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

Summary of St. Lucia Ecological Surveys July 2011

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. However, 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.

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, Barbados, Dominican Republic, Antigua, and St Vincent and Grenadines. Aimed at those assisted the FORCE field team in its work, this report briefly outlines the work and ecological status of St. Lucia coral reef studied. Detailed analyses of the huge amount of data collected will be disseminated in due course.

What We Did & How We Did It

Reef communities were surveyed at 10-15m depth in eight locations in St. Lucia (Fig. 1) during July 2011.

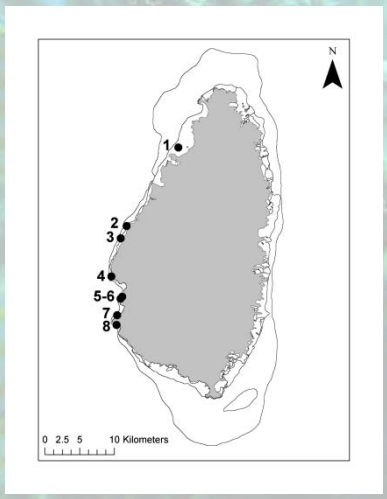

Fig. 1 Study sites in St. Lucia (black dots), numbers correspond to sites: 1) Vigie Beach, 2) Anse Cochon, 3) Anse Jambette, 4) Turtle Reef, 5) Malgretoute, 6) Petit Piton Reserve, 7) Coral Garden, and 8) Blue Hole.

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Our methodology included the following

1) 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 in particular site/region. Coral, soft coral, sponge, and algae cover (%) was recorded every 10 cm along six 10 m point intercept transect lines. Presence of coral bleaching and of disease (% of affected corals) were recorded as measures of coral health. Coral recruitment data help improve understanding of the resilience potential of coral reefs. Coral recruitment and algal biomass were also measured in 25 cm^2 quadrat along each transect line (Fig. 2). We also counted the presence of the herbivorous long-spined sea urchin (*Diadema antillarum*) in 1 m wide belt transects.

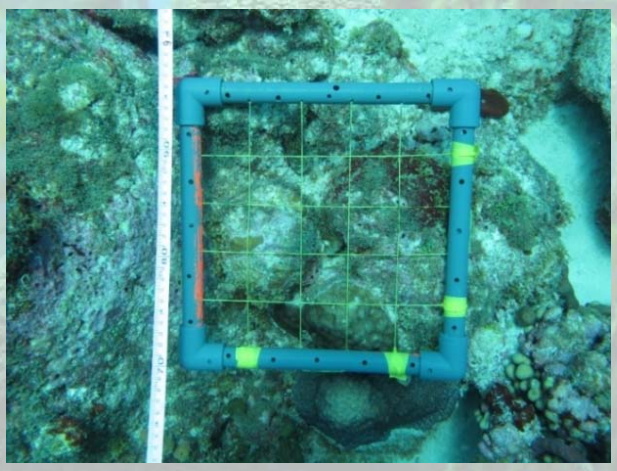

Fig. 2 Picture of 25 cm^2 quadrat next to transect.

2) Reef habitat structure can provide refuge for prey and hiding places for predators, this the complexity of this structure should be conducive to reef biodiversity. Reef structural complexity was assessed i) visually on a scale from 0 [flat] to 5 [highly complex] ('rugosity'), ii) by draping a 10 m chain over the reef contour and measuring the actual distance covered by the reef surface, iii) by counting holes of difference sizes, and iv) by measuring angle of reef slope and vertical relief every 2.5 m along a 10 m transect.

3) All fish within two 30m x 4m transects at each depth were identified to species, their numbers counted, and their size estimated. Diversity was assessed as species richness (number of species present).

What We Found

Bottom Communities

We found the diversity of bottom-dwelling organisms to be overall low in St. Lucia, with the exception of sponge diversity which was the second highest to date for FORCE countries. There were a total of 23 hard coral, 7 soft coral, 59 sponge, and 7 sessile invertebrate species, and 15 algal genera identified in St. Lucia. The dominant benthic substrates at all sites were algae (28%), sponges (21%), and coral (16%). Overall mean soft coral and invertebrate cover was low (1% and 1%, respectively).

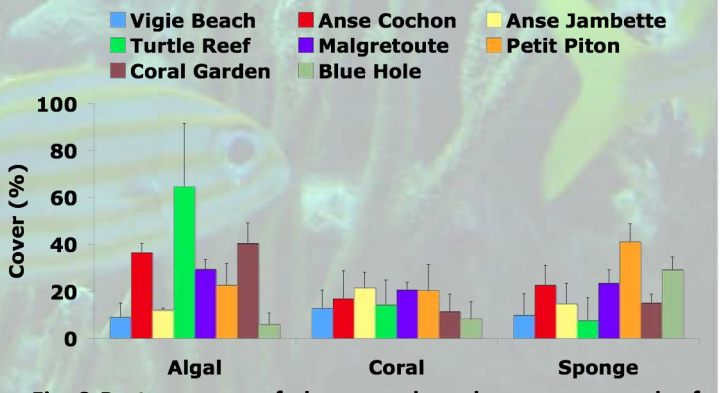

Fig. 3 Bottom cover of algae, corals and sponges at each of the locations in St. Lucia.

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The highest mean coral cover per site was found at Anse Jambette (22%). While the lowest coral cover was observed at Blue Hole (9%). Most of the sites has a layer of silt (river) and cyanobacteria covering the bottom.

