

Turneffe Atoll is the largest and most biologically diverse of the three offshore Atolls lying to the east of the coastal shelf of Belize. It is considered to be an integral part of Belize's reef system. Turneffe is recognized as the most well developed Atoll within the Mesoamerican Reef (MAR) region, with its complexity of interconnected terrestrial and marine environments - a global ecological hotspot for threatened and endangered marine and terrestrial biodiversity.

Long Term Vision

Turneffe Atoll Marine Reserve is a model of effective planning and management that ensures that the unique ecological values and associated social and economic benefits are used sustainably for future generations through active stakeholder stewardship.



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Turneffe Atoll Marine Reserve

Planning for Effective Management

Turneffe Atoll has been recognized as a management gap for many years, and the focus of several past efforts to establish a management regime for the area. Building on the achievements of the past, and integrating multi-stakeholder participation to ensure effective management in the future, the Atoll has now been established as a Marine Reserve (22nd December, 2012; SI 111 of 2012). A five year management plan guides the Belize Fisheries Department and the Turneffe Atoll Sustainability Association in the management of the marine protected area.

The management plan is based on the outputs from a series of workshops, stakeholder focal group meetings, interviews, discussions and comments, as well as past and ongoing research data from the Atoll, and provides structured programs, strategies and actions that will lead towards fulfilling the stakeholder vision:

Turneffe Atoll is a model of effective planning and management that ensures that the unique ecological values and associated social and economic benefits are used sustainably for future generations through active stakeholder stewardship

In moving Turneffe Atoll forwards towards an improved management regime, the process has been strengthened through the integration of a series of management action planning workshops in 2011, facilitated by The Nature Conservancy, bringing key stakeholders together to discuss and assess

the status of biodiversity of the Atoll, and the threats to the continued viability of the area as one of the more pristine, and one of the relatively un-impacted, biodiverse sites within the Mesoamerican Reef ecoregion.

The Atoll is critical in supporting a traditional fishing industry, and provides world renowned tourism opportunities for both divers and sport fishermen. However, challenges lie ahead, as reef health continues to decline in the face of climate change. This is exacerbated by increasing site-level pressures. Caye development, with the associated dredging of seagrass beds is increasing the impacts of sedimentation on the reef. The clearance of coastal vegetation is also removing critically important mangrove forests and reducing the extent of some of the last stands of littoral forest, the most threatened ecosystem in Belize. Additionally, increased fishing pressure has reduced commercial stocks to levels considered unsustainable, with an urgent need for management to be put in place.



Belize Fishermen Federation



Turneffe Atoll Trust

Introduction

Turneffe Atoll Marine Reserve

Turneffe Atoll has well-developed reefs along its entire margin, particularly at its southern end, with a complex interior lagoon matrix of numerous interconnected mangroves and seagrass beds, supporting Antillean manatees, dolphins and several seabird breeding colonies.

The waters of the Atoll also provide nursery and feeding habitats for at least thirty species of international concern, recognized under the IUCN Redlist as Critically Endangered, Endangered or Vulnerable, including four species of critically endangered and endangered marine turtles. The wider Turneffe area, with its deep water passages, provides an important habitat for pelagic species such as marlin, sailfish, mackerel, jacks, kingfish, sharks and cetaceans. It is also the MPA with the most significant representation of the deep water, identified as the largest gap in ecosystem coverage within Belize's National Protected Areas System. The reefs of the Atoll also provide important habitat for Critically Endangered staghorn and elkhorn corals, the endemic white spotted toadfish (*Sanopus astrifer*), whilst the sandy beaches and brackish lagoons provide some of the best remaining nesting and adult habitat for American saltwater crocodiles in the Caribbean.

The seagrass and mangroves of the Atoll lagoons provide a protected nursery area for many juvenile commercial fish species, as well as habitat for lobster and conch – the backbone of Belize's capture fishery. They also have an important role to play in carbon sequestration.

Critically important spawning aggregation sites have been identified on the reef wall surrounding the Atoll. These are essential for the national and regional viability of commercially important snapper and grouper (including the endangered Nassau grouper), and for permit, a species critical for the success of the Atoll as a sport fishing destination.

