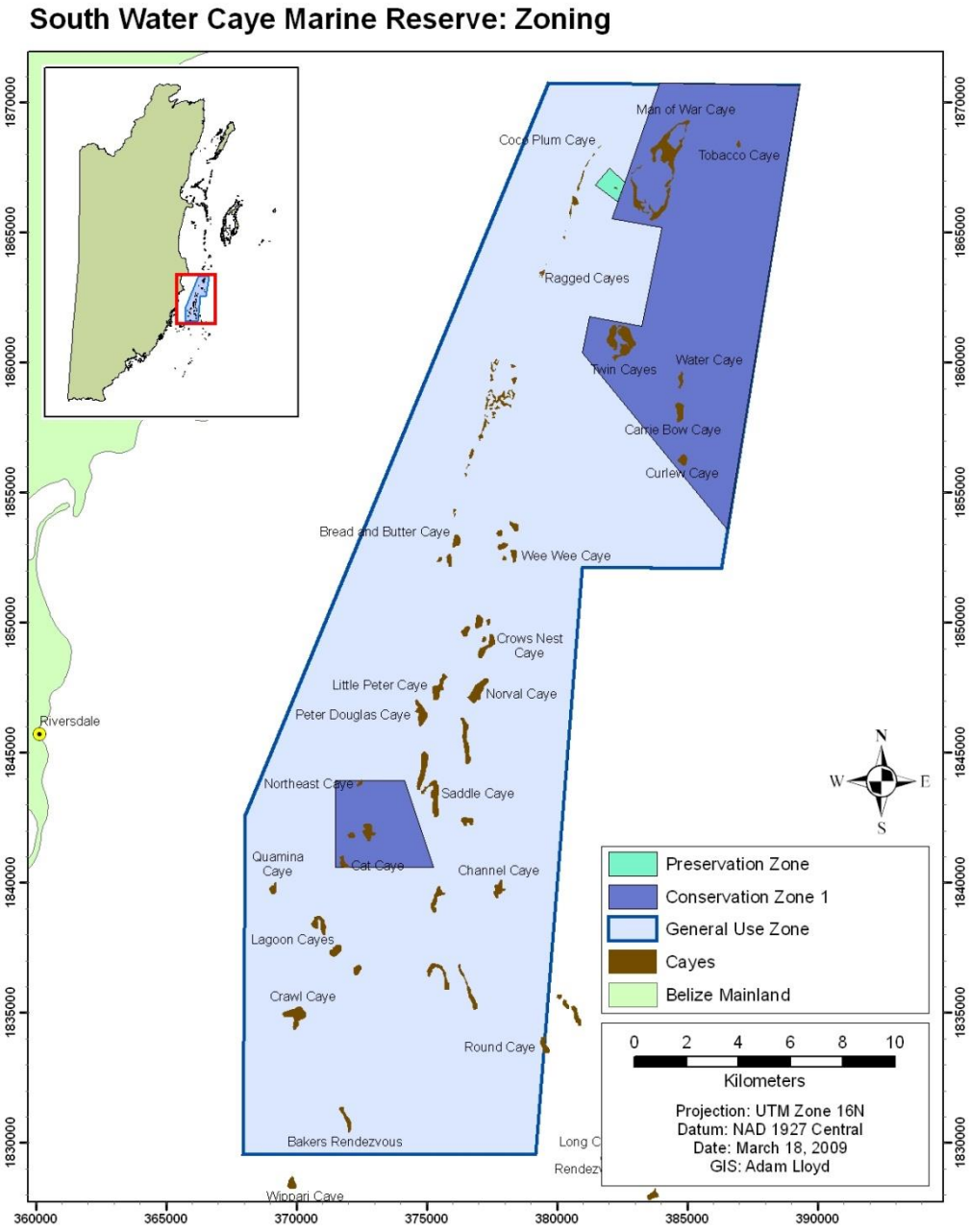
- Commercial fishing is allowed in this area.
- Gears such as longlines and gillnets can not be used within this area.
- Sports fishing is allowed whenever spearfishing is not employed and fish can only be retained for subsistence during tour.
- Anchors should not be cast or dragged.

Conservation Zone

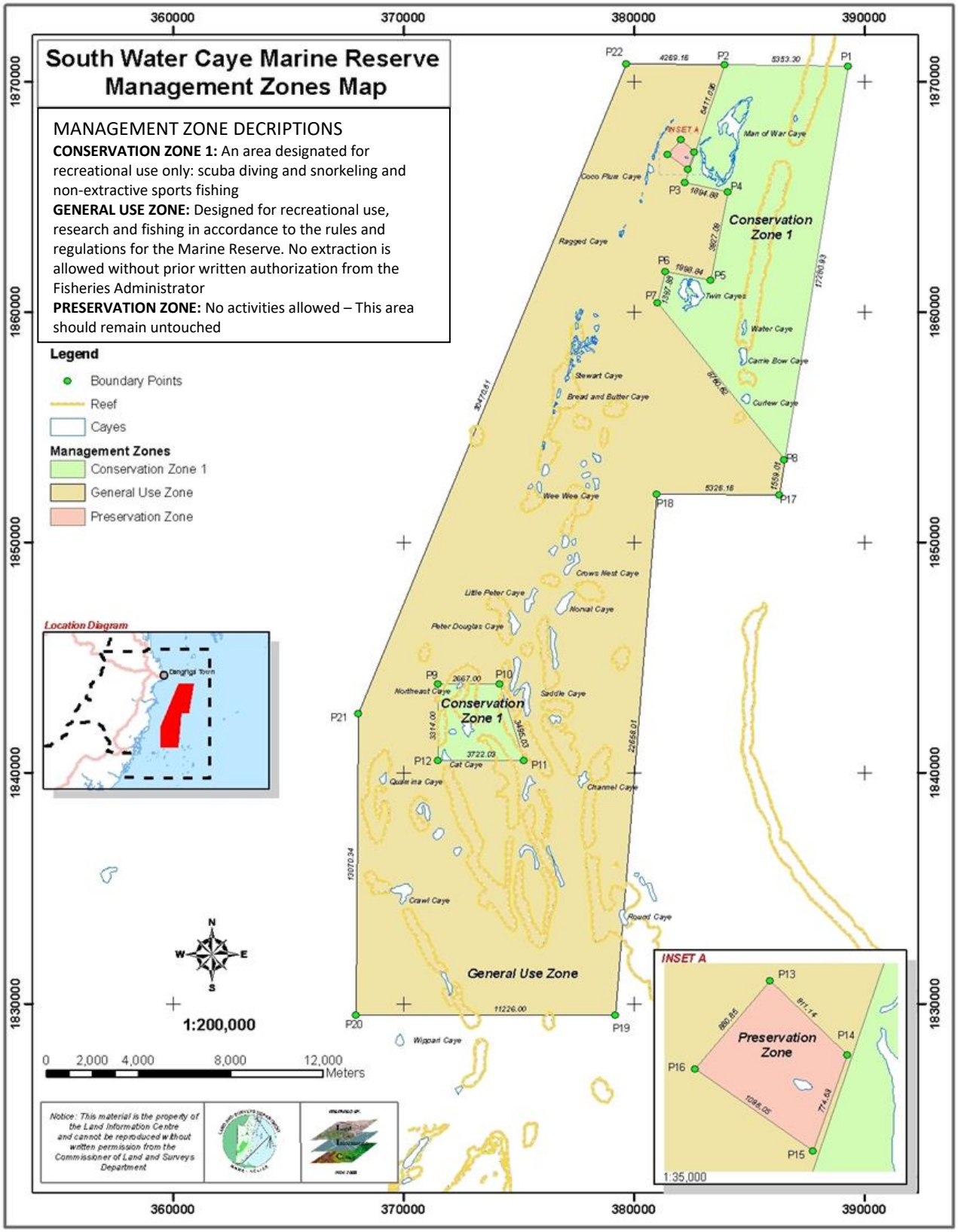
The Conservation Zone covers approximately 22,143 acres (8,961 ha, or 18.7%) of the Marine Reserve. Within this zone, Marine life is fully protected, with strict regulations stating that “no person shall harass or in any way tamper with any fauna…”

Only non-extractive recreational activities are permitted within this zone, with no commercial, sport or subsistence fishing allowed.

All boats are to be secured using officially designated mooring buoys, to prevent anchor damage to the seabed – except in emergency situations, or with prior written permission from the Reserve Manager.



MAP 11: CURRENT ZONES OF SOUTH WATER CAYE MARINE RESERVE (1)



MAP 12: CURRENT ZONES OF SOUTH WATER CAYE MARINE RESERVE (2)

CONSERVATION ZONE REGULATIONS

- No commercial or extractive fishing; only recreational activities permitted.
- Only catch and release sports fishing allowed in specified zones (Tobacco Caye channel and westside of South Water Caye).
- Every boat captain must register with Reserve Station prior to using this area.
- When within the Conservation Zone all boat captain must have their divers down flag when divers or snorkelers are in the water.
- All boat captains must ensure that at all time there is a ratio of no more than eight (8) divers or snorkelrs per licensed tour guide at all times.
- Tour guides must explain the rules of the Reserve to divers or snorklers.
- Only certified scuba instructors are allowed to conduct dive training.
- No person shall harass or in any way tamper with any fauna within the Conservation 1 Zone.
- No person shall engage in water-skiing or jet skiing.
- Divers are required to be certified, or undergoing training with a certified instructor, to dive within the Conservation Zone.
- Charter dive boats must obtain a license before operating in the Conservation Zone.
- All boat operators are required to observe the low wake zone boat way when approaching snorkelers or divers.

Preservation Zone

The Preservation Zone covers approximately 190 acres (76.6 hectares) – 0.16% of the protected area, and has been established to protect the bird nesting colony of Man-O-War Caye – one of Belize's original crown reserves.

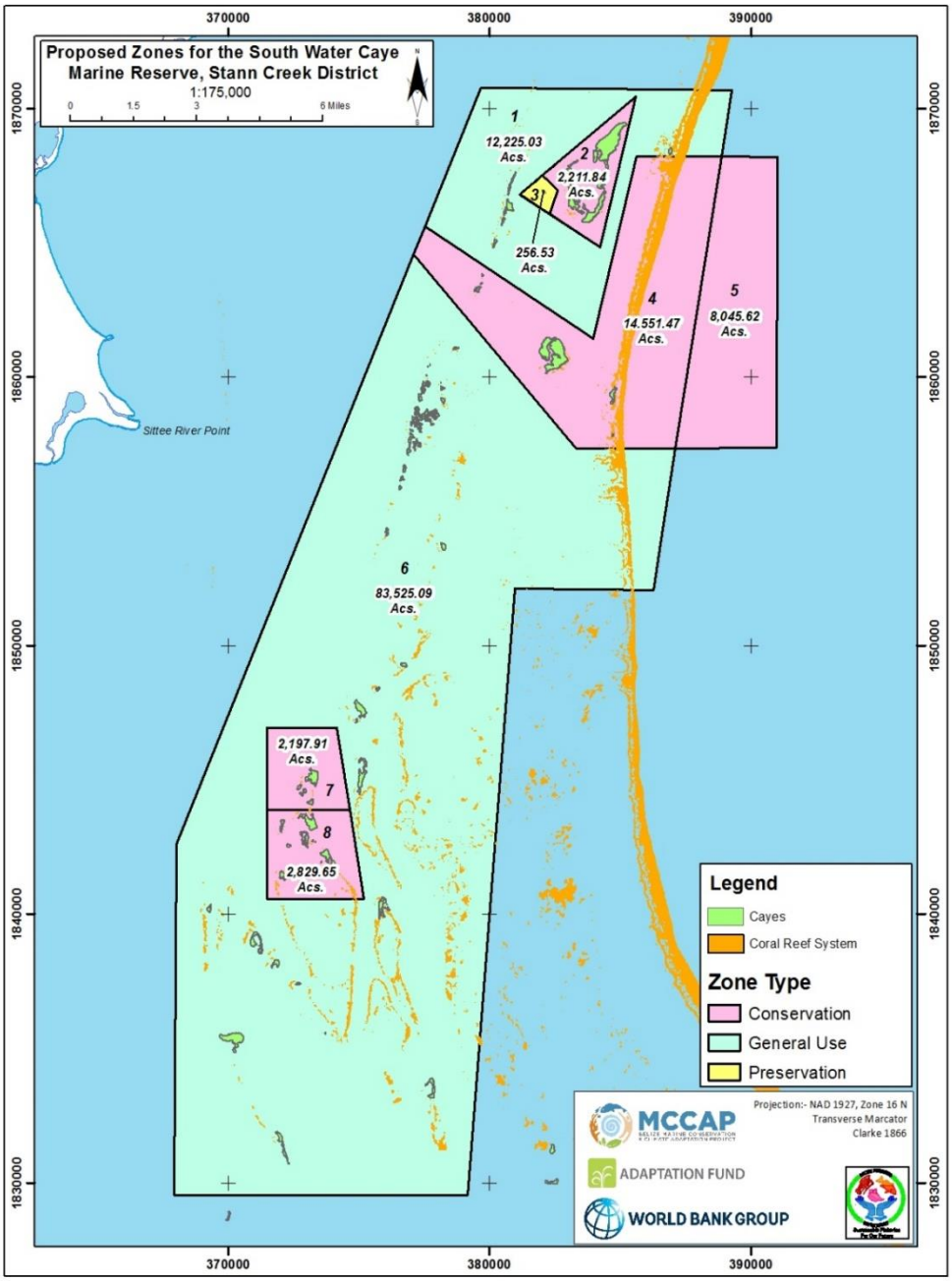
Activities are restricted, with no fishing, sport fishing, diving or any other activity permitted within the Zone.

PZ REGULATIONS

- Not allowed: fishing, diving, sport fishing or any other activity within zone. Subject to sub-regualtion.
- No one should operate a motor boat in the zone except in case of emergency or where written permission has been obtained from the fisheries administrator.

PROPOSED REVISED ZONES – PROVISIONAL DRAFT

The zones have been reviewed and are being revised with extensive community consultation, under the Belize Marine Conservation and Climate Change Adaptation Project (MCCAP). There is currently a proposed re-zoning map to be presented at the final open consultation to finalize the outputs.



MAP 13: PROVISIONAL DRAFT SOUTH WATER CAYE EXPANSION AND ZONES

This realignment addresses a number of issues identified during community consultations and national assessments:

- Improved access to the General Use Zone for commercial fishing for Tobacco Caye residents
- Improved representation of deep sea ecosystems in the National Protected Areas System
- Improved protection for the Pelican Cayes and Tobacco and Blue Ground Ranges
- Improved integration of Man O War Caye into the management zones of the Marine Reserve

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.

Managed Access is a fisheries management tool that provides 'rights-based' access to customary fishers for their fishing grounds. It focuses on protecting the rights of fishers in their traditional fishing areas, whilst stopping the unsustainable growth in the number of fishers. It achieves this through developing, encouraging and incentivizing good stewardship, towards better catches and improved incomes. Identification of customary users is based on validation of Belize residency, and through a transparent, peer review process led by the Community Managed Access Committees, comprised of local fisher representatives, Fisheries Department and co-management partners.

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

Managed Access is now being rolled out nationally to eight distinct areas, or TURF's, with the open sea considered as the ninth area. South Water Caye Marine Reserve lies in Fishing Area 3, which encompases the Marine Reserve, Gladden Spit Silk Cayes Marine Reserve, Laughing Bird Caye National Park and the coastal waters from the barrier reef to the coastline. Implementation of Managed Access is based on the establishment of area-specific fishing licenses for traditional fishers, and supported by a robust monitoring and enforcement regime. It is also supported by science-based catch limits through a total allowable catch (TAC), to guide sustainable management of the fishery, and by improvements to livelihoods and the fishing industry by linking Belize's sustainable seafood to premium markets.

Belize's Managed Access Strategy is based on the current patterns of fishing, reflecting customary resource use patterns. It establishes user rights for Belizean fishermen, facilitating action against trans-boundary fishing incursions. The Managed Access Committee for Area 3 consists of representatives from the 8 key stakeholder communities, some communitie holding multiple seats.

MA AREA 3 COMMITTEE SEATS
Dangriga (3)
Hopkins (2)
Sarteneja (1)
Riversdale (1)
Seine Bight (1)
Placencia (1)
Monkey River (1)
Independence (1)

3.4.4 Strategies for the Belize Barrier Reef Reserve System – World Heritage Site

Belize's World Heritage Site has recently been removed from the list of sites in danger following the addressing of a number of criteria for the seven sites, including South Water Caye Marine Reserve to the satisfaction of the members of the IUCN World Heritage Convention. These include:

- finalization, endorsement and implementation of the revised Fisheries Act (the Living Aquatic Resource Bill) – in process, September, 2018)
- revision of the Mangrove Protection Act / Regulations
- elimination of all oil concession in and around the WHS, through legislation
- permanent cessation of the sale and lease of lands throughout the WHS through legal instrument
- clear definition and strict control of development rights on existing private and leased lands within the WHS

UNESCO, 2015

Whilst Belize has been able to remove the Belize Barrier Reef Reserve World Heritage Site from the list of sites in danger, maintaining and improving the status of the flagged criteria is considered important.

3.4.5 Caye Development Guidelines

Development guidelines have been established in the Integrated Coastal Zone Management Plan - South-Northern and South-Central Regions (CZMAI, 2016), which identified recommendations for acceptable development levels on the cayes. It should be remembered, however, that as part of Belize's World Heritage Site, private caye ownership and caye development are issues brought up during the assessment of the site, resulting in its categorization as 'Endangered'. Any new development being considered should therefore be carefully considered before approval is given through the NEAC process.

> *"While some of the cayes are elevated or have high firm land, and their soil profile suggests their suitability for development activity, their ecological sensitivity, protected status, and world heritage designation in the instances of Glovers Reef and South Water Caye, directs that a precautionary approach be applied to future development of the region"*
>
> ***CZMP South-Northern Regional, 2016***

The CZMP categorizes land use on the cayes as Residential; Resort and Research/Scientific Station, and Undeveloped. Where lands are held under private ownership:

"*the CZMAI recognizes the right of the landowner to develop their land in any matter they see fit there must be measures in place to steer future development in order to ensure sustained ecosystem services. Therefore, in the case of these lands, if there is no development activity within the first five (5) years of the passage of this planning document then all future development activities, after the time period, MUST follow development standards as outlined within this coastal development guideline."*

Conservation Development: Cayes in the South-Northern Region

that are not recommended for major development but can accommodate very small scale infrastructure – Research stations, low scale ecotourism lodge, residential/ fisherman's camps with temporary structures.

Conservation I land use category:

- Upper Tobacco Caye Range,
- Curlew, Caye
- Blue Ground Range.

Conservation II land use category:

- Southern Long Caye,
- Glory Caye,
- Columbus Caye,
- Sand Fly Range,
- Lower Tobacco Caye Range,
- Rockers Island,
- Ragged Caye

Recommendations (CZMAI, 2016):

1. Increased collaboration among local stakeholders, interest groups and the agencies responsible for land allocation, including the conditions applied to lease approval and the regulation of lot sizes
2. Limit the number of piers per property or caye
3. Prohibit the construction of buildings on piers
4. Preserve remaining crown lands in the region
5. All new developments must be constructed using the standards developed by LUA and CZMAI in the creation of these management guidelines.
6. Although permitted, coastal agriculture and aquaculture activities must be closely monitored and not allowed to occur near important watersheds and lagoons. Relating to this, proper pesticide use and waste water disposal is key to ensuring that the marine environment is not polluted. Therefore enforcement agencies will be required to conduct regular water testing.

Sub-division Criteria	**Development Standards Conservation Development**	
Use Category	Conservation I	Conservation II
Primary Use	Conservation	Conservation
Secondary Use	Fishermen Camp	Residential I
Minimum Lot Size	1 acre	1 acre
Net Housing Density	2 per acre	2 per acre
Maximum # Habitable Rooms / acre	4	4
Maximum Building Coverage	4%	6%
Maximum Site Clearance	50%	50%
Building Setback Front	50 ft.	50 ft.
Building Setback Side	25 ft.	25 ft.
Building Setback Back	50 ft.	50 ft.
Between Buildings	25 ft.	25 ft.
Building Height	28 ft.	28 ft.
Maximum # of Floors	2	2
# of Pier per Site	1	1

TABLE 32: CONSERVATION DEVELOPMENT STANDARDS FOR CAYES (CZMAI, 2016)

3.4.6 Community Engagement and Investment

The Community Engagement Strategy (draft, 2018) provides recommendations for community engagement and empowerment strategies targeted at Dangriga and Hopkins that encourage stakeholder participation in the management and conservation of the natural resources of the Marine Reserve

The Strategy also looks at the enabling environment required for successful engagement of these communities, with identification of synergies for strengthening communication, collaboration and coordination across stakeholders at the local level. This is essential to achieve strong, long term sustainable outcomes with proactive participation of communities in the management of the protected area, and promotion of community ownership.

