



Grenada Carriacou Petite Martinique

Coral Reef Report Card
2016




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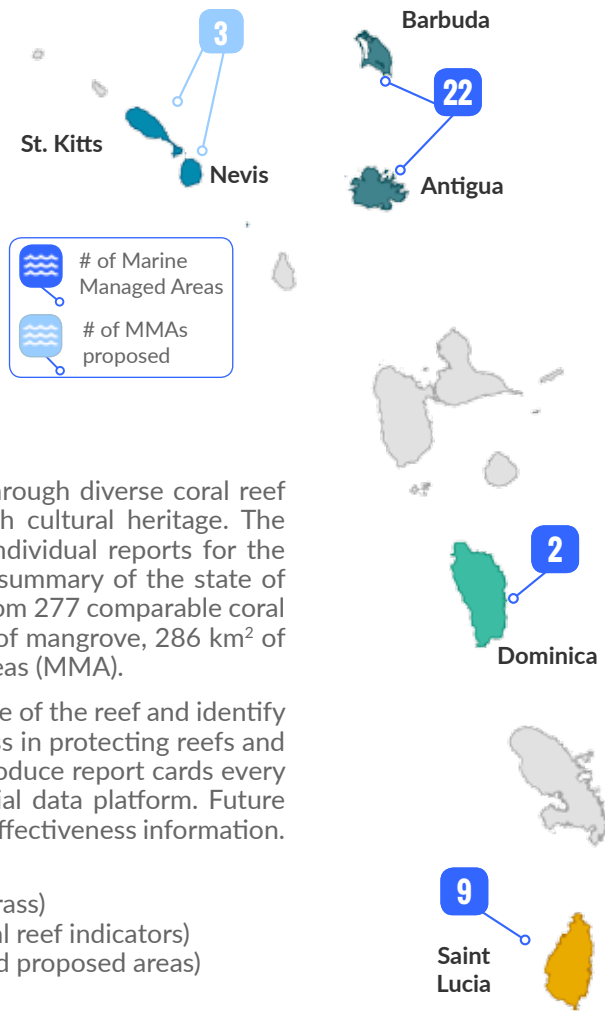
based on a decision of the German Bundestag

Eastern Caribbean Coral Reef Report Cards

 **6** PARTICIPATING COUNTRIES
224,813 SQUARE KM OF OCEAN

 **44** AREAS DESIGNATED SINCE 1973
526 SQUARE KM OF OCEAN

 **50** AREAS PROPOSED
990 SQUARE KM OF OCEAN



The 2016 Coral Reef Report Cards

The Eastern Caribbean Seascape is an arc of islands linked through diverse coral reef ecosystems, oceanic currents, migratory pathways and a rich cultural heritage. The Eastern Caribbean Coral Reef Report Cards are a series of individual reports for the 6 participating countries and provide an easy-to-understand summary of the state of the region's marine resources. The Report Cards collate data from 277 comparable coral reef surveys and map in detail 383 km² of coral reefs, 19 km² of mangrove, 286 km² of seagrass, 44 designated and 50 proposed Marine Managed Areas (MMA).

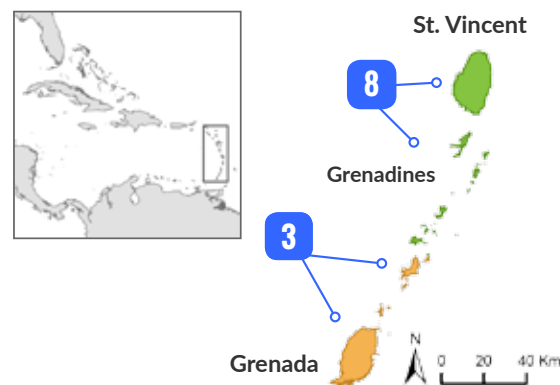
The Report Cards provide an initial baseline on the current state of the reef and identify gaps. Reporting this type of information will help track progress in protecting reefs and inform future monitoring and management. The vision is to produce report cards every 2 years and share data through the CaribNode regional spatial data platform. Future report cards will include key socioeconomic and management effectiveness information.

Each Report Card includes information on:

- Key Habitats (location and extent of coral, mangrove, seagrass)
- Reef Health Index (a measure of the health of four key coral reef indicators)
- Marine Managed Areas (size and location of designated and proposed areas)

The Framework

To protect the region's marine biodiversity, it is essential to understand key issues and share critical data. The Climate-Resilient Eastern Caribbean Marine Managed Areas Network (ECMMAN) project developed the following framework to advance national and regional data collection and strengthen marine managed areas in the region.