Extensive terrestrial and mangrove vegetation and the close connectivity of mangrove habitat to the productive coral reefs and seagrass beds, provides the critical ecosystem connectivity necessary for many of the reef species on which the tourism and fishing industries depend. This, combined with Turneffe's location, beyond the sedimentation plumes emanating from mainland Belize, makes the Atoll unique, with a high potential for fish stock recovery, and for resilience to climate change.

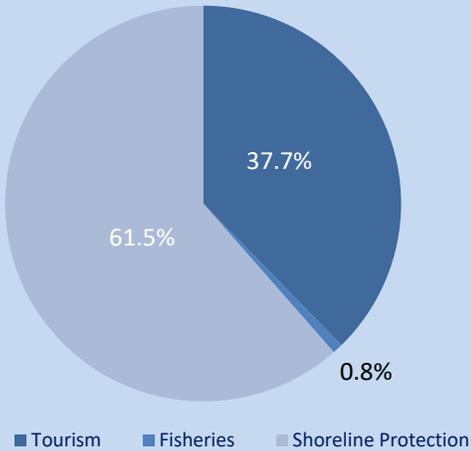
The location of the Atoll and the integrity of its reef crest, cayes and mangroves provide protection from storm events along the coast of Belize (including Belize City). The presence and location of the Atoll also breaks the force of wave action, providing a sheltering buffer to the barrier reef from St. George's Caye down to Emily Caye (Caye Glory), resulting in the relatively intact nature of the reef crest in this stretch of the barrier reef.

The expansive back reef flats provide habitat for species such as permit and bonefish, whilst tarpon are found in the deeper channels, supporting a flourishing, world-renowned and lucrative sport fishing industry.



Turneffe Atoll Marine Reserve

Socio-Economic Values... Turneffe Atoll provides important natural resources sustaining livelihoods through fishing and tourism, and protection during storms.



Relative contribution of economic benefits of Turneffe Atoll (Fedler, 2011)

Traditional Fishery: The traditional fishery of Turneffe Atoll is based predominantly on lobster and conch, and has a current estimated value of US\$518,400, contributing 5% of product towards total national cooperative sales, with additional markets outside the cooperatives.



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This is perhaps the sector with the largest social dependence, supporting an estimated 180 to 200 fishermen, their families and to some extent, their communities, with few viable alternative options available if the Turneffe fishery continues to decline, including trap fishers with temporary and permanent camps around the atoll and sailboat fishers from the northern communities of Copper Bank, Chunox and Sarteneja.

Protection: The presence of coral reefs and extensive mangrove forests at Turneffe provide a physical barrier that breaks the force of tropical storms, providing an annual economic contribution estimated at US\$38.3 million, based on the damages avoided. The structure of the Atoll provides significant potential for protection of Belize City, the primary population centre in Belize.



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Tourism: Sport Fishing:

Turneffe is recognized as a world class sport fishing destination, with sport fishing for bonefish, permit and tarpon becoming of increasing importance over the years in its contribution towards the tourism sector GDP. Virtually all bonefish, permit and tarpon caught by sport fishermen in Belize are released back to the water alive making this annual economic contribution fully sustainable. Legislation was passed in 2009 restricting use of these species to the sport fishing industry.

Tourism: Diving / Snorkelling: Turneffe is considered one of Belize's primary marine attractions, with the potential to see turtle, sharks, rays and a multitude of colourful corals and fish in a pristine setting. The shallow, clear waters provide sheltered snorkelling opportunities. The deeper reefs and steep drop off of the Atoll walls attract a multitude of divers seeking everything from large pelagics to decorative crabs. Turneffe draws an estimated 4,000 divers and snorkelers to the area annually, with a value estimated at US\$23.5 million.



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Turneffe Atoll Marine Reserve

Management Action Planning: a collaborative and structured approach to conservation management, providing a forum for effective stakeholder participation and using the principles of adaptive management to develop and implement successful conservation strategies.

The management plan has incorporated Conservation Action Planning (CAP), through a series of five workshops and additional focal meetings that occurred between July and December, 2011. Over 60 fishermen and tour guides, protected area managers, researchers and Government officers have contributed towards the process, providing important information for integration into the Plan. Outputs from this process provide recommendations for improving management effectiveness of Turneffe Atoll Marine Reserve.

