Future Of Reefs in a Changing Environment: *considering people, corals & marine life in finding the best ways to manage Caribbean coral reefs.*

Summary of Barbados Surveys March 2011

The overall aim of FORCE is to provide coral reef managers with a toolbox of sustainable management practices that minimize the loss of coral reef health and biodiversity. So far, the ecological team, consisting of scientists from University of Newcastle (England) and the University of Costa Rica have surveyed coral reef communities in Honduras, Belize, Curaçao, Bonaire, Jamaica and Barbados. This report summarizes the project work on describing the ecological status of coral reefs in Barbados.

Why This Study Is Important

Coral reefs provide many ecosystem services to coastal communities including the support of fisheries, tourism, coastal protection from storms, generation of sand and building materials, pharmacological products and the highest marine biodiversity on Earth. Despite their great value, the ecological state of Caribbean reefs has deteriorated rapidly in the last few decades. As the human population increases in the wider Caribbean, the demand for reef-based resources will likely increase. The decline in coral cover poses a real threat for human societies: corals provide complex structures that influence biodiversity, fisheries production and the provision of a structural barrier to wave energy.

The FORCE project uses an ecosystem approach that links the health of the ecosystem with the livelihoods of dependent communities, and identifies the governance structures needed to implement sustainable development. This project plays an important and measurable role in helping communities adapt to climate change in the Caribbean.

What We Did & How We Did It

Reef communities were surveyed at eight locations (Fig. 1). At each location surveys were conducted at 10-15 m during 2-16 March, 2011.

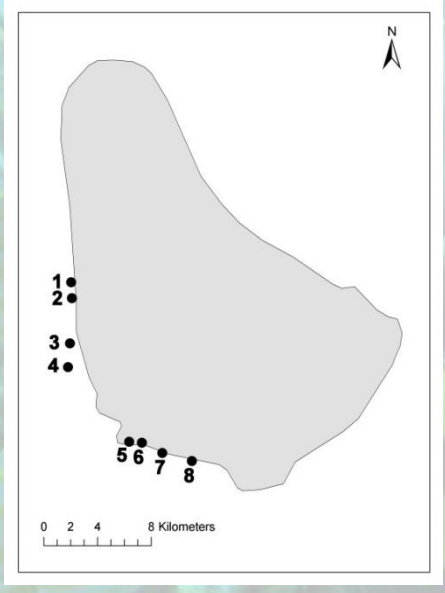

Fig. 1 Study sites in Barbados (black dots), site numbers correspond to locations: 1) Folkestone, 2) Paynes Bay, 3) Escape, 4) Clarks, 5) Asta, 6) Boot, 7) Pieces of Eight, and 8) Welcome Inn.

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Visual surveys along transect lines (Fig. 2) recorded the following information:

1) At each location, we measured the coral, soft coral, sponge, and algae on three 10 m transect lines. In order to measure coral health, the presence of coral bleaching and disease was recorded. Coral recruitment and algal biomass was also measured along each transect line. We also counted the presence of an important reef herbivore, the long-spined sea urchin, *Diadema antillarum*.

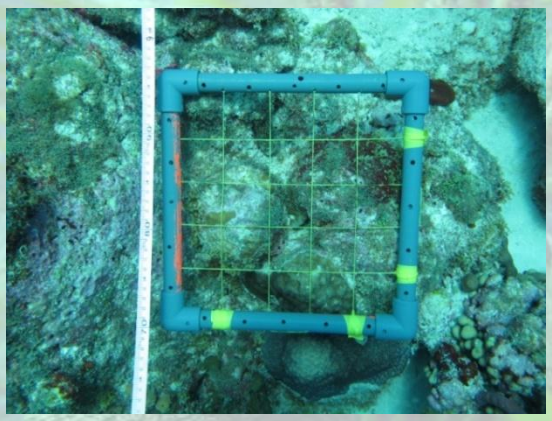

Fig. 2 Picture of 25 cm^2 quadrat next to transect.

