Molinière-Beauséjour Marine Protected Area
Grenada

Management Plan

Grenada Ministry of Agriculture, Forestry & Fisheries

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Acknowledgments

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Acronyms

BOD	Biochemical oxygen demand
BHC	Benzene Hexachloride
CBD	Convention on Biological Diversity
CC	Climate Change
CEHI	Caribbean Environmental Health Institute
CERMES	Centre for Resource Management and Environmental Studies
COD	Chemical oxygen demand
COTS	Caribbean Open Trade Support
CPUE	Catch per unit of effort
CRM	Coastal Resource Use Map (Grenada) project
DDT	Dichlorodiphenyltrichloroethane
ECS	Eastern Caribbean States
ECSPP	Eastern Caribbean States Partnership Program
EIA	Environmental impact assessment
EPA	Environmental Protection Agency (US)
GoG	Government of Grenada
ICZM	Integrated Coastal Zone Management
IUCN	International Union for Conservation of Nature
LAMA	Local Areas Management Authorities
MB MPA	Molinière-Beauséjour Marine Protected Area
MoU	Memorandum of Understanding
MPA	Marine Protected Area
NWDA	North West Development Authority
NFWF	National Fish and Wildlife Foundation
NGO	Non-Governmental Organization
OAS	Organization of American States
OECS	Organization of Eastern Caribbean States
PCB	Polychlorinated Biphenyls
SGU	St. George's University
SocMon	Global Socioeconomic Monitoring Initiative for Coastal Management
SRO	Statutory Rules and Orders
TKN	Total Kjeldahl nitrogen
TNC	The Nature Conservancy
TSS	Total suspended solids
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WINDREF	Windward Islands Research and Education Foundation

Units

HP	horse power
km	kilometre
mph	mile per hour
ppm	parts per million
µM	micromole
µg	microgram

PART A
DESCRIPTION AND BACKGROUND OF THE MOLINIÈRE-BEAUSÉJOUR MPA

1. Summary

The Molinière-Beauséjour MPA was gazetted in 2001 by the Fisheries (Marine Protected Areas) Order which presented boundaries and a zoning scheme. Although regulations applicable to MPAs were detailed in the Fisheries (Marine Protected Areas) Regulations, no formal management plan had yet been drawn up, thus preventing the implementation of specific measures and hindering enforcement of regulations for the protection of the area and the sustainable use of its resources.

Recent surveys around the world, in Grenada and in the Molinière-Beauséjour MPA point to a continuous degradation of reef resources and stress the urgency to take action to preserve these vital ecosystems which tremendous value and critical importance have been largely demonstrated.

Effective management for the conservation and the sustainable use of the coral reefs and associated resources requires the guidance of a strategic document to describe the current status of resources within the MPA – *Where we are* – which identifies issues and sets goals – *Where we want to go* – and identifies options to meet them – *How to get there*. This management plan will be implemented following an adaptive approach and, hence, is not applicable for a specific period. Rather, it is meant to be monitored and revised on a continuous basis as new information will become available or according to changes in the resources status.

The approach for the preparation of the management plan was to build on existing knowledge and identify knowledge gaps that hinder the conception of management decisions to guide future monitoring and research. Much of the baseline information and management options were identified as outputs of the MPA Realization in Grenada project implemented in 2005-2006. Management options were identified with the support of the MPA stakeholders committee.

In Grenada, the legislative basis for the designation and management of marine protected areas is the Fisheries Act No. 15, 1986 and the Fisheries (Marine Protected Areas) Regulations of 2001. MPA management plan development and implementation comes under the Fisheries Division of the Ministry of Agriculture, Forestry and Fisheries.

2. Introduction

As is the case with other islands of the Lesser Antilles[1], Grenada's marine and coastal environment and associated species are under constant threat from stressors such as rapid development, particularly of the tourism sector, land-based pollution, sediment runoff from cleared land, overfishing, and in particular, climate change related coral bleaching and disease.

The Fourth National Report of Grenada to the CBD mentions that the trend for coastal ecosystem condition is toward degradation and that much of the coral reefs have been degraded from pristine to seriously stressed due to overuse, pollution and sedimentation. This report identifies the main threats to marine and coastal ecosystems: Unsustainable fisheries practices and overexploitation of commercial species; Habitat destruction and food web alteration; Poaching and illegal extraction;

[1] Wilkinson 2008

Beach sand mining; Pollution through dumping of solid and liquid wastes; Oil spills; Overuse of ecosystem for agriculture, energy , tourism and construction; Unsustainable farming practices. The main drivers to Grenada's marine ecosystem degradation are economic interests (tourism development, unsustainable agriculture and fishing practices) and factors such as concentration of population, housing and infrastructure expansion, industrial and commercial waste disposal and high frequency of disasters.

In 2004, Hurricane Ivan caused unprecedented damage to the country tearing down 95% of buildings, decimating the nutmeg plantations which are the island's main source of employment and income for hundreds of farmers, and ravaging large tracts of Grenada's pristine rainforest and coral reef. In 2005, while the country was still recovering from the impact of Ivan, Hurricane Emily caused additional damage particularly in the north of the island. Since then, the government has kept looking increasingly to tourism development while struggling to balance conservation with economic development in its efforts to recover the island's economy. Tourism is the main growth sector since the 1980s, and plays an important role in the overall economic diversification strategy.

Further degradation of the countries' coastal and marine resources would greatly affect their capacity to support local livelihoods as well as their potential for future social and economic development by disrupting such ecosystem services that are currently provided by the marine coastal resources, notably in the Molinière-Beauséjour MPA:

- Food safety and security
- Protection of critical habitats for the maintenance of the fish populations that sustain fisheries
- Access to safe, clean and sanitary public recreation areas
- Opportunities for livelihood diversification through increased tourism
- Natural scenic beauty
- Shoreline protection.

The level of intensity of hurricanes in the Caribbean has been shown to increase since 1970. As this trend is expected to increase even further, human-induced warming may have devastating consequences on the Caribbean coral reefs[1]. Ocean acidification caused by the uptake of CO_2 from the atmosphere will result in slower growth of corals. It is concluded that "*The only possible way to sustain some live coral on the reefs around the world will be to carefully manage the direct pressures like pollution, fishing and damaging coastal developments, and hope that some coral species are able to adapt to the warmer environment*."

The Molinière-Beauséjour MPA was gazetted in 2001 by the Fisheries (Marine Protected Areas) Order which presented boundaries and a zoning scheme. Although regulations applicable to MPAs were detailed in the Fisheries (Marine Protected Areas) Regulations, no formal management plan had yet been drawn up, thus preventing the implementation of specific measures and hindering enforcement of regulations for the protection of the area and the sustainable use of its resources.

[1] Status of Caribbean Coral Reefs after Bleaching and Hurricanes in 2005.

To move from the stage of being merely a protected area on paper to being an effective tool to maintain biodiversity and ecosystem services to the benefit of local people and national interests, the MPA must be managed following the guidance of a comprehensive, strategic and operational management plan.

The management plan is structured in two sections. Part 1 looks at the background of the MPA, provides a description of the MPA and its resources, and an overview of the environmental conditions, and presents the main uses and users of the area and resources and the surrounding communities. Part II presents management issues and actions.

The management plan was elaborated on the basis of available information from publications and unpublished reports, mainly of the *MPA Realization in Grenada* project which had been implemented in 2005 and 2006 with the support of NFWF. A first zoning scheme had been developed for the gazetting of the protected area and a second zoning, made simpler and more applicable, was proposed as an outcome of the *MPA Realization in Grenada* project. Management decisions have been taken through meetings with members of the MPA stakeholders committee. Additional data were collected with USAID-COTS support when essential information was not available. The remaining knowledge gaps are identified in the different sections of the plan in order to focus research and monitoring efforts on collecting information needed for managing the Molinière-Beauséjour MPA following an adaptive approach and as part of a network.

3. History of the protected area, gazettement and boundaries

3.1. Purpose and history of the creation of the Molinière-Beauséjour marine protected area

Knowledge of the history of the protected area and early planning efforts is critically important as it provides insight into the current situation.

Facing increasing pressures on the country's natural resource base while the demand for recreational opportunities and education programs for Grenada's population was growing, the Government of Grenada had placed the establishment of a national park and protected areas program as a priority in the development plan for 1986. With technical assistance from the Organization of American States (OAS), a plan and policy document was elaborated to guide the establishment and management of a system of national parks and protected areas aiming at protecting and developing the natural resources of Grenada and Carriacou[1].

The Molinière Reef was identified as a priority for the establishment of a “protected seascape” as the site was considered to hold the finest reefs in Grenada. Based on inventories, the site was given priority for the protection of representative samples of Grenada ecosystems, namely large areas of coral reef, littoral woodland, and cactus scrub, and medium to small area of seagrass bed. The

[1] Government of Grenada and OAS. 1988. Plan and Policy for a System of National Parks and Protected Areas.

Government of Grenada/OAS 1988 document describes the Molinière Reef as consisting of a series of coral reefs and sea fans beds. The description further referred to "*a wide diversity of life forms on this outstanding reef, considered to be the best reef off the island of Grenada*". "*The area has been protected from exploitation by man by the local divers. As a result, lobsters are prevalent as are both soft and hard corals. A wreck with a steel hull is seen at 80 feet below sea level which harbours beautiful reef fishes and is beginning to be colonized by various species of coral."*

The following management objectives were then recommended: To protect and maintain the Molinière Bay ecosystem and its outstanding natural features and to provide opportunities for recreation, interpretation, research, environmental education and protection of over-exploited fish, lobster, and coral.

Well-known for the pristine condition of the coral reefs, the area was attracting many visitors and divers, notably due to the proximity of the site to the capital city and main tourist areas. At the same time, the reefs and near shore resources were threatened by heavy use for fishing aggravated by the accessibility of the resources. The open access to these different uses led to significant user conflicts, in particular among fishermen (seine vs towing nets) and between fishermen and charter boats. Following the recommendations of the GoG/OAS document, the groundwork for the creation of a marine protected area in Molinière-Beauséjour coastal area was initiated in the early '90s by the Fisheries Division with the support of the French cooperation. A vast consultation process with local communities led to the recommendation to extend the area northward to include Beauséjour Bay where most fishing activities were taking place, with the intention to address user conflicts.

The main purpose for the establishment of the marine protected area in the Molinière-Beauséjour coastal area was thus to provide a management framework to reduce user conflicts as well as protect coral reefs and associated resources.

The protected area was created in 2001 and a management committee was set up but soon ceased its operations.

The MPA Realization in Grenada project was implemented from October 2005 to September 2006. This one-year project was funded by the US NFWF as part of a joint initiative between the WINDREF and the Grenada MPA Programme. The project objective was to support the development of coral reef conservation in Grenada through a revision and strengthening of MPAs with a special emphasis on Molinière-Beauséjour MPA. The project included capacity building activities, partnership development, surveys on resources, and workshops on uses, threats and alleviation of threats.

Subsequent to this, the Grenada Board of Tourism funded the installation of a few mooring buoys at various sites in the Molinière-Beauséjour MPA to prevent boats from anchoring on the reef. The Grenada Board of Tourism also provided a patrol boat to enable monitoring and enforcement. A MPA coordinator was appointed in 2009 and a stakeholder committee was gathered to advise and assist him with the management of the MPA and contribute to the elaboration of the present

management plan. This committee was instated by the Cabinet to act as the national-level MPA Management Committee.

3.2. Designation of the MPA

On the 28th December 2001, the Fisheries (Marine Protected Areas) Order, 2001 (SRO No 77 of 2001) declared fishery waters delineated in the attached map (schedule 2) and the foreshore adjacent thereto as the Molinière-Beauséjour Marine Protected Area and Multi-zone Management system (Annex 1). The schedule 2 provided a zoning scheme indicating fishing, mooring and diving areas and the coordinates for the boundaries of the MPA. It was further specified that the Fisheries (Marine Protected Areas) Regulations (SRO No 78 of 2001) applied to this area.

3.3. Boundaries, zoning and boundary plans

The zoning of the MPA presented in the Fisheries (Marine Protected Areas) Regulations (SRO No 77 of 2001) was deemed impractical because the communication and enforcement of a complex scheme involving numerous zones is not realistically achievable. It was also found that the boundary coordinates were inaccurate and had to be revised.

A more simple and practical zoning plan was put forward in 2006 (Figure 8) as an output of the MPA Realization in Grenada project to replace the zoning in SRO No. 77, 2001. This new zoning was elaborated on the basis of additional surveys and information collected from regular users and in consultation with them. The coordinates of the seaward boundaries were revised in 2010 and are illustrated in Figure 1. The revised coordinates are, from North to South:

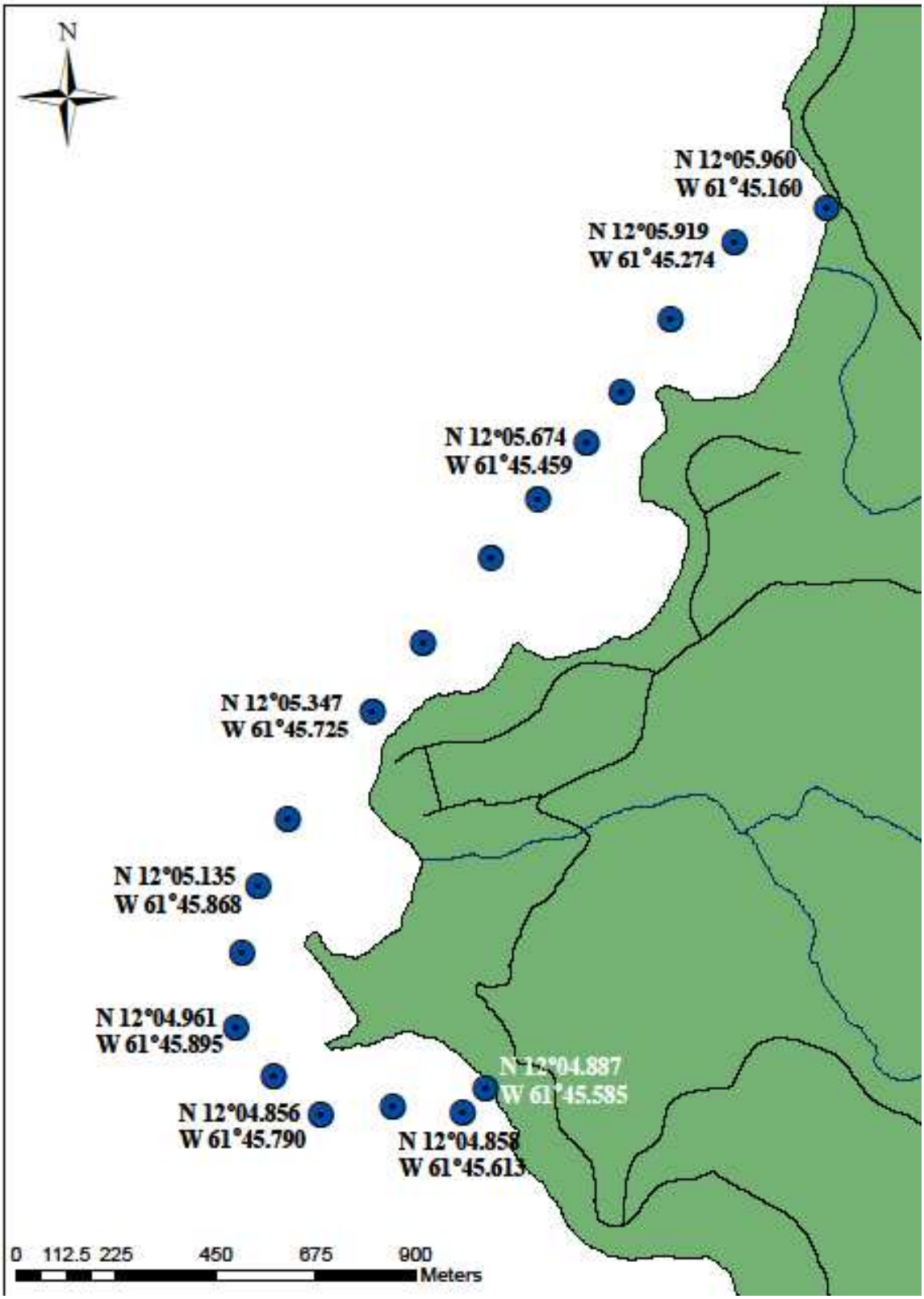
N 12.05.960, W 61.45.160
N 12.05.919, W 61.45.274
N 12.05.674, W 61.45.459
N 12.05.347, W 61.45.725
N 12.05.135, W 61.45.868
N 12.04.961, W 61.45.895
N 12.04.856, W 61.45.790
N 12.04.858, W 61.45.613
N 12.04.887, W 61.45.585

The seaward boundary is defined by the outer edge of the continental shelf and the seaway for North – South maritime traffic and for the ferry to Carriacou Island. The landward boundary is determined by the high watermark. A portion of the beaches is included up to the landward boundary (high water mark).

All beaches in Grenada are public up to a few feet above the high watermark. Rocky shorelines are also government property up to the high watermark. Beyond this border, all land is private.

The small mangrove in Beauséjour is not included in the MPA. The recommendation to extend boundaries landward to include any adjoining wetland to control activities that may adversely affect the protected area does not apply as the mangrove is not permanently connected to the coastal area, and does not form a single ecological entity with the marine coastal area.

Figure 1. Delineation of the Molinière-Beauséjour MPA and coordinates of the boundaries



4. Physical characteristics

4.1. Climate and climate change

Grenada's is characterized by humid tropical climate: warm and humid in the rainy season and cooled by northeast trade winds in the dry season. Temperatures are relatively constant throughout the year averaging 26°C, dropping by only a few degrees or so in the cooler months of December to February. The mean maximum temperature is 31.4 °C while the mean minimum is 24.0°C.

Total mean annual rainfall varies from about 13 feet (4000 mm) in high mountains to less than 4 feet (1000 mm) in the southwest and northeast ends of the country (see Figure 2). The MPA is one of the most showered coastal areas. The driest months are typically from January to May with a monthly mean rainfall ranging between 100 and 150 mm, and the wettest months are from June to December with a monthly mean rainfall between 300 and 350 mm. Average monthly rainfall based on 1992 to 2004 records taken at the Beauséjour rainfall station are shown in the Table 1.[1]

Table 1. Average monthly rainfall in Beauséjour based on 1992 to 2004 records.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1992-2004 average (mm)	210.6	138.0	112.5	137.2	136.4	318.4	305.5	344.1	283.6	332.4	345.1	233.1

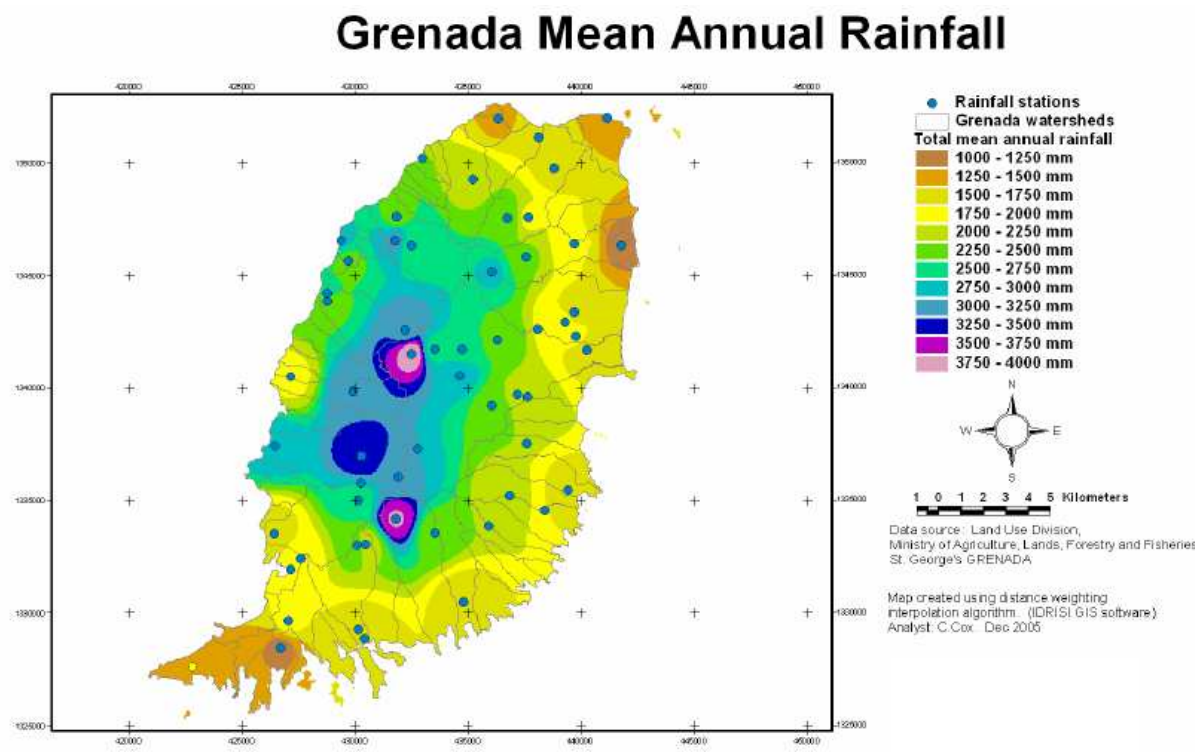


Figure 2. Grenada mean annual rainfall (from CEHI/UNEP. 2006)

[1] GoG. 2000. Grenada's Initial Communication to the UNFCCC

Recent climate trends show that mean annual temperature in Grenada has increased by around 0.6°C since 1960, at an average rate of 0.14°C per decade. Mean rainfall change over Grenada is not statistically significant.[1]

According to Global Circulation Models projections of future climate, the mean annual temperature is projected to increase by 0.7 to 2.6°C by the 2060s, and 1.1 to 4.3°C by the 2090s. Projections of mean annual rainfall from different models in the ensemble are broadly consistent in predicting decreases in rainfall for Grenada.[4] Most models predict a decrease in annual precipitation in the region of 5 to 15 % with the greatest change during the months of June to August.[2]

The Caribbean is most vulnerable to the anticipated effects of global climate change on sea level, sea surface temperature, and precipitation as well as wind and ocean currents. The environmental impacts resulting from these changes will affect many economic sectors including tourism, agriculture, fisheries and water resources. Based on research carried out by the Caribbean Planning for Adaptation to Global Climate Change Program, the massive fish kills of 1999 in Guyana, Grenada, St. Lucia, St. Vincent and the Grenadines, Barbados and Trinidad and Tobago, were due to changes in the salinity and ocean acidification of the Caribbean sea brought on by above average rainfall attributed to climate change.[3]

Grenada lies in the path of the North East Trade Winds and although located south of the hurricane belt, the country is vulnerable to tropical storms, occasional hurricanes and storm surges. The hurricane season runs from June to November. Grenada was hit by major hurricanes in the last fifty-five years. Hurricane Janet passed over Grenada in 1995 with winds of 115 mph, causing severe damage. The most recent storms to hit have been Hurricane Ivan in 2004 causing severe damage and thirty-nine deaths and Hurricane Emily in 2005 causing serious damage in Carriacou and in the north of Grenada. Hurricane Ivan was the 10th most intense Atlantic hurricane ever recorded. An analysis of the status of Caribbean coral reefs[4] after bleaching and hurricanes highlighted the devastating consequences of the human-induced warming as shown by an increase of the proportion of *intense* hurricanes since 1970, while the total number of hurricanes has not changed much. This trend is expected to increase even further.

4.2. Oceanography

4.2.1. Salinity

Salinity recorded in May and June 2006 from surface samples collected in the MPA varied from 32 to 36 ‰.

[1] UNDP CC Country Profile for Grenada, 2008.
[2] Trotman et al. 2008
[3] www.islandsfirst.org/islands/caribbean.html
[4] Wilkinson C. and D. Souter. 2008

4.2.2. Depths

Depths recorded in the MPA range from 15 feet (4.5 m) in the southern part of the reef to 85 feet (26 m) at the outer edge of the reef in Flamingo Bay (see Figure 4). Depths in Beauséjour Bay are not recorded. The coastal areas on the west are steeper than that on the east coast, resulting in a narrower continental shelf and deep water found close to the shore in comparison to the south and east coasts which possess an extensive shelf.

4.2.3. Tide and currents

Maximum tidal range in Grenada is 1.7 feet (0.52 m).[1]

The southwest coast is bounded by the Caribbean Sea and the prevailing currents are variable northwest and southeast.[2] No consistent information was found on the coastal currents.

Increasing the knowledge on coastal currents dynamics should be addressed in future research activities. An understanding of the current dynamics in the coastal area would enable the testing of hypothesis related to coral recruitment and would support the assessment of the pollution threats related to the proximity of the Perseverance dump north of the MPA, operations at the oil tank farm in Grand Mal and discharge of the two rivers into the waters of the Molinière-Beauséjour MPA.

4.2.4. Sea level rise

One of the main expected negative impacts of climate change is sea level rise and its consequences on resources such as coral reefs and seagrass beds and coastline vulnerability to erosion. In its 2007 report, the International Panel on Climate Change projected a global sea level rise of 18 to 59 cm (0.59 to 1.93 feet) from 1990 to the 2090s. Recent studies published in 2009 and 2010 based on semi-empirical approaches yield a central estimate of 114 cm[3] (3.74 feet).

A tide gauge has been installed on the west coast south of St. George in 1986 by the National Council for Science and Technology through a Coastal Monitoring Programme funded by the OAS and the Government to monitor sea level. It has not been possible yet to obtain information on the results of this monitoring.

Climate change models for Grenada do not predict significant coastal erosion from sea level rise and extreme climatic events for the shoreline of the Molinière-Beauséjour MPA. The monitoring of beach erosion in Grand Anse has shown an annual erosion rate of about 11% during 1984 to 1986.[4]

4.2.5. Water quality

Water quality is an important issue to consider as pollution is one of the leading causes of coral reef degradation. Coral reefs are adapted to tolerate variations in water quality, however when critical

[1] www.tide-forecast.com/locations/Grenada/tides/latest
[2] Mitchell (2010)
[3] Rahmstorf (2010)
[4] GoG (2000) *Grenada's Initial Communication to the UNFCCC*

thresholds are exceeded they may be adversely impacted. Major water quality variables affecting coral reef health include water salinity, nutrient and suspended sediment concentrations, as well as other toxicants. Oil, gas and pesticide contamination poisons coral and marine life. Reefs are harmed when river systems carry animal waste or fertilizer to reef waters as these pollutants increase the level of nitrogen, causing an overgrowth of algae which smothers reefs and prevent coral settlement.

Water quality is a matter of concern in the case of the Molinière-Beauséjour MPA, because pollution may come from a variety of sources. The MPA vulnerability is due to the proximity of the Perseverance dump site, the discharge of two rivers into the MPA including the Beauséjour River which has a large drainage basin, and the nearby navigation route of oil tankers to Grand Mal oil tank farm.

The Perseverance landfill area is located about 1 km north of the Molinière-Beauséjour MPA and 200 m inland from the coast. The old dump is on the western side of the Salle River and an asphalt plant is located on the other side of the river. All wastes generated in the neighbouring parishes are dumped in this landfill and, besides household waste, include industrial, medical and chemical wastes as well as wastes containing heavy metals such as batteries and electronic wastes.

The main pollutant categories associated with dumps/landfills are heavy metals, bacteria, nutrients, and toxic organic compounds. Heavy metals, bacteria, and toxic organic compounds are of concern because they threaten public health as well as coral reef, seagrass and fish health. Nutrients are of concern because they enhance algal growth which then threatens coral reef health. Since the MPA serves as a nursery to support coastal fisheries and beaches are used for recreation, the public health concern is relevant, as metals and toxic organic compounds concentrate in fish tissue and may also contaminate sediments.

It is therefore important to have a thorough understanding of potential pollution threats that might affect the MPA resources and human health. Water contamination in the MPA has been assessed for a restricted set of parameters in 2006 and a broader screening for a variety of contaminants has been conducted in 2010 to see whether the MPA is subjected to any pressure from potential contamination sources.

Water quality assessment in 2006. Three repeat surface samples (1 m depth) were taken in May and June 2006 to assess water quality from 2 sites within the Molinière-Beauséjour MPA, Beauséjour Bay and Dragon Bay and 2 sites located North and South of the MPA, Halifax Bay, at the bottom of the Perseverance dump, and Grand Mal.

Sampling site	Surface T °C	Dissolved O_2	pH	Salinity ‰	Coliform cells / 100 ml
Halifax Harbour	29.8 – 30.1	3.7 – 4.2	8.14 – 8.16	34 – 36	3 – >1100
Beauséjour Bay	29.9	3.7 – 4.2	8.15 – 8.18	32 – 35	3 – 460
Dragon Bay	29.9 – 30.0	2.8 – 3.9	8.09 – 8.17	35 – 36	3 – 3.6
Grand Mal	29.8 – 29.9	3.4 – 3.9	8.15 – 8.17	35 – 36	3

Table 2. Water quality assessment in Molinière-Beauséjour MPA from samples collected in 2006 (22 May, 12 June, 14 June). Minimum and maximum values are indicated.

Parameters did not vary much between locations and between dates (see Table 2), with the exception of coliform counts. This measurement was null for every site on May 22 and June 12. However, coliform counts on June 14 were above 1100 colonies for Halifax Bay and 460 colonies for Beauséjour Bay. These results are easily explained as Halifax Bay is located at the foot of the Perseverance dumpsite and Beauséjour Bay collects the waters drained throughout the Beauséjour River watershed. The absence of coliforms in the two other water samples is rather unexpected. A potential explanation could be related to low rainfall in the period preceding the sampling but this remains a mere hypothesis in the absence of more detailed information. No information was collected on nitrogen compounds or on potential contaminant concentrations other than coliforms.

Water quality assessment in 2010. Water and sediment samples were collected in May 2010 from two locations from within the MPA, to assess water quality for a wider array of potential contaminants. It is worth mentioning that samples were collected during an unusually dry period which had been lasting for a long time.

A table in Annex 2 summarizes the results of the contaminant analyses. Coastal water quality standards are included in the table to facilitate interpretation. These include *i*) Ambient Water Quality Standards recommended by CEHI in St. Lucia; *ii*) U.S. Virgin Islands Water Quality Standards for maintenance and propagation of desirable species of aquatic life and for primary contact recreation (e.g. swimming); applicable numeric standards for toxic pollutants are EPA'S current national recommended water quality criteria for the protection of saltwater aquatic life (Clean Water Act section 304(a), using values for chronic (long term) toxicity to saltwater aquatic life; and *iii*) Specific values for coral reefs are from scientific literature: Deocadiz and Montaño 1999 for TSS, Global Coral Reef Alliance 2010, Goreau and Thacker 1994, for nutrients.

Heavy metals

Many metals are biologically essential, but all have the potential to be toxic to biota above certain threshold concentrations. Organism growth, reproduction and behaviour are affected by elevated metal concentrations. Cadmium has been known to have extremely toxic effects on fish and zooplankton. Lead is a toxic element that accumulates in fish skeletal structures. Zinc is extremely and acutely toxic to aquatic organisms, particularly fish. Mercury compounds are highly toxic and bioaccumulate, i.e. build up through the trophic chain over time. Following industrialisation, unnatural quantities of metals are being released into the aquatic environment notably through agricultural (fertilizers) and wastewater discharges.

Water and sediment samples were tested in 2010 for lead (Pb), cadmium (Cd), zinc (Zn) and mercury (Hg) in the total form. Lead and cadmium concentrations in the MPA water samples were below the laboratory equipment detection level. Since detection levels for these two metals are above water quality standards adopted by CEHI in St. Lucia and the Virgin Islands, we cannot

conclude that these metals concentrations are safe for coral reefs and contact recreation (bathing). Zinc and mercury levels were below both water quality standards.

Lead and zinc are the only metals that were detected in the MPA sediment samples. In the absence of criteria for sediment contamination in a tropical environment, it is not possible to assess whether these concentrations are likely to be harmful or not. However, the presence of these contaminants may be an indicator of the influence of the contamination coming from the Perseverance dump as these results are consistent with the leachate composition which indicated lead, zinc and copper contamination. The existing landfill leachate was analysed in the context of an environmental impact assessment (EIA)[1]. The presence of lead is likely due to the disposal of used batteries.

The laboratory that conducted the analyses in St. Lucia could not analyse tissue samples. However, future monitoring should endeavour to test for heavy metals in tissue samples. In many cases, metals may be nearly undetectable in water samples, yet animals will bio-concentrate them and that is where they will show up. Many metals concentrate in fine silts and organic sediments (not sand) and the organisms (worms or other benthic organisms) that live in the bottom sediments. Therefore, in addition to water and sediment samples, benthic tissues should be tested as well.

Toxic organic compounds

Organochlorine pesticides are man-made organic chemicals that have been used to control everything from fungus to grasshoppers. Most of them are no longer in use but many are extremely persistent in the environment. Many organochlorine pesticides and PCBs have been linked to hormone disruption and reproductive problems in aquatic invertebrates, fish, birds, and mammals. These effects combined with a slow rate of breakdown make many organochlorines a long-term environmental concern. PCBs have varying degrees of toxicity and bioaccumulate through the food chain. Anthropogenic sources include municipal waste discharge. Chronic exposure to organochlorine products from agricultural run-off has the potential to harm seagrasses and corals.

Water samples were tested in 2010 for DDT, BHC, Endosulfan and PCBs. The concentrations of these compounds were below detection levels in the MPA water samples. As for heavy metals, whenever possible, future monitoring should include tissue samples.

Bacteria

Fecal coliforms are not really that important to coral reef health, but are important to test in water samples for public health concerns. They are indirect indicators of a host of other forms of bacteria and viruses that are usually found wherever fecal coliforms are present. These bacteria can enter rivers directly or from agricultural and storm runoff carrying animal waste, and from human sewage discharged into the water.

According to common water quality standards, bathing water can have a maximum of 200 colonies of coliform-bacteria *Escherichia coli* per 100 ml of water. The current EPA recommendation for

[1] Hydroplan (2009)

body-contact recreation is fewer than 100 colonies/100 ml and the standard for the Virgin Islands is 70 colonies/100 ml.

The coliform counts from the MPA water samples are below any of these criteria. However, the validity of these results is limited in itself as this test requires that repeat samples (5 or 6) be collected at regular intervals within a month period and the result is based on the calculated mean of the counts from the repeat samples.

Nutrients

Coral reefs are the most nutrient-sensitive of all aquatic ecosystems, requiring the lowest external inputs to trigger eutrophication or habitat degradation due to excessive growth of algae. The two main nutrients, nitrogen and phosphorus, exist in several forms in marine waters.

Nitrogen. Water column nitrogen – or total nitrogen – includes inorganic nitrogen forms (ammonia, nitrites and nitrates), dissolved organic nitrogen and particulate nitrogen. Nitrates are the main and most stable form of combined nitrogen found in natural waters. Nitrites are normally present in only minute quantities in surface waters but are toxic to aquatic life at relatively low concentrations. Anthropogenic sources for nitrates and nitrites include sewage disposal, agriculture and urban development. Total Kjeldahl nitrogen (TKN) is a measure of both the organic nitrogen and the ammonia in a water sample and its presence in water indicates a nearby source of organic or ammonia nitrogen, such as a wetland or organic wastes. Excess ammonia contributes to eutrophication of water bodies through algal growth enhancement having deleterious impacts on other aquatic life and recreational uses.

Phosphorus. Similarly, phosphorus exists as dissolved inorganic (phosphates) and organic phosphorus, and particulate phosphorus. Since phosphorous is generally the most limiting nutrient, its input can cause extreme proliferations of algal growth. Such inputs are the prime contributing factors to eutrophication in most aquatic systems. Total phosphorus is a measure of both organic and inorganic forms. Phosphates are the most readily available form of phosphorous for uptake during photosynthesis and high concentrations generally occur in conjunction with algal blooms. Anthropogenic sources of phosphorus and phosphates include the use of fertilizers and sewage disposal.

High nutrient concentration impact. Coral communities and their symbiotic algae take up dissolved nutrients directly from the water column. Elevated nutrient concentrations result in a range of impacts on coral communities:

- Macroalgae may bloom and overgrow coral structures, out-compete polyps for space, shade coral colonies to critical levels, and eventually dominate hard substratum rendering it unsuitable for coral growth[1]. This effect has been demonstrated in numerous coral reef systems worldwide.
- High phosphate concentrations were found to suppress coral reef calcification by more than 50% resulting in less dense and weakened skeletons. This process known as bioerosion makes

[1] Mohammed and Mgaya (2001)

colonies more susceptible to damage from storm action. Benthic coralline algae which are significant coral reef builders are also affected by high phosphate levels.[1]

- A shift in species composition of the reef community where slow-growing organisms thriving in nutrient-poor waters are replaced by smaller, rapidly growing species may occur when nutrient concentrations are raised.

Acceptable limits. Nutrients are necessary for aquatic life but are problematic in excess, and appropriate nutrient concentrations vary by waterbody type, climate and geology. For this reason, most agencies in charge of water quality have adopted narrative statements for nutrients rather than numerical criteria. However, studies conducted in 1992 on coral reefs in Australia and Belize have provided consistent information on critical levels of nutrients to maintain healthy coral reefs in environmental conditions comparable to Grenada's coastal waters[2]. Biologically available nitrogen (nitrate plus ammonia) needs to be below 1.0 micromole per litre (less than 0.014 ppm of nitrogen and 0.04 ppm of nitrate), and biologically available phosphorus (orthophosphate plus dissolved organic phosphorus) needs to be below 0.1 micromole per litre (less than 0.003 ppm of phosphorus and 0.007 ppm of phosphate).

Observed nutrient concentrations. Very high concentrations of nutrients were found in the MPA water samples. Concentrations of total nitrogen measured in the MPA water samples are excessive: 50 mg/L in Flamingo Bay and 23 mg/L in Beauséjour Bay. These values largely exceed CEHI criteria (0.1 mg/L) or the threshold for healthy coral reef (0.014 mg/L). The validity of these unlikely results is doubtful. The Total Kjeldahl Nitrogen value of 1.45 mg/L measured in Beauséjour exceeds the eutrophication threshold of 1 mg/L determined for the Virgin Islands. As a comparison, an average TKN concentration of 0.04 mg/L was measured in coral reef habitats around St. Croix (Virgin Islands, USA), with a maximum of 0.17 mg/L, and an average TKN value of 0.34 mg/L was obtained for submerged vegetation habitat.[3]

Phosphorous concentrations are also excessive as total phosphorous and phosphate concentrations reach 0.21 mg/L and 0.07 mg/L in Flamingo Bay and 0.16 mg/L and 0.18 mg/L in Beauséjour Bay as compared to Virgin Islands criteria for phosphorous of 0.05 mg/L and the standard for healthy coral reefs of 0.003 mg/L for phosphorous and 0.007 mg/L for phosphates. The high nutrient concentrations shown by these results are undoubtedly detrimental to the health of the coral reefs in the MPA.