The management plan is based on the outputs from the workshops, on stakeholder focal group meeting, interviews, discussions and comments, as well as past and ongoing research data from organizations active on the Atoll, and provides structured programs, strategies and actions that will lead towards fulfilling the stakeholder vision of an effective marine reserve, providing benefits for all stakeholders.



The Conservation Action Planning Cycle

These contribute towards the adaptive management process ensuring that Turneffe Atoll fulfills its future role within Belize's National Protected Areas System.



Wildtracks



Participation from a broad range of stakeholders – including Government sector, researchers, fishermen and tour guides - has been a key component of the management planning process

Management Action Planning

Turneffe Atoll Marine Reserve

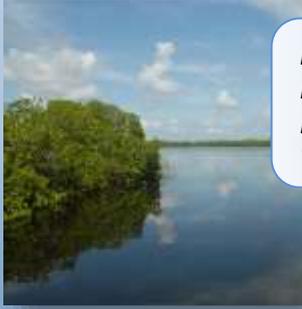
Coral Reef Ecosystem



Coral Reef Ecosystem: The reef-building coral species and the myriad of inter-dependent reef organisms that support both the tourism and fishery industries

Nine **Focal Targets** were chosen to represent and encompass the biodiversity values of the Turneffe Atoll, providing a basis for setting goals, developing strategies, and monitoring success. Each of these targets has a series of associated **nested targets** – species or species assemblages considered of particular conservation importance that are represented by the target.

Lagoon System



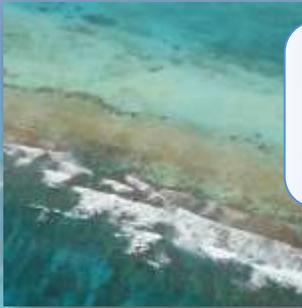
Lagoon Ecosystem: A complex mosaic of lagoons and mangrove-lined creeks that form the centre of Turneffe.

Commercial Species: Lobster, conch and finfish (particularly snapper and grouper species) that support the traditional fishing industry of Belize, as well as new species such as sea



Commercial Species

Back Reef Flats



Back Reef Flats: Important habitat for the maintenance of sport fishing species, and as a nursery for conch.

Spawning Aggregation Sites: Critical congregations of spawning finfish including snapper, grouper and other species.



Spawning Aggregation Sites

Seagrass



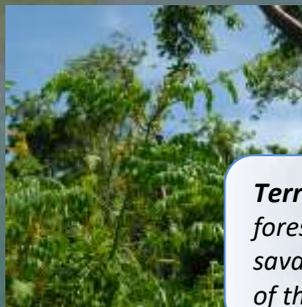
Seagrass: Key ecosystem linking coral reef and mangrove, important for its primary productivity nursery functionality and role in carbon sequestration

Sport Fishing Species: Primarily permit, tarpon and bonefish – species that make Turneffe a World class sport fishing destination.



Sport Fishing Species

Terrestrial Ecosystems



Terrestrial Ecosystems: Littoral forests, coastal strand vegetation, savanna, mud flats and sandy beaches of the Turneffe cayes

Deep Sea Ecosystems: Turneffe encompasses marine ecosystems with depths of greater than 200m, under-represented within the national protected areas system.



Deep Sea Ecosystems

Management Targets

Target Viability

It is important to develop a good understanding of the current viability, or ‘health’ of the targets being conserved, and the viability goal to be achieved through management strategies. Based on an assessment of the size, condition and landscape context of each target, the overall viability rating for Turneffe Atoll is considered to be **GOOD** - one of the reasons for the area’s high conservation importance. One target, seagrass, rates as **VERY GOOD**, whilst two rate as **FAIR – Coral Reef** and **Commercial Species**. The remaining targets are assessed as **GOOD**.