A Theory of Change model identified the long term goal for the strategy:

> **GOAL 1: ENGAGED COMMUNITIES DEMONSTRATING SUPPORT AND GOOD STEWARDSHIP OF SWCMR**
>
> **GOAL 2: STRONG STAKEHOLDER PARTNERS, ENGAGED, SUPPORTIVE AND PARTICIPATORY IN MANAGEMENT ACTIVITIES THAT STRENGTHEN SWCMR**

With three **Key Strategic Themes** identified to frame the Strategy:

- **RECOGNITION OF ECOSYSTEM SERVICES VALUES:** Ensuring that stakeholders are fully aware of the ecosystem services provided by SWCMR

- **ACTIVE STAKEHOLDER ENGAGEMENT AND SUPPORT:** Ensuring that stakeholders / communities have accurate information for decision making, and mechanisms that facilitate meaningful participation, towards improved stewardship of the marine reserve.

- **INCOME DIVERSIFICATION:** The structures and processes that need to be in place for successful income diversification project implementation in the communities.

Four SMART targets have been identified, linked to the five outcomes:

KEY STRATEGIC THEME ONE: RECOGNITION OF ECOSYSTEM SERVICES VALUES

TARGET ONE: By 2022, at least 30% of people surveyed in Dangriga and Hopkins recognise the ecosystem values associated with SWCMR and support its conservation and sustainable use

KEY STRATEGIC THEME TWO: ACTIVE STAKEHOLDER ENGAGEMENT AND SUPPORT

TARGET TWO: By 2022, there has been an increase of 20% in sustained, active support of SWCMR in Dangriga and Hopkins over the 2018 baseline

TARGET THREE: By 2022, at least 10 local tourism operations have developed strong collaborative partnerships with SWCMR to strengthen management of the Marine Reserve

KEY STRATEGIC THEME THREE: INCOME DIVERSIFICATION

TARGET FOUR: By 2022, at least 20% of SWCMR fisher households in Dangriga and Hopkins have benefited either directly or indirectly from income diversification strategies, and have demonstrated reduced impacts on the marine protected area over the 2018 baseline

COMMUNITY PARTICIPATION IN MANAGEMENT PLANNING ON TOBACCO CAYE, 2017

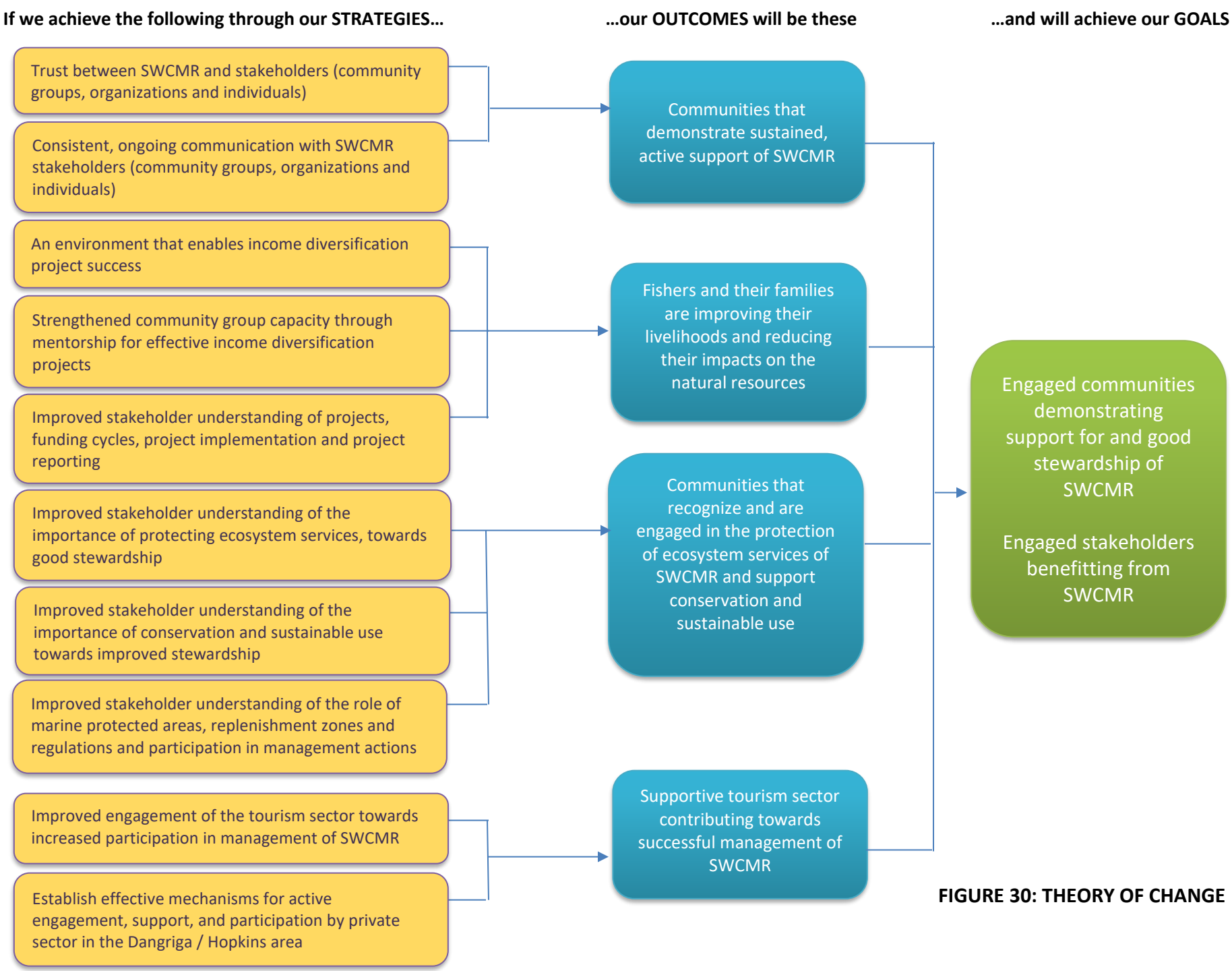


FIGURE 30: THEORY OF CHANGE

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 to strengthen communication and collaboration between Program areas is also important, with inter-Program collaboration mechanisms for greater adaptive management effectiveness.

Six Management Programmes are identified to provide the framework for management of the marine protected area:

A. Natural Resource Management and Protection
B. Research and Monitoring
C. Community Development and Outreach
D. Tourism and Recreation
E. Management and Administration
F. Infrastructure, Operations and Maintenance

The plan identifies intervention strategies for improving conservation target viability and mitigation of threats identified during the planning process – strategies that are incorporated into the management programmes, and into the measures of success programme for effective management. As well as site-specific strategies, the strategies defined during the conservation planning process for the Southern Belize Reef Complex (of which South Water Caye Marine Reserve is a component) are also integrated, contributing towards seascape management. Also taken into consideration is the protected areas status as part of the World Heritage Site, requiring extra steps to be taken to safeguard its unique values.

Programme Areas

Natural Resource Management and Protection	Research and Monitoring	Community Development and Outreach	Tourism and Recreation	Management and Administration	Infrastructure, Operations and Maintenance
▪ *Surveillance and Enforcement* ▪ *Zoning and Boundaries* ▪ *Fishery Management* ▪ *Ecosystem and Species Management* ▪ *Addressing Specific Threats*	▪ *Monitoring* ▪ *Research* ▪ *Data Management and Dissemination of results*	▪ *Environmental Education* ▪ *Public Outreach and Information* ▪ *Alternative Livelihoods / Income Diversification* ▪ *Community Capacity Building*	▪ *Visitor Safety and Protection* ▪ *Visitor Education and Interpretation*	▪ *Planning* ▪ *General Management and Administration* ▪ *Financial Management* ▪ *Concessions / Commercial Uses* ▪ *Partnership Relations* ▪ *Information Technology*	▪ *Docking Facilities* ▪ *Administration and Operational Infrastructure* ▪ *Tourism Infrastructure* ▪ *Fleet Operations and Management*

TABLE 33: MANAGEMENT PROGRAMS OF SOUTH WATER CAYE MARINE RESERVE

3.5.1 Natural Resource Management Programme

The Natural 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 Programme falls under the responsibility of the site manager. Six sub-programmes have been identified (Figure ..).

Natural Resource Management and Protection
▪ *Surveillance and Enforcement*
▪ *Zoning and Boundaries*
▪ *Fishing (Marine Resource Extraction)*
▪ *Habitat and Species Management*
▪ *Cultural Resource Management*
▪ *Addressing Specific Threats*

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

- Use of SMART technology (Spatial Monitoring and Reporting Tool), allowing rangers and managers to plan and implement intelligence-based patrols through collection and analysis of georeferenced data, assisting 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 SWCMR, increasing respect for the patrol team, and enabling increased night patrols.

The **Surveillance and Enforcement** sub-program for South Water Caye Marine Reserve is focused on supporting and upholding the Marine Reserve legislation, and regulations, ensuring fishing and tourism regulations are enforced. It also supports the implementation of Managed Access, rolled out nationally in 2016.

Priority strategies for 2019 – 2023 include:

- Ensuring SWCMR has the human resources, equipment and training for effective surveillance and enforcement
- Strengthening collaborative enforcement with coastguard
- Strengthening enforcement of tourism regulations through collaboration with BTB and tourism police
- Building trust with fishers
- Continue and strengthen work with fishermen towards effective implementation of Managed Access in SWCMR

The **Habitat and Species Management** sub-program addresses strategies such as mechanisms for management of conservation targets, as highlighted under the Conservation Planning section. It also addresses threats to the viability of biodiversity within the Marine Reserve.

Priority strategies for for 2018 – 2028 include:

- Strengthening management actions and strategies to address the future impacts of climate change and build resilience, based on the Climate Change Adaptation outputs
- Participate actively in assessment of EIAs and ECPS to ensure sustainable development on the cayes
- Ensuring any development is aligned with the recommendation of the Coastal Zone Management Plan
- Developing collaborative strategies with other organizations with similar agendas, for addressing threats from land-based pollution
- Developing collaborative strategies with other organizations with similar agendas, specifically for strengthening coordinated assistance to communities towards improved natural resource stewardship
- Working with tour guides and tour operators to improve tourism best practices in SWCMR
- Continuing to address lionfish in SWCMR

Natural Resource Management Program		
NRM 1: Surveillance and Enforcement	**Timeframe**	**Measuring Success Indicators**
NRM 1.1 Surveillance and Enforcement		
☐ Ensure surveillance activities are strategic and effective, based on SWCMR enforcement data, incidence mapping and identification of hotspots, key times, key offending boats (both tourism and fishing) and with integration of SMART technology, supporting Managed Access	1 – 5	▪ # patrols per year ▪ Mapping of patrol routes ▪ Mapping of incursion hotspots ▪ # of warnings give per year
☐ Expand surveillance activities to include caye development and environmental impacts within SWCMR, in collaboration with DoE and BTB	1 - 5	▪ # of cases taken to court ▪ # successful convictions
☐ Strengthen cost and time effectiveness of surveillance through use of drones and other technologies	1 – 5	▪ Total annual fines ▪ # repeat offenders
☐ Maintain and strengthen collaborative partnership with the Belize Coastguard for armed patrols in SWCMR, with clearly defined roles and responsibilities	1 - 5	▪ # of patrols in reserve expansion areas per year ▪ # of joint surveillance and enforcement activities with DoE
☐ Strengthen partnership with the Southern Environmental Association for collaborative surveillance and enforcement in the SBRC seascape	1 – 5	▪ # Joint patrols per year with Belize Coastguard
☐ Strengthen communication and collaboration mechanisms with Forest Department and the Department of the Environment for enforcement of new Mangrove Regulations	1 – 5	▪ # Patrols conducted in collaboration with SEA ▪ # Patrols conducted in collaboration with Forest Department in response to mangrove issues
☐ Implement effective enforcement of visitor regulations in SWCMR, in collaboration with BTB (e.g. tour guide-guest ratios, licenses, visitor qualifications for diving etc.) and enforcement of site-specific zone regulations regarding jet skis, catch and release fishing etc.	1 - 5	▪ # Patrols conducted in collaboration with Department of the Environment in response to caye development issues ▪ # Patrols conducted in collaboration with BTB

Natural Resource Management Program		
NRM 1: Surveillance and Enforcement	**Timeframe**	**Measuring Success Indicators**
☐ Strengthen communication and collaboration mechanisms with the Belize Tourism Board and Department of the Environment for enforcement of laws that impact the Marine Reserve (sewage and other forms of water contamination, poor fuel storage, oil, pesticide use, over-the water structures, dock construction)	1 – 5	▪ # Patrols conducted in collaboration with BTB ▪ # Patrols dedicated to boat to boat fisher engagement ▪ % of SWCMR fishers who consider Managed Access is working at SWCMR
☐ Maintain and strengthen engagement and communication with fishers using a boat to boat approach	1 – 5	▪ % of SWCMR fishers who feel they trust the Fisheries Officers at SWCMR to be fair
☐ Strengthen Managed Access committee, addressing identified capacity building needs	1 – 5	▪ # Area 3 MA Committee meetings per year ▪ # of enforcement issues re. fishing of parrotfish % fishers (resident / non-resident) demonstrate awareness of SWCMR regulations
Awareness of Regulations		
☐ Ensure all tour guides, fishermen and SWCMR residents are aware of location, rules and regulations and rationale for the boundaries, zones and expansion through brochures, handouts and other educational material related to regulations	1 - 5	▪ % of tour guides demonstrate awareness of SWCMR regulations ▪ % of resident resort managers demonstrate awareness of SWCMR regulations
☐ Ensure all resident subsistence fishermen are informed and aware of new Conservation Zone policies for subsistence fishing before implementation	1 – 5	▪ % of required signage on rules and regulations that are in place
☐ Inform all visitors of rules and regulations when visiting the Marine Reserve through information board in Dangriga and on Tobacco Caye, distribution of brochures, and handouts and other educational material	1 – 5	▪ SWCMR information office open in Dangriga ▪ % of visiting live-aboard vessels that have been provided with information on rules and regulations, including Port Authority regulations
☐ Maintain / install signage at Tobacco Caye, Dangriga and Hopkins	1 - 2	
☐ Establish information / ticket sales office in Dangriga	1 – 5	
☐ Increase awareness of visiting live-aboard boats on the rules and regulations of SWCMR, mooring sites, zones, bilge water / wastewater, restricted recreational activities and non-extractive designation	1 - 5	

Natural Resource Management Program		
NRM 1: Surveillance and Enforcement	**Timeframe**	**Measuring Success Indicators**
Awareness of Regulations		▪ # people from cayes attending presentation on SWCMR zones, rules and regulations per year ▪ # tourism infractions per year ▪ % of staff positions identified as required for effective management of SWCMR that are filled ▪ % patrol staff who are considered fully trained for effective patrols ▪ Presence of second enforcement team based in southern SWCMR ▪ Agreement for long term use of caye / part of caye for southern base ▪ % staff familiar with tourism regulations relevant to SWCMR ▪ % of staff that demonstrate an adequate knowledge on the ecosystem services provided by SWCMR and the purpose of MPAs ▪ % of court cases with successful outcomes ▪ % of SWCMR fishers that consider that they trust the Fisheries Officers
☐ Provide an annual refresher presentation on SWCMR zone rules and regulations at each resort for owners / managers / tour guides	1 – 5	
☐ Enforce tourism / recreational fishing regulations	1 – 5	
Human Resources and Training		
☐ Ensure protected area staff numbers are sufficient for effective management of the Marine Reserve. At minimum (on rotation): ○ Station One (Twin Cayes):1 Reserve Manager, 3 Rangers, 1 boat captain ○ Station Two: Reserve Assistant Manager, 3 Rangers, 1 boat captain	1 – 3	
☐ Increase number of Fisheries Officers to establish a second enforcement team for expansion of surveillance to southern SWCMR to support Managed Access / Area fisheries roll-out	1 – 5	
☐ Seek collaboration with caye owner for southern base	1 – 3	
☐ Fisheries officers are fully trained for surveillance and enforcement activities, use of SMART, case file preparation, public relations	1 – 5	
☐ Ensure ongoing capacity building for all staff for effective surveillance and enforcement of tourism regulations, in collaboration with BTB	1 – 5	
☐ Ensure staff are aware of the critical role they and the protected areas play in maintenance of fisheries and tourism resources, livelihoods, critical ecosystems / ecosystem services and threatened species	1 – 5	
☐ Collaborate with Forest and Fisheries Departments for provision of awareness materials to magistrates on the legal, national and cultural context for Fisheries and wildlife laws, to strengthen penalties for enforcement issues	1 – 5	

Natural Resource Management Program		
NRM 2: Boundaries and Zones	**Timeframe**	**Measuring Success Indicators**
☐ Effective demarcation of current boundaries of SWCMR, particularly in key identified areas of conflict	1 – 5	▪ % of required buoys that are in place ▪ % of amended zones that are adequately demarcated with marker buoys
☐ Finalize realignment of zones and ensure clear zone demarcation	1 – 2	
☐ Ensure clear zone demarcation and dissemination of information on zones and zone regulations to all fishermen and other users of the Marine Reserve and fair enforcement of zone regulations across all fishermen	1 – 3	▪ % of staff who know the location of boundaries, zone and reasons for establishment ▪ % of fishers using SWCMR who know the location of boundaries, zone and reasons for establishment ▪ % of tourism sector users who know the location of boundaries, zone and reasons for establishment
☐ Maintenance and replacement of boundary and zone marker buoys as needed	1 – 5	
NRM 3: Fisheries Management		
☐ Implement Managed Access roll out at SWCMR	1 – 5	▪ % of SWCMR fishers are considered fully engaged in the implementation of Managed Access ▪ # infractions reported for possession of fillet without skin patches, parrotfish, undersize / out of season lobster / conch, out of season / size grouper, per year ▪ % fishing vessels using SWCMR that are part of the vessel monitoring system ▪ Sustainable fishery plans
☐ Engage fishermen in implementation of the Managed Access framework	1 – 5	
☐ Address issue of gill nets and long lines in SWCMR through increased awareness of fishers, gear regulations enforcement	1 – 5	
☐ Assessment of existing traps, implementation of trap registration and lobster shades and increased awareness of trap / shade regulations	1 – 2	
☐ Encourage fisher diversification into lionfish	1 – 5	
☐ Collaborate with WCS to mainstream vessel monitoring system	1 – 5	
☐ Ensure that fisheries management is guided by baseline data and sustainable fishery plans	1 – 5	
☐ Ensure impartial enforcement of regulations across all fishers	1 - 5	

Natural Resource Management Program		
NRM 4: Ecosystem and Species Management	**Timeframe**	**Measuring Success Indicators**
☐ Engage tourism industry and local tour guides in restoration of Man O' War Caye	1 – 2	▪ Man O' War Caye stabilized ▪ % successful turtle nests per year
☐ Maintain surveillance of threats to conservation targets and indicators (e.g. turtle nesting beaches, parrotfish, sharks, littoral forest, mangroves)	1 – 5	▪ # infractions reported for possession of fillet without skin patches, parrotfish, undersize / out of season lobster / conch, out of season / size grouper, per year
☐ Ensure those caye owners and developers that can influence turtle nesting success have access to best practices and are engaged in nest protection	1 – 5	
☐ Ensure adequate protection of key herbivores to maintain live coral cover and ecological functions	1 – 5 1 – 5	▪ Map of more resilient coral areas ▪ Map of coral replenishment sites and % coral cover
☐ Provide prioritised enforcement for identified resilient coral species and areas within SWCMR		▪ # patrols per year that target identified critical coral areas
☐ Continued coral replenishment in partnership with Fragments of Hope	1 - 5	
☐ Engage land owners, caye developers, residents and users in littoral forest, mangrove, caye and beach vegetation areas in best management practices, protection and restoration		▪ Extent of mangroves per year ▪ Extent of littoral forest per year ▪ % of cayes considered to be managed under
NRM 5: Addressing Specific Threats	**Timeframe**	**Measuring Success Indicators**
Caye Development		▪ % of caye developments that fall within CZMP guidelines ▪ % EIAs that will impact SWCMR that have recommendations submitted to NEAC by Fisheries Department ▪ % of caye developments considered to be following environmental best practices ▪ # patrols per year that check on ECP adherence with DoE ▪ Environmental Sustainability Plan for SWCMR cayes
☐ Engage and encourage caye owners in following WCS best practices ICZMP development and WHS guidelines	1 – 5	
☐ Ensure all EIAs are adequately vetted and approved, and that Fisheries Department plays a vocal part in NEAC in relation to environmental sustainability of development within SWCMR	1 – 5	
☐ Monitor development activities on the cayes and liaise with DoE to ensure they are compliant with ECPs	1 – 5	
☐ Develop an Environmental Sustainability Plan for SWCMR cayes to mitigate current impacts, and identify synergies for reducing ecological footprint	1 - 3	

