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Finding solutions to the global coral reef crisis: Corporate Social Responsibility (CSR) programs

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Tropical nations in the Indian and Pacific Oceans rely on healthy coral reefs for food, jobs, revenue from tourism and fisheries, and protection from rising sea levels and intensifying storms. Coral reefs are the most diverse ecosystems in the oceans, supporting over 25% of all marine fish during various stages of their life cycles and providing a key source of cultural, recreational and economic benefits. Recent economic valuation studies put the value of coral reef related tourism at USD 12 billion per year, and the overall value of all reef-associated benefits may be as high as USD 11 trillion per year! Yet, reefs are in trouble.

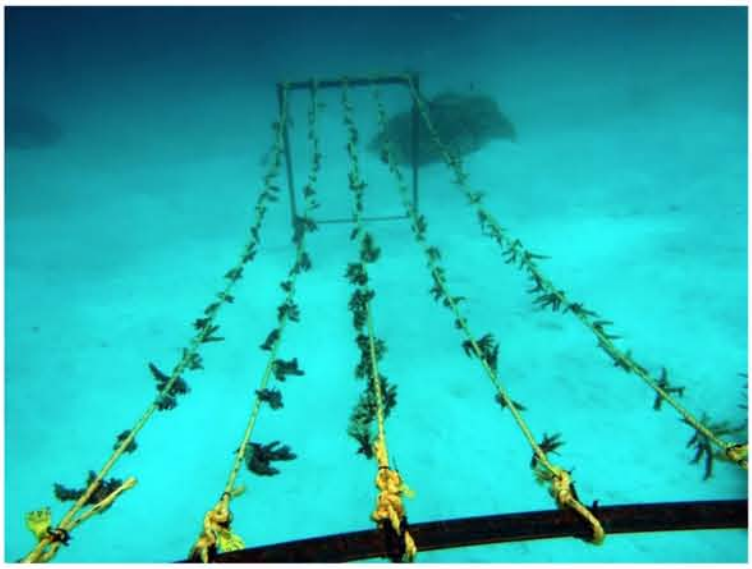
Andrew Bruckner and Georgia Coward, Coral Reef CPR

Severe outbreak of coral disease photographed on a reef adjacent to resort development sites

Over the past three years we have witnessed a dramatic increase in negative press coverage on the precarious state of coral reefs. During 2015 to 2017, coral reefs worldwide experienced catastrophic losses due to abnormally high seawater temperatures associated with a severe El Niño event. Concurrently, man's pressures on these ecosystems continue to rise – threats from plastic pollution, agricultural run-off and sewage, unsustainable fishing, coastal development and growing tourism are compounding natural stressors, and reducing their resilience to climate change. Recent predictions suggest that reefs will begin to bleach annually by 2025, and 90% of the world's reefs will disappear entirely by 2050.

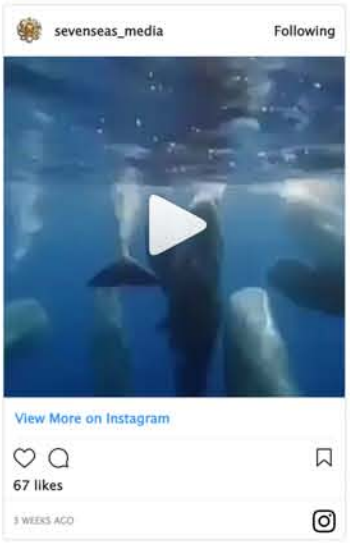
An undeveloped atoll in the Maldives

The Maldives is one of the most vulnerable coral reef nations in the world, as the small islands that dot through the 26 atolls are a mere 1-1.5 m above sea level, and the people are entirely dependent on reefs for their livelihoods and future survival. High temperatures in 2016 led to mass coral bleaching, with many reefs losing 80-95% of the branching, plating, foliaceous, and tabular corals. Mortality was greatest among acroporid staghorn and table corals, which were formerly the dominant species. While the skeletons of these corals continued to provide important structure used as habitat by reef fishes, they have begun to crumble and abundances of algae, tunicates, and other opportunistic pest species are rapidly increasing. Concurrently, outbreaks of coral predators, including *Acanthaster planci* (crown-of-thorns starfish), *Culcita* spp. (cushion starfish), and *Drupella* spp. (coral-eating snails), have concentrated these corallivores on the few corals that survived bleaching and they are also feeding on the newly settled corals. Such predation is greatly delaying, and possibly even preventing, the recovery of these reefs.



