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

Summary of the Bay Islands, Honduras Surveys October 2010

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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 Newcastle University (England) and the University of Costa Rica have surveyed coral reef communities in Honduras, Belize, Curaçao, Bonaire, Jamaica and Barbados. This report summarizes FORCE field work to describe the ecological status of coral reefs in Honduras.

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 15 locations in the Bay Islands, Honduras (Fig. 1). At each location surveys were conducted at two depths: 5-10 m and 15-20 m between October 12 and November 4, 2010.

Fig. 1 Study sites in the Bay Islands, Honduras (black dots).

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

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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*).

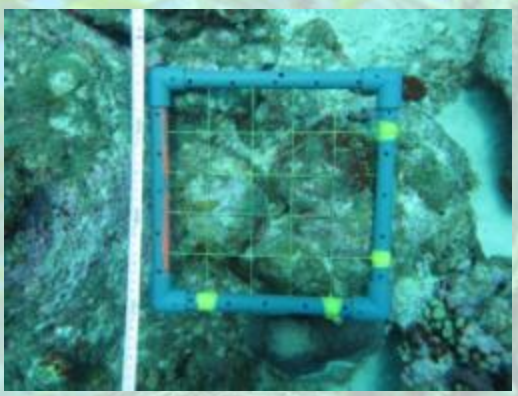

Fig. 2 Picture of 25 cm^2 quadrat next to transect.

2) Reef structure can provide prey with refuge and by predators for ambushing. A reef structure with lots of small holes could provide 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 calculated by draping a 10 m chain over the reef contour and measuring the actual distance covered. Additionally, counts of holes of different sizes, angle of reef slope, and vertical relief measured every 2.5 m along a 10 m transect were recorded.

3) All fish within two 30 m by 4 m transects at each depth were identified to species and counted, and their body sizes 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 in particular site/region. We found the diversity of bottom-dwelling organisms to be higher in the Bay Islands (Honduras) than other countries surveyed by FORCE thus far. For example, there were a total of 42 hard coral, 43 soft coral, 53 sponge and 21 sessile invertebrate species, and 20 algal genera identified in Honduras. Reef communities in the Bay Islands were very similar to Belize. Algae was the dominant benthic substrate (41%) at all 15 sites. Overall, mean hard and soft coral cover were moderate (23% and 15%, respectively) while sponge and invertebrate cover were low at all sites.

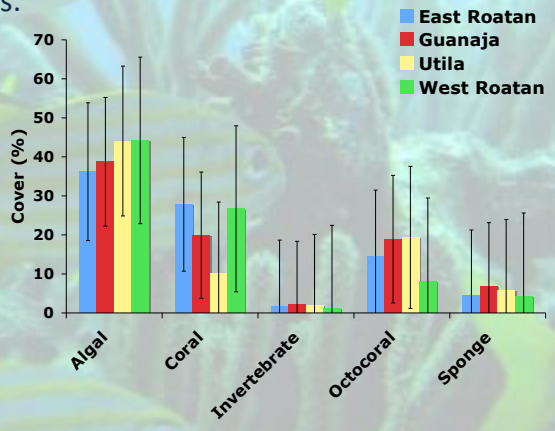

Fig. 3 Bottom cover at each of the locations in the Bay Islands, Honduras.

Coral cover at West and East Roatán was higher than at Utila and Guanaja (Fig. 3). The highest coral cover was found at West Roatán (Cordelia, 38.8%), while the lowest coral cover found was at Utila (Pumpkin Hill, 3.5%). The main coral species

at all three locations was thin leaf lettuce coral (*Agaricia tenuifolia)*. This species has the ability to utilize a greater range of habitats and is more resilient to some of the threats generally faced by corals. Bleaching and disease incidence was relatively low at all locations with the exception of Utila with a bleaching incidence of 20%. The encrusting tunicate *Trididemnum solidum,* was very prominent in Roatán and Guanaja. This organism is known to overgrow corals and suffocate them.

Coral Recruitment

Measurements of coral recruitment help managers and scientists better understand the resilience potential of coral reefs. Coral recruitment in the Bay Islands (6.7 recruits/m^2) was higher than Belize, Curaçao and Bonaire, but lower than Barbados and Jamaica. However, the available substrate for corals to recruit was the highest of six countries (44.5%, Table 1).

Table 1. Recruits and substrate available in all locations, Honduras.