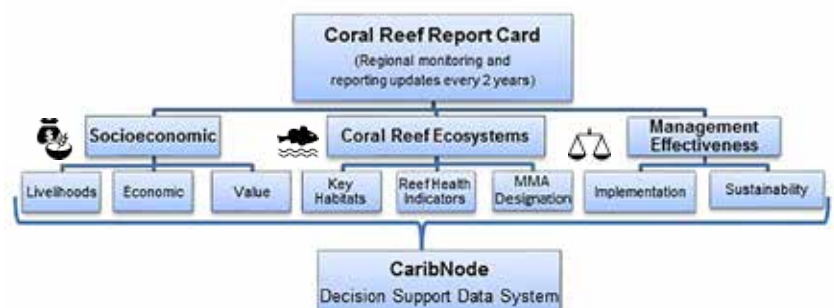


ECMMAN countries and number of MMAs with designated borders

1) **ECMMAN Monitoring Network:** The Network collects, analyzes and shares data through standardized methods. Three main themes include ecological, socio-economic, and marine management effectiveness. Indicator data (diagram right) are shared through the CaribNode.

2) **CaribNode:** This online information system combines regional and national data to create resource management tools. The Coral Reef Assessment Tool provides standardized indicators to monitor the marine environment, evaluate management, and track the wellbeing of coastal communities (www.caribnode.org)

3) **Coral Reef Report Cards:** Includes the Reef Health Index, an assessment tool to measure coral reef health. The Report Card integrates monitoring data and engages stakeholders to help protect marine ecosystems.

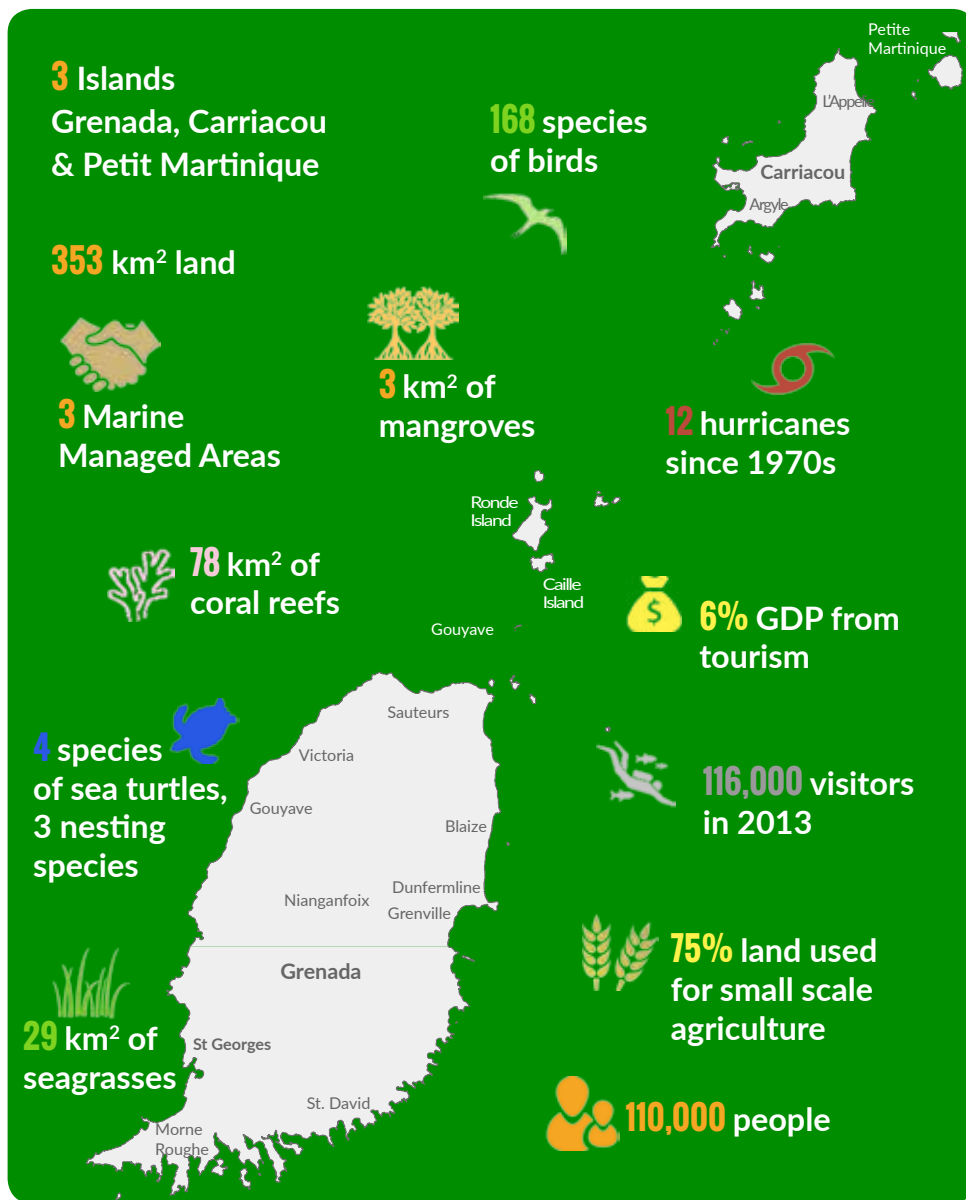


Kramer PR, Roth LM, Constantine S, Knowles J, Cross L, Kramer PA, Nimrod S, Phillips M. 2016. Grenada's Coral Reef Report Card 2016. The Nature Conservancy. (www.CaribNode.org).