2) Reef structure is very important for sustaining the ecosystem. A reef structure with lots of small holes provides refuge for many small fish (e.g. damsels). However, fish too big for these holes may be at risk from predators. Reef structure was visually assessed (on a scale of 0-5), and measured by draping a 10 m chain over the reef contour and measuring the actual distance covered. Counts of holes of different sizes, angle of reef slope, and vertical relief were also measured every 2.5 m along a 10 m transect were recorded.

3) All fish within four 30 m by 4 m transects at each site were identified to species, counted, and body size estimated.

What We Found

Bottom Communities

The cover of bottom-dwelling organisms (coral, algae, sponges etc.), coral recruitment, and species diversity are widely utilized measurements in identifying the current state of a coral reef. We found the diversity of bottom-dwelling organisms to be lower in Barbados than Honduras, Belize and Jamaica. For example, there were a total of 19 hard coral, 11 soft coral, 38 sponge, and 2 sessile invertebrate species, and 20 algal genera identified in Barbados. The dominant benthic substrates at all sites were coral (29%), algae (27%), and sponge (13%). Soft coral and invertebrates were absent at many sites.

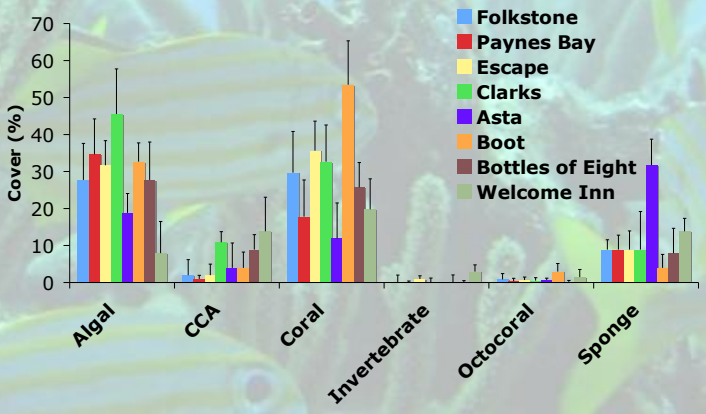

Fig. 3 Bottom cover at each of the locations in Barbados.

Coral cover on the west coast was slightly higher (33%) than along the south coast (26%). The highest coral cover was found at Boot (53%). While the lowest coral cover found was observed at Asta (12%).

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The main coral species at all locations were great star coral (*Montastrea cavernosa)* and mustard hill coral (*Porites astreoides)*. Bleaching and disease incidence was very low at all locations in Barbados (<0.001%). There were not many adult *Agaricia* colonies recorded.

In Barbados, density of long-spined urchin (*Diadema antillarum)* was the highest (0.98 m^{-2}) recorded to date for the FORCE project. This sea urchin consumes algae and their high densities could explain the low algal cover recorded on the reefs in Barbados.

Coral Recruitment

Measurements of coral recruitment help managers and scientists to better understand the resilience potential of coral reefs. Coral recruitment in Barbados (15.9 recruits/m^2) was higher than in the Bay Islands (Honduras), Belize, Curaçao, Bonaire and Jamaica. Available substrate for corals to recruit was the third highest of the six countries (41.6%). Although there were few adult *Agaricia* colonies found, recruits of these species were present.

Reef Complexity & Fish Communities

Almost two kilometers of reef were surveyed by 60 fish transects in Barbados. In total 91 species of fish were identified, with on average 21 species on each transect. Fish communities were characterised by red band and stoplight parrotfish, soldier fish and graysbys, and low number of basslets and lionfish.

