

Antigua & Barbuda

Coral Reef Report Card
2016

Eastern Caribbean Coral Reef Report Card



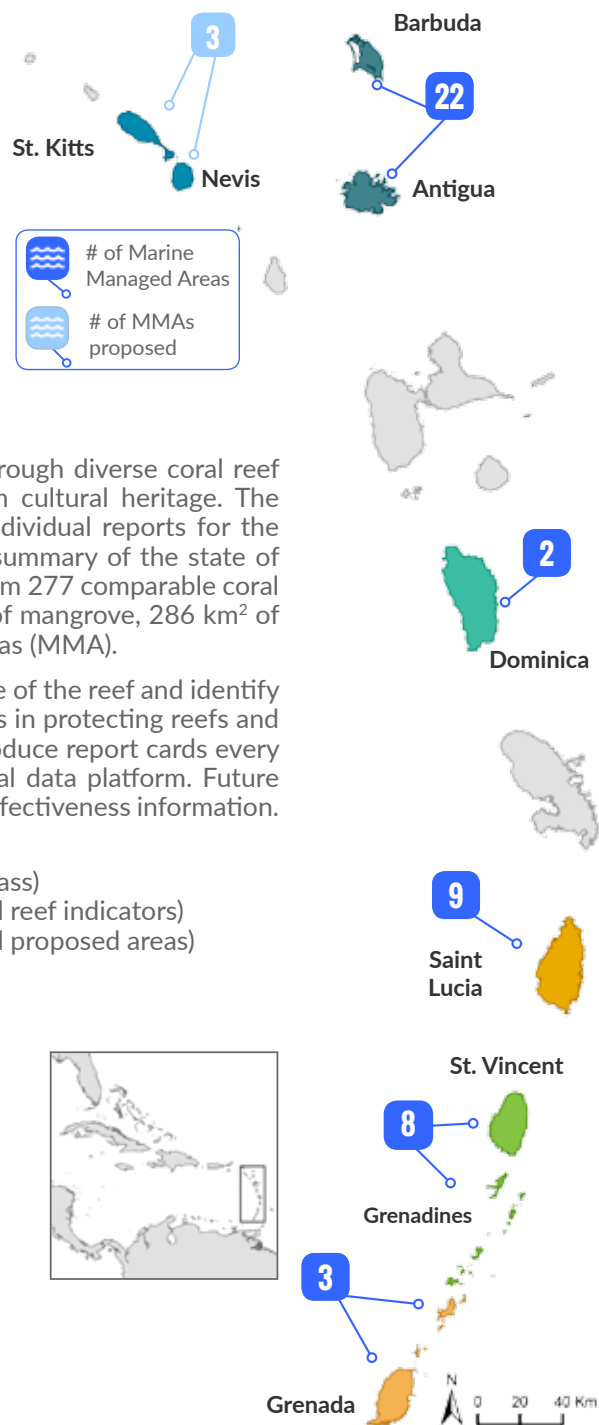
6 PARTICIPATING COUNTRIES
224,813 SQUARE KM OF OCEAN



44 AREAS DESIGNATED SINCE 1973
528 SQUARE KM OF OCEAN



50 AREAS PROPOSED
990 SQUARE KM OF OCEAN



ECMMAN countries and number of MMAs with designated borders

The 2015 Coral Reef Report Card

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)

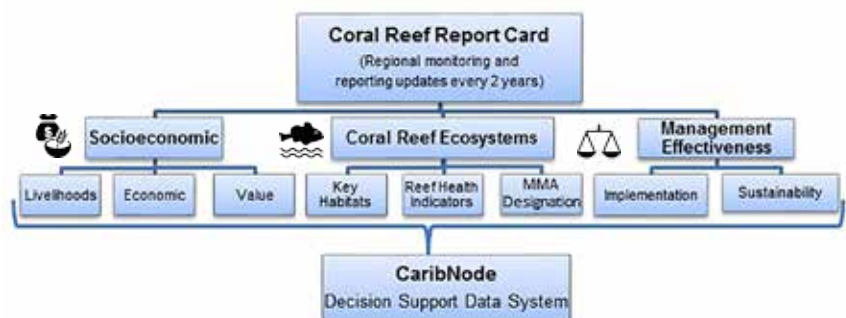
The Framework

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.

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)

