

Annual Report to the Ocean Reef Club

November 2013 – October 2014

Coral reefs make up only a small percentage of the ocean floor; however, they act as a home and feeding ground to a third of all marine fish and invertebrate species, protect coastlines, and create beautiful seascapes for divers and snorkelers. In the Caribbean, two critical reef-building coral species, elkhorn (*Acropora palmata*) and staghorn (*Acropora cervicornis*), were once the dominant building blocks of coral reefs. Unfortunately, over the past three decades both elkhorn and staghorn coral populations in the Caribbean have declined by 98% due to multiple and cumulative stressors. In an effort to restore these species, the Coral Restoration Foundation (CRF) has developed affordable and effective coral nursery and restoration techniques for both species. These restoration methods are implemented through CRF's community-based program that engages local and visiting volunteers to help maintain offshore coral nurseries and transplant nursery-grown corals onto degraded coral reefs, actively enhancing remaining populations of these threatened corals.

Since 2006, the Ocean Reef Club (ORC), through the Ocean Reef Rod and Gun Club and then the Ocean Reef Conservation Association, has been a partner providing both funding and equipment to support the CRF mission. The success CRF has experienced would be impossible without the dedication and support of local community organizations like the ORC. A primary tenet of CRF's mission is to have local communities take ownership of the restoration of their "house reefs". Ocean Reef has inspired us by being the first community to fulfill this aspect of our mission. In the fall of 2013 ORC became CRF's first community donor as well as one of our largest private donors. The CRF Team could not be more excited for this partnership and support! Our expansion of restoration efforts north to Carysfort Reef would not be possible without it.

Carysfort Coral Nursery

The Carysfort nursery was established in August 2013 in order to propagate both staghorn (*Acropora cervicornis*) and elkhorn (*Acropora palmata*) corals to be used for the restoration of the iconic Carysfort Reef off North Key Largo. Under a permit from the Florida Keys Marine Sanctuary (FKNMS), CRF staff stocked the nursery with "fragments of opportunity" collected from various wild populations of both species that were native to North Key Largo. These initial fragments came from the surviving wild

populations of coral that still remained on the reef after decades of stressors, so they have been deemed fit for restoration work. These corals serve as the “parent” colonies for the nursery, where they will continue to be held and grow for the duration of their lifetime. By holding these parent colonies in the nursery, CRF is able to cut fragments from the colony to create second-generation corals that can then be used for tree replenishment or outplanting onto the reef. There is a continuous cycle of outplanting and replenishment in the nursery, where every 6-9 months corals are taken from the nursery for outplanting, and the tree stock is replenished with new fragments from the parent colonies.

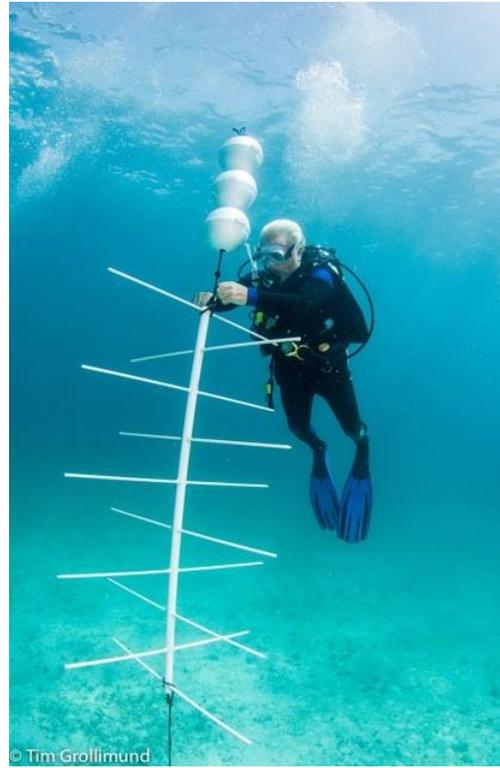


Figure 1 (L) Ken Nedimyer pounding in coral tree anchors (R) CRF volunteer, John Hauk, floating a new coral tree.

To date, CRF has installed 35 coral trees in the Carysfort nursery, 33 of them are populated with 50-100 fragments of coral, for a total of approximately 2,505 pieces of coral growing in the nursery. At present, the Carysfort nursery contains 18 distinct genetic strains of staghorn coral and 21 genetic strains of elkhorn coral for a total of 39 different genetic strains. The nursery has produced 540 reef-competent staghorn corals and 60 reef-competent elkhorn corals that were outplanted to Carysfort Reef in late August of 2014.



Figure 2 (L) Ken Nedimyer and John Hauk hanging frags on a new coral tree (R) Reef squid swimming among the branches of an elkhorn tree-nursery at Carysfort.

The Ocean Reef Club has been essential in the development of the Carysfort nursery. Trips to the nursery, hosted by Cristal Clear Dive Charters, allowed members of the community to actively participate in developing the nursery and outplanting corals on the reef. The Adopt-A-Coral program provided necessary funds to establish new trees in the nursery, which allowed us to increase numbers of corals and genotypes housed in the nursery. The first tree to be adopted was by the Davidson family who participated in the installment of their tree and hung new fragments to the tree. This event began a trend of other coral tree adoptions, which generated over \$31,000 for the project.



Figure 3 Coral Reef families work on adopted trees during dive programs.

