

**UK Overseas Territories and Crown Dependencies
Training and Research Programme**

**JNCC Research Contribution Project Report
Appendix 1**

**Increasing biodiversity of coral reefs by
creating an Acropora nursery in Grand
Turk**

September 2010

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APPENDIX 1
INCREASING BIODIVERSITY OF CORAL REEFS BY CREATING AN ACROPORA
NURSERY IN GRAND TURK, TURKS AND CAICOS ISLANDS.
FINAL REPORT

For the past four years, the Department of Environment and Coastal Resources (DECR) has worked tirelessly to keep its two BioRock® Reefs located in Grand Turk (*one at Governors Beach and the other in front of the South Base Oasis Dive Shop*) at peak performance.

The technology behind the BioRock® is simple as it works by submerging a negatively charged cathode framework structure made up of construction grade steel (in any desired shape) and a positively charged anode. With the structure in place, a low voltage electric current which poses no risk to swimmers or divers, runs from the shore and between the steel causing white limestone (calcium carbonate) to crystallize from seawater onto the framework. Harvested stressed, bleached and damaged corals are attached to the reef using simple steel tie wire. The advantage of this technology is that corals transplanted to these structures grow faster and can survive exposure to higher temperatures, 16-50 times more than corals that are in their natural setting. This factor is particularly important given the impacts facing many coral reef ecosystems due to rising sea temperatures from global warming.

After hurricanes Hanna and Ike (September 2008 (with Hurricane Ike was the strongest hurricane on record to hit Grand Turk.)) the Governor's Beach structure was fully standing since the waves passed straight through with little damage. The Oasis structures which were tie-wired rather than welded; did unfortunately sustained damage. One of the modules collapsed due to the impacts of the bad weather conditions. This module has since been replaced with a new, welded structure.

Most cables were replaced following the hurricanes due to damage from debris and high wave action. The projects lost about a third of the corals due to hurricanes. Most of those lost had only been wired a few days before and had not yet attached themselves firmly. After the impacts of Hanna and Ike the DECR moved more corals to the structures in an effort to replace the ones that were washed away by the hurricanes. Fish populations have increased with large numbers of juvenile fish along with seahorses, barracuda, turtles and stingrays. Soft corals and sponges have shown rapid growth but gorgonians have been susceptible to diseases and flamingo tongue snails. These projects have regenerated corals and fish populations in areas which were primarily barren sand or bedrock and which are now attractive to snorkelers.

Systematic monitoring of the corals overtime showed that one species in particular, *Acropora sp*, was a lot more sensitive than the other corals that had been transplanted and that this was not caused by the hurricane impacts. After careful consultation with Dr. Thomas Goreau, President of the Global Coral Reef Alliance, who was the co-creator of the BioRock technology and a leading coral expert, it was initially determined that they might be running into oxygen deficiency problems at night due to hydrogen

bubbling from the Biorock process. It then was suggested to manage the power supply to the structures in a way that they are only powered during the hours of daylight.

Acropora palmata (common name elkhorn coral) and *Acropora cervicornis* (common name staghorn coral) are two species common to the Turks and Caicos Islands (TCI), and along with other variety of *Acropora* across the Caribbean, their numbers have decreased significantly over the past twenty years due to White-band disease and their high sensitivity to various anthropogenic and natural factors. The question therefore was what could be done to address this problem?

The DECR decided that another smaller, dome-shaped, structure could be built to act as a nursery specifically for the struggling elkhorn and staghorn coral and to manage power supply for this structure specifically as recommended by Dr. Goreau. Consequently a project proposal was submitted to the Joint Nature Conservation Committee (JNCC). The project was approved and funds were granted by the JNCC to support this effort. As with previous structures, the construction of the new dome-like nursery was done by a local company: CB Construction and took approximately four weeks to complete. It was placed in the center of the older more established reef at Governors Beach.

In fall 2009, staff of the DECR with the help of volunteers (a tradition established by the DECR in Grand Turk for supporting the Biorock projects) successfully transferred the new structure to the center of the older more established reef at Governors Beach. This structure remained for certain time to allow sufficient accretion of calcium carbonate on the framework before transplanting corals onto it.