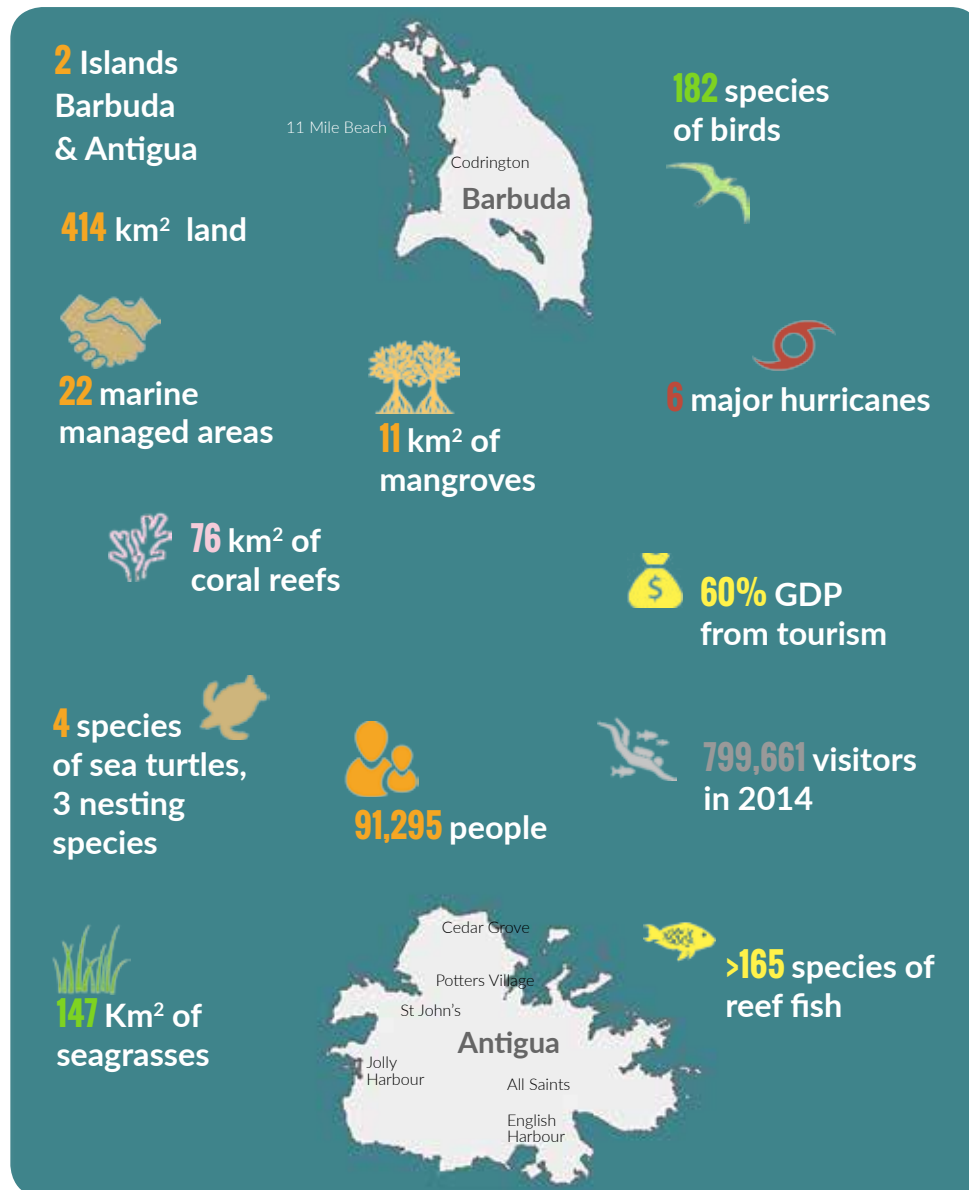
3) **Coral Reef Report Cards:** Includes the Reef Health Index, an assessment tool to measure coral reef health. The Report Card integrates monitoring data and engages stakeholders to help protect marine ecosystems.





Antigua and Barbuda Coral Reef Report Card

Antigua and Barbuda has the largest Economic Exclusive Zone (EEZ) (108,085 km²) and shelf area (3,930 km²) of the 6 ECMMAN countries. The two islands are situated on a submerged platform and separated 45 km by waters only ~30 m deep. Antigua, of volcanic and limestone origin, covers 276 km² of land with over 267 km of undulating coastline. Barbuda, a flat low lying coralline limestone island only 45 m above sea level, covers 138 km² with 203 km of coastline. Along Barbuda's west coast is Codrington Lagoon, the largest lagoon in the Eastern Caribbean. The small uninhabited island of Redonda is 0.6 km². The economy is based mainly on tourism. Local communities have a long cultural heritage linked to their coastal waters. Like many EC islands, nearshore waters are affected by coastal development, sediments, pollution, unsustainable fishing practices, storms and coral bleaching. Antigua and Barbuda are protecting marine resources through marine management, fisheries regulations, educational programs and community outreach.



Antigua and Barbuda Timeline

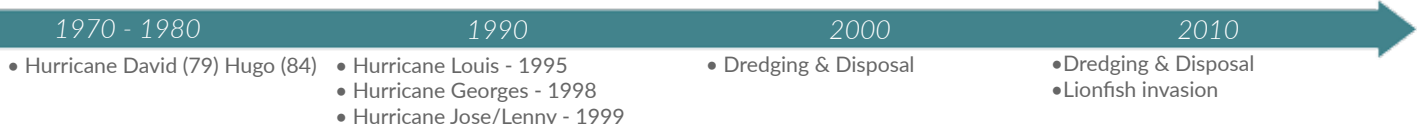
Protection for reefs (above line) / Key events impacting coral (below)

- Diamond & Palaster reefs Protected - 1972
- Nelson Dock Yard National Park - 1984
- EAG established - 1989

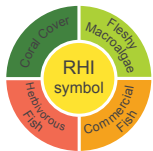
- Jumby Bay Hawksbill Project - 1987
- Fisheries Regulations - 1990
- Great Bird Island Restoration - 1995
- Cades Bay Marine Reserve - 1999

- Codrington Lagoon - 2005
- NEMMA - 2005
- OPAAL Project - 2005
- Cades Bay SocMon - 2005
- Fisheries Act - 2006
- EAG Sea Turtle Project - 2007

- Off shore island restoration - 2012
- CARIFICO FAD Project - 2013
- Fisheries Regulations - 2013
- ECMMAN - 2013
- Blue Halo in Barbuda - 2014
- SIRMM Project - 2014
- Environmental Protection and Management Act - 2015



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).