A newly established coral rope nursery

So what are the solutions? Australia has dedicated USD 1.6 million towards a contest to find answers to restore the Great Barrier Reef and millions more are already being spent on high tech solutions. Some people suggest that the installation of shade cloth (used in agriculture) above the reef could protect corals from bright sunlight that exacerbates bleaching, while others have recommend complex engineering solutions to pump water from the deep ocean to cool reef habitats. Other groups are collecting the sperm and eggs during the annual coral spawning events, growing them into



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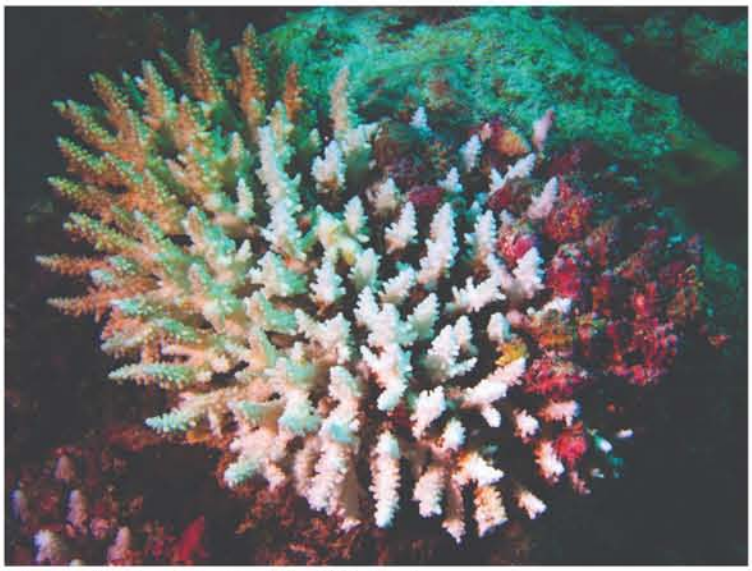
groups are collecting the sperm and eggs during the annual coral spawning events, growing them into larvae in tanks, and seeding them onto a damaged reef. Scientists are also using genetic engineering techniques to alter corals' DNA to make them more heat-resistant. While all of this research is important, it is costly, effective on a very small scale, and does not address other issues affecting reefs, such as increased acidity of our oceans, and sedimentation and nutrient runoff from land-based sources.



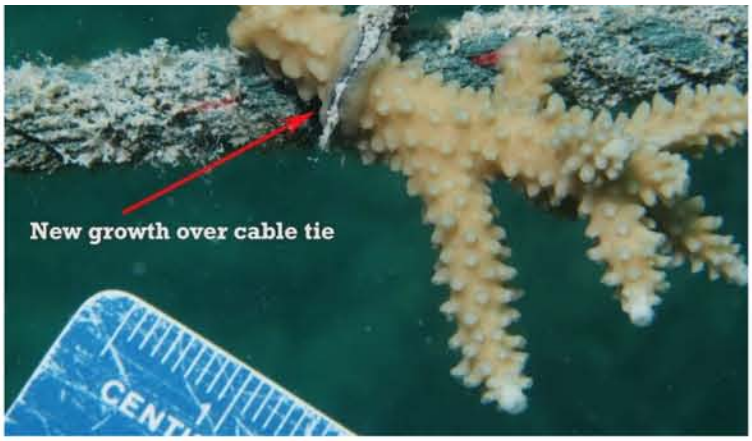
An Acropora coral being devoured by over 200 coral-eating snails (Drupella spp.)

At Coral Reef CPR, we recognize the need for aggressive conservation strategies, but these must to be scalable. We also believe that simpler, low tech solution that can be implemented at a global scale, at a low cost, is the only practical solution for most island nations, especially developing countries, as they have limited capacity and resources. The private sector, especially resorts and local communities as well as the tourists that visit these tropical destinations hold the key to successful implementation of these solutions.

Tourism is critical for developing nations, as it fuels the economy. However, it can also lead to the destruction of what attracts tourists in the first place – the coral reefs. Too many tourists translates in to more pressure on the natural resources for seafood and increased recreational fishing, as well as increased plastic waste, more nutrients from sewage and run-off, and continued burial of reefs to create new islands to build new resorts to keep up with the growing demand.

A scuba diver on a reef with large staghorn coral stands in southern Maldives

However, when tourism is done in a sustainable manner, it can benefit the reefs. In the Maldives, each resort occupies a single island, and these islands are adjacent to local islands. The resort island is surrounded by a "house reef" – which becomes a *de facto* marine protected area as it is (supposed to be) off limits to fishing. Through CSR (corporate social responsibility) initiatives, resorts can give back to the oceans by taking responsibility for the company's effect on both the surrounding environment and the local community's social well-being.