The source for this nutrient contamination could be the Perseverance dump as these results are consistent with the leachate composition which indicated high nutrient contents as shown by values of 27.9 mg/L for TKN, 0.55 mg/L for phosphorus and 1.70 mg/L for phosphates. High ammonium values are usual in leachate composition. The landfill leachate was analysed in the context of an environmental impact assessment (EIA)[4]. The impact of the landfill leachate on the

[1] Haynes D. (2001)
[2] Bell (1992), Lapointe *et al.* (1993)
[3] Toller and Villanueva-Mayor (2006)
[4] Hydroplan (2009)

water quality of the nearby Salle River which flows into Halifax Bay, north of the MPA, was also highlighted by a strong contribution of ammonium (inorganic form of nitrogen) into the river.

Oil and grease

Oil spills or accidental discharge during transfer operations can harm reefs, especially if it occurs during coral spawning because oil can kill eggs and sperm. Significant amounts were found in the water samples: 1271 mg/L in Flamingo Bay and 1473 mg/L in Beauséjour Bay.

Total suspended solids (TSS)

TSS is a measure of the particulate matter that is suspended in the water column. High TSS concentrations can result in damage to fish gills and impair spawning habitats by smothering fish eggs. It may also have two major effects on coral reefs and seagrasses: blockage of light, and smothering of organisms by deposition of sediments and plugging of cavities in reefs. TSS concentrations reported in open tropical marine waters typically range from 0.1 to 1 mg/L and from about 1 to 30 mg/L in surface waters within a few tens of kilometres of the coast[1]. Average TSS concentrations in the range of 25-80 mg/L represent moderate water quality.

A TSS long-term tolerance level for corals of 3.85 mg/L was found for Keeper reef in Australia[2]. The TSS value of 128 mg/L found in the Flamingo Bay water sample is largely above this level which indicates that this condition might be a threat to coral reefs in this bay. The two rivers, Molinière and Beauséjour, could be the main sources of suspended sediments as the TSS content of the Salle River which is impacted by the Perseverance landfill was low (9.0 mg/L at the mouth of the river).

Biochemical oxygen demand (BOD) and Chemical oxygen demand (COD)

BOD is a measure of the amount of oxygen that bacteria consume while decomposing organic matter under aerobic conditions. COD does not differentiate between biologically available and inert organic matter, and is a measure of the total quantity of oxygen required to oxidize all organic material of a sample into carbon dioxide and water. Comparison of BOD with COD assesses whether the compound is readily biodegradable and a COD:BOD ratio of greater than 100 means that the compound is relatively non-biodegradable. The ratios measured for Flamingo and Beauséjour were respectively 700 and 630, thus indicating that the organic material present in the water samples is highly non-biodegradable. On the other hand, low BOD may merely mean that the test microbes needed longer than the test period to begin breaking the compound down and that other biodegradation testing should be used.

4.3. Location and access

The Molinière-Beauséjour MPA is located only 3 miles (5 km) north of St. George's, the capital of Grenada, on the western side of the island, and can be accessed within 20 minutes by boat from St. George's Harbour. The MPA stretches along the coastal zone over about 1.4 mile (2.2 km), from

[1] Deocadiz and Montaño (1999)
[2] Hawker and Connell (1991)

Molinière Point up to Brizan, including Dragon, Flamingo and Beauséjour bays, and extending seaward up to 1/2 mile from the coast (see Figure 1). The MPA boundaries are delineated on Figure 1 and the total area covers approximately 0.23 sq miles (60 hectares). The MPA is accessed by sea without obstacle, and main beaches are easily accessed by small roads passing through Happy Hill and Molinière and directly from the main road in Beauséjour.

The area is included in the St. George parish where the tourist infrastructure is more extensive than in the rest of the country as it holds the world famous Grand Anse Beach, other popular beaches, many of the island's holiday resorts, and Grenada's only active airport, Maurice Bishop International Airport. It is also home to St. George's University. St. George's city is regarded as the most picturesque capital in the Caribbean. As of 2001, St. George parish had a population of 35,559, making it the most populous parish of Grenada.

4.4. Coastline

The Molinière-Beauséjour MPA coastline may be described as rocky shores and cliffs intermixed with a natural sandy beach in each bay: yellow/white sand beaches in Flamingo Bay, Dragon Bay and at the foot of Molinière Point and a black sand beach in Beauséjour.

Beach profiles change owing to sea level rise, extreme climatic events and sand mining. Based on a conservative figure of 0.29 ft (8.9 cm) by 2025 for sea level rise, long-term erosion trends and shoreline retreat were predicted for 20 bays around Grenada, including Grand Mal, south of the Molinière-Beauséjour MPA. Long term estimations for Grand Mal (south of MPA) predict a 4 m inland retreat from the shoreline until 2025. Short term or storm-induced erosion is predicted to have a far greater impact on the shoreline than long-term erosion.[1]

A local fisherman reported that intense sand mining was taking place in Beauséjour around 30 years ago. This beach had the largest sand resource on the west coast of Grenada and many families then lived off the sand resource. This sand mining led to coastal erosion and the coastline receded by 20 to 30 feet within 20 years. An analysis of beach changes in Grenada between 1985 and 1991 showed negative changes due to sand mining: -24% between 1985 and 1988 in the northern part of the beach and of -10% between 1985 and 1990 in the central part.[2] The depletion of the sand put a stop to the activity and, although a few individuals still persist in sand mining, the beach gives signs of recovery since trees planted 20 feet from the shoreline 20 years ago are now 40 feet from the shoreline. The beach in Dragon Bay also was once sand mined to the rock.

4.5. Watersheds

The watershed of a river – or river basin – is the land area that is drained by a river and its tributaries. It starts up at the headwaters of the streams and rivers that ultimately drain down to the coastal areas. As the streams and rivers flow to coastal waters, they are influenced by many land

[1] CEAC Solutions (2006)
[2] Isaac, C. (1996)

and water uses such as farming, domestic, industrial, and recreation. As water flows over the ground and along rivers it picks up nutrients, sediment, and pollutants which get transported towards the coastal area, and can affect the ecological processes along the way as well as in the receiving environment. It is therefore imperative to assess whether watersheds are potential sources of pollution for the MPA.

Two rivers run into the MPA coastal waters: the Beauséjour River which opens into the northern part of Beauséjour Bay and the Molinière River which flows into Dragon Bay. While the latter drains a small watershed not extending further than Mt. Moritz and Molinière settlements, the Beauséjour River has a large catchment area extending up to the Annandale forest as shown on Figure 3.

A forest management plan exists for the Annandale forest at the head of the Beauséjour River watershed and a Watershed management unit sees to its implementation. Between Annandale and the MPA, potential pollution sources are nutrients from fertilizers associated with farming activities by private owners (agriculture and livestock) and sewage from low income settlements that don't have proper sanitation. A short field visit in the Beauséjour River drainage area did not allow the observation of any development or activity likely to have a negative impact on the water quality of the river. Although houses do not seem to be connected to a sewage collection network, settlements are scattered. Riverbank condition could not be evaluated, however in most areas, banks had a natural vegetal cover with the exception of a few small scale banana plantations where vegetation had been cleared.

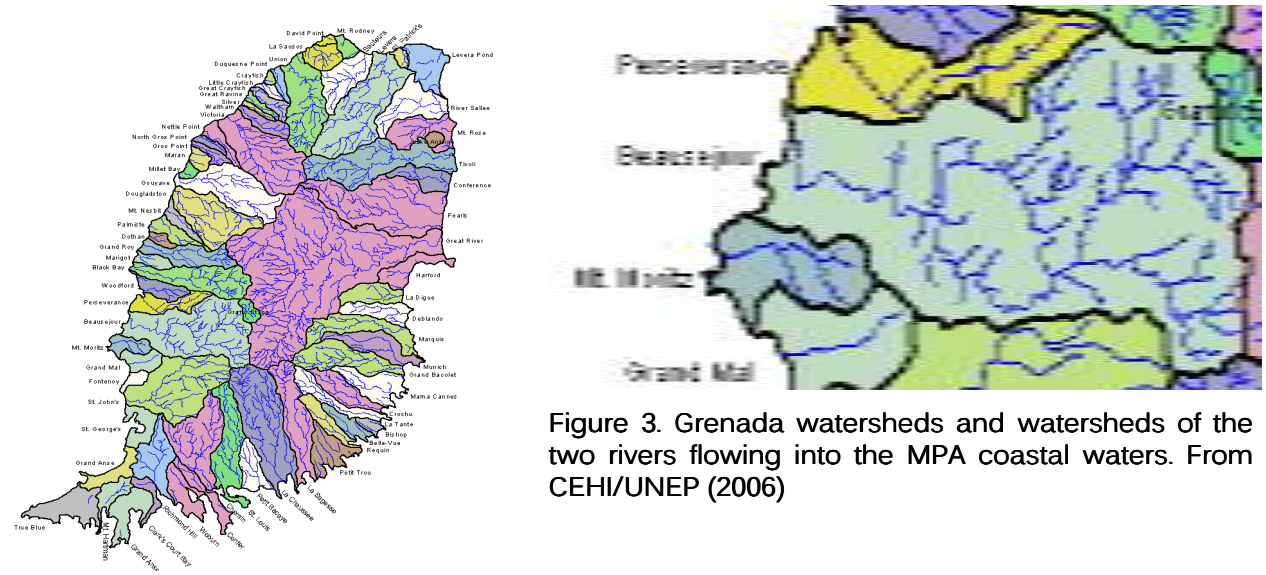


Figure 3. Grenada watersheds and watersheds of the two rivers flowing into the MPA coastal waters. From CEHI/UNEP (2006)

It was often reported that a large sediment plume was visible in Beauséjour Bay after a heavy rain. These sediments may result from erosion taking place throughout the drainage basin during heavy rains. Another potential explanation was put forward by a local fisherman living in Beauséjour[1]. The Beauséjour River now flows into the bay at the northern end of the beach but the mouth of the river used to be at the other end. It is suggested that sediment built up until the mouth was blocked and

[1] McQueen C. personal communication

the river was diverted north, creating a meander that runs along the top of the beach, and outflowing at the northern end of the beach. During heavy rains, the river flow gets strong enough to breach the sediment mound and the river discharges directly into the sea from the northern end of the beach, thus causing a large sediment plume.

5. Significant resources

The baseline information provided in this section is a compilation of available information collected from existing databases and reports and completed by a resource distribution map (Figure 4).

5.A Natural resource values

5.1. Coral reefs

5.1.1. Reef ecosystem

Main values Coral reefs are highly productive ecosystems and harbor high biodiversity. This complex habitat provides shelter and food for hundreds of species of fish and invertebrates. Marine turtles also roam around coral reefs. Globally, corals cover less than 1 percent of the ocean floor but they support about 25 percent of all animals that live in the ocean. Coral reefs play a critical role as habitat and nursery grounds for fisheries that provide food and income to local communities. Coral reefs protect coastlines from wave and storm damage and erosion yet contribute to beach formation. Some life-saving medicines come from coral reefs. Snorkelling and diving are important aspects of ecotourism and also depend on maintaining healthy coral reefs. Because of their accessibility, the Molinière-Beauséjour MPA coral reefs have an educational and research value. The area where Ivan caused coral damage in Dragon Bay and the underwater sculpture park offer opportunities to study coral regeneration and marine colonization.

Distribution Coral reefs surrounding Grenada are estimated at 12.5 square km (655 acres)[1]. The Molinière-Beauséjour MPA surface area is 0.6 square km and the reef covers about two thirds of the area, giving a rough estimate of 0.4 square km for the reef surface. The reef extends from Molinière Point to the southern part of Flamingo Bay.

General trend In 1988[2], the reef in the MPA was estimated at 2.65 square km but, unfortunately, no data is available from surveys conducted during this period, which prevents comparisons with current reef condition. The Molinière Reef was then described as “outstanding and consisting of a series of coral reefs and sea fans beds with a prevalence of lobsters, soft and hard corals”. Notwithstanding the observed degradation of coral reefs, this large discrepancy questions the accuracy of the reef coverage estimated in 1988.

[1] GoG. 2009. 4th National Report to the CBD
[2] GoG / OAS. 1988.

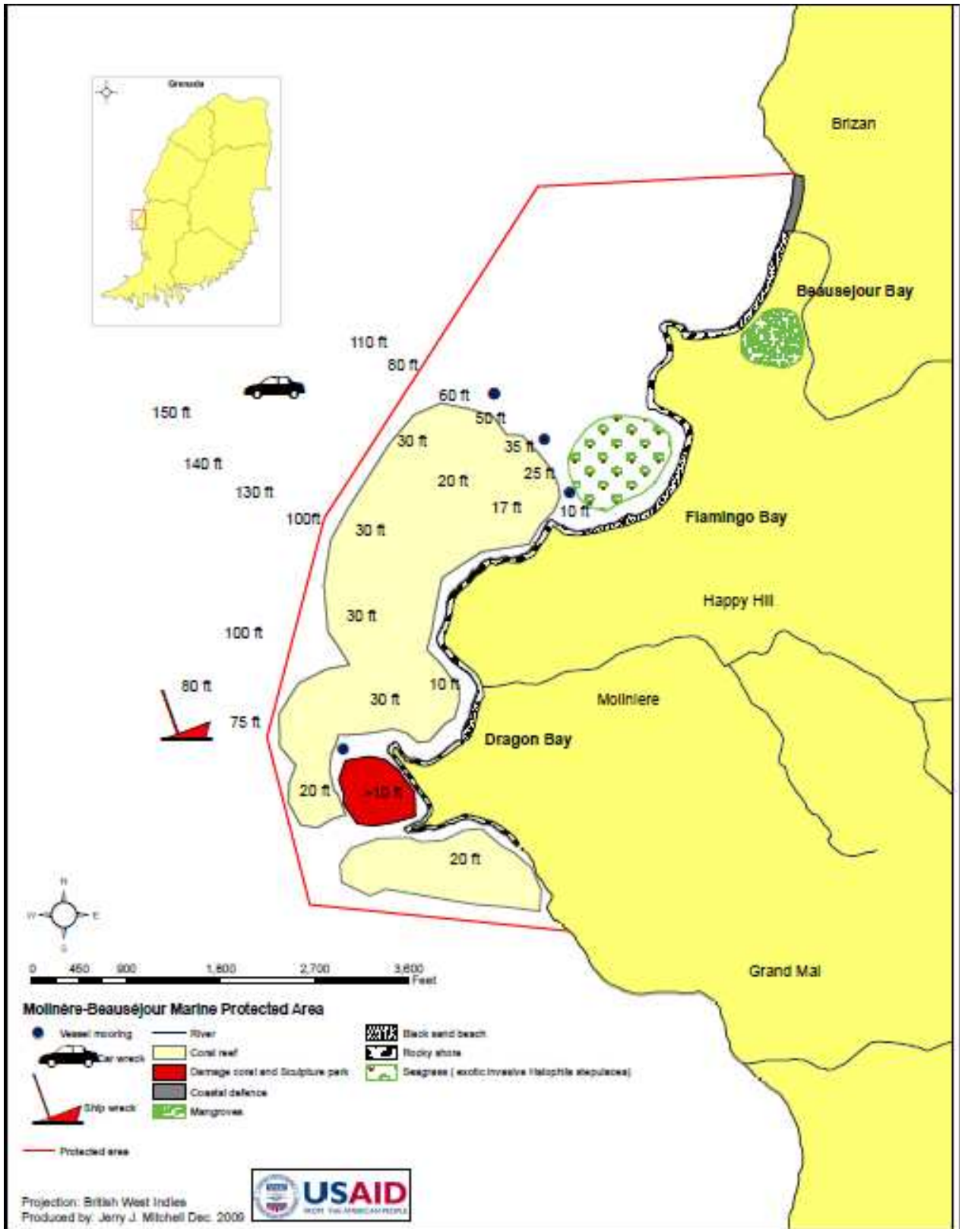


Figure 4. Molinière-Beauséjour MPA resource distribution map

The 2008 report on the status of coral reefs of the Lesser Antilles[1] mentions that coral reefs remained relatively healthy until the early 1980s, but that coral cover has been decreasing since then and algal cover increasing, with most of the reefs having lost more than half of their corals. The recent trend observed in Grenada is that macro-algae remained the largest component of benthic cover on south-west reefs, followed by hard coral cover, which declined at some sites from 23 – 38 % in 2007 to 6 – 20 % in 2008. The sea urchin *Diadema antillarum* was either rare or absent.

Status Coral reefs in the Molinière-Beauséjour MPA are threatened by algal smothering and bleaching. Intense bleaching (30 to 60%) was recorded in 2005, mostly for the reef building genera *Agaricia* and *Montastrea.* No coral disease was recorded in Flamingo Bay in 2006 although Yellow Band Disease has been recorded in other sites in Grenada. Part of the reef in Dragon Bay was damaged by Hurricane Ivan in September 2004.

Several reef surveys were conducted in the Molinière-Beauséjour MPA. Besides the early surveys that led to the designation of the MPA, surveys were conducted *i*) in 2002 as part of the Eastern Caribbean States Partnership Program (ECSPP), *ii*) in 2005-2006 as part of the Marine Protected Areas Realization in Grenada project funded by the NFWF and implemented by WINDREF/SGU and the Grenada Marine Programme, and *iii*) yearly since 2007, by the Wisconsin Lutheran College, under the supervision of Dr. Bob Anderson, as part of a long-term research program on Grenada near-shore waters. Coral condition has been studied in 2005 and 2006 in Flamingo Bay as part of Dr. Weil's (University of Puerto Rico) research on coral bleaching and disease in the Caribbean.

A coral reef and coastal zone monitoring program using the ECS protocol was conducted in October-November 2002 in Grenada and Antigua through a pilot project for promoting a regional approach to the assessment and selection of coral reef marine protected area sites in the Eastern Caribbean States, the ECSPP. The survey sites in Grenada included the Molinière-Beauséjour MPA (Flamingo Bay identified as Happy Hill, and Dragon Bay), Grand Anse, Carriacou and Ile de Ronde. In the Molinière-Beauséjour MPA, 24 transect lines were surveyed for benthic coverage and 19 transect lines for fish communities. The ECS method used a volunteer team of 15 persons made up mainly of St Georges University students and diving operators to conduct in situ assessments of benthic habitats and coral reef fish assemblages, using 30-m transects with point intercepts at 0.5 m intervals. The results of the benthic surveys are presented in Table 3 to allow a comparison with similar observations made in the same areas in 2006.

The relative coverage of benthic substrate types for the two sites in the Molinière-Beauséjour MPA based on the 2002 ECSPP surveys differed significantly from the coverage recorded in the three other sites in Grenada: the relative algal coverage was higher and the relative coral coverage was lower in the Molinière-Beauséjour MPA than in the three other sites.

[1] Bouchon et al. 2008

% coverage	Year	Corals	Gorgonians	Sponges	Reef complex	Algae	Non living
Molinière	2006	11.24	2.86	1.62	15.72	71.04	12.58
Dragon Bay	2002	17.0	1.0	0.5	18.6	71.0	10.4
	2006	14.18	3.34	1.78	19.30	57.92	22.82
Flamingo Bay	2002	13.2	21.9	14.1	49.2	35.3	15.2
	2006	23.3	5.52	11.38	40.20	30.78	29.04
M-B MPA (average)	2002	15.1	11.5	7.3	33.9	53.2	12.8
	2006	16.24	3.9	4.92	25.06	53.24	21.48

Table 3. Mean percent (%) benthic cover for coral reef complex in the bays of the Molinière-Beauséjour MPA, from benthic surveys conducted in 2002 (ECS Pilot Programme) and in 2006 (MPA Realization in Grenada Project). Reef complex is an integration of corals, gorgonians and sponges.

Surveys for the MPA realization in Grenada project (2005-2006) included a total of 15 30-m transects distributed in Flamingo Bay, Dragon Bay, and off Molinière Point. Beauséjour Bay which is most used for fishing was not included in the survey as the reef does not extend beyond the southern half of Flamingo Bay (see Molinière-Beauséjour MPA Resource map, Figure 4). It is likely that the high sediment load transported by the Beauséjour River and the continual use of seine nets in the bay prevent corals from settling in this area.

Although 2002 and 2006 surveys were not related and may have used different areas within the same site, the results in Dragon Bay are consistent from one year to another, except for a reduction in algal cover and an increase in non-living substrate. The observations in Flamingo Bay show a reduction in gorgonians but an increase in corals and non-living substrate. The proportion of algae remained similar in both sites.

The Wisconsin Lutheran College program is monitoring coral reefs in five coastal areas in Grenada. Two sampling areas are located within the Molinière-Beauséjour MPA (Dragon Bay and Flamingo Bay) and three other sampling areas are along a larger unprotected reef south of the MPA. Substrate type, algae cover, coral condition, bottom dwelling organisms and fish species are recorded in each site along four 30-m transects. Data collection is enhanced by the use of high definition video and photography.

Initial analysis of the observations made in 2007 and in 2008 is consistent with the results of the 2005-2006 surveys conducted in the context of the MPA Realization in Grenada project. Flamingo Bay had the greatest reef complex (coral+gorgonian+sponge) cover of all sites. The results of 2008 indicate that it also had the lowest occurrence of algae.

Threats **Low abundance of grazers.** It is hypothesised that the low coral coverage is due to the smothering of corals reefs by algae overgrowth, in turn due to the low abundance of grazers (herbivore fish and urchins). Urchins were decimated by a disease that affected the *Diadema* populations in the Caribbean. The low abundance of large grazer fish would be attributable to

selective fishing pressure targeting these species, namely spear fishing which is legally prohibited in any MPA in Grenada.

This hypothesis regarding the influence of grazers is challenged by the comparison of herbivore fish diversity and abundance among three sampling sites in the Molinière-Beauséjour MPA (in section 6.1.2) which shows the lowest herbivore fish abundance and diversity in Flamingo Bay where the greatest reef complex (coral+gorgonian+sponge) cover of all sites is also found.

It has been repeatedly demonstrated that the shift from a healthy coral dominated state to a weedy algae-dominated state can be triggered by a loss of algae-consuming herbivores, especially parrotfishes and surgeonfishes. However, experiments on the Great Barrier Reef[1] have shown that not all herbivorous fish can have a significant impact on reef recovery from algal overgrowth. The dominant browser was a rare species while parrotfishes and surgeonfishes which are the usual consumers of seaweed on coral reefs, were unable to reverse algal blooms. Thus, to contribute to reverse the coral-algal shift, it might be wise to encourage herbivore fish species diversity by restricting selective fishing in the vicinity of the MPA coral reefs.

Findings of another study on the Great Barrier Reef[2] have shown that large herbivorous fishes play a key role in the ability of coral reef ecosystems to recover from bleaching events and maintain resilience in the face of thermal stress due to rises in sea temperature – which strongly suggests that preventing chronic overfishing may not only help ensure reef health under stable conditions, but may also significantly boost the resilience of coral reefs in the face of bleaching events.

The low abundance of large grazer fish might also reflect the impact of a fish-kill outbreak which affected several southeastern Caribbean countries, including Grenada, from July to September 1999[3]. Of the various hypotheses examined to explain the kill events, the algae bloom - associated with an increase of the influx of nutrient-rich water form the Orinoco and Amazon Rivers in South America, an increase of water temperature, and oxygen depletion - is supported by physical observations made by fishermen and airline pilots, indicating the presence of greenish/brownish discoloration of the sea water before and at the time of the kill events. This hypothesis is further supported by satellite pictures of the Caribbean clearly showing an unusual volume of the influx from the rivers into the affected areas, including a gradient increase of temperature and of the sea water nutrient content as measured by chlorophyll gradient levels. The presence of pathogenic microorganisms from moribund fish was also demonstrated in Barbados.

High nutrients concentrations. The results of the water quality analyses conducted in 2010 show elevated nutrients concentrations in the water (see section 5.2.5 Water quality) which surely stimulates algal growth in the MPA. Indiscriminate anchoring by boat operators is considered to be another important human threat to coral reefs on Grenada's southwest coast. Storm surges and hurricanes are the largest natural threats.

[1] Bellwood, Hugues, and Hoey (2006)
[2] Hugues T.P. et al. (2007)
[3] PAHO 2000

Knowledge gaps An assessment of current coral health and bleaching status is required. The impact of beach seine fishing on large herbivore fish in Flamingo Bay fish must be assessed.

5.1.2. Reef species: fish, coral, sponges

Main values The high biodiversity of reef species is a major attraction for divers and snorkelers. Reef fish contribute to support local communities' food security and livelihood as fishing is a significant subsistence and commercial activity for part of the population.

Species composition, distribution and abundance According to the 2008 report on the status of coral reefs of the Lesser Antilles[1], surveys conducted in Grenada in 2006 and 2007 identified 33 hard coral species, the most common being *Porites porites* followed by *P. astreoides* and *Montastraea annularis*. Macro-algae, especially *Dictyota* and *Halimeda*, comprised the largest component on the bottom at 9 sites in south-west Grenada with mean cover from 36.5% to 53.2%. Hard corals were the second most common component, ranging from 23.8% to 38.1%. The sea urchin *Diadema antillarum* was either rare or absent.

The species lists for fish, corals and sponges were compiled from reef surveys and completed with the support of experienced diving operators and local fishermen using visual aid material. Surveys were conducted in 2005 and 2006 along 15 30-m transects located off the Molinière Point, in Dragon Bay, and in the southern part of Flamingo Bay. This allowed the identification of a total of 124 fish species belonging to 44 families (Table 5), 28 coral species belonging to 10 families (Table 7), and 15 sponge species belonging to 9 families (Table 8). The 15 30-m transects also allowed the assessment of species and family abundance in each site for 47 fish species belonging to 16 families (Table 6). By comparison, in 2002, a total of 110 fish species had been observed through 219 surveys conducted in four distinct regions of Grenada by the ECSPP[2], including 59 species in the Molinière-Beauséjour MPA through 19 surveys.

A summary of fish species abundance and diversity indices based on Table 6 (2005-2006 MPA Realization in Grenada surveys) is given below to facilitate the comparison among the three sampling sites in the Molinière-Beauséjour MPA. The most obvious difference is that total fish abundance and fish diversity (as measured by the number of species or families present) were much higher in Dragon Bay than off Molinière Point and in Flamingo Bay. However, when fish diversity is measured using the Simpson D index which takes into account the proportion of each species – or the evenness with which individuals are distributed among the different species – Molinière has the highest biodiversity value while Flamingo Bay, the lowest. It is also interesting to note that Flamingo Bay differs from the other sites by its lower herbivore fish diversity and much lower herbivore fish abundance. These indices were based on a compilation of surgeonfishes and parrotfishes and functional groups were determined for each species through consulting the relevant information on FishBase.

[1] Bouchon et al. 2008
[2] ECSPP. 2003.

Abundance and diversity indices	Molinière	Dragon Bay	Flamingo Bay	Total
Fish abundance	335	827	413	1 575
Number of fish species	23	37	27	44
Number of fish families	9	14	13	16
Simpson D index	4.8	4.0	2.5	4.8
Herbivore fish abundance	79	45	12	136
Number of herbivore fish species	6	6	4	7

Surgeonfish (herbivores) and yellowhead wrasse (benthic carnivores) were more abundant off Molinière than in the two other sites. Brown chromis, the most abundant fish species in this survey, is very abundant in Dragon Bay (n=371) and Flamingo Bay (n=259) but absent from the site off Molinière. Inversely, bicolour damselfish, the second most abundant species, is very abundant off Molinière (n=132) and in Dragon Bay (n=164) while hardly any were observed in Flamingo Bay (n=12). Parrotfish and surgeonfish (herbivores) abundance was especially low in Flamingo Bay.

A comparison of the occurrence of fish functional groups and substrate types among the sampling sites within the Molinière-Beauséjour MPA (2005-2006 surveys) does not bring out any clear association, with the exception of parrotfish which are more abundant where algal coverage is higher. This observation is consistent with ECSPP results for all sites surveyed in Grenada in 2002.

Planktivorous fish represented 65% of all fish observed in Grenada in the ECSPP survey of 2002: the bicolour damselfish was the most commonly observed species and brown chromis was by far the most abundant fish species recorded in Grenada. The other most abundant species comprised blue chromis and creole wrasse. The functional group with the highest biomass was herbivores including striped parrotfish, redband parrotfish and princess parrotfish. In the Molinière-Beauséjour MPA, planktivorous damselfish as well as bluehead wrasse were among the most abundant species. There were significantly more surgeonfish (herbivores) at Dragon Bay than other sites in Grenada.

Trend A comparison with healthy coral reef species assemblages suggests that the community trophic structure in the Molinière-Beauséjour MPA is altered, mostly because of the low abundance of large grazer fish and of *Diadema* urchins. Recent surveys have given indications of local improvement of coral coverage in Flamingo Bay.

People with a long experience in the fisheries witness the disappearance of some species that used to occur in the area: rock lobsters, crabs, and herring, or the drastic decline in abundance and diversity of others such as the urchin *Diadema*, spanish mackerel, goat fish, groupers, parrotfish, rock hind, grunt, butterfish, snappers and aquarium fishes, leading to critical fish community changes.

Knowledge gap Long-term trend and seasonal variability in species occurrence, distribution and abundance; factors explaining species occurrence variability among sampling sites in the MPA

Table 5. Fish species (Phylum Chordata) recorded in the Molinière-Beauséjour MPA in 2006.

Family Name	Family	Scientific Name	Common Name	Functional group
Class Actinopterygii (ray-finned fishes)				
Acanthuridae	Surgeonfishes	*Acanthurus bahianus*	Ocean surgeonfish	Herbivores
		Acanthurus chirurgus	Doctor fish	Herbivores
		Acanthurus coeruleus	Blue tang	Herbivores
Antennariidae	Frogfishes	*Antennarius multiocellatus*	Longlure frogfish	Carnivores
Aulostomidae	Trumpetfishes	*Aulostomus maculatus*	Trumpetfish	Carnivores
Balistidae	Triggerfishes	*Balistes vetula*	Queen triggerfish	Carnivores
		Melichthys niger	Black durgon	Carnivores
Belonidae	Needlefishes	*Platybelone argalus*	Keeltail needlefish	Piscivores
Blenniidae	Blennies	*Ophioblennius macclurei*	Red lipped blenny	-
Bothidae	Lefteye Flounders	*Bothus lunatus*	Peacock flounder	Carnivores
Carangidae	Jacks	*Caranx latus*	Horse eye jack	Carnivores
		Decapterus macarellus	Mackeral scad	Carnivores
		Elagatis bipinnulata	Rainbow runner	Carnivores
Chaenopsidae	Blennies	*Acanthemblemaria maria*	Secretary blenny	Benth. carniv.
Chaetodontidae	Butterflyfishes	*Chaetodon aculeatus*	Longsnout butterflyfish	Corallivores
		Chaetodon capistratus	Foureye butterflyfish	Corallivores
		Chaetodon ocellatus	Spotfin butterflyfish	Corallivores
		Chaetodon striatus	Banded butterflyfish	Corallivores
Congridae	Garden eels	*Heteroconger longissimus*	Brown garden eel	Planktivores
Dactylopteridae	Flying Gurnard	*Dactylopterus volitans*	Flying gurnard	Benth. carniv.
Diodontidae	Porcupinefishes	*Diodon holocanthus*	Balloonfish	Benth. carniv.
		Diodon hystrix	Porcupinefish	Benth. carniv.
Gobiidae	Gobies	*Coryphopterus personatus*	Masked goby	Benth. carniv.
		Ctenogobius saepepallens	Dash goby	Benth. carniv.
		Gobiosoma genie	Cleaning goby	Benth. carniv.
		Gobiosoma horsti	Yellowline goby	Benth. carniv.
Grammatidae	Basslets	*Gramma loreto*	Royal basslet	Specialists
Haemulidae	Grunts	*Anisotremus surinamensis*	Black margate	Benth. carniv.
		Anisotremus virginicus	Porkfish	Benth. carniv.
		Haemulon album	White grunt	Benth. carniv.
		Haemulon carbonarium	French grunt	Benth. carniv.
		Haemulon chrysargyreum	Smallmouth grunt	Benth. carniv.
		Haemulon macrostomum	Spanish grunt	Benth. carniv.
		Haeumlon sciurus	Bluestriped grunt	Benth. carniv.
Holocentridae	Squirrelfishes	*Holocentrus adscensionis*	Squirrelfish squirrelfish	Benth. carniv.
		Holocentrus rufus	Longspine squirrelfish	Benth. carniv.
		Myripristis jacobus	Blackbar soldierfish	Planktivores
		Sargocentron coruscum	Reef squirrelfish	Benth. carniv.
Inermiidae	Bonnetmouths	*Inermia vittata*	Boga	Planktivores
Kyphosidae	Chubs	*Kyphosus sectatrix*	Bermuda chub	Omnivores
Labridae	Wrasses	*Bodianus rufus*	Spanish hogfish	Benth. carniv.
		Clepticus parrae	Creole wrasse	Planktivore
		Halichoeres bivittatus	Slippery dick	Benth. carniv.

Family Name	Family	Scientific Name	Common Name	Functional group
		Halichoeres garnoti	Yellowhead wrasse	Benth. carniv.
		Halichoeres maculipinna	Clown wrasse	Benth. carniv.
		Halichoeres radiatus	Puddingwife	Benth. carniv.
		Thalassoma bifasciatum	Bluehead wrasse	Planktivores
Lutjanidae	Snappers	*Lutjanus analis*	Mutton snapper	Gen. carniv.
		Lutjanus apodus	Schoolmaster	Gen. carniv.
		Lutjanus campechanus	Red snapper	Gen. carniv.
		Lutjanus jocu	Dog snapper	Gen. carniv.
		Lutjanus mahogoni	Mahogonay snapper	Gen. carniv.
		Lutjanus synagris	Lane snapper	Gen. carniv.
		Ocyurus chrysurus	Yellowtail snapper	Gen. carniv.
Malacanthidae	Tilefishes	*Malacanthidae plumieri*	Sand tilefish	Benth. carniv.
Monacanthidae	Filefishes	*Aluterus schoepfii*	Orange filefish	Herbivores
		Aluterus scriptus	Scribbled leatherjacket filefish	Herbivores
		Cantherhines macrocerus	American whitespotted filefish	Spongivores
		Monacanthus tuckeri	Slender filefish	Omnivores
Mullidae	Goatfishes	*Mulloidichthys martinicus*	Yellow goatfish	Benth. carniv.
		Pseudupeneus maculatus	Spotted goatfish	Benth. carniv.
Muraenidae	Moray Eels	*Echidna catenata*	Chain moray	Carnivores
		Gymnothorax funebris	Green moray	Carnivores
		Gymnothorax miliaris	Goldentail moray	Carnivores
		Gymnothorax moringa	Spotted moray	Carnivores
Ophichthidae	Snake Eels	*Echiophis intertinctus*	Spotted spoon-nose eel	Carnivores
		Myrichthys breviceps	Sharptail snake eel	Carnivores
		Myrichthys ocellatus	Goldspotted eel	Benth. carniv.
		Ophichthus ophis	Spotted snake eel	Carnivores
		Quassiremus ascensionis	Blackspotted snake eel	Carnivores
Opistognathidae	Jawfishes	*Opistognathus macrognathus*	Banded jawfish	Benth. carniv.
Ostraciidae	Boxfishes	*Acanthostracion polygonius*	Honeycomb cowfish	Omnivores
		Acanthostracion quadricornis	Scrawled cowfish	Omnivores
		Lactophrys bicaudalis	Spotted trunkfish	Omnivores
		Lactophrys triqueter	Smooth trunkfish	Omnivores
Pomacanthidae	Angelfishes	*Holacanthus ciliaris*	Queen angelfish	Spongivores
		Holacanthus tricolor	Rock beauty	Spongivores
		Pomacanthus arcuatus	Gray angelfish	Spongivores
		Pomacanthus paru	French angelfish	Spongivores
Pomacentridae	Damselfishes	*Abudefduf saxatilis*	Sergeant major	Omnivores
		Chromis cyanea	Blue chromis	Planktivores
		Chromis mutilineata	Brown chromis	Planktivores
		Microspathodon chrysurus	Yellowtail damselfish	Omnivores
		Stegastes adustus	Dusky damselfish	Omnivores
		Stegastes diencaeus	Longfin damselfish	Omnivores

Family Name	Family	Scientific Name	Common Name	Functional group
		Stegastes leucostictus	Beaugregory damselfish	Omnivores
		Stegastes partitus	Bicolor damselfish	Planktivores
		Stegastes planifrons	Threespot damselfish	Omnivores
		Stegastes variabilis	Cocoa damselfish	Omnivores
Priacanthidae	Bigeyes	*Heteropriacanthus cruentatus*	Glasseye	Carnivores
		Priacanthus arenatus	Atlantic bigeye	Carnivores
Scaridae	Parrotfishes	*Scarus iserti*	Striped parrotfish	Herbivores
		Scarus taeniopterus	Princess parrotfish	Herbivores
		Scarus vetula	Queen parrotfish	Herbivores
		Sparisoma aurofrenatum	Red Band parrotfish	Herbivores
		Sparisoma rubripinne	Yellow Tail parrotfish	Herbivores
		Sparisoma viride	Stoplight parrotfish	Herbivores
Sciaenidae	Drums	*Equetus lanceolatus*	Jacknife fish	Benth. carniv.
		Equetus punctatus	Spotted drum	Benth. carniv.
Scombridae	Mackerels	*Scomberomorus cavalla*	King mackerel	Piscivores
		Scomberomorus maculatus	Atlantic Spanish mackerel	Piscivores
		Scomberomorus regalis	Cero	Piscivores
Scorpaenidae	Scorpionfish	*Scorpaena plumieri*	Spotted scorpionfish	Benth. carniv.
		Scorpaenodes caribbaeus	Reef scorpionfish	Benth. carniv.
Serranidae	Groupers/Sea Basses	*Cephalopholis cruentatus*	Graysby	Gen. carniv.
		Cephalopholis fulva	Coney / Butterfish	Gen. carniv.
		Epinephelus adscensionis	Rock hind	Gen. carniv.
		Epinephelus guttatus	Red hind	Gen. carniv.
		Rypticus saponaceus	Greater soapfish	Gen. carniv.
		Serranus tigrinus	Harlequin bass	Gen. carniv.
	Hamlet	*Hypoplectrus guttavarius*	Shy hamlet	Gen. carniv.
		Hypoplectrus nigricans	Black hamlet	Gen. carniv.
		Hypoplectrus puella	Barred hamlet	Gen. carniv.
Sparidae	Porgies	*Calamus calamus*	Saucereye porgy	Benth. carniv.
		Archosargus probatocephalus	Sheepshead porgy	Benth. carniv.
Sphyraenidae	Barracudas	*Sphyraena barracuda*	Great barracuda	Piscivores
		Sphyraena picudilla	Southern sennet	Piscivores
Syngnathidae	Seahorses	*Hippocampus reidi*	Longsnout seahorse	Carnivores
Synodontidae	Lizardfishes	*Synodus intermedius*	Sand diver	Piscivores
Tetraodontidae	Pufferfishes	*Canthigaster rostrata*	Sharpnose puffer	Omnivores
Class Elasmobranchii (sharks and rays)				
Dasyatidae	Stingrays	*Dasyatis americana*	Southern stingray	Benth. carniv.
Narcinidae	Electric Rays	*Narcine brasiliensis*	Brazilian electric ray	Benth. carniv.
Myliobatidae	Mantas	*Manta birostris*	Giant manta ray	Planktivores
	Eagle rays	*Aetobatus narinari*	Spotted eagle ray	Benth. carniv.