Grenada, Carriacou & Petit Martinique Seascape

The main island of Grenada, along with Carriacou and Petit Martinique have a combined land area of 353 km². Grenada is further south with Carriacou and Petit Martinique to the north. The islands have steep landscapes surrounded by coral reefs, mangroves, and seagrasses. Most people live in Grenada in St. George's, Grenville and Gouyave, with an economy based on tourism and agriculture (nutmeg, cocoa, banana). Local communities have a long cultural heritage linked to their coastal waters. Nearshore waters are affected by disturbances like sediments (coastal development, agriculture), pollution and nutrients, unsustainable fishing, storms and coral bleaching. Grenada's government is a regional leader with comprehensive marine management, fisheries regulations, educational programs and community outreach.

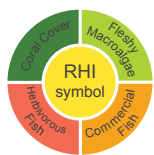


Grenada Timeline

Protection for reefs (above line) / Key events impacting coral (below)

- | | | | |
|---|--|---|---|
| <ul style="list-style-type: none"> • Cartagena Convention - 1983 | <ul style="list-style-type: none"> • Convention on Biodiversity - 1992 • White sea urchin moratorium • Fisheries Regulations - 1996 | <ul style="list-style-type: none"> • WCCMPA - 2001 • MPA Legislation MBMPA - 2001 • Protected Area Declaration- 2006 • TNC Parks in Peril - 2007 • Caribbean Challenge - 2008 • Mangrove restoration WCCMPA | <ul style="list-style-type: none"> • AWE Project (TNC) - 2011 • MPA governance (CERMES) - 2012 • WCCMPA- Management plan - 2012 • RAMSAR Site Declared - 2012 • MPA enforcement training - 2012 • Caribbean Biodiversity Fund - 2012 • ECMMAN - 2013 • Launch (MPA) -SIOBMPA-MBMPA • Coastal Zone Policy (GIZ) - 2015 • Lionfish Action Plan - 2014/15 • Coral Nurseries -2015 |
| 1970 - 1980 | 1990 | 2000 | 2010 |
| <ul style="list-style-type: none"> • Coral die-off due to disease • <i>Diadema</i> urchin die-off | <ul style="list-style-type: none"> • Hurricane Lenny - 1999 • Fish kill - 1999 | <ul style="list-style-type: none"> • Hurricane Ivan & Emily • World economic crash -2008 • Coral bleaching - 2005 | <ul style="list-style-type: none"> • Fish kills 2011, 2015 • Drought - 2010 • Coral bleaching - 2010 |

Tracking Coral Reef Health



The Reef Health Index (RHI) integrates four indicators to measure coral reef health (coral cover, fleshy macroalgae, herbivorous fish and commercial fish). The RHI “pie” symbol on the map is displayed at the site, subregional and national levels.* (For more information visit www.caribnode.org)



Grenada

The Reef Health Index includes comparable data from different surveys. **Grenada:** 2 surveys in 2014 by Grenadines Network of Marine Protected Areas (GNMPA) (1 long term monitoring site (LTM) in Moliniere Beausejour Marine Protected Area (MPA), 1 in Woburn Clark Court MPA) and 8 surveys in 2015 by Steve Nimrod/ The Nature Conservancy (TNC)/ Fisheries. **Carriacou:** 14 sites in 2005 by TNC, 2 surveys in 2014 by Robert Steneck of University of Maine and 1 LTM site by GNMPA in 2014. Grenada is divided into subregions based on similar biogeographic features. Data were not available for 3 subregions. Subregions for the 6 ECMMAN countries are numbered 1 to 41 from Grenada north to St. Kitts and Nevis.

ID	Sub-region	Subregion Description	# Sites	Score
1	Grenada South	Wide shallow shelf, thickets of finger corals (<i>Porites porites</i>). Hardbottom reefs - abundant crustose coralline algae (CCA), small-sized corals, <i>Diadema</i> urchins and some elkhorn corals (<i>Acropora palmata</i>). Woburn Clark's Court MPA. Nearby seagrass, mangroves.	1	
2	Grenada West	Central: Narrow shelf, high relief spur and grove reefs near Flamingo Bay, high coral cover, high fleshy macroalgae, few <i>Diadema</i> . Complex reef structure has many small fish and lobster. Moliniere Beausejour MPA. Reefs affected by upland run off. Southwest: Wide shallow shelf, low relief reefs, small corals, abundant CCA and <i>Diadema</i> ; deep high relief fringing reefs, high coral & macroalgal cover, few large fish.	9	
3	Grenada: East	Reef surveys not available for these areas. Subregions East (3) & North (4): Broad shallow shelf, high wave energy, hardground/gorgonian plains. Subregion 5: Rhonde Island & Les Tantes, high wave energy. Kick'em Jenny submarine volcano. Reefs need to be surveyed.	0	
4	Grenada: North			
5	Grenada: Rhonde			
6	Carriacou West	Sandy Island & Mabouya - high relief deep fringing reefs, many finger corals (<i>Madracis</i> , <i>Porites</i>), high macroalgae, few <i>Diadema</i> ; Nearshore areas with patch reefs, hardbottom/gorgonian plains, more <i>Diadema</i> .	9	
7	Carriacou East	Carriacou East: Wide, shallow shelf with lower relief, low coral cover patch reefs and hardbottom/gorgonian plains. Frigate and Saline Islands and Petite Martinique have better developed reefs.	8	