Antigua and Barbuda

The Reef Health Index for Antigua and Barbuda includes comparable data from different surveys and dates. Antigua: 14 surveys in 2005 (2-13m depth) by Marilyn Brandt et al. (University of Miami), 8 surveys in 2011 (10m fore reefs) by FORCE¹ and 7 sites in 2013 (10m fore reefs) by Robert Steneck, University of Maine. Barbuda: Barbuda Blue Halo Initiative surveyed 234 sites in 2013, 116 sites were included in this analysis, herbivorous fish data were not available at the site level. Steneck did 5 surveys, only coral and algal data were available (no fish data).* Antigua and Barbuda has 7 subregions based on similar habitats. 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
31	Antigua	Subregion 31: South coast - less developed fringing reefs, large areas of low relief hard bottom with small corals and numerous gorgonians. Subregion 32: West coast - wide sandy shelf. Further offshore in depths of 10-15 m are low relief reefs, many small corals, gorgonians. Subregion 33: Northeast corner - indented coastline has wide shelf with greatest coral reef development and highest living coral cover. North East Marine Management (NEMMA) is located in this subregion.	5	
32			4	
33			20	
34	Barbuda	Subregion 34: West coast - leeward side protected from direct oceanic waves, most extensive seagrass beds and mangroves found in highly productive Codrington Lagoon, few isolated patch reefs to the south. Subregion 35: South - most extensive patch reefs with highest coral cover. Remnant reefs of elkhorn and some mountainous star coral. Subregion 36: East coast - windward side, Atlantic oceanic swells limits the amount of true reef development; instead, a low relief carbonate algal ridge with naturally low coral cover extends along most of east coast. Subregion 37: North shore has numerous inshore patch reefs of low coral cover and high gorgonian cover, several isolated living elkhorn occur.	9	
35			51	
36			25	
37			36	

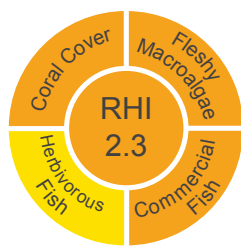
Indicator	Description of Antigua and Barbuda's Reef Health	Threatened	Healthy
 Corals	Corals build the reef's 3D structure, provide habitat, and protect coastlines <ul style="list-style-type: none"> Greater reef structure in NE Antigua & patch reefs in south Barbuda Coral cover varied by reef type, but lower than historic Small corals healthy; some large corals diseased; few live elkhorn Bleaching (2005) impacted >35% of corals in NE Antigua Recruits abundant, varied by reef type, most were smaller-sized species 		
 Fleshy macroalgae	Fleshy macroalgae, when too abundant, outcompete corals <ul style="list-style-type: none"> Many reefs had more algae than live coral, but less than other areas Less macroalgae, more herbivores on NE Antigua reefs than West/SW Lack of crustose coralline algae means less substrate for coral recruits Increasing herbivory will increase substrate for corals & coral recruits Reducing sediments and nutrients will improve sea urchin habitat 		
 Herbivores	Herbivorous fish & Diadema urchins clean algae off reefs <ul style="list-style-type: none"> Antigua: herbivorous fish biomass range 1818-9967 g/100m² Barbuda: parrotfish (680 g/100m²), surgeonfish (640 g/100m²) Antigua: abundant <i>Diadema</i>, more on East Coast fore, back & patch Barbuda: <i>Diadema</i> less abundant, except south coast patch reefs Many reefs with more urchins had less seaweed 		
 Commercial Fish	Groupers & snappers are key predators that keep food chain in balance <ul style="list-style-type: none"> Fish abundance varied with reef type and habitat complexity Antigua: commercial fish biomass avg 652 g/100 m² (range 36-3746 g/100m²) Barbuda: biomass avg 347 g/100m² (range 7-1783 g/100m²) Lack of large-sized adult fish means fewer eggs to replenish populations Protecting nearby mangroves/seagrass is important for fish to recover 		

Reef Health Index Scores (RHI)

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 right). 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*					
The Reef Health Index (RHI)	Critical 1-1.8	Poor 1.9-2.6	Fair 2.7-3.4	Good 3.5-4.2	Very Good 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