Figure 5. Chart illustrating fish family abundance based on the 2005-2006 surveys in the Molinière-Beauséjour MPA (15 30-m transects).

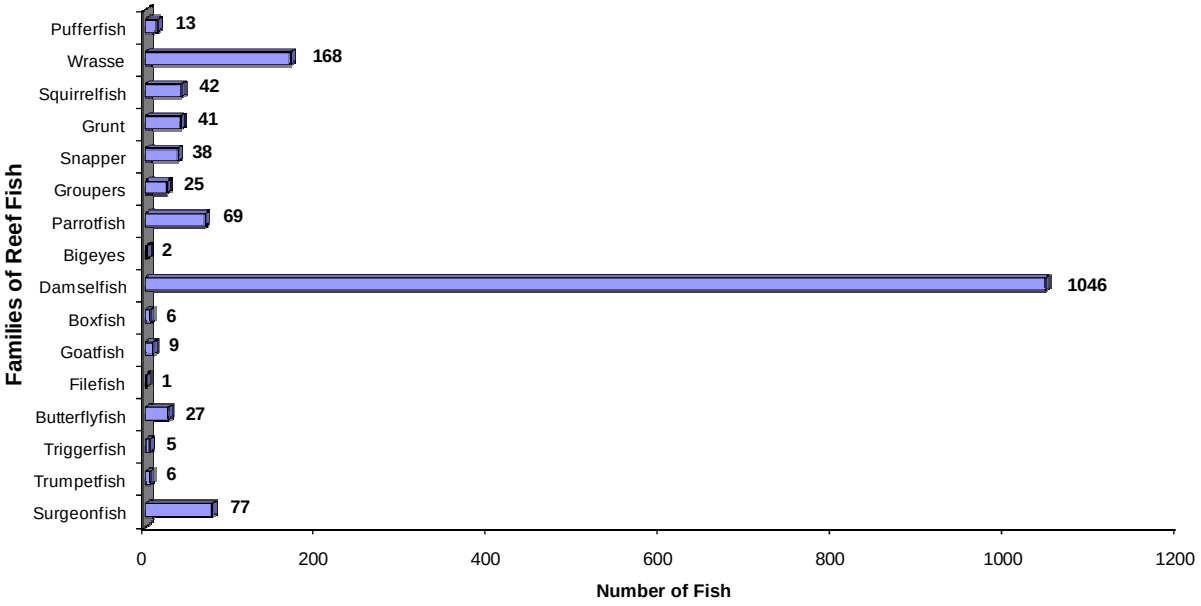


Figure 6. Chart illustrating the proportion of reef fish community functional groups based on the 2005-2006 surveys in the Molinière-Beauséjour MPA (15 30-m transects).

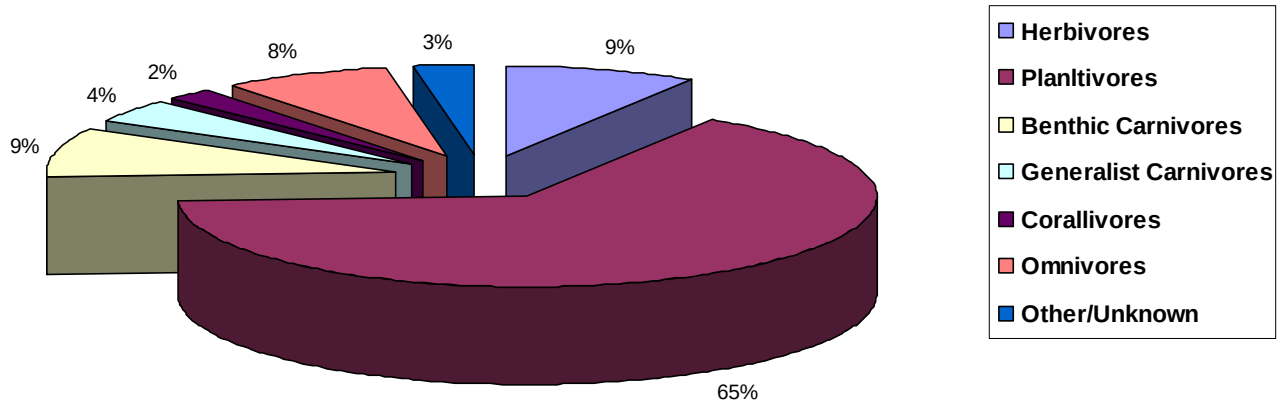


Table 6. Abundance of fish species recorded in the Molinière-Beauséjour MPA in 2006 – M: off Molinière Point – D: Dragon Bay – F: Flamingo Bay

Family Name	Scientific Name	Functional group	Common Name	M	D	F
Acanthuridae (77)	*Acanthurus bahianus*	Herbivores	Ocean surgeonfish	22	13	2
	Acanthurus chirurgus	Herbivores	Doctor fish	16	8	4
	Acanthurus coeruleus	Herbivores	Blue tang	12	-	-
Aulostomidae (6)	*Aulostomus maculatus*	Carnivores	Trumpetfish	-	3	3
Balistidae (5)	*Melichthys niger*	Carnivores	Black durgon	-	5	-
Chaetodontidae (27)	*Chaetodon capistratus*	Corallivores	Foureye butterflyfish	6	13	2
	Chaetodon ocellatus	Corallivores	Spotfin butterflyfish	-	1	-
	Chaetodon striatus	Corallivores	Banded butterflyfish	-	2	3
Haemulidae (41)	*Haemulon carbonarium*	Benth. carnivores	French grunt	-	31	3
	Haeumlon sciurus	Benth. carnivores	Bluestriped grunt	-	3	2
Holocentridae (42)	*Holocentrus adscensionis*	Benth. carnivores	Squirrelfish squirrelfish	2	8	9
	Myripristis jacobus	Planktivores	Blackbar soldierfish	-	17	6
Labridae (168)	*Bodianus rufus*	Benth. carnivores	Spanish hogfish	1	-	-
	Clepticus parrae	Planktivores	Creole wrasse		38	20
	Halichoeres bivittatus	Benth. carnivores	Slippery dick	2	14	-
	Halichoeres garnoti	Benth. carnivores	Yellowhead wrasse	64	18	1
	Halichoeres maculipinna	Benth. carnivores	Clown wrasse	-	-	2
	Thalassoma bifasciatum	Planktivores	Bluehead wrasse	3	5	-
Lutjanidae (38)	*Lutjanus apodus*	Gen. carnivores	Schoolmaster	-	6	-
	Lutjanus mahogoni	Gen. carnivores	Mahogonay snapper	-	25	1
	Ocyurus chrysurus	Gen. carnivores	Yellowtail snapper	2	-	3
Monacanthidae (1)	*Monacanthus tuckeri*	Omnivores	Slender filefish	-	1	-
Mullidae (9)	*Mulloidichthys martinicus*	Benth. carnivores	Yellow goatfish	1	3	-
	Pseudupeneus maculatus	Benth. carnivores	Spotted goatfish	-	2	3
Ostraciidae (6)	*Lactophrys triqueter*	Omnivores	Smooth trunkfish	3	3	-
Pomacentridae (1046)	*Abudefduf saxatilis*	Omnivores	Sergeant major	-	-	20
	Chromis cyanea	Planktivores	Blue chromis	13	23	26
	Chromis mutilineata	Planktivores	Brown chromis	-	371	259
	Microspathodon chrysurus	Omnivores	Yellowtail damselfish	2	6	3
	Stegastes adustus	Omnivores	Dusky damselfish	12	-	-
	Stegastes partitus	Planktivores	Bicolor damselfish	132	164	12
	Stegastes planifrons	Omnivores	Threespot damselfish	-	-	1
	Stegastes variabilis	Omnivores	Cocoa damselfish	-	2	-
Priacanthidae (2)	*Heteropriacanthus cruentatus*	Carnivores	Glasseye	-	1	1
Scaridae (69)	*Scarus iserti*	Herbivores	Striped parrotfish	4	2	-
	Scarus taeniopterus	Herbivores	Princess parrotfish	-	4	-
	Sparisoma aurofrenatum	Herbivores	Red Band parrotfish	8	12	3

Family Name	Scientific Name	Functional group	Common Name	M	D	F
	Sparisoma viride	Herbivores	Stoplight parrotfish	17	6	3
Serranidae (25)	*Cephalopholis cruentatus*	Gen. carnivores	Graysby	-	1	-
	Cephalopholis fulva	Gen. carnivores	Coney / Butterfish	1	2	-
	Serranus tigrinus	Gen. carnivores	Harlequin bass	8	8	2
	Hypoplectrus nigricans	Gen. carnivores	Black hamlet	-	1	-
	Hypoplectrus puella	Gen. carnivores	Barred hamlet	-	1	-
Tetraodontidae (13)	*Canthigaster rostrata*	Omnivores	Sharpnose puffer	-	4	9
Total fish abundance in each site (Total MPA: 1575 fish)				335	827	413
Species richness (MPA : 44 species)				23	37	27
Family richness (MPA : 16 families)				9	14	13
Simpson Diversity Index (MPA : 4.8)				4.8	4.0	2.5

Table 7. Reef building coral (Phylum Cnidaria) species recorded in the Molinière-Beauséjour MPA in 2006

Order	Family	Scientific Name	Common Name
Class Anthozoa, Subclass Hexacorallia			
Scleractinia	Agariciidae	*Agaricia agaricites*	Lettuce coral
		Agaricia fragilis	Fragile saucer coral
		Agaricia lamarcki	Lamarck's sheet coral
	Astrocoeniidae	*Madracis decactis*	Ten ray star coral
		Madracis auretenra	Yellow pencil coral
		Stephanocoenia intersepta	Blushing star coral
	Caryophylliidae	*Eusmilia fastigiata*	Smooth flower coral
	Faviidae	*Colpophyllia natans*	Boulder brain coral
		Diploria clivosa	Encrusting brain coral
		Diploria labrynthiformis	Grooved brain coral
		Diploria strigosa	Symmetrical brain coral
		Favia fragum	Golf ball coral
		Manicina areolata	Rose coral
		Montastrea annularis	Boulder star coral
		Montastrea cavernosa	Great star coral
	Meandrinidae	*Dendrogyra cylindrus*	Cathedral or pillar coral
		Dichocoenia stokesii	Elliptical star coral
		Meandrina meandrites	Maze coral
	Mussidae	*Isophyllastrea rigida*	Rough star coral
		Mussa angulosa	Spiney flower coral
		Mycetophyllia danaana	Low ridge cactus coral
	Poritidae	*Porites astreoides*	Encrusting coral
		Porites divaricata	Thin finger coral
		Porites porites	Finger coral
	Siderastreidae	*Siderastrea radians*	Lesser starlet coral
		Siderastrea siderea	Massive starlet coral
Zoantharia	Sphenopidae	*Palythoa caribaeorum*	White encrusting zoanthid
Class Hydrozoa (Hydrocorals), Subclass: Hydroidolina			
Anthoathecata	Milleporidae	*Millepora complanata*	Blade Fire coral

Table 8. Marine sponges (Phylum Porifera, Class Demospongiae) species recorded in 2006 in the Molinière-Beauséjour MPA

Order	Family	Scientific name	Common name
Dictyoceratida	Thorectidae	*Ircinia felix*	Stinker sponge
		Ircinia strobilina	Black ball sponge
Hadromeida	Clionaidae	*Spheciospongia vesparium*	Loggerhead sponge
Halichondrida	Dictyonellidae	*Scopalina ruetzleri*	Orange lumpy encrusting sponge
Haplosclerida	Callyspongiidae	*Callyspongia plicifera*	Azure vase sponge
		Callyspongia vaginalis	Branching vase sponge
	Niphatidae	*Amphimedon compressa*	Erect rope sponge
	Petrosiidae	*Neopetrosia subtriangularis*	Spawling sponge
		Xestospongia muta	Giant barrel sponge
Poecilosclerida	Iotrochotidae	*Iotrochota birotulata*	Green finger sponge
Verongida	Aplysinidae	*Aplysina fistularis*	Yellow tube sponge
		Aplysina fulva	Scattered pore rope sponge
		Verongula gigantea	Netted barrel sponge
		Verongula rigida	Pitted sponge
	Pseudoceratinidae	*Pseudoceratina crassa*	Branching tube sponge

5.1.3. Reef species status

Table 9 lists the species identified in the MPA in 2006 which are on IUCN red list of threatened species (IUCN, 2010). The species with *least concern* status were included in the table only when the population trend was not stable.

Table 9. Species recorded in the Molinière-Beauséjour MPA in 2006 and their global status according to IUCN Red List (version 2010.1).

	Scientific name	Common name	Status	Population trend
Fish	*Balistes vetula*	Queen triggerfish	Vulnerable A2d	(needs updating)
	Lutjanus analis	Mutton snapper	Vulnerable A2d	(needs updating)
	Cephalopholis fulva	Coney / Butterfish	Least concern	Decreasing
	Epinephelus adscensionis	Rock hind	Least concern	Decreasing
	Epinephelus guttatus	Red hind	Least concern	Decreasing
	Hippocampus reidi	Longsnout seahorse	Data deficient	Unknown
	Narcine brasiliensis	Brazilian electric ray	Data deficient	Unknown
	Manta birostris	Giant manta ray	Near threatened	Unknown
	Aetobatus narinari	Spotted eagle ray	Near threatened	Decreasing
Coral	*Agaricia fragilis*	Fragile saucer coral	Data deficient	Unknown
	Agaricia lamarcki	Lamarck's sheet coral	Vulnerable A4ce	Decreasing
	Montastrea annularis	Boulder star coral	Endangered A2ace	Decreasing
	Dendrogyra cylindrus	Cathedral or pillar coral	Vulnerable A4ce	Stable
	Dichocoenia stokesii	Elliptical star coral	Vulnerable A4c	Decreasing
	Mycetophyllia danaana	Low ridge cactus coral	Least concern	Unknown
	Porites astreoides	Encrusting coral	Least concern	Increasing

5.2. Seagrass beds

Main values Seagrasses are aquatic plants that form meadows in near-shore brackish or marine waters in temperate and tropical regions. The seagrass communities of reefs support a high level of biodiversity and are highly productive. Numerous species of reef fish use seagrass as a protective nursery and marine turtles (green and hawksbill) as a feeding and foraging site. Seagrasses also help to control erosion of beaches and shorelines.

Distribution In the Molinière-Beauséjour MPA, a seagrass bed dominated by an exotic invasive species, *Halophila stipulacea* is located in Flamingo Bay at depths over 10 m and only 15 m from the reef[1] (see Figure 4). This seagrass is also found in Dragon Bay at similar depths and in Beauséjour Bay but its fine spatial distribution in the MPA is not documented. A fisherman reports that, approximately 30 years ago, Beauséjour Bay's water was clear and the bay was covered with a large seagrass bed.

A recent survey[1] conducted in the south and southwest coastal areas of Grenada confirmed that *H. stipulacea* had extended its range from seagrass meadows to coral reef ecosystems in Boss Reef. *Halophila stipulacea* is displaying great plasticity in its growth pattern, growing in long vines instead of the typical dense patches. Such vines may have the ability to overrun hard substrate that otherwise would be suitable for the settlement of new corals.

Trend This seagrass, native to the Red Sea, is an exotic invasive species that was recently observed offshore Grenada. Its presence is documented in Dominica and St. Lucia, demonstrating it has spread across part of the eastern Caribbean. In Dominica, populations were concentrated in or adjacent to bays frequented by recreational or commercial boats, likely vectors for the introduction[2] (via anchors).

In Grenada, *H. stipulacea* has a mean lateral bed expansion rate of 0.31 cm/day to 0.42 cm/day[1], which is lower than the rate found in Dominica (0.5 cm/day to a maximum rate of over 6 cm/day). Patches are monospecific, exclusive of the otherwise dominant seagrasses of the Caribbean. The potential for the expansion of *H. stipulacea*, combined with its tolerance for a wide spectrum of environmental conditions, positions it as a potential threat to local and regional biodiversity[2].

Knowledge gap A fine assessment of the distribution of the seagrass in the MPA could be included in future monitoring efforts and future research activities could assess its potential impact on coral reefs and coral settlement.

5.3. Mangrove

Main values Mangroves act as sediment and contaminant filters, are habitat to various species collected by local communities thus contributing to food security, and provide wood that is used for farming structures.

[1] Sharmaine. 2010
[2] Willette and Ambrose. 2009

Distribution A small mangrove is located in Beauséjour, behind the beach berm (see Figure 4. Resource distribution map). Although it is not included within the MPA boundaries, a brief description is provided as the mangrove is connected to the marine environment when the natural beach berm is breached by high flow levels. The description is taken from the Grenada and Grenadines Wetlands Assessment Preliminary report[1].

Status and trend. The mangrove is located at the mouth of a small river at the base of a steep mountainside. The connection with the ocean is blocked by the natural beach berm. At high flow levels, the berm is breached and water floods into the ocean. Because of its location at the base of the steep slopes, the wetland area is relatively confined. There is little or no direct marine influence.

It is described as a geologically isolated basin mangrove, protected by a basalt sand barrier beach. This small basin-type mangrove system lacks a typical fringing *Rhizophora mangle* community, but gains protection from coastal storms from a high beach front formation. It is dominated by *Laguncularia racemosa* but scattered *Avicennia germinans* were observed. A deep pool occurs within the center of the system, collecting freshwater runoff from the steep surrounding topography. Although small and marginal as a true mangrove 'community' *per se*, the system appeared healthy.

Several fish were observed at the site, including mullet (probably freshwater), and a few marine species that are tolerant of low salinity conditions, including needlefish (Belonidae), schoolmaster snapper (*Lutjanus apodus*) and mojarra (*Eucinostomus* sp.). Other fish included freshwater gobies and mullet. The outlook is that it will continue to function as river system with little marine influence.

Knowledge gaps The importance of this small mangrove as a habitat for bird, crustacean or mollusc species should be assessed.

5.4. Marine turtles

Distribution The presence of turtles in the MPA is suggested by anecdotal evidence of turtles nesting on beaches, mostly in Beauséjour (sightings by fishermen and scientists, from interviews). Turtles used to be harvested in Flamingo Bay. Marine turtles nest between April and August and hatching is occurring six weeks later.

Status and trend Three species occur in Grenada: the leatherback turtle (*Dermochelys coriacea*) globally critically endangered, the green turtle (*Chelonia mydas*) globally endangered, and the hawksbill turtle (*Eretmochelys imbricata*) globally endangered. The three species global population trends are decreasing. In Grenada, the leatherback turtle is protected and the exploitation of two other species, the green turtle and hawksbill turtle, is managed through seasonal closure.

Threats Turtles are reportedly hunted all year round and the regulation is not enforced.

Knowledge gaps Although the importance of the MPA as a habitat for marine turtles is not significant, beaches could be patrolled regularly to record signs of turtle crawls and nesting, and provide a reliable estimate of the occurrence of marine turtles in the Molinière-Beauséjour MPA.

[1] Layman et al. 2006

5.A Summary of main natural resource values, status and knowledge gaps

Resources	Main values	Status and long-term trend	Knowledge gaps[1]
Coral reefs	High biodiversity High productivity ecosystem Beach formation Coastal protection from waves and surges	Smothering of corals by algae overgrowth Intense bleaching (30 to 60%) recorded in 2005, mostly for the reef building genera *Agaricia* and *Montastrea* No coral disease recorded in Flamingo bay in 2006 although Yellow Band Disease was recorded in Valley (site in Grenada) Coral damage in Dragon Bay by Hurricane Ivan in September 2004 Local coral coverage improvement in Flamingo Bay	Current coral health and bleaching status Long-term trend of coral reef distribution and species composition Relative importance of the factors affecting coral vs algae prevalence (selective fishing, nutrients) Connectivity and sources of recruitment among coral reefs in the area Knowledge of the coastal currents dynamics to allow the assessment of pollution and siltation threats from various sources, and for understanding the sources of recruitment
Reef fish	High biodiversity	Altered trophic structure (food web): low grazer fish abundance	Long-term trend Factors explaining low grazers abundance other than selective fishing
Mangrove and resources	Sediment and contaminant filter	Small size	Importance as a habitat for bird, crustacean or mollusc species Connectedness with coastal area
Rocky shore	Habitat for intertidal species	Stable	
Seagrass beds	Fish nurseries Marine turtle (Green and hawksbill) feeding and foraging site Erosion control	Monospecific seagrass bed *Halophila stipulacea* invasive exotic species which high expansion rates threaten coral reefs Beauséjour Bay used to be covered with a large seagrass bed (30 years ago)	Assessment of the threat of the invasive seagrass species (*Halophila stipulacea*) to coral reefs or other resources in the MPA and the need to control or eradicate Appropriate method to control the invasive species to avoid dissemination of propagules if control is required (opaque sheets)

[1] Knowledge needed for developing management strategies and actions

Resources	Main values	Status and long-term trend	Knowledge gaps[1]
Sandy beaches	Marine turtles nesting site in Beauséjour (Leatherback) and Flamingo Bays (hawksbill)	Likelihood of disturbance (poaching, egg collection, harassment) due to proximity of the settlements	Importance and consistency of turtles occurrence on MPA beaches

5.B Human use values

5.5. Fisheries resources: Small coastal pelagics

A brief fishery survey was conducted in 2010 to understand the importance of the fisheries resources in the MPA to local communities. The survey took place in the settlements concerned by the Molinière-Beauséjour marine protected area to fill knowledge gaps about the fishery activity to assess its socioeconomic importance to local people. These settlements are: Molinière, Happy Hill, Beauséjour, Brizan, Grand Mal, and Mt. Moritz. Results are presented in Annex 4.

Main values The results of the survey on local fisheries indicate that fisheries resources in the MPA contribute to local communities' food security, and to some degree to the livelihood of a small proportion of households in the neighbouring settlements.

Distribution and abundance Little is known about the distribution and abundance of coastal pelagics in the Molinière-Beauséjour MPA. Fishermen report that jacks are present all year round in Flamingo Bay.

According to the fisheries survey conducted in 2010, local fishermen mainly target tunas, snappers, hind and couvalli jacks (Annex 4, Table 19). When fishermen's estimates are averaged, these fish compose approximately 30% of the catch except for hind which makes up 20% of the catch. Jacks, ocean gars and butterfish are also targeted but to a lesser extent. Jacks and butterfish make up close to half of the catch. There is no relation between main target fishes and price per pound.

The identification of the main types of fish landed on a typical fishing trip by fishermen fishing in the MPA is based on the number of occurrences as main catch species according to fishermen's answers. The main types of fish caught in the MPA are tuna, snapper, hind, couvalli, jack, ocean gar, butterfish, bonita, robin, grunt, and barracuda. It must be mentioned that relatively few fishermen provided information about the catch composition (% of catch). Thus, the information regarding the types of fish caught in the MPA must be interpreted, at best, as indicative.

Trend People with a long experience in the fisheries witness the disappearance of some species that used to occur in the area: rock lobsters, crabs, and herring, or the drastic decline in abundance and diversity of others such as the urchin *Diadema*, spanish mackerel, goat fish, groupers, parrotfish, rock hind, grunt, butterfish, snappers and aquarium fishes, leading to critical fish community changes.

They also witness that the importance of the fishing activity for local communities' livelihood and subsistence is declining potentially due to the depletion of the resources. Reportedly, people used to fish with boats while they now mostly fish from the shore.

Knowledge gap Little is known about the coastal fisheries. The absence of statistics is due to the relatively low economic importance of the activity in this area. Yet, it may hinder the assessment of the impact of a management measure related to the fishing activity on neighbouring communities.

5.6. Secluded bays

Main values The MPA is located close to the capital city, yet distant enough from main ports to offer a quiet place to halt briefly. Dragon Bay, Flamingo Bay and the coastal area around Molinière Point provide opportunities for mooring. There are currently 1 vessel mooring in Molinière Point and 3 vessel moorings in Flamingo Bay. No service is available besides moorings. Moorings are showing some technical problems as they were installed too low in the water which may be convenient for dinghy dive boats but not for larger boats.

5.7. Sandy beaches

Main values The beaches in the Molinière-Beauséjour MPA are especially important for local communities. They provide all year round social and recreation sites regularly used by local communities, mostly on weekends by young men for sports and recreation and also by families for picnic and leisure. Beaches also provide areas suitable for beach seine fishing in Flamingo Bay and in Beauséjour Bay, as well as landing, fishing gear storage and maintenance areas for local fishers.

Although of limited or uncertain importance, it is worth mentioning that beaches in the MPA have been reported as nesting sites for marine turtles: for leatherback turtles in Beauséjour and for hawksbill turtles in Flamingo Bay. The proximity of settlements reduces the suitability of these beaches because of the high likelihood of disturbance from poaching, egg collection, and harassment.

Trend The width of beaches was shown to fluctuate naturally with seasons[1]. The access to the beach in Beauséjour is influenced by the sediment transported by the Beauséjour River and deposited at the mouth of the river. The condition of beaches is also determined by their variable cleanliness and erosion due to human activities. Until recently, beaches were spoiled with litter left by direct users, dumped over cliffs by neighbouring population and as a result of hurricane activity. The most important impact of Hurricane Ivan on beaches is unearthed garbage.

Major underwater and beach cleanup efforts conducted with the collaboration of local people and shops and a local NGO successfully improved beach cleanliness and contributed to develop their ownership. An overview of marine litter data in Grenada highlights the very high contribution

[1] CEAC Solutions. 2006

(76.8%) of shoreline and recreational activities in the composition of the marine litter collected during beach cleanups[i].

Knowledge gaps: The importance of the sand mining issue as well as the importance and consistency of turtles' occurrence on MPA beaches could be assessed as part of the regular monitoring activities in the MPA.

5.8. Rocky shores

Main values Rocky shores are mainly used for subsistence line fishing and thus contribute to food security for local communities. They provide habitat for intertidal species, contribute to coastal protection and to the aesthetical value of the area.

Trend According to Grenada's coast erosion map[1] the littoral in the MPA is not at risk.

5.9. Aesthetic, cultural and recreational resources

Main values Aside from the few areas spoiled by litter, the rocky shores, beaches and cliffs make up a picturesque landscape and offer a nice view from the sea.

The Molinière-Beauséjour MPA offers several opportunities for recreational activities (beaches, coral reefs, wrecks, and underwater sculpture park) while having the advantage of being easily accessible from the capital city and the main touristic area in the country. Beaches and reefs were previously described. A boat wreck with a steel hull is seen at 80 feet below sea level. It harbours beautiful reef fishes and is beginning to be colonized by various species of coral. The underwater sculpture park off Molinière Point is a unique and internationally renowned diving and snorkelling attraction.

The presence of petroglyphs near the Beauséjour River has been reported by a local fisherman. Petroglyphs are one of the few remainders of the Amerindian culture left by indigenous people, the Caribs and the Arawaks, that inhabited the Island up until the French colonized the Island in the 1650's. Some are found in the Mt. Rich area.

Trend There is a certain degradation of underwater sculptures.

5.10. Educational and Research opportunities

The Molinière-Beauséjour MPA is easily accessible from the capital city and from St. George's University which makes it highly practical for field-based studies. The reef area destroyed by Hurricane Ivan, off Molinière Point, and the underwater sculpture park offer opportunities to study coral regeneration and marine colonization.

[1] Sheavily Consultants. 2006

6.B Summary of main human use values, status and knowledge gaps

Resources	Main values	Status and long-term trend	Knowledge gaps[1]
Coral reefs	▪ Diving and snorkelling attraction ▪ Economic value ▪ Educational and research value ▪ The underwater sculpture park offer opportunities to study coral regeneration and marine colonization	▪ Smothering of corals by algae overgrowth ▪ Intense bleaching ▪ Coral damage in Dragon Bay by Hurricane Ivan in September 2004	▪ Users willingness to pay for diving in the MPA ▪ Economic valuation of the reef ecosystem
Reef fish	▪ Livelihood resource for local communities ▪ Fisheries resource / Food security	The number of coastal/artisanal fishermen using the MPA is decreasing	Coastal fisheries statistics
Small coastal pelagics	Fisheries resource /Food security	Some species have disappeared from the area	Coastal fisheries statistics
Secluded bays	▪ Mooring sites ▪ Aesthetical value	12 mooring blocks, 8 with buoys, in the MPA	Level of use (frequency and duration) of moorings
Rocky shore	▪ Subsistence fishing (line and gleaning) ▪ Coastline protection ▪ Aesthetical value	Stable	--
Mangrove and resources	▪ Food security ▪ Wood use (farming structures)		Potential for collecting crustaceans or wood
Underwater sculptures and ship wreck	▪ International diving and snorkelling attraction ▪ Economic value ▪ Research value	Degradation	--
Sandy beaches	▪ All year round social and recreation sites for local communities, mostly sports and recreation for youth and families ▪ Fishing, landing and fishing gear storage and maintenance area for local fishers ▪ Protection to the coastline	▪ Variable (seasonal) width and access for Beauséjour, cleanliness and erosion ▪ Impact of Hurricane Ivan on beaches (unearthed garbage) ▪ Dragon and Beauséjour Bays recovering from heavy sand mining over many years ▪ Small scale sand mining still occurring regularly	--

[1] Knowledge needed for developing management strategies and actions

6. Local communities

This section briefly describes local communities and provides a few elements of a socioeconomic baseline. The main purpose for acquiring socioeconomic information is to assess the relative importance of MPA resources to local communities. The baseline provides indicators that may be used to monitor the effect of the implementation of the management plan.

In the framework of the MPA realization in Grenada project in 2006, a survey documented people's awareness and perceptions of the MPA, their use and willingness to pay. In 2010, a socioeconomic survey was conducted in the settlements concerned by the Molinière-Beauséjour marine protected area to fill knowledge gaps about the communities and their perception and use of the MPA and its resources, and at the same time, to update and complement the 2006 social survey. A total of 160 households were interviewed throughout all settlements. Results are presented in Annex 3.

In order to obtain results that would have been statistically representative of the communities, sample sizes would have had to be larger than what could be realistically achieved in the context. Although actual sample sizes are not statistically representative of the entire population, the results do provide a useful understanding of the population. The SocMon Caribbean[1] guide suggests sample sizes of 25 and 40 for populations of 100 and 200.

6.1. General description

The main settlements bordering the MPA are, from the South to the North, Grand Mal, Mt. Moritz, Molinière, Happy Hill, Beauséjour, and Brizan. Grand Mal and Brizan are located on the coast on either side of the MPA and Mt. Moritz is located higher up the hill, east of Molinière. These three settlements were included in the survey as the population is likely to use the MPA resources or have an impact on it. Population sizes in 2001 (last census) are provided in Table 10. The number of households is estimated assuming that the average household size in Grenada is 4.5 people in 2010[2].

Settlements	Population size according to the 2001 census			Estimated household number
	M	F	Total	
Grand Mal	486	500	986	219
Mt. Moritz	338	376	714	159
Molinière	247	226	473	105
Happy Hill	466	472	938	208
Beauséjour	75	91	166	37
Brizan	32	31	63	14
Total	--	--	3340	743

Table 10. Population sizes and estimated household numbers for the settlements bordering the Molinière-Beauséjour MPA.

[1] Bunce and Pomeroy. 2003

[2] Estimation is from the following site: http://ww2.unhabitat.org/habrdd/conditions/latinamerica/grenada.htm

The settlements bordering the MPA are Molinière, Beauséjour and Happy Hill the largest one. Grand Mal and Mt. Moritz are also important settlements. Housing is mostly sparsely scattered along the main and secondary roads and there are no clear boundaries between settlements.

A similar pattern is found in Gouyave where the government has relocated houses away from the coast after a number of storm surges and tropical storms. Many households moved to surrounding settlements which caused the community to disperse.[1]

Historical elements Some interesting historical events of the turbulent history of Grenada have taken place in the area. The site of Molinière was a military stronghold set up to guard the approaches to Fort Royal in St. George which had been built in 1649 as the first French settlement in Grenada. The remnants of a coastal battery in Molinière bear witness of this period. During the 18th century, when Great Britain was again at war with France in the West Indies, the French forces landed at Molinière Bay and marched to St. George's where Fort George had become the main defence post for the British.

Beauséjour was the second military settlement also established in 1649 by the French and it was frequently attacked by the Caribs who themselves had arrived in Grenada in the 1500's. The Fort Du Marquis was located on the point of the Beauséjour Bay and river. The site was abandoned by the French in 1654 after being ransacked and burnt by the Caribs[2]. By 1753, there were around 100 indigo, tobacco, coffee, cocoa and sugar plantations and up to 12,000 slaves in Grenada. The country was captured by the English in 1763 and taken back by the French in 1779 but then permanently ceded to England by the Traité de Versailles in 1783. Grenada was a British colony until 1974, when it became an independent state.

Molinière was called after a French colonist who owned the area in the 1700's. The settlement was largely inhabited by slaves who worked on root and tuber crops and later on sugar plantations. From Grand Mal to Molinière, the area was occupied by two big sugar plantations and sugar mills. Over Dragon Bay, land use was mostly for ground provision and sugar plantations. Population was mainly concentrated in Happy Hill[3]. Having gained possession of Grenada (1783), the British started importing large numbers of slaves from Africa and the sugar plantations became big business. During the 1795-1796 rebellion, plantations were burnt. After 1800's, people started getting out of slavery which was definitively abolished in 1833 and people concentrated around Flamingo Bay. After the abolition of slave trade, the planters tried to keep the ex-slaves in a system of unpaid apprenticeship and repression. The majority of farmers, though, became independent farmers.

[1] Grant. 2006.
[2] Jessamy M. 1998
[3] Jessamy, M. personal communication

6.2. Molinière-Beauséjour MPA stakeholders

6.2.1. Identification of stakeholders

Primary users are defined as the ones who directly use or depend on the resources for their livelihood, either in situ or by harvesting. **Secondary users** use a particular resource following the direct harvesting or in situ uses. **Partners** include research institutions such as WINDREF at St. George's University, TNC and USAID which contributed to the project through offering training, facilities and resources to support preparatory activities.

Categories	Description	Type	Identification
Local actors	Communities who live and work close to the resources, who use beaches on weekends and holidays	Primary users	Local communities Local schools Volunteers (monitoring, beach cleanups) Local shops
Natural resource users	Local and non-local, direct users for subsistence and income purposes	Primary users	Fishermen
		Secondary users	Southern Fishermen's Association
Businesses and industries	Local and national tourism operators, water users, etc. which benefit significantly from natural resources	Primary users	Divers and diving operators Day charter companies Grenada Scuba Diving Association Marine and Yachting Association of Grenada
National authorities and agencies	Explicit mandate over the territory or resource sector	Implementing partners	Grenada Fisheries Division/ Ministry of Agriculture, Forestry and Fisheries Grenada Board of Tourism/ Ministry of Tourism and Civil Aviation Min. of Environment/ Coastal Zone Management Grenada Ports Authority Grenada Coast Guard MPA Co-Management Committee
NGOs	For professional concerns	Implementing partners	Northwest Development Authority Conservation Grenada? TNC
Research institutions	For professional concerns	Implementing partners	St. George's University SGU / WINDREF CERMES
Donors		Implementing partners	US NFWF USAID

Table 11. Identification of the Molinière-Beauséjour MPA main stakeholders

A socioeconomic survey at the level of households in the neighbouring settlements provides, among other information, a profile of local communities' members (Annex 3). This profile includes information about descriptors such as role of respondent in the household, gender, age group, size of household, number of years of household's presence in settlement, education, primary occupation, and livelihood diversification. Data (means, counts or frequencies) is usually given for each settlement and for the total number of respondents and, for specific questions, for all members of respondents' households.

6.2.2. Stakeholder's awareness, attitude, perceptions and opinions

Besides a profile of communities, the socioeconomic survey at the level of households (presented in Annex 3) provides insight into local communities' level of awareness, their perception of MPA benefits, their perception of MPA resources condition, problems and solutions, their attitude about the MPA and opinions on its management, and perspectives on participation and communication. Finally, respondents had the opportunity to identify matters not addressed in the survey that they wished to stress or get more information about. Main results are outlined in this section but the reader should refer to Annex 3 for a more detailed presentation of results.

Awareness

2010 survey 56% of respondents were aware of the Molinière-Beauséjour MPA. In Beauséjour, most respondents (79%) were aware of the MPA by contrast to Brizan where no more than 14% of respondents knew about it. In the other settlements, the level of awareness varied from 51% to 60% which is rather elevated considering the absence of signage on the coast or on the road.

2006 survey 29% of respondents were aware of the Molinière-Beauséjour MPA.

