



CORAL



MICRO REEFS

- Organ Pipe Corals
- Pico Livestock
- Ultra-Hardy Fishes

ecotype: A distinct variety within a species that is adapted to certain environmental conditions, as in some corals whose appearance or physical characteristics change depending on water depth.

genotype: The genetic code of an organism or group of related organisms. See also *phenotype*, the appearance and observable traits of an organism.

cf. : An abbreviation used in taxonomy as a suggestion to “compare to” for a species with a questionable identification. It is usually inserted between the genus and species name, as in *Tubipora cf. musica*, for a coral that resembles a known species but that may, in fact, be a different species.

octocoral: Any of a range of corals, including gorgonians and soft corals, that do not form a stony, calcium carbonate skeleton. The polyps are distinguished by having eight tentacles.

pinnate: Having a feathery appearance, as in the tentacles of certain corals.

pinnule: The feathery side branch of an octocoral polyp’s tentacle.

phenotype: An organism’s observable characteristics or traits, including anatomy

and coloration, as well as biochemical properties. The phenotype of an organism is the expression of its genotype.

spicule: A small skeletal inclusion composed of calcium that supports the soft body or polyps of soft corals and some octocorals. Also known as a *sclerite*.

trophic level: The relative position of a plant or animal in the food chain. These levels are:

1. Primary producers (autotrophs): Mostly algae and plants that produce their own food via photosynthesis.

2. Primary consumers (herbivores): Organisms that consume live plants.

3. Secondary consumers (carnivores): Animals that eat herbivores.

4. Tertiary consumers: Carnivores that eat other carnivores.

5. Apex predators: Carnivores at the top of the food chain that have virtually no predatory pressure on them.

6. Decomposers (detritivores): Organisms that consume dead plants and animals, and their wastes, to recycle the mineral nutrients.



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Saint Vincent, Lesser Antilles
Windward Island, Southern Caribbean

Unidentified Triplefin Blenny,
Enneanectus sp., Family Tripterygiidae

— LARRY P. TACKETT is the co-author, with Denise Nielsen Tackett, of *REEF LIFE: Natural History and Behaviors of Marine Fishes and Invertebrates* (Microcosm/TFH, 2002). Image from the new *CORAL Reef Life Wall Calendar 2018*.

Something is missing in this photo...
Help us reverse this

International Year of the Reef 2018

www.coralreefcpr.org



REEF STEWARDSHIP |

ANDREW BRUCKNER, PH.D. & GEORGIA COWARD

A typical Indian Ocean resort island in the Maldives. Note the "water villas" extending into the lagoon and multiple channels dredged from the shore through the reef.

International Year of the Reef 2018

ALL: A. BRUCKNER, PH.D.