The National Reef Health Index

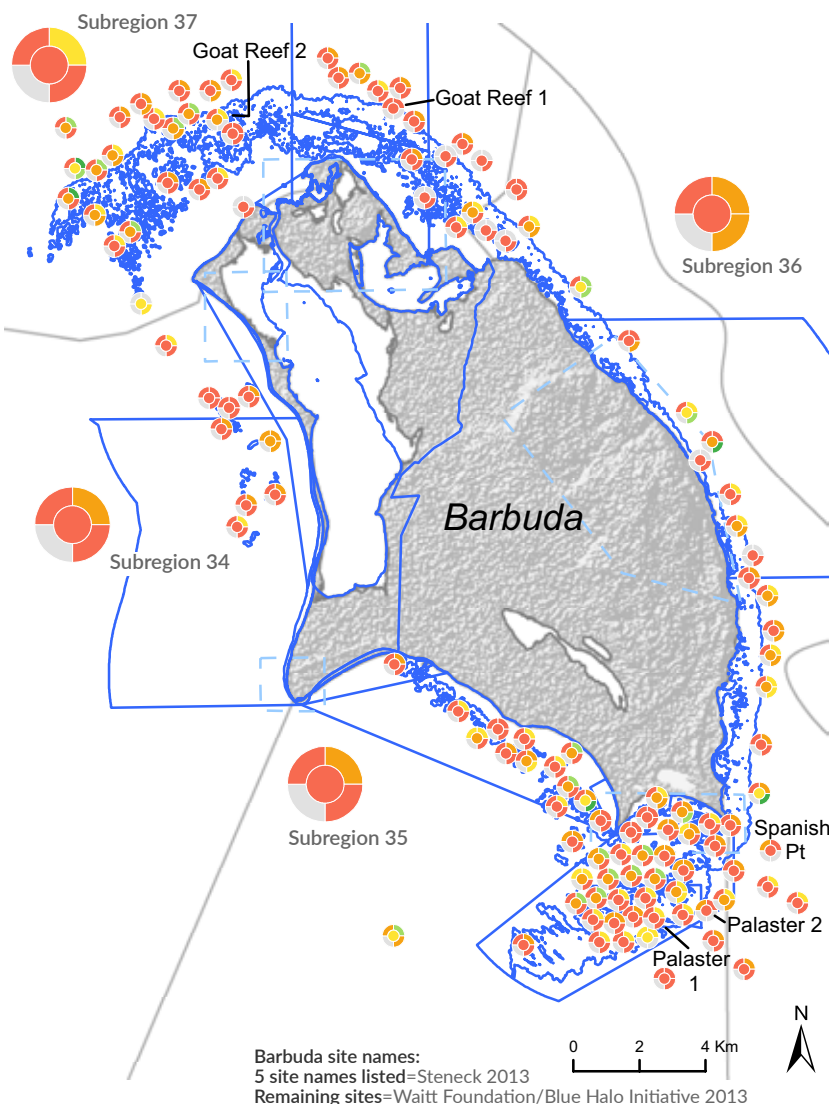
The National Reef Health Index (RHI) was 2.3 (out of 5). Antigua and Barbuda have many different reef types, each provides important habitat (coral cover score=2). Herbivorous fish biomass was higher in Antigua. Fleshy macroalgae (score=2) were abundant, especially in areas with few herbivores. Commercial fish biomass (score=2) varied with reef type and was often higher on reefs with greater reef structure. The wide variety of reefs and nearby mangrove and seagrass habitat suggests reefs could support a greater number of fish.

Antigua and Barbuda's Reef Health Index (RHI)

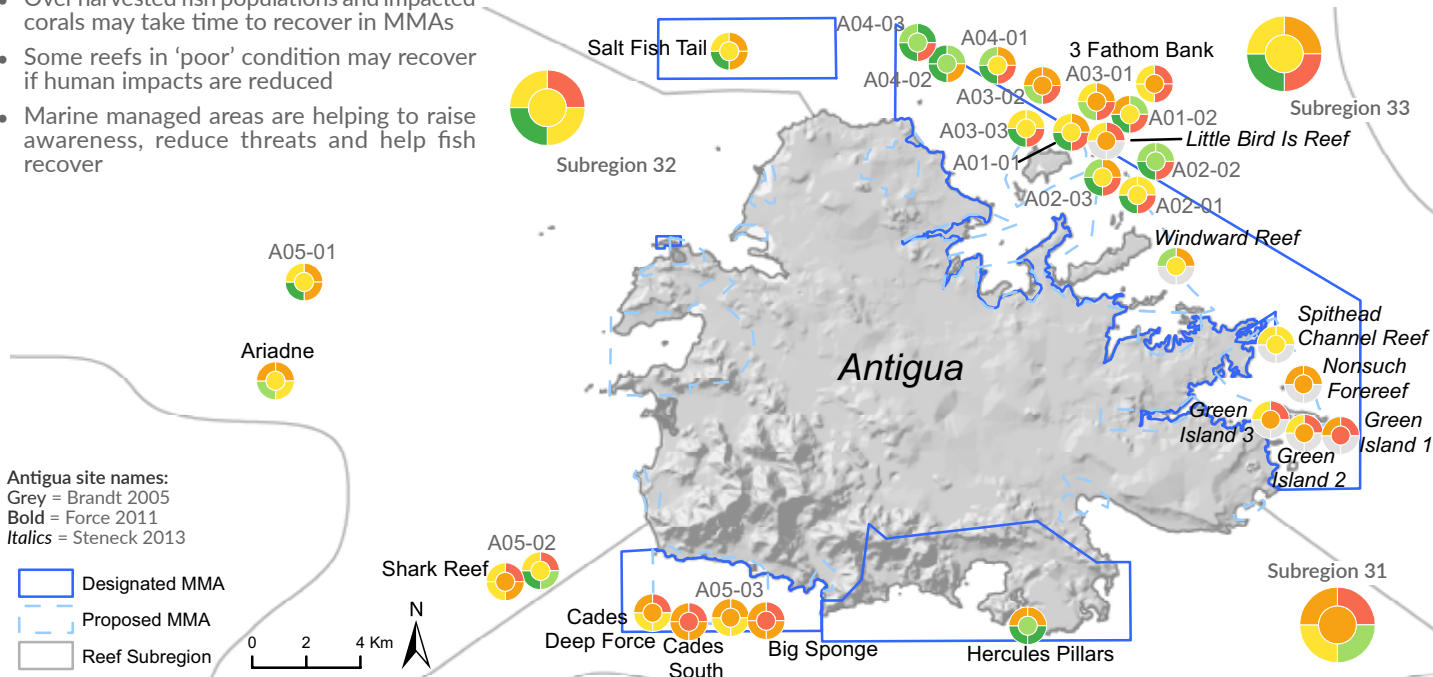
Indicator	Year	Score	Average	Trend	Caribbean**
Coral Cover	2015	Poor	9	n/a	14
Fleshy Macroalgae	2015	Poor	18	n/a	30
Herbivorous Fish	2015	Fair	2810	n/a	3928
Commercial Fish	2015	Poor	500	n/a	2823