Conservation Targets	Landscape Context	Condition	Size	Viability Rank
Coral Reefs	Very Good	Poor	Good	Fair
Lagoon System	Very Good	Fair	Very Good	Good
Terrestrial Ecosystems	-	Fair	Fair	Fair
Seagrass	Very Good	Very Good	Very Good	Very Good
Spawning Aggregations	Very Good	Fair	-	Good
Commercial Species	Good	Fair	Fair	Fair
Back Reef Flats	Very Good	Fair	Good	Good
Sport Fishing Species	-	Good	Good	Good
Overall Biodiversity Health Rating				Good

Critical Threats for Turneffe Atoll

Very High

- Climate Change
- Unsustainable Development
- Dredging / removal of habitats
- Fishing Pressure / Unsustainable Fishing Practices

High

- Illegal Fishing

Medium

- Invasive Species - Lionfish

Low

- Extraction of Non-Timber Forest Products
- Anthropogenic Fires
- Boat Impacts
- Improper Sport Fishing Practices
- Tourism / Recreation Impacts

Overall threat status: Very High

Threats

Turneffe Atoll has long been described as one of the jewels of Belize, with its marine ecosystems facing with fewer threats than many other areas in Belize. With its distance from the Belize mainland, the Atoll lies outside the majority of coastal impacts – the sediment loads delivered by rivers, laden with agrochemicals and exacerbated by the clearance of the riparian vegetation.

However, despite this, reef health is declining, with a trend of increasing coral bleaching episodes and mortality related to increasing water temperatures, reducing the resilience of the reef. Whilst these global impacts are difficult to address, the reef becomes more susceptible when affected by more local, anthropogenic impacts, which can be mitigated. Unsustainable development, with the associated destruction of mangroves and coastal vegetation, leading to increased erosion and sedimentation impacts on the reef; the impacts from increasing tourism pressure; and the removal of key predators and herbivores through unsustainable fishing practices...all these reduce the resilience of the reef to the biggest threat – climate change.



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Unsustainable Development

Target and Threat Assessment

Turneffe Atoll Marine Reserve

Threats were assessed using the TNC Conservation Action Planning methodology, with participation from a broad range of stakeholders, including the fishing and tourism sectors, property owners, researchers, Fisheries and Forest Departments, and the Department of Geology and Petroleum.

The stresses and sources of stress were identified and assessed through analyzing the stresses in terms of scope and severity, and the sources of stress through assessment of contribution and irreversibility. This provided prioritization of management actions and resources towards the most critical threats.

The overall threat rating for Turneffe Atoll is assessed as **Very High**, with the highest threats identified as:

- **Unsustainable Development**
- **Dredging / Removal of Habitats**
- **Fishing Pressure / Unsustainable Fishing Practices,**

Three focal targets have threat ratings of **Very High**, reflecting the particularly heavy pressure on the natural resources from unsustainable development and fishing:

- **Coral Reefs**
- **Commercial Species**
- **Sport Fishing Species**

Threats Across Targets	Coral Reefs	Lagoon System	Terrestrial Ecosystems	Seagrass	Spawning Aggregations	Commercial Species	Back Reef Flats	Sport Fishing Species	Overall Threat Rank
Climate Change	Very High	Low	Very High	Low	High	Very High	Medium	Very High	Very High
Unsustainable Development	Medium	Low	Very High		Medium	High	Medium	Very High	Very High
Dredging / removal of habitats	Very High	Low		Low			High	Very High	Very High
Fishing Pressure / Unsustainable Fishing Practices	Very High	Low			High	Very High	High	High	Very High
Illegal Fishing					Medium	Very High			High
Invasive species - Lionfish	High	Low							Medium
Anthropogenic fires			Medium						Low
Extraction of NTFP			Medium						Low
Boat impacts							Low	Low	Low
Improper Sport Fishing Practices							Low	Low	Low
Tourism / recreation impacts	Low			Low					Low
Threat Status for Targets and Project	Very High	Low	Very High	Low	High	Very High	High	Very High	Very High

Target and Threat Assessment

Turneffe Atoll Marine Reserve

Climate Change

Belize is highlighted globally as an area highly vulnerable to climate change impacts, with it becoming increasingly important to understand and integrate climate change adaptation into protected area management. Turneffe Atoll has been identified as a site with high potential resilience to climate change, and its protection as a critical tool in Belize's climate change adaptation strategies for the marine environment.

Managing for Climate Change is a necessity of marine conservation in the current environment of predicted increasing sea surface temperatures, ocean acidification and tropical storm strength. There is also a need to determine resilience to climate change, and implement adaptive strategies that can assist in maintaining the viability of the Atoll and its terrestrial and marine life.