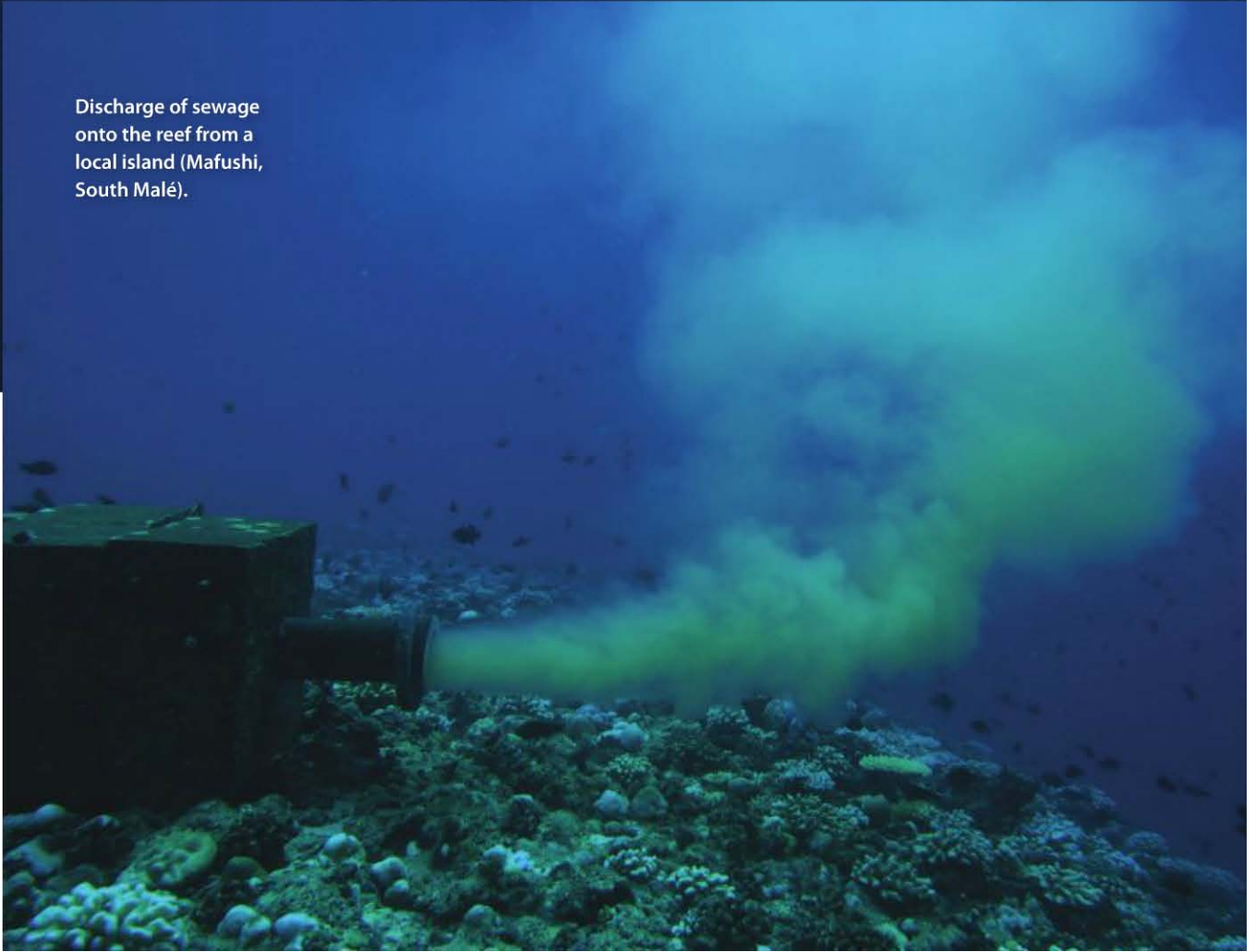
Over the past three years we have witnessed a dramatic increase in disturbing press coverage on the precarious state of coral reefs globally, with over 80 percent of the world's reefs experiencing mass bleaching and colossal losses of corals as a result of climate change and El Niño in 2016. Concurrently, man's pressures on these ecosystems continue to rise—threats from plastic pollution, agricultural runoff and sewage, unsustainable fishing, coastal development, and growing tourism are compounding natural stressors and reducing the reefs' resilience to climate change. With entire reef systems disappearing and predictions that reefs will begin to bleach annually by 2050, the coral reef crisis is rapidly reaching a point of no return.

A Coral Reef's Last (Plastic) Straw?