Outlook

- Corals have been affected by past coral bleaching and are susceptible to future events
- Protecting parrotfish and *Diadema* urchins will help reduce algae and promote coral growth
- Protection of contiguous mangrove, seagrass and reef habitat will help maintain nursery habitats and larval corridors
- Over harvested fish populations and impacted corals may take time to recover in MMAs
- Some reefs in 'poor' condition may recover if human impacts are reduced
- Marine managed areas are helping to raise awareness, reduce threats and help fish recover



Barbuda site names:
5 site names listed=Steneck 2013
Remaining sites=Waitt Foundation/Blue Halo Initiative 2013



Antigua site names:
Grey = Brandt 2005
Bold = Force 2011
Italics = Steneck 2013

- Designated MMA
- Proposed MMA
- Reef Subregion

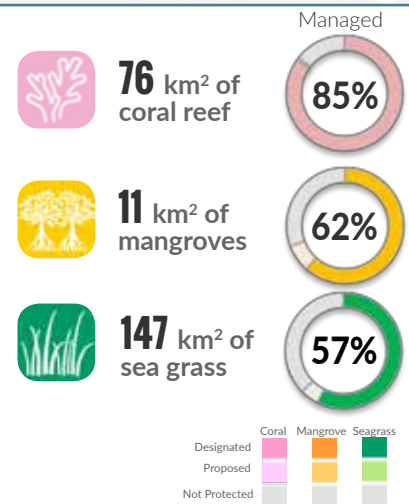
*Reef Health Index developed by Healthy Reefs Initiative (healthyreefs.org) **Caribbean average based on AGRRA regional database 2011-2014 (agrra.org) A trend is calculated after an indicator has been assessed for at least two years, otherwise it is listed as not available (n/a). For data, maps, and references see www.caribnode.org. *Future of Reefs in a Changing Environment (FORCE) (www.force-project.eu). Notes: Data were collected in different years, times of days, reefs and by different surveyors. The National Reef Health Index combines data from both islands, but individual RHI symbols are provided for each island since they have different reef types. Map, data and references are available on www.caribnode.org.

Protecting Key Habitats

Key Habitats of Antigua and Barbuda

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

- Habitat maps for Antigua are based on several sources (caribnode.org). Benthic habitat surveys of Barbuda were conducted in 2012 by the Blue Halo Initiative.
- Contiguous areas with corals, mangroves and seagrasses are important nursery areas and corridors for resident and transient species.
- Habitats are threatened by direct damage, unsustainable coastal development practices, poor water quality, unsustainable fishing and global climate change.
- Antigua and Barbuda has proactive programs for marine management, fisheries regulations, youth education and community outreach.
- New proposed MMAs, if adopted, would protect 1% more coral reefs (86% of all reefs would be protected), 8% more mangroves (69% total of mangroves), and 5% more seagrass beds (63% of all seagrass).

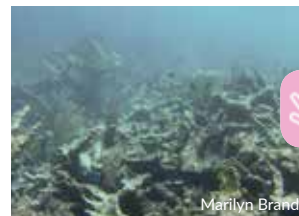


Antigua & Barbuda's Habitat Types

Threatened

Healthy

Coral reefs: Types vary with wave exposure, water depth, location. **Antigua:** 48 km²; NE coast - patch, back, crest, & fore reefs, N coast - fringing; South/west coasts -hardbottom areas, low relief reefs to west. **Barbuda:** 28 km²; most reefs in south/north as patch reefs; East coast - carbonate algal ridges, naturally low coral cover. Reefs affected by unsustainable fishing, coastal development, storms and coral bleaching/disease. Healthy reefs provide shoreline protection, greater resources and higher economic and recreational benefits.