Natural Resource Management Program		
NRM 5: Addressing Specific Threats	**Timeframe**	**Measuring Success Indicators**
Caye Development		▪ Environmental Sustainability Plan for Tobacco Caye
☐ Develop an Environmental Sustainability Plan for Tobacco Caye in collaboration with residents to mitigate current impacts, and identify strategies and synergies for reducing ecological footprint	1 – 3	▪ # incidences of illegal dredging per year ▪ # patrols that are conducted in collaboration with DoE focused on caye development
☐ Strengthen links with DoE for proactive knowledge of current and future EIAs and ECPs	1 - 5	▪ % required mooring buoys installed in identified critical coral reef locations
☐ Strengthen links with Mining Unit for proactive knowledge of potential dredging activity	1 – 5	▪ # patrols conducted in collaboration with BTB per year
☐ Include guidelines for fogging of pesticides and use of herbicides on cayes within the Marine Reserve, and investigate the merits of using the least harmful types available, or alternatives	1 – 5	▪ % tour groups checked that do not follow BTB regulations re. dive: snorkeler ratio
Reducing Pressures on Coral Reef		▪ % tour guides considered to instil best practices while leading diving / snorkelling tours
☐ Install and maintain sufficient mooring buoys in critical coral reef locations – key dive sites, safe harbours	1 – 5	▪ # incidences per year of poor environmental practices by boats operating within SWCMR
☐ Enforce diver and snorkeler / guide ratios in collaboration with BTB	1 – 5	▪ % required navigational buoys installed in identified navigational routes through reef
☐ Increase awareness of best dive and snorkelling practices for divers, snorkelers and guides using the marine reserve – including use of life jackets	1 – 5	▪ Protocol for charter boats that have no local guide / boat captain
☐ Increase awareness of environmental best practices for boats entering the marine reserve	1 – 5	
☐ Ensure navigational routes through reef areas are adequately marked	1 – 2	
☐ Ensure all charter boats have the required local guide and to have a protocol in place if there is no guide	1 - 5	
☐ Develop an emergency response plan with the input of DoE, in case a major shipping incident should occur	1 – 5	
☐ Work closely with Port Authority, Coast Guard and DoE towards ensuring that all boats are seaworthy and captains are licensed	1 - 5	

Natural Resource Management Program		
NRM 5: Addressing Specific Threats	**Timeframe**	**Measuring Success Indicators**
Agricultural Runoff		▪ # meetings per year with agencies / organizations seeking to address agrochemical contamination in the watersheds west of SWCMR
☐ Partner with organizations seeking to mitigate agrochemical contamination of waterbodies in the watersheds west of SWCMR, through better practices for agricultural chemical use	1 – 5	
☐ Collaborate with PCB, Agriculture and UB to improve information on agrochemical use in the watersheds	1 – 5	▪ % fishing and tourism users that demonstrate awareness of the issue of lionfish
		▪ % local restaurants and resorts that serve lionfish
Invasive Species	1 – 5	
☐ Continue to improve awareness in stakeholders of potential impacts of lionfish	1 – 5	▪ # lbs of lionfish removed from the reef as a result of organized activities
☐ Encourage use of lionfish as a protein source and sale to local restaurants and resorts	1 – 5	▪ % of caye owners / managers that demonstrate awareness of the issues of releasing non-caye fauna on cayes
☐ Provide opportunities for stakeholders to actively participate in removal of lionfish from the reef – under strict guidelines	1 – 2	▪ % cayes with dogs on them
☐ Collaborate with other organizations in finalization and implementation of the lionfish management strategy	1 – 5	
☐ Increase awareness in stakeholders of the problems caused by releasing non-caye fauna and flora onto the cayes	1 - 5	
☐ Develop and implement a *Casuarina* removal campaign		

Natural Resource Management Program		
NRM 6: Reporting	**Timeframe**	**Measuring Success Indicators**
☐ Maintain comprehensive patrol reports - number of patrols, zones patrolled, number of boats checked, infractions noted, warnings given, and arrests made - strengthened with integrated use of SMART system	1 – 5	▪ Quarterly and annual reports that include patrol data ▪ Annual map of patrol routes / effort
☐ Maintain log of traditional fishermen and boat presence within the South Water Caye Marine Reserve	1 – 5	▪ List of traditional fishers and boats using SWCMR
☐ Produce quarterly reports, and submit to Fisheries Department and Advisory Committee	1 – 5	▪ List of tourism vessels using SWCMR
☐ Produce annual reports and submit to Fisheries Department and Advisory Committee	1 - 5	

3.5.2 Research and Monitoring Programme

Research and monitoring are essential activities to ensure informed, effective management, and to assess the effectiveness of the Marine Reserve in achieving its objectives of ecosystem and fisheries management. The Research and Monitoring Programme comes under the responsibility of the Reserve Biologist, is administered under three sub-programmes:

Research and Monitoring

- *Monitoring*
- *Research*
- *Data Management and Dissemination of results*

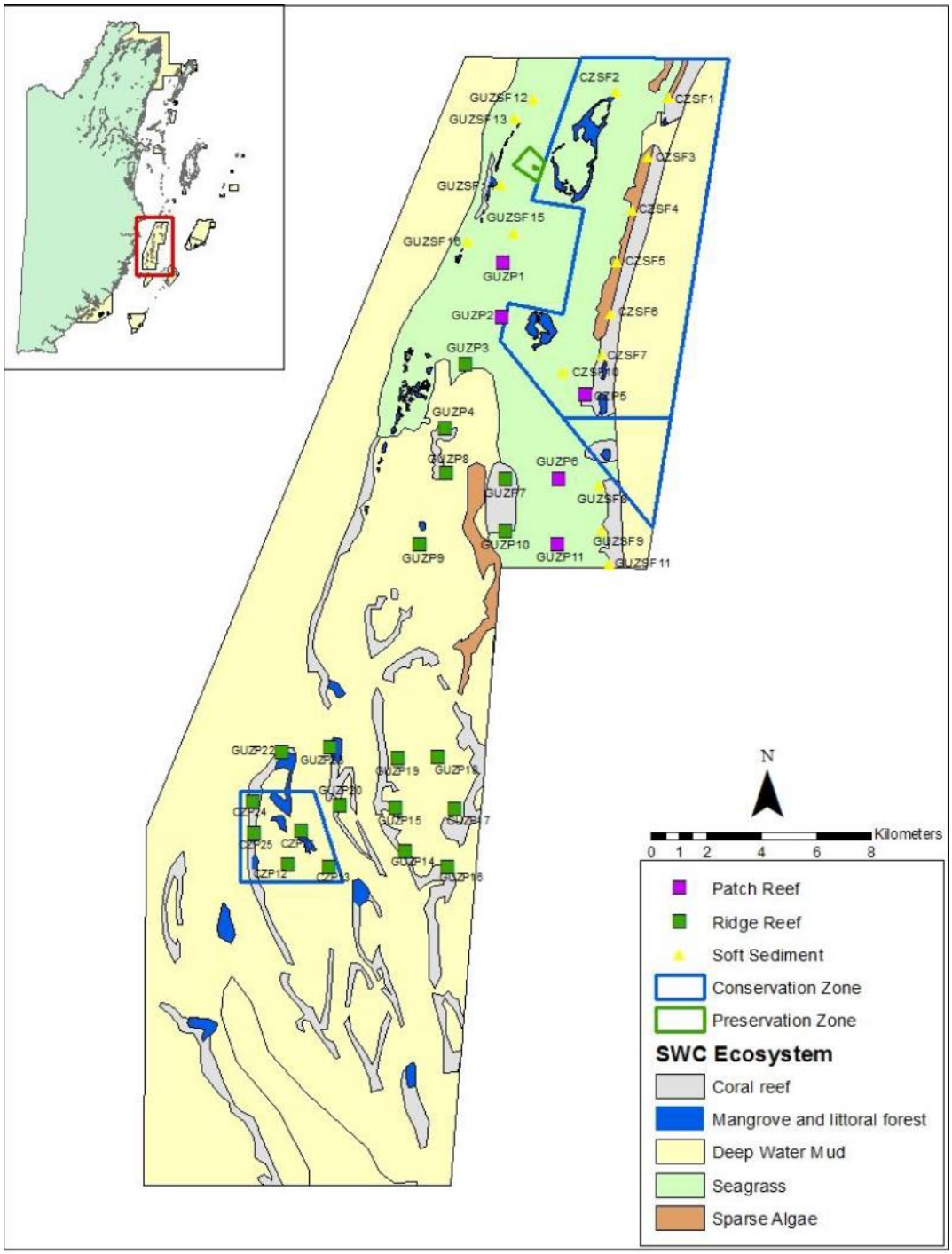
- **Monitoring**
- **Research**
- **Data Management and Dissemination of Results**

Monitoring: Monitoring targets and activities align with the Fisheries Department monitoring programmes (Managed Access catch assessments, in-water pre- and post-season sampling of lobster and conch a part of continuous monitoring of stocks, and Healthy Reef site monitoring of coral reef health, with the assistance of Projects Abroad. Fisheries Department partners with the Wildlife Conservation Society for use of Long-term Atoll Monitoring Program (LAMP II) monitoring protocols at South Water Caye Marine Reserve with the objective of monitoring and analyzing the viability of exploited populations, as well as habitats set aside in no-take areas, to enhance fished populations, overall biodiversity and ecosystem health. LAMP II extends the original protocols to monitoring of an holistic set of species (including but not limited to Queen conch, Caribbean spiny lobster, sea cucumber, five commercially important fin fish (black grouper, Nassau grouper, hogfish, mutton snapper and Queen triggerfish), parrotfish (six species – stoplight, redtail, yellowtail / redfin, princess, striped and redband), as well as monitoring of critical habitats.

The specific objectives include:

- Gathering data on the number of animals in various size classes including reproductive individuals
- Providing a baseline of habitat quality, beginning with sand flats/seagrass beds
- Comparing populations and habitats between management zones in the reserve
- Providing scientifically credible information for use in future management decisions on size regulations, rules of use and zoning to maintain profitable and sustainable fisheries and non-extractive activities throughout the South Water Caye Marine Reserve.

Forty-one monitoring sites have been established within the Marine Reserve, sampling both in the Conservation Zone and General Use Zones, and include 25 reef sites (5 patch reefs and 20 ridge reefs) and 16 sand flats/seagrass sites.



MAP 14: SWCMR SAMPLING SITES FOR THE ENHANCED "LONG-TERM ATOLL MONITORING PROGRAM" (MODIFIED LAMP). WCS, 2015

Managed Access fisheries data collection is also conducted to monitor catch per unit effort for commercial species. Monitoring focuses on the fisher catch on the sailboats and skiffs, with recording of date, fisher name, boat, species caught, fishing gear, and total fishing effort (hours fished to 0.5 hr. accuracy) for each fisher's catch. The survey area is limited to northern SWCMR from Wee Wee Caye northwards.

Monitoring activities also extend to turtle nesting beaches and adjacent spawning aggregation site. Monitoring targets are also identified in the Conservation Planning / Climate Change Planning section for measuring success, though there is not yet a measures of success monitoring framework at site or system level in Belize yet.

Monitoring priorities include:

- Continued ongoing monitoring of commercial species, with data guiding management, and dissemination of accessible data outputs to stakeholders
- Continued monitoring of coral bleaching and coral reef health
- Develop and implement the monitoring programme for Limits of Acceptable Change for key visitor use areas
- Continue to use and measure success of direct interventions – e.g. coral nurseries, coral replenishment, promoting higher herbivore densities
- Implement water quality / contamination monitoring in key sites

Research: The majority of the research activities at SWCMR are conducted by independent researchers. Research proposals are reviewed by the Fisheries Department, and if approved, a research license is granted on an annual basis. There are a number of research initiatives based within the Marine Reserve.

Research priorities include:

- Develop and implement effective watershed to reef water quality baseline and monitoring programme
- Assessment of the economic value of the Marine Reserve to the stakeholders and to the economy of the country
- Promote and support key research that identifies land-based sources of water contamination
- Investigate the impacts of sport fishing, with particular focus on reef flats bone fishing and associated trampling impacts, and use of cast nets for bait collection

Most notable is the Smithsonian Institute's marine research station, established in 1997 and based on Carrie Bow Caye, producing significant scientific outputs over many years through the Caribbean Coral Reef Ecosystems Program (CCRE), and ongoing monitoring through the CARICOMP monitoring programme, providing data on permanent transects in Conservation

Zone I and Conservation II, focusing on lobster, conch, fish, corals, and seagrass. Long term permanent plots have also been established on Twin Cayes to assess productivity of the mangrove ecosystem, and in seagrass areas. The Station also supports an Environmental Monitoring System (EMS), installed in 2000, and designed to continually monitor real time meteorological (wind speed/direction, solar radiation, rain rate/accumulation, barometric pressure, air temperature, and relative humidity), oceanographic (water level, temperature, salinity, dissolved oxygen, pH, and turbidity, chlorophyll, blue-green algae, and FDOM), and system conditions.

Whilst not all research is immediately applicable to management, work has bene conducted on the genetics of key fishery species and larval transport systems, to identify where SWCMR fits within the larger seascape. Similar work is also being conducted on lobster.

Developing baselines are an important component of the Research sub-programme

Use and Dissemination of Results: The Fisheries Department has an ongoing monitoring programme to inform management of the key commercial species, with data feeding into CITES permits, decisions on timing for closed seasons and harvesting levels. There is also an increasing need to be able to measure the conservation results of investments into conservation through use of output, outcome and impact indicators, measured as part of the monitoring programme. Indicators range from biological indicators (dealt with here, in the biodiversity monitoring sub-programme, and socio-economic indicators) developed as part of the community engagement strategy.

The Fisheries Department and their partners, the Wildlife Conservation Society, ensure that the monitoring outputs are successfully disseminated through the production of survey reports and the presentation of data at local, national and international fora. Scientific and technical partners (the Smithsonian Institute and researchers using South Water Caye as a base) also produce papers and technical reports, disseminating outputs through their organizations and sharing outputs at scientific symposia and conferences.

Research and Monitoring Programme		
RMP 1: Monitoring	**Timeframe**	**Measuring Success Indicators**
☐ Continue pre- and post-season in-water surveys of lobster, conch and sea cucumber	1 – 5	▪ Annual SWCMR Bio-reports ▪ LAMP II reports
☐ Continue synoptic / LAMP II monitoring programmes	1 – 5	▪ CPUE data
☐ Continue monitoring of catch assessment through Managed Access log books	1 – 5	▪ Integration of CPUE data into annual report ▪ % coral bleaching
☐ Continue boat-based monitoring of catch	1 – 5	▪ % coral mortality linked to bleaching
☐ Continue monitoring for coral bleaching, as part of the Coral Reef Monitoring Network	1 – 5	▪ SWCMR data on the CRMN database ▪ Summary Status of SWCMR report on CAP and other indicators (once every 2.5 years)
☐ Monitor Conservation Action Planning Indicators: ○ Total extent of mangrove ecosystem ○ Total extent of littoral forest ○ Abundance of juvenile fish (nursery functionality) ○ % seagrass cover ○ Seagrass density (SeagrassNet) ○ Coral recruitment ○ Coral bleaching ○ % live coral cover ○ Parrotfish density ○ Biomass of commercial fish ○ Adult conch density ○ Lobster density	1 - 5 1 – 5 1 – 5	▪ Output report for SPAG monitoring ▪ Water quality monitoring data ▪ Water Quality monitoring report (once every 2.5 years)
☐ Continue monitoring of turtle nest success and turtle nesting beaches	1 – 5	
☐ Continue monitoring the spawning aggregation site at Emily / Caye Glory	1 – 5	
☐ Implement effective watershed to reef water quality monitoring programme	1 – 5	
☐ Prioritize monitoring of agrochemical contamination in water / tissue samples	1 - 5	

Research and Monitoring Programme		
RMP 1: Monitoring	**Timeframe**	**Measuring Success Indicators**
☐ Monitor threats and impacts:	1 – 5	▪ Water Quality monitoring report (once every 2.5 years)
o Monitor nutrient levels and relative algal growth on a regular basis to monitor anthropogenic impacts in high visitor-use areas, adjacent to the cayes, mooring buoys and popular dive sites and in control site, using methods such as stable isotope analysis	1 – 3	▪ Post-impact assessments ▪ % post-impact assessments completed of impacts requiring action
o Develop rapid assessment protocols for post-impact assessments for events (boat groundings, hurricanes, earthquakes, oil spills),	1 – 5	▪ Lionfish density ▪ % cayes with introduced species
o Monitor presence and density of lionfish population	1 - 5	▪ Mapping of caye land use over time
o Monitor presence of introduced species – rats, green iguanas, tokay geckos (every 2.5 years)	1 - 5	▪ Visitor Use Plan with integrated Limits of Acceptable Change indicators
o Monitor caye land use change using drone mapping (every 2.5 years)	1 – 5	▪ Maximum % coral bleaching during one year
o Develop Limits of Acceptable Change indicators and monitoring programme for monitoring visitor impacts at key use sites	1 – 3	▪ % coral bleaching ▪ Accessible water and weather data from Smithsonian Institute
☐ Climate change monitoring:	1 – 5	
o Continue monitoring for coral bleaching, with input into NCRMN	1 – 5	
o Characterize water currents critical for coral recruitment at SWCMR	1 – 5	
o Continue to measure success of direct interventions – e.g. coral nurseries, coral replenishment, promoting higher herbivore densities		
o Work closely with partners to monitor climate change effects and identify appropriate national and regional management strategies	1 – 5	
o Develop agreement and data transfer mechanism for improved accessibility to Smithsonian Institute data on weather and water parameters	1 - 5	

Research and Monitoring Programme		
RMP 1: Monitoring	**Timeframe**	**Measuring Success Indicators**
☐ Integrate Conservation Action Planning indicator outputs and outputs of other monitoring programmes into a Measures of Success framework that measures conservation outputs, outcomes and impacts	1 – 5	▪ Measures of Success indicator framework ▪ 5-Year report on Measures of Success
Socio Economic Monitoring	1 – 5	▪ Socio-economic report on key stakeholder communities
☐ Maintain and update accurate socio-economic data on stakeholder communities (fishers and tour guides) (Every 5 years)	1 – 3	▪ Data on fisher and tour guide income from using SWCMR
☐ Maintain and update accurate data on stakeholder benefits of fishers and tour guides using SWCMR (Every 5 years)	1 – 5	▪ Visitor Use Plan with Limits of Acceptable Change indicators (including Visitor and Tour Guide Satisfaction)
☐ Develop Limits of Acceptable Change indicators for key tourism sites and monitor	1 – 5	▪ Status report on cayes (Baseline, WCS, 2014)
☐ Monitor visitor satisfaction under the Limits of Acceptable Change program	1 – 5	▪ Report on impacts to Man O' War Caye
☐ Monitor tour guide satisfaction under the Limits of Acceptable Change program	1 - 5	
☐ Update data on number of residents and residential properties occupied or under construction on SWCMR cayes, septic systems etc. (Every 5 years)		
☐ Monitor Man O' War Caye for erosion impacts using drone imagery and on-site impact assessment		
RMP 2: Research	**Timeframe**	**Measuring Success Indicators**
☐ Improve communication of research needs to research stakeholders of SWCMR to address management questions	1 – 5	▪ List of priority research activities ▪ List of research stakeholders
☐ Strengthen communication and collaboration with the Smithsonian Institute, Conservation international and other researchers for filling critical information gaps.	1 – 5	▪ # research permits per year ▪ % research permit agreements that are fulfilled, with submission of final reports
☐ Continue and strengthen collaborative relationship with Smithsonian Institute	1 – 5	▪ # research agreements with research institutions using SWCMR

Research and Monitoring Programme		
RMP 2: Research	**Timeframe**	**Measuring Success Indicators**
☐ Establish new research partnerships – ECOSUR (contamination and larval connectivity and ECOMAR (turtles)	1 – 5	▪ # research agreements with research institutions using SWCMR
☐ Strengthen mechanisms for accessing research outputs (IZE (South Water Caye), Smithsonian have individual permits, Projects Abroad and Tobacco Caye Marine Station have their own research permits)	1 – 5	▪ # meetings with Wildlife Conservation Society, Smithsonian Institute, and other research partners per year to discuss research, outputs
☐ Ensure all researchers are aware of the rules and regulations of the Marine Reserve, and research regulations under the Fisheries DepartmentDevelop a comprehensive baseline species list of fish, corals and other invertebrates for the protected area	1 – 5	▪ # of infractions of SWCMR regulations by researchers Baseline list of fish, corals and other invertebrates
☐ Develop accurate information on the distribution of the two native gecko species on the cayes – *Phyllodactylus insularis* and *Aristelliger georgeensis* and feed into species management decisions for invasive species on Middle Caye	1 – 3	▪ Report on status and mapping of distribution of *Phyllodactylus insularis* and *Aristelliger georgeensis*
☐ Develop baseline of environmental impacts of Tobacco Caye and South Water Caye on the adjacent ecosystems	1 - 3	▪ Report on baseline impacts of Tobacco Caye and South Water Caye on the adjacent ecosystems
☐ Establish baseline for bird nesting colonies and roosts within South Water Caye Marine Reserve		▪ Reporting on mapping, status and threats for bird nesting colonies
RMP 3: Data Management and Dissemination of Results	**Timeframe**	**Measuring Success Indicators**
☐ Maintain database of GIS data, research and monitoring information for ease of access and to enhance the level of coordination between researchers, help identify gaps in information, and to provide a platform from which the results can be communicated to a wider audience	1 – 5	▪ Database – effective management of SWCMR data ▪ Annual bio-reports
☐ Continue presenting monitoring results in annual reports, and integrate into the adaptive management cycle	1 – 5	▪ % recommendations from Annual Reports that are integrated into annual workplans

Research and Monitoring Programme		
RMP 3: Data Management and Dissemination of Results	**Timeframe**	**Measuring Success Indicators**
☐ Provide data to the National Biodiversity Monitoring Programme, Healthy Reefs, and the National Coral Reef Monitoring Network Repatriation / dissemination of research articles	1 - 5	▪ Presence of SWCMR data in relevant national / regional databases ▪ # presentations given at local, national and international levels on monitoring and research outputs
☐ Use available forums for dissemination of results (eg. workshops, conferences, Advisory Committee meetings etc.)	1 – 5	
☐ Translate research and monitoring outputs into a form that the public understands, and make available to stakeholders	1 - 5	▪ Improved understanding of research outputs by local stakeholders

3.5.3 Community Development and Outreach Programme

Community Development and Outreach

- *Environmental Education*
- *Public Outreach and Information*
- *Alternative Livelihoods / Income Diversification*
- *Community Capacity Building*

The SWCMR Community Engagement Strategy (Wildtracks, 2018) provides recommendations for community engagement and empowerment strategies targeted at Dangriga and Hopkins to encourage stakeholder participation in the management and conservation of the natural resources of the Marine Reserve. The report also looks at the enabling environment required for successful engagement of communities, with identification of synergies and areas for strengthening of communication, collaboration and coordination across stakeholders at the local level. This is considered essential for achieving strong, long term, sustainable outcomes with proactive participation of communities in the management of the protected area, and promotion of ownership.