Perception of MPA benefits

Perception of the Molinière-Beauséjour MPA benefits since its creation in 2001

No answer. A third of respondents do not have an opinion about this and there is a larger proportion who considers the MPA has not brought them any benefit. This proportion is much higher in Brizan than in the other settlements. His opinion is somewhat more positive in Beauséjour and in Grand Mal where a larger proportion of respondents use the area for recreation or for fishing.

Yes Most people who consider that the MPA has been beneficial say that beaches are cleaner and healthier for bathing; fishing is improved; there is less sand mining and resource degradation. Many see that tourism has increased and that fisheries conflicts have reduced.

No Most people who consider that the MPA brings no benefit say that nothing has changed and no revenue is generated for the country. Sand mining goes on as well as drug smuggling. Spearfishing is not controlled and damages corals. Some claim that the use of the area is limited to tourists while local

people's use is restricted.

Perception that the Molinière-Beauséjour MPA will benefit them in the future

People are optimistic about the future benefits of the Molinière-Beauséjour MPA as 79% of respondents believe the Molinière-Beauséjour MPA will benefit them inn the future. This proportion reaches 90% in Beauséjour and in Grand Mal where a larger proportion of respondents acknowledged having benefited from the MPA since its creation.

Respondent's opinion about whether the Molinière-Beauséjour MPA makes any difference to them.

37% of respondents feel the existence of the MPA makes a difference to them while 45 % feel it doesn't. The main reasons why the MPA does make a difference to respondents are related to beaches, general condition of the area, marine life, and economy. Many respondents fear that sand mining would resume. Another frequent comment is that beaches would get dirty and would no longer be suitable for recreation. Respondents who feel it does not make any difference do not use the MPA or say that nothing has changed since its creation. Overall, 11 % of respondents identified non market / non use values related to the existence of the MPA, such as preserving the environment and resources for future generations and for contributing to maintain social harmony and quality of life.

Perception of MPA resources condition, problems and solutions

Beaches are the MPA resource on which most people – 70% – had an opinion. However, taken separately, people from Molinière and Mt. Moritz had little opinion on beaches in contrast to people from Beauséjour. Obviously, people have an opinion on the resources that they directly use or see.

Attitude about the MPA and opinions on its management

Support to the Molinière-Beauséjour MPA

2010 88% of respondents are in support and 3% were not in favour of a MPA in this area (9% did not answer). Respondent's support to the Molinière-Beauséjour MPA in each settlement is in accordance with their opinion about MPA future benefits. Support is total in Brizan, Beauséjour and Grand Mal and very high in Mt. Moritz.

2006 78% of respondents were in support and 22% were not in favour of a MPA in this area

Respondent's opinion on what should be the main purposes of the Molinière-Beauséjour MPA

Similar proportions think that the main purpose of the Molinière-Beauséjour MPA should be fishing and tourism. People from Beauséjour and Grand Mal had a more diverse perspective on the potential purpose of the MPA, including the protection of marine resources and of the coastline, reflecting a higher understanding of the role of a protected area.

A majority of respondents (70%) consider that fishing and tourism can thrive well together in the Molinière-Beauséjour MPA to provide livelihoods.

Most consider there is too little tourism while views about the amount of fishing are more evenly distributed between "just right" and "too little".

Participation and communication

Influence on the management of the Molinière-Beauséjour MPA	Most respondents (67%) think they can have little or no influence at all on the management of the Molinière-Beauséjour MPA. A higher proportion of respondents with a more confident attitude (thinking they can have much / very much influence) are found in Beauséjour and Happy Hill.
Interest in a meeting to present the survey results	A majority of respondents are willing to attend a meeting organized to report back on the results of the survey, which is consistent with the rate of support to the MPA.
Means of communication	Television and radio are the best communication means to pass on information about the MPA to community members.
Representatives	Respondents made recommendations for communities' representatives on a stakeholders group.

Matters that respondents from local communities wished to stress or get more information about:

- Clean beaches
- Information on the MPA and its resources
- Control
- MPA management
- Volunteering
- Signage
- Sense of community
- Development

Perception of main issues

Stakeholders' committee members shared their views during individual interviews about the main issues that should be addressed in the MPA management plan.

Table 12. Main issues highlighted by stakeholder committee members. Asterisks give a relative indication of the number of times the issue was mentioned.

Issues	Description	Suggestions
Awareness and ownership (*****)	Lack of awareness and ownership from users and local communities / Restricted opportunities to develop incentives for local communities to foster their ownership of the MPA	Highlight benefits for local communities Highlight contribution of MPA to the quality of life of local communities and as a recreational area for youths and families Hold public information campaigns on - MPA location - MPA resources and benefits - MPA regulations - Environmental education

Issues	Description	Suggestions
Pollution (****)	Land-based and through watersheds: - Oil spills - Perseverance dump - Plastic - Nutrients from fertilizers - Untreated domestic sewage - Siltation - Litter from MPA users and adjacent settlements	Waste management: - educate people about opportunities for waste reduction and develop recycling - beach cleanups
Fish community alterations (***)	- Loss of biodiversity - Reduced abundance, notably of herbivores - Increased algal cover - Spearfishing impact - Pollution impact - Drastic decline of the urchin *Diadema* sp.	Enforce existing regulations Address pollution problems
Management and enforcement (***)	Illegal activities and open access - Sand mining - Overnight anchoring - Indiscriminate anchoring on reef	- Implement a transparent and operational management - Install additional moorings - Control access - Enforce existing regulations - Install clear signage and landmarks - Communication: issue a notice to charters and publish notices in the monthly publication to disclose MPA location and regulations to all ship owners - Hire a ranger - Involve the coast guard - Impose penalties
User conflicts (**)	Spear fishers vs scuba divers Seine fishers vs charter boats Small outboard boats vs divers (safety)	Zoning
Knowledge management	Information is not easily accessible	Develop a database specific to each MPA that can be accessed freely and searched by all concerned stakeholders
Governance	Local communities are represented in the MPA stakeholder group by fishermen and through a local NGO	Involve local communities more directly and more actively in the MPA stakeholder group
Financial mechanism	Insufficient resources for the implementation of the management plan	Develop a payment system for users
Legislative framework for MPA management	Current law does not allow for collaborative management of MPAs	Revise the legislative framework
Exotic invasive species	Introduction from yachts ballast waters and ships hull	Restrict overnight anchoring
Protection of species	Marine turtles are hunted all year round Seasonal hunting is permitted for 3 species	Enforce existing regulations Ban marine turtle hunting

Issues	Description	Suggestions
Monitoring and research	Collaboration opportunities for monitoring and research - with SGU students - with dive shops and divers for monitoring reef communities	- Establish a MoU with SGU to foster the involvement of students in research and monitoring projects related to the MPA - Develop a monitoring protocol and survey material in collaboration with SGU scientists and dive shop operators

Table 13. Main issues highlighted by respondents in the household survey. Asterisks give a relative indication of the number of times the issue was mentioned.

Issues	Suggestions
Pollution, litter on beaches and nets on the bottom (*****)	- Set up year round cleaning and clean-up campaigns involving youths, - Install bins, - Hire a person for watching and cleaning, - Educate people, - Impose penalties
Sand mining and beach erosion (**)	- Hire a security guard to prevent sand mining and arrest offenders.
Overexploitation or destruction of natural resources (*)	- Control fishing, gear and fishing effort, - Impose penalties for illegal fishing, - Hire a security guard to prevent spear fishing, anchoring on reefs or dynamite fishing, - Educate people.
Insecurity, drug smuggling, and illegal behaviour (*)	- Hire a security guard to stop illegal activities
Lack of development (*)	- Plant trees, - Install additional buoys, toilet facilities and hand rail to facilitate beach access - Sink old boat to create more reef habitat.
Sea surge	- Coastal management – sea defence
Too many rights given to a small number of people	- Ensure equal rights and opportunities to all

7. Resource uses and users

In 2006, in the framework of the MPA Realization in Grenada project, consultations were held with resource users of the Molinière-Beauséjour MPA to identify the resources within the MPA and how these resources were used. The results of these consultations are summarized in the Table 14.

Table 14. Uses of the resources within the Molinière-Beauséjour MPA in 2006.

Resource	Resource Use
Coral reefs	Recreational diving/snorkelling Hook & line fishing (rock fishing) Spear fishing
Seagrass beds	Seine fishing Muck diving
Sandy beaches	Seine fishing Recreational activities
Sand patches	Recreational dive training
Reef fishes	Hook and line fishing (rock fishing) Net fishing Spear fishing Recreational diving/snorkelling
Pelagic fishes	Seine fishing Hook & line fishing (rock fishing)
Demersal fishes	Seine fishing Hook and line fishing
Wrecks	Recreational diving

Socioeconomic and fishery surveys were conducted in early 2010 in the six local communities surrounding the Molinière-Beauséjour MPA (Beauséjour, Molinière, Grand Mal, Happy Hill, Brizan, and Mt. Moritz) to update and complement data collected in 2006, and provide a baseline for management and future monitoring. The results of the household survey are presented in chapters 7 and 8 and detailed in the annex 3 and those of the fishery survey are detailed in the annex 4. The most relevant information is integrated in the following sections on the main types of uses taking place in the Molinière-Beauséjour MPA. The various uses include the legal and illegal activities that take place in the area.

7.1. Coastal fishing

The relative importance of coastal fishing in the Molinière-Beauséjour MPA for local communities was assessed through the socioeconomic household and fishery surveys as no data on fishing effort and catch, costs and revenues/benefits are routinely collected for this type of fishery. The main purpose for carrying out a fishery survey with fishermen using the MB MPA was thus to draw a general picture of the fishing activity in the MPA and provide a baseline for management and future monitoring. Results are presented in Annex 4.

In 2010, coastal fishing in the Molinière-Beauséjour MPA is practiced by 22% of the population from the six surrounding settlements (assuming that respondents are representative of the population). This result is quite different from the 2006 survey findings where 41% of respondents were fishing in the MPA. It is unclear whether this difference reflects an effective decrease within just 4 years or a difference in sampling. Indeed, 32% of respondents in Molinière and in Beauséjour use the MPA for fishing which is a proportion less dissimilar to the observations made in 2004.

Fishery survey

51 fishermen were interviewed; 27 of them (53%) use the MPA for fishing and 24 (47%) fish outside the MPA. Among the fishermen who fish in the MPA, 40% were from Grand Mal, 30% from Beauséjour and 22% from Happy Hill and the other two are from Molinière and from Brizan. Of the 24 fishermen who fish outside the MPA, 19 are from Grand Mal and 5 are from Beauséjour.

Fishermen's role in the fishery. Most frequently, fishermen work as crew, in a higher proportion for fishers who do not fish in the MPA (50%) in comparison with fishers fishing in the MPA (30%). A third of them own their boat (33%) in both groups. A higher proportion of fishers fishing in the MPA work as net men (22%) when compared with fishers who do not fish in the MPA (8%).

By comparison with Grenada and Gouyave[1] fishermen, a higher proportion of fishermen in the area covered by this survey own their boat and the proportion of fishermen who act as crew members is lower. This proportion is similar for fishermen who fish outside the MPA, most likely on larger boats.

Fishermen's profile. Fishermen using the MPA are slightly younger (45 as compared to 49) but have a similar fishing experience (19 as compared to 21 years). Education level for the majority of fishermen in both groups is the primary. By comparison with fishers from Grenada and from Gouyave, a higher proportion has reached the secondary level. The proportion of fishermen who are members of fishermen's groups is also higher in this survey (26%) than in Gouyave (14%). A lower proportion of the fishermen using the MPA (67%) own 1 to 4 boats (average of 1.1 boat) while 88% of fishermen not using the MPA own one boat (average of 0.8 boat).

The most obvious distinctions between the 2 groups are with their boats. For fishermen using the MPA, most boats are made of wood and are powered with an outboard engine from 10 to 85 HP. For fishermen not using the MPA, most boats are made of fibreglass and are powered with an inboard engine of 110 HP (on average) or with an outboard engine from 25 to 285 HP. Half of boats of fishermen using the MPA are parked in various locations within the MPA, the other half in Grand Mal, while most fishermen not using the MPA leave their boat in Grand Mal. Most boats are registered.

Main primary occupation of household members over 16. The results of the socioeconomic survey show a high rate of unemployment, 19.4%, in the settlements surrounding the MPA as compared

[1] Finlay 1990, Grant 2006

with national statistics of 12.5%[1]. This proportion is inflated to some extent as it includes students aged over 16. This proportion is higher in the settlements that are directly adjacent to the MPA, Beauséjour, Molinière and Happy Hill. The proportion of retired persons among all household members is 17.2%.

Most common types of occupation are employee/staff and manual workers. Farming and fishing occupy 7.5% of persons and this proportion is higher in Brizan where 13.3% of household members were farming as their primary occupation (no one was fishing) and in Beauséjour where 13.6% of household members were fishing as their main occupation.

Fishing in the MPA as a livelihood. The fishing activity taking place in the Molinière-Beauséjour MPA is small scale and semi-subsistence and its socioeconomic importance varies from one settlement to another. As an example, 26% of respondents from Beauséjour – where 13.6% of household members are fishing as their main occupation – derive an income from fishing. In the other settlements, most if not all people fish for their own consumption.

For most fishers, fishing grounds include the whole area as well as the closest beach to the fisherman's place. This open access artisanal fishery mostly uses beach seines and hook and line from rocky shores or from boat. The most common types of fish that are caught in the MPA are snapper, butterfish, hind, barracuda, jacks, robin, tuna, and long gar.

Spear fishing is an elusive activity that very few respondents have admitted practising but many report that it is actually taking place in the MPA. This activity is reportedly practiced by outsiders, and not so much by people from adjacent communities but this remains to be verified.

Livelihood diversification among respondents. To maintain and improve their quality of life, households may pursue livelihood diversification strategies to support their household. Diversification of income sources reduces risks such as those related to seasonal and cyclical fluctuations of the natural resources which fishing and farming livelihoods depend on. In the surveyed population around the MPA, 17% of respondents have more than one occupation but fishing is a secondary or third occupation for only 3% of them.

The results of broad socioeconomic surveys in the Caribbean observed that fishers are not homogeneous and may be categorised as full-time or part-time, career or transient. Research in Grenada has distinguished a category of transient fishers who not only engage in fishing on a part-time basis but often remain unattached to a particular boat crew. Fishing is generally linked to the short-term need to secure immediate income.[2]

Fishing activity per gear type by fishermen fishing in the MPA. The fishing gear most used in the MPA is the fishing line, followed by nets and seines. Longlines and bottom lines are mentioned by fishermen but are not used in the MPA. Fishing line strain is variable, high strain lines are more likely used offshore (outside the MPA) to target large pelagic species. Fishing trips/outings duration is

[1] CIA World Factbook. (2000 estimation)

[2] Kishore et al. 2006

variable as well as the average catch. Beach seines are typically used in the MPA and mostly target jacks but also couvalli, robin and bonita. Fishing outings last an average of 3.6 hours (from 2 to 6 hours). Fishermen said they were using nets in the MPA but this assertion might be incorrect due to some confusion about the MPA seaward boundaries.

Favourable weather for fishing. A rather clear pattern emerged for the type of weather, especially for stating that the months of February to June were good weather. However, there was no consistency among respondents about fish landing high/low season when analysed by fish type.

Main types of fish landed on a typical fishing trip by fishermen fishing in the MPA. Fishermen mainly target tunas, snappers, hind and couvalli jacks. These fish are said to compose a third of the catch except for hind which makes up 20% of the catch. Jacks, ocean gars and butterfish are also targeted but to a lesser extent. Jacks and butterfish make up close to half of the catch. There is no relation between main target fishes and price per pound.

Relatively few fishermen provided information about the catch composition (% of catch). The figure in brackets gives the number of answers. Thus values must be interpreted, at best, as indicative.

Marketing arrangements per type of fish (for fishermen using the MPA). About a third of the main catch species (tuna, snapper, hind, couvalli, dolphin fish, jacks and ocean gar) is sold wholesale vendors. Barracudas, grunts and robins which are less frequent catches are sold to wholesale vendors in a higher proportion. Fishermen retain an average of 12% of the catch for their own consumption and tend to retain barracudas, butterfish and swordfish in a higher proportion. Very little is given to family and friends and none is sold to restaurants. Sailfish which is an uncommon catch is sold to retail vendors, as well as butterfish, hind and snapper but in a lower proportion (37% to 55%). Little is directly sold to consumers; only robins which appear to have the lowest price per pound are directly sold to consumers in a proportion of 47%. Flying fish, an uncommon catch, marlin and swordfish are sold to processing plants in a high proportion (68%), as well as dolphin fish, ocean gar and king fish (39% to 45%).

For fishermen using the MPA, selling locations are diverse, the most frequent being the fish market. For other fishermen, half of them sell to fisheries associations, the others to the fish market.

Contribution of MPA fish to local communities' food security. The Molinière-Beauséjour MPA is a source of seafood for 62% of respondents and it is the main source of fish for 40% of respondents' households. This proportion rises to 83% in Brizan and to 68% in Beauséjour. In comparison, seafood form Grenada (outside the MBMPA) is a source of seafood for 80% of the population and the main source of seafood for 59% of the population – imported seafood is eaten by 62% of the local communities but is the main source of seafood for only 1% of them.

7.2. Recreation

Beach recreation is taking place in Dragon, Flamingo and Beauséjour bays, for sport, leisure and family picnics, mostly on weekends and holidays, and occasionally during the week.

The 2010 household survey conducted in neighbouring settlements has shown that 67% of respondents were using the MPA for recreational activities, whether for bathing/swimming, football, or diving. Most respondents from Brizan, Beauséjour, Happy Hill and Molinière (72% to 100%) use the MPA for swimming/bathing while much less people from Grand Mal (39%) and Mt. Moritz (25%) use the MPA for any type of recreational activity. In 2006, the survey had revealed that 52% of respondents were using the MPA for recreational activities. The collaborative efforts to clean beaches and plant trees may have contributed to render this area more attractive, develop ownership and contribute to this increase. Beaches are used by young people from Beauséjour and Happy Hill as a playground to play football. People use the closest beach to their house for their recreational activities.

Diving is a major recreational activity in the MPA which reef has been recognized as exceptional decades ago. The compilation of data on a total of 1,406 dives from 5 dive shops between October 2005 and May 2006 shows that the MPA diving sites accounted for 9.4% to 26.2% of the dives made in all diving sites of Grenada. Diving statistics from June to September 2006, as well as more recent diving data, are available from the dive shops but additional human resources are required to compile statistics.

Month	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06	Apr-06	May-06
%	26.2%	12.4%	9.4%	13.0%	20.2%	14.8%	22.8%	16.2%

Table 15. Proportion of the scuba dives in Grenada from October 2005 to May 2006 that were made in the Molinière-Beauséjour MPA.

Scuba diving in the MPA is mostly practiced in Flamingo Bay where the reef is the main attraction, but people also dive in Dragon Bay, in Grand Mal and on a ship wreck located off Molinière Point.

Snorkelling is mostly practiced in Dragon and Flamingo bays on relatively shallow reefs. The Molinière-Beauséjour MPA is one of the few sites easily accessible and suitable for snorkelling. All day-charter boats, yachts and 4 catamarans organize day snorkelling trips.

Scuba diving is essentially a commercial activity mostly done by tourists but some people from Beauséjour and Molinière also use the area for diving/snorkelling or sailing.

An **underwater sculpture park** sited within the Molinière-Beauséjour MPA is a major and unique attraction for divers. The artist Jason de Caires Taylor installed sixty-five stunning sculptures in an area of 800 sq metres off Molinière Point to create the first underwater sculpture park in the world. The sculptures are sited in clear shallow waters to afford easy access by divers, snorkelers and those in glass-bottomed boats. The site had suffered considerable damage due to hurricanes which destroyed the coral reef and the placement of an artificial structure provided a new base for marine life to proliferate. By using sculptures to create artificial reefs in an area that had suffered damage, the artist wished promoted hope and recovery, and underlined the need to understand and protect the natural world. The sculptures were also designed to create a diversion from other areas of coral reef currently vulnerable to overuse from water activities. The sculptures highlight ecological processes while offering visitors an uncommon opportunity to view modern art in

absolute interaction with its environment. The life span of these sculptures is not known and some of them have showing signs of deterioration. Local private operators are making efforts to maintain this unique asset and to acquire and install new sculptures to keep the area attractive.

Kayaking, canoeing and sailing are occasionally done in the MPA

Tourism operators. The tourism operators who use the MPA include:

- 7 dive shops
- 8 day charter operators possessing 1 to 3 boats each
- 1 glass-bottom boat

Cruising yachts. 4000 yachts/year visit Grenada – of them, approximately 10 yachts per month use the Molinière-Beauséjour MPA. A representative of the Marine and Yachting Association of Grenada is of the opinion that overnight anchoring restrictions will not be a great impediment to yacht people. The permit to access the MPA should include information on zoning and regulations.

7.3. Sand mining

A local fisherman reported that intense sand mining was taking place in Beauséjour around 30 years ago. This beach had the largest sand resource on the west coast of Grenada and many families then lived off the sand resource. This sand mining led to coastal erosion and the coastline receded by 20 to 30 feet within 20 years. An analysis of beach changes in Grenada between 1985 and 1991 showed negative changes due to sand mining: -24% between 1985 and 1988 in the northern part of the beach and of -10% between 1985 and 1990 in the central part.[1] The depletion of the sand put a stop to the activity and, although a few individuals still persist in sand mining, the beach gives signs of recovery since trees planted 20 feet from the shoreline 20 years ago are now 40 feet from the shoreline. The beach in Dragon Bay also was once sand mined to the rock.

7.4. Research and education

WINDREF / SGU The Molinière-Beauséjour MPA is easily accessible from the capital city and from St. George's University which makes it highly practical for field-based studies by students or scientists. The WINDREF Research Institute is based in St. George University. One of its primary goals is to promote international collaborative research in the area of marine biology. In 2005, Dr. Clare Morrall, Director of the Marine Biology Program at SGU and WINDREF Research Fellow was awarded a grant from the US NFWF to implement a 12-month project entitled "Marine Protected Area Realization in Grenada" with the support of Mr Stephen Nimrod, project manager (lecturer in the Marine Biology Program). The aim of this project was the implementation of coral reef protection, using a partnership approach, to develop an adaptive management plan and coral reef monitoring program at the Molinière-Beauséjour MPA. Currently, a moratorium on diving at SGU (for students and faculty) restricts considerably the potential to use national MPAs as living laboratories for marine research and education.

[1] Isaac, C. (1996)

Dr B. Anderson / Wisconsin Lutheran College A small group of scientists and students from the Wisconsin Lutheran College under the supervision of Dr. Bob Anderson have been conducting yearly surveys of the Molinière-Beauséjour MPA coral reef since 2007 in the context of the "Grenada Near Shore Waters Marine Monitoring" project. This project funded by a private donor intends to make a significant contribution to management of Grenada's near shore waters by monitoring corals and associated organisms including fish along the southwest coast of Grenada. They plan to accumulate at least 10 years of data. The team is developing an innovative monitoring protocol that will enhance data collection efficiency by the use of high definition video and high quality digital photography. Two of the sampling areas are in the Molinière-Beauséjour MPA: Flamingo Bay and Dragon Bay.

Dr Ernesto Weil / University of Puerto Rico Flamingo Bay and Dragon Bay are also two of the study sites of Dr Ernesto Weil, a world renowned coral disease expert from the University of Puerto Rico, for his research on the vulnerability of bleached coral to coral diseases in the Caribbean and as part of a global reef assessment. He has been conducting field studies in the Molinière-Beauséjour MPA since 2006.

The Nature Conservancy (TNC), an international conservation organization, has been working in Grenada since 2001, first through the USAID funded "Grenadian Parks in Peril" Program which main goal was to strengthen the conservation effectiveness of the marine protected area system in Grenada and St. Vincent and the Grenadines. TNC is providing support in the areas of conservation planning and management, institutional capacity building, and environmental education through workshops, seminars, training sessions and technical expertise.

7.5. User conflicts

Current user conflicts include:

- Circling seine fishers (targeting schooling fish) and yachts/boat anchoring
- Towing fishermen and seine fishermen
- Spear fishers and divers
- Any boat/marine vehicle with a propeller and divers/swimmers (safety issue)
- Fishermen tying bait sacks to moorings and divers
- Cruising yachts using moorings without permit

Most conflicts and inappropriate fishing/boating practices could be attributable to

- Lack of awareness and enforcement of applicable regulations
- Lack of a coherent set of rules related to each zone in the MPA

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9. Annexes

Annex 1: Gazette notice and proposed boundaries of the protected area

A401

2001 *Fisheries (Marine Protected Areas) Order* *SRO. 77*

GRENADA
STATUTORY RULES AND ORDERS NO. 77 OF 2001

IN EXERCISE OF TH POWER CONFERRED BY SECTION 23 OF THE FISHERIES ACT (CAP. 108) THE MINISTER MAKES THE FOLLOWING ORDER:-

(GAZETTED 28TH December, 2001).

1. This Order may be cited as the

FISHERIES (MARINE PROTECTED AREAS) ORDER, 2001.

2. **Declaration of Marine Protected Areas**: (1) The area of fishery waters delineated in schedule 1, and the foreshore adjacent thereto, is declared to be a Marine Protected Area, to be known as the Woburn/Clarks Court Bay Marine Protected Area and Multi-zone Management System.

   (2) The area of fishery waters declined in schedule 2, and the foreshore adjacent thereto, is declared to be Marine Protected Area, to be known as the Moliniere/Beasejour Marine Protected Area and Multi-zone Management System.

3. **Regulations apply**: For the avoidance of doubt, it is declared that the fisheries (Marine Protected Area) Regulations 2001 apply to the areas delineated in Schedule 1 and 2.

Proposed boundaries

A first delineation and a zoning of the MPA were presented in the schedule No. 2 of the Fisheries (Marine Protected Areas) Regulations (S.R.O. No 77 of 2001). Later, the zoning was deemed impractical and the boundary coordinates were found to be inaccurate.

A new zoning plan was put forward in 2006 as an output of the MPA Realization in Grenada project to replace the zoning in SRO No. 77, 2001, on the basis of additional surveys and information collected from regular users and in consultation with them. This proposed zoning is presented in Figure 8, Section 13.

The coordinates of the seaward boundaries were revised in 2010 and are illustrated in Figure 1. The revised coordinates are, from North to South:

N 12.05.960, W 61.45.160
N 12.05.919, W 61.45.274
N 12.05.674, W 61.45.459
N 12.05.347, W 61.45.725
N 12.05.135, W 61.45.868
N 12.04.961, W 61.45.895
N 12.04.856, W 61.45.790
N 12.04.858, W 61.45.613
N 12.04.887, W 61.45.585

Annex 2. Summary table for contaminant analyses and coastal water quality indicators

Category	Contaminants	Water quality standards (µg/L)			Samples			
					Water (µg/L)[1]		Sediment (µg/g)	
		CEHI [2]	Virgin Is.[3]	Coral reefs[4]	Flamingo	Beauséjour	Flamingo	Beauséjour
Heavy metals	Total lead (Pb)	4.4	8.1	---	< 20	< 20	7	16
	Total cadmium (Cd)	0.7	8.8	---	< 5	< 5	< 0.5	< 0.5
	Total mercury (Hg)	0.1	0.94	---	< 0.02	0.03	0.01	0.04
	Total zinc (Zn)	15	81	---	< 5	< 5	51	106
Bacteria	Fecal coliforms (count/100 ml)	< 200	70	---	17	1	---	---
Nutrients	Total nitrogen	100	narrative	14	50 000	23 000	219	348
	Total Kjeldahl nitrogen	---	1 000	---	710	1 450	219	347
	Nitrates	9.8	narrative	40	20	10	---	---
	Nitrites		narrative	---	3	2	---	---
	Total phosphorus	15	50	3	210	160	249	418
	Soluble phosphates	2.5	---	7	70	180	---	---

[1] Results for water samples are expressed in µg/L unless otherwise stated.

[2] Ambient Water Quality Standard recommended by CEHI

[3] U.S. Virgin Islands Water Quality Standards. Chapter 7. Water Pollution Control. Subchapter 186. Water Quality Standards for Class B Waters: for maintenance and propagation of desirable species of aquatic life and for primary contact recreation (swimming, etc.). Applicable numeric standards for toxic pollutants are EPA'S current national recommended Clean Water Act section 304(a) water quality criteria for the protection of saltwater aquatic life. Values for chronic toxicity to saltwater aquatic life are used as criteria (CCC – Criterion Continuous Concentration).

[4] Standards for coral reefs: Deocadiz and Montaño 1999 for TSS, Global Coral Reef Alliance 2010, Goreau and Thacker 1994, for nutrients

Category	Contaminants	Water quality standards (µg/L)			Samples			
					Water (µg/L)[1]		Sediment (µg/g)	
		CEHI [2]	Virgin Is.[3]	Coral reefs[4]	Flamingo	Beauséjour	Flamingo	Beauséjour
Toxic organic compounds / Pesticide residues	Dichloro Diphenyl Trichloroethane (DDT)	Not detectable using best technology available	0.001	---	< 0.05	< 0.05	---	---
	Benzene hexachloride (BHC)		0.16[1]	---	< 0.05	< 0.05	---	---
	Endosulfan		0.0087	---	< 0.05	< 0.05	---	---
Toxic organic compounds / PCBs	Polychlorinated biphenyls (PCBs)	Arochlor 1242: 0.3 Arochlor 1254: 0.01	0.03	---	< 0.05	< 0.05	---	---
Oil	Oil and grease **(mg/L)**	---	No visible oil film[2]	---	1271	1473	< 100	< 100
	Hydrocarbons (C1-C6)	---	---	---	< 10	< 10	---	---
Other	Total suspended solids (TSS) **(mg/L)**	5	Narrative	3.85	126	128	---	---
	Biochemical oxygen demand (BOD) (mg/L)	---	---	---	< 1	< 1	---	---
	Chemical oxygen demand (COD) (mg/L)	---	---	---	700	630	---	---

[1] Criteria Maximum Concentration is used as no Criterion Continuous Concentration provided.

[2] Surface water must be free from floating petroleum or non petroleum oil

Annex 3. Individual & Household Survey for the Molinière-Beauséjour MPA Management Plan

Methodology

A socioeconomic survey was conducted in the settlements concerned by the Molinière-Beauséjour marine protected area to fill knowledge gaps about the communities and their perception and use of the MPA and its resources, and to assess its socioeconomic importance to local people. These settlements are: Molinière, Happy Hill, Beauséjour, Brizan, Grand Mal, and Mt. Moritz. The socioeconomic survey sampled a total of 161 households among these settlements.

To obtain statistically representative description of the communities, sample sizes should have been larger than what could be realistically achieved in the context of this intervention. For this reason, standard deviations were not calculated and there was no attempt to test the significance of observed differences between settlements. Although actual sample sizes are not statistically representative of the entire population surrounding the MPA, the results provide a useful profile of the local population.

A systematic random sampling method was adopted to maximise chances that data would be representative of the entire group. Households were selected at fixed intervals in proportion to the ratio of the group the sample should represent. The SocMon Caribbean guide[1] suggests sample sizes of 25 and 40 for populations of 100 and 200. The smaller the group, the larger the portion of households that must be interviewed because the smaller the sample size, the greater the effect of biases on the results. The number of households was estimated assuming that the average household size in Grenada is 4.5 people in 2010[2]. Sampling of households was thus planned to ensure a proportional representation of each settlement, based on the population size from the last census and each settlement's representation is given in the table. Some data were about household members, which slightly changed the relative representation of each settlement:

Settlements	Population size according to 2001 census			Estimated household number[a]	Respondents		Respondents' household members	
	M	F	T		Sample size	%	Sample size	%
Molinière	247	226	473	105	25	16	66	16
Happy Hill	466	472	938	208	39	24	99	24
Beauséjour	75	91	166	37	19	11	62	15
Brizan	32	31	63	14	7	4	15	4
Grand Mal	486	500	986	219	40	25	97	23
Mt. Moritz	338	376	714	159	31	19	76	18
Total	--	--	3340	743	161		415	

[1] Bunce and Pomeroy (2003)

[2] Estimation taken from http://ww2.unhabitat.org/habrdd/conditions/latinamerica/grenada.htm

Profile of respondents and their households

			Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Sample size	Respondents		**161**	**7**	**19**	**39**	**25**	**40**	**31**
	Respondents households		**415**	**15**	**62**	**99**	**66**	**97**	**76**
			% of respondents / household members in each group						
Respondent's relationship to the head of the household	Head of household		67	57	53	54	96	68	71
	Wife / husband		12	14	11	10	0	20	13
	Child		13	29	21	15	4	10	13
	Parent		1	0	0	0	3	0	0
	Other relative		7	0	11	18	0	3	3
Average size of households[1]			3	3	3.6	3.5	3.2	3.3	2.7
Average number of years presence of households in each settlement			31	27	23	31	36	27	39
Gender	Male	Respondents	52	57	47	56	52	48	55
		Households	50	40	59	52	45	50	46
	Female	Respondents	44	43	47	39	48	45	42
		Households	49	60	39	46	55	47	53
Age group	Less than 30	Respondents	16	0	21	23	8	17	13
		Households	27	0	32	33	27	28	22
	31-40	Respondents	20	57	26	15	4	30	13
		Households	22	53	30	11	11	30	20
	41-50	Respondents	22	29	11	23	32	23	19
		Households	14	13	8	14	22	14	12
	51-60	Respondents	15	0	16	15	24	18	7
		Households	12	7	8	14	11	16	12
	Over 60	Respondents	26	14	26	23	32	12	45
		Households	17	13	14	15	21	10	27

[1] This value is based on respondents' answers to a question on size of households while the sample size for household members is based on the total number of people in households for which additional information was collected (specific questions of the interview). Based on the average size of households, the total sample size for respondents households should have been higher. The discrepancy between these two values reflects the number of people about whom the information was not provided.

Role of respondent in the household. For the whole survey, two-thirds of respondents were the heads of their household but this proportion reached 96% in Molinière. In the other settlements, most respondents were the spouse or the children of the head of the household. The information collected is thus likely to be exact.

Size of household. The average size of households was 3 persons for all settlements, varying from 2.7 in Mt. Moritz to 3.6 in Beauséjour. This average is the same as the average found in 2006 for fishermen households in Gouyave[1]. These households were established in their respective location for an average of 31 years; this average fluctuates from 23 in Beauséjour to 36 years in Molinière and 39 years in Mt. Moritz.

Gender. Men (52%) were a little more represented than women (44%) among respondents but when considering all household members aged over 16, the ratio (M:F) is 1.02 which is close to the national statistic[2] of 1.08 for total population. The examination of this ratio for each settlement however shows that this ratio is different in Beauséjour where men represent 59% of household members and in Brizan and Molinière where women represent 60% and 55% of household members. Gender was not written down for 4% of respondents.

Age groups. The age groups over 40 years and especially over 60 years among respondents are over-represented by comparison with their proportion among household members – this is most likely due to the fact that interviewers requested to hold the interview as much as possible with the head of the household. The comparison of the age group distribution in the samples with the national statistics (0-14: 25.8%, 15-64: 65.4%, >65: 8.8%) shows a higher proportion of individuals >60 years old, even when proportions are corrected to take into account the fact that the 0-15 age group was not included in the survey. The prevalence of elders is more pronounced in Mt. Moritz and in Molinière where the age group >60 represents 27% and 21% of household members.

[1] Grant S. 2006

[2] CIA World Factbook. (2010 estimation)

Education			Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Sample size	Respondents		161	7	19	39	25	40	31
	Respondents households		415	15	62	99	66	97	76
			% of respondents / household members in each group						
Highest level of education attained	Primary	Respondents	58	29	63	67	64	58	45
		Households	50	53	45	55	55	51	41
	Secondary	Respondents	26	43	32	15	0	30	29
		Households	38	33	47	34	33	43	36
	Technical	Respondents	12	29	5	10	12	10	19
		Households	8	13	5	8	8	4	12
	University	Respondents	3	0	0	5	4	0	3
		Households	4	0	2	2	5	1	11

Education. The difference between households and respondents level of education is most likely attributable to the fact that respondents belong to older age groups. On average, 50% of household members have attended the primary school level and 38% have attended the secondary school. The most conspicuous difference among settlements is the higher proportion of people who have reached the post-secondary/technical level in Brizan (13%) and in Mt. Moritz (12%) and the university level in Mt. Moritz (11%).

Primary occupation		Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Sample size	Respondents' households[1]	415	15	62	99	66	97	76
		% of respondents and other household members in each group						
Main primary occupations of respondents and household members	Farmer / Fisher	7.5	13.3	13.6	4.3	7.5	3.9	9.2
	Trader/ Business manager	8.9	10.0	6.8	6.5	7.5	9.2	13.8
	Executive/ Higher management	1.4	3.3	2.3	0.0	0.0	0.0	4.6
	Intermediate professional	8.0	10.0	0.0	9.7	1.9	9.2	13.8
	Employee /Staff	17.2	6.7	11.4	24.7	20.8	19.7	9.2
	Manual worker	18.3	16.7	22.7	14.0	18.9	26.3	12.3
	Self-employed	2.2	3.3	0.0	1.1	1.9	3.9	3.1
	Pensioner	17.2	30.0	15.9	17.2	13.2	9.2	24.6
	Unemployed	19.4	6.7	27.3	22.6	28.3	18.4	9.2

[1] Respondents' households include respondents and other household member aged over 16.

Main primary occupation of household members over 16. These data are illustrated in Figure 7. Results show a high rate of unemployment, 19.4%, in the settlements surrounding the MPA as compared with national statistics of 12.5%[1]. This proportion is inflated to some extent as it includes students aged over 16. This proportion is higher in the settlements that are directly adjacent to the MPA, Beauséjour, Molinière and Happy Hill.

The proportion of retired persons among all household members is 17.2%. This proportion reaches 30% in Brizan (which may not be significant due to the low sampling size) and 24.6% in Mt. Moritz where it is consistent with the high proportion of persons aged over 60.

Most common types of occupation are employee/staff and manual workers. Farming and fishing occupy 7.5% of persons and this proportion is higher in Brizan where 13.3% of household members were farming as their primary occupation (no one was fishing) and in Beauséjour where 13.6% of household members were fishing as their main occupation.

Livelihood diversification among respondents. To maintain and improve their quality of life, households may pursue livelihood diversification strategies to support their household. Diversification of income sources reduces risks such as those related to seasonal and cyclical fluctuations of the natural resources which fishing and farming livelihoods depend on. 17% of respondents have more than one occupation and fishing is a secondary or third occupation for 3% of them.