Mangroves: Most extensive mangroves in Eastern Caribbean (EC); red, black, white, buttonwood species. **Antigua:** 3km², low-lying coasts have salt ponds/ tidal mud flats with mangroves, forms vary - single trees to complex swamps, largest in Hanson's Bay. **Barbuda:** 8km², largest mangrove lined bay in EC, largest nesting colony of frigate birds, inland salt ponds with mangroves. Mangroves have been cleared for marinas and coastal development. Intact mangroves provide higher quality habitat, protect shorelines, and improve water quality.



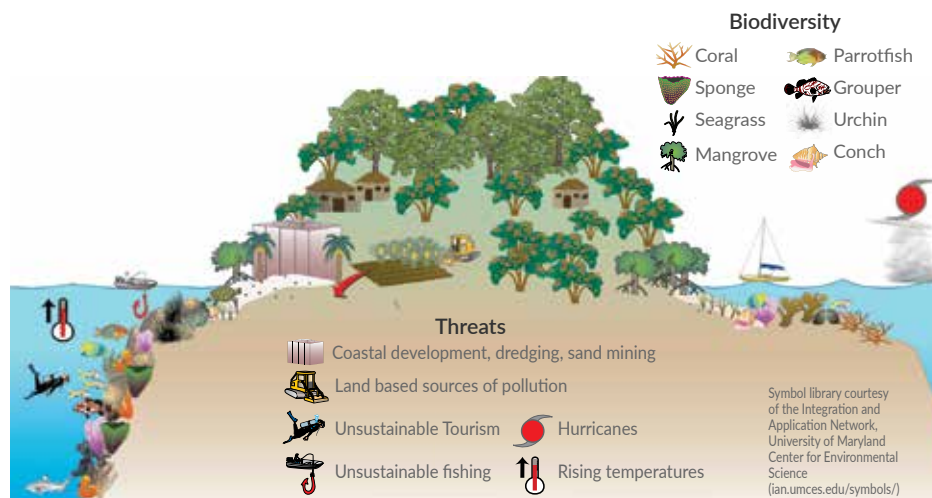
Seagrass: Most extensive seagrass beds in EC. **Antigua:** 64 km², found around island. **Barbuda:** 83 km², lush seagrass beds in Codrington Lagoon, north and southwest coasts. Seagrass beds provide fish, conch, and lobster habitat and sea turtle and bird foraging areas. Native seagrasses are impacted by sediment runoff, destruction and storms. Healthy seagrass stabilizes sediments, reduces beach erosion and improves water clarity.



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



22 Areas Designated Since 1973

379 Square KM of Ocean



24 Areas Proposed

13 Square KM of Ocean

Ocean Protected

Shelf Protected

Marine Managed Areas

Designated

Proposed

Not Protected

<1%

9%

Marine Managed Area	Year (km ²)	Area
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Designated*

1	Diamond Reef	1973	14.6
2	Northeast MMA	2005	108.5
3	Ft Barrington	2008	0.3
4	Devils' Bridge	2008	1.0
5	Nelson's Dockyard	1989	41.0
6	Cades Bay	1999	18.2
7	Goat Point Sanctuary	2014	18.2
8	Coral Reef Buffer 20m	2014	45.2
9	Goat Point No Net Zone	2014	8.2
10	Codrington Lagoon	2005	66.8
11	Goat Island Flash Sanctuary	2014	4.4
12	Two Foot Bay	2014	48.4
13	Lagoon Sanctuary	2014	21.2
14	Low Bay Mooring Area	2014	4.9
15	Low Bay Sanctuary	2014	48.7
16	River Hallow Mooring Area	2014	3.2
17	River Dock Shipping Area	2014	0.2
18	Southern No Net Zone	2014	21.1
19	Cocoa Point Mooring Area	2014	0.7
20	White Bay Mooring Area	2014	0.6
21	Palaster Reef Sanctuary	2014	22.8
22	Palaster Reef	1973	3.2