Sea surface temperature rise

Predicted regional increase of water temperature by up to 5°C by 2080 causing:

- Increased coral bleaching and eventual loss of ecosystem functionality.
- Increased coral disease.
- Possible impacts from new invasive species and algal blooms.
- A shift towards more tolerant species and symbiont types, and more opportunistic species, with reduced diversity.
- May alter localized current patterns and therefore larval dispersion. an increase in coral bleaching.



Increased storm intensity

Predicted regional increase in storm intensity, with:

- Increased mechanical damage to corals, increased sedimentation.
- Flushing of sediments and agrochemicals from watersheds in heavy rain events
- Removal of macro algae, resulting in more available substrate for recruitment.
- Mixing of the water column, bringing cooler water to the Atoll
- Fragmentation of coral, assisting with dispersal and colonization.



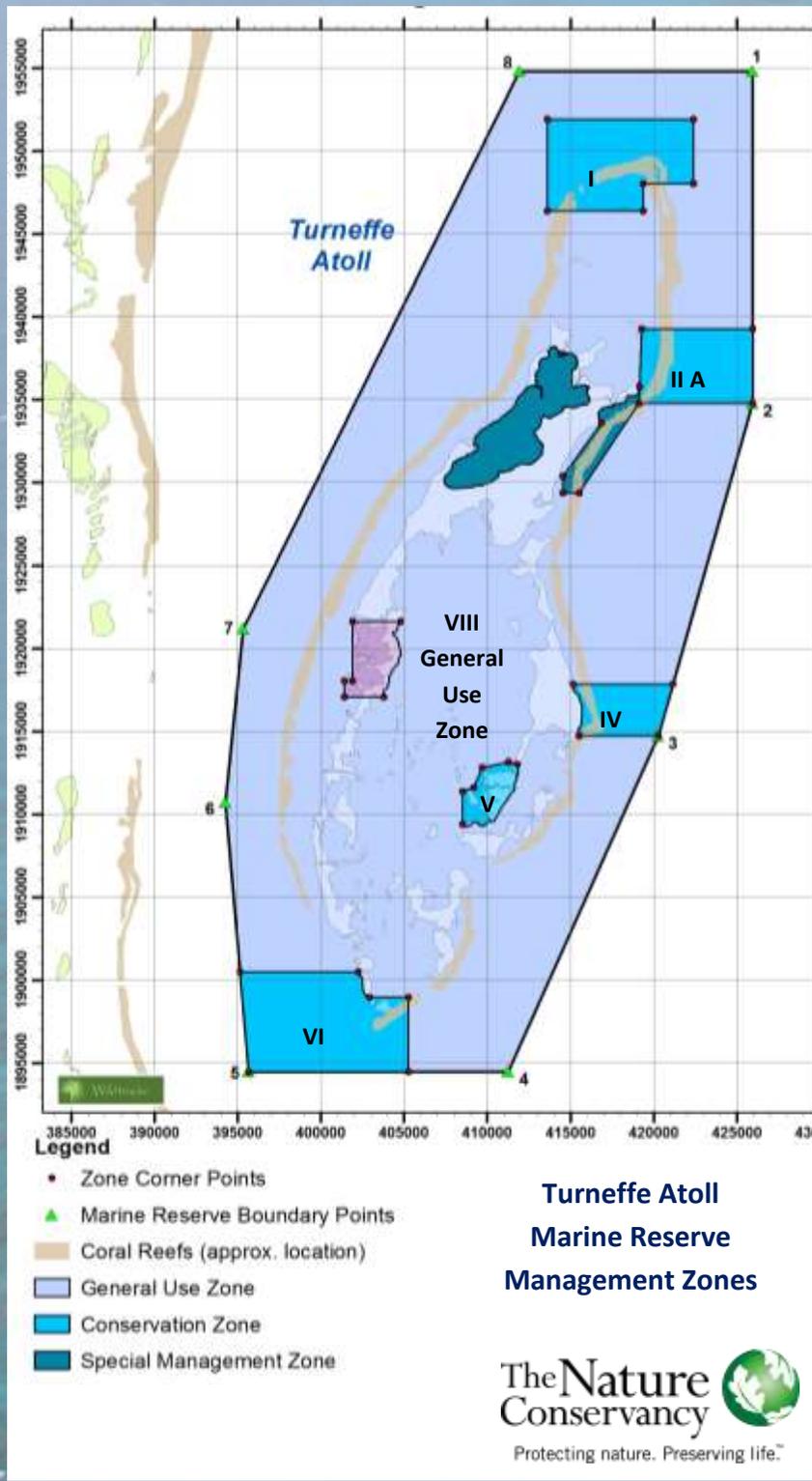
Climate change will have an impact on not only the biodiversity of Turneffe Atoll, but also on the tourism and fishing livelihoods, and the environmental services provided by the Atoll.

