CORAL | THE REEF & MARINE AQUARIUM MAGAZINE

CORAL

REEF SPAWN

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JANUARY/FEBRUARY 2017

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COVER CREDITS: Fisheye lens view of coral reef: Jamie Craggs/Horniman Museum & Gardens. Background: *Clavularia* soft coral: Werner Fiedler.

CORAL

FEATURE ARTICLES

AQUARIUM PORTRAIT

DEPARTMENTS

Whoa!
Bazinga!
Cowabunga!
Holy Smokes!
Shazam!
Zowie!
Wow!

OMG!

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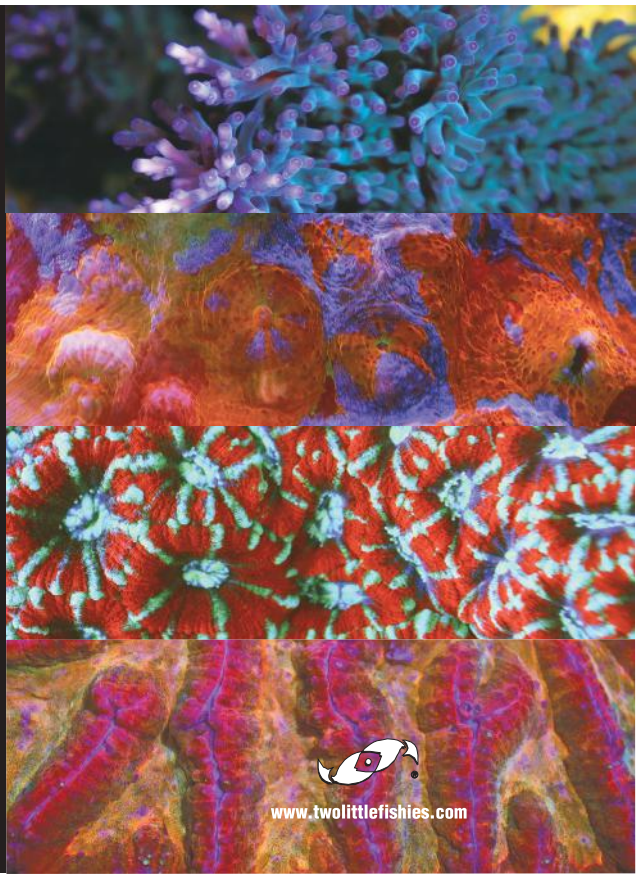

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New Rescue Tactics for Bleached Reefs in the Maldives

One of our rope nurseries. Each 16-foot (5-m) rope holds 50 coral fragments.

By early summer, the devastating El Niño of 2015 and 2016 had finally subsided. Gone were the calm, gin-clear, bathtub-temperature waters. As the monsoon season kicked in, the water temperature gradually declined to a cool but coral-sustaining 82.4°F (28°C). Devastation of the branching, table, and plating corals could be seen throughout the Maldives, and more than 95 percent of some species vanished within one month. Shallow reef-flat communities between 3 and 20 feet (1–6 m) wide had been transformed from flourishing coral gardens in which 60 to 80 percent of the corals were alive to graveyards full of brown, algal-covered skeletons. The acroporids were hardest hit. Formerly the dominant corals on most Maldivian reefs, they are one of the most important, providing high-relief habitat for hundreds of species of reef fishes. In many areas only the hardiest of the massive corals, and a few scattered branching and encrusting species, survived.

However, despite our initial impressions, we soon realized that hope was not lost. With a bit of searching,

Older, traditional coral frames have been used throughout the Maldives. Very few hold corals that survived the bleaching event.

Anantara Dhigu's resident manager attaching coral fragments to ropes.

we identified numerous survivors—certain reefs provided refuge from the high temperatures, certain habitats fared slightly better, and certain corals appeared to have resisted bleaching. It was these areas that we began targeting as sources of stock for our coral nurseries, but we knew that we had to take precautions to minimize impacts on the remaining coral populations. We also knew that to grow corals in the Maldives we needed to introduce a novel approach—one that was non-destructive to source populations and generated hardy colonies that could be used to restore and rejuvenate damaged areas.