Location	Recruit #	Substrate Available (%)	Density (ind m^{-2})
West Roatan	21	46.1	6.1
East Roatan	36	48.1	8.0
Utila	15	42.5	6.3
Guanaja	12	38.4	5.6

Species of coral recruits varied between locations. The main recruits in all three islands were *Agaricia* spp. and *Siderastrea siderea.*

Density of the long-spined urchin (*Diadema antillarum)* was low (0.004 m^{-2}) at all locations in Honduras. This sea urchin consumes algae and its low densities could explain the high algal cover on reefs in the Bay Islands.

Reef Complexity & Fish Communities

Almost two kilometers of reef were surveyed by 64 fish transects in the Bay Islands. In total 125 species of fish were identified, with on average 28 species on each transect. Fish communities were characterised by bicolour damsels, sharpnose puffers, blue-headed wrasses, striped parrots and redband parrots.

Sites in West Roatán had the highest fish abundance (Fig. 4), while the eastern portion of Roatán had the highest diversity of fishes. Utila had the lowest diversity and abundance of fish (Fig. 4). No significant difference in fish abundance was recorded between the two depths.

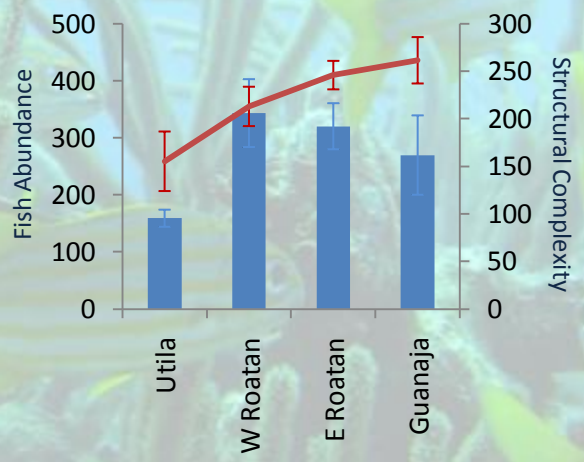

Fig. 4 Variation in reef complexity (red line) and fish abundance (blue bars) in the Bay Islands, Honduras

Reef complexity was assessed by 92 transects around the Bay Islands. Guanaja's reefs had the highest measures of complexity, with East Roatán quite similar (Fig. 4). The reef around Utila was significantly less complex than the other sites.

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Average hole sizes followed a similar trend where the largest average hole size was found in Guanaja (19.9 cm) and the smallest in Utila (12.3 cm).

Fish diversity tended to be greatest at intermediate levels of reef complexity (Fig. 5). This means there tended to be fewer fish species on both the more complex and the less complex reefs (such as those found around the north and east coasts of Utila) in the Bay Islands.

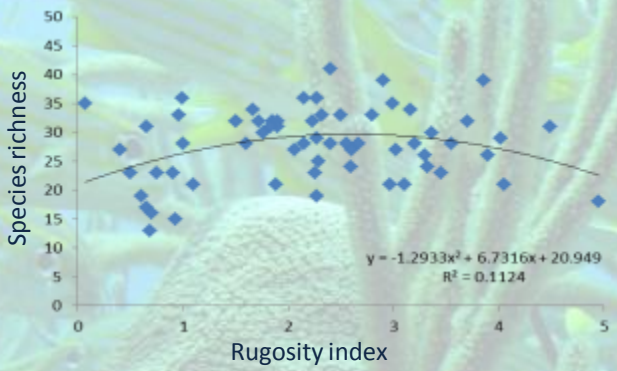

Fig. 5 Relationship between reef complexity and fish diversity

What this Means

As our first study location, Honduras provides a basis for comparison with other areas that we will survey. For the most part, reefs around the Bay Islands were in relatively good condition with high fish diversity and a moderate level of reef habitat complexity.

Out of the three islands, Utila's reefs were surprisingly poor, with low complexity, fish abundance and the lowest coral coverage. However, there was considerable variability, and one site around the Utila Cays had very high fish diversity and complexity. The reefs around Roatán had high recruits and high coral cover and are in a relatively healthy state with high fish diversity and abundance.

A social scientist team from FORCE is to visit the Bay Islands to interview stakeholders, identify 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 different scenarios of climate change and governance and how they could affect reefs and 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

Nic Bach and Roatán Marine Park
Utila Center of Marine Ecology
-Steve Box, Steve Canty and Andrzej Narozanski
Libby Rodgers and Deep Blue Divers Utila
Reef House Resort – Mike and all the staff
George and Ginger at Clearwater Paradise

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

Our project partners:

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- Caribbean Research & Management of Biodiversity -CARMABI
- El Colegio de la Frontera Sur - ECOSUR
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- 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