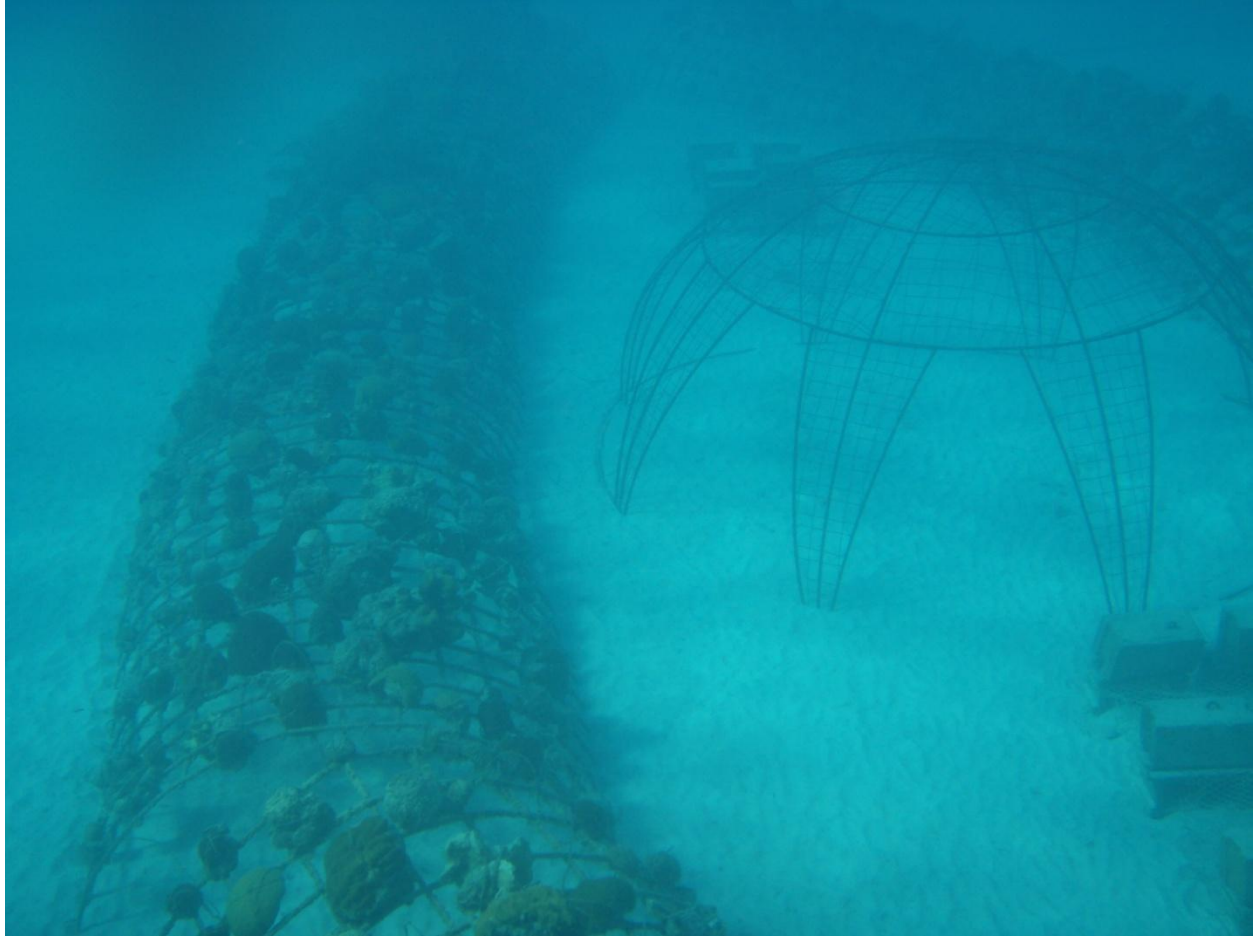


Figure 1. The new structure for the nursery placed in the center of Governor's Beach Biorock Project. Fall 2009



Figure 2. Partial view of Governor's Beach Biorock Project. Spring 2010

In summer 2010 more than 50 fragments of corals were transplanted onto the structure. These fragments were obtained from still alive parts of damaged *Acropora sp* corals, located at Chief Minister's dive site, the closest to Governor's Beach Biorock Project. The fragments were not directly attached to the structure but hanged on a nylon fishing line. This method was used to avoid damaging the coral fragments because, being very small, if they had been attached directly onto the structure with steel tie wires (traditional method for Biorock projects) it would have affected their growth negatively



Figure 3. Partial view of *Acropora sp.* fragments in the nursery. Summer 2010

Consequently, the nursery has been successfully established and the goal of the project achieved. However this is just the first stage of the nursery which requires long-term monitoring and maintenance. During the next stage (in principle 4 to 5 weeks), the structure would be left without power to monitor coral health and growth in those conditions. Once health and growth are properly recorded, the structure would be powered only during daylight using a timer that will turn the power off at night. The dome-shape of the structure creates ideal conditions to subject the corals to the electrical field without being directly attached to the structure. Coral growth and health would be then recorded under these new conditions and compared with the previous records without power. According to the conclusions of this comparison it would be decided if more corals should be transplanted onto the structure.

DECR, September, 2010

For more about the Biorock projects in Grand Turk see:

<http://www.environment.tc/content/root/files/20090414105717-BiorockGuidelinesGrandTurk.pdf>