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

Summary of Curaçao Surveys January - February 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. This report summarizes project field work to describe the ecological status of coral reefs in Curaçao. This was conducted by a team of personnel from Newcastle University (England) and the University of Costa Rica.

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 8 locations in Curaçao (Fig. 1). At each location surveys were conducted at a depth of 10-15m between January 8th and February 2nd 2011.

Fig. 1 Study sites in Curaçao (black dots), site numbers correspond to locations: 1) Playa Kaiki, 2) Playa Lagun, 3) Vaernsenbaai, 4) Boka 5) Playa Grandi, 6) Marie Pampoen, 7) Lagun Blanku, and Oostpunt.

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

1) Benthic (bottom) assessments were conducted on six 10 m transects at each site. Benthic cover (coral, soft coral, sponge, algae, rock, sand etc.) was recorded every 10 cm, and coral recruits and algal biomass were measured every 1 m in a 25 cm^2 quadrat. Incidence of disease and bleaching to determine coral health were also recorded, as were counts of the important long-spined black urchin (*Diadema antillarum*) within 1 metre either side of the transect.

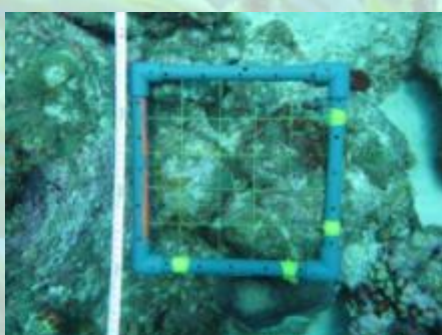

Fig. 2 Picture of 25 cm^2 quadrat next to transect.

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 four 10 m by 4 m transects were identified to species, counted, and size estimated. Larger individuals (>20cm) only were then counted on 8, 30m by 4m transects.

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 low in Curaçao than other countries surveyed during this project. For example, there were a total of 20 hard coral, 12 soft coral, 21 sponge and 3 sessile invertebrate species, and 4 algal genera identified in our transects. The dominant benthic substrates at all eight sites were algae (40%) and coral (27%). Overall, mean soft coral, sponge and invertebrate cover were low (3%, 3%, and 2%, respectively). High cyanobacteria cover was recorded at Boka and Playa Grandi.

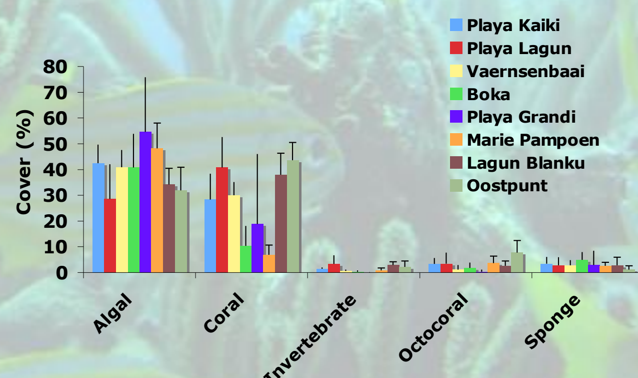

Fig. 3 Bottom cover at each of the locations in Curaçao. Vertical bars denote standard deviations.

The highest mean coral cover per site was found at East Point (44%) and Playa Lagun (41%). While the lowest coral cover was observed at Marie Pampoen (7%).

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The main coral species recorded in our surveys were mountainous star coral (*Montastraea faveolata), yellow* pencil coral *(Madracis mirabilis),* and lettuce coral (*Agaricia agaricites*). *Montastraea faveolata* is an important reef building specieis. In Curaçao, prevalence of coral bleaching was high (19%) and was recorded at seven of the eight sites. *M. faveolata* and *M. annularis* (boulder star coral) suffered the most bleaching and we observed the most bleached corals at Playa Lagun (40%). The prevalence of disease was low. However, we noticed a lot of blushing star coral (*Stephanocoenia intersepta)* colonies infected with a particular disease (DSD-II disease).

Coral Recruitment

Measurements of coral recruitment help managers and scientists better understand the resilience potential of coral reefs. Coral recruitment in Curaçao (3.3 recruits/m^2) was higher than Bonaire, but lower than Bay Islands (Honduras), Belize, Barbados and Jamaica. The available substrate for corals to recruit was the lowest of the six countries (35.9%).