Indicator

Description of Grenada's Reef Health

Threatened

Healthy



Corals

Corals build the reef's 3D structure, provide habitat, and protect coastlines

- Coral cover high, lower than historic, corals small but healthy
- West coast reefs more complex, more live coral, but more macroalgae
- Thickets of finger coral common and several healthy elkhorn corals
- Reefs affected by chronic disturbance & bleaching events (2005)



Fleshy macroalgae

Fleshy macroalgae, when too abundant, outcompete corals

- West coast deep reefs often have more seaweed than live coral
- Crustose coralline algae were abundant on east coast and shallow reefs
- Less macroalgae on reefs with abundant *Diadema*
- Nutrients and lack of herbivory contributing to higher macroalgae



Herbivorous Fish

Herbivorous fish clean algae off reefs, large parrotfish remove more algae

- Herbivorous fish are often most abundant fish, but small in size
- Few large parrotfish, less grazing of algae
- Several larger parrotfish found in MMAs
- Parrotfish are overharvested, but could increase if protected



Commercial Fish

Groupers & snappers are key predators that keep food chain in balance

- Groupers & snappers were rare, small sizes, few mature adults
- More fish on reefs with complex structure and deeper water
- Predatory fish are overharvested, may take time to recover in MMAs
- Protecting nearby mangroves/seagrass nurseries is important



Diadema

Diadema urchins clean algae off reefs and open space for coral recruits

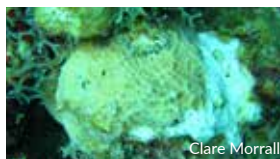
- East coast reefs and shallow reefs had more *Diadema*
- Reefs with more urchins had less seaweed and more coral cover
- *Diadema* urchins are important since few large herbivorous fish
- If nutrients and sediments reduced, urchins could increase



Coral Recruits

Coral recruits are "baby" corals. Recruits prefer macroalgal free areas

- Recruits present, mostly smaller-sized coral species
- High macroalgae & increased sediments reduced space for coral recruits
- Coral recruits on reefs with crustose coralline algae
- Reducing sediments and increasing herbivory will improve substrate