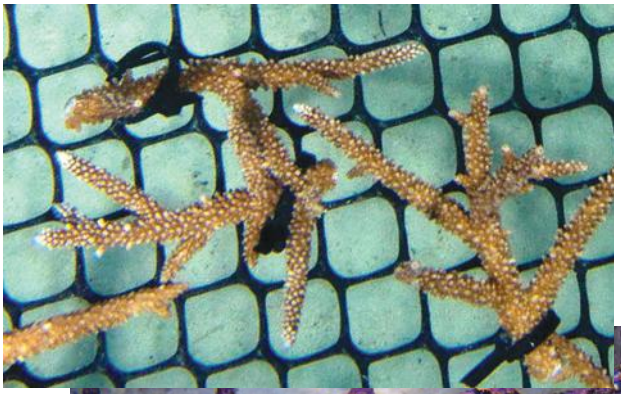
Of the 1,192 islands that make up the 26 atolls in the Maldives, most are remote and uninhabited. While this certainly helps to keep the reefs healthy, there are also about 200 inhabited islands, more than half of which are resort islands. These resorts and the 276 safari boats that circumnavigate the reefs provide most of the jobs and income for Maldivians, but snorkel and dive tourism, which is integral to their survival, depends on healthy reefs. Most visitors come to the Maldives to view iconic Manta Rays, turtles, and various reef sharks, but these species, and the reef fishes and invertebrates associated with them, rely on flourishing coral communities—and all of them will disappear once the coral vanishes.

Traditionally, many of these resorts offered guests an opportunity to contribute to reef conservation by supporting "Adopt a Coral" programs. The guests could purchase a metal (rebar) frame to which small coral branches were attached. The frames were usually placed in a shallow lagoon close to the resort and photographed monthly or quarterly so the guests could witness the growth of "their" corals. Sadly, very few of them survived the high water temperatures in April and May of 2016, largely because they were located in very shallow lagoonal habitats where water circulation was minimal and temperatures climbed to extreme levels (91.4–95°F/33–35°C). These frames had other drawbacks: they would eventually rust, they were easy targets for Crown of Thorns Starfish and other coral predators, and it was virtually impossible to remove the corals from the frames for use in reef restoration.

Using lessons learned in the Caribbean, the Coral Reef CPR team chose to establish coral nurseries using plastic mesh–covered tables raised about 39 inches (1 m) off the seabed and nylon ropes suspended in the water column. This minimizes smothering by sediment and algal growth and also prevents coral losses due to predation. Rope nurseries have added benefits: they al-

Our team attaches coral fragments to a nursery table on South Malé Atoll.

low more water circulation, and smaller predators such as the coral-eating gastropod Drupella cannot climb onto the ropes. They are also easier to maintain—they can be shaken gently to remove any trapped sediment or algae. We use nylon and plastic because coral fragments appear to readily fuse and grow over them and the resulting corals can be removed easily to be transplanted on the reef.



Left: *Acropora* fragments on a new coral nursery table.

Below: The same *Acropora* fragments display amazing survivorship and growth after just two months.

Between August and November we established small nurseries in six locations on South Malé Atoll near Anantara Dhigu and Veli, and two on Baa Atoll, near Anantara Kihavah. We selected different habitats and depths, which will allow us to determine optimal growth rates and species and to grow species that can be transplanted to reefs with similar environmental conditions. We also put corals in certain areas that are frequented by snorkelers and dive boats, placing them in spots where previously existing corals had suffered catastrophic mortality. Our sites include a shallow lagoon formerly dominated by flourishing stands of Staghorn Coral, a sand slope on a pinnacle reef, a rubble slope on an outer reef, a protected, deep, sandy lagoonal channel, and a sand flat within a leeward lagoonal reef. Depths range from 6.6 to 49 feet (2–15 m).