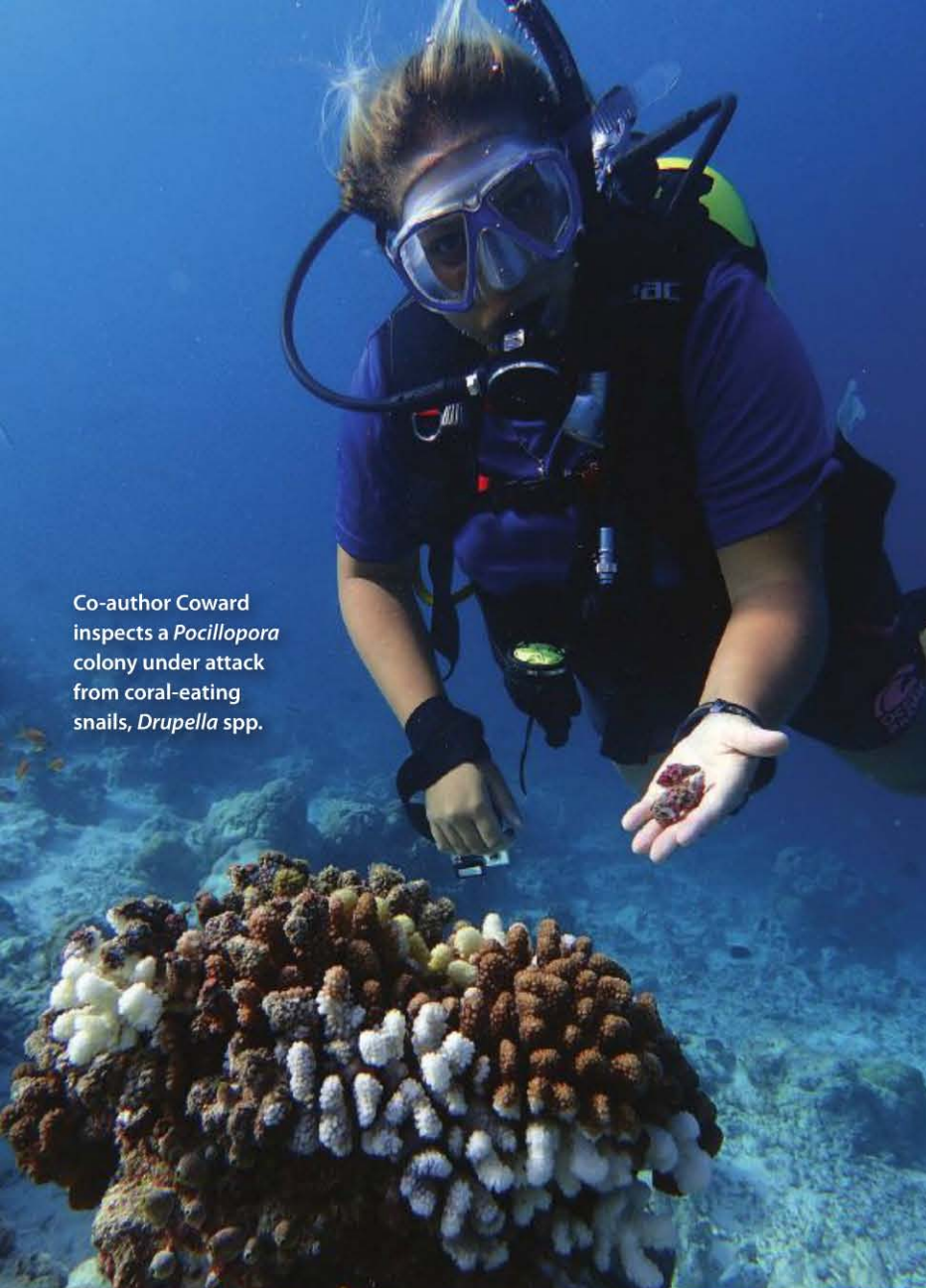
An aerial view of Malé City, one of the most densely crowded islands in the world, where more than 150,000 people are spread over 2.2 square miles (5.8 km²). The island is only 5 feet (1.5 m) above sea level.

Discharge of sewage onto the reef from a local island (Mafushi, South Malé).





Severe coral bleaching in April/May 2016 on a reef dominated by *Acropora* and *Pocillopora*.



Co-author Coward inspects a *Pocillopora* colony under attack from coral-eating snails, *Drupella* spp.



A small *Acropora* fragment rescued from a site of sand extraction and attached to a rope within our nursery.