	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents	7	19	30	25	40	31
People having more than one occupation	0	4 (21%)	6 (20%)	5 (20%)	6 (15%)	7 (22%)
People having occupations related to fishing or farming	No one is fishing or farming	3 are fishing as 1st occupation (≥ 50% of time)	1 is fishing and 3 are farming as 1st occupation	3 are farming as 1st occupation 1 is fishing as 3rd occupation	4 are fishing as a 2nd occupation (10 to 50% of their time) 1 is farming as 1st occupation and 1 is fish vendor	5 are farming as 1st or 2nd occupation No one is fishing

[1] CIA World Factbook. (2000 estimation)

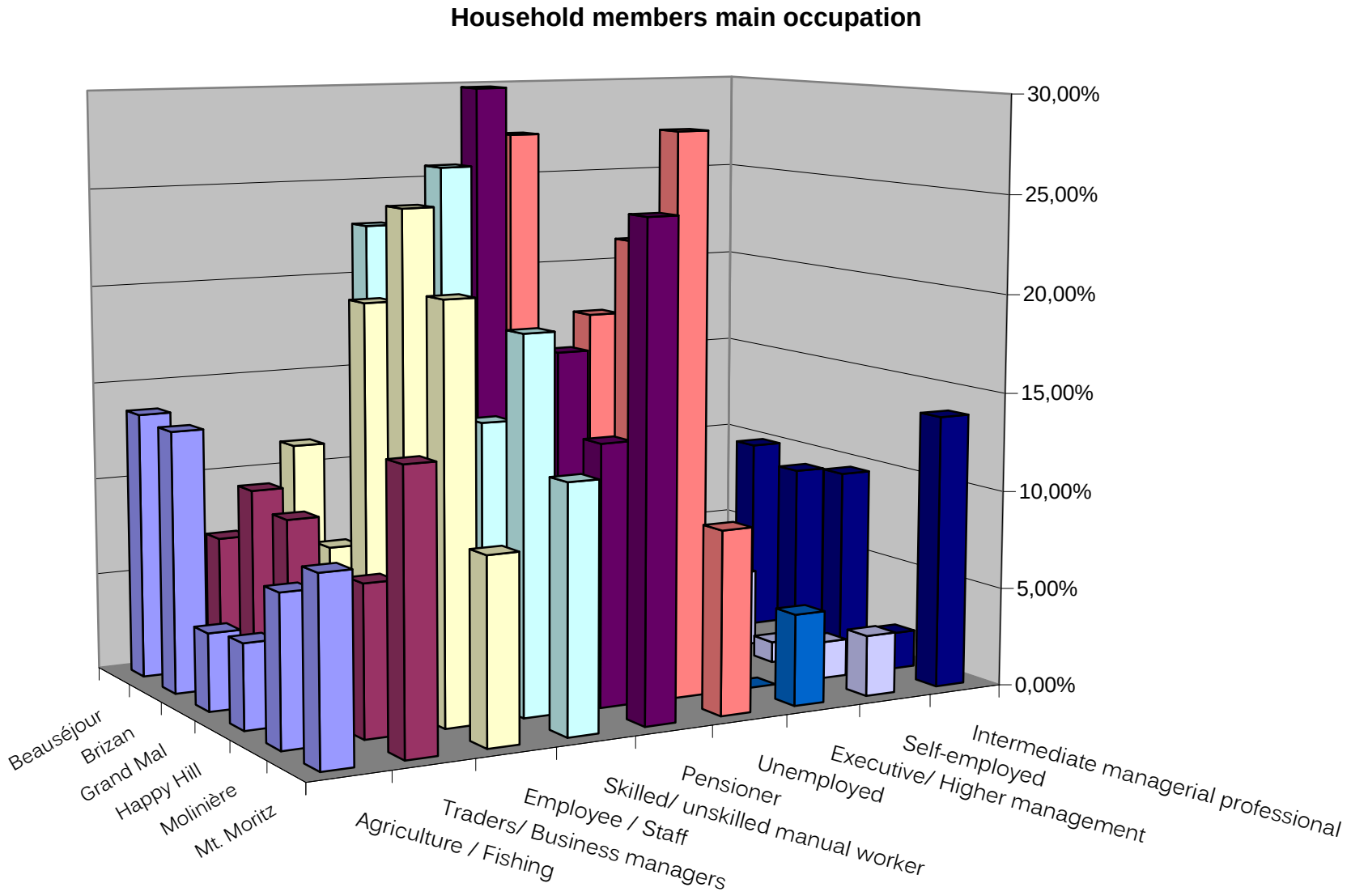


Figure 7. Household members' main occupation

Use of MPA and resources

Activities done by household members in the Molinière-Beauséjour Marine Protected Area and along its coast for work or recreation

Settlement	Nb resp.	% people who carry on these activities in MB MPA				Fishing		Location of activities	
		Swim/bathe	Football	Dive/snorkel /sail	Fishing	Type of fish caught	% people who derive an income	Swimming and others	Fishing grounds
Total	161	67	5	2	22		9		
Brizan	7	100			14	-	0	Rock City Beach and various places	Whole area
Beauséjour	19	89	17	17	32	Snapper Hind Butterfish Jacks Robin Barracuda	26	Mostly Beauséjour	Mostly whole area and Beauséjour
Happy Hill	39	83	13		18	Butterfish Long gar	0	Mostly Flamingo Bay	Flamingo Bay and whole area
Molinière	25	72		8	32	Snapper Butterfish Jacks	8	Mostly Dragon Bay	Dragon Bay and whole area
Grand Mal	40	39	5		24	Snapper Butterfish Tuna	10	Dragon Bay and Grand Mal	Whole area and Dragon Bay
Mt. Moritz	31	25			13	Butterfish Hind Snapper Barracuda	6	Mostly Dragon Bay	Mostly Dragon Bay
2006 survey	79	52			41				

Recreation. Most respondents from Brizan, Beauséjour, Happy Hill and Molinière use the MPA for swimming/bathing while much less people from Grand Mal and Mt. Moritz use the MPA for any type of recreational activity. Beaches are used by young people from Beauséjour and Happy Hill as a playground to play football and some people from Beauséjour and Molinière also use the area for diving/snorkelling or sailing. People use the closest beach to their house for their recreational activities.

Fishing. 22% of respondents from all surrounding settlement fish in the MPA. This result is quite different from the 2006 survey findings where 41% of respondents were fishing in the MPA. It is unclear whether this difference reflects a real diminution in only 4 years or a difference in sampling. Indeed, 32% of respondents in Molinière and in Beauséjour use the MPA for fishing which is a proportion less dissimilar to the observations made in 2004. 26% of respondents from Beauséjour derive an income from fishing. In the other settlements, most if not all people fish for their own consumption. People mostly use the whole area and the closest beach to their place for fishing. The most common types of fish caught are snapper, butterfish, hind, barracuda, jacks, robin, tuna, and long gar.

Contribution of MPA fish to local communities' food security

		Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz	Total
Average number of meals in a typical week that include seafood		3	3.5	2.8	3	2.7	2.7	2.9
	Rank	Proportion of respondents who consume fish from various locations						
Seafood from MBMPA	1st	83	68	35	38	43	14	40
	2nd	0	21	16	29	14	31	20
	3rd	0	5	3	0	0	3	2
	Total	83	94	54	67	57	48	62
	Not using	17	5	46	33	43	52	38
Seafood from Grenada outside the MBMPA	1st	17	32	62	58	54	86	59
	2nd	0	32	16	34	22	14	20
	3rd	0	0	3	0	0	0	1
	Total	17	64	81	92	76	100	80
	Not using	83	37	19	8	24	0	20
Imported seafood	1st	0	0	3	4	0	0	1
	2nd	0	42	32	17	22	31	27
	3rd	0	42	22	58	27	38	34
	Total	0	84	57	79	49	69	62
	Not using	100	16	43	21	51	31	38

On average, respondents' families consume three meals a week that include sea food. This frequency is slightly higher in Beauséjour where a higher proportion of the population goes fishing.

The data in this table highlight the relative importance of the Molinière-Beauséjour MPA resources for the neighbouring communities' food security as compared with fish from around Grenada, outside from the MPA, and imported fish. The Molinière-Beauséjour MPA is a source of seafood for 62% of respondents and it is the main source of fish for a majority of the respondents living in Brizan and Beauséjour. 80% of respondents consume fish from Grenada (outside the MBMPA) which is the main source of fish for respondents living in Mt. Moritz, Happy Hill, Molinière and Grand Mal. Imported fish is used by 62% of respondents but mostly as a third or second source of seafood.

Awareness of Molinière-Beauséjour MPA

		Total 2010	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz	2006 survey
Nb respondents		**161**	**7**	**19**	**39**	**25**	**40**	**31**	**79**
% of people aware of MB MPA before survey	Yes	56	14	79	51	60	53	58	**29**
	No	44	86	21	49	40	47	42	**71**
Year of 1st hearing of Molinière-Beauséjour MPA (%)	2000-2001	18	-	47	5	7	19	17	
	2002-2006	11	-	13	10	-	14	16	
	2007	16	-	7	5	33	19	17	
	2008	17	-	-	15	27	14	28	
	2009	22	-	20	35	7	28	17	
	2010	1	-	-	-	7	-	-	
	No answer	15	100	13	30	20	5	5	
% people aware of MB MPA collaborative management group	Yes	5	0	11	0	12	7	0	
	No	85	100	63	87	76	90	94	
	No answer	10	0	26	13	12	3	6	
Year of 1st hearing of management group (nb of persons)	2001-2002	2	-	1	-		1		
	2007-2008	4	-		-	2	2		
	No answer	2	-	1	-	1			

When a survey was conducted in 2006 in the context of the MPA Realization in Grenada project, only 29% of respondents were aware of the Molinière-Beauséjour MPA. In 2010, this proportion had risen to 56%. In Beauséjour, most respondents (79%) were aware of the MPA by contrast to Brizan where no more than 14% of respondents knew about it. In the other settlements, the level of awareness varied from 51% to 60% which is rather elevated considering the absence of signage on the coast and on the road.

The respondents from Beauséjour were also the first to hear about the MPA, half of them knew about the MPA the year the MPA was created and the preceding one. Public consultations were held to define the MPA boundaries prior to its creation and it is likely that they mostly took place where the fishing activity was concentrated. In the other settlements, most people heard about the MPA between 2007 and 2009, a little earlier in Molinière than in the other places.

This awareness also applies, but to a lesser degree, to the existence of a collaborative management group. A small percentage of respondents in Beauséjour, Molinière and Grand Mal were aware of this group and had heard about it in 2001-2002 (when the co-management group was established) or in 2007-2008.

Only 5 respondents, all fishermen, had previously participated in a meeting or workshop organized by the Fisheries Division to give their input into matters related to the Marine-Beauséjour Marine protected area. They did not specify for what matters their input had been solicited. The vast majority of respondents said they had not participated because they were not aware of or had not been invited to any meeting related to the MPA.

Perception of MPA benefits

Proportion (%) of people who consider that the Molinière-Beauséjour MPA has been beneficial to them since its creation in 2001

	Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents	164	7	19	40	25	41	32
No	39	71	42	39	32	48	23
Yes	30	29	42	25	20	37	29
No answer	31	0	16	36	48	15	48

No answer. A third of respondents do not have an opinion about this and there is a larger proportion who considers the MPA has not brought them any benefit. This proportion is much higher in Brizan than in the other settlements. His opinion is somewhat more positive in Beauséjour and in Grand Mal where a larger proportion of respondents use the area for recreation or for fishing.

Yes Most people who consider that the MPA has been beneficial say that beaches are cleaner and healthier for bathing, fishing is improved; there is less sand mining and resource degradation. Many see that tourism has increased and that fisheries conflicts have reduced.

No For the people who consider that the MPA brings no benefit, most say that nothing has changed, nothing is happening and no revenue is generated for the country. It was mentioned that sand mining goes on as well as drug smuggling, and some claim that the use of the area is limited to tourists while local people's use is restricted. Spearfishing is not controlled and damages corals.

Proportion (%) of people who believe that the Molinière-Beauséjour MPA will benefit them in the future

	Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents	164	7	19	40	25	41	32
No	8	14	0	8	20	3	10
Yes	79	86	90	74	60	90	77
No answer	13	0	10	18	20	7	13

People are optimistic about the future benefits of the Molinière-Beauséjour MPA as 79% of respondents believe the Molinière-Beauséjour MPA will benefit them inn the future. This proportion reaches 90% in Beauséjour and in Grand Mal where a larger proportion of respondents acknowledged having benefited from the MPA since its creation.

Yes. The reasons underlying the widespread positive attitude of people give insight into their expectations towards future benefits associated with the Molinière-Beauséjour MPA. Everywhere, the highest expectation is that the MPA will bring in employment opportunities. Comments show a shared concern for children and future generations. Other general expectations include preservation of marine life and fisheries resources for future generations, the enjoyment of healthier and cleaner beaches, improved fishing for food and livelihood, and higher national revenues from increased tourism. The prevalent optimism is somewhat moderate in Molinière where only 60% of respondents answered positively.

No. Most people who do not expect benefits from the MPA did not explain why; one said that the area is used as a dump.

Respondent's opinion (% of respondents) about whether the existence of the Molinière-Beauséjour MPA makes any difference to them.

	Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents	164	7	19	40	25	41	32
Yes	37	29	42	28	48	28	51
No	45	71	42	41	44	58	29
No answer	18	0	16	31	8	14	20

Yes. The main reasons why the MPA does make a difference to respondents are related to beaches, general condition of the area, marine life, and economy. Many respondents fear that sand mining would resume. Another frequent comment is that beaches would get dirty and would no longer be suitable for recreation. Respondents expect that people will do as they want, create problems and deteriorate the area. There is a belief that if the area is protected, people will use it more carefully. Respondents worry that the marine life would get more exposed to pollution and overexploitation and deteriorate, and that reefs would get damaged. A few respondents stress the need to protect and sustain natural resources. Respondents are also concerned about the fact that the area would get less attractive for tourists which would have a negative impact on income generation. A few respondents complained about fishing restrictions. Overall, 11 % of respondents had a concern for non market / non use values, such as preserving the environment and resources for future generations and for contributing to maintain social harmony and quality of life.

No. The reasons why the MPA does not make a difference to some are due to the fact that they do not use the area or have no interest for it. Some consider that the protection status does not make any difference: people fish, bathe and everything remained the same. A few made the observation that the area was filthy even if it was protected.

Main problems observed by respondents with the marine resources in the Molinière-Beauséjour MPA and solutions they recommend

Nature of problem	Nb of respondents who observed the problem (n=161)	Recommended solutions
Pollution, litter on beaches and nets on the bottom	47	- Set up year round cleaning and clean-up campaigns involving youths, - install bins, - hire a person for watching and cleaning, - educate people, - impose penalties
Sand mining and beach erosion	18	- Hire a security guard to prevent sand mining and arrest offenders.
Overexploitation or destruction of natural resources	10	- Control fishing, gear and fishing effort, - impose penalties for illegal fishing, - hire a security guard to prevent spear fishing, anchoring on reefs or dynamite fishing, - educate people.
Insecurity, drug smuggling, and illegal behaviour	10	- Hire a security guard to stop illegal activities
Lack of development	9	- Plant trees, - install additional buoys, toilet facilities and hand rail to facilitate beach access - sink old boat to create more reef habitat.
Sea surge	4	- Coastal management – sea defence
Too many rights given to a small number of people	1	- Ensure equal rights and opportunities to all

The same problems and similar solutions were given in the same proportion by respondents from all settlements and the most frequent ones are related to the resources that they use most: the beach and fishery resources. The problem of inequity was underlined by only one respondent but nonetheless deserves attention in a context where local communities' involvement is sought for the management of the protected area.

Perception of MPA resources condition, problems and solutions

Respondents' perception of the evolution of the condition of Molinière-Beauséjour MPA resources based on familiar locations between 2000, 2005 and 2010 (% respondents).

All settlements (n=161)

Beaches	Ten years ago 2000	Five years ago 2005	Today 2010
very good	29.2	5.0	7.5
good	30.4	31.1	21.7
neither good nor bad	5.6	22.4	25.5
bad	0.6	9.9	12.4
very bad	0.6	1.2	5.0
no opinion	33.5	30.4	28.0

Seagrass beds	Ten years ago 2000	Five years ago 2005	Today 2010
very good	5.6	2.5	3.1
good	14.3	8.7	6.8
neither good nor bad	4.3	13.0	11.2
bad	1.9	1.2	1.9
very bad			2.5
no opinion	73.9	74.5	74.5

Coral reefs	Ten years ago 2000	Five years ago 2005	Today 2010
very good	4.3	1.2	1.9
good	14.9	9.9	6.2
neither good nor bad	7.5	14.3	14.9
bad	0.6	1.9	1.2
very bad		0.6	1.9
no opinion	72.7	72.0	73.9

Shallow reef fisheries	Ten years ago 2000	Five years ago 2005	Today 2010
very good	23.6	3.7	5.0
good	17.4	23.0	10.6
neither good nor bad	7.5	18.0	14.9
bad	0.6	2.5	12.4
very bad		0.6	7.5
no opinion	50.9	52.2	49.7

Offshore, deep water, fisheries	Ten years ago 2000	Five years ago 2005	Today 2010
very good	21.1	6.8	5.6
good	13.7	21.7	14.3
neither good nor bad	5.6	11.8	12.4
bad	0.6	0.6	7.5
very bad			2.5
no opinion	59.0	59.0	57.8

Beaches are the MPA resource on which most people – 70% – had an opinion. However, taken separately, people from Molinière and Mt. Moritz had little opinion on beaches in contrast to people from Beauséjour. Obviously, people have an opinion on the resources that they directly use or see. Consequently, 74% of respondents had no opinion on seagrass beds, 73% had no opinion on coral reefs, 59% had no opinion on deep fisheries and 51% had no opinion on shallow reef fisheries.

Among the people who had an opinion, most saw a degradation of resources, especially of fisheries resources, from very good/good to neither good nor bad/bad. Some people also observed a degradation of the condition of coral reefs and seagrass beds from good to neither good nor bad between 2000 and 2005. The most pronounced deterioration of beaches is also reported between 2000 and 2005.

Attitude about the MPA and opinions on its management

People's support of a MPA in this area (% respondents)

	2010 Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz	2006 survey
Nb respondents	164	7	19	40	25	41	32	79
No	3	0	0	8	8	0	0	22
Yes	88	100	100	77	76	98	87	78
No answer	9	0	0	15	16	2	13	0

2010 Respondent's support to the Molinière-Beauséjour MPA in each settlement is in accordance with their opinion about MPA future benefits. Support is total in Brizan, Beauséjour and Grand Mal and very high in Mt. Moritz. Only in Molinière and Happy Hill were a few respondents (8%) clearly not supporting the MPA or not answering the question which is consistent with the rates found for the previous question.

2006 When the same question was asked in 2006 in the context of the MPA Realization in Grenada project, 22% of respondents were not in favour of a MPA in this area and this proportion has now dropped to 3% over the whole area.

Respondent's opinion on what should be the main purposes of the Molinière-Beauséjour Marine Protected Area

Settlement	Whole area	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents	164	7	19	40	25	41	32
	% of respondents who consider the following should be one of the main purposes of the MB MPA						
Fishing	43	71	37	58	36	46	25
Tourism	44	43	16	48	48	50	47
Recreation / socialization	15	29	-	20	20	15	12
Swimming / bathing	15	57	21	22	12	7	3
Protection of marine resources / coastline	8	-	16	-	4	15	9
Diving /snorkelling	4	-	11	10	-	2	6
Everything for everyone	2	-	5	5	-	2	3
Development	1	-	5	5	-	-	-

Interestingly, similar proportions of respondents think that the main purpose of the Molinière-Beauséjour MPA should be fishing and tourism. People from Beauséjour and Grand Mal had a more diverse perspective on the potential purpose of the MPA, including the protection of marine resources and of the coastline, reflecting a higher understanding of the role of a protected area.

The following purposes were also identified by one respondent

- in Beauséjour: for family picnics, for keeping big boats away;
- in Happy Hill: for yachting, planting trees, sand exploitation and marine port;
- in Grand Mal: for controlling fisheries.

People's opinion about the potential for fishing and tourism thriving well together in the Molinière-Beauséjour MPA to provide livelihoods (% respondents).

	Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents	164	7	19	40	25	41	32
Yes	70	43	95	67	52	75	71
No	15	43	5	15	16	13	19
No answer	15	14	0	18	32	12	10

A majority of respondents (70%) consider that fishing and tourism can thrive well together in the Molinière-Beauséjour MPA to provide livelihoods. The proportion of positive answers is highest in Beauséjour but moderate in Brizan and Molinière.

Yes. The suggestions made by respondents who consider that tourism and fishing can both contribute to provide livelihoods to local communities may be summarized as follows:

- Fishermen could sell fish to yachts and to tourists, directly or through seafood restaurants
- During the low season, fishers could take tourists on tours, for diving or for fishing as a recreation, and educate them on fish and fishing,
- Beaches could be developed and enhanced by planting trees and increasing security.

No. The reasons given by the respondents who consider that tourism and fishing cannot thrive well together in the Molinière-Beauséjour MPA to provide livelihoods are summarized in these two opposing views:

- Tourism interferes with fishing and does not provide any benefit to locals,
- Fishing should not be allowed in this area to preserve marine life.

People's opinion about the amount of fishing and tourism in the whole Molinière-Beauséjour MPA (% respondents)

		Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents		164	7	19	40	25	41	32
Tourism	Too much	13	0	0	18	16	22	3
	Just right	30	71	5	39	28	30	26
	Too little	57	28	95	43	56	48	71
	No answer	0	0	0	0	0	0	0
Fisheries	Too much	5	0	5	0	4	8	10
	Just right	36	29	26	44	36	50	16
	Too little	36	57	53	46	40	20	26
	No answer	23	14	16	10	20	22	48

Everyone has an opinion on the amount of tourism while 23% of respondents did not have an opinion about the amount of fishing that should take place in the MPA, which might reflect the fact that fisheries is more sensitive issue. A higher proportion of respondents consider there is too little tourism, and this view is more pronounced in Beauséjour and in Mt. Moritz. A lower proportion thinks there is

just enough tourism and only a few see it as excessive. Views about the amount of fishing are more evenly distributed between "just right" and "too little". As for tourism, very few consider fishing as being excessive in the Molinière-Beauséjour MPA.

People's opinion on fishermen capacity to work together among themselves to solve fishery problems in the marine protected area (% respondents)

	Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents	**164**	**7**	**19**	**40**	**25**	**41**	**32**
Yes	60	43	90	56	36	63	64
No	22	57	5	13	20	32	26
No answer	18	0	5	31	44	5	10

A majority of respondents are confident of fishermen's capacity to manage fisheries problems among themselves and this positivism is particularly strong in Beauséjour (90%). It is worth noting that 44% of respondents in Molinière and 31% in Happy Hill did not answer this question.

Yes. The numerous suggestions made by respondents who are positive about fishermen's capacity to solve fisheries problems on their own may be summarized as follows:

- Communication, meeting, and sharing ideas,
- Seek unity through the formation of a group and learning to work together,
- Identify leaders and those who are knowledgeable,
- Intergenerational knowledge transfer, including the respect for nature.

No. The reasons given by the respondents who think that fishermen cannot agree to solve fisheries problems on their own are as follows:

- Fishermen's individualism and reluctance to cooperate,
- Fishermen need assistance from the Government for specific issues,
- Age differences among fishermen are a constraint,
- External influence is required to motivate people

Participation and communication

Amount of influence that respondents feel they can have on the management of the Molinière-Beauséjour MPA (% respondents)

	Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents	164	7	19	40	25	41	32
Very much influence	6	0	5	5	4	8	7
Much influence	6	0	16	10	4	0	3
Some influence	18	29	11	10	12	28	23
Little influence	34	71	42	33	44	15	36
No influence at all	33	0	21	36	28	45	32
No answer	4	0	5	5	8	5	0

Most respondents (67%) think they can have little or no influence at all on the management of the Molinière-Beauséjour MPA. A higher proportion of respondents with a more confident attitude (thinking they can have much / very much influence) are found in Beauséjour and Happy Hill.

Respondent's willingness to attend a meeting where the results of the survey would be presented (% respondents)

	Total	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents	164	7	19	40	25	41	32
Yes	83	100	95	82	64	88	84
No	10	0	5	10	16	10	10
No answer	7	0	0	8	20	2	6

A majority of respondents are willing to attend a meeting organized to report back on the results of the survey, which is consistent with the rate of support to the MPA.

Best way to pass on information about the Molinière-Beauséjour MPA to communities' members (% of respondents who identified these means of communication)

	Television	Radio	School	Workplace	Flyers/posters	Newspapers	Local liming spot	Organization	Other
Total	76	62	1	2	8	9	9	4	14

Television and radio are the best communication means to pass on information about the MPA to community members. The category "Other" is through phone calls and email, meetings in the community, youth groups, church groups and local development committees. Local liming spots are the Brizan square in Brizan, the seawall in Beauséjour, the ice cream parlor and Ms Emily Joseph's shop in Happy Hill, Ms Margaret's shop in Molinière, Ms Yvonne's shop in Grand Mal, and the Footsy bar in Mt. Moritz.

Recommendations for communities' representatives

Respondents have recommended a few members of the communities as representatives of local communities in the collaborative management group for the Molinière-Beauséjour Marine Protected Area, to speak on behalf of local communities and convey their concerns and priorities. The table presents the names that were recommended at least twice.

	Brizan	Beauséjour	Happy Hill	Molinière	Grand Mal	Mt. Moritz
Nb respondents	7	19	40	25	41	32
Suggestions and number of respondents who made these suggestions	Keith Mitchell (2)	Keith Mitchell (2)	Dottin Malachi (3)	Dottin Malachi (3)	Alvin Searles (8)	Nicholas Harris (8)
	Zingo (2)				Augustine Jones (5)	Lionel Goddard (7)
					James Nicholas (3)	Byron Campbell (4)
					Sharon Martin (2)	Nigel Metford (2)

Matters not addressed in the survey that respondents wished to stress or get more information about

Responses may be summarized and grouped into the following 8 issues:

1. **Clean beaches.** Beaches, rivers and the whole area must be cleaned and kept clean and beach access should be improved to make the area safer and more enjoyable for local people, especially for elders, and to attract tourists. More trees should be planted. Youths should get involved in this chore.

2. **Information on the MPA and its resources**. People wish to know more about the MPA and its resources and understand what benefits it provides to local communities. They request more public education on sustainable use and protection of the area and its resources. Many wish to see the underwater sculpture park. In two settlements, a return on the information collected through the surveys conducted in 2010 was requested.

3. **Control**. Everywhere, people demand more control in the MPA to stop people from degrading the area. People wish the MPA were more renowned, respected and protected through a better enforcement of laws and regulations. Some say that fishing should be controlled and that sanctions for fishing illegal sizes should be more severe while others think that more control is needed to keep boats away from net setting areas and that MPA management should be more present on site to support fishermen. Many think that a beach patrol is needed to prevent drug smuggling in the area.

4. **MPA management**. Many questions were about the MPA management: what and when? People wish to have more information on the MPA management, MPA restricted areas and restrictions, dos and don'ts, what sanctions will be applied and when restrictions will be effective.

5. **Volunteering.** People wish to volunteer in the MPA activities and wish to know how to get involved.

6. **Signage**. People wish the area to be more conspicuous and clearly delimited for locals as well as for tourists, including the location of the underwater sculpture park

7. **Sense of community**. The MPA management should contribute to the development of a sense of community and improve social harmony among communities and among fishers. The MPA is seen as an opportunity to "build on what we have for a better tomorrow".

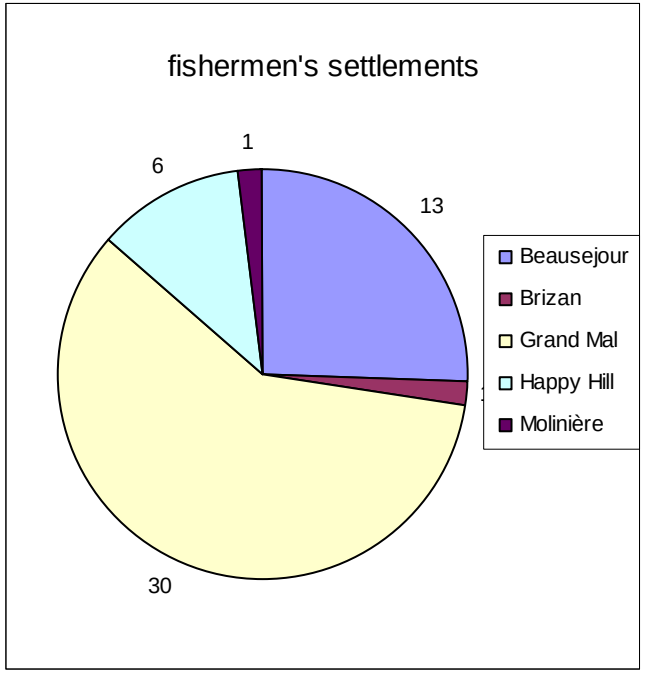
8. **Development**. Many wish to see more development in the area – more than an underwater sculpture park – especially on beaches, and more job opportunities.

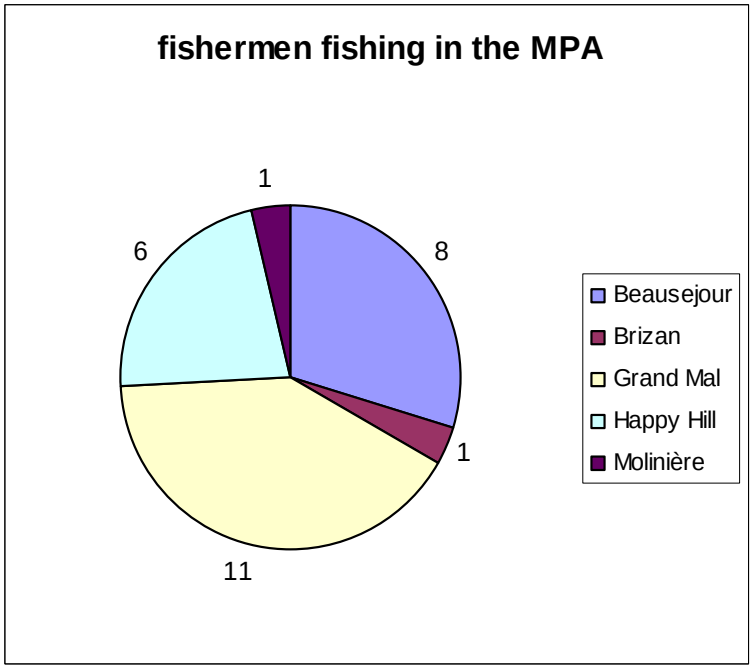
Annex 4. Molinière-Beauséjour MPA Fishery Survey

Profile of fishermen

Although identification was optional, most fishermen willingly gave their name (2 gave only their nickname). 51 fishermen were interviewed; 27 of them (53%) use the MPA for fishing and 24 (47%) fish outside the MPA.

Settlement: 60% of all interviewed fishermen were from Grand Mal, 25% from Beauséjour, 12% from Happy Hill, 2% from Brizan and 2% from Molinière. If we consider only the fishermen who fish in the MPA, 40% were from Grand Mal, 30% from Beauséjour and 22% from Happy Hill and the other two are from Molinière and from Brizan. Of the 24 fishermen who fish outside the MPA, 19 are from Grand Mal and 5 are from Beauséjour. Since the purpose of this survey is to acquire some knowledge about the fishing activity taking place in the Molinière-Beauséjour MPA, the results are compiled separately for the two groups, i.e. fishermen who use the MPA as a fishing ground and fishermen who do not fish in the MPA.





In order to obtain results that would have been statistically representative of the communities, sample sizes should have been larger than what could be realistically achieved in the framework of this intervention. For this reason, standard deviations were not calculated and there was no attempt to test the significance of observed differences between the fishermen groups. Although actual sample sizes are not statistically representative of the entire fishermen population, the results provide a useful profile of this section of the local population.

Table 16. Fishermen's roles in the fishery. Note: Totals are meaningless as fishermen may carry out more than one type of activity in the fishery.

Number of fishers whose role is...	Fishers fishing in MPA (n=27)		Fishers fishing outside MPA (n=24)		Whole survey (n=51)		Grenada fishers[1]	Gouyave fishers[2]
		%		%		%	%	%
Captain	**4** (of which 2 boat owners)	**15**	**2** (one also gear owner)	**8**	**6** (incl. 2 boat owners and 1 gear owner)	**12**	**38.3**	**32.0**
Boat Owner	**9** (2 are captain, 1 also net man)	**33**	**8** (2 also crew)	**33**	**17** (2 are captain, 2 are also crew, 1 also net man)	**33**	**6.2**	**12.4**
Gear Owner	--	**0**	**1** (also captain)	**4**	**1** (also captain)	**2**	-	-
Crew	**8** (3 also net men)	**30**	**12** (2 also line fishers, 2 also boat owners)	**50**	**20** (3 also net men, 2 also line fishers, 2 also boat owners)	**39**	**54.9**	**55.6**
Spear fisher	--	**0**	**--**	**0**	--	**0**	**-**	**-**
Line fisher	**3** (1 also net man)	**11**	**2** (also crew)	**8**	**5** (1 also net man, 2 also crew)	**10**	-	-
Net men	**6** (3 also crew, 1 boat owner, 1 line fisher)	**22**	**2** (1 also line fisher)	**8**	**8** (3 also crew, 1 boat owner, 2 line fisher)	**16**	**-**	**-**
Work on boat	**1**	**4**	**0**	**0**	**1**	**2**	**-**	**-**

Most frequently, fishermen work as crew, in a higher proportion for fishers who do not fish in the MPA (50%) in comparison with fishers fishing in the MPA (30%). A third of them own their boat (33%) in both groups. A higher proportion of fishers fishing in the MPA work as net men (22%) when compared with fishers who do not fish in the MPA (8%).

By comparison with Grenada and Gouyave fishermen, a higher proportion of fishermen in the area covered by this survey own their boat and the proportion of fishermen who act as crew members is lower. This proportion is similar for fishermen who fish outside the MPA, most likely on larger boats.

[1] Finlay, 1990
[2] Grant, 2006

Table 17. Fishermen's profile

		Fishers using MPA n=27	Fishers not using MPA n=24
Average age		45 (17 to 61)	49
Gender		All men	All men
Fishermen association membership		15% (4) are members	38% (9) are members
Fishing experience		19 years	21 years
Education	Primary	81%	75%
	Secondary	11%	12.5%
	Post-sec / technical	7%	4%
Boat ownership	Nb of boat owners	18 fishers own from 1 to 4 boats	21 possess 1 boat
	Boat nb / fisherman	average of 1.11 boat	average of 0.8 boat
	Total nb of boats	30 boats	21 boats
Boat average length		18,8 feet	28,3 feet
Boat material	Plywood or wood	73% (22 boats)	29% (6 boats)
	Fibreglass	23% (7 boats),	67% (14 boats)
	Steel	3% (1 boat)	--
	Not identified	--	1
Boat engine	Outboard	21 boats	7 boats
	Power	from 10 to 85 HP	from 25 to 285 HP
	Inboard	2 boats	10 boats
	Power	average of 45.2 HP	average of 111.2 HP
Boats mooring/ anchoring / parking location	Grand Mal	12	10
	Beauséjour	9	3
	Melville St fish market		1
	Molinière Beach	4	
	Brizan	1	
	Happy Hill	1	
	any beach	1	
Fish selling location	fish market	6	4
	fisheries associations	3	7
	Beauséjour Bay	2	1
	Carénage	1	
	to consumers	1	1
	wholesale	1	
	anywhere	1	
Boat registration		5 boats not registered 1 boat damaged, not used	4 boats not registered 1 boat damaged, not used

Fishermen using the MPA are slightly younger (45 as compared to 49) but have a similar fishing experience (19 as compared to 21 years). Education level for the majority of fishermen in both groups is the primary. By comparison with fishers from Grenada and from Gouyave, a higher proportion has attended the secondary level. The proportion of fishermen who are members of

fishermen's groups is also higher in this survey (26%) than in Gouyave (14%). A lower proportion of the fishermen using the MPA (67%) own 1 to 4 boats (average of 1.1 boat) while 88% of fishermen not using the MPA own one boat (average of 0.8 boat).

The most obvious distinctions between the 2 groups are with their boats. For fishermen using the MPA, most boats are made of wood and are powered with an outboard engine from 10 to 85 HP. For fishermen not using the MPA, most boats are made of fibreglass and are powered with an inboard engine of 110 HP (on average) or with an outboard engine from 25 to 285 HP. Half of boats of fishermen using the MPA are parked in various locations within the MPA, the other half in Grand Mal, while most fishermen not using the MPA leave their boat in Grand Mal. Most boats are registered.

For fishermen using the MPA, selling locations are diverse, the most frequent being the fish market. For other fishermen, half of them sell to fisheries associations, the others to the fish market.

Table 18. Fishing activity per gear type by fishermen fishing in the MPA

Type of gear mainly used	Line (14) Hooks, rod	Net (6)	Seine (5)	Longline (6)	Bottom line (4)	Spear gun (1) / Fish pot (1)
Type of fish mainly targeted	Snapper Hind Butterfish[1] Tuna Couvalli Jacks Bonita[2] Dolphinfish	Marlin Ocean gar Big jacks Tuna	Jacks, Couvalli, Robin, Bonita	Tuna Dolphinfish Ocean gar Other ocean species	Hind Snapper Butterfish	Cacabawi (parrotfish)
Mesh size/ strain	12 to 400 lbs	½, 3, 4 in	1 to 4 in	---	---	---
Fishing hours per trip	8.2 (4 to 20)	(4 to 24)	3.6 (2 to 6)	80 (12 to 240)	9 (6 to 12)	Not answered
Average catch per trip[1]	4 to 700 lbs (2 to 88 lbs per hour)	700 to 10 000 (29 to 60 lbs per hour)	512 lbs (173 per fishing hour)	350 to 10 000 lbs (4 to 83 lbs per hour)	Not answered	Not answered
Main fishing area	MPA (5) Beauséjour (4) Ocean (5) Point Saline Coastal area	MPA (2) Beauséjour (2), Whole area	Beauséjour (3), Molinière Point Whole area	Point Saline Ocean West coast Grand Mal	Point Saline (3), South of island	Not answered

[1] Based on last 12 months

The fishing gear most used in the MPA is the fishing line, followed by nets and seines. Longlines and bottom lines are mentioned by fishermen but are not used in the MPA. Fishing line strain is

1 *Cephalopholis fulva*
2 *Sarda* sp.

variable, high strain lines are more likely used offshore (outside the MPA) to target large pelagic species. Fishing trips/outings duration is variable as well as the average catch. Beach seines are typically used in the MPA and mostly target jacks but also couvalli, robin and bonita. Fishing outings last an average of 3.6 hours (from 2 to 6 hours). Fishermen said they were using nets in the MPA but this assertion could be erroneous due to some confusion about the MPA seaward boundaries.