Reef Health Index



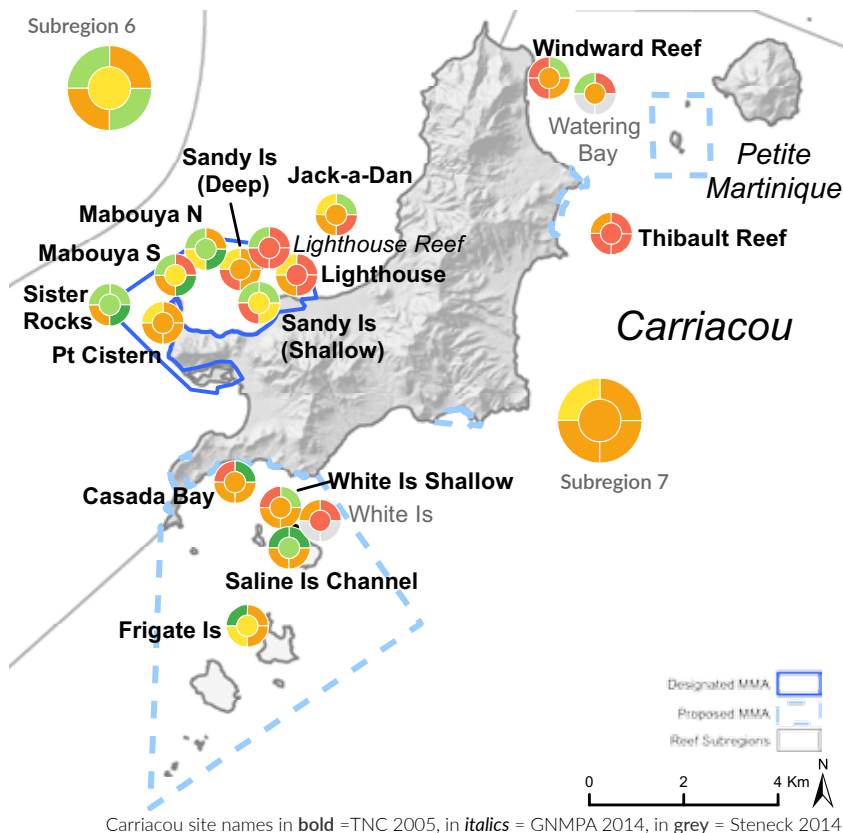
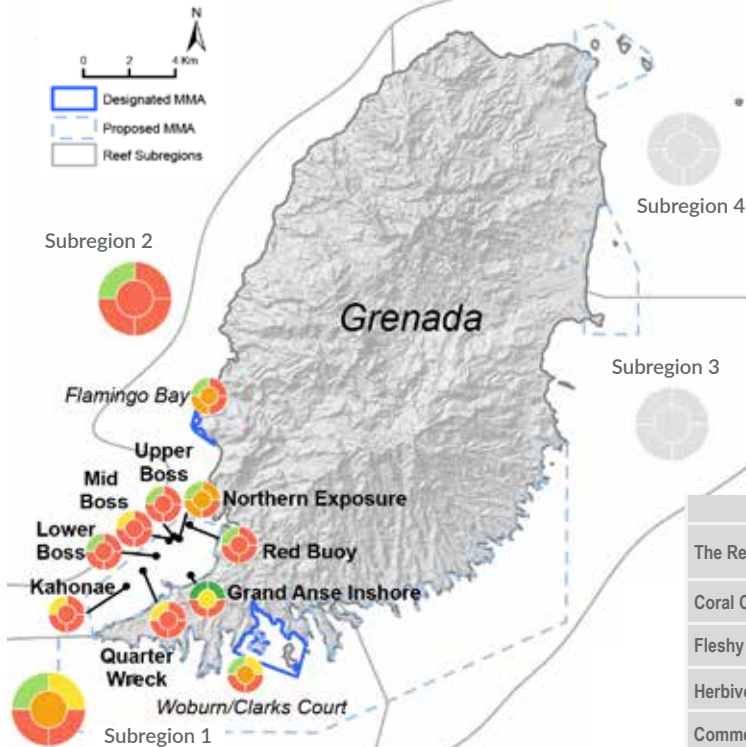
Grenada's Reef Health Index (RHI)

The national Reef Health Index was 2.5 (out of 5). Coral cover is 'good' (score=4), suggesting these reefs could support greater fish populations. Herbivorous fish are abundant but small in size so biomass estimates are low (score=2). Fleshy macroalgae (score=2) is abundant in areas without herbivory and could be reduced if herbivorous fish, especially parrotfish, were protected. Commercial fish biomass is low, although more larger-sized fish were found in protected areas (score=2).

Key findings:

- Grenada has many different coral reef types, each provides important habitat
- More fish found on reefs with complex structure and deeper water
- Reefs with abundant *Diadema* urchins had less macroalgae
- Lack of large-sized female fish means fewer eggs to replenish populations
- Marine managed areas are helping fish recover, but increases will take time
- Reefs at high risk to chronic upland impacts and coral bleaching
- Reefs in 'poor' condition may recover if human impacts are reduced

Grenada site names:
Bold = Nimrod/TNC 2015
Italics = GNMPA 2014



Carriacou site names in **bold** = TNC 2005, in *italics* = GNMPA 2014, in grey = Steneck 2014

Grenada's Reef Health Index (RHI)

Indicator	Year	Score	Average	Trend	Caribbean**
Coral Cover	2015	Good	22	n/a	14
Fleshy Macroalgae	2015	Poor	20	n/a	30
Herbivorous Fish	2015	Poor	1004	n/a	3928
Commercial Fish	2015	Poor	692	n/a	2823

Reef Health Index Scores

The Reef Health Index "scores" are calculated by converting the average data value of each indicator into a condition ranking from 'critical' to 'very good' based on reference values (table below). The four scores are averaged to obtain the overall RHI score. The pie displays the overall RHI (middle) and each individual indicator to show how each indicator affects the score.

	Reef Health Index Reference Values*				
	Critical	Poor	Fair	Good	Very Good
The Reef Health Index (RHI)	1-1.8	1.9-2.6	2.7-3.4	3.5-4.2	4.3-5
Coral Cover (%)	<5	5.0-9.9	10.0-19.9	20.0-39.9	≥40
Fleshy Macroalgal Cover (%)	>25.0	12.1-25	5.1-12.0	1.0-5.0	0-0.9
Herbivorous Fish (g/100m ²)	<960	960-1919	1920-2879	2880-3479	≥3480
Commercial Fish (g/100m ²)	<420	420-839	840-1259	1260-1679	≥1680

*Reef Health Index developed by Healthy Reefs Initiative (www.healthyreefs.org) **Caribbean average based on AGRR regional database 2011-2014 (www.agrra.org) A trend is calculated after an indicator has been assessed for at least two years, otherwise it is listed as not available (n/a). For data, maps, and references see www.caribnode.org.