The main coral species recorded in our surveys were mustard hill coral *(Porites astreoides)* and round starlet coral (*Siderastrea siderea*) an important reef building species. The prevalence of coral bleaching and disease was low (<0.27%).

Coral Recruitment

Coral recruitment in St. Lucia (6.1 recruits/m^2) was lower than most of the other countries surveyed, with exception in Dominican Republic, Curaçao, and Bonaire, where densities were less than 6.0 recruits/m^2). The available substrate was the lowest observed until now (14 %), this could be due to the high abundance of cyanobacteria and silt.

The most common recruits at all locations were *Agaricia* spp. (lettuce coral).

Long-spined urchins (*D. antillarum*) were the most abundant species of invertebrates surveyed on St. Lucia reefs (0.21 ind m^{-2}). This sea urchin consumes algae and their high densities could explain the low algal cover recorded on the reefs in St. Lucia.

Reef Complexity & Fish Communities

Approximately two kilometres of reef were surveyed by 31 short (10 m) detailed fish transects and 61 long (30 m) transects in St Lucia. In total 108 species of fish were identified, with on average 23 species on each transect.
Fish communities were characterised by high abundances of graysbys, wrasses (blueheaded, yellowhead and creole), and parrotfish (red band, stoplight, striped and princess).

Coral Gardens (Gros Piton) had the highest fish abundance, while Vigie Beach had the lowest (Fig. 4). Mean fish species richness was highest in the Petit Piton area (32.25 per transect) and lowest in Vigie Beach (18 per transect)

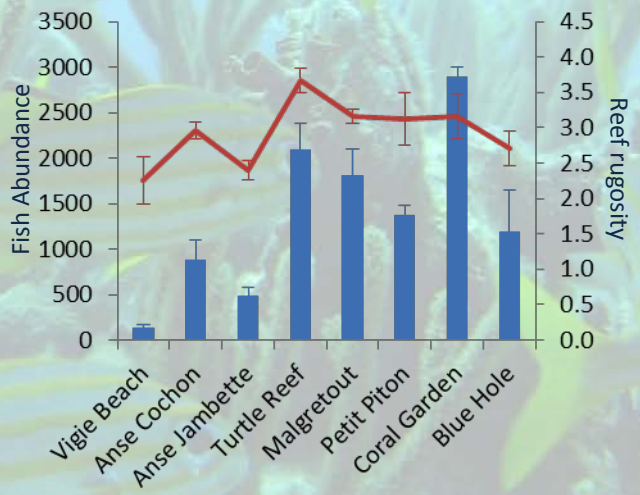

Fig. 4 Variation in reef rugosity (red line) and fish abundance (blue bars) in St Lucia.

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Reef habitat complexity was assessed through 31 transects on St Lucian reefs. Reef complexity was highest in Turtle Reef, and lowest in Vigie Beach (Fig. 4).

Fish diversity tended to be positively related to reef complexity. This means the more complex reefs typically had more diverse fish communities in St Lucia, and the flatter reef areas had fewer species.

What this Means

Overall, St. Lucian reefs were characterised by large boulders which provided a refuge to a wide diversity of fish. In terms of fish communities, these reefs were some of the healthiest recorded by the FORCE team in the Caribbean. Fish communities were not only highly diverse, but also high in total abundance and occurrence of larger individuals. The establishment and enforcement of the Soufriere Marine Reserve appears to be very valuable, containing the reefs with highest complexity and fish diversity.

In contrast, the total mean coral cover (16%) was the second lowest compared to other countries surveyed in the Caribbean by the FORCE team. However, sponge cover and diversity were the second highest to date. Many organisms and fish species use the structure of sponge as a refuge.

The algal cover was lower than most countries surveyed by FORCE and this could be due to the relatively high abundance of *D. antillarum*. At many reefs, bottom communities were covered in silt and cyanobacteria. This may be due to land and river runoff in the region. High silt cover on these reefs could account for the low coral recruitment. Reefs in St. Lucia may improve if land development and use are regulated.

These ecological assessments represent part of a series of studies to understand the ultimate and proximate drivers of reef health. Ultimately the FORCE project will assemble a toolbox of sustainable management practices that minimise the loss of coral reef health and biodiversity, which will also benefit high-level policy makers by highlighting the governance reform needed to implement such tools effectively. We expect this project to play an important and measurable role in helping communities adapt to climate change in the Caribbean.

Institutions We Thank

Fisheries Department, SMMA, Captain Emmanuel John, Scuba St. Lucia, and Peter Butcher.

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

Our project partners:

- Alterra
- Bar-Ilan University
- Caribbean Research & Management of Biodiversity -CARMABI
- El Colegio de la Frontera Sur - ECOSUR
- Integrated Marine Management
- Institute for Marine Resources & Ecosystem Studies
- Leibniz Center for Tropical Marine Ecology
- National Oceanographic & Atmospheric Administration
- Newcastle University
- Rosenstiel School of Marine & Atmospheric Science
- Rotterdam Zoo
- Royal Netherlands Institute for Sea Research -NIOZ
- University of Amsterdam
- Universidad de Costa Rica – CIMAR
- University of Exeter
- Universidad Nacional Autónoma de México
- University of Queensland
- University of the West Indies - CERMES
- Utila Centre for Marine Ecology
- Wageningen University

A European Union 7th Framework Programme Project, Grant Agreement 244161