In recognition of the need to strengthen awareness about the importance of reefs and the threats affecting these ecosystems and promote more effective partnerships between governments, stakeholders, and the public, 2018 has been declared the Third International Year of the Reef (IYOR) (see Resources below). This declaration is an urgent plea to resource managers, scientists, and coral reef user groups to take immediate action to halt the loss of coral reefs by implementing management strategies that enhance conservation, increase resilience, and promote sustainable use.

It is our hope that a wider recognition of IYOR by Maldivian resorts and guest houses, government agencies, corporations, and the private sector will play a key role in enhancing our conservation efforts in the Maldives. 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; land reclamation and creation of artificial islands are at an all-time high. While most resorts were concentrated around Malé City (North Malé Atoll) until the introduction of seaplanes in the 1990s, over the last 10 years there has been a 60 percent increase in the number of resorts and a 1,760 percent increase in the number of guest houses. By the end of 2017, there were 146 resort islands and 421 guest houses in the Maldives. For the first time in 2013, the number of international tourist arrivals surpassed 1 million, reaching 1.2 million by 2015, and the government target is 2 million by 2020.

TOO MANY TOURISTS?

While tourism fuels the economy, it can also lead to the destruction of what attracts tourists in the first place—the coral reefs. Too many tourists means more pressure on natural resources for food and increased recreational fishing and diving, and results in increased plastic waste, more nutrients from sewage and runoff, and continued burial of reefs to create new islands to keep up with demand. This can become a vicious cycle.

However, when this is done in a sustainable manner, tourism can benefit the reefs. Each resort in the Maldives is surrounded by a “house” reef—which becomes a de facto marine protected area, as it is off-limits to fishing. Through corporate social responsibility (CSR) initiatives, a resort 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.

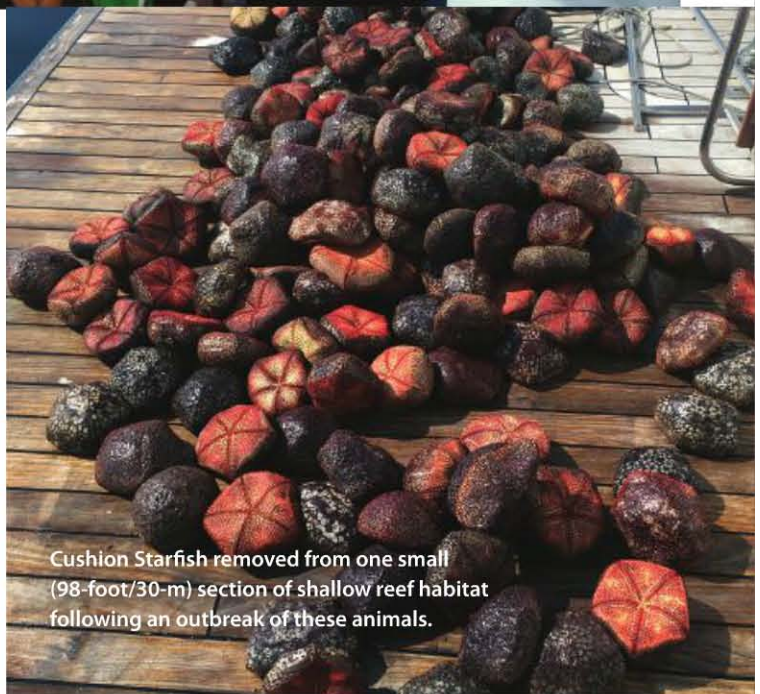
At Coral Reef CPR, we partner with resorts to implement CSR initiatives—conducting coral reef research, monitoring, reef cleanups, coral gardening, and reef restoration. We provide training and educational seminars on coral reef conservation strategies and involve guests, resort staff, and local high school students in all of our in-water conservation activities. To date, with the help of volunteers, we have removed over 15,000 Crown-of-Thorns Starfish (*Acanthaster* spp.) from affected reefs, saving an estimated 1,779 acres (720 ha) of reef over the lifespan of these starfish. Most recently, we removed over 2,500 Cushion Starfish (*Culcita schmideliana*) from a single reef system. These starfish