The Community Engagement Plan is focused on achieving four outcomes:

TARGET ONE: By 2022, at least 30% of people surveyed in Dangriga and Hopkins recognise the ecosystem values associated with SWCMR and support its conservation and sustainable use

TARGET TWO: By 2022, there has been an increase of 20% in sustained, active support of SWCMR in Dangriga and Hopkins over the 2018 baseline

TARGET THREE: By 2022, at least 10 local tourism operations have developed strong collaborative partnerships with SWCMR to strengthen management of the Marine Reserve

TARGET FOUR: By 2022, at least 20% of SWCMR fisher households in Dangriga and Hopkins have benefited either directly or indirectly from income diversification strategies, and have demonstrated reduced impacts on the marine protected area over the 2018 baseline

Until recently, management of South Water Caye Marine Reserve has been operating with only limited engagement of the stakeholders, with the majority of management activities focused on the surveillance and regulation of fishing activities. This is partly a result of the limited staff available for management of one of the largest marine protected areas in central / southern Belize, and partly a result of the fisheries management mandate under which SWCMR was established. Moving forward into the future, there is a critical need to engage new, supportive stakeholders – the tourism sector and the youths of the community – increasing appreciation and pride in the marine protected area, recognition of benefits and providing mechanisms for active participation in management activities and improved stewardship of the marine resources. The eventual outcome being sought is improved stewardship of the natural resources, whether in and around the communities or at South Water Caye Marine Reserve. Moving from outreach to engagement for improved stewardship is based on a "desire to encourage community members to adopt and sustain reef-friendly behaviours" (Marshall et al., 2015), and is considered a critical management tool when working with communities towards effective management

KEY MESSAGES OF THE DRAFT COMMUNITY ENGAGEMENT, EDUCATION AND PUBLIC AWARENESS STRATEGY (2018)

Improve knowledge and understanding of:

- Reef, seagrass and mangrove ecosystems and biodiversity, and their local, national, regional and global importance
- Marine conservation and marine protected areas, and their roles in conserving biodiversity and the environment and maintaining a sustainable fishery
- Belize Fisheries policies and regulation
- Management zones of SWCMR and their role in sustainable fishery
- The SWCMR Management Plan and its components
- The history of the establishment of SWCMR
- Conflicts, threats and challenges that are barriers to effective management of SWCMR
- Ways in which the public can be involved in management and outreach/opportunities associated with SWCMR

Environmental Education: It is recognized that to engage people in conservation of natural resources, there needs to be a basic understanding of the value of those resources to their lives - the ecosystem services they provide that impact the community – the protection from storm events provided by the barrier reef, the economic benefits from tourism and the provision of food and income through traditional fishing activities. Dangriga, in particular, is considered a significant gap in coverage of marine conservation education activities in coastal

KEY CONCEPTS

- Benefits of SWCMR
- Roles of marine protected areas, replenishment zones and regulations
- Ecosystem services
- SWCMR targets and threats
- Threatened Species
- Climate change impacts, adaptation and resilience
- Community involvement in the protection and conservation efforts of SWCMR

communities in Belize - ensuring that this gap is filled is particularly important. Building knowledge and understanding of the role and importance of SWCMR and the services it provides in both Dangriga and Hopkins is therefore considered key to the success of any engagement activities in the communities. A series of three knowledge / understanding pre-conditions – the Key Concepts - were identified during the Theory of Change planning process, essential for ensuring an enabling environment:

- Understanding of the importance of ecosystem services of SWCMR, including climate change adaptation and resilience values
- Understanding of the importance of conservation and sustainable use
- Understanding the role of protected areas, replenishment zones and regulations

The importance of engaging youths through education activities in schools cannot be over-emphasized, but to date, efforts have been project-based, resulting in limited continuity of presence in the schools, with stops and starts to engagement activities, duplication of effort by organizations and limited cohesive structure or messaging. Marine ecosystem values and good stewardship are not being successfully transferred to youths through the education system. As a result, the majority of students in Dangriga are considered to have a low level of understanding and engagement – not only for support of SWCMR, but for the marine environment and conservation generally. The key school-based strategy is focused on the development of a structured, collaborative, long-term programme that interacts with students at key stages in primary and high school, building knowledge and understanding of the key concepts and identified pre-conditions, engaging students throughout their schooling, and developing conservation leadership skills to improve outcomes. It also integrates a focus on 'learning by doing' through outdoor experience, considered critical as experience has shown that exposure to the marine environment is the most effective way to engage youths and develop a long-term interest in the marine environment and conservation, building a future culture of conservation stewardship in the communities.

Public Outreach and Information: SWCMR currently has a draft Community Engagement, Education and Awareness Strategy, designed for implementation over an eight-month period that focuses on a series of key messages that align with the Key Concepts defined in this document. To achieve a change in attitude and behaviour in communities, however, a much more sustained campaign is required, over a number of years. Key communication strategies focused on SWCMR stakeholders are identified in the SWCMR management plan, for implementation over a five-year period. Dangriga is traditionally considered a challenging community to engage in marine conservation for a number of reasons, including the limited focus on marine conservation in the education system - youths don't leave school with the basic information necessary to understand and respect the importance of SWCMR and the ecosystem services it protects to their health, safety and livelihoods. This limited awareness continues as they become adults. The town is more business-focused than Hopkins, with few people reliant on the marine environment – only a small percentage of the community are either tour guides

or fishermen, with few tourism opportunities linked to the reef. This reduces the interest and motivation of many community members to attend meetings to learn more. The lack of a long-term NGO or co-management partner active in the area to implement consistent education / awareness activities has also been a significant challenge to raising awareness. Where organizations are present (e.g. Punta Gorda, Placencia), communities are considered to have a much better understanding of the roles of the marine protected areas.

Hopkins, however, is more receptive to being informed about the key concepts – the community has largely embraced tourism, with a stronger recognition of the links between tourism, the state of the reef and the state of Hopkin's economy. There is an active BTIA chapter and the Stann Creek Tour Guide Association that are receptive to information on the marine environment and SWCMR, for integration into tours. Communication with and engagement of the tourism sector, in general, though, has not been prioritised by SWCMR in the past.

The most effective tool for increasing fisher awareness has proved to be boat-to-boat conversations - a strategic outreach tool refined by Belize Audubon Society, providing information to fishers that mirrors the community outreach messages, and reinforcing the key concepts. Whilst this strategy focuses on fishers of Dangriga, Hopkins and Tobacco Caye, the boat-to-boat conversations are also relevant for engaging and communicating with SWCMR fishers from other communities such as Sarteneja and Placencia. It has been shown that, for greatest effectiveness, boat-to-boat activities should:

- be led by the Outreach Officer rather than an enforcement officer
- provide the fishers with incentives for participation (generally soft drinks and chips)
- be conducted without the presence of uniformed rangers and coastguard, to ensure easy distinction between outreach and enforcement activities

The fishers in both communities have expressed appreciation at currently having an SWCMR Outreach Officer in the communities that they can approach for information – one not associated with fisheries enforcement (Fisher consultations, 2017 / 2018). Information to fishers will also be able to be transferred at the new Reserve Headquarters at Twin Cayes, once completed.

The tourism sector has been under-engaged by SWCMR, but is identified as a key opportunity for improving support and collaboration for the marine protected area. However, a significant investment in time and effective communication is required towards setting a foundation for future engagement. Unlike the fishing sector, the tourism sector is considered to be more open to being engaged, and has more capacity to be able to support SWCMR. A key recommendation of the Community Engagement Strategy is that significant, sustained effort should be made to partner with the tourism industry and develop an environment of pride and supportive stewardship of the marine protected area, bringing tour guides, hotels and resorts to the table

and fully engaging them in management activities. Improved communication is the first step towards achieving the move towards strong partnerships.

Alternative Livelihood / Income Diversification: Over the last ten years, there has been a surge in interest by marine conservation organizations in supporting income diversification for fishermen in the coastal communities towards reduced pressure on the marine resources. However, successful outputs have been very limited in terms of scale and long term sustainability. There are many reasons for this, including the independent nature of fishers, their strong cultural ties to the sea, the seasonal nature of fishing, limited education for moving into other occupations, the difficulties of shifting from a known income source to unknown, the impacts of natural disasters…all of these are barriers to successful alternative livelihood and income diversification outcomes.

Despite some advances in the success of income diversification outcomes through initiatives such as seaweed production, the number of fishers and fisher households who have been able to successfully diversify their income base has been minimal. Two key pre-conditions have been identified for facilitating success of income diversification investments:

- Community understanding of projects, funding cycles, project implementation and project reporting
- Consistent support of community groups / projects: Good communication, continuity of presence, mentoring,

The absence of an established conservation organization in Dangriga or Hopkins with the capacity to take on the role of mentoring, improving consistent communication and support of fisher association, coordinating meetings and capacity-building trainings, and monitoring of projects and micro-loans is considered a significant barrier. It is therefore recommended that, should there be continued investment in income diversification projects, the role of oversight and mentoring be filled by a Development Officer, in addition to the Outreach Officer, based in the SWCMR Office, with relevant project development and implementation skills. Also considered key is the recognition of the important role women can play in income diversification for fishing households and the communities as a whole. A review of lessons learnt from past projects highlights the need for consistent communication and mentoring not just during the short term project time frame, but also in the medium term, beyond the life of single projects, if outputs are to be successful in changing lives and reducing dependence on the marine resources.

Community Engagement and Outreach		
CEO 1: Environmental Education	**Timeframe**	**Measuring Success Indicators**
☐ Develop and implement a 5-year School Outreach Strategy in collaboration with partners in the seascape, that engages students in both primary and high schools, to ensure grounding in key concepts.	1 – 2	▪ Outreach strategy ▪ List of partners involved in preparation of the Outreach Strategy
☐ Strengthen collaboration with Reef Keepers Belize to lead implementation of the School Outreach Strategy in Dangriga and Hopkins, to ensure that students have opportunities to experience and understand the ecosystem values of SWCMR, building future conservation leaders in the communities	1 – 5	▪ Agreement with Reef Keepers Belize ▪ # of environmental clubs in schools supported by SWCMR per year ▪ # teachers participating in annual SWCMR field trip to build knowledge of key concepts ▪ # students visiting SWCMR per year from schools in the stakeholder communities ▪ # presentations provided per year to each class / school on SWCMR and key concepts
☐ Encourage establishment of and support at least five environmental clubs in Dangriga / Hopkins schools	1 – 5	
☐ Improve knowledge, understanding and delivery of key concepts by teachers	1 – 5	
☐ Continue to implement day trips to SWCMR for high school biology students from stakeholder communities, to engage their interest in the marine environment	1 – 5	
☐ Presentations targeting primary and secondary schools in stakeholder communities on South Water Caye Marine Reserve and its environmental and socio economic benefits	1 – 5	
CEO 2: Public Outreach and Information	**Timeframe**	**Measuring Success Indicators**
☐ Review, revise and expand the 2017 Communication, Education and Public Awareness Strategy for dissemination of information to all stakeholder sectors, to the Advisory Committee, surveillance and enforcement and research partners, funding partners, and other Government agencies	1 – 2 1 – 5 1 - 5	▪ Revised 5-year Communication Strategy ▪ List of collaborating partners for development of Communication Strategy ▪ Annual report on Measures of Success for implementation of the Communication Plan ▪ 5-year report measuring success of outcomes and impacts of Communication Plan

Community Engagement and Outreach		
CEO 2: Public Outreach and Information	**Timeframe**	**Measuring Success Indicators**
☐ Ensure SWCMR has the human and logistical resources for implementation of the Communication, Education and Public Awareness Strategy	1 – 5	▪ Annual Needs Assessment for Outreach ▪ % Outreach Needs Assessment recommendations met ▪ Dedicated Outreach Vehicle and fuel
☐ Ensure SWCMR Advisory Committee members participate in and are kept informed of reserve activities and management decisions	1 – 5	
☐ Ensure SWCMR fishers, tour guides and SWCMR resort owners are kept informed of reserve activities and management decisions affecting them	1 – 5	▪ % Outreach Needs Assessment recommendations met
☐ Ensure there are large, clear signs with a map of the Marine Reserve, positioned at key departure points (eg. Dangriga, Tobacco Caye) including information on fees, zones and regulations	1 -5	▪ Equipped office in Dangriga / Hopkins ▪ Dedicated Outreach Vehicle ▪ Annual fuel allowance for Outreach
☐ Provide regular presentations on research and monitoring results, and reserve activities to fishers, tour guides and stakeholder communities	1 – 5	▪ # SWCMRAC considered active on committee ▪ % of SWCMR fishers who consider that they are well informed about SWCMR management decisions and activities
☐ Develop and produce poster / laminated card for distribution to resorts with map of SWCMR highlighting zones, regulations, major dive / snorkeling sites, and dive best practices	1 – 2	
☐ Produce and disseminate best practices guidelines for caye-based tourism operations and other residents. WCS guidelines are recommended	1 – 2	▪ % of SWCMR tour guides who consider that they are well informed about SWCMR management decisions and activities
☐ Ensure there is awareness of SWCMR and the environmental services and benefits it provides to the communities through use of media opportunities and posters (focusing particularly on biodiversity protection, fisheries production and tourism)	1 – 5	▪ Tourism regulation poster / laminated card ▪ % of resorts that have a copy of the WCS caye best practices guidelines ▪ # Videos, posters, etc. that inform public of ecosystem services of SWCMR
☐ Displays and exhibits placed at public events such as Garifuna Settlement Day, Earth Day, etc.	1 – 5	▪ # public events attended by SWCMR Outreach Officer to promote the Marine Reserve
☐ Support the annual Conch and Fish Fest at Tobacco Caye	1 – 5	
☐ Produce an annual summary flier of reserve activities and achievements, to be distributed to residents, tour guides, tour operators and fishers	1 - 5	▪ Annual summary flier ▪ Distribution list for annual flier

Community Engagement and Outreach		
CEO 2: Public Outreach and Information	**Timeframe**	**Measuring Success Indicators**
Fishing Sector		▪ % of fishers who consider the Managed Access Committee is functioning well ▪ Level of attendance at MA committee meetings ▪ Number of tourism sector representatives participating on tourism committee ▪ Strategic Plan for development and marketing of SWCMR as a tourism destination
☐ Ensure fishers are kept informed of SWCMR activities and management decisions affecting them	1 – 5	
☐ Regular boat-to-boat discussions with fishers in SWCMR using boat-to-boat protocols	1 – 5	
☐ Integrate fisher communication strategies into the umbrella Communication, Education and Public Awareness Strategy	1 – 2	
Tourism Sector		
☐ Ensure the tourism sector is kept informed of SWCMR activities and management decisions affecting them	1 – 5	
☐ Improve knowledge of tourism best practices by SWCMR tour guides	1 – 5	
☐ Integrate tourism sector communication strategies into the umbrella Communication, Education and Public Awareness Strategy	1 – 2	
Government and NGO Sector		
Maintain ongoing communication with relevant NGOs and Government agencies on SWCMR management activities	1 – 5	
CEO 3: Income Diversification / Alternative Livelihoods	**Timeframe**	**Measuring Success Indicators**
☐ Engage a Development Officer with the skills to provide project support for Income Diversification projects	1 – 5	▪ ToR and signed contract for Development Officer ▪ Database of community groups, individuals, private sector and public sector partners in and associated with SWCMR ▪ List of community project partners
☐ Identify and support motivated, committed fisher associations / fisher entrepreneurs with viable start-up and ongoing projects that align with the SWCMR investment criteria	1 – 5	
☐ Establish strong, consistent partnerships with identified groups and individuals, with clear understanding of their vision and goals	1 - 5	

Community Engagement and Outreach		
CEO 3: Income Diversification / Alternative Livelihoods	**Timeframe**	**Measuring Success Indicators**
☐ Run annual workshops for proposal development, to ensure clear partner understanding of project cycles, timeframes, implementation, reporting requirements, roles and responsibilities	1 – 5	▪ # entrepreneurs being supported through projects per year ▪ # proposals developed
☐ Address the language and literacy levels of project participants to avoid this becoming a barrier to project implementation.	1 – 5	▪ # proposals approved ▪ # proposals successfully implemented
☐ Ensure integration of a conservation / environment component into projects and project agreements	1 – 5	▪ Annual evaluation of Income Diversification partner knowledge and perceptions
☐ Identify and support exchange visits and capacity building sessions for potential participants to increase knowledge/ understanding and success rate of income diversification projects	1 – 5	▪ Annual evaluation of participant income - % income derived from SWCMR fishery ▪ Number of days SWCMR fisher participants spend fishing per year
☐ Follow-on investment to implement lessons learntIdentify and invest in income diversification opportunities for fishers and fisher families based on individual interests, and on a combined grants / loan system	1 – 5	▪ # and % SWCMR fishers participating in exchange visits
☐ Investigate seaweed farming in SWCMR in collaboration with TNC, and identify and support fishers interested in participating	1 – 3	▪ # and % SWCMR tour guides participating in exchange visits
☐ Establish combined grant / micro-loan system for support of small projects	1 – 2	▪ # and % SWCMR fishers participating in capacity building workshops
☐ Identify and invest in projects that support increased employment opportunities in tourism sector in Dangriga	1 – 5	▪ # and % SWCMR tour guides participating in in capacity building workshops
☐ Provide support grants / loans to fishers or fisher family members wanting to take the tour guide course and add-on qualifications – fly fishing, diving	1 – 5	▪ # and % SWCMR tour guides participating in in capacity building workshops
☐ Identify and invest in training support recipients with viable business ideas	1 - 5	▪ # local entrepreneurs participating in in capacity building workshops

Community Engagement and Outreach		
CEO 4: Community Engagement and Capacity Building	**Timeframe**	**Measuring Success Indicators**
☐ Build capacity of grant / loan recipients to be able to continue to succeed beyond individual project timeframe (governance, organizational, business and financial management, team building and leadership)	1 – 5	▪ % of fishers who consider the Managed Access Committee is functioning well ▪ Level of attendance at MA committee meetings
☐ Establish a tourism committee with BTIA, local tour guides, hotel and large resort representatives to provide recommendations for improved visitor management and infrastructure at SWCMR	1 – 5	▪ Number of tourism sector representatives participating on tourism committee
☐ Partner with BTB, BTIA local chapters and the tourism sector towards improving international marketing of SWCMR as a tourism destination	1 – 5	▪ Strategic Plan for development and marketing of SWCMR as a tourism destination
☐ Identify a champion organization willing to lead and work with SWCMR towards creating a first class sustainable tourism destination	1 – 2	▪ # fishers participating in Man O' War caye restoration
☐ Continue and strengthen the Community Researcher Programme	1 – 5	▪ # fishers employed during Man O' War caye restoration activities
☐ Strengthen fisher associations for improved representation of fishers, two-way flow of information, and effective organizational, financial and project management, towards improved stewardship of the marine resources	1 - 5	▪ Number of tour guides / tourism sector representatives participating in restoration activities
☐ Build capacity of and support an effective Managed Access committee for Area 3	1 – 5	▪ Status of Man'O'War Caye
☐ Use Keystone Man'O'War caye restoration project to bring fisher and tourism stakeholders together	1 – 2	▪ Number of tour guides / tourism sector representatives participating in plastic use reduction
☐ Engage and partner with the local tourism sector and develop an environment of pride and supportive stewardship of the marine protected area, bringing tour guides, hotels and resorts to the table and fully engaging them in management activities	1 – 5	▪ Lbs of plastic removed
☐ Participatory development of project ideas for reducing plastic use in SWCMR	1 – 5	

Community Engagement and Outreach		
CEO 4: Community Engagement and Capacity Building	**Timeframe**	**Measuring Success Indicators**
☐ Develop mechanisms for tour guides to participate in monitoring activities of turtles, coral bleaching and lionfish 1 - 5ngage caye residents in the monitoring of turtles and turtle nesting ☐ Provide opportunities and incentives for lionfish eradication	1 – 5 1 – 5 1 - 5	▪ Number of tour guides / tourism sector representatives participating in lionfish removal ▪ Number of tour guides / tourism sector representatives participating in turtle and turtle nesting monitoring

3.5.4 Tourism and Recreation Programme

Tourism and Recreation

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

The Tourism and Recreation Programme encompasses two primary activity areas: Visitor Safety and Protection, and Visitor Education and Interpretation. Tourism is focused primarily on snorkeling and diving, based from resorts on the cayes, from Tobacco Caye, and from resorts on the mainland. South Water Caye Marine Reserve is, however, currently significantly under-utilized by the tourism sector, and management actions focus primarily on fisheries management. There is great potential for the Marine Reserve to become a key tourism destination, particularly if the tourism sector can be engaged in playing an active role in marketing at international level. If this is achieved, increasing the financial sustainability of the Marine Reserve, it will need to be balanced by ensuring that this does not impact the environmental sustainability of the reefs that attract the visitors.