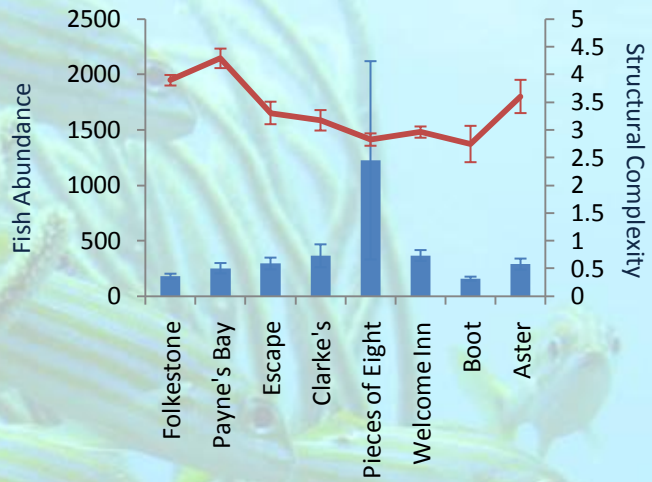

Fig. 4 Variation in reef complexity (red line) and fish abundance (blue bars) in Barbados

The highest fish abundance and diversity was recorded at Pieces of Eight (Fig. 4), with diversity also high at Welcome Inn. The lowest diversity and abundance of fish was at Boot (Fig. 4).

Reef complexity was assessed through 32 transects along the south and east coasts of Barbados. Complexity was higher on the west coast than the south. The highest complexity was at Payne's Bay while the lowest was at Boot.

Hole size did not follow any obvious pattern. The highest hole size was at Boot (14.5cm), the site with the lowest complexity. Pieces of Eight (9.1cm) had the lowest average hole size. Both sites were on the south coast.

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Fish diversity had no clear relationship with reef complexity (Fig. 5). Thus in this case, there was no evidence that more complex reefs typically had more diverse fish communities.

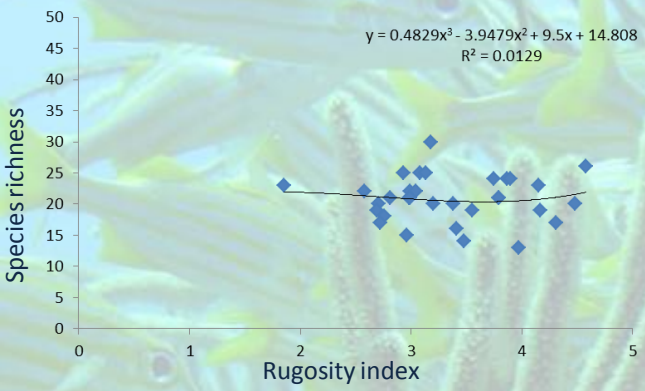

Fig. 5 Relationship between reef complexity and fish diversity

What this Means

The coral cover at the sites surveyed was similar to that which has been recorded around the Caribbean. The resilience potential of coral reefs in Barbados could be high due to the combination of high coral recruitment and low algal cover. Since other herbivores (parrotfish) are absent, the low algal cover at all sites is best explained by the high density of *D. antillarum*. The species diversity of coral and soft coral was very low. The reefs in Barbados had a high diversity of parrots but low diversity of snappers (mahogany and yellowtail) and groupers (graysby and coney). Barbados reefs show signs of overfishing with low snapper, grouper and parrotfish densities in comparison to the wider Caribbean. Parrotfish biomass of 81 kg per 100 m^2 of reef was only slightly higher than in Jamaica, and considerably lower than Curacao, Honduras, Belize and Bonaire.

A social scientist team from FORCE has now interviewed many stakeholders, and identified the present economic status, governance structure, and social composition. This information will be used in combination with the data described here to increase understanding of how different scenarios of climate change and governance may affect reefs and related livelihoods in the region. In addition, data that are collected in the field will be reviewed in a published document describing the geographical differences of benthic and fish communities in the greater Caribbean region.

People We Thank

Coastal Zone Management Unit - Dr Leo Brewster
The Dive Shop - Fatema
Captain Trevor

For more information please visit www.force-project.eu

Our project partners:

- Alterra
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- El Colegio de la Frontera Sur - ECOSUR
- Integrated Marine Management
- Institute for Marine Resources & Ecosystem Studies
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