Carysfort Reef Outplanting

In August of 2014 CRF staff and volunteers from the Ocean Reef Club outplanted 540 staghorn and 60 elkhorn onto the back reef area at Carysfort Reef. These were corals that had been grown in the Carysfort nursery. CRF restoration techniques can trace their origins back to the aquarium trade where the “fragging” of hard corals, soft corals, and gorgonians got its start. CRF has taken many of these ideas and developed unique techniques for fragging, growing, and outplanting corals in the open ocean. For both staghorn and elkhorn coral, each coral colony is attached directly to the reef using a two-part marine epoxy to glue the colony in place. Within a few months, the coral tissue grows over their attachment points, and the epoxy is no longer visible, giving the outplanted coral a natural appearance. Staghorn corals are outplanted in clusters of 10-15 colonies, with each cluster containing corals from one unique genetic strain. Elkhorn colonies are outplanted in a similar fashion, but with just 3-5 colonies per cluster. Each cluster of coral is marked, and multiple genetic strains are placed in close proximity to each other to facilitate cross fertilization once the corals reach sexual maturity (about two years).



Figure 4 (L) Ken Nedimyer hands off corals to Jessica Levy to be placed on Carysfort Reef. (R) Outplanting staghorn coral to Carysfort Reef.

The rationale for creating these coral clusters is based on the idea that larger coral groups may have a greater chance of survival compared to individually outplanted corals. These larger groups are more likely to withstand low-level disturbances such as those caused by fireworm predation and damselfish infestation. In addition, this strategy recreates the appearance of natural staghorn thickets that appear in the wild.



Figure 5 (L) One of the first clusters of outplanted staghorn at Carysfort Reef. (R) One of the first clusters of outplanted elkhorn at Carysfort Reef.

CRF also places a high priority on maintaining genetic diversity of outplanted corals to increase overall success of restoration techniques and promote natural reef recovery. When corals are moved from the nurseries to restoration sites, not only are multiple genotypes outplanted at a given site, but they are also outplanted in clusters in close proximity to their neighbors of a different genotype. The purpose is twofold: 1) it is impossible to predict what effect various stressors will have on different genotypes and 2) it is conducive to successful sexual reproduction via broadcast spawning events and coral recruitment. Maintaining a large genetic bank in both nursery and restoration efforts provides the greatest chance to successfully restore these coral species.

Ocean Reef Community Involvement

One of the many benefits of the relationship between Ocean Reef Club and CRF is getting to work with a community that is so committed to restoring the reefs in their own back yard. On many occasions members of the CRF team got to meet with and interact with residents during street fairs, education days, presentations, and dive programs.

During the summer season, CRF and ORC began a joint internship program providing the opportunity for a university student to represent both CRF and the ORC as a Marine Conservation Intern. Bridget Hickey, an undergraduate at The University of Tampa (UT), magnificently represented the values of both organizations as the first-ever joint intern. In the position, Bridget gave multiple short presentations to the Ocean Reef Club and its guests, assisted in dive programs, and led various conservation related activities at the club. She also assisted CRF in growing its nursery and restoration programs throughout the Florida Keys. Her work continues on even after the internship as she continues to give presentations at UT highlighting her experiences with the Ocean Reef

Club and CRF. She was even featured on her school website in a homepage article at: <http://www.ut.edu/Marine-Science-Major-Dives-on-Glow-in-the-Dark-Reef.aspx>.

Proposal Status

Per the proposal dated March 15, 2013, CRF was to achieve the following during the first year:

1. Gain nursery permits and set up a 20-tree nursery at Carysfort Reef.
2. Stock nursery with ten trees of 100 staghorn coral fragments and ten trees of fifty elkhorn coral fragments from existing nurseries.
3. Train volunteers through at least four training trips.
4. Educate and reach out to the community by conducting at least two lectures for the Ocean Reef community and four school visits.
5. Conduct five CRF staff restoration trips.
6. Transplant 500 staghorn corals from Carysfort nursery to Carysfort Reef.

CRF is happy to report meeting or exceeding all the requirements of this proposal:

1. The Carysfort nursery is permitted and a total of 35 coral trees are installed with 33 populated.
2. The Carysfort nursery has 13 staghorn trees with 70-100 fragments per tree and 15 elkhorn trees with 60 fragments on average and 5 trees with both staghorn and elkhorn fully populated with 100 fragments per tree.
3. CRF conducted Carysfort volunteer training dive programs ten times during this reporting period (12/10/13, 1/9, 2/27, 3/8, 4/17, 5/29, 6/19, 8/21, 10/16, and 11/13).
4. Ken Nedimyer conducted two lectures for the Ocean Reef community and Bridget Hickey conducted three. For interaction with school-aged children, CRF conducted two 2-day ORC Summer Camps (6/26-27 and 7/24-25) and four Street Fairs (3/4, 3/15, 4/17, and 10/25).
5. CRF staff have executed nine logged restoration trips (8/2/13, 8/8/13, 12/30/13, 5/3, 5/31, 8/5, 8/19-20, and 10/2) as well as associated support dives and land-based preparation activities.
6. Through all programs, a total of 540 staghorn and 60 elkhorn corals from Carysfort nursery have been outplanted onto Carysfort Reef.

CRF looks forward to continuing this important five-year community-sponsored program into the future.