Visitor safety and Protection: As tourism visitation increases, ensuring a safe environment for visitors is essential, through information on best practices, infrastructure in key visitor use locations, and enforcement of tourism regulations. There is a critical need to increase the focus on tourism management, particularly on visitor safety, with tourism stakeholders identifying areas of concern that require signage and marker buoys to avoid potentially fatal accidents when boats enter high visitor use areas (primarily around Tobacco Caye and South Water Caye). It is also important to ensure that visitors are well informed, for their own safety and for the protection of the environment.

Under the tourism legislation, visitor management and safety is, to some extent, the responsibility of the tour guides and tour operators, with regulations covering the need for certified guides and dive instructors, and the requirement for boat captains and dive guides to explain the rules of the Reserve to a diver within the Reserve. However it is also recognized that there needs to be greater education of visitors and tour guides as to Best Practices for tourism use of the marine resources for sustainability.

PROTECTED AREA REGULATIONS – VISITOR MANAGEMENT

Dive Groups

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

(i) To acquaint passengers with the rules of the Reserve.
(ii) To moor at the buoys provided when in the Conservation and General Use Zones.
(iii) To fly the "divers down" flag during all dives.
(iv) Only certified scuba divers or those undergoing an approved training course will be allowed to use scuba tanks"

Sport Fishing

If carrying passengers to carry out sport fishing, the captain/guide is responsible for the following

(i) To submit details to the Reserve Manager when requested, of catch and the area where fishing took place.
(ii) To release fish wherever possible.

REGULATIONS. SOUTH WATER CAYE MARINE RESERVE

Visitor Interpretation and Education: The current key mode of information transfer to visitors to SWCMR is via the tour guides. Ensuring that tour guides are aware of and using best practices, are well informed about the Marine Reserve and Belize's World Heritage Site, and knowledgeable about the marine life is therefore important for high visitor education and satisfaction.

GOOD ENVIRONMENTAL PRACTICES

SNORKELING

Coral reefs are among the world's most spectacular ecosystems and snorkeling is an excellent way to explore them. As coral reefs face an increasingly uncertain future, snorkelers and other coral reef visitors can play an important role in helping protect these fragile habitats. Follow these simple guidelines to become a "coral friendly" snorkeler.

BEFORE SETTING OUT TO EXPLORE THE REEFS

- For your vacation, choose an environmentally friendly resort or hotel; one that practices energy conservation, recycles, and treats sewage and solid waste in responsible ways.
- Pay user fees or make a donation when visiting coral parks and other marine conservation areas.
- Get the best possible snorkeling instruction you can.
- Practice snorkeling skills away from the reef.
- Make sure your equipment fits properly before you snorkel near corals—it can be very difficult to adjust in the water.
- If you feel uncertain, or are an inexperienced snorkeler, consider wearing a snorkel vest for added buoyancy.
- Learn all you can about coral reefs—they are fascinating and fragile environments.

IN THE WATER

- Never touch corals; even slight contact can harm them. Some corals can sting or cut you.
- Select points of entry and exit to avoid walking on corals.
- Maintain a comfortable distance from the reef, so as to avoid contact.
- Know where your fins are at all times and don't kick up sand.
- Stay horizontal in the water while you're near or above the reef.
- Learn to swim without using your arms.
- Take nothing living or dead out of the water except recent garbage which does not have living organisms on it.
- Move slowly and deliberately in the water—relax as you swim and take your time.
- Avoid using gloves in coral environments.
- Remember, look but don't touch.

Good snorkelers know that the best way to enjoy a reef is to slow down, relax and watch as reef creatures go about their daily lives undisturbed.

Be sure to find out about local laws and regulations as they may differ from these general guidelines.

GOOD ENVIRONMENTAL PRACTICES

SNORKELING

MINIMIZE CONTACT WITH MARINE LIFE

- Never chase, harass or try to ride marine life.
- Never touch or handle marine life.

ON BOATS

- Choose snorkel operations whose boats make use of available moorings —anchors and chains destroy fragile corals.
- Make sure garbage is well stowed, especially light plastic items.
- Be sure to take away everything you brought on board, such as packaging, used batteries and bottles.

SHORESIDE

- Support coral parks and other conservation projects:
  - Visit established coral parks and pay applicable user fees that support marine conservation.
  - Encourage and support the use of boat moorings.
  - Participate in local initiatives to monitor the marine environment.
  - Participate in cleanups.
  - Make a donation or volunteer your skills to support a coral park. For example, you can participate in a reef survey, conduct outreach, or help educate others about reef conservation.
  - Donate used equipment such as cameras, dive gear or reef identification books.
- Avoid purchasing souvenirs made from coral, turtles or other marine life—this is often illegal, and it's never environmentally wise.
- Speak up. Make sure your snorkeling buddies understand these simple but important conservation practices.

The Coral Reef Alliance (CORAL) is a member-supported, non-profit international organization dedicated to keeping coral reefs alive around the world. Visit our website http://www.coral.org

Visit the Project AWARE Foundation website at www.projectaware.org to find out more about protecting the aquatic environment and its resources.

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GOOD ENVIRONMENTAL PRACTICES

DIVING

Divers are some of the strongest and most effective advocates for coral reef conservation. Please follow these simple guidelines to become a "coral friendly" diver.

AS A RESPONSIBLE TOURIST

- For your vacation, choose an environmentally friendly resort or hotel; one that practices energy conservation, recycles, and treats sewage and solid waste in responsible ways.
- Choose coral friendly dive operations that practice reef conservation by:
  - Giving environmental briefings.
  - Holding buoyancy control workshops.
  - Using available moorings.
  - Using available wastewater pump-out facilities.
  - Actively supporting local coral parks.
  - Participating in local conservation projects.
- Pay user fees or make a donation when visiting coral parks and other marine conservation areas.
- Avoid purchasing souvenirs made from coral, turtles or other marine life—this is often illegal, and it's never environmentally wise.
- Learn all you can about coral reefs—they are fascinating and fragile environments.

IN THE WATER

- Never touch corals; even a slight contact can harm them and some corals can sting or cut you.
- Carefully select points of entry and exit to avoid areas of reef.
- Make sure all your equipment is well-secured.
- Make sure you are neutrally buoyant at all times.
- Maintain a comfortable distance from the reef.
- Practice good finning and body control to avoid accidental contact with the reef or stirring up the sediment.
- Stay off the bottom and never stand or rest on corals.
- Avoid using gloves and kneepads in coral environments.
- Take nothing living or dead out of the water, except recent garbage.

Good divers know that the best way to enjoy a reef is to slow down, relax and watch as reef creatures go about their daily lives undisturbed.

Be sure to find out about local laws and regulations as they may differ from these general guidelines.

GOOD ENVIRONMENTAL PRACTICES

DIVING

MINIMIZE CONTACT WITH MARINE LIFE

- Never chase, harass or try to ride marine life.
- Do not touch or handle marine life.

PHOTOGRAPHY & VIDEOGRAPHY

Divers need advanced diving skills to take pictures and video underwater. Photographic and video equipment is cumbersome and affects a diver's buoyancy and mobility in the water. It is all too easy to touch and damage marine life when concentrating on "the perfect shot."

ON DIVE BOATS

- Choose dive operations whose boats make use of available moorings—anchors and chains destroy fragile corals.
- Make sure garbage is well stowed, especially light plastic items and cigarette butts.
- Be sure to take away everything you brought on board, such as packaging, used batteries and bottles.

SHORESIDE

- Support coral parks and other conservation projects:
  - Visit established coral parks and pay applicable user fees that support marine conservation.
  - Encourage and support the use of dive moorings.
  - Participate in local initiatives to monitor the marine environment.
  - Participate in cleanups.
  - Make a donation or volunteer your skills to support a coral park. For example, you can participate in a reef survey, conduct outreach, or help educate others about coral reef conservation.
  - Donate used equipment such as cameras, dive gear or reef identification books.
- Speak up. Make sure your dive buddies understand these simple but important conservation practices.

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Printed using soy-based ink on 100% recycled paper/50% post consumer waste.

Visitor Management Program		
☐ Develop a Visitor Use Plan for SWCMR that includes Limits of Acceptable Change, in collaboration with stakeholders	1 - 2	▪ Visitor Use Plan for SWCMR with integrated Limits of Acceptable Change
VMP 1: Visitor Safety and Protection	**Timeframe**	**Measuring Success Indicators**
☐ Ensure ongoing capacity building for all staff for effective visitor hospitality and management at SWCMR, and first aid	1 – 5	▪ # Fisheries Officers that have visitor hospitality training
☐ Ensure relevant information on rules and regulations is available for dissemination to fishermen, tourists and other visitors	1 – 5	▪ # Fisheries Officers that have first aid training
☐ Enforce recreational regulations ▪ Dive boats follow the legislated diver / snorkeler : licensed guide ratio of 8:1 (in collaboration with BTB) ▪ Dive boats fly ' divers down' flag when divers are in the water ▪ Exclusion of jet ski and water-ski use within the Conservation and Preservation Zones	1 – 5	▪ # tourism infractions reported ▪ # Patrols conducted in collaboration with BTB ▪ % tourism stakeholders using SWCMR considered to be fully engaged and compliant with BTB and SWCMR regulations
☐ Strengthen engagement of and collaboration with tour guides to improve best tourism practices, compliance with BTB laws and SWCMR regulations	1 – 5	▪ Accreditation system for tour operators linked to best practices in SWCMR Tourism best practice guide for tourism sector using SWCMR
☐ Develop / adopt 'Tourism Best Practices' guide for tour guides, dive leaders and dive boats in collaboration with tourism and reef stakeholders	1 – 5	
☐ Support accrediting system for tour companies that show awareness of impact mitigation in their boat handling, mooring, intro. presentations to tourists, and group management	1 – 5	▪ % of required marker buoys that have been installed in key snorkeling areas
☐ Increase awareness of best practices for boats entering the marine reserve	1 - 5	▪ % of required signs that have been installed to identify key snorkeling areas
☐ Place and maintain marker buoys and signs defining key snorkeling locations around Tobacco Caye and South Water Caye and disseminate maps to boat captains, resorts and tour guides	1 – 2	▪ # incidences of significant tourism injury in SWCMR
☐ Install sufficient mooring buoys in key dive sites	1 – 2	▪ % of required mooring buoys that have been installed at key visitor use sites
☐ Maintain first aid response capability at Twin Cayes	1 - 5	

Visitor Management Program		
VMP 1: Visitor Safety and Protection	**Timeframe**	**Measuring Success Indicators**
☐ Ensure visitors on live-aboards and in independent sailboats visiting South Water Caye Marine Reserve are aware of management zones and rules and regulations, mooring buoy locations and mooring regulations and safe visitor use areas	1 – 2	% live-aboards and in independent sailboats that have been given information on zones, navigational channels, safe snorkeling areas etc. per year
☐ Develop and produce laminated poster for distribution to resorts with map of South Water Caye Marine Reserve highlighting zones, regulations, major dive / snorkeling sites, and dive best practices	1 – 2	Laminated poster of zones and regulations Dissemination list for zone / regulation poster
☐ Produce and disseminate best practices guidelines for caye-based tourism operations and other residents. WCS guidelines are recommended	1 - 2	
VMP 2: Visitor Education and Interpretation	**Timeframe**	**Measuring Success Indicators**
☐ Establish Visitors Centre / Information Centre on Twin Caye, equip with interpretive information designed to raise awareness of the environmental and socio-economic benefits and services of the Marine Reserve, traditional fishing, and its designation as a World Heritage Site	1- 2	▪ Visitor's Centre ▪ Interpretive information ▪ Gift shop ▪ Visitor satisfaction with Visitors' Center and interpretive information ▪ Student and teacher satisfaction with Visitors' Center and interpretive information ▪
☐ Investigate potential for assistance with display material from WCS and Smithsonian Institute	1 – 2	
☐ Include information targeted specifically at fishermen, using it as a platform to inform fishermen on results of conch, lobster, coral and other surveys and on ongoing research	1 – 5	
☐ Ensure information also targets local school visit requirements	1 – 5	
☐ Change displays on a regular basis to ensure there are still items of interest to attract regular visitors	1 – 5	
☐ Include a small gift shop area in the Visitor's Centre / Information Centre, as for additional income generation	1 – 2	

Visitor Management Program		
VMP 2: Visitor Education and Interpretation	**Timeframe**	**Measuring Success Indicators**
☐ Ensure continued production and distribution of brochures on South Water Caye Marine Reserve	1 – 5	▪ SWCMR brochures in English and Spanish ▪ Library containing key SWCMR publications (hard copy / digital) ▪ Interpretive boardwalk with signs ▪ # presentations provided to student groups at the Visitors' Centre ▪ Self-guided leaflet on terrestrial and marine life of Twin Cayes ▪ Quarterly presentations on biodiversity and ecosystem services of SWCMR targeting tour guides ▪ % SWCMR tour guides that attend presentations ▪ 2-day workshop for tour guides building knowledge and capacity (annual) ▪ % SWCMR tour guides that participate in the workshop
☐ Translate brochure into Spanish for distribution to Spanish speaking fishermen and visitors	1 – 5	
☐ Develop a library of key publications and videos at the Visitors' Centre as a resource for Reserve staff, visitors, and students. Copies of all published work on South Water Caye Marine Reserve should be available in this library	1 – 2	
☐ Re-establish the interpretive boardwalk on Twin Caye, including interpretive signs	1 – 5	
☐ Provide structured presentations / interpretive visits for student groups	1 – 5	
☐ Provide additional interpretive information on Twin Cayes on the terrestrial and marine life, as a self-guided leaflet	1 – 5	
☐ Provide quarterly presentations for tour guides that cover SWCMR activities, monitoring outputs, key messages, guest presentations on biodiversity and ecosystem services of the protected area, and ways to reduce tourism impacts	1 – 5	
☐ Design and implement a 2-day workshop for tour guides providing site-specific information on SWCMR and the biodiversity of the area to improve accuracy of interpretation for guests. Repeat annually.	1 - 5	

3.5.5 Management and Administration

The administration of the Marine Reserve is the responsibility of the Fisheries Department, under the Ecosystems Management Unit. The Reserve Manager reports directly to the Unit's Marine Protected Area Coordinator.

Management and Administration

- *Planning*
- *General Management and Administration*
- *Financial Management*
- *Concessions / Commercial Uses*
- *Partnership Relations*
- *Information Technology*

Planning and general administration (including human resources) are managed both on-site by the Reserve Manager, and from the Belize City Fisheries Department office. The Reserve Manager is responsible for the day to day on-site and financial management of the Marine Reserve, including management of surveillance and enforcement activities, human resource management, site-level annual book keeping, planning and reporting, and collection of visitor fees. Local partnerships with other NGOs, liaising schedules with the Coast Guard for joint patrols, and communication and collaboration with local stakeholders are also managed under the Marine Reserve activities.

In the Belize City office, the Ecosystems Management Unit is responsible for supporting the Reserve Manager, and planning at the system level. Administration, financial and human resource management are scaled up to cover all activities of the Fisheries Department. Larger scale agreements and partnerships with organizations such as WCS are managed at the national level, as is the issuing of fishing and research permits.

Management and Administration Program		
MAP 1: Planning	**Timeframe**	**Measuring Success Indicators**
☐ Preparation of annual workplan / operational plan and budget in October of each year	1 – 5	▪ Annual workplan ▪ Monthly, quarterly and annual reports
☐ Produce monthly, quarterly and annual reports and submit to Ecosystem Management Unit, following Fisheries Department reporting procedures	1 – 5	▪ Annual review report on management plan implementation and outputs (% activities successfully implemented)
☐ Conduct review of management plan strategy implementation and outputs every two years with stakeholder input, and adapt management plan as required, as part of the adaptive management cycle	1, 3, 5	▪ Annual management effectiveness assessment report
☐ Conduct management effectiveness assessment (based on national indicators -Young et al., 2005) annually, and integrate output recommendations into annual workplan /operational plan	1 – 5	▪ Emergency Plan ▪ # staff who are familiar with and trained to implement protocols under the Emergency Plan
☐ Ensure an effective Emergency Plan is in place (to include natural and anthropogenic disasters, medical evacuation etc.), and staff are trained in implementation	1 – 2	▪ # members of Advisory Committee that participate effectively in planning for the Marine Reserve
☐ Build the capacity of the Advisory Committee to be able to participate in planning for the Marine Reserve	1 – 5	▪ # members of Managed Access Committee that participate effectively in planning for the Marine Reserve
☐ Build the capacity of the Managed Access Committee to be able to participate in planning for the Marine Reserve	1 – 5	
☐ Engage the tourism sector in development of a tourism committee to assist in planning for improved tourism management at SWCMR	1 – 5	▪ Established and active tourism committee ▪ Tourism Plan for SWCMR
☐ Assess and plan for potential liability issues	1 – 2	▪ Annual review report on tourism plan implementation and outputs (% activities successfully implemented)
☐ Develop a Measures of Success framework integrating management plan indicators and outcome / impact indicators, and implement every five years	1, 5	▪ Liability Issues report ▪ Measures of Success Framework ▪ Baseline and 5 yr MoS reports

Management and Administration Program		
MAP 2: General Management and Administration	**Timeframe**	**Measuring Success Indicators**
Human Resources		
☐ Ensure all staff are familiar with Fisheries Department and Reserve management policies, including job descriptions, employee policies, transport policies, and gender issues	1 – 5	▪ % staff demonstrate familiarity with Fisheries Department and SWCMR management policies
☐ Ensure the Reserve Manager is trained in marine resource management	1 – 5	▪ Qualifications of the Reserve Manager
☐ Ensure the Reserve Manager has sufficient administrative training for effective general and financial management	1 – 5	▪ Trainings completed successfully by Reserve Manager
☐ Ensure surveillance and enforcement staff have the training required for effective surveillance and enforcement	1 – 5	▪ Relevant trainings completed successfully by surveillance and enforcement staff
☐ Ensure staff are trained in natural resource policies and legislation	1 – 5	▪ % of staff that demonstrate knowledge of natural resource policies and legislation
☐ Ensure relevant staff are trained in operation and maintenance of reserve equipment (boat handling, basic outboard repair etc.)		▪ % of relevant staff trained in operation and maintenance of reserve equipment
☐ Ensure staff are trained in conflict resolution, consensus building and communications skills	1 – 5	▪ % of staff trained in conflict resolution, consensus building and communications skills
☐ Ensure the Biologist is trained in monitoring protocols and data analysis	1 – 5	
☐ Ensure staff are trained in CPR, First Aid and use of the oxygen kit	1 – 5	
☐ Ensure on-site staff have adequate support	1 – 5	▪ Qualifications of the Biologist
☐ Annual evaluation of staff performance	1 – 5	▪ Relevant trainings completed successfully by the Biologist
☐ Conduct a capacity needs assessment of staff and identify and address capacity building requirements on an annual basis	1 – 5	▪ % of staff trained in CPR, First Aid and use of the oxygen kit
☐ Contract an Outreach Officer for implementing the Community Engagement Strategy in Dangriga and Hopkins	1 – 2	▪ % of Reserve staff consider they have sufficient support from Belize City office
☐ Contract a Development Officer to provide support for organizations benefitting from investments in income diversification activities	1 - 2	▪ Annual capacity needs assessment outputs
		▪ % of capacity needs assessment recommendations implemented by 1 year

Management and Administration Program		
MAP 3: Financial Management	**Timeframe**	**Measuring Success Indicators**
☐ Investigate and implement mechanisms for more effective fee collection	1 – 5	▪ Increase in income
☐ Conduct a financial needs assessment for management of SWCMR	1 – 2	▪ Financial needs assessment for SWCMR
☐ Develop and implement a Financial Sustainability plan for the marine reserve that identifies viable financial sustainability mechanisms	1 – 2	▪ Financial Sustainability Plan ▪ % of activities in Financial Sustainability Plan that are successfully implemented
☐ Investigate options for reducing operational costs through strategic partnerships in all programme areas (e.g. as part of SBRC)	1 - 5	▪ Agreements for strategic partnerships that reduce operational costs
MAP 4: Commercial Use	**Timeframe**	**Measuring Success Indicators**
☐ Continue permitting fishers for Managed Access Area 3 based on recommendations from the Area 3 Managed Access Committee	1 - 5	▪ # permits issues for Area 3 fishers ▪ # fishers using SWCMR
MAP 5: Partnership Relations	**Timeframe**	**Measuring Success Indicators**
☐ Strengthen communication and collaboration with Forest Department and Department of the Environment for effective regulation of development within SWCMR	1 – 5	▪ Strategic plan for effective communication and collaboration with Forest Department and DoE
☐ Implement the SWRC Communication Plan to ensure effective, consistent communication with partner organizations and stakeholders	1 – 5	▪ % of activities in Communication Plan that are successfully implemented
☐ Develop and implement joint strategic goals and activities for strengthening collaboration with the Southern Environmental Association, as part of the SBRC	1 - 5	▪ Agreement with SEA for collaboration in the SBRC seascape
MAP 6: Information Technology	**Timeframe**	**Measuring Success Indicators**
☐ Maintain database of GIS data, research and monitoring information for ease of access and to enhance the level of coordination between researchers, help identify gaps in information, and to provide a platform from which the results can be communicated to a wider audience		▪

3.5.6 Infrastructure, Operations and Maintenance Programme

The Facility Operations and Maintenance Programme covers maintenance of present infrastructure such as buildings and docks, construction of new infrastructure, and purchase and maintenance of equipment.