Understanding the climate changes predicted for Belize, and more specifically for Turneffe Atoll and those stakeholder communities reliant on the Atolls resources, is fundamental to being able to adapt. It is also important to start the process with an understanding of the implications of these changes in the seascape context, and how these will impact the natural resources, both at national and site level.

A series of critical targets were identified based on their risk from climate change, to assist in the development of climate change mitigation strategies:

- **Priority Conservation Targets**
 - Coral Reefs
 - Caye Ecosystems
 - Commercial Species
 - Sport fishing Species
- **Key Vulnerable Communities**
 - Northern Fishing Communities
- **Key Socio-Economic Activities**
 - Tourism
 - Fishing

Turneffe Atoll Marine Reserve



General Use Zone (Zone VIII)



Special Management Areas

Zone II B: Cockroach – Grassy Caye



Zone III: Vincent's Lagoon



Conservation Zone



Zone II A: Dog Flea

Zone IV: Blackbird Caye

Zone V: Long Bogue

Zone VI: Caye Bokel

Preservation Zone



Zone VII: Preservation Zone

Fishing is permitted (fin fish)

Fishing is permitted (conch / lobster)

Sport fishing is permitted

Snorkeling and diving is permitted

Activity is not permitted

Activity is permitted with special license

Turneffe Atoll Marine Reserve

Management Objectives for Turneffe Atoll Marine Reserve

Objective One: Maintain and improve healthy, resilient, biodiverse reefs of Turneffe Atoll Marine Reserve at or above the 2010 IRHI status of FAIR up to and beyond 2022.

Objective Two: By 2017, Turneffe Atoll will be a model for ecologically sustainable tourism, with 100% of tourism industry and research stakeholders certified as Best Practices users of the Atoll.

Objective Three: By the end of 2012, a multi-agency patrol has been established, with effective patrolling covering the entire Turneffe Atoll Marine Reserve area

Objective Four: By 2016, reverse the decline in commercial production demonstrated at Turneffe Atoll over the last five years by 50%

Objective Five: By the end of 2013, a Fisheries Management Plan is adopted and implemented for the Turneffe Atoll Marine Reserve through active participation of fisheries resource users

Objective Six: By 2017, the population of invasive lionfish at Turneffe Atoll has been reduced by 50% from the 2010 baseline.

Objective Seven: By 2013, adopt and implement the TACAC Management guidelines and Best Practices for development within Turneffe Atoll

Objective Eight: By the end of 2014 establish and implement sustainable financial mechanisms to finance operations and management of Turneffe Atoll Marine Reserve

Priority Cross Cutting Climate Change Adaptation Strategies for Turneffe Atoll Marine Reserve

General Management

- Establish a stakeholder management team to spearhead implementation of action steps
- Implement the climate change adaptation strategies in the management plan

Marine Resource Management

- Establish monitoring baselines for monitoring success of climate change adaptation
- Regulate equipment to reduce by-catch and total fishing pressure
- Implement seasonal closures and other elements of fisheries management

Policy and Planning

- Review and conduct gap analysis of relevant policies (fishery / tourism / development related), develop recommendations and lobby for revision
- Develop and implement a financing plan, targeted at accessing climate change adaptation funds, blue carbon etc. for financing management s at Turneffe
- Provide support for revision and adoption of Coastal Zone Management Plan, and advocate for implementation
- Support and participate in national efforts to ensure exclusion of oil exploration from the marine environment

Education and Outreach

- Develop and implement education program raising awareness and knowledge of climate change impacts of all stakeholders of Turneffe Atoll

Community Adaptation

- Conduct needs assessment to establish baseline scenario per community
- Develop and implement adaptation plan for livelihood diversification and alternatives