A coral fragment with growth over the cable tie one week after nursery establishment

Coral Reef CPR has partnered with resorts to implement CSR initiatives since 2015– conducting coral reef research, monitoring, reef-clean-ups, coral gardening, and reef restoration. We provide training and educational seminars on coral reef conservation strategies and involve guests, resort staff, and local high school students in all of our in-water conservation activities. Our nurseries are the first step towards the recovery of Maldivian reefs from the devastating 2016 coral bleaching event. But we need support to expand these nurseries throughout the country and into other tropical areas that require similar help.

A 35m snorkel trail built by the Coral Reef CPR team using salvaged and rescued organisms

To achieve this, resorts with corporate responsibility to protect the environment *need* to invest more in to reef conservation, even if this doesn't translate into direct financial gain. Most large tourism enterprises recognize the need to rehabilitate damaged reefs, as it is in their long term marketing interests and they benefit when their customers are aware that they are proactively conserving their reefs. Nevertheless, active reef restoration is often seen as prohibitively expensive, technically difficult, and beyond the scope of these businesses.

A resort construction site – a regular sight now in the Maldives

Resorts often support traditional "adopt a coral frame" programs as their primary CSR initiative, where tourists sponsor the program, getting their name on a coral fragment or coral frame in

exchange for payment of hundreds of dollars. Often these are "feel good" initiatives that can do more harm than good. In the Maldives, resorts continue to use metal (rebar) frames that are placed in shallow, sandy lagoonal areas. While these are often coated with epoxy/cement and sand, the frames ultimately begin to rust, which promotes the growth of harmful algae at the expense of the coral. Some resorts attach entire coral colonies to the frames. Shockingly, this practice is often advised from the highest management level in a weak attempt to show guests that the coral frame they sponsored is growing quickly. Given the large losses of corals these reefs sustained last year, it is entirely inappropriate to remove whole colonies from the reef. While these frames can provide some habitat in a low-relief sandy area, coral reefs are not normally found in the location they are placed, so the benefit is questionable. Further, coral nursery programs need to produce new colonies that can be transplanted onto degraded reefs, to supplement the remaining corals and help restore the reef system, and it is not possible to remove the corals from these frames for use in reef restoration.

A typical resort island in the Maldives

Reef-building corals are among the organisms most vulnerable to rising temperatures. Corals inhabit a wide variety of environments, and they are exposed to different temperature extremes and variations between minimum and maximum temperatures, yet they live at just 1° to 2°C below their upper thermal limits. Research has shown that genetic variation associated with thermal tolerance is already present in corals, and this could be enough to help the corals adapt to increasing temperatures. By propagating corals that survived a mass bleaching event, the frequency of these thermal tolerance genotypes will be increased. When outplanted on the reef among corals that settled from the wild, it could help spread and mix their genetic makeup along with genes present in local populations that help increase tolerance to other environmental stressors.

Coral nurseries require regular maintenance to remove unwanted pests, algae and sediment

With a bit of effort, you can find hundreds of fragments that have naturally broken off larger colonies (or accidently broken by divers/snorkelers standing on the reef) and are sitting in the sand. These can be further subdivided into small (2-5 cm) fragments, attached to ropes suspended in the water column, and cultivated with minimal effort and maintenance. Within a year will grow into a large colony that is suitable for transplantation onto a degraded reef. It is also possible to salvage corals from construction and dredging sites, and remove branches from corals that are under attack by coral-eating snails and starfish, saving the corals from eventual death.

It is our hope that Maldivian resorts and guest houses, government agencies, corporations and the

private sector increase their recognition and support for in-water CSR programs that target coral gardening and restoration, as this will play a key role in enhancing conservation efforts in the Maldives and elsewhere. This is of paramount importance, due to the reliance of the country and its people on coral reefs for jobs, revenue, food, and tourism. Since 2015, the Maldives has entered a new phase of economic development, with land reclamation and creation of artificial islands at an all-time high. While most resorts were concentrated around Malé City (North Malé Atoll) until the 1990s, the last 10 years has seen a 60% increase in the number of resorts and a 1,760% increase in guest houses. By the end of 2017, there were 146 resort islands and 421 guest houses and this number continues to grow. For the first time in 2013 the number of international tourist arrivals surpassed 1 million, reaching 1.2 million by 2015, with government targets of 2 million by 2020.

A typical reef scene before the bleaching event in 2016

The time to act is now. If tropical countries (and resorts that rely on tourism) continue to ignore the warning signs, coral reefs *will* be lost forever. In the process, communities dependent on reefs will lose protection for their coastlines, user groups will lose their economic vitality, and the world will lose a major source of biodiversity.

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