Infrastructure, Operations and Maintenance

- *Administration and Operational Infrastructure*
- *Tourism Infrastructure*
- *Fleet Operations and Management*

During the 5-year management planning period, priorities include:

- Addressing erosion control at Twin Cayes
- Construction of the new SWCMR Fisheries Base and dock, providing improved staff facilities
- Construction of a second surveillance and enforcement base in southern SBRC
- Construction and equipping of visitor interpretation facilities, facilitating on-site entrance fee payment, an additional resource for tour guides, improved transfer of information and an on-site gift shop
- Acquisition of a support vehicle for outreach and income diversification activities
- Improve in-water tourism infrastructure – marker buoys for demarcating navigational channels and safe swimming areas, and mooring buoys in key visitor use sites
- Ensure all programme areas have the equipment for effective operations

The new Headquarters is envisaged as a 24' x 52' two story building with a visitor's center and small office space on the lower floor, and staff accommodation upstairs for staff and other enforcement agency partners. Electricity supply focuses on renewable energy through solar power, with generator for backup power. Communication is strengthened through connection to SMART phone and internet.

Infrastructure, Operations and Maintenance Programme		
IOMP 1: Administration and Operational Infrastructure	**Timeframe**	**Measuring Success Indicators**
☐ Stabilize Twin Cayes Headquarters site through erosion control	1 – 2	▪ Area of Twin Caye HQ site / rate of erosion
☐ Construction and maintenance of the new SWCMR Headquarters	1 – 2	▪ Completed SWCMR headquarters
☐ Equipping of Headquarters – office, kitchen, accommodation and store room	1 – 2	▪ Equipped office, kitchen and accommodation
☐ Construct improved dock for ease of access	1 – 2	
☐ Identification of potential location and development of agreement for construction of base in southern SBRC	2 – 5	▪ Completed dock ▪ Agreement for use of southern base site
☐ Construction and equipping of patrol base in southern SBRC	2 – 5	▪ Construction of southern base
☐ Ensure SWCMR is equipped for effective surveillance and enforcement activities – including but not limited to SMART system, GPS, night patrol lights, first aid kit, freezer	1 – 5	▪ Equipment needs assessment report per programme ▪ % of surveillance and enforcement equipment identified in needs assessment that has been acquired
☐ Ensure SWCMR is equipped for effective monitoring activities – including but not limited to dive equipment, compressor, water quality monitoring equipment	1 – 5 1 – 5	▪ % of research and monitoring equipment identified in needs assessment that has been acquired
☐ Ensure adequate demarcation of Marine Reserve zones through installation and maintenance of marine reserve marker buoys	1 - 5	
IOMP 2: Tourism Infrastructure	**Timeframe**	**Measuring Success Indicators**
☐ Ensure key navigational routes are marked clearly by marker buoys	1 – 5	▪ % key navigational routes clearly marked by marker buoys
☐ Ensure safe swimming areas adjacent to cayes identified by tourism sector that are marked by marker buoys	1 – 5 1 – 5	▪ % safe swimming areas clearly marked by marker buoys
☐ Ensure key boat mooring sites have adequate mooring buoys		
☐ Maintenance of buoys	1 – 5	▪ % required mooring buoys installed and maintained
☐ Equip Visitor Interpretive Center at Twin Cayes and rotate interpretive displays	1 – 2	▪ % of Visitor Interpretive information and equipment that is in place / installed
☐ Construct SWCMR office in Dangriga / Hopkins	1 - 2	▪ Completed Dangriga / Hopkins office
☐ Ensure required signage is in place in Dangriga and on Tobacco Caye with map, tourism fees, rules and regulations of SWCMR		▪ % key signage installed and maintained

Infrastructure, Operations and Maintenance Programme		
IOMP 3: Fleet Operation and Maintenance	**Timeframe**	**Measuring Success Indicators**
☐ Maintenance and, when necessary, replacement of patrol vessel	1 – 5	▪ Operational patrol vessel that is adequate for the task
☐ Maintenance and, when necessary, replacement of research and monitoring vessel	1 – 5	▪ Operational research and monitoring vessel that is adequate for the task
☐ Maintenance and, when necessary, replacement of vehicle for outreach and engagement activities	1 – 5	▪ Operational vehicle that is adequate for the task
☐ Ensure adequate fuel allocation for effective operations in all programme areas	1 - 5	▪ % Scheduled maintenance activities per vessel and vehicle that have been implemented ▪ % of required fuel for effective operations that has been allocated to SWCMR

3.6 Timeline, Evaluation and Review

The Management Program matrices form the basis of an implementation plan, and indicated the time frame for each of the management activities, as well as indicators to guide monitoring and evaluation of plan implementation. 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.

The management plan should not be considered as 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 (Outcome and Impact)**	
Surveillance and Enforcement							
Ensure surveillance activities are strategic and effective, based on SWCMR enforcement data, incidence mapping and identification of hotspots, key times, key offending boats and with integration of SMART technology, supporting Managed Access						Patrols are effective, targeted, strategic and intelligence-based. Improved integration of informed, improved patrol effort at hotspots with reduced infractions and improved catch	***Current Status:*** Surveillance end enforcement would benefit from strengthening, with training in use of SMART and more effective analysis of SMART data to identify hotspots.
Expand surveillance activities to include caye development and environmental impacts within SWCMR, in collaboration with DoE and BTB						Improved collaboration towards ensuring compliance with ECPs and ICZMP recommendations in EIAs. Reduced environmental impacts	***Current Status:*** Limited communication / collaboration between departments limiting effective site level surveillance and interventions
Maintain and strengthen collaborative partnership with the Belize Coastguard for armed patrols in SWCMR, with clearly defined roles and responsibilities						Patrols are effective, targeted, and respected, with reduced infractions and improved catch	***Current Status:*** Limited accommodation limits potential for partnering on an ongoing basis with Coast Guard. Patrol is respected more when CG are present

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 (2018)**	**Status (2019)**	**Status (2020)**	**Status (2021)**	**Status (2022)**	**Status (2023)**	**Desired Status**
Surveillance and Enforcement							
Ensure surveillance activities are strategic and effective, based on SWCMR enforcement data, incidence mapping and identification of hotspots, key times, key offending boats and with integration of SMART technology, supporting Managed Access	Surveillance end enforcement would benefit from strengthening, with training in use of SMART and more effective analysis of SMART data to identify hotspots.						Patrols are effective, targeted, strategic and intelligence-based. Improved integration of informed, improved patrol effort at hotspots with reduced infractions and improved catch
Expand surveillance activities to include caye development and environmental impacts within SWCMR, in collaboration with DoE and BTB	Limited communication / collaboration between departments limiting effective site level surveillance and interventions						Improved collaboration towards ensuring compliance with ECPs and ICZMP recommendations in EIAs. Reduced environmental impacts
Maintain and strengthen collaborative partnership with the Belize Coastguard for armed patrols in SWCMR, with clearly defined roles and responsibilities	Limited accommodation limits potential for partnering on an ongoing basis with Coast Guard. Patrol is respected more when CG are present						Patrols are effective, targeted, and respected, with reduced infractions and improved catch

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 SWCMR staff and other program 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 SWCMR.

Table 36: Example: Natural Resource Management Program						
Management Activity	**Notes**	**Year**				
		1st	**2nd**	**3rd**	**4th**	**5th**
Surveillance and Enforcement						
Ensure surveillance activities are strategic and effective, based on SWCMR enforcement data, incidence mapping and identification of hotspots, key times, key offending boats and with integration of SMART technology, supporting Managed Access	**Responsible:** Ecosystem Management Unit Reserve Manager					
Expand surveillance activities to include caye development and environmental impacts within SWCMR, in collaboration with DoE and BTB	**Responsible:** Ecosystem Management Unit Reserve Manager					
Maintain and strengthen collaborative partnership with the Belize Coastguard for armed patrols in SWCMR, with clearly defined roles and responsibilities	**Responsible:** Ecosystem Management Unit Reserve Manager					
Strengthen partnership with the Southern Environmental Association for collaborative surveillance and enforcement in the SBRC seascape	**Responsible:** Ecosystem Management Unit Reserve Manager					
Strengthen communication and collaboration mechanisms with Forest Department and the Department of the Environment for enforcement of new Mangrove Regulations	**Responsible:** Ecosystem Management Unit Reserve Manager					
Implement effective enforcement of visitor regulations in SWCMR, in collaboration with BTB (e.g. tour guide-guest ratios, licenses, visitor qualifications for diving etc.) and enforcement of site-specific zone regulations regarding jet skis, catch and release fishing etc.	**Responsible:** Ecosystem Management Unit Reserve Manager					

4. Implementing the Plan

The following outline presents the first steps toward 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 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 34)

2. Define the current status, and status of implementation and outcome indicators (Table 35)

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 1:

LEGISLATION – SOUTH WATER CAYE MARINE RESERVE

BELIZE:

STATUTORY INSTRUMENT

No. 51 of 2009

ORDER made by the Minister responsible for Fisheries in exercise of the power conferred upon him by section 14 of the Fisheries Act, Chapter 210 of the Substantive Laws of Belize, Revised Edition 2000-2003, and all other powers thereunto him enabling.

(Gazetted 11th April, 2009.)

1. The Order may be cited as the

Short title.

FISHERIES (SOUTH WATER CAYE MARINE RESERVE) (AMENDMENT) ORDER, 2009

and shall be read and construed as one with the Fisheries (South Water Caye Marine Reserve) Order, 1996.

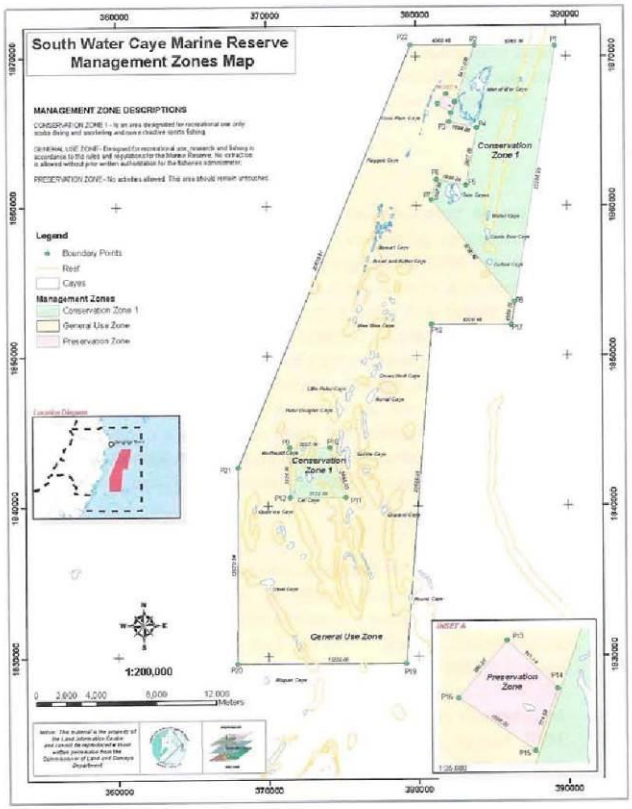
S.I. 118 of 1996.

2. The principal Order is amended by repealing the Schedule and substituting the following

Amendment of Schedule.

"

SCHEDULE
SOUTH WATER CAYE MARINE RESERVE
[Para. 2]



approximately 30,470.6 meters to a point P22 having UTM coordinate 379668 East and 1870775 North; thence in a general southeasterly direction for a distance of approximately 4,269.2 meters to a point P2 having UTM coordinate 383937 East and 1870733 North; thence to a southeasterly direction for a distance of approximately 5,353.3 meters to the point of commencement.

3. This Order comes into force on signature. **Commencement.**

MADE by the Minister of Agriculture and Fisheries this 01 day of April 2009.

(RENE MONTERO)
Minister of Agriculture and Fisheries

meters to a point P7 having UTM coordinate 381024 East and 1860420 North; thence in a southeasterly direction for a distance of approximately 8,760.6 meters to a point P8 having UTM coordinate 386513 East and 1853619 North; thence to a northeasterly direction for a distance of approximately 17,280.9 meters to the point of commencement.

2. ALL THAT AREA comprising sea, reef and cayes, excluding all private property, on the west of Saddle Caye containing approximately 2,622.2 acres commencing at a point P9 having scaled UTM coordinate 371491 East and 1843891 North; thence in a general northeasterly direction for a distance of approximately 2,667.0 meters to a point P10 having scaled UTM coordinate 374158 East and 1843893 North; thence in a southeasterly direction for a distance of approximately 3,495.0 meters to a point PII having scaled UTM coordinate 375213 East and 1840561 North; thence in a general northwesterly direction for a distance of approximately 3,722.0 meters to a point P12 having UTM coordinate 371491 East and 1840577 North; thence in a northerly direction for a distance of approximately 3,314.0 meters to the point of commencement.

GENERAL USE ZONE

ALL THAT AREA comprising of sea and cayes, excluding areas designated and described as Preservation Zone and Conservation Zone and all private property, comprising of approximately 95,794.5 acres and commencing at a point P1 having scaled UTM coordinate 389289 East and 1870680 North; thence in a southwesterly direction for a distance of approximately 17,280.9 meters to a point P8 having scaled UTM coordinate 386513 East and 1853619 North; thence in a southwesterly direction for a distance of approximately 1,559.0 meters to a point P17 having scaled UTM coordinate 386298 East and 1852080 North; thence in a general northwesterly direction for a distance of approximately 5,326.2 meters to a point P18 having UTM coordinate 380973 East and 1852121 North; thence in a southwesterly direction for a distance of approximately 22,658.0 meters to a point P19 having UTM coordinate 379168 East and 1829535 North; thence in a general northwesterly direction for a distance of approximately 11,226.0 meters to a point P20 having scaled UTM coordinate 367942 East and 1829542 North; thence in a northeasterly direction for a distance of approximately 13,070.3 meters to a point P21 having UTM coordinate 368036 East and 1842612 North; thence in a northeasterly direction for a distance of

ALL THAT PORTION of Caribbean Sea, reef and cayes situated southeast of Dangriga Town in the Stann Creek District consisting of approximately 117,874.9 acres and comprising the Preservation Zone, two areas described as the Conservation Zone I, General Use Zone, and excluding all private property, and more fully described as follows

PRESERVATION ZONE

ALL THAT AREA comprising sea and cayes, excluding all private property, on the west of Man of War Caye containing approximately 189.1 acres commencing at a point P13 having scaled UTM coordinate 382022 East and 1867505 North; thence in a southeasterly direction for a distance of approximately 811.1 meters to a point P 14 having scaled UTM coordinate 382604 East and 1866940 North; thence in a southwesterly direction for a distance of approximately 774.5 meters to a point P15 having scaled UTM coordinate 382348 East and 1866209 North; thence in a northwesterly direction for a distance of approximately 1,096.0 meters to a point P16 having UTM coordinate 381449 East and 1866836 North; thence in a northeasterly direction for a distance of approximately 880.9 meters to the point of commencement.

CONSERVATION ZONE I

1. ALL THAT AREA comprising sea, reef and cayes, excluding all private property, on the east of Coco Plum Caye containing approximately 19,269.1 acres commencing at a point P1 having scaled UTM coordinate 389289 East and 1870680 North; thence in a northwesterly direction for a distance of approximately 5353.3 meters to a point P2 having scaled UTM coordinate 383937 East and 1870733 North; thence in a southwesterly direction for a distance of approximately 5,411.0 meters to a point P3 having scaled UTM coordinate 382193 East and 1865611 North; thence in a southeasterly direction for a distance of approximately 1,894.9 meters to a point P4 having UTM coordinate 384050 East and 1865234 North; thence in a southwesterly direction for a distance of approximately 3,927.1 meters to a point P5 having UTM coordinate 383301 East and 1861379 North; thence in a northwesterly direction for a distance of approximately 1,998.8 meters to a point P6 having scaled UTM coordinate 381343 East and 1861781 North; thence in a southwesterly direction for a distance of approximately 1,397.9

Proposed realignment of boundaries and zones for SWCMR

Legal Description South Water Caye Marine Reserve.

ALL THAT PORTION of the Caribbean Sea, patch reef and cayes zoned as **SOUTH WATER CAYE MARINE RESERVE** and more fully described using the North American Datum of 1927 (NAD27) and scaling all coordinates, in metres, on Zone 16 of the Universal Transverse Mercator (UTM) projection.

South Water Caye Marine Reserve: Commencing at a point having coordinates 379668 East, 1870775 North; thence East for approximately 5.2 nautical miles (9.6 kilometres) to a point having coordinates 389290 East, 1870681 North; thence South-West for approximately 1.4 nautical miles (2.5 kilometres) to a point having coordinates 388888 East, 1868212 North; thence East for approximately 1.2 nautical miles (2.1 kilometres) to a point having coordinates 391030 East, 1868200 North; thence South for approximately 5.8 nautical miles (10.8 kilometres) to a point having coordinates 390985 East, 1857375 North; thence West for approximately 2.1 nautical miles (3.9 kilometres) to a point having coordinates 387120 East, 1857352 North; thence South-West for approximately 2.9 nautical miles (5.3 kilometres) to a point having coordinates 386299 East, 1852080 North; thence West for approximately 2.9 nautical miles (5.3 kilometres) to a point having coordinates 380973 East, 1852121 North; thence South-South-West for approximately 12.2 nautical miles (22.6 kilometres) to a point having coordinates 379168 East, 1829535 North; thence West for approximately 6.1 nautical miles (11.2 kilometres) to a point having coordinates 367942 East, 1829542 North; thence North for approximately 7.1 nautical miles (13.1 kilometres) to a point having coordinates 368036 East, 1842612 North; thence North-East for approximately 12.8 nautical miles (23.8 kilometres) to a point having coordinates 377102 East, 1864564 North; thence North-East for approximately 0.6 nautical miles (1.1 kilometres) to a point having coordinates 377535 East, 1865611 North; thence North-East for approximately 3.0 nautical miles (5.6 kilometres) to the point of origin an encompassing an area of approximately 148.14 square nautical miles (125,844.13 acres 50,927.31 hectares).