Table 19. Main types of fish landed on a typical fishing trip by fishermen fishing in the MPA

Fish type	Nb of occurrences as main catch species	% of catch	Average selling price per lb (EC$)	May be caught in MPA[1]
Tuna	**16**	29% (7)	$ 6.05	✓
Snapper	**11**	32% (3)	$ 6.00	✓
Hind	**9**	21% (4)	$ 5.70	✓
Couvalli	**9**	30% (5)	$ 5.90	✓
Dolphin fish	**8**	7.5% (4)	$ 5.85	
Jacks	**8**	47% (5)	$ 4.90	✓
Ocean gar	**7**	19% (4)	$ 5.80	✓
Butterfish	**6**	45% (2)	$ 6.10	✓
Marlin	**5**	10% (2)	$ 5.70	
Bonita	**4**	20% (3)	$ 5.80	✓
Swordfish	**4**	1% (2)	$ 6.00	
King fish	**4**	22% (3)	$ 6.00	
Robin	**4**	18% (3)	$ 4.60	✓
Grunt	**3**	20% (1)	$ 5.75	✓
Barracuda	**2**	5% (1)	$ 6.50	✓
Sailfish	**1**	20% (1)	$ 5.50	
Flying fish	**1**	--	$ 6.00	
Average	n.a.	n.a.	$ 5.77	

[1] based on fishing grounds

Fishermen mainly target tunas, snappers, hind and couvalli jacks. These fish are said to compose a third of the catch except for hind which makes up 20% of the catch. Jacks, ocean gars and butterfish are also targeted but to a lesser extent. Jacks and butterfish make up close to half of the catch. There is no relation between main target fishes and price per pound. Few fishermen provided information about the catch composition (% of catch). The figure in brackets gives the number of answers. Thus values must be interpreted, at best, as indicative.

Table 20. Favourable weather for fishing

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Weather *(B or G)*	B/G	G	G	G	G	G	B/G	B	B	B/G	B/G	B/G

A rather clear pattern emerged for the type of weather, especially for stating that the months of February to June were good weather. However, there was no consistency for fish landing high or low season when analysed by fish type.

Table 21. Marketing arrangements per type of fish (for fishermen using the MPA)

		Percentage of the catch						
Fish type (nb of occurrences as main catch species)	Average selling price per lb	Retained by fisher	Given to family and friends	Sold to wholesale vendors	Sold to retail vendors	Sold to hotels / restaurants	Sold to processing plant	Sold directly to consumer
Tuna (16)	$ 6.05	7	3	34	20	0	31	5
Snapper (11)	$ 6.00	17	7	28	34	0	0	6
Hind (9)	$ 5.70	6	5	34	43	0	0	7
Couvalli (9)	$ 5.90	13	5	30	23	0	0	13
Dolphin fish (8)	$ 5.85	5	4	34	13	0	44	0
Jacks (8)	$ 4.90	9	3	34	20	0	31	5
Ocean gar (7)	$ 5.80	5	4	39	14	0	39	0
Butterfish (6)	$ 6.10	27	11	7	55	0	0	0
Marlin (5)	$ 5.70	5	4	24	25	0	68	0
Bonita (4)	$ 5.80	6	0	35	24	0	25	5
Swordfish (4)	$ 6.00	27	2	3	0	0	68	0
King fish (4)	$ 6.00	11	3	24	0	0	45	17
Robin (4)	$ 4.60	10	7	37	0	0	0	47
Grunt (3)	$ 5.75	23	13	45	20	0	0	0
Barracuda (2)	$ 6.50	35	10	55	0	0	0	0
Sailfish (1)	$ 5.50	0	0	0	100	0	0	0
Flying fish (1)	$ 6.00	5	5	0	0	0	90	0
Average	$ 5.77	12	5	29	22	0	22	8

About a third of the main catch species (tuna, snapper, hind, couvalli, dolphin fish, jacks and ocean gar) is sold wholesale vendors. Barracudas, grunts and robins which are less frequent catches are sold to wholesale vendors in a higher proportion. Fishermen retain an average of 12% of the catch for their own consumption and tend to retain barracudas, butterfish and swordfish in a higher proportion. Very little is given to family and friends and none is sold to restaurants. Sailfish which is an uncommon catch is sold to retail vendors, as well as butterfish, hind and snapper but in a lower proportion (37% to 55%). Little is directly sold to consumers; only robins which appear to have the lowest price per pound are directly sold to consumers in a proportion of 47%. Flying fish, an uncommon catch, marlin and swordfish are sold to processing plants in a high proportion (68%), as well as dolphin fish, ocean gar and king fish (39% to 45%).

PART B
MANAGEMENT FRAMEWORK, ISSUES, OBJECTIVES AND ACTIONS

10. Long-term goal for the Molinière-Beauséjour MPA

A goal is a general statement of ends. The starting point for adaptive management involves clearly defining what it is you are trying to achieve. The MPA Stakeholders Committee agreed on the following goal:

> **The sustainable use of resources in the Molinière-Beauséjour Marine Protected Area is promoted to ensure provision of livelihoods and a viable ecosystem for current and future generations.**

10.1. Connection with regional and national goals and strategies

This mission statement is connecting this management plan to regional and national goals and strategies:

- The Grenada 25-25 Declaration: At the 8th Conference of the Parties of the CBD in 2006, the Government of Grenada made a public announcement to effectively protect 25 % of its terrestrial and near-shore marine resources by 2020.

  Among the associated commitments, the Government agreed

  - to keep intact the critical ecosystem services provided by forests and oceans,
  - to act to sustain livelihoods and the quality of life and beauty of the islands for future generations,
  - to adopt the ecosystem approach and implement integrated management plans for each protected area in collaboration with NGOs and local communities,
  - to strengthen partnerships between the Government, NGOs, private sector and local communities engaged in conservation of natural resources and sustainable use of biodiversity,
  - to keep a long term vision for the management of natural resources.
  - to reverse the declining population trend of endemic and endangered species that inhabit the lands and waters of Grenada.

- The Caribbean Challenge is a regional initiative by which countries commit to effectively protecting 20 % of their near-shore and shelf habitat by 2020 and establishing conservation trust funds that will provide sustainable financing to the countries' national protected area systems. In 2008, the governments of Grenada, St. Vincent and the Grenadines, Jamaica, the Dominican Republic and the Bahamas had joined the challenge.

- The National Biodiversity Strategy and Action Plan (2000) identified 6 priorities among which 3 are relevant to the purpose of establishing and managing a MPA: *i*) protecting key ecosystems from negative human induced impacts, *ii*) encouraging sustainable use of biological resources that are essential to the livelihood of local communities, and *iii*) ensuring a fair and equitable sharing of the benefits arising from the use of genetic and ecosystem resources.

- The National Environmental Management Strategy (2005) states that "The Government and People of Grenada, Carriacou and Petit Martinique envision a healthy and productive

environment that guarantees the sustainability of development activities and processes and that contribute fully to social and cultural development, to economic prosperity, and to the quality of human life"

- St. George's Declaration of Principles for Environmental Sustainability (2000) in the OECS is a commitment to undertake actions necessary to achieve development goals while maintaining or improving environmental quality, to conserve biological diversity and to protect areas of outstanding scientific, cultural, spiritual, ecological, scenic and aesthetic significance.

10.2. Connection with IUCN protected area management categories

The Fisheries (Marine Protected Areas) Order 2001 (SRO No. 77) formalises the creation of the Molinière-Beauséjour MPA as follows:

"The area of fishery waters declined in Schedule 2, and the foreshore adjacent thereto, is declared to be a Marine Protected Area and Multi-zone Management System."

The assignment of a management category according to a system that is globally accepted helps to define conservation targets and type of management and provides a common reference which allows to share and benefit from experiences with other MPAs in the world. According to this declaration and the zoning proposed in Schedule 2, the corresponding category of protected area according to IUCN system is a category VI. The category VI is the only category in the IUCN system where sustainable use of natural resources is adopted as a means to achieve nature conservation, together with other actions common to other categories such as protection.

The IUCN Guidelines for Protected Area Management Categories (1994) define a category VI Managed Resource Protected Area as follows: *"An area containing predominantly unmodified natural systems managed to ensure long term protection and maintenance of biological diversity while providing at the same time a sustainable flow of natural products and services to meet community needs*[1]*."*

The guidelines revised in 2008 included marine protected areas and defined a Category VI MPA as follows: *"An area that maintains predominantly natural habitats but could allow the sustainable collection of particular elements, such as particular food species or small amounts of coral or shells for the tourist trade*[2]*."*

The point where an area managed for resource extraction becomes a category VI marine protected area may sometimes be hard to judge and will be determined ultimately by reference to whether the area meets the overall definition of a protected area or not, as well as whether the area achieves verifiable ecological sustainability as measured by appropriate indicators.

The management objectives for a category VI protected area may a combination of the following:

[1] IUCN, 1994
[2] Dudley, 2008

Management objectives	Relative importance
Preservation of species and genetic diversity	Primary
Maintenance of environmental services	Primary
Sustainable use of resources from natural ecosystems	Primary
Wilderness protection	Secondary
Maintenance of cultural and traditional attributes	Secondary
Protection of specific natural and cultural features	Potentially applicable
Scientific research	Potentially applicable
Tourism and recreation	Potentially applicable
Education	Potentially applicable

Protection of natural ecosystems and promotion of sustainable use must be integrated and mutually beneficial. Category VI protected areas are not designed to accommodate large-scale industrial harvest and IUCN recommends that a portion is retained in natural condition, which may imply the designation of a specific area as a no-take zone.

11. Management framework

This section presents current arrangements for management in terms of the legal framework, institutional arrangements, infrastructure, equipment and human resources available for management.

11.1. Legislative and regulatory framework

It is important that MPA personnel and bodies in charge of coordinating and supervising its management understand the legislation relevant to their work, including the laws and regulations specific to the MPA, other national legislation relevant to its management, and the international law that provides the overall context. A list of the relevant national legislative and regulatory texts with reference to sections pertaining to the MPA resources, their management and protection is presented in Annex 6 and a list of International Conventions and Agreements on Biodiversity in Annex 7.

In Grenada, marine protected areas and marine reserve (protected area) are designated under the Fisheries Act No. 15, 1986 and the Fisheries (Marine Protected Areas) Regulations of 2001.

The Fisheries Act 1986 allows the Minister responsible for the Act, currently the Minister of Agriculture, Lands, Forestry and Fisheries to declare any area of fisheries waters and any adjacent or surrounding land as a marine reserve for the purpose of:

- affording special protection to the flora and fauna of the area and to protect and preserve the natural breeding grounds and habitats of aquatic life, with particular regard to flora and fauna in danger of extinction
- allowing for the natural regeneration of aquatic life in areas where such life has been depleted
- promoting scientific study and research
- preserving and enhancing the natural beauty.

The Fisheries (Marine Protected Areas) Regulations (SRO No. 78, 2001) further define a marine reserve as a marine protected area. The Regulations allow a part of a marine protected area to be established as a marine historical site (contains structures, artefacts or human remains and which needs to be protected for its historical or cultural value), a marine park (reserved for public recreation), a marine reserve (special management for the purpose of protecting the natural resources), a marine sanctuary (open only for the purpose of scientific research), or a combination of any. These designations generally serve as zones for management planning processes of marine reserves but they can also be specific to categorize a site.

The Fisheries Amendment Regulations (SRO No. 24, 1996) provide amendments on fishery conservation measures regarding the exploitation of lobster, turtle, conch, sea urchin and oyster, specify forbidden actions for the protection of coral and coral reefs, and forbid the use of beach seine nets which mesh size is smaller than regulation allows.

The Fisheries (Marine Protected Areas) Regulations (SRO No. 78, 2001) specify Management Committee composition and procedures, activities or actions prohibited in a MPA, potential zones and allowed activities, vessel access and conditions, and officers responsible for enforcement.

Other legislative and regulatory texts concern the preservation or management of the resources within a MPA or activities that may have an impact on it. These include:

- The Birds and Other Wildlife (Protection of) (Amendment) Ordinance No. 26, 1964 forbids possession of lobsters of less than one pound or less than 9 inches, capturing females with eggs, and specifies closing season.
- The Beach Protection Law No. 67 of 1979 forbids digging, taking, carrying away any sand, stone, shingle or gravel from any beach or seashore in Grenada.
- The Oil in Navigable Waters Act Cap 218 makes provision against the discharge or escape of oil into the territorial sea of Grenada.
- The Physical Planning and Development Control Act, No. 25 of 2002 makes provision for the control of physical development notably to protect and conserve the natural and cultural heritage, and to maintain and improve the quality of the physical environment in Grenada and requires an environmental impact assessment to be carried out for permission to develop land in Grenada if proposed development could significantly affect the environment.
- The Waste Management Act, No. 16 of 2001 specifies that dumping any litter or other waste in any national park or protected area, territorial waters, beach, foreshore, marine waters, river or river bank without lawful authority is an offence liable to a 50,000$ fine and imprisonment for 6 months.

11.1.1. Legislative and regulatory constraints

Some constraints for MPA management are related to the current legislative and regulatory framework, in particular with the regulations on MPA (SRO No. 78, 2001). Their identification may facilitate the elaboration of recommendations for amendments to update, adjust or complement current legislation/regulation .

- Management Authority definition is ambiguous (Art. 3) and its remit is not specified;
- A quorum of 3 representatives, not specifying which ones, invalidates the co-management or participatory management approach (Art. 5.3);
- Procedures are not clearly defined (Art. 5.2 “normal”) and should specify who convenes the meetings, at what frequency, reporting and communication requirements;
- The local community representative is not a permanent member of the group and is to be invited to attend meetings as deemed necessary (Art. 4.2) – Appropriate governance rules would require local communities to be included as permanent members of the MPA stakeholder committees;

- Management authority at local MPA level is not provided for – an amendment needs to specify composition, remit and duties, procedures for identifying and appointing members, and reporting requirements;
- Fishing Priority Area is defined in the Fisheries Act No. 15, 1986 but not in the SRO No. 78 on MPAs which only mentions "fishing areas";
- Permit fees for diving, and using buoys are fixed in schedules rather than through a flexible procedure.

11.2. Institutional arrangements for management

11.2.1. Current arrangements

Co-management takes place on two levels:

At the national level: The MPA Management Committee is defined in Regulation 4 of the Fisheries Marines Protected Areas Regulations 2001 (SRO No. 78). This committee deals with MPA policy issues at the national level and advises specific MPA committees. A first committee was set up shortly after the creation of the protected area but was never operational. It was re-appointed by the Minister in October 2009 following the composition set forth in the regulations. It was decided to appoint the chairmen of Molinière-Beauséjour and Sandy Island MPAs Stakeholders Committees as representatives of NGOs having a special interest in marine environmental matters. Its operation started in 2010.

At the MPA level: A MPA Stakeholder Group/Committee was set up to assist with decision making and implementation of the Molinière-Beauséjour MPA management plan but it has not been formalized yet as the MPA legislation has no provision for this committee. Although informal, this committee has been operational since early 2009, meeting on a monthly basis. Minutes have been taken in recent meetings to keep track of the decisions taken.

11.2.2. Current and planned management structure

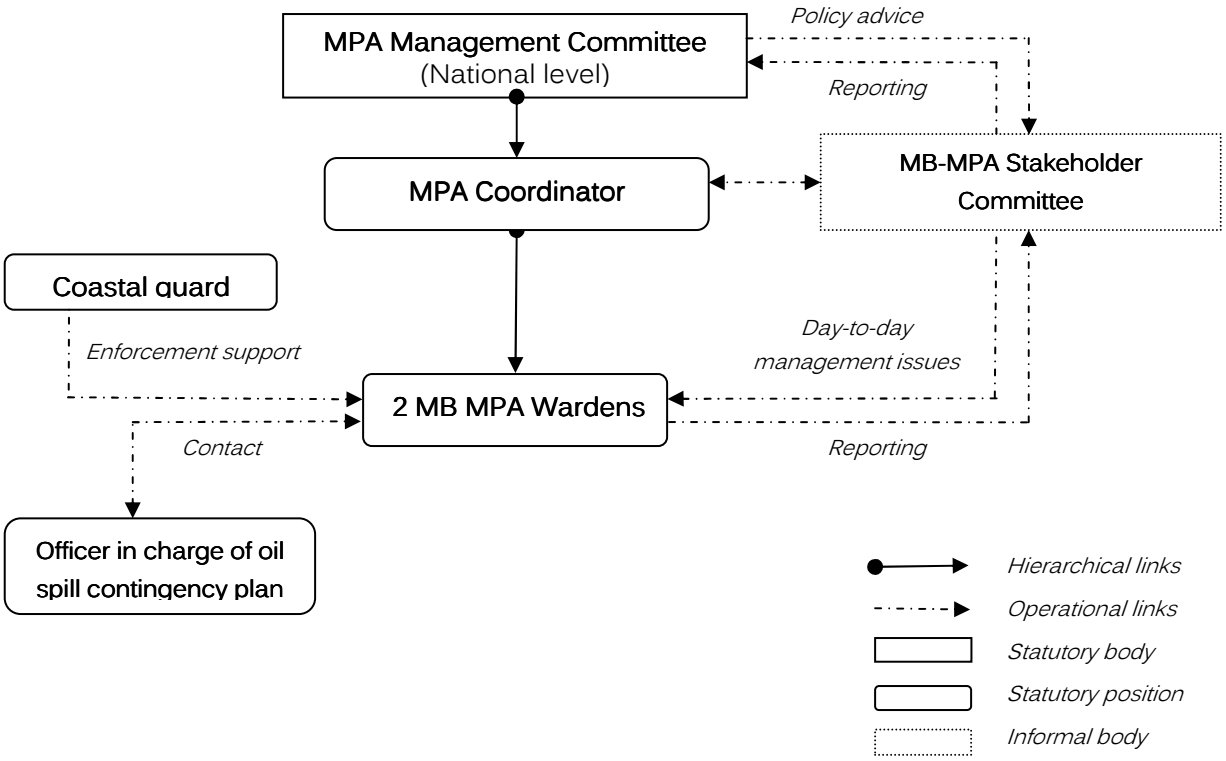
The management structure sets out the relationships between all the stakeholder bodies and groups involved in the management of an MPA. This is illustrated in an organisational chart showing lines of authority and responsibility, i.e. hierarchical links, and functional links where coordination or collaboration is required. An organizational chart shows such links between the Fisheries Division, the national MPA Co-Management Committee and the Molinière-Beauséjour MPA Stakeholder Committee, and also with other stakeholder groups and bodies concerned by specific aspects of the development and implementation of the management plan, such as enforcement bodies.

Note that the Molinière-Beauséjour MPA Stakeholder Committee is not formal in the current management structure. Currently, the law on fisheries does not provide for MPA co-management or

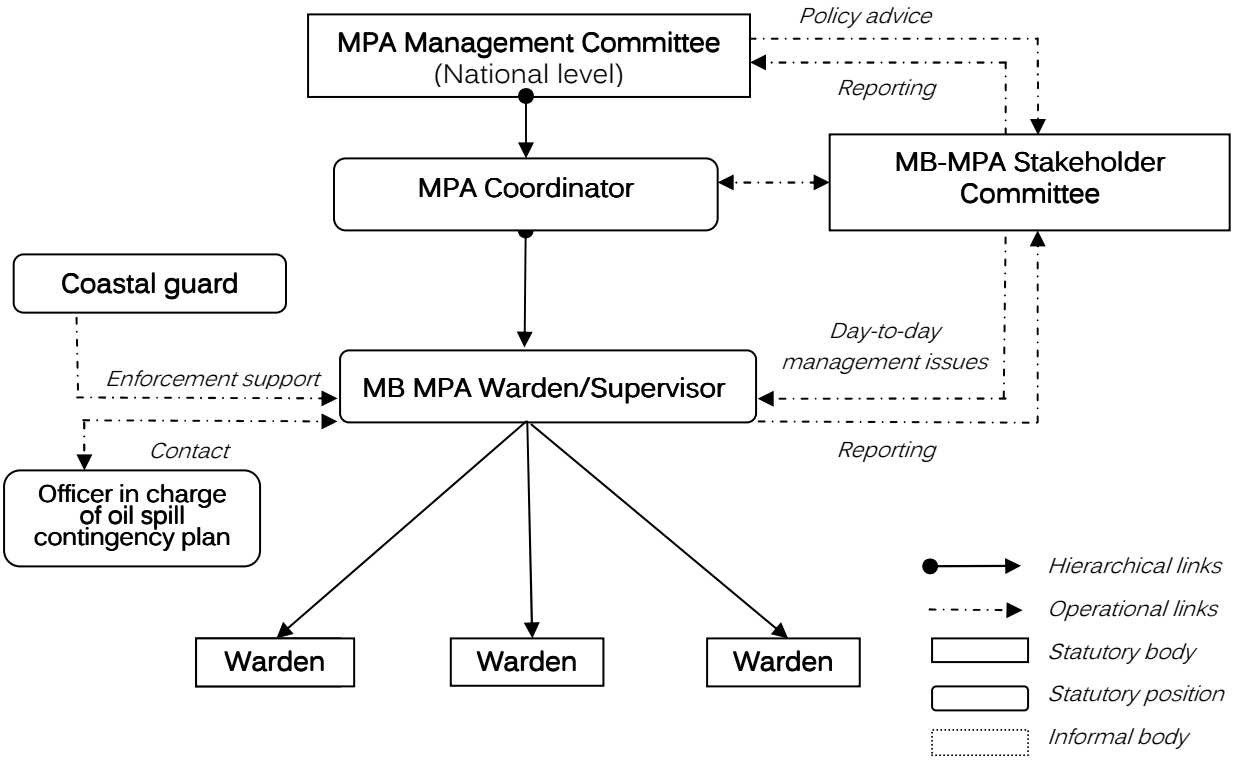
collaborative management – the arrangements for the management of a specific MPA could be defined in a specific regulation for the management of the Molinière-Beauséjour MPA.

Current management structure for the Molinière-Beauséjour MPA

The following institutional structure will be effective until new institutional arrangements are adopted and enforced.



Planned management structure for the Molinière-Beauséjour MPA



Note: Links with the judiciary (e.g. police, court), as well as government planning bodies and research institutes are important bodies which could feature on a full organisational chart.

11.2.3. Governance / Composition of the MPA Stakeholders Committee

This Committee must represent key stakeholder groups, including local communities, scientists and academic institutions, the private sector, national and international NGOs and donors, and the various government agencies involved.

Experience has shown that the imposition of an MPA located near human settlements and without broad stakeholder participation, consensus and acceptability can lead to failure. However, current legislation does not allow for MPA co-management and has no provision for a MPA Stakeholder Committee. Local communities are not directly represented in the Molinière-Beauséjour MPA stakeholder group other than through a NGO and fishermen. The people from adjacent settlements that use beaches for recreational and social purposes should get more actively and directly involved through permanent representatives on the Molinière-Beauséjour MPA stakeholder committee or through village level advisory committees.

Representatives of every stakeholder category must be included in the proposed stakeholder committee composition – or – an appropriate mechanism must ensure that their concerns, aspirations and suggestions will be effectively communicated and taken into account in management decisions and operations.

Many MPAs have committees for specific purposes and village level advisory committees are very important in some MPAs, where communities play an important role in decision-making.

11.2.4. Role and powers of the MPA Stakeholder Committee

The existence of a legally mandated MPA decision-making and management body, responsible for implementing the management plan, will lead to more professional management of the MPA. This is more effective if it has some decision making powers than if it has to respond to directives from some higher authority. Role and powers may include:

- Advisory role to the MPA Management Committee for the management of the Molinière-Beauséjour MPA until the stakeholder committee is formalized. Then, the national MPA management committee will delegate management powers to the Stakeholder MPA Committee;
- Planning and oversight of daily MPA operation;
- Management of staff (wardens) appointed by the Ministry;
- Raising funds, investing and spending powers within the MPA budget allocated by the MPA Management Committee – after the formalization of the committee;
- Permit issuance and fee collection;
- Coordination of the implementation, monitoring and assessment of the results (on the basis of indicators) and revision of the Molinière-Beauséjour management plan.

11.2.5. Operational procedures of the MPA Stakeholder Committee

Members will be appointed by the MPA administration, and the Committee's role, functions and procedures should be clearly defined in terms of reference or even in law. The procedures should address the following points as a basis for drafting the Molinière-Beauséjour MPA stakeholder committee procedures. Once agreed, the procedures will be ratified by the national MPA Management Committee.

- Transparent procedures for appointing members representatives on the Molinière-Beauséjour MPA stakeholder committee (conditions for nomination/election of members on the committee, invitations, appointment of new members)
- Clear definition of the roles, duties and authority of the stakeholder committee members
- Quorum for a meeting involving decision-making, attendance requirements by individual members to ensure an effective representation of stakeholder groups, and invitation of non members for specific issues
- Periodicity and arrangements for the meetings convened by the chairman
- Reporting requirements (responsibility for taking, saving and distributing minutes and distribution list)

- Clear operational framework and communication procedures and requirements between the co-management and stakeholders committees

11.2.6. Institutional agreements

Current agreements with partner institutions or individuals for research and monitoring, capacity building, funding, advocacy and other support include

- A MoU signed between TNC and the Government of Grenada in 2009 in the framework of a national program to support capacity development to encourage local communities participation in MPA planning, biodiversity management and ecotourism development, the development of scientific and regulatory frameworks that provide decision making tools, the provision of alternative income sources for resource dependent communities, and raising awareness of decision makers, private industry leaders, and the public on key threats to marine and coastal biodiversity.
- A MoU signed in 2009 between USAID/COTS and the Ministry of Agriculture, Forestry and Fisheries to provide assistance until September 2010 which includes the provision of an expert in fisheries and co-management of protected areas to work with the Molinière-Beauséjour MPA Management Committee to write a management plan for the MPA, the installation of moorings and demarcation buoys within the MPA, public awareness activities and material (logo, signage, documentary, and promotional material for the official launching of the MPA), training on equipment maintenance and review and amendment of the current MPA legislation/regulation .
- A MoU between TNC and WINDREF to work towards a better environmental management including protected areas.

Additional agreements could be elaborated between the Ministry of Agriculture, Forestry and Fisheries and St. George's University, namely the Department of Public Health, the Department of Liberal Studies, the Marine Biology Programme and WINDREF

- to develop collaborative programs involving students in MPA monitoring activities and research projects in the framework of their academic training;
- To host an online electronic database on the Molinière-Beauséjour MPA including images, maps, data files on resources and research documents.

11.3. Infrastructure and equipment

11.3.1. Office and Resource Centre

Description: A small one-level building with electricity and running water with large storage space. A small laboratory could be set up for simple water analysis, for handling samples or other type of uncomplicated analysis as required for the monitoring activities.

Location: In Grand Mal, near the marina

Access: Currently controlled by the Fisheries Division

Maintenance: Responsibility of the Stakeholder Committee

11.3.2. Patrol boat

Description: A 21-foot fibreglass boat was provided by the Grenada Board of Tourism to allow monitoring and enforcement in the Molinière-Beauséjour MPA. Two (2) 40 HP outboard engines were provided by the Buccoo Reef Trust NGO in Tobago and the Grenada Board of Tourism. All communication (radio) and safety equipment were provided by the Fisheries Division as required by applicable regulation.

Location: The boat will be kept at the jetty of the Melville Street fish market.

Access: The policy for using the boat will be set by the MPA Co-Management Committee, supervised by the MPA Coordinator, and executed by the MPA warden.

Maintenance: Responsibility of the Stakeholder Committee

11.3.3. Moorings

Description: The installation of moorings was funded by the Grenada Board of Tourism and private operators to prevent dive boats and day charter yachts that frequent the MPA from anchoring on the reefs. 12 4-ton mooring blocks designed for day-time use were installed in the MPA. The design was modified because the substrate is a thin layer of sand. 4 buoys are missing.

Location	Current moorings		Additional moorings required	
	Blocks	Buoys	Commercial boats	Pleasure boats
Flamingo Bay	4	4	2	4
Dragon Bay	2	1	2	-
Molinière Point	5	3	1 small	-
Grand Mal Bay	1	-		3
Total	12	8	5	7

Access: Currently, there is a time limit of 45 minutes to use a mooring – it is recommended to increase it to 75 minutes.

Maintenance Equipment needs to be checked every 6 months.

11.3.4. Demarcation and signage

Currently, a few panels are set along the road in Happy Hill to prevent garbage dumping over the cliff. No signage gives a clear indication of the MPA boundaries, zoning and allowed/forbidden activities in the MPA.

Additional signage is required to increase the MPA visibility and public awareness about its location, zoning and regulations:

- Large boards along the road at the North and South limits of the MPA and at the ports of arrival (airport and cruise ship terminal) indicating MPA location, allowed / prohibited activities using pictograms
- Signage on the coast (to be viewed from the sea) in the marine park and in the fishing priority area indicating MPA and main prohibited activities using pictograms: no spear gun, no anchoring, no line fishing from a boat, no littering)

11.4. Human resources

11.4.1. Warden

The Fisheries Division has recently hired a ranger for the MPA. Training has taken place in June 2010.

MPA warden's powers are specified in the Fisheries (Marine Protected Areas) Regulations SRO No. 78, 2001. Additional warden's powers are recommended:

If he/she has reasonable grounds to believe that a person has committed an offence, the officer may –

- Interrogate a person found in a MPA, outside of a fishing zone, in possession of fish, mollusc, crustacean, coral or shell.
- Call upon any person to produce a license or permit that is - or was at the time of the offence – required by the regulation
- Stop and search a person, or vessel or boat
- Under the authority of a search warrant, enter and search premises occupied by that person and seize any material which he/she has reasons to believe has been taken or used in or for the purpose of the commission of the offence
- Arrest any person that is reasonably suspected of being concerned in the offence and who refuses to give his/her name and address – or – if he has reason to believe that such person will abscond.

MPA warden's duties

- Information dissemination to MPA users and visitors on boundaries, zoning and regulations to encourage compliance
- Collection of MPA users and community members' suggestions and grievances to inform MPA stakeholder committee
- Enforcement of applicable regulations to prevent illegal fishing or other illegal activities in the MPA (warden's powers and enforcement procedures must be clearly defined)
- Monitoring (see below)
- Maintenance (boat, engines, building in Grand Mal and other equipment)
- Reporting to the MPA stakeholder committee and MPA Coordinator

- Contact with coast guard and officer in charge of implementing the oil tank farm contingency plan in Grand Mal
- Fee collection / issuing permits and recording related information

MPA warden's monitoring duties in the MPA

- Water T°, turbidity and pH (in each bay)
- Sea level
- Daily use of moorings (location, identification of mooring, fee collected and duration)
- Daily diving activities (for SCUBA diving and snorkelling) (location, operator, number of divers, fee collected)
- Occurrence of significant conflicts (nature of the conflict, people involved, need for follow-up action)
- Occurrence of significant accidents (type of accident, people involved if so, intervention if so, need for follow-up action)
- Occurrence of illegal activities (if enforcement does not successfully prevent the offence or if the offence was already committed) including but not limited to:
    - Evidence of sand mining
    - Fishing with prohibited gear or in prohibited areas
    - Anchoring (anywhere in the MPA except in fishing priority areas)
    - Using moorings without valid permit
    - Diving without valid permit

Constraints

- Additional human and financial resources needed for enforcement and monitoring
- Until regulations amendment, lack of a cohesive legislative and regulatory reference for enforcement

11.4.2. Volunteers

The essential role played by volunteers must not be overlooked. From the stakeholders involved in current management meetings and decisions, to all the people who get involved in the beach cleanups, to the dive shops and divers who contribute to the resource surveys, to the stakeholders who share their experience and knowledge, all are making an invaluable contribution to the preservation of the Molinière-Beauséjour MPA and its resources. This must be clearly acknowledged, promoted and encouraged.

In the context of the MPA Realization in Grenada project, in 2005/2006, some capacity building activities have been conducted to raise volunteers technical capacity to contribute to resource monitoring, namely through a training on the ECS reef survey method and a training leading to a scuba diving certification for 2 volunteers.

Local communities and NGO. The results of the socioeconomic survey indicate that there is a real potential for volunteerism among local communities. This is demonstrated by the large participation

in beach cleanups, but in many places, the interests and open attitude expressed in people's comments go beyond participation to this type of activity. The NWDA is involved in the organization of beach cleanups and in developing local communities' capacities regarding public health issues.

SGU students. The Molinière-Beauséjour MPA is easily accessible from St. George's University which makes it highly practical for field-based studies by students. The establishment of a permanent collaboration could be jointly beneficial as it would allow the implementation of a long term monitoring of important environmental, socioeconomic or governance parameters which will provide essential information for the management of the MPA and still provide interesting multi-level data series which could be exploited for scientific and academic purposes. There are a few avenues for involving SGU students in monitoring and research activities:

1. A Community service course involves giving back the community 30 hours of voluntary service. On average, 100 students attend it and the course is given every semester including summer.
2. During the course of their final year, students are required to conduct a 1-year independent study in any area, involving data collection. These studies are supervised and involve approximately 25 students.
3. A course on research and ethics is offered every semester and attended by approximately 30 students.

Constraint: A moratorium on diving at SGU (for students and faculty) imposes a restriction for any field work requiring in situ observations in the marine environment.

Divers and dive shops. Volunteer monitoring programs involving concerned local citizens and passionate amateurs have been developed for contributing to the preservation and knowledge of natural habitats and resources, such as water quality monitoring of lakes and rivers, bird watching and monitoring of other terrestrial, aquatic and marine wildlife.

Various initiatives involving volunteers in the monitoring of marine resources have been developed in the 90s, such as the REEF Fish Survey Project or Reef Check. This type of initiative allows volunteer SCUBA divers and snorkelers to collect and report information on marine fish populations or other marine organisms using easy standardized methods and survey material such as identification color plates, and data are housed in a publicly-accessible database. While they learn about the environment they are diving in, participants produce valuable information which adds to the knowledge base of reef ecosystems, facilitates informed decision-making and is useful to scientists and marine park staff.

This type of volunteer monitoring could be easily developed for Grenada reefs with the support of participant dive shops. A few dive shop owners were met and are willing to engage in volunteer monitoring of reef species involving client divers.

12. Main issues and root causes

The previous sections have presented the physical, biological and human dimensions of the MPA and its resources and the framework for its management. Gaps were identified as well as potential and opportunities. Gaps and constraints concern the knowledge of resources and their use, the legislative and institutional frameworks, governance, awareness, enforcement, pollution and financial resources. Thus the main issues that the management plan must address consist of tackling the threats affecting the MPA, its ecosystems and resources and those gaps that constrain the implementation of the management plan.

Main issues include:

- Legislative and regulatory gaps and constraints (section 12.1.1)
- Governance and institutional constraints (inadequate representation of local communities and stakeholder committee not provided for in the legislation on MPAs) (section 12.2)
- Inadequate financial resources
- Lack of awareness of MPA, its boundaries, zoning and related rules, resource values and vulnerability, and detrimental impact of some practices
- Lack of enforcement of applicable legislation/regulation to alleviate unsustainable pressure on main resources due to illegal practices ex. small mesh sizes, spear fishing, sand mining, littering and dumping waste
- Pollution impact on water quality and beach condition and further impacts on coral reefs, public health and tourism
- User conflicts, inappropriate practices and management of fishing priority area. Most conflicts and inappropriate fishing/boating practices are attributable to lack of awareness and enforcement of MPA boundaries, zoning and applicable regulations, and lack of a coherent set of rules related to each zone in the MPA
- Knowledge gaps on resources, on pressures/threats and on methods to reduce their impact

12.1. Summary of main pressures on resources and root causes

Understanding the main issues and threats and their root causes will allow the identification of key strategies and/or objectives to alleviate or mitigate their impact on the key values of the MPA. Assessment of importance of threat: (**H**) High – (**S**) Significant – (**NS**) Non-Significant – (**DD**) Data Deficient (**High** requires urgent intervention as long as it can be addressed by management measures or actions, **Significant** requires intervention as long as it can be addressed by management measures or actions, **Non-Significant** does not require intervention but might require monitoring, **Data Deficient** requires additional knowledge through monitoring or research)

Resources	Status and long-term trend	Threats	Importance of threat	Root causes
Coral reefs	Degradation Smothering of corals by algae overgrowth No reported coral disease	Selective fishing (spear fishing) disrupting reef community structure	Elusive activity S	Lack of awareness of the negative impact of inappropriate fishing practices Lack of enforcement of applicable regulations
		Pollution (sediments and nutrients) of runoff waters from river watersheds (Beauséjour and Molinière)	High in 2005 ++ sediment Beauséjour	No land management plan for the watershed, except for the Annandale forest / no integrated coastal zone management
		Pollution by the dump leachate through stream, porous coastal soil and coastal currents	DD	Inappropriate site for the dump - No impact assessment conducted prior to establishing the dump – No assessment of impact on coastal resources
		Pollution from ship borne effluents (yachts anchoring overnight)	Potential	Uncontrolled access to the MPA Lack of awareness and enforcement of applicable regulations
		Pollution from solid waste	H	Lack of awareness and enforcement of applicable regulations
		Oil pollution from boats or minor spills at the oil tank farm	Potential for minor spill accidents	Potential problem related to the implementation of the contingency plan *(Verify whether the contingency plan takes into account the proximity of the Molinière-Beauséjour MPA and the major current patterns)*

Resources	Status and long-term trend	Threats	Importance of threat	Root causes
	Severe bleaching in 2005[1]	Climate change	**H**	Climate change/ Global phenomenon Cannot be addressed by the management plan other than increasing coral reef resilience
	Local damage by hurricane in Dragon Bay	Natural hazards / storm surge Increasing rate of high intensity hurricanes	**H**	
	Localized physical damage	Anchoring in inappropriate locations	**H** in 2005	Uncontrolled access to the MPA Insufficient / inadequate moorings Lack of awareness and enforcement of existing regulations
		Spear fishing	Elusive **DD**	Lack of enforcement of applicable regulations Uncontrolled access to the MPA
		Careless diving practices	Potential	Lack of understanding of the vulnerability of coral reefs
		Abandoned fishing gear	Low in 2005	Lack of understanding of the vulnerability of coral reefs
Reef fish	Altered community trophic structure: reduction of grazer fish abundance	Selective fishing targeting grazer fish (spear fishing)	**S**	Lack of awareness of the negative impact of inappropriate fishing practices Lack of enforcement of applicable regulations
Small coastal pelagics	Decline in fish abundance and diversity	Habitat degradation and pollution	**DD**	(Pollution causes addressed for coral reefs)
		Non selective fishing practice: Overfishing due to small mesh size of fishing nets	**DD**	Lack of awareness of the negative impact of fishing practices Lack of enforcement of applicable regulations
Marine turtles	Sporadic	Poaching, harassment, egg collection	**DD**	Lack of awareness of the vulnerability of resources and of the negative impact of hunting and egg collection
Seagrass bed	Localized physical damage	Beach seine nets	**DD**	Lack of awareness of the negative impact of fishing practice

[1] (30-60% in Flamingo, 2005 - Weil)

Resources	Status and long-term trend	Threats	Importance of threat	Root causes
		Anchoring in inappropriate locations	DD	Lack of awareness and enforcement of existing regulations No demarcation signs on land or on the coast Lack of appreciation of the value and vulnerability of the MPA resources
	Altered species composition	Invasive exotic species (*Halophila stipulacea*)	DD	Uncontrolled access to the MPA (likely introduced to Grenada via recreational yachts)
Mangrove	Small	Pollution	DD	
Sandy beaches	Variable width and variable access for Beauséjour bay	Natural seasonal processes Hurricanes / storm surge	NS	Global phenomenon that cannot be addressed by the management plan
		Erosion in watershed causing siltation	S	
	Beach erosion	Sand mining	S	Lack of awareness and enforcement of applicable regulations
	Variable cleanliness	Solid waste left by beach users Solid waste thrown over the cliff by local people (Flamingo Bay)	H	Lack of awareness and enforcement of applicable regulations Lack of appreciation of the value and potential benefits of the MPA resources for local communities
Rocky shores	---	---	---	---
Secluded bays	---	---	---	---
Underwater sculptures and wreck	Degradation	Natural processes	---	---

12.2. Sustainable financing mechanisms / Access fees

The financial resources from the government budget which are available for the management of the Molinière-Beauséjour MPA are not consistent from one year to another. The Fisheries Department has not yet collected fees for the use of the two designated marine MPAs but plans to implement the fee Schedule in the *Marine Protected Area Regulations*.