Protecting Key Habitats

Key Habitats of Grenada

Three main habitats - coral reefs, mangroves and seagrass beds - support productive fisheries, stabilize coastlines and host tourism activities.

- The Nature Conservancy conducted benthic habitat surveys in parts of Grenada and Carriacou (www.caribnode.org).
- Contiguous areas with corals, mangroves and seagrasses are important nursery areas and corridors for resident and transient species.
- Habitats are threatened by direct removal and damage, coastal development, poor water quality, unsustainable fishing practices and global climate change.
- Grenada's government has proactive programs for marine management, fisheries regulations, youth education and community outreach.
- New proposed MMAs, if adopted, would protect 65% more reefs, 35% more mangroves and 41% more seagrass.



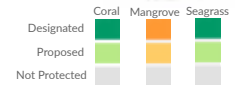
78 km² of coral reef



3 km² of mangroves



29 km² of seagrass

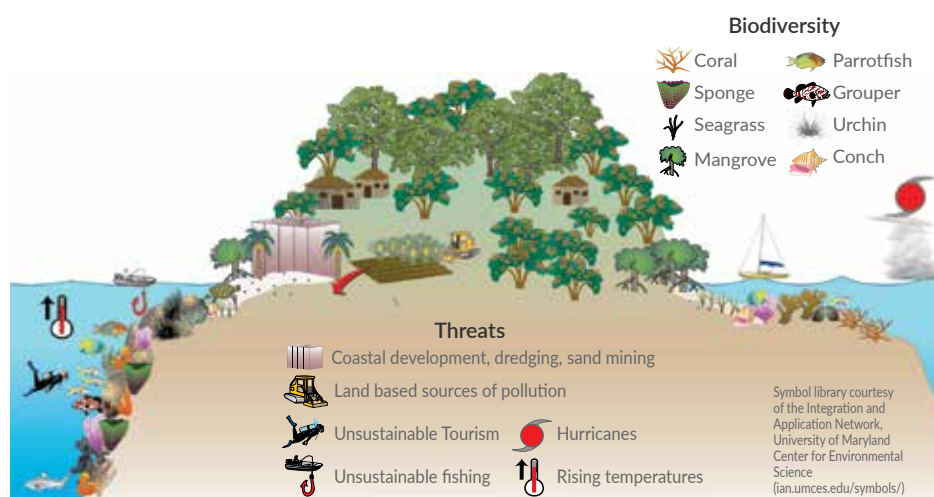


Grenada's Habitat Types	Threatened	Healthy
<p>Coral reefs: Reef types vary with wave exposure, water depth, east/west location. East coast: wide shallow shelf, low relief patch reefs, hardbottom, low diversity. West coast: narrow shelf, deep high relief spur & groove reefs, higher diversity. Grand Anse: wide shallow shelf, low relief inshore reefs. Reefs affected by unsustainable fishing, high siltation, poor water quality and coral bleaching/disease. Healthy reefs provide shoreline protection, greater resources and higher economic and recreational benefits.</p>		
<p>Mangroves: Red, black & white mangroves and buttonwood common. Grenada: ~22 mangrove areas, most on east and south coasts. Large stands near Levera, Conference and Woburn. Carriacou: Main mangrove forests near Petit Carenage Bay, Saline Island, Tyrrel Bay and Lauriston Point. Mangroves have been cleared in several areas for marinas and coastal development. Intact mangroves provide higher quality habitat, protect shorelines, and improve water quality.</p>		
<p>Seagrass: Seagrass found around each island. Species include <i>Syringodium filiforme</i>, <i>Halodule wrightii</i>, <i>Thalassia testudinum</i>, and <i>Halophila decipiens</i>. The exotic seagrass <i>Halophila stipulacea</i>, first found in 2002, invaded several areas (e.g., Flamingo Bay). Seagrass beds provide fish, conch, and lobster habitat and sea turtle and bird foraging areas. Native seagrasses are impacted by sediment runoff, destruction and storms. Healthy seagrass stabilizes sediments, reduces beach erosion and improves water clarity.</p>		

Climate Change Impacts

Local and regional resource managers need to incorporate planning for climate change in their efforts to protect coral reefs.

- Rising ocean temperatures increase coral bleaching, disease and mortality
- Oceans will become more acidic as more atmospheric carbon dioxide is dissolved reducing calcification in corals and other calcifying animals
- The intensity and frequency of hurricanes will increase as oceans continue to warm and will damage corals, coastlines and infrastructure
- Rising sea levels will flood coastal areas and may reduce light in seagrass beds and coral reefs



Marine Managed Areas



3 Areas Designated Since 1973

11 Square KM of Ocean



12 Areas Proposed

210 Square KM of Ocean

Ocean Protected

Shelf Protected



Marine Managed Areas
 Designated Proposed Not Protected

Marine Managed Area **Year** **Area (km²)**

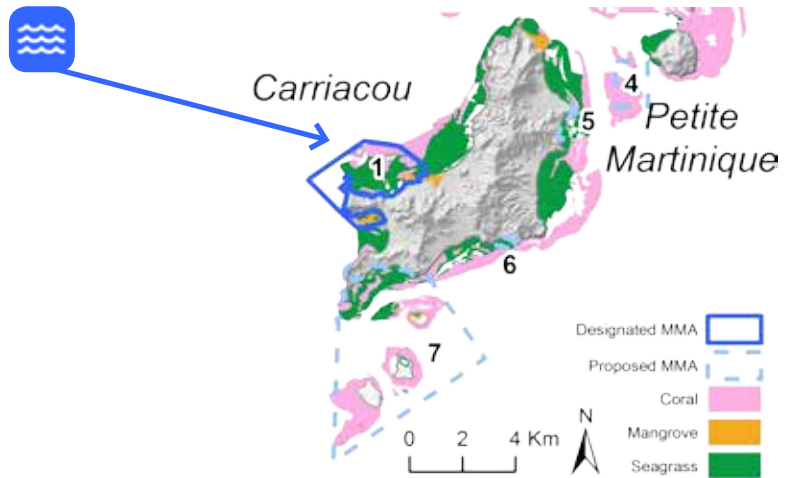
Designated*

1	Sandy Island-Oyster Bed MPA	2009	6.6
2	Moliniere-Beausejour MPA	1999	0.8
3	Woburn-Clark's Court Bay MPA	1999	4.2

Proposed

	Area (km ²)	
4	Petite Dominique	2.0
5	Limlair Theboud	0.2
6	Sabazan	0.3
7	South Carriacou Islands	23.8
8	Ronde Island Group	69.3
9	Levera	6.9
10	Conference Bay	10.8
11	Southern Seascape	91.9
12	Grand Anse MPA	13.4
13	La Sagesse	0.2
14	Hog Island	0.4
15	Calivigny Island	0.1

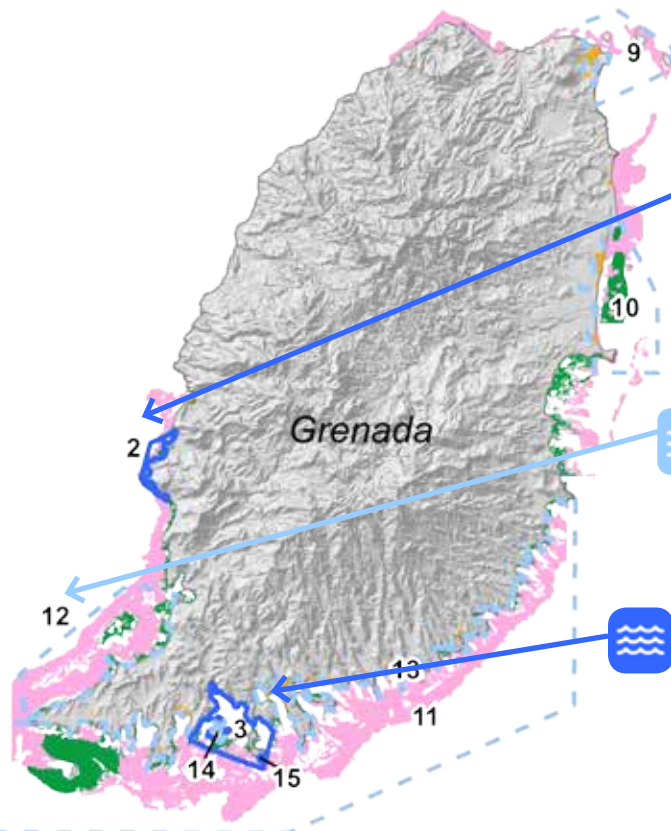
Sandy Island Oyster Bed MPA - Largest seascape of corals-mangroves-seagrass in Carriacou - provides critical nursery grounds and mangrove oyster habitat. Positive health signs - high coral cover, diversity, reef complexity, numerous small fish. Poor health signs - high fleshy macroalgae, low herbivory, few large fish. At risk due to clearing of adjacent mangroves, sedimentation, pollution and illegal fishing. Management efforts include installing mooring buoys, monitoring, restoration and reducing illegal fishing.



Marine Managed Areas

Grenada's MMAs are important as they:

- Protect marine biodiversity by conserving critical habitats
- Provide refugia and replenishment zones for exploited fisheries
- Reduce negative impacts associated with human use
- Foster a higher level of sustainable use
- Increase community involvement and educational opportunities



Moliniere Beausejour MPA - High relief, most complex reef structure. Positive health signs - high coral cover, diversity, complexity. Poor resilience signs - fleshy macroalgae, low herbivory, low *Diadema*, low fish biomass, nutrient pollution and sedimentation. Signs of recovery - some larger parrotfish/seabass, several small snappers, abundant lobster. Proactive management is helping to improve reef health, including user zones (Fishing Priority, Marine Park, Recreational and Yacht Mooring), Junior Ranger Programs, Monitoring, Community Outreach and active patrols to ensure compliance and collection of user fees.