1: General Use Zone 1: Commencing on a point having coordinates 379668 East, 1870775 North; thence South-East for approximately 1.4 nautical miles (2.5 kilometres) to a point having coordinates 388888 East, 1868212 North; thence West for approximately 1.8 nautical miles (3.3 kilometres) to a point having coordinates 385623 East, 1868230 North; thence South-West for approximately 3.8 nautical miles (7.0 kilometres) to a point having coordinates 383983 East, 1861423 North; thence North-West for approximately 4.2 nautical miles (7.7 kilometres) to a point having coordinates 377535 East, 1865611 North; thence North-East for approximately 3.0 nautical miles (5.6 kilometres to the point of origin, having an approximate area of 14.40 square nautical miles (12,225.03 acres or 4,947.29 hectares), noting the computed area for this zone is save-and-except the following area:

Commencing at a point having coordinates 385603 East, 1870449 North; thence South-West for approximately 3.1 nautical miles (5.8 kilometres) to a point having coordinates 384248 East, 1864825 North; thence North-West for approximately 1.2 nautical miles (2.3 kilometres) to a point having coordinates 382302 East, 1866079 North; thence North-West for approximately 0.73 nautical miles (1.3 kilometres) to a point having coordinates 381173 East, 1866807 North; thence North-East for approximately 0.6 nautical miles (1.0 kilometres) to a point having coordinates 382022 East, 1867505

North; thence North-East for approximately 2.5 nautical miles 4.6 kilometres) to the point of origin and encompassing an area of approximately 2.91 square nautical miles (2,468.36 acres or 998.91 hectares).

2: **Conservation Zone 1:** Commencing at a point having coordinates 385603 East, 1870449 North; thence South-West for approximately 3.1 nautical miles (5.8 kilometres) to a point having coordinates 384248 East, 1864825 North; thence North-West for approximately 1.2 nautical miles (2.3 kilometres) to a point having coordinates 382302 East, 1866079 North; thence North-East for approximately 0.5 nautical miles (0.9 kilometres) to a point having coordinates 382604 East, 1866940 North; thence North-West for approximately 0.4 nautical miles (0.8 kilometres) to a point having coordinates 382022 East, 1867505 North; thence North-East for approximately 2.5 nautical miles (4.6 kilometres) to the point of origin and encompassing an area of approximately 2.61 square nautical miles or 895.10 hectares.

3: Preservation Zone: Commencing at a point having coordinates 382022 East, 1867505 North; thence North-East to for approximately 0.4 nautical miles (0.8 kilometres) to a point having coordinates 382604 East, 1866940 North; thence South-West for approximately 0.5 nautical miles (0.9 kilometres) to a point having coordinates 382302 East, 1866079 North; thence North-West for approximately 0.7 nautical miles (1.3 kilometres); thence for North-East for approximately 0.6 nautical miles (1.1 kilometres) to the point of origin and encompassing an area of approximately 0.30 square nautical miles (256.53 acres or 103.81 hectares).

4: Conservation Zone 2: Commencing at a point having coordinates 377535 East, 1865611 North; thence South-East for approximately 4.2 nautical miles (7.7 kilometres) to a point having coordinates 383983 East, 1861423 North; thence North-East for approximately 3.8 nautical miles (7.0 kilometres) to a point having coordinates 385623 East, 1868230 North; thence East for approximately 1.8 nautical miles (3.3 kilometres) to a point having coordinates 388888 East, 1868212 North; thence South-West for approximately 5.9 nautical miles (11.0 kilometres) to a point having coordinates 387120 East, 1857352 North; thence West for approximately 2.0 nautical miles (3.8 kilometres) to a point having coordinates 383334 East, 1857329 North; thence North-West for approximately 5.2 nautical miles (9.5 kilometres) to a point having coordinates 377102 East, 1864564 North; thence North-East for approximately 0.6 nautical miles (1.1 kilometres) to the point of origin and encompassing an area of approximately 17.17 square nautical miles (14,551.47 acres or 5,888.77 hectares).

5: Conservation Zone 2B: Commencing at a point having coordinates 388888 East, 1868212 North; thence East for approximately 1.2 nautical miles (2.1 kilometres) to a point having coordinates 391030 East, 1868200 North; thence South for approximately 5.8 nautical miles (10.8 kilometres) to a point having coordinates 390985 East, 1857375 North; thence West for approximately 2.1 nautical miles (3.9 kilometres) to a point having coordinates 387120 East, 1857352 North; thence North-East for approximately 5.9 nautical miles (11.0 kilometres) to the point of origin and encompassing an area of approximately 9.49 square nautical miles or (8,045.62 acres or 3,255.95 hectares).

6: General Use Zone 2: Commencing at a point having coordinates 377102 East, 1864564 North; thence South-East for approximately 5.2 nautical miles (9.5 kilometres) to a point having coordinates 383334 East, 1857329 North; thence East for approximately 2.0 nautical miles (3.8 kilometres) to a point having coordinates 387120 East, 1857352 North; thence South-West for approximately 2.9 nautical miles (5.3 kilometres) to a point having coordinates 386299 East, 1852080 North; thence West for approximately 2.9 nautical miles (5.3 kilometres) to a point having coordinates 380973 East, 1852121 North; thence

South-West for approximately 12.2 nautical miles (22.6 kilometres) to a point having coordinates 379168 East, 1829535 North; thence West for approximately 6.1 nautical miles (11.2 kilometres) to a point having coordinates 367942 East, 1829542 North; thence North for approximately 7.1 nautical miles (13.1 kilometres) to a point having coordinates 368036 East, 1842612 North; thence North-East for approximately 12.8 nautical miles (23.8 kilometres) to the point of origin, having an approximate area of 98.55 square nautical miles (83,525.09 acres or 33,801.40 hectares), noting the computed area for this zone is save-and-except the following area:
Commencing at a point having coordinates 371491 East, 1846939 North; thence East for approximately 1.4 nautical miles (2.7 kilometres) to a point having coordinates 374157 East, 1846939 North; thence South-East for approximately 1.7 nautical miles (3.1 kilometres) to a point having coordinates 374661 East, 1843893 North; thence further South-East for approximately 1.8 nautical miles (3.4 kilometres) to a point having coordinates 375213 East, 1840561 North; thence West for approximately 2.0 nautical miles (3.7 kilometres) to a point having coordinates 371491 East, 1840577 North; thence North for approximately 1.8 nautical miles (3.3 kilometres) to a point having coordinates 371491 East, 1843891 North; thence further North for approximately 1.6 nautical miles (3.0 kilometres) to the point of origin and encompassing an area of approximately 5.96 square nautical miles (5,027.56 acres or 2,034.58 hectares).

7: Conservation Zone 3: Commencing at a point having coordinates 371491 East, 1846939 North; thence East for approximately 1.4 nautical miles (2.7 kilometres) to a point having coordinates 374157 East, 1846939 North; thence South-East for approximately 1.7 nautical miles (3.1 kilometres) to a point having coordinates 374661 East, 1843893 North; thence West for approximately 1.7 nautical miles (3.2 kilometres) to a point having coordinates 371491 East, 1843891 North; thence North for approximately 1.6 nautical miles (3.0 kilometres) to the point of origin and encompassing an approximate area of 2.59 square nautical miles (2,197.91 acres or 889.46 hectares).

8: Conservation Zone 4: Commencing at a point having coordinates 371491 East, 1843891 North; thence East for approximately 1.7 nautical miles (3.2 kilometres) to a point having coordinates 374661 East, 1843893 North; thence South-East for approximately 1.8 nautical miles (3.4 kilometres) to a point having coordinates 375213 East, 1840561 North; thence West for approximately 2.0 nautical miles (3.7 kilometres) to a point having coordinates 371491 East, 1840577 North; thence North for approximately 1.8 nautical miles (3.3 kilometres) to the point of origin and encompassing and approximate area of 3.34 square nautical miles (2,829.65 acres or 1,145.12 hectares).

BELIZE:

SOUTH WATER CAYE MARINE RESERVE REGULATIONS 2009

ARRANGEMENT OF REGULATIONS

13. Cancellation of licenses.

14. Condition of licenses.

15. Duty to report accidents or damage to property.

16. Non-liability of Government.

17. Application of Fisheries Regulations.

18. Opening days of Reserve.

19. Admission fees.

20. Prohibition of certain acts.

21. Fisheries Administrator may designate certain areas.

22. Rendering fish catch information to rangers.

23. Officers to uphold Regulations.

24. Offences and penalties.

25. Negative Resolution.

SCHEDULE

Note: Gazetted as SI No. 74 of 2009

BELIZE:

STATUTORY INSTRUMENT
No. ... of 2009

REGULATIONS made by the Minister of Agriculture and Fisheries in exercise of the powers conferred upon him by section 13 of the Fisheries Act, Chapter 210 of the Laws of Belize, Revised Edition 2000-2003, and all other power thereunto him enabling.

(*Gazetted* ....., 2009).

PART I
Preliminary

1. These Regulations may be cited as the

FISHERIES (SOUTH WATER CAYE MARINE RESERVE) REGULATIONS, 2009.

Interpretation.

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

"Advisory Committee" means the committee established under Regulation 3;

"Fisheries Officer" means any fisheries officer, assistant fisheries officer, biologist or ranger employed by the Reserve;

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

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

S.I. 118 of 1996.

"Reserve" means the South Water Caye Marine Reserve declared under the Fisheries (South Water Caye Marine Reserve) Order, 1996;

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

"Schedule" means the Schedule to these Regulations;

Short title.

"Sport fishing" means catch and release fishing;

"subsistence fishing" means fishing conducted by persons who reside within the reserve for the purpose of consuming but not for selling such fish

PART II

Establishment of an Advisory Committee

Establishment of an Advisory Committee.

3. (1) The Fisheries Administrator shall establish an Advisory Committee for the purpose of assisting in the management of the Reserve.

(2) The Committee members shall be appointed by the post they hold in their organization.

(3) The Committee shall consist of representatives from the following organizations

(a) one representative of the Fisheries Department;
(b) one representative of the Forestry Department;
(c) one representative of the Coastal Zone Management Authority and Institute;
(d) one representative of the BTIA
(e) one representative of the Dangriga Town Council;
(f) one representative of the Smithsonian Institute;
(g) two persons representing Tobacco Caye Residents;
(h) one representative of the Northern Fishermen Cooperative;
(i) one representative of the Sarteneja Fisherman Association
(j) Hopkins Fishermen Association
(k) Riversdale Fishermen Association
(l) two persons representing South Water Caye Residents.
(m) any person agreed by the committee

PART III

Establishment of Zones and Rules for Zones

Establishment of Zones.

4. (1) For the purposes of these Regulations and for the control of the Reserve, there shall be established within the Reserve, the following three zones

(a) the General Use Zone;
(b) the Conservation Zone; and
(c) the Preservation Zone;

S.I. 118 of 1996.

(2) The description of the above Zones shall be as set out in the Schedule to the Fisheries (South Water Caye Marine Reserve) Order, 1996.

Rules for General Use Zone.

5. (1) The General Use Zone is restricted to fishing by licensed fishermen who currently use this Zone and a fishermen who is desirous of fishing in this Zone shall apply for a license to fish in accordance with these Regulations.

(2) Residents of South Water Caye who have special licenses to fish may fish solely for subsistence purposes, and such fishing shall be determined by the terms and conditions of each resident's license.

(3) No person is permitted to use long lines, spear-guns or gill nets in the Reserve unless authorized by the Fisheries Administrator.

(4) Sport Fishing is allowed in the General Use Zone only accordance with the following

(a) spear fishing is not permitted;

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

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

Rules for Conservation Zone.

6. (1) There shall be only non-extractive recreational activities in the Conservation Zone.

(2) No person shall engage in commercial, sport or subsistence fishing within the Conservation 1 Zone.

(3) No person shall secure a boat to the sea bed of the Conservation 1 Zone 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.

(4) Every diver in the Conservation 1 Zone shall adhere to the following rules

(a) divers shall register with the Reserve Manager prior to entering the Conservation 1 Zone;

(b) charter dives shall first obtain a license in accordance with these Regulations, before operating in the Conservation 1 Zone and all dive boats shall fly the "divers down flag" when they have divers in the water;

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

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

(e) every boat owner desirous of operating a boat in this Zone, shall first register his boat with the Fisheries Administrator in accordance with these Regulations;

(f) every operator of a motor boat shall observe the low wake zone boat way when approaching snorkelers or divers;

(g) for Scuba tours, a maximum of eight divers per licensed dive master is permitted;

(h) for snorkel tours, a maximum of eight snorkelers per licensed tour guide is permitted;

(i) no person shall harass or in any way tamper with any fauna within the Conservation 1 Zone.

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

(6) No person shall engage in water-skiing or jet skiing within the Conservation Zone.

Rules for Preservation Zone.

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

(2) No person shall operate a motor boat within the Preservation Zone except in cases of emergency, or where written permission has first been obtained from the Fisheries Administrator.

PART III

Commercial Fishing, Research, and Registration of Dive Boats

Commercial fishing licenses. Form I. Schedule.

8. (1) A person desirous of fishing within the Reserve shall apply to the Fisheries Administrator, in the form prescribed as Form I in the Schedule, for a commercial fishing license.

Form II. Schedule.

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

Form I. Schedule.

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

(4) A fee of twenty-five dollars ($25.00) is payable upon the receipt of a fishing license or for the renewal of that license.

Research Licenses. Form III. Schedule.

9. (1) A person desirous of conducting research within the Reserve shall apply to the Fisheries Administrator, in the form prescribed as Form III in the Schedule, for a license to conduct such research.

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

(3) The Fisheries Administrator may attach conditions to a research license issued under these Regulations.

(4) A fee of five hundred dollars (BZ $500.00) is payable by an applicant upon the receipt of a research license or for the renewal of that license.

(5) The Fisheries Administrator may waive or vary, at his discretion, the fee payable for a research license.

Registration of dive boats. Form IV.

10. (1) A boat operator desirous of conducting SCUBA diving and snorkeling within the Reserve shall apply to the Fisheries Administrator for registration in the form prescribed as Form IV of the Schedule.

(2) A fee of one hundred dollars (BZ$100.00) is payable upon registration of a boat pursuant to sub-regulation (1) above.

(3) Boat registration pursuant to this Regulation expires on the 31st day of December next, after the date of issue.

PART IV
GENERAL

Licenses not transferable.

11. Every license issued pursuant to these Regulations shall not be transferable.

Duration and renewal of licenses.

12. Every license issued under these Regulations, unless otherwise stated, is valid until December 31st of any year and may be renewed for a like period upon payment of the fees prescribed in these Regulations.

Cancellation of licenses.

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

Conditions of licenses.

14. In issuing a license under these Regulations, the Fisheries Administrator may attach conditions to such licenses, as the case may be, having due regard to the nature of the license and the need to protect the environment and natural resources.

Duty to report accidents or damage to property.

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

Non-liability of government.

16. The Government is not liable for any personal injury or damage to property occurring within the Reserve.

Application of Fisheries Regulations. Sub. Leg. Vol. IV. CAP. 174 p.7.

17. Notwithstanding the provisions of these Regulations, the Fisheries Regulations, as amended, shall apply within the Reserve.

Opening days of Reserve.

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

Admission fees.

19. (1) The fees payable by foreign visitors for all water recreational activities, excluding sports and recreational fishing, are ten dollars (BZ $10.00) per person per day or thirty dollars (BZ $30.00) per person per week.

(2) No fees are payable by Belizeans and children below twelve years of age.

Prohibition of certain acts. CAP. 210.

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

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

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

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

Fisheries Administrator may designate certain areas.

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

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

Rendering fish catch information to Rangers.

22. Every commercial, recreational, subsistence, and sport fisherman shall render to the Reserve Rangers upon request, the weight of fish caught within the Reserve.

Officers to uphold Regulations.

23. Every person employed by the Reserve for the purpose of management of the Reserve, is a Fisheries Officer charged with upholding the Reserve Regulations as well as the Fisheries Regulations.

Offences and penalties.

24. (1) A person who contravenes any of the provisions of the Regulations commits an offence and is liable on summary conviction to a fine

not exceeding five hundred dollars or to imprisonment for a term not exceeding six months, or to both such fine and imprisonment.

CAP. 1

(2) Notwithstanding anything to the contrary contained in the Interpretation Act, a person who damages any coral shall pay an administrative fine not exceeding twenty five thousand dollars and a penalty based on damage assessment, which penalty shall not exceed twenty five million dollars.

Negative Resolution.

25. These Regulations are subject to negative resolution of the National Assembly.

MADE by the Minister of Agriculture and Fisheries this ____ day of _____ 2009.

_____

(RENE MONTERO)
Minister of Agriculture and Fisheries

Note: Signed 13th May, 2009

SCHEDULE

FORM I

[Reg. 8]

APPLICATION FOR A COMMERCIAL FISHERMAN'S LICENSE OR FOR RENEWAL THEREOF

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

To: The Fisheries Administrator.

PART A

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

Name……. Age ……. years
(block capitals)

Fishing Experience……. Years (Full time….. yrs; Part time ... yrs)

Home Address…….. I am a boat owner……(yes/no)

……. Boat operator……(yes/no)

……. Crewman……(yes/no)

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

Name of Co-operative if a member……

Membership No. …… Previous Fisherman's license no……

Date Issued ……

PART B

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

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

Lobster	Scale Fish	Conch	Other
Traps ( ) No. ( )	Seine nets ( ) No.( )	Diving ( )	Product
Drums ( ) No. ( )	Cast nets ( ) No.( )		----------
Beach			

Traps ( ) No. ( ) Set nets ( ) No. ( ) Method
Diving ( ) No.( ) Tangle Nets ( ) No. ( ) ---------
Other ( ) No. ( ) Gill Nets ( ) No. ( ) No. of
Trammel net ( ) No.( )-l or 2 wall Units
Beach traps ( ) No. ( )-shore or open sea ---------
based
Fish pots ( ) No.( )-any type
Drop lines ( )
Long lines ( ) No.( )-indicatehooks/100yards.

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

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

FORM II

[Reg. 8]

FISHERMAN LICENCE

License No .....

This license is issued to

…….....

(full name)

of ……..under the

(address)

provisions of the Fisheries Act and Regulations made thereunder.

This license is not transferable and takes effect from the date of issue and remains in force unless canceled.

Until ..……

Fee Paid ……..Receipts ……..……..

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

PHOTOGRAPH

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

FORM III

[Reg. 9]

APPLICATION FOR LICENCE TO CONDUCT RESEARCH OR SCIENTIFIC INVESTIGATION WITHIN THE CAYE CAULKER MARINE RESERVE

Date of Application .....

Name of Applicant including title or designation
……

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

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

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

Period during which work is to be carried out
……

The following documents are to be attached to this application:

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

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

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

I wish to conduct research/an investigation in Belize on my own behalf/as leader of a group of ( ) students/on the behalf of the institution named above for the following purposes: .....
.....
.....
.....
.....
.....
.....details of which are contained in the attached pages. I will wish to collect specimens for study in Belize and will/will not wish to export these specimens for further study at the end of my stay. I shall want to collect ( ) specimen of species for study/and export.

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

FORM IV

[Reg. 10]

APPLICATION FOR BOAT REGISTRATION FOR OPERATION IN THE SOUTH WATER CAYE MARINE RESERVE

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

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

Date:..... Signature .....

Registration Form

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

This boat is registered to carry up to ..... passengers and to conduct the following activities in the Caye Caulker Marine Reserve. i.e.
.....
.....
.....

Conditions of registration

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

(i) To acquaint passengers with the rules of the Reserve.
(ii) To moor at the buoys provided when in the Conservation and General Use Zones.
(iii) To fly the "divers down" flag during all dives.

(iv) Only certified scuba divers or those undergoing an approved training course will be allowed to use scuba tanks.

If carrying passengers to carry out sport fishing, the captain/guide is responsible for the following

(i) To submit details to the Reserve Manager when requested, of catch and the area where fishing took place.
(ii) To release fish wherever possible.

To apply the mark/sticker provided in a prominent position on the registered boat.

Date

……

Fisheries Administrator

_____****_____

CHAPTER 210

118 of 1996.

FISHERIES (SOUTH WATER CAYE MARINE RESERVE) ORDER

(Section 14)

[31st August, 1996.]

Short title.

1. This Order may be cited as the

FISHERIES (SOUTH WATER CAYE MARINE RESERVE) ORDER

Declaration of Marine Reserve. Schedule.

2. The area known as the "South Water Caye", as more fully described in the Schedule hereto, is hereby declared to be a marine reserve for the purposes of the Fisheries Act.

MADE by the Minister of Agriculture and Fisheries this 28th day of August, 1996.