The establishment of a sustainable financing mechanism is essential for implementing the management plan in the long term. There is no sustainable mechanism to provide adequate financial resources for the implementation of the Molinière-Beauséjour MPA management plan. No financial/business plan has been prepared yet for the Molinière-Beauséjour MPA and the time and resources available in the context of the elaboration of this management plan did not allow its preparation. Its elaboration thus becomes one of the priorities of the action plan.

12.3. MPA Access

Once tourism and recreational activities are allowed in a protected area, the question arises about the appropriate type and level of tourism or the number of visitors who should access the MPA at one time, since the main purpose of the management is to protect the area and its resources. This question is referred to as the concept of carrying capacity

Carrying capacity. While the definition of tourism carrying capacity by the World Tourism Organization focuses on preventing a decrease in the quality of visitor's satisfaction, the concept of carrying capacity in a protected area must aim at preserving the values for which it was established. Carrying capacity may be defined at various levels: *physical* (the maximum number of visitors that the area is able to support), *economic* (may be seen as the point at which increased revenue brought by tourism development is overtaken by inflation caused by tourism or when tourism development displaces services or shops intended for the local community), *social* (the level of tourism development which leads to negative sociocultural impacts in local communities), and *biological* (the level of habitat or resource use at which damage or deterioration exceeds the capacity to regenerate).

The MPA physical carrying capacity for diving is limited by the number of moorings and the maximum number of divers on a diving boat since most divers access the area by sea. The economic carrying capacity around the MPA is not a concern at the moment. The social carrying capacity however should require special attention given the fact that, despite a general support for the MPA, a fraction of the local population feels that the benefits brought by the existence of the MPA are mostly for tourists, and people have high expectations from tourism development related to the MPA.

The MPA biological carrying capacity for diving cannot be easily and reliably assessed. However, the adoption of a precautionary approach is recommended due to the small size of the reef and the ease of access of the site due to its proximity to the capital city and main tourist sites. The approach

of defining *limits of acceptable change* consistent with the MPA objectives may be more realistic but requires close monitoring and evaluation of the vulnerable resources.

12.4. Communication, public awareness, education and interpretation

The success of this MPA depends largely on the managers' capacity to give back the area and its resources to local people and users. For the moment, many feel disconnected with what is going on there, don't understand the purpose of establishing a MPA and what it implies. Illegal uses are often due, at least in part, to ignorance of applicable laws and regulations.

One of the important challenges for the management of the Molinière-Beauséjour MPA is to foster MPA ownership by local communities. This can be addressed by communication, public awareness, education and interpretation

- about the MPA, its location, its values and short and long-term benefits
- about applicable regulations: local understanding of MPA rules and regulations which will reduce the need for enforcement and must precede any type of enforcement

12.5. Enforcement, Operational Management and Logistics

Current situation: Illegal practices are taking place and illegal fishing gear is used in the Molinière-Beauséjour MPA (spear gun, small mesh size nets, lines of over 30 lbs resistance, sand mining, anchoring other than in anchoring areas, use of moorings without permit or license) which results in undue pressures on MPA resources and missed opportunities for collecting funds. This situation may be attributable to gaps such as

- No surveillance and no record of illegal practices
- Lack of awareness and understanding of applicable regulations among users and local communities
- No signage of demarcation of MPA boundaries and inadequate legal reference
- Lack of human resource and adequate equipment to enforce existing regulations

12.6. Pollution

The pollution issue was partially addressed under the sections on water quality and on sand beaches. This section goes over this information again to present an integrated overview of the pollution issue in the Molinière-Beauséjour MPA.

The following pollution sources threaten the MPA resources and users:

1. Molinière River and Beauséjour River watersheds: sediments, nutrients and pollutants
2. Perseverance dump
3. Oil tank farm in Grand Mal
4. Yachts anchoring overnight (sewage water and litter)
5. Litter from recreational users and neighbouring population

1. **Watersheds**. Ideally, the MPA and its resources would be better protected if it were integrated into a unified coastal zone management programme. Such a programme has not been developed yet. It is important to assess the potential for pollution from the watersheds of the two rivers that outflow into the MPA although no large scale industrial or intensive agricultural activities are conducted therein that could impact the water quality of the rivers and therefore the water quality in the MPA coastal area.

A forest management plan was developed for the Annandale forest at the head of the Beauséjour River and a Watershed management unit sees to its implementation. Upstream the MPA, the Perseverance protected area was established to protect the habitat of the Grenada dove. Between these two protected areas, pollution sources throughout the watershed are likely to be mostly related to private small scale farming activities (agriculture and livestock) and untreated domestic wastewater from low income settlements that don't have access to proper sanitation.

2. **Perseverance dump** The Perseverance landfill area is located about 1 km north of the MPA and 200m inland from the coast. All wastes generated in the neighbouring parishes are dumped in this landfill and, besides household waste, include industrial, medical and chemical wastes as well as wastes containing heavy metals such as batteries and electronic wastes.

The landfill pollution enters the river and coastal waters via groundwater seepage and surface water runoff. In an open dump such as the one in Perseverance, rain water moves through the waste and absorbs any organic and inorganic compounds, including metals, pesticides and solvents that are in the waste. The resulting leachate enters the soil and the groundwater below the dump, thus posing a risk to the environment and human health, especially in the presence of toxic chemicals. The leachate must inevitably reach the marine coastal area through seepage and when it rains and have a certain level of toxicity for vulnerable resources. However, without understanding the current dynamics in the coastal area, it is not possible to ascertain that this pollution reaches the MPA even if minute concentrations may have a detrimental impact on coral reefs.

3. **Oil tank farm.** Water and sediment analyses have shown oil contamination. This pollution might result from Grand Mal tank farm operations. A contingency plan was established for the tank farm, required equipment is in place and people trained. It is not clear whether the plan includes a communication plan. The MPA warden must be aware of the contingency plan and keep contact with the officer in charge of implementing the contingency measures. In case of an accident, a communication protocol between the MPA ranger and this officer should be defined.

4. **Yachts anchoring overnight.** Yachts are not allowed to anchor in a MPA except in an anchoring zone (SRO 78, section 6.1e). Risk associated with overnight anchoring is real as there are no facilities for pumping out sewage waters outside marinas and enforcement is difficult at night. It has been decided that no overnight anchoring or mooring will be allowed in the MPA for cruising yachts.

5. **Litter**. Litter source is mostly from recreational users and thrown over the cliff by neighbouring population. Garbage is collected twice a week, so there is no reason to throw garbage over the cliff.

It does not seem possible to install bins on the beach (too far from the road to be collected) according to the Solid Waste Management Authority which is in charge of collecting and transporting domestic waste.

The collaboration of the Solid Waste Management Authority should be sought to address this aspect of the pollution issue. According to the Solid Waste Management Authority Act, No.11 of 1995, duties of the Authority include the development of all aspects of solid waste management in Grenada (…) with due regard to ecological and environmental factors, and to provide promptly as needed facilities, services and other resources required for solid waste management.

The Waste Management Act, No. 16 of 2001 makes provision regarding litter deposit in a MPA:

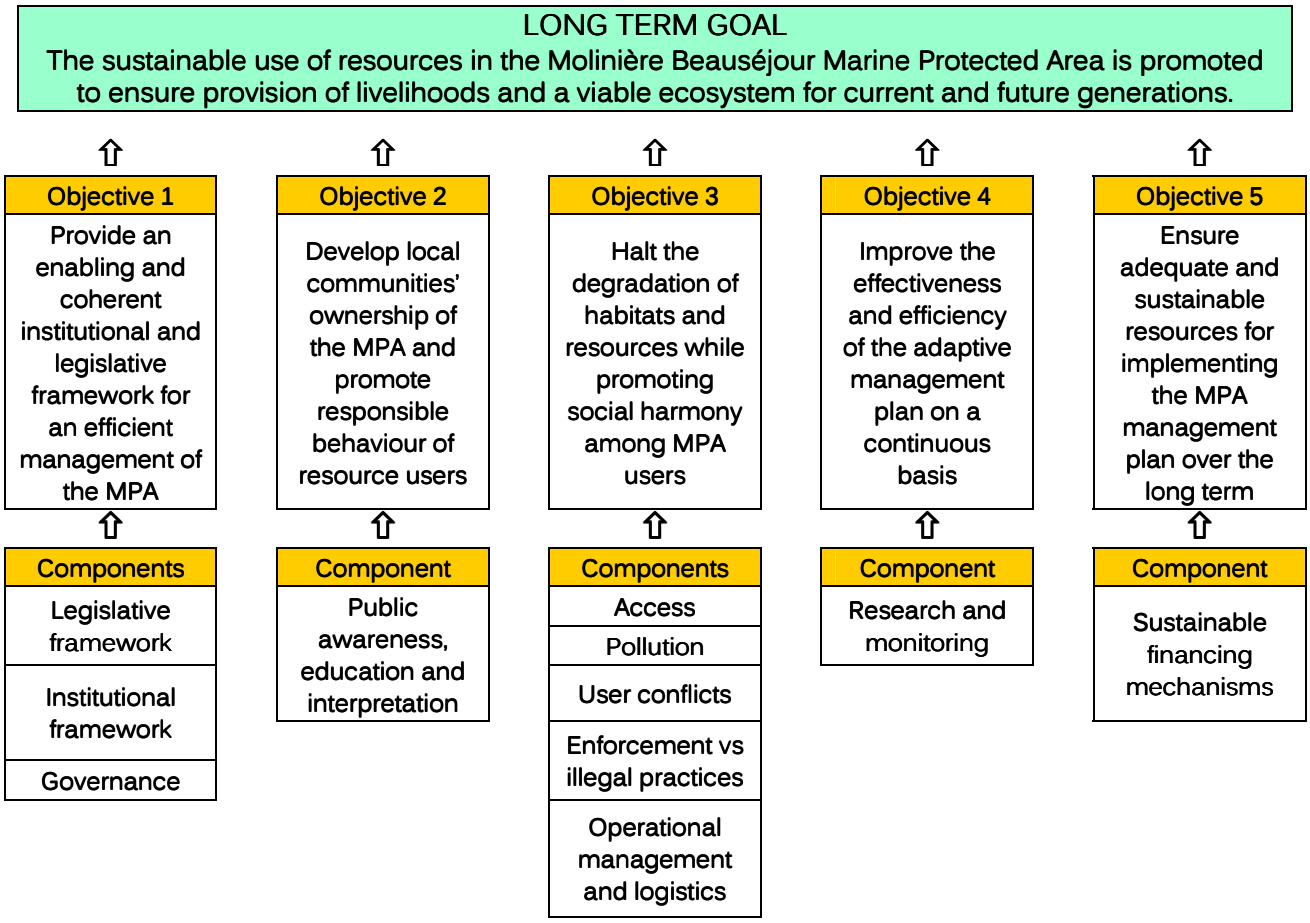
- To deposit or cause to be deposited any litter or other waste in or on any national park or protected area, territorial waters, beach, foreshore, marine waters, river or river bank without lawful authority is an offence (fine 50,000$ and imprisonment for 6 months).
- Authorized officers may be designated in writing by the Minister; every police officer and environmental health officer – on written direction of the Minister, may search any ship or aircraft to take the measures necessary to prevent that waste on board to be off-loaded.

12.7. Conflicts

The various issues may also be viewed as conflicts between:

Type of conflict	"Protagonists"			Root cause
Various uses and conservation of natural values	Spearfishing	⇆	Coral reefs	Lack of enforcement
	Beach seine fishing	⇆	Seagrass beds	Adequacy of MPA zoning?
	Anchoring	⇆	Coral reefs and seagrass beds	Lack of enforcement Insufficient moorings
	Sand mining	⇆	Beaches	Lack of enforcement
	Littering	⇆	Beaches	Lack of enforcement Lack of awareness
	Perseverance Landfill	⇆	Air / water / soil / quality	Need for integrated watershed management
One resource component and another	Algae	⇆	Corals	Low grazer fish abundance High nutrient concentration
	Invasive seagrass	⇆	Native seagrass	Uncontrolled access
	Water from river watersheds	⇆	Coastal resources	Need for integrated watershed management
Various uses and the resource they target or depend on	Divers	⇆	Coral reefs	Lack of awareness
	Beach seine fishing (small mesh size)	⇆	Reef fish	Lack of enforcement Lack of awareness?
	Spear fishing	⇆	Grazing reef fish	Lack of enforcement
One use and another	Diving	⇆	Spearfishing (safety)	Lack of enforcement
	Charter boats	⇆	Seine fishers	Need for regulations relatives to MPA zones

13. Management objectives and actions



This section presents objectives corresponding to the major issues, and these objectives are translated into intended results. Proposed actions are identified under each component to correspond to management objectives and lead to intended results. It is assumed that the implementation of these actions will lead to the realization of the intended results and that these results will eventually lead to the attainment of the objectives, which will contribute to the achievement of the long term goal. Indicators are identified for each intended result and allow testing whether the actions are appropriate and effective to achieve the intended results. Result indicators are often referred to as performance indicators. Operational indicators are objectively verifiable factual evidence to allow monitoring whether actions have been successfully carried out. A procedure for evaluating and reviewing the management plan is suggested in Section 15.

Some issues can be addressed directly by the management plan while other issues can only be addressed by other actors with whom the MPA Management Committee or the Molinière-Beauséjour MPA Stakeholders Committee will need to establish communication and collaboration. All actions will be integrated in an annual work plan that will indicate frequency or time period, responsibility /accountability and partners (Annex 5).

13.1. Objective 1 - Provide an enabling and coherent institutional and legislative / regulatory framework for an efficient management of the MPA

13.1.1. Legislative and regulatory framework

Intended result	Actions	Operational indicators
A legislative/regulatory framework provides an unambiguous legal foundation to manage the MPA and guide procedures if a prohibited activity takes place. **Result indicators:** 1. Implementation of the management plan is efficient 2. Responsibilities are clearly attributed among committees and among committee members	Revise existing legislation and regulation regarding the management of marine protected areas to address the constraints identified in section 12.1.1 and other issues as identified by the MPA Management Committee and the Molinière-Beauséjour MPA Stakeholder Committee	Existence and adequacy of enabling legislation/regulation

13.1.2. Institutional framework

Intended results	Actions	Operational indicators
A formal body bringing together representatives of the Molinière-Beauséjour MPA stakeholder groups oversees the management of the Molinière-Beauséjour MPA **Result indicator:** The Molinière-Beauséjour MPA Stakeholder Committee is formalized and operational	1. Revise existing legislation/regulation on the management of marine protected areas to make provision for a Stakeholder Committee 2. Define Stakeholder Committee's role, powers, duties and operational procedures	1. Existence of a legally mandated MPA management body 2. Activity level of the Stakeholder Committee / Minutes of regular meetings

13.1.3. Governance

Intended result	Actions	Operational indicators
Local stakeholders concerns and priorities are taken into account in the MPA management decisions **Result indicator:** Satisfaction level of MPA stakeholders regarding the management of the MPA and its resources	1. Verify local communities' interest to choose representative members to sit on the Stakeholder Committee or to set up Local Advisory Committees, or both. 2. Involve local communities more directly and more actively in the MPA stakeholder group	1. Representation of major stakeholder groups on the Molinière-Beauséjour MPA Stakeholder Committee 2. Effectiveness and consistency of information sharing between local communities and the MPA Stakeholder Committee through Local Advisory Committees 3. Existence and activity level of Community Advisory Committees

13.2. Objective 2 - Develop local communities' ownership of the MPA and promote responsible behaviour of resource users

The emphasis is on information, education and encouraging compliance.

13.2.1. Public awareness, education and interpretation

Intended result	Actions	Operational indicators
Increased understanding leads to increased compliance which reduces the need for enforcement **Result indicator:** 1. Number of offences 2. Perception of non-use and non-market values	Revise and complete the communication plan, establish a contact list with relevant contact information, a communication agenda and assess financial resources needed	Availability of revised communication plan, contact list, communication agenda and resources required for the implementation of the communication plan
	Prepare educational and promotional material	Availability and adequacy of required material
	Implement the communication plan for the MPA, including targeted educational and information programs for the general public and schools	Level of implementation of the communication plan: number of public information/ education/ interpretation sessions and attendance
Increased respect for the MPA **Result indicators:** 1. Amount of litter from local users according to beach cleanups analyses 2. Level of understanding of human impact on resources	Organize an awareness campaign on litter's impact on marine resources, notably plastic garbage, in conjunction with annual beach cleanups	Proportion of stakeholders informed about MPA resources, values, benefits and vulnerability Level of participation of local population in annual beach cleanups
	Hold public awareness and education activities for local communities to highlight the values, potential benefits and vulnerability of the MPA resources	
Reduced incidence of activities having a detrimental impact on MPA resources **Result indicator:** Frequency and type of offence	Hold information sessions on MPA zoning and rules, applicable regulations and enforcement for local communities	Level of knowledge and understanding of applicable regulations regarding authorized activities and practices in the MPA

13.3. Objective 3 - Halt the degradation of habitats and resources while promoting social harmony among Molinière-Beauséjour MPA users

13.3.1. Access

Intended result	Actions	Operational indicators
Human activities carried out in the MPA do not have a direct or indirect detrimental effect on the MPA valued resources	1. Revise and formalize boundaries and zoning of the MPA 2. Prepare and distribute maps and notification to concerned	1. Molinière-Beauséjour MPA boundaries and zoning formalized 2. Number of meetings held, attendance and level of

Intended result	Actions	Operational indicators
Result indicators: 1. Deterioration of coral reef condition due to physical destruction (diving, fishing, anchoring) 2. Coral recruitment rate	authorities and stakeholders 3. Organize information sessions for concerned authorities and stakeholders on Molinière-Beauséjour MPA boundaries and zoning	satisfaction among participants
	1. Prepare a short reminder for diving operators to remind divers about careful practices when diving, especially in a MPA 2. Analyse the evolution of coral reef condition in correlation with diving pressure to define the limit of acceptable change in relation to diving frequency or maximum number of divers in one location at one time	1. Recommendations made to diving operators 2. Limits of acceptable change defined for coral reefs and related to diving frequency or maximum number of divers in one location at one time
Result indicators: 3. Abundance of herbivore fish species in the catch of coastal fishing activities 4. Incidence of marine turtles killing, harassment and egg collection in the MPA.	Hold public awareness, education and interpretation activities to increase awareness of the value and vulnerability of coral reefs, and on the negative impact of inappropriate practices such as sand mining or non selective fishing	Level of understanding of the value and vulnerability of coral reefs and other marine resources in the MPA and of the measures adopted to protect it.
	Revise existing regulations to ban any activity affecting marine turtles, i.e. hunting, harassment, egg collection, alteration of the beaches frequented by marine turtles	Prohibition of marine turtles hunting, harassment, or egg collection in Grenada.

13.3.2. Pollution

Intended result	Actions	Operational indicators
Improved water quality for marine resources and public health **Result indicator:** 1. Oil content in MPA water and sediment samples 2. Nutrients concentration in MPA water samples 3. Bacterial concentrations in MPA water samples in relation to acceptable limits for public health	Enforce existing legislation/regulation	Adequate measures are taken to reduce the various pollution sources that affect the MBMPA, its resources and users.
	Promote the implementation of integrated watershed management or ICZM, and ensure MPA Stakeholders Committee representation on an ICZM committee, to convey MPA committee's concerns about the land-based pollution and excess siltation issues.	

Intended result	Actions	Operational indicators
and coral protection.	Ensure that an EIA is conducted for any intervention that could potentially threaten the MPA resources and values, as legally requested	Availability of EIA reports
Improved quality of beaches as habitat and improved safety for public health **Result indicator:** Proportion and amount of litter on beaches from users and surrounding communities	Enforce legislation regarding the deposit of waste in a protected area, on beaches or marine waters – Waste Management Act No. 16 of 2001, Sect.33	1. Annual beach cleanups 2. Analysis of litter composition 3. Local participation to annual cleanups
	Institutionalize and promote voluntary annual beach and underwater cleanups	
	Involve local advisory committees (if and once they are set up) in the organization and promotion of beach and underwater cleanups	
	Educate people about opportunities to reduce waste and develop recycling	

13.3.3. User conflicts

Intended result	Actions	Operational indicators
The MPA biodiversity objective is reconciled with the sustainable livelihood objective. **Result indicator:** Perception of non use and non market values of the MPA among stakeholders	1. Formalize Molinière-Beauséjour MPA zoning and associated rules 2. Inform at first and later enforce MPA zoning and rules 3. Hold public awareness, education and interpretation sessions to highlight the benefits of the MPA for stakeholders and local communities 4. Examine the potential for developing initiatives to ensure an equitable sharing of the benefits provided by the MPA	Level of understanding of the long term benefits of a MPA among stakeholders and surrounding population
MPA provides equitable benefits to stakeholders **Result indicator:** Perception of inequity among users		1. Users understanding of the purpose of the zoning and rules within the Molinière-Beauséjour MPA 2. Users level of compliance with the rules

When the Molinière-Beauséjour MPA was gazetted in 2001, the SRO No. 77 presented boundaries and a zoning scheme. Regulations applicable to MPAs were detailed in the Fisheries (Marine Protected Areas) Regulations (SRO No. 78 of 2001). On the basis of additional surveys and consultation with stakeholders, a second zoning scheme, made simpler and more applicable, was put forward in 2006 as an outcome of the MPA Realization in Grenada project.

In addition to applicable regulations in force, different regulations are put forward for fishing, diving, yachting and other uses according to this new zoning. These regulations are recommended in order to meet objectives addressing priority issues for the sustainability of the MPA and its

resources. Table 21 specifies what can be done in each zone and under what conditions and takes into account applicable regulations that require enforcement in specific zones

Figure 8. Recommended zoning for the Molinière-Beauséjour MPA

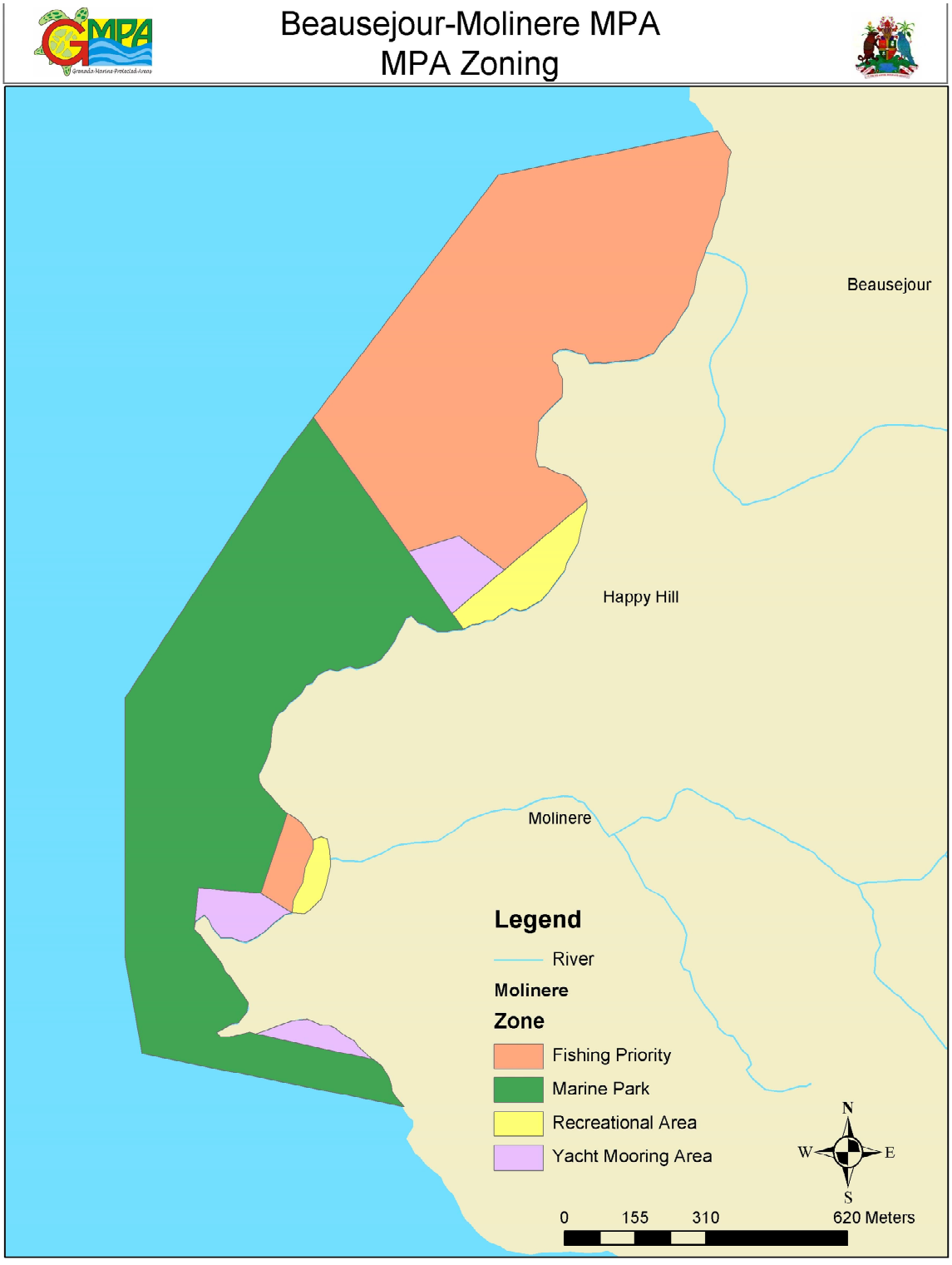


Table 21. Regulations associated to each zone in the MPA

✗ : forbidden ✓ : allowed --- : not applicable

Activity	Conditions	Zones				
		Fishing priority area	Marine Park	Recreation areas (beaches)	Yacht mooring area	Rocky shores
Research	For the preservation and improvement of the MPA and its resources	✓	✓	✓	✓	✓
Education		✓	✓	✓	✓	✓
Commercial fishing		✓	✗	✗	✗	✗
Line fishing	Maximum 30 lbs breaking strain in accordance with SRO 78 Art. 11 (e)	✓	✗	---	✗	✓
Spearfishing	Carrying or using is prohibited in MPA under any condition	✗	✗	---	✗	---
Seine fishing	Avoid seagrass area, respect mesh size regulation	✓	✗	✓	✗	---
Live bait sack		✓	✗	---	✗	---
Exercise and sport on land		---	---	✓	---	---
Swimming and bathing		✓	✓	✓	---	---
Picnic	Littering prohibited in accordance with SRO 78 s.6(1)l and Waste Management Act No.16 s.33(1)	---	---	✓	---	---
Aquatic sports (canoeing, sailing, kayaking)	Allowed provided there is no interference with priority activity	✓	✓	---	✓	---
Water-ski / any water sport using a boat with a propeller	In accordance with SRO 78 s.6(1)k,j	✗	✗	✗	✗	---

Activity	Conditions	Zones				
		Fishing priority area	Marine Park	Recreation areas (beaches)	Yacht mooring area	Rocky shores
Scuba diving and snorkelling	Close monitoring of coral reef condition with the collaboration of dive shop operators Under the supervision of a certified diver in accordance with SRO 78 s.6(1)h	×	✓	---	✓	---
Anchoring	In accordance with SRO 78 s.6(1)e	✓	×	×	×	×
Vessel movement in access zones	Speed max 5 mph at right angle to the shore in accordance with SRO 78 s.11a	✓	✓	---	✓	---
Dredging, sand mining / any material extraction	Prohibited in a MPA under any conditionin accordance with SRO 78 s.6(1)d and Beach Protection Law No. 67	×	×	×	×	×
Shell collection	In accordance with SRO 78 s.6(1)a	×	×	×	×	✓
Waste or pollutant disposal	In accordance with SRO 78 s.6(1)l and Waste Management Act No.16 s.33(1)	×	×	×	×	×
Alteration of the natural environment Construction/ erection of building or any structure on/over land or water	In accordance with SRO 78 s.6(1)m Mandatory EIA (under the Physical Planning Unit) for any coastal development that might impact the MPA and its resources – to ensure that whatever is done outside MPA boundaries must not contribute to alter the MPA natural environment – MPA and Fisheries Division representatives must be involved in the review process	×	×	×	×	×

13.3.4. Enforcement of applicable legislation/regulation regarding illegal practices

Intended result	Actions	Operational indicators
A reduction of illegal practices in MPA alleviates pressures on MPA resources (fish, coral, sand beaches) **Result indicators:** 1. Population level of herbivore fish and Diadema urchins in relation to desired reference level 2. Coral reef condition (rate of bleaching and disease) 3. Biodiversity indices (species richness for the main taxonomic groups, Simpson's index) 4. Depth of beaches	Formalize Molinière-Beauséjour MPA zoning and associated rules	Clearly defined enforcement procedures
	Notify concerned authorities and stakeholders of revised MPA boundaries on navigational charts and MPA zoning and associated regulations	1. Information material and maps elaborated and distributed 2. Number of meetings and attendance
	Issue a notice to charters and publish notices in the monthly publication to publicize MPA location and regulations to all ship owners	
	Hold meetings to inform enforcement bodies (coastal guards, port authority, and police) of MPA boundaries, zones and regulations (included in the communication plan)	
	Until MB MPA revised boundaries, zones and regulations are formal, **enforce** applicable regulations on sand mining, spear fishing, fishing gear, and littering **and inform** surrounding communities and users on the MPA planned zoning and allowed uses	1. Incidence of illegal fishing practices (Spearfishing, small mesh size nets, high strain fishing lines) 2. Incidence of sand mining 3. Incidence of anchoring 4. Incidence of boats using moorings without valid permit 5. Incidence of diving boats without valid permit 6. Incidence of littering (from boats, recreational activities on the beach, throwing garbage over the cliff, or other) 7. Incidence or evidence of oil spills
	Carry out surveillance of coastal areas within the MPA according to amended regulation and MPA rules	
	Hold public awareness and education activities on the negative impact of inappropriate practices on resources (ex. sand mining, non selective fishing) for surrounding communities (included in the communication plan)	

Enforcement will be part of the MPA warden's duties, but the collaboration of other government personnel with 'powers of arrest' will be requested to arrest offenders (coastal guard and police).

13.3.5. Operational management, human resources and logistics

Intended result	Actions	Operational indicators
Enforcement and monitoring are effective in the MPA **Result indicator:** Implementation of the management plan including the monitoring activities according the planned schedule	Provide equipment, communication and staff as required for adequate enforcement	1. Availability and adequacy of the equipment required for adequate enforcement 2. Availability and competency of MPA staff
	Provide sufficient and adequate moorings according to committee's technical recommendations	Availability and adequacy of moorings
Molinière-Beauséjour MPA staff and MPA Stakeholder Committee are competent in the performance of their duties **Result indicator:** Effectiveness and timeliness of the performance of management tasks	Assess training needs for MPA staff, Stakeholder Committee, and volunteers	Availability of the assessment of training needs and opportunities
	Organize or facilitate training sessions according to required capacities	Type and number of trainings attended by MPA staff, stakeholder committee members and volunteers

13.4. Objective 4 - Improve the effectiveness and efficiency of the adaptive management plan on a continuous basis

13.4.1. Research and monitoring

Intended result	Actions	Operational indicators
Scientific understanding expanded through research and monitoring and shared with stakeholders and partners improves the efficiency and effectiveness of the MPA management **Result indicators:** 1. Level of satisfaction of stakeholders regarding knowledge produced and shared 2. Number of research projects which results are effectively integrated or taken into account to improve the management of the MPA	Collect and analyse information on the Molinière-Beauséjour MPA and produce a MPA-specific database that can be accessed freely and searched by all concerned stakeholders	Availability of a knowledge management system which allows collecting, analysing and sharing environmental, biological, and socioeconomic information
	Prepare a digest of relevant information accessible and understandable to all stakeholders involved in the periodical revision of the management plan	
	Organize and participate in information sharing events (conferences, seminars) about MPA issues	Number of events and level of satisfaction of participants

Intended result	Actions	Operational indicators
A sustainable collaboration with SGU and with local diving operators enables understanding the evolution of important parameters **Result indicator:** 1. Effectiveness and timeliness of the monitoring of important parameters 2. Number of research projects providing relevant information to improve the management plan and assess its effectiveness	1. Establish a MoU with local universities to foster the involvement of students in research and monitoring projects related to the MPA 2. Establish a MoU or simple agreements with diving operators to foster the participation of divers to monitoring activities related to the MPA 3. Develop a monitoring protocol and survey material in collaboration with local universities scientists and dive shop operators	1. Existence of agreements on research and monitoring protocols 2. Production of scientific papers and data, shared and integrated in the MPA database

13.5. Objective 5 - Ensure adequate and sustainable resources for implementing the MPA management plan over the long term

13.5.1. Sustainable financing mechanism

Intended result	Actions	Operational indicators
A sustainable financing mechanism provides adequate financial resources for the implementation of the Molinière-Beauséjour MPA management plan in the long term **Result indicator:** Availability and allocation of MPA financial resources	Develop a financial plan to evaluate the cost of implementing the Molinière-Beauséjour MPA management plan over a 5 to 10 year period.	1. Availability of the MPA financial plan 2. Availability of annual financial statements regarding the management of the MPA
The administration of the revenues of the payment system is transparent and efficient and provides a sustainable financing for the MPA management **Result indicator:** Proportion of the recurrent MPA operational costs that is covered by the revenues generated by the payment system for users	Develop and implement a payment system for users (operators, divers and vessels using moorings)	Proportion of the revenues generated for the use of the MPA that are invested in its management

A financial plan will evaluate the cost of implementing the M-B MPA management plan on the basis of the management objectives and actions, over a 5 to 10 year period, assess secured revenues and calculate the gap. This plan could look into creative financing mechanisms and devise a funding strategy to increase direct revenue based on the valuation of the MPA resources as goods

and services. The active participation of the private sector to devise and implement such financing mechanism based on resource user contribution is indispensable.

Cost assessment must include:

1. Recurrent operational and administrative costs for the regular operations in the MPA, such as wages and cost for patrolling, compliance/enforcement, monitoring, communication, maintenance, and community outreach and education;
2. Occasional or one-off expenditures, such as attendance at meetings and events;
3. Capital investments for infrastructure (such as MPA office, visitors facilities), major equipment, baseline assessment, and training and research.

As part of the funding strategy, this plan could look into innovative financing mechanisms to increase direct revenue, independently of the government regular budget and following the user-payer concept on the basis of the identification of the MPA resources and values as goods and services.

Such mechanisms may include resource user contribution through payment for access (annual permits, licences, and user fees), the establishment of supporting groups that could raise funds for the MPA locally, and application to donor agencies for special investment and research projects.

Financial/business plans were prepared as part of the management plans for Sandy Island/Oyster Bed MPA in Grenada and Tobago Cays Marine Park. Guided by these methodologies, some steps will apply directly or will be easily adapted to M-B MPA or provide reference values to facilitate the elaboration of the financial plan.

The following points require decision-making:

- ⇨ Fees for the use of moorings
- ⇨ Permits and fees for MPA access
- ⇨ Flexible procedure for determining fees (instead of fixed fees in the law)
- ⇨ Who collects fees and fines from whom, how, and pays to what fund?
- ⇨ Who manages that fund and makes decision on how to spend the fund and its revenues?
- ⇨ How to ensure that at least part of the fees collected for using the MPA will be available for the MPA operation and investments?
- ⇨ Accounting, management and resource allocation rules and procedures

14. Research, monitoring, evaluation and integration of new knowledge for adaptive management

Research and monitoring efforts are required to *i)* collect information needed to identify appropriate management measures (or options) to meet objectives and reach intended results, *ii)* define a baseline against which the effectiveness of the management plan will be assessed and *iii)* track the evolution of the result indicators to assess and review the management measures.