The long-spined sea urchin (*Diadema antillarum)* was absent at all locations in Curaçao. This sea urchin consumes algae and its absence could explain the relatively high algal cover on reefs in Curaçao.

Reef Complexity & Fish Communities

Almost two kilometers of reef were surveyed by 65 fish transects in Curaçao. In total 101 species of fish were identified, with on average 22 species on each transect. Fish communities were characterised by graysbys, parrotfish (princess, red band and stoplight), soldier fish and abundant gobies.

Sites in Vaersenbaai had the highest fish abundance (Fig. 4), while the highest diversity of fishes was recorded at Vaersenbaai and Lagun Blanku (Fig. 5). Marie Pampoen had the lowest diversity and abundance of fish (Fig. 4).

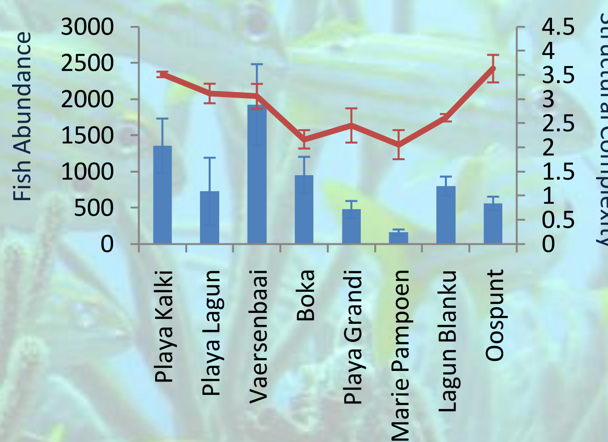

Fig. 4 Variation in reef complexity (red line) and fish abundance (blue bars) in Curaçao

Reef complexity was assessed through 38 transects long the south coast of Curaçao. The reefs at either end of the island to the East and West had the highest measures of complexity. The eastern most point was the most complex.

Average hole size did not follow a noticeable geographic pattern, the more central site of Vaersenbaai (19.11cm) had the greatest average hole size and Marie Pampoen (11.69cm) had the lowest average hole size.

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Fish diversity tended to be positively related to reef complexity (Fig. 5). This means the more complex reefs typically had more diverse fish communities in Curaçao, and the flatter reef areas fewer species.

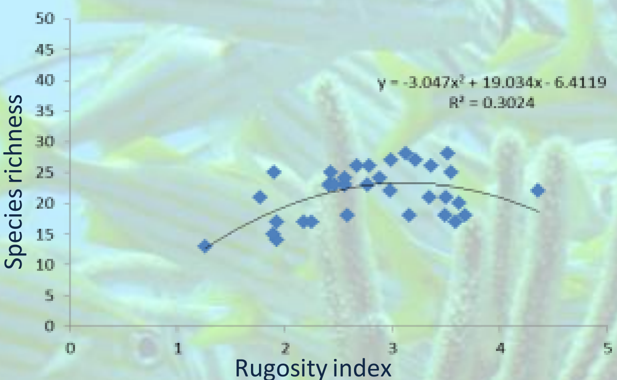

Fig. 5 Relationship between reef complexity and fish diversity

What this Means

In comparison to other surveys conducted in the Caribbean by the FORCE team, the fish communities in Curaçao were second in diversity only to Bonaire. However, the reefs off Curaçao had some of the highest densities of fish, largely due to high numbers of plankton-feeding chromis. Coral reefs in Curaçao were relatively healthy with high coral cover, fish abundance and diversity.

The overall mean coral cover found in Curaçao tended to be higher than in those countries previously surveyed for the FORCE project (Honduras, Belize, Jamaica, and Barbados). Coral cover was slightly lower than in Bonaire, and species diversity of benthic organisms was lower than in those previously surveyed areas.

A social scientist team from FORCE will in due course visit to interview stakeholders, identify the present economic status, governance structure, and social composition. This will be used in combination with the data described here to increase understanding of different scenarios of climate change and governance and how they 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

All the staff at CARMABI – Caribbean Research and Management of Biodiversity – for their support and assistance

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

Our project partners:

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