(RUSSELL GARCIA)

Minister of Agriculture and Fisheries

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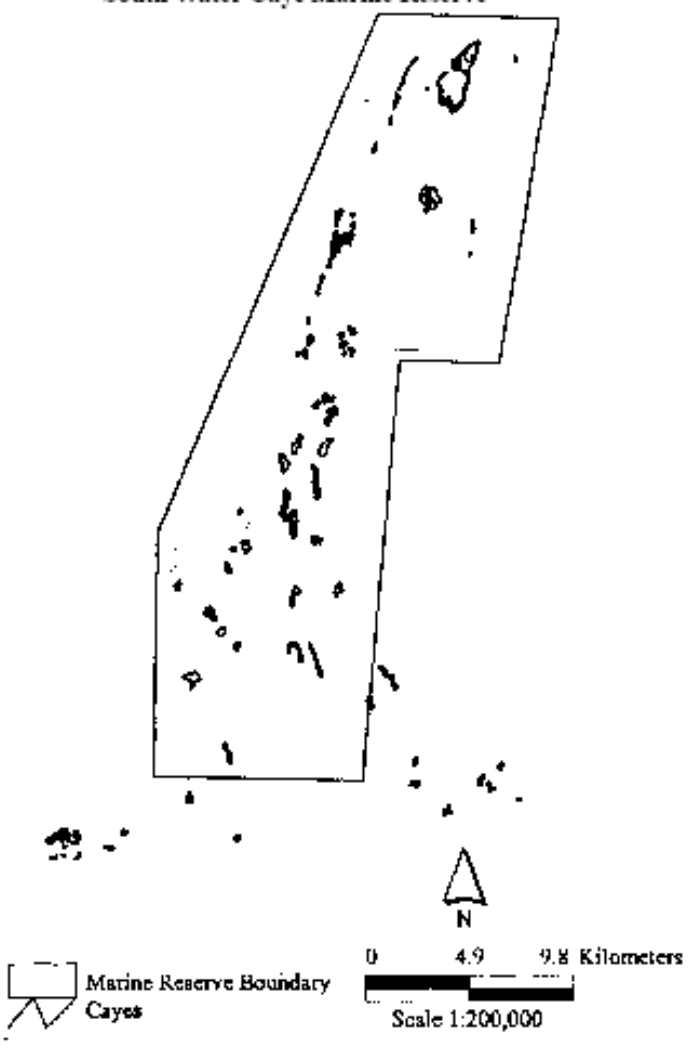
South Water Caye Marine Reserve



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SCHEDULE (PARAGRAPH 2)

SOUTH WATER CAYE MARINE RESERVE

ALL THAT portion of the Caribbean Sea being part thereof and being described as follows:

On the South bounded by an East-West line approximately 1,000 m. South of Wappari Caye, on the East by the Caribbean Sea, on the North by an East- West line approximately 1,250 m. North of Tobacco Range and on the West by the Inner Channel therein enclosed, more particularly described as follows:

Commencing at a Point A Southeast of Carrie Bow Caye having scaled UTM coordinates 386 299 East 1852 080 North; thence in a general northerly direction to a Point B Northeast of Tobacco Caye Entrance having scaled UTM coordinates 3 89 290 East 1870 681 North; thence in a general westerly direction to a Point C Northwest of Coco Plum Caye having scaled UTM coordinates 379 668 East 1870 775 North; thence in a general south-westerly direction to a Point D Northwest of Quamina Caye having scaled UTM coordinates 368 036 East 1842 612 North; thence in a general southerly direction back to a Point E Northwest of Wippari Caye having scaled UTM coordinates 367 942 East 1829 542; thence in a general easterly direction to a Point F Southwest of Tarpum Caye having scaled UTM coordinates 379 168 East 1829 535 North; thence in a general northerly direction to a Point G Southwest of Wee Wee Caye having scaled UTM coordinates 380 973 East 1852 121 North; thence in a general easterly direction back to the point of commencement.

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ANNEX 5:

SCIENTIFIC PUBLICATIONS

Scientific Publications from Carrie Bow Caye

Caribbean Coral Reef Ecosystems Program

Achatz, J.G., M.D. Hooge, and S. Tyler (2007). Convolutidae (Acoela) from Belize. *Zootaxa* 1479: 35-66.

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Acosta, C.A. & M.J. Butler (1997): Role mangrove habitat as a nursery for juvenile spiny lobster, *Panulirus argus*, in Belize. Mar. Freshwater Res., 48: 721-727.

Adey, W.H. (1977). Shallow-water Holocene bioherms of the Caribbean Sea and West Indies. Proceedings, Third International Coral Reef Symposium (Miami) 2: xxi-xxiv.

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(1998).
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Antonius, A. & E. Ballesteros: Epizoism: a threat to coral health in Caribbean reefs. Rev. Biol. Trop. 46 Sup;. 5: 145-156 (1998).
Arnold, S. N. and R.S. Steneck. 2011. Settling into an increasingly hostile world: the rapidly closing 'recruitment window' for corals. PloS One6(12):e28681.
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ANNEX 6: SPECIES LISTS

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

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

Fish Species of The South Water Caye Marine Reserve			
Family	**Species**	**Common name**	**IUCN**
Gobiidae	*Coryphopterus personatus*	Masked goby	
	Gnatholepsis thompsoni	Goldspot goby	
	Gobionellus saepepallens	Dash goby	
	Gobiosoma dilepsis	Orangesided goby	
	Gobiosom evelynae	Sharknose goby	
	Gobiosoma genie	Cleaning goby	
	Gobiosoma horsti	Yellowline goby	
	Gobiosoma illecebrosum	Barsnout goby	
	Gobiasoma prochilos	Broadstripe goby	
	Elacatinus colini		
	Elacatinus lobeli		
	Elacatinus lori		
	Lophogobius cyprinoides	Crested goby	
Gramistinidae	*Gramma loreto*	Fairy basslet	
	Gramma melacara	Blackcap basslet	
	Liopropoma rubre	Peppermint basslet	
Haemulidae	*Anisotremus surinamensis*	Black margate	
	Anisotremus virginicus	Porkfish	
	Haemulon album	White margate	
	Haemulon aurolineatum	Tomtate	
	Haemulon carbonarium	Caesar grunt	
	Haemulon chrysargyreum	Smallmouth grunt	
	Haemulon flavolineatum	French grunt	
	Haemulon macrostomum	Spanish grunt	
	Haemulon melanurum	Cottonwick	
	Haemulon parrai	Sailor's choice	
	Haemulon plumieri	White grunt	
	Haemulon sciurus	Bluestriped grunt	
	Haemulon striatum	Striped grunt	
Hemiramphidae	*Hemiramphus brasiliensis*	Ballyhoo	
Holocentridae	*Holocentrus adscensionis*	Squirrelfish	
	Holocentrus coruscus	Reef squirrelfish	
	Holocentrus marianus	Longjaw squirrelfish	
	Holocentrus rufus	Longspine squirrelfish	
	Holocentrus vexillarius	Dusky squirrelfish	
	Myripristis jacobus	Blackbar soldierfish	
	Neoniphon marianus	Longjaw squirrelfish	
Inermiidae	*Emmelichthyops atlanticus*	Bonnetmouth	
	Inermia vittata	Boga	
Kyphosidae	*Kyphosus sectatrix*	Bermuda chub	
Labridae	*Bodianus pulchellus*	Spotfin hogfish	
	Bodianus rufus	Spanish hogfish	
	Clepticus parrae	Creole wrasse	
	Doratonatus megalepis	Dwarf wrasse	

Fish Species of The South Water Caye Marine Reserve			
Family	**Species**	**Common name**	**IUCN**
Labridae	*Halichoeres bivittatus*	Slippery dick	
	Halichoeres cyanocephalus	Yellowcheek wrasse	
	Halichoeres garnoti	Yellowhead wrasse	
	Halichoeres maculipinna	Clown wrasse	
	Halichoeres radiatus	Puddingwife	
	Halichoeres socialis (Endemic)		
	Hemipteronotus novacula	Pearly razorfish	
	Lachnolaimus maximus	Hogfish	VU
	Thalassoma bifasciatum	Bluehead wrasse	
	Xyrichtys martinicensis	Rosy razorfish	
	Xyrichtys spendens	Green razorfish	
Lutjanidae	*Lutjanus analis*	Mutton snapper	VU
	Lutjanus apodus	Schoolmaster	
	Lutjanus cyanopterus	Cubera snapper	VU
	Lutjanus griseus	Grey Snapper	
	Lutjanus jocu	Dog snapper	
	Lutjanus mahogani	Mahogany snapper	
	Lutjanus synagris	Lane Snapper	
	Ocyurus chrysurus	Yellowtail snapper	
Malacanthidae	*Malacanthus plumieri*	Sand tilefish	
Mobulidae	*Manta birostris*	Atlantic manta	
	Mobula hypostoma	Devil ray	
Muglidae	*Mugil curema*	White mullet	
Mullidae	*Mulloidiochthys martinicus*	Yellow goatfish	
	Pseudopeneus maculatus	Spotted goatfish	
Muraenidae	*Enchelycore carychroa*	Chestnut moray	
	Gymnothorax funebris	Green moray	
	Gymnothorax miliaris	Goldentail moray	
	Gymnothorax moringa	Spotted moray	
	Gymnothorax vicinus	Purplemouth moray	
Myliobatidae	*Aetobatus narinari*	Spotted eagle ray	
Ogcocephalidae	*Ogcocephalus nasutus*	Shortnose batfish	
Ophicthidae	*Myrichthys breviceps*	Sharptail eel	
Opisthognatidae	*Opistognathus aurifrons*	Yellowhead jawfish	
	Opistognathus macrognathus	Banded jawfish	
	Opistognathus whitehurstii	Dusky jawfish	
Ostraciidae	*Acanthostracion polygonia*	Honeycomb cowfish	
	Acanthostracion quadricornis	Scrawled cowfish	
	Lactophrys bicaudalis	Spotted trunkfish	
	Lactophrys trigonus	Buffalo trunkfish	
	Lactophrys triqueter	Smooth trunkfish	
Pempheridae	*Pempheris schomburgki*	Glassy sweeper	
Pomacanthidae	*Holacanthus ciliaris*	Queen angelfish	
	Holacanthus tricolor	Rock beauty	

Fish Species of The South Water Caye Marine Reserve			
Family	**Species**	**Common name**	**IUCN**
Pomacanthidae	*Pomacanthus arcuatus*	Grey angelfish	
	Pomacanthus paru	French angelfish	
Pomacentridae	*Abudefduf saxatilis*	Sergeant major	
	Abudefduf taurus	Night sergeant	
	Chromis cyanea	Blue chromis	
	Chromis insolata	Sunshinefish	
	Chromis multilineata	Brown chromis	
	Microspathodon chrysurus	Yellowtail damselfish	
	Stegastes diencaeus	Longfin damselfish	
	Stegastes fuscus	Dusky damselfish	
	Stegastes leucostictus	Beaugregory	
	Stegastes partitus	Bicolor damselfish	
	Stegastes planifrons	Threespot damselfish	
	Stegastes variabilis	Cocoa damselfish	
Priacanthidae	*Priacanthus arenatus*	Bigeye	
	Priacanthus cruentatus	Glasseye snapper	
Rhincodontidae	*Rhincodon typus*	Whale shark	
Scaridae	*Scarus coelestinus*	Midnight parrotfish	
	Scarus coeruleus	Blue parrotfish	
	Scarus guacamaia	Rainbow parrotfish	VU
	Scarus iserti	Striped parrotfish	
	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	Yellowtail parrotfish	
	Sparisoma viride	Stoplight parrotfish	
Sciaenidae	*Equetus acuminatus*	Highhat	
	Equetus punctatus	Spotted drum	
	Equetus umbrosus	Cubbyu	
	Odontoscion dentex	Reef croaker	
Scombridae	*Scomberomorus regala*	Cero	
Scorpaenidae	*Scorpaena plumieri*	Spotted scorpionfish	
Serranidae	*Alphestes afer*	Mutton hamlet	
	Cephalopholis fulvus	Coney	
	Epinephelus adscensionis	Rock hind	
	Epinephelus cruentatus	Graysby	
	Epinephelus guttatus	Red hind	
	Epinephelus inermis	Marbled grouper	
	Epinephelus itajara	Goliath grouper	CR
	Epinephelus morio	Red grouper	
	Epinephelus striatus	Nassau grouper	EN

Fish Species of The South Water Caye Marine Reserve			
Family	**Species**	**Common name**	**IUCN**
Serranidae	*Hypoplectrus aberrans*	Yellowbelly hamlet	
	Hypoplectrus chlorurus	Yellowtail hamlet	
	Hypoplectrus gemma	Blue hamlet	
	Hypoplectrus gummingatta	Golden hamlet	
	Hypoplectrus guttavarius	Shy hamlet	
	Hypoplectrus indigo	Indigo hamlet	
	Hypoplectrus nigricans	Black hamlet	
	Hypoplectrus puella	Barred hamlet	
	Hypoplectrus unicolor	Butter hamlet	
	Hypoplectrus sp. Nov.	Mayan hamlet	
	Mycteroperca bonaci	Black grouper	CR
	Mycteroperca interstitialis	Yellowmouth grouper	
	Mycteroperca rubra	Comb grouper	
	Mycteroperca tigris	Tiger grouper	
	Mycteroperca venenosa	Yellowfin grouper	
	Paranthias furcifer	Creole-fish	
	Rypticus saponaceus	Greater soapfish	
	Serranus baldwini	Lantern bass	
	Serranus flaviventris	Two-spot bass	
	Serranus tabacarius	Tobaccofish	
	Serranus tigrinus	Harlequin bass	
	Serranus tortugarium	Chalk bass	
Sparidae	*Calamus bajonado*	Jolthead progy	
	Calamus calamus	Saucereye porgy	
Sphyraenidae	*Sphyraena barracuda*	Barracuda	
	Sphyraena picudilla	Southern sennet	
Sphyrnidae	*Sphyrna mokarran*	Great Hammerhead	
	Sphyrna tiburo	Bonnethead	
Sygnathidae	*Cosmocampus elucens*	Shorthorn pipefish	
	Hippocampus erectus	Northern seahorse	VU
Synbranchidae	*Ophisternon aenigmaticum*	Obscure swamp eel	
Synodontidae	*Synodus intermedius*	Sand diver	
	Synodus saurus	Bluestriped lizardfish	
Tetraodontidae	*Canthigaster rostrata*	Sharpnose puffer	
	Chilomycterius antennatus	Bridled burrfish	
	Chilomycterius antillarum	Web burrfish	
	Diodon holocanthus	Ballonfish	
	Diodon hystrix	Porcupinefish	
	Sphoeroides spengleri	Bandtail puffer	
	Sphoeroides testudineus	Checkered pufferfish	
Triglidae	*Prionotus ophryas*	Bandtail searobin	
Tripterygiidae	*Enneanectes altivelis*	Lofty tripletail	
	Enneanectes atrorus	Blackedge triplefin	
Urolophidae	*Urolophus jamaicensis*	Yellow stingray	

Fish Species of The South Water Caye Marine Reserve			
Species possibly present but requiring further verification			
Family	**Species**	**Common name**	**IUCN**
Carcharhinidae	*Carcharhinus brevipinna*	Spinner Shark	
	Carcharhinus galapagensis	Galapagos shark	
Gobiidae	*Ctenogobius saepapellans*	Dash goby	
Haemulidae	*Haemulon parra*	Sailor's choice	
	Haemulon chrysargyreum	Smallmouth grunt	
	Haemulon striatum	Striped grunt	
Labridomidae	*Malacoctenus triangulatus*	Saddled blenny	
Pomacentridae	*Chromis encrysurus*	Yellowtailed reeffish	
	Chromis insolata	Sunshinefish	
Scaridae	*Cryptotomus roseus*	Bluelip parrotfish	
	Scarus guacamaia	Rainbow parrotfish – has this been seen recently	
Sphyrnidae	*Sphyrna lewini*	Scalloped hammerhead	
Triakidae	*Mustelus canis*	Dusky smooth hound	
Echeneidae	*Echeneis neucrates*	Remora …is this different from neucratoides?	

Bird Species of South Water Caye Marine Reserve		
Family	**Species**	
Sulidae	Brown Booby	*Sula leucogastor*
Pelecanidae	Brown Pelican	*Pelecanus occidentalis*
Phalacrocoracidae	Double-crested Cormorant	*Phalacrocorax auritus*
Fregatidae	Magnificent Frigatebird	*Fregata magnificens*
Ardeidae	Great Blue Heron	*Ardea herodias*
	Great Egret	*Ardea alba*
	Snowy Egret	*Egretta thula*
	Little Blue Heron	*Egretta caerulea*
	Tricolored Heron	*Egretta tricolor*
	Cattle Egret	*Bubulcus ibis*
	Green Heron	*Butorides virescens*
	Yellow-crowned Night-Heron	*Nyctanassa violacea*
Threskiornithidae	White Ibis	*Eudocimus albus*
	Scarlet Ibis	*Eudocimus ruber*
Anatidae	Black-bellied Whistling Duck	*Dendrocyna autumnalis*
	Blue-winged Teal	*Anas discors*
	Lesser Scaup	*Aythya affinis*
Accipitridae	Osprey	*Pandion haliaetus*
	Common Black Hawk	*Buteogallus anthracinus*
	Peregrine Falcon	*Falco peregrinus*
Rallidae	Rufous-necked Woodrail	*Aramides axillaris*
	Grey-necked Wood-Rail	*Aramides cajanea*
	Clapper Rail	*Rallus longirostris*
Charadriidae	Black-bellied Plover	*Pluvialis squatarola*
	Wilson's Plover	*Charadrius wilsonia*
	Semipalmated Plover	*Charadrius semipalmatus*
Scolopacidae	Greater Yellowlegs	*Tringa melanoleuca*
	Spotted Sandpiper	*Actitis macularia*
	Whimbrel	*Numenius phaeopus*
	Marbled Godwit	*Limosa fedoa*
	Ruddy Turnstone	*Arenaria interpres*
	Least Sandpiper	*Calidris minutilla*
	Short-billed Dowitcher	*Limnodromus griseus*
	Common Snipe (Wilson's Snipe)	*Galinago delicata*
Laridae	Laughing Gull	*Larus atricilla*
	Caspian Tern	*Sterna caspia*
	Royal Tern	*Sterna maxima*
	Sandwich Tern	*Thalasseus sandvicensis*
	Roseate Tern	*Sterna dougalii*
	Least Tern	*Sternula antillarum*

Bird Species of South Water Caye Marine Reserve / 2		
Family	**Species**	
Laridae	Bridled Tern	*Onychoprion anaethetus*
Columbidae	White-crowned Pigeon	*Columba leucocephala*
Cuculidae	Groove-billed Ani	*Crotophaga sulcirostris*
Trochilidae	Green-breasted Mango	*Anthracothorax prevostii*
	Cinnamon Hummingbird	*Amazilia rutila*
	Ruby throated Hummingbird	*Archilochus colubris*
Alcedinidae	Belted Kingfisher	*Ceryle alcyon*
Tyrannidae	Caribbean Elaenia	*Conotopus martinica*
	Eastern Wood-Pewee	*Contopus virens*
	Great-crested Flycatcher	*Myiarchus crinitus*
Vireonidae	Mangrove Vireo	*Vireo magister*
	Philadelphia Vireo	*Vireo philadelphicus*
	Yellow-green Vireo	*Vireo flavoviridis*
	Yucatan Vireo **(YE)**	*Vireo magister*
Hirundinidae	Purple Martin	*Progne subis*
	Gray-breasted Martin	*Progne chalybea*
	Tree Swallow	*Tachycineta bicolor*
	Mangrove Swallow	*Tachycineta albilinea*
	Cliff Swallow	*Petrocheilidon pyrrhonata*
	Barn Swallow	*Hirundo rustica*
Turdidae	Wood Thrush	*Hylocichla mustelina*
	Gray Catbird	*Dumetella carolinensis*
Bombycillidae	Cedar Waxwing	*Bombycilla cedrorum*
Parulidae	Tennessee Warbler	*Vermivora peregrina*
	Tropical Parula	*Parula pitiyamui*
	Yellow Warbler	*Dendroica petechia*
	Chestnut-sided Warbler	*Dendroica pensylvanica*
	Magnolia Warbler	*Dendroica petechia*
	Yellow-throated Warbler	*Dendroica dominica*
	Palm Warbler	*Dendroica palmarum*
	Bay-breasted Warbler	*Dendroica castanea*
	Black-and-white Warbler	*Mniotilta varia*
	American Redstart	*Setophaga ruticilla*
	Prothonotary Warbler	*Protonotaria citrea*
	Ovenbird	*Seiurus aurocapilla*
	Northern Waterthrush	*Seiurus noveboracensis*
	Louisiana Waterthrush	*Seiurus motacilla*
	Common Yellowthroat	*Geothlypis trichas*
	Gray-crowned Yellowthroat	*Geothlypis poliocephala*

Bird Species of South Water Caye Marine Reserve / 3		
Family	**Species**	
Parulidae	Hooded Warbler	*Wilsonia citrine*
	Canada Warbler	*Wilsonia canadensis*
Thraupidae	Summer Tanager	*Piranga rubra*
	Scarlet Tanager	*Piranga olivacea*
Cardinalidae	Rose-breasted Grosbeak	*Pheucticus ludovicianus*
	Indigo Bunting	*Passerina cyanea*
	Dickcissel	*Spiza americana*
	Great-tailed Grackle	*Quiscalus mexicanus*
	Orchard Oriole	*Icterus spurious*
	Baltimore Oriole	*Icterus galbula*

Status

Legend

v = very common
c = common
f = fairly common
u = uncommon
o = occasional
l = local
X = one or two records only

P = permanent resident
S = seasonal resident
V = visitor
T = transient (migrant)
W = winter resident
F = former resident

Regional Endemics

Legend (L. Jones)

YE Yucatan Endemic