14.1. Preparation of a monitoring program

The monitoring program will include all result indicators for the purpose of monitoring the effectiveness of the management actions, and all operational indicators for the purpose of monitoring whether actions are effectively and timely implemented. Table 22 may be used to include additional indicators. It is important to link indicators to management objectives or intended results; otherwise the interpretation and use of these indicators will not be clear.

The monitoring program must indicate who is accountable for measuring indicators and for collecting and compiling data, and if needed, refer to simple protocols. It must be specified who collects what information, at what frequency, where data is stored and with whom it should be systematically shared.

Knowledge gaps should be continuously identified throughout the implementation and evaluation of the management plan and point to research and monitoring needs.

In Table 22, the status of key resources is summarized and main knowledge gaps identified to lay a foundation to identify priority monitoring or research needs. Frequency and potential collaborations are suggested.

14.2. Monitoring tasks included in the warden's duties

The following tasks should be included in the warden's duties:

- Water turbidity, temperature and pH (in each bay, on a weekly basis) and water level (on a monthly basis)
- Daily use of moorings (location, identification of mooring, fee collected and duration)
- Daily diving activities (for SCUBA diving and snorkelling) (location, operator, number of divers, fee collected)
- Occurrence of significant conflicts (nature of the conflict, people involved, need for follow-up action)
- Occurrence of significant accidents (type of accident – including oil spill – people involved if so, intervention if so, need for follow-up action)
- Occurrence of illegal activities (if enforcement does not successfully prevent the offence or if the offence was already committed) – such illegal activities may include:
    - Evidence of sand mining
    - Fishing with prohibited gear or in prohibited areas
    - Anchoring (anywhere in the MPA)

- Using moorings without valid permit
- Diving without valid permit
- Littering (from boats, recreational activities on the beach, throwing garbage over the cliff)

14.3. Information storage

Digitized information should be available on a website hosted and managed at WINDREF / SGU. Paper and map documents could be duplicated as much as possible and stored at the Fisheries Division and at WINDREF / SGU. Information storage should be part of an institutional agreement between the Molinière-Beauséjour MPA and SGU/WINDREF.

Table 22. Status of main resources, knowledge gaps and monitoring or research needs

Resources	Status and long-term trend	Knowledge gaps[1]	Monitoring/ research	Frequency	Potential collaboration
Coral reefs	▪ Smothering of corals by algae overgrowth ▪ Intense bleaching (30 to 60%) recorded in 2005, mostly for the reef building genera *Agaricia* and *Montastrea* ▪ No coral disease recorded in Flamingo bay in 2006 although Yellow Band Disease was recorded in Valley (site in Grenada) ▪ Coral damage in Dragon Bay by Hurricane Ivan in September 2004 ▪ Local improvement in Flamingo Bay	The relative importance of the factors affecting coral vs algae prevalence (selective fishing, high nutrient concentration)	Monitoring of coral coverage in relation to water quality (esp. nutrient concentrations) and incidence of spear fishing	Bi-annual: dry and rainy seasons	Public Health Dept. / SGU (must be negotiated as part of an institutional agreement) Ranger, Dr. Bob Anderson, Wisconsin Lutheran College
		Approaches to control water quality problems in MPA (nutrient, TSS, oil)	To be determined	As needed	Forestry Dept. Authorities in charge of oil tank farm Public health
		▪ Current coral health and bleaching status ▪ Seasonal variability of coral health and bleaching status ▪ Capacity development for monitoring coral diseases and bleaching required	Monitoring of coral health and bleaching status	Bi-annual (to capture the seasonal variability)	Dr. Clare Morrall, WINDREF/SGU, Dr. Bob Anderson, Wisconsin Lutheran College Dr. Ernesto Weil, Uni. Puerto Rico
		Long-term trend of coral reef distribution and species composition (abundance, diversity and seasonal variability)	ECS surveys for same transects	Bi-annual (to capture the seasonal variability)	Dr. Bob Anderson, Wisconsin Lutheran College –: long term plan (10 years)

[1] Knowledge needed for developing management strategies and actions

Resources	Status and long-term trend	Knowledge gaps[1]	Monitoring/ research	Frequency	Potential collaboration
		Long-term trend and seasonal variability of water quality	Monitoring of water pH, dissolved O_2, coliforms, N, P, phosphates, TSS, oil and grease	Bi-annual: dry and rainy seasons	Ministry of Public Health Dept. Environmental Health /SGU
		Long-term trend and seasonal variability of water quality	Assessment of techniques and approaches to reduce rivers sediment load (Beauséjour and Molinière)	To be determined	Forestry Dept. Dialogue and collaboration with upstream watershed board or committee
		Connectivity and sources of recruitment among coral reefs	Research project Coastal current dynamics	To be determined	Steve Nimrod and Jerry Mitchell, WINDREF/SGU
		Knowledge of the coastal currents dynamics to assess pollution and siltation threats from various sources, and as a fundamental element for understanding the connectivity and sources of recruitment among coral reefs			
		Assessment of the impact of coastal fisheries, namely beach seine fishing, on herbivore fish species	Monitoring of beach seine catch composition	To be determined	To be determined
		Economic valuation of the reef ecosystem	Economic study		

Resources	Status and long-term trend	Knowledge gaps[1]	Monitoring/ research	Frequency	Potential collaboration
Reef fish	Altered trophic structure (food web): low grazer fish abundance	Long-term trend for reef fish communities		Yearly	Dr. Bob Anderson, Wisconsin Lutheran College Participating dive shops
	The number of coastal/artisanal fishermen using the MPA is decreasing	Evolution of the fishing activity for local communities' livelihood and subsistence			
Small coastal pelagics	Some species have disappeared from the area	Long term evolution			
		Impact of non selective gear (small mesh nets) on fish recruitment			
		Potential for reappearance of species as fishing pressure lowers			
Secluded bays	5 vessel moorings in Molinière Point, 2 in Dragon Bay, 1 around the corner towards Grand Mal and 4 moorings in Flamingo Bay	Level of use of moorings (frequency and duration)	Monitoring of the use of moorings (frequency and duration)		
Mangrove	Small size	Importance as a habitat for bird, crustacean or mollusc species Connectedness with coastal area Potential for crustacean or wood collection	Resource survey	Surveys conducted during dry and rainy seasons	

Resources	Status and long-term trend	Knowledge gaps[1]	Monitoring/ research	Frequency	Potential collaboration
Rocky shores	Stable		Visual monitoring of vulnerable areas	Annual	
Seagrass beds	▪ Monospecific seagrass bed ▪ *Halophila stipulacea* invasive exotic species which high expansion rates threaten coral reefs ▪ Beauséjour Bay used to be covered with a large seagrass bed (30 years ago)	Importance of *Halophila stipulacea* threat to coral reefs or other resources in the MPA	Assessment of the threat of the invasive seagrass species (*Halophila stipulacea*) to coral reefs or other resources in the MPA and the need to control or eradicate	To be determined	SGU Marine Dept
		Appropriate method to control the invasive species while avoiding dissemination of propagules if control or eradication is deemed required		To be determined	

Resources	Status and long-term trend	Knowledge gaps[1]	Monitoring/ research	Frequency	Potential collaboration
Sandy beaches	▪ Variable (seasonal) width and access for Beauséjour ▪ Hurricane unearthed marine litter ▪ Dragon and Beauséjour Bays are recovering from heavy sand mining which had taken place over many years ▪ Sand mining is still occurring regularly in Beauséjour but is the action of a few people on a relatively small scale ▪ Litter dumped from cliffs and recreational activities		Beach monitoring following the UNESCO Sandwatch approach[1] : recording of erosion and accretion, beach composition, human activities, beach debris, water quality, waves, longshore currents, and plants and animals.		
	Likelihood of disturbance of marine turtles (poaching, egg collection, harassment) due to proximity of the settlements	Importance and consistency of turtles occurrence on MPA beaches	Monitoring of marine turtles tracks	Daily	MPA warden
Underwater sculpture park	Degradation	Users willingness to pay for diving in the MPA			

1 Cambers and Diamond. 2009.

14.4. Adaptive management

Adaptive planning recognizes the uncertainty about the outcomes of any particular action as well as knowledge gaps. Indeed, there is no such thing as complete information. A complete knowledge of biodiversity and ecology and a full understanding of the social, economic and political environment at one time are rarely possible. Knowledge of ecological relationships is incomplete and, therefore, the management of natural resources is always experimental. Despite incomplete information and despite unpredictability, immediate action is required. Managers and conservationists cannot wait until all knowledge is acquired to take action and counter pressing threats. Adaptive management therefore aims to improve management effectiveness by incorporating research into conservation action and monitoring the effects of implemented actions to learn and adapt.

Adaptive management is regarded as an iterative process of implementation, review and revision, not as a series of fixed prescriptions to be implemented. The actual results of actions are monitored and used to assess the effectiveness of actions to meet intended results, inform decision-making and, where necessary, modify or adapt management practices or options. This process is illustrated in Figure 9.

Performance Evaluation and Adaptive Management. Monitoring is important to determine if management actions have been successful in achieving the intended results and their stated objectives and goals. For example, if the goal of an MPA is to protect corals and increase fish stocks on depleted coral reefs, then monitoring the status of the coral and fish communities will determine if the management actions have been successful. Similarly, social monitoring of local communities can inform managers whether their objective of improving local communities' perceptions and compliance has been successful. This information is essential to inform stakeholders of the success (or otherwise) of the management actions, and to modify management practices where they have not been successful in achieving their goals. The aim of adaptive management is to modify management practices to be more successful, based on lessons learned from previous management actions.

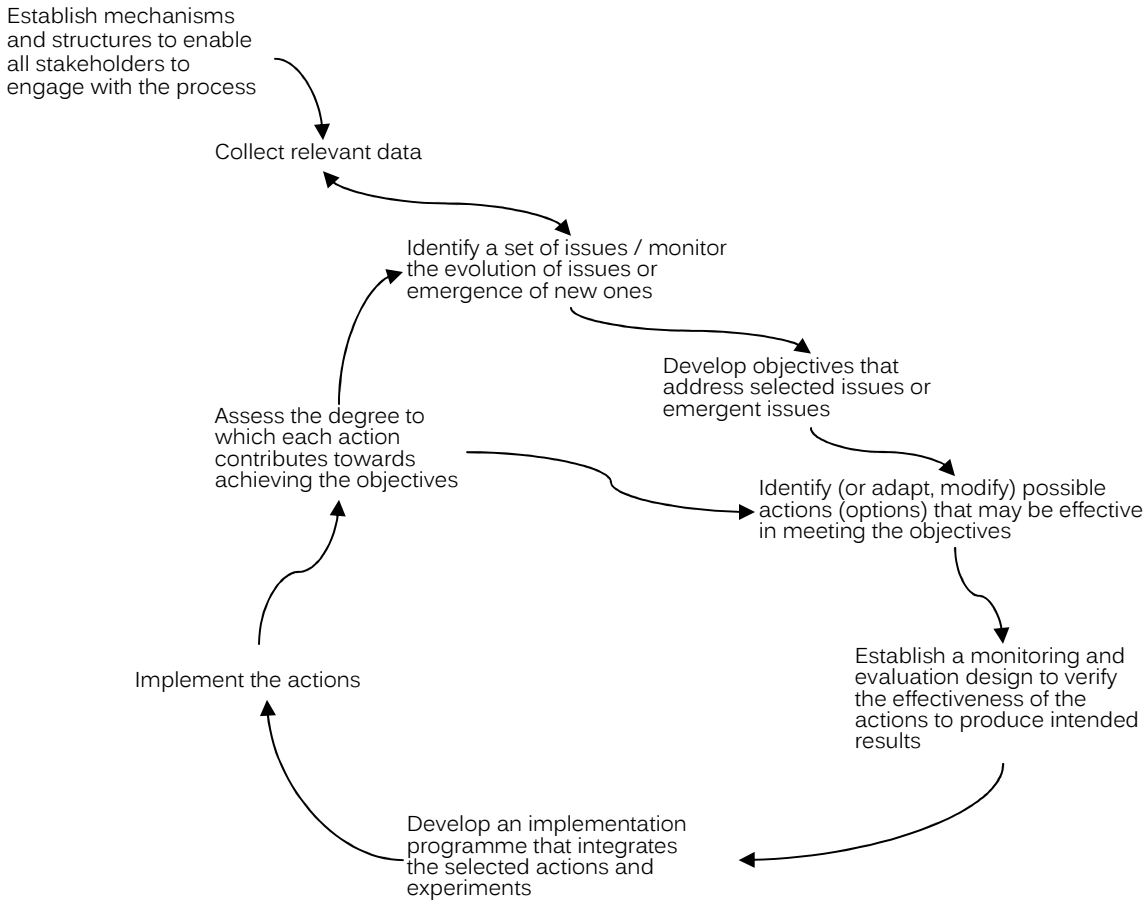


Figure 9. Outline of a rational, adaptive and participatory planning process.
Source: Adapted from Lockwood, 2006.

15. Communication plan

The communication plan includes objectives for the purpose of information and coordination. The communication plan is built as a matrix identifying target groups, main messages, appropriate communication tools, frequency, calendar, and needed resources.

Objectives of the communication plan

Information	▪ Promote a large participation for the official launching of the Molinière-Beauséjour MPA ▪ Raise awareness of local communities about the importance of protecting M-B coastal area and resources, ▪ Highlight benefits for all stakeholders to develop ownership, encourage compliance and voluntary involvement in the various tasks required to meet the management plan objectives ▪ Advocate in favour of MPA benefits with Government and donors to ensure an appropriate allocation of resources for the management of the MPA
Coordination	▪ Ensure the effective participation of primary stakeholders in the implementation of the Molinière-Beauséjour management plan ▪ Incorporate the decisions of the MPA Management Committee in the management plan of the Molinière-Beauséjour MPA ▪ Enforcement ▪ Ensure the liaison with other agencies and organizations ▪ Ensure the coordination of research and monitoring activities ▪ Ensure timely reporting to donors and MPA Management Committee

Communication plan

	Target Groups	Means[1] of communication	Main messages / purpose	Frequency	Resp.
Coordination	M-B MPA stakeholders committee members	Email	Daily management of the MPA	As needed	Chairman of Stakeholder Committee
		Email / telephone	Calling of meetings	Monthly and as needed for specific matters	
	National MPA Co-management Committee	To be determined	Policy matters	As needed	Chairman of Nat. MPA Committee
		Report	Progress report on management plan implementation	Quarterly	
	Enforcement bodies	Telephone	In case of arrest, seizure, confiscation, or commission of offence	As needed	To be determined
	Local volunteers	Local meetings and through local advisory committees	Beach cleanup	Yearly	To be determined
	Local volunteers	Email	Coordination of resource monitoring activities	Twice a year	To be determined
	Divers	Through participating diving operators	Voluntary monitoring of reef resources	Yearly	To be determined
	Research institutions and scientists: WINDREF, SGU Public Health Dep., CERMES, Wisconsin Coll.	Email	Planning research and monitoring activities in the MPA and development of research proposals	As needed	To be determined
			Coordination of meetings for revising the adaptive management plan through the evaluation and integration of research and monitoring results	Yearly	Chairman of Stakeholder Committee
	Other Ministries, Departments, Governmental bodies and agencies	To be determined	Coordination for collaboration or enforcement	As needed	MPA Coordinator
		To be determined	According to objectives and actions, notably with organizations in the watershed or any organization related to the Perseverance landfill rehabilitation to help solve pollution issues from external sources	As needed	Chairman of Stakeholder Committee

[1] Radio, Local and national televisions, newspapers, posters and leaflet, mail and email, telephone, press release, interviews,

	Target Groups	Means[1] of communication	Main messages / purpose	Frequency	Resp.
Information	Local population, tourists	Billboards (4' x 8') along the main road (Mt Moritz intersection and Brizan) and in each of the 3 bays	MPA location, zoning, and allowed / prohibited activities using pictograms	Permanent signs	MPA Coordinator
		Leaflet	- MPA map, zoning and rules (dos and don'ts) - MPA location, resources, values and short and long-term benefits - Highlight contribution of MPA to the quality of life of local communities and as a recreational area for youths and families - Environmental education - Awareness campaign on litter's impact on marine resources, notably plastic garbage, in conjunction with annual beach cleanups	Official MPA launching and as needed	
		Public information campaigns and meetings in community centers			
		Government Information Service			
	MPA resource users	Signage on the coast (to be viewed from the sea) in the **marine park**	Name of the MPA and main prohibited activities using pictograms: no spear gun, no anchoring, no line fishing from a boat, no littering)	Permanent signs	MPA Coordinator
		Signage on the coast (to be viewed from the sea) in the **fishing priority area**	Name of the MPA, fishing priority area, and main prohibited activities using pictograms: no spear gun, no diving, no littering)	Permanent signs	MPA Coordinator
		Local meetings	MPA location, values and short and long-term benefits	As needed	Chairman of Stakeholder Committee
		Small informative signs along access routes from the road	Spear gun prohibited	Permanent signs	MPA Coordinator
Information	Local communities	Local meetings	Report back on fishery and household socioeconomic surveys conducted with USAID/COTS support	Once	USAID-COTS ?
		Local event, banners, promotional material	Launching of the MPA	Once	MPA Coordinator
		Posters	Miniature of billboards: MPA location, zoning, and allowed / prohibited activities using pictograms	Once	MPA Coordinator

	Target Groups	Means[1] of communication	Main messages / purpose	Frequency	Resp.
	Divers	Through participating dive shops	Short guidelines on "dos and don'ts and why" for the use of the dive master to brief divers before diving in the MPA	Continuous	To be determined
			Promotion of volunteering for reef monitoring activities	Continuous	Participating dive shops
	Visitors to Grenada	Leaflet distributed at all ports of entry	Grenada's MPAs, their location, specific values, benefits and allowed / prohibited activities, requesting visitors to contribute to the preservation of the country's natural resources and refrain from taking or buying coral, threatened species shells, turtle shell, or items made of these	Permanent	MPA Coordinator
		Board at airport arrival in the waiting area		Permanent	
		Board at cruise ship terminal		Permanent	
		Charters and other ship owners	Notice in the monthly publication to publicize MPA location and regulations	?	MPA Coordinator
	Donors	Email	Submission of proposals	Unspecified	To be determined
		Reports	Reporting on achievements related to allocated resources and status of MPA resources	Yearly	Chairman of Stakeholder Committee
	Medias	To be determined	Invitation for MPA official launch	Once	To be determined
		To be determined	Background information on Grenada's MPAs and resources, values, benefits for public dissemination	As needed	
	MPAs of the national or regional network	Email	MPA Annual reports	Yearly	Chairman of Stakeholder Committee
		Email / website	Workshops / trainings / experience sharing	As needed	To be determined

16. Annexes

Annex 5: Annual work plan framework (template)

Annex 6. Grenada legal provisions concerning the management of marine protected areas and their resources

Annex 7. International Conventions and Agreements on Biodiversity

Annex 5: Annual Work Plan framework (template)

Molinière-Beauséjour Management Plan Annual Work Plan

Activities	Responsibility / partners♠	2011											
		J	F	M	A	M	J	J	A	S	O	N	D
		1	2	3	4	5	6	7	8	9	10	11	12
Objective 1 - Provide an enabling and coherent institutional and legislative / regulatory framework for an efficient management of the MPA													
1.1 Legislative and regulatory framework													
Revise existing legislation and regulation regarding the management of marine protected areas to address the constraints identified in section 12.1.1 and other issues as identified by the MPA Management Committee and the Molinière-Beauséjour MPA Stakeholder Committee													
1.2 Institutional framework													
Revise existing legislation/regulation on the management of marine protected areas to make provision for a Stakeholder Committee													
Define Stakeholder Committee's role, powers, duties and operational procedures													
1.3 Governance													
Verify local communities' interest to choose representative members to sit on the Stakeholder Committee or to form local advisory committees, or both.													

♠ Responsibility is underlined and refers to the responsibility for initiating activities and accountability for the results. Partners are actively involved in carrying out the activity but do not hold the responsibility. Abbreviations or acronyms may be used to identify the individuals or institutions

Activities	Responsibility / partners♠	2011											
		J	F	M	A	M	J	J	A	S	O	N	D
		1	2	3	4	5	6	7	8	9	10	11	12
Involve local communities more directly and more actively in the MPA stakeholder group													
Objective 2 - Develop local communities' ownership of the MPA and promote responsible behaviour of resource users													
Public awareness, education and interpretation													
Revise and complete the communication plan, establish a contact list with relevant contact information, a communication agenda and assess financial resources needed													
Prepare educational and promotional material													
Implement the communication plan for the MPA, including targeted educational and information programs for the general public and schools													
Organize an awareness campaign on litter's impact on marine resources, notably plastic garbage, in conjunction with annual beach cleanups													
Hold public awareness and education activities for local communities to highlight the values, potential benefits and vulnerability of the MPA resources													
Hold information sessions on MPA zoning and rules, applicable regulations and enforcement for local communities													
Objective 3 - Halt the degradation of habitats and resources while promoting social harmony among MPA users													
Access													
Revise and formalize boundaries and zoning of the MPA													

Activities	Responsibility / partners♠	2011											
		J	F	M	A	M	J	J	A	S	O	N	D
		1	2	3	4	5	6	7	8	9	10	11	12
Prepare and distribute maps and notification to concerned authorities and stakeholders													
Organize information sessions for concerned authorities and stakeholders on Molinière-Beauséjour MPA boundaries and zoning													
Prepare a short reminder for diving operators to remind divers about careful practices when diving, especially in a MPA													
Analyse the evolution of coral reef condition in correlation with diving pressure to define the limit of acceptable change in relation to diving frequency or maximum number of divers in one location at one time													
Hold public awareness, education and interpretation activities to increase awareness of the value and vulnerability of coral reefs, and on the negative impact of inappropriate practices such as sand mining or non selective fishing													
Revise existing regulations to ban any activity affecting marine turtles, i.e. hunting, harassment, egg collection, alteration of the beaches frequented by marine turtles													
Pollution													
Enforce existing legislation/regulation													

		2011											
Activities	Responsibility / partners♠	J	F	M	A	M	J	J	A	S	O	N	D
		1	2	3	4	5	6	7	8	9	10	11	12
Promote the implementation of integrated watershed management or ICZM, and ensure MPA Stakeholders Committee representation on a ICZM committee, to convey MPA committee's concerns about the land-based pollution and excess siltation issues.													
Ensure that an EIA is conducted for any intervention that could potentially threaten the MPA resources and values, as legally requested													
Enforce legislation regarding the deposit of waste in a protected area, on beaches or marine waters – Waste Management Act No. 16 of 2001, Sect.33													
Institutionalize and promote voluntary annual beach and underwater cleanups													
Involve local advisory committees (if and once they are set up) in the organization and promotion of beach and underwater cleanups													
Educate people about opportunities to reduce waste and develop recycling													
User conflicts													
Formalize Molinière-Beauséjour MPA zoning and associated rules													
Inform at first and later enforce MPA zoning and rules													

Activities	Responsibility / partners♠	2011											
		J	F	M	A	M	J	J	A	S	O	N	D
		1	2	3	4	5	6	7	8	9	10	11	12
Hold public awareness, education and interpretation sessions to highlight the benefits of the MPA for stakeholders and local communities													
Examine the potential for developing initiatives to ensure an equitable sharing of the benefits provided by the MPA													
Enforcement of applicable legislation/regulation regarding illegal practices													
Formalize Molinière-Beauséjour MPA zoning and associated rules													
Notify concerned authorities and stakeholders of revised MPA boundaries on navigational charts and MPA zoning and associated regulations													
Issue a notice to charters and publish notices in the monthly publication to publicize MPA location and regulations to all ship owners													
Hold meetings to inform enforcement bodies (coastal guards, port authority, and police) of MPA boundaries, zones and regulations (included in the communication plan)													
Until MB MPA revised boundaries, zones and regulations are formal, enforce applicable regulations on sand mining, spear fishing, fishing gear, and littering and inform surrounding communities and users on the MPA planned zoning and allowed uses													
Carry out surveillance of coastal areas within the MPA according to amended regulation and MPA rules													

Activities	Responsibility / partners♠	2011											
		J	F	M	A	M	J	J	A	S	O	N	D
		1	2	3	4	5	6	7	8	9	10	11	12
Hold public awareness and education activities on the negative impact of inappropriate practices on resources (ex. sand mining, non selective fishing) for surrounding communities (included in the communication plan)													
Operational management, human resources and logistics													
Provide equipment, communication and staff as required for adequate enforcement													
Provide sufficient and adequate moorings according to committee's technical recommendations													
Assess training needs for MPA staff, Stakeholder Committee, and volunteers													
Organize or facilitate training sessions according to required capacities													
Objective 4 - Improve the effectiveness and efficiency of the adaptive management plan on a continuous basis													
Research and monitoring													
Collect and analyse information on the Molinière-Beauséjour MPA and produce a MPA-specific database that can be accessed freely and searched by all concerned stakeholders													
Prepare a digest of relevant information accessible and understandable to all stakeholders involved in the periodical revision of the management plan													
Organize and participate in information sharing events (conferences, seminars) about MPA issues													

		2011											
Activities	Responsibility / partners♠	J	F	M	A	M	J	J	A	S	O	N	D
		1	2	3	4	5	6	7	8	9	10	11	12
Establish a MoU with local universities to foster the involvement of students in research and monitoring projects related to the MPA													
Establish a MoU or simple agreements with diving operators to foster the involvement of students in research and monitoring projects related to the MPA													
Develop a monitoring protocol and survey material in collaboration with scientists from local universities and dive shop operators													
Objective 5 - Ensure adequate and sustainable resources for implementing the MPA management plan over the long term													
Sustainable financing mechanism													
Development of a financial plan to evaluate the cost of implementing the Molinière-Beauséjour MPA management plan over a 5 to 10 year period.													
Develop a payment system for users (operators, divers and vessels using moorings)													

Annex 6. Grenada legal provisions concerning the management of marine protected areas and their resources

Title	Relevant provisions
Beach Protection Law No. 67 of 1979 (Beach Protection Ordinance (Cap. 32) is repealed)	Digging, taking, carrying away any sand, stone, shingle or gravel from any beach or seashore in Grenada or assisting in is declared to be an offence – Persons acting in contravention of this Law may be arrested without a warrant– denunciation rewarded
Beach Vending (Regulation) Act No. 21, 1998.	An Act to regulate beach vending and to provide for connected matters. Also provides for the prohibition of harassment.
Birds and Other Wildlife (Protection of) (Amendment) Ordinance No. 26, 1964	Amends Birds and Other Wildlife (Protection of) Act Cap 34, 1957. Possession of lobsters of less than one pound or less than 9 in. forbidden unless lobster farm – capturing females with eggs forbidden – closing season – for exportation, permit required from Minister of Trade and Production
Cruise Ship (Visitors Levy) (Amendment) Act No. 32, 1991.	An Act to provide for an increase in the levy on cruise ship visitors.
Fisheries Act No. 15, 1986	Provides for the promotion and management of fishing and fisheries in Grenadian waters. Sect. 3, 4: Preparation and review of a plan for fisheries management and development to ensure optimum utilization of the resources in consultation with fishermen and local authorities Sect. 11, 12, 14: Use of local fishing vessel require a valid fishing license which validity is 12 months max, and which requires payment of fees for every license Sect. 19: Minister may designate local fisheries management areas to be managed by a body representing local fishermen Sect. 21: A fishing priority area may be declared by an order of the Minister to protect authorized fishing Sect. 23: Makes provision and specifies purposes for the Minister to declare any area of the fishery water and adjacent lands as marine reserves, and specifies permitted activities. Sect. 25, 26: Prohibit destructive fishing methods (explosives, poison, noxious substances) and use of nets of irregular mesh size or other irregular fishing gear Sect. 27, 28: Powers of authorized officer for enforcement designated by Minister may include stopping and boarding a vessel, examine license, examine fishing gear at sea or on land, and seize vessel, gear, and fish if it is believed on reasonable grounds that an offence has been committed. Sect. 39: About collecting fine in respect of a local fishing vessel. Sect. 40: Specifies Minister's remit regarding fisheries regulation. Purposes include the management of marine reserves, fishing priority areas and protection of endangered marine species

Title	Relevant provisions
Fisheries Regulations (SRO No. 9, 1987)	Sect. 2: Specifies the composition of the Fisheries Advisory Committee, procedures and functions. Sect. 8-11: Conditions for local fishing licenses, including fixed fees (Schedule 6) Sect. 16-20: Fisheries conservation measures for lobster, turtles, conch, coral, and aquarium fish. These measures are amended by SRO No. 24 Schedules 1-14: Application and license forms and related fees
Fisheries Amendment Regulations (SRO No. 24, 1996)	Sect. 16 – 21: Provide amendments on fishery conservation measures regarding the exploitation of lobster, turtle, conch, sea urchin, and oyster. Sect. 22: Fishing with beach seine nets having mesh sizes smaller than regulation allows is forbidden Sect. 23: Specifies procedures to operate a SCUBA diving facility Sect. 24: Forbidden actions for the protection of coral and coral reefs: disposal of rubbish or discharge of any material; water skiing; anchoring of boats unless such areas have been designated; removal of vegetation; handling of coral or standing on it. Sect. 25: Foreigners are not allowed to use a spear gun in fishery waters
Fisheries (Marine Protected Areas) Order (SRO No. 77, 2001)	Designation of 2 MPAs: Molinière-Beauséjour and Woburn's Clarks Court Bay, including maps with delineation and zoning
Fisheries (Marine Protected Areas) Regulations (SRO No. 78, 2001)	Sect. 3: Definition of Management Authority (ambiguous); its remit is not specified. ▪ No provision for a MPA Stakeholder Committee (MPA level) Sect. 4: Composition of the Management Committee. A member of local communities may be invited a meeting if decision is to be made about specific matter. Sect. 5: Procedures of the committee are not clearly defined (Sect. 5.2 "normal") Sect. 5.3: The quorum is set at 3 representatives, not specifying which ones.

Title	Relevant provisions
Fisheries (Marine Protected Areas) Regulations (SRO No. 78, 2001) (Continued)	Sect. 6: The following is prohibited in a MPA: ▪ destroying, damaging or injuring plants or animals, or taking them except in fishing zones, ▪ taking or damaging artefacts, ▪ removing sand, rock or coral, ▪ anchoring except in an anchoring zone, ▪ causing anchor damage to artefacts, corals, reef, and marine plant or animal, ▪ mooring a vessel other than at a buoy, ▪ SCUBA or snorkel diving for non qualified divers unless supervised by a qualified diver, ▪ using jet skis or hovercraft, or water skis except in a water ski zone, ▪ dumping any refuse, waste, vehicle, oil, bilge water, pesticide or any harmful substance ▪ erecting any structure unless permitted by the Minister, ▪ use or have in his/her possession a firearm, spear gun, air gun, or other weapon, except for the MPA warden, ▪ accessing by foot except on designated routes.
	Sect. 7: A marine park (a category of MPA) is open to all persons by land or sea. Sect. 8 -10: Prohibited activities in marine reserves, marine sanctuaries and marine historical sites. Sect. 11: Categories of potential zones in a MPA and activities that are allowed therein are specified: access zones, anchoring zones, aquatic sports zones, camping zones, fishing zones (where commercial and recreational fishing from shoreline, small drifting craft, using light tackle of no more than 30 lbs breaking strain is allowed), parking zones, swimming zones, training zones and water-ski zones. Sect. 12 Provides for specimen collection by scientists. Sect. 13-15 Dive and charter vessels must have valid permits to operate in a MPA. Sect. 16: MPA Authority may prohibit the entrance of any type or class of vessel in a MPA Sect. 21: Officers responsible for enforcing the MPA regulations are marine park wardens and any police officer. The powers of a MPA warden are specified.
Oil in Navigable Waters Act Cap 218	An act to make provision against the discharge or escape of oil into the territorial sea of Grenada. Sect. 3: Discharging oil or allowing it to escape directly or indirectly into the territorial waters of Grenada and the water of harbours therein is an offence.

Title	Relevant provisions
Oil in Navigable Waters Ordinance Cap 204 of 1928	An ordinance to make provision against the discharge or escape of oil into the territorial waters of the "colony". Sect. 3: Discharging or allowing to escape any oil, whether directly or indirectly, into any territorial water of the "colony" and the waters of the harbours therein, is an offence. Sect. 6: Any liquid contained in spaces used for carriage of oil are deemed to be oil for purposes of the ordinance.
Physical Planning and Development Control Act, No. 25 of 2002	An act to make fresh provision for the control of physical development, to continue the Land Development Authority, to require the preparation of physical plans for Grenada, to protect and conserve the natural and cultural heritage, and to maintain and improve the quality of the physical environment in Grenada, including its amenity. Sect. 25: The Land Development Authority may require an Environmental Impact Assessment to be carried out for permission to develop land in Grenada if proposed development could significantly affect the environment. Sect. 40. The Land Development Authority functions as the national service for the identification, protection, conservation and rehabilitation of the natural and cultural heritage of Grenada Sect. 41. The Natural and Cultural Heritage Advisory Committee advises the Authority on matters such as the declaration of places of natural beauty or interest to be environmental protection areas, and the incorporation of the protection, conservation and rehabilitation of the natural and cultural heritage into planning policy at the level of local, regional and national development plans. Sect. 43. No person may execute or cause to permit any disturbance of a site included in a list which would seriously affect its character unless permitted.
Ports Authority Act No. 14 of 1978 (CAP. 247)	Establishes Grenada Ports Authority - Responsible for the administration and operations of all Grenada's seaports including the ports of St. George's and others, and Oil terminal at Grand Mal.
Solid Waste Management Authority Act, No.11 of 1995	Sect.11 (a) Duties of Authority: to develop all aspects of solid waste management in Grenada... with due regard to ecological and environmental factors, and to provide promptly as needed facilities, services and other resources required for solid waste management
Tourist Board Act No. 29 Cap 321, 1988	An Act to establish a Tourist Board charged with the duty of developing the tourist industry and promoting its efficiency.
Waste Management Act, No. 16 of 2001	Sect. 33 (1) To deposit or cause to be deposited any litter or other waste in or on any national park or protected area, territorial waters, beach, foreshore, marine waters, river or river bank without lawful authority is an offence: fine 50,000$ and imprisonment for 6 months Sect. 42 Authorized officers: may be designated in writing by the Minister; every police officer and environmental health officer – on written direction of the Minister, may search any ship or aircraft to take the measures necessary to prevent that waste on board to be off-loaded

Title	Relevant provisions
Yachting Act No. 38 of 1998	Ports Authority has jurisdiction over the licensing and control of yacht movements
-	Anchoring. Yachts may not anchor within 200 metres offshore of any beach in Grenada, Carriacou or Petite Martinique. Visiting yachtsmen must check with customs to see if they need a coastwide clearance (for which there is no charge), to visit the other islands and harbours.
Yachting Act No. 17, of 2000	Yachts must have a valid license (1 year) or cruise permit (temporary) in Grenada territorial sea – fees are paid into the Consolidated Fund – the Director of Maritime Affairs has a register of all licensed yachts

Annex 7. International Conventions and Agreements on Biodiversity

Excerpt from: James Finlay (1999) *Assessment and Analysis of Fisheries - Marine and Coastal Areas*. *Report for the preparation of the Grenada National Biodiversity Strategy and Action Plan* – UNDP/GEF Project No. GRN/98/G31/A/1G/99.

Grenada as part of the global and regional community of nations and as a small island nation state recently emerged from colonialism, has signed or ratified or acceded to many conventions and agreements and protocols promoting biological diversity. All such agreements and conventions are referred to as "soft law" since each needs to be translated into specific local acts or regulations and supported by local institutional arrangements. The most notable agreements and conventions relevant to biodiversity may be defined as (not all adopted by Grenada as yet).

- Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere (1940)
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar, 1971)
- World Heritage Convention (1972)
- International Convention on the Prevention of Marine Pollution by Dumping Waste and Other Matter (1972)
- Convention on the Conservation of Migratory Species of Wild Animals (1972)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1973)
- International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)
- Amazon Co-operation Treaty (ACT, 1978)
- United Nations Convention on the Law of the Sea (UNCLOS, III 1982)
- Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention, 1983) and its Protocol Concerning Specially Protected Areas and Wildlife (SPAW, 1990)
- Convention for the Protection of the Ozone Layer (Vienna Convention and its Montreal Protocol of 1987)
- Convention on the Control of Transboundary Movements of Hazardous Wastes (Basel, 1989)
- International Convention on Oil Pollution Preparedness, Response and Co-operation (OPPRC, 1990)
- Convention on Biological Diversity (CBD, 1992)
- United Nations Framework Convention on Climate Change (UNFCCC, 1992 and the Kyoto Protocol, 1997)
- United Nations Convention to Combat Desertification (1992)
- Central American Biodiversity Convention (CABD. 1992). The Central American Commission on Environment and Development (CCAD) is charged with implementing the Convention and updating the Central American Forestry and Protected Area Action Plans

- International Coral Reef Initiative (ICRI, 1995)
- Global Programme of Action for the Protection of the Marine Environment from Land based Activities (GPA, 1995)

RELEVANT REGIONAL PROGRAMMES AND ORGANISATIONS

- UNESCO's Man and the Biosphere Programme (MAB, 1972)
- Caribbean Environment Programme of UNEP (CEP, 1981)
- Organisation of Eastern Caribbean States (OECS, 1981) and its Natural Resources Management Unit
- Tropical Forestry Action Plan (TFAP, 1985)
- Sub-Commission of UNESCO's Inter-governmental Oceanographic
- Commission (IOC) for the Caribbean and Adjacent Regions (IOCARIBE)

Subregional (OECS) agreements intended to indirectly conserve biodiversity include OECS Fisheries Zones Surveillance Agreement 1991 and OECS Fisheries Zones Fishing Agreement.

Some of the above International Conventions and Agreements have become treaties, some with, some without Grenada's participation as signatory such as the International Convention on Trade in Endangered Species (CITES, 1992), Grenada is expected to sign on in 1999. Many of Grenada laws and regulations predating conventions agreements and protocols and programmes and institutions cited above contain some general or even specific provisions for conserving biodiversity of fisheries, marine and coastal resources. However, the era of International Conventions etc. adopted for the purposes of biodiversity dating back to the 1940's demonstrate a greater focus for nation states in formulating national law and administration for the purpose.