Proposed

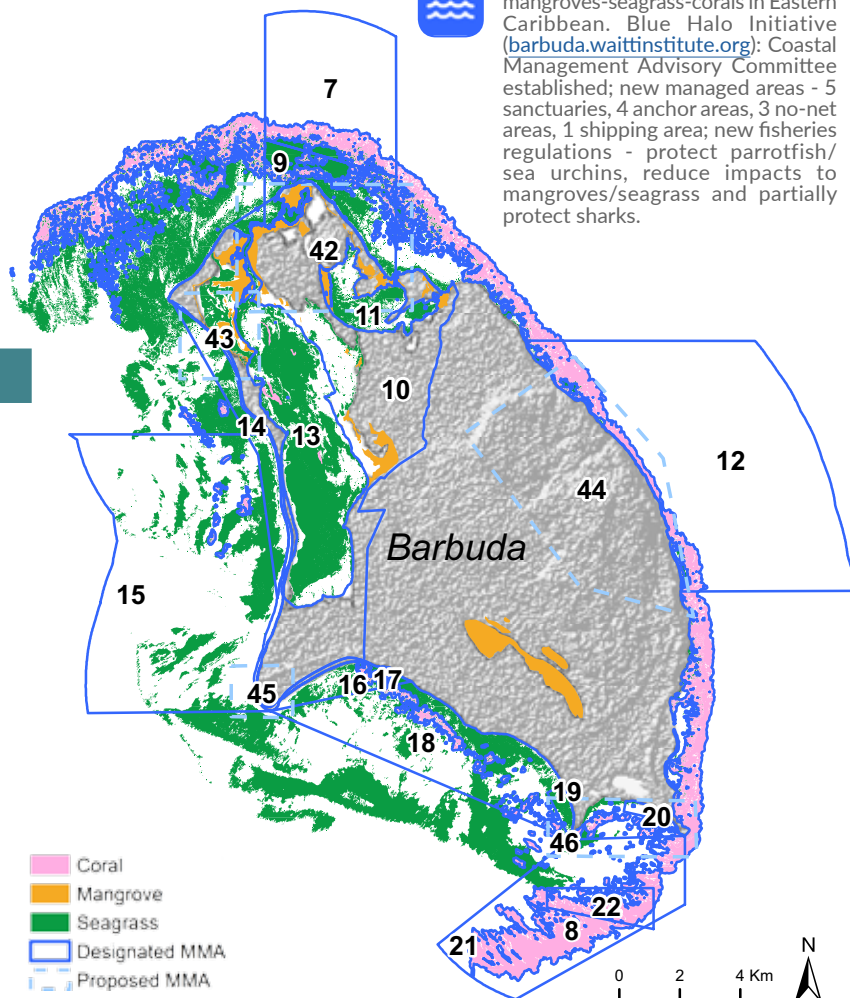
23	McKinnon's Pond Wetlands	0.8
24	Fort Bay Pond Wetlands, Beach & Fort	0.6
25	Yepton's Pond Wetlands	1.0
26	Galley Bay Wetlands	0.2
27	Hansen Bay Flashes Coastal Reserve	15.9
28	Jabberwock Beach and Coastal FR	3.4
29	Long Island Marine Reserve	5.4
30	Fitches Creek Wetlands	2.0
31	Fitches Creek2 Wetlands	0.5
32	Parham Harbor Wetlands	3.0
33	Guiana Bay Islands Marine Reserve	16.6
34	Mercers Creek Wetlands	3.2
35	Green Island Indian Town Point MR	9.3
36	Ayers Creek & Black Ghaut Wetlands	2.5
37	Fryes & Darkwood Beaches Coastal Reserve	0.8
38	Cades Bay Marine Reserve	10.7
39	Carlisle Bay Wetlands	0.7
40	Willoughby Bay Wetlands/Christian Cove Wetlands	1.7
41	Half Moon Bay Beach & Coastal Reserve	0.5
42	Goat Island Wildlife Reserve	21.9
43	Frigate Bird Reserve	6.7
44	Highlands Cliffs and Caves Reserve	30.9
45	Palmetto Point Reserve	3.1
46	Gravenor Bay Reserve	8.4

Marine Managed Areas

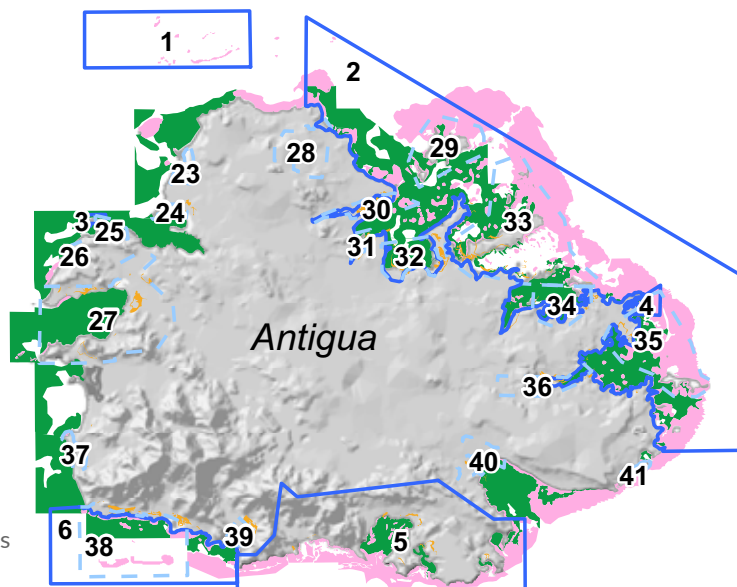
- Protect marine biodiversity by conserving critical habitats
- Provide refugia and replenishment zones for exploited fisheries
- Reduce negative impacts associated with human use
- Foster a higher level of sustainable use
- Increase community involvement and educational opportunities



Barbuda MMA: Largest seascape of mangroves-seagrass-corals in Eastern Caribbean. Blue Halo Initiative (barbuda.waittinstitute.org): Coastal Management Advisory Committee established; new managed areas - 5 sanctuaries, 4 anchor areas, 3 no-net areas, 1 shipping area; new fisheries regulations - protect parrotfish/sea urchins, reduce impacts to mangroves/seagrass and partially protect sharks.