We are using "fragments of opportunity" in all of our nurseries. This means all of our corals are sourced from broken, damaged, or diseased corals and those that would otherwise die. We find a large number of live broken fragments on the reef slope, while the "mother" colonies in the shallows bleached and died. For various reasons, these fragments had detached from corals on the reef flat and carried down the slope; they were being buried by sediment and had lost parts of their tissue. They are also one of the main targets of coral-eating snails. On some fragments we have found more than 200 snails, concentrated on the underside, that are slowly consuming the tissue. Hence, harvesting these fragments saves them from certain death.

We are also discovering an increase in coral disease among colonies that bleached and survived. Black Band disease and White Syndrome manifest on the corals after they have regained their pigmentation, slowly advancing up the branches or radiating outward across a table or plate. When left alone, these coral fragments do die. However, we can clip off the ends of the branches, away from the disease, and the fragments usually survive.

Dredging and sand-extraction sites provide another source of corals that would otherwise be buried or crushed. Throughout the Maldives, most local and resort islands regularly extract sand to reclaim land lost during the monsoon season and to address rising sea level. This is typically done in the vicinity of a coral reef, and the outcome is a dead reef. To supply one nursery, we identified a large, unusually diverse population of small (0.4–2 inches/1–5 cm) acroporid recruits and juveniles that were starting to develop branches and had settled onto dead coral rubble. There was an active sand extraction project in this area that would have overturned and buried the rubble if it were left in place. By delaying the start of the project, we were able to collect many of the corals that would have otherwise died.

Because the corals are already stressed, we expect to lose a portion of them. However, we minimize stress by transporting them underwater and fragmenting and attaching them to our mesh and rope within a few hours of collection. The pilot nurseries we established in July and August showed unusually high survival rates. We planted

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over 1,000 corals in five areas; 80 to 95 percent of them were still alive after three months, and new growth had already occurred. The main cause of mortality was predation by Drupella snails; some fragments had bleached and succumbed to disease. We attempt to place corals at the same depth from which they were collected, as transplantation of colonies from deep water to shallow nurseries inevitably results in bleaching.

During October and November we expanded all five original nurseries and established nurseries in three new locations, emphasizing our rope nurseries. For these, we extend 16–32.8-foot (5–10-m) pieces of 3/8" nylon rope between two metal "staples" and attach 30 to 50 fragments to the rope with cable ties. One of our nurseries is located within a very shallow lagoon that has lost 99.5 percent of its coral. This site formerly had flourishing staghorn coral stands and served as a critical nursery area. It was also easily accessible to tourists. We placed rope frames at this site, using small branches of the same species that were being rapidly consumed by coral-eating snails. Once the fragments grow into small bushes (6–7 inches/15–18 cm), they will be transplanted back into the area to begin reestablishing the population. The key to our success is to place colonies of a single species, but different genetic individuals, into small clusters so they can reproduce and produce larvae that will recolonize other areas.

Our intent is to allow these fragments to grow for 15 to 18 months before transplanting them to neighboring reefs, concurrently adding new rope frames and mesh tables to each site and expanding nursery areas into new locations. Our main challenge thus far is finding funding to purchase necessary supplies and to support local Maldivians who help maintain the nurseries, as well as to build nurseries in new areas. To attract supporters, we are offering exciting opportunities for corporate and in-

dividual sponsorships to help fund our vital conservation efforts. Donors have the opportunity to purchase a rope, a coral frame, or a restoration plot. If you choose to get involved, we place your name on a plaque at the nursery and you can follow your coral's growth online, knowing that you are actively helping to restore a reef. We also sell our team t-shirts, and all donations are used to continue establishing coral nurseries throughout the nation.

With your help, we can reverse the damage these reefs sustained during the 2016 mass bleaching event. To find more information on sponsorships and see photos of our nurseries, visit coralreefcpr.org or contact us at coralreefcpr@gmail.com.

Andrew Bruckner, Ph.D., *and* **Georgia Coward** *are currently working in the Maldive Islands doing coral reef research and restoration for Coral Reef CPR, www.CoralReefCPR.org.*

ON THE INTERNET

The full text of this article can be found online, where comments may be posted.

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