Grand Anse Bay - Wide shelf area supports variety of reefs. Northern Exposure Reef - high herbivorous & commercial fish biomass, good coral cover. Grand Anse Inshore Reef - >60% coral cover, many *Diadema*, high CCA, low macroalgae. Grand Anse is in the process of being officially designated as a Marine Managed Area. This new MMA will protect coral reefs, support recreational activities, and promote sustainable livelihoods.



Woburn Clark's Court MPA - Largest seascape of corals-mangroves-seagrass. Nursery area for fish, lobster, and conch. Positive health signs - high coral cover, healthy corals, high CCA, abundant coral recruits, low macroalgae, abundant *Diadema*. Poor health signs - few parrotfish, groupers, snappers, most fish small in size. Loss of mangroves due to clearing, sedimentation. Management efforts seek to balance protecting biodiversity and supporting recreational activities popular in area.

*All three designated MMAs are operational with active management.

Eastern Caribbean Regional Overview

Status of coral reefs in the Eastern Caribbean (EC)

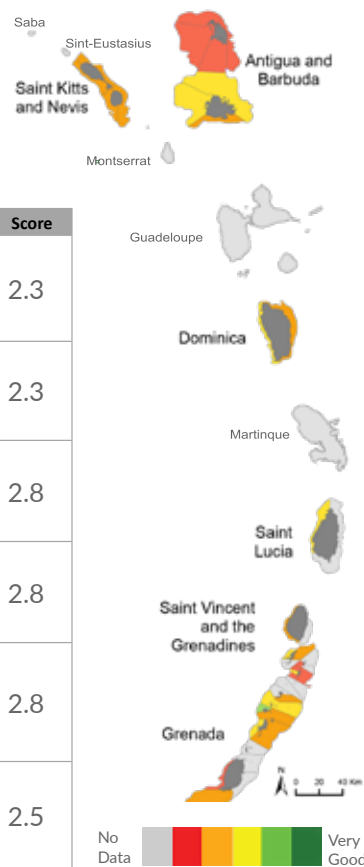
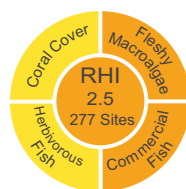
The Region's overall Reef Health Index (RHI) score was "fair" (2.5 of 5). Coral cover and herbivorous fish biomass were scored "fair", while fleshy macroalgae and commercial fish biomass were "poor". Reef condition varied at the local scale, but several regional patterns of reef condition were common:

- Endangered elkhorn/staghorn corals are recovering (NE island areas)
- Fleshy algae are often found on leeward reefs and near settlements
- Lack of large parrotfish has reduced grazing on several reefs
- *Diadema* urchins are abundant on several reef types in the EC
- Reefs with greater structure and relief have higher fish abundance
- Reefs under some level of protection have higher fish abundance, especially fully protected areas and longer established MMAs

Status of MMAs in the Eastern Caribbean

The long-term health and resilience of these ecosystems will depend on both effective local management and adopting collaborative and transboundary management strategies among the 6 nations.

- Currently 44 designated MMAs protect 526 km² of marine resources
- Many MMAs were designated >25 years ago (17 of 44)
- Most of the designated MMAs are small (27 of 44 are <10 km²)
- Few MMAs are fully protected "no take" zones, which had more fish
- Several key nursery areas with adjacent coral, mangrove & seagrass remain unprotected
- 50 new proposed MMAs will protect 990 km² of marine resources



# sites	Reef Health Index	Score
St. Kitts & Nevis 25		2.3
Antigua & Barbuda 29/121		2.3
Dominica 16		2.8
Saint Lucia 17		2.8
St. Vincent & Grenadines 42		2.8
Grenada 27		2.5

Next Steps

The following Management Recommendations and Monitoring Priorities are suggested to help protect Grenada's coral reefs:

I. Management Recommendations

- Continue MMA support & management to help reefs recover
- Continue protecting parrotfish to reduce seaweed
- Create more fully protected replenishment areas to let fish grow larger and produce more fish for the future
- Protect reefs adjacent to mangrove and seagrass beds
- Improve nearshore water quality to increase reef resilience
- Improve ridge to reef management to reduce impact of land based activities

II. Monitoring Priorities

- Coral Reef Monitoring
 - Surveys in 2016 (Grand Anse, WCCMPA, SIOBMMA)
 - Survey strategic reefs: Grenada gaps - Subregion 3 (South seascape, Conference Bay, Levera), Subregion 5 (Ronde Island); Carriacou - Subregion 6 (gaps), Subregion 7 (representative, lobster/ conch surveys), Petite Martinique
 - Establish long-term monitoring sites
- Socioeconomic monitoring in MMAs
- MMA effectiveness monitoring
- Produce Report Cards in 2017 based on 2016 surveys
- Update CaribNode data platform with new data (caribnode.org)



The return of healthy endangered elkhorn corals gives hope for the future