North East Marine Management (NEMMA): Wide shelf supports the most extensive complex coral reefs, numerous mangroves, seagrass beds and >30 islands. Important habitat and nursery area for seabirds, sea turtles, elkhorn coral and variety of marine life. The Environmental Awareness Group and Antiguan Government are protecting biodiversity through marine management, fisheries regulations, educational programs and community outreach.



* Marine Managed Area boundaries are based on geospatial data available. See www.caribnode.org for details.

Eastern Caribbean Regional Overview

Status of coral reefs in the Eastern Caribbean (EC)

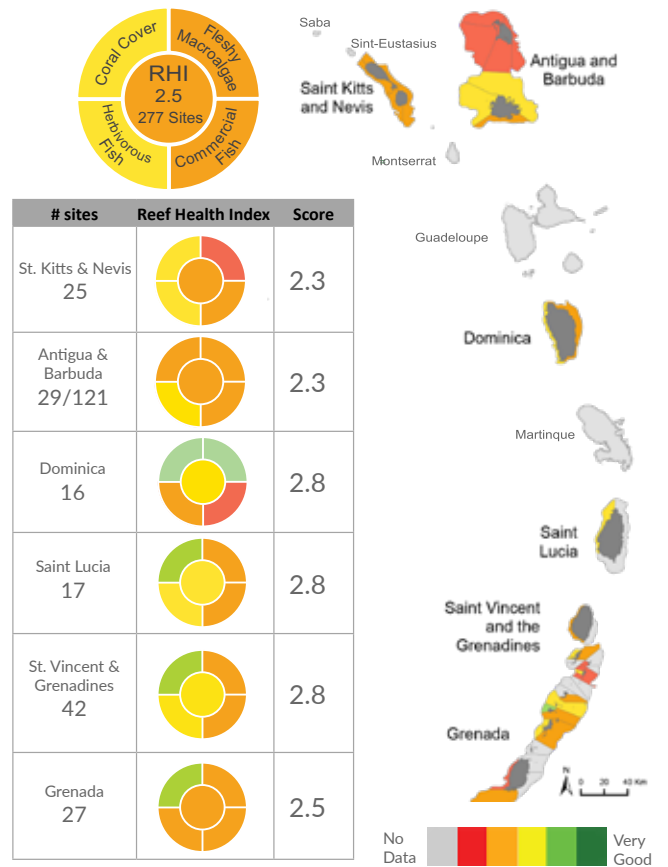
The Region's overall Reef Health Index (RHI) score was "fair" (2.5 of 5). Coral cover and herbivorous fish biomass were scored "fair", while fleshy macroalgae and commercial fish biomass were "poor". Reef condition varied at the local scale, but several regional patterns of reef condition were common:

- 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



Next Steps

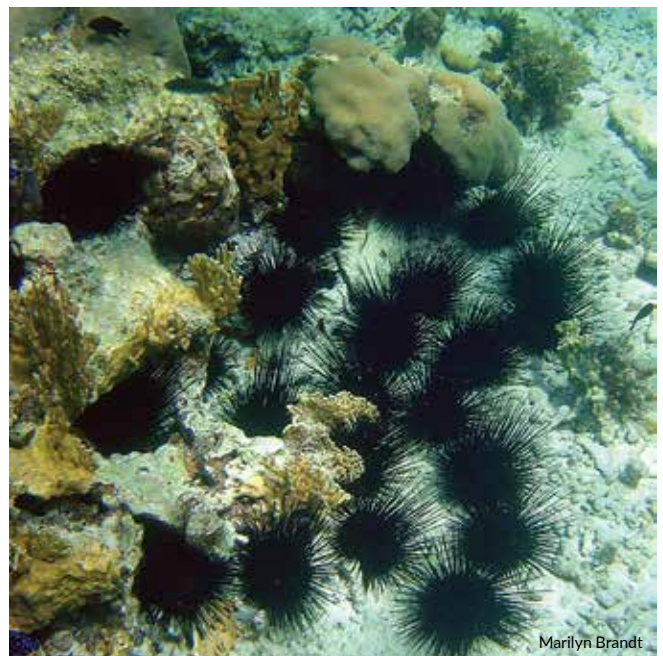
The following Management Recommendations and Monitoring Priorities are suggested to help protect Antigua and Barbuda's coral reefs:

I. Management Recommendations

- Continue MMA support & management to help reefs recover
- Continue to protect parrotfish and other herbivores to reduce harmful macroalgae
- 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

II. Monitoring Priorities

- Coral Reef Monitoring - 2016
 - Representative surveys: Antigua Island wide, high priority NEMMA, Diamond, Cades Bay
 - Survey strategic reefs: near coastal development areas, popular dive sites, lobster/conch surveys, spawning areas
 - Establish long-term monitoring sites: NEMMA, Diamond, Cades Bay, W. Antigua, Palaster
- 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 grazing *Diadema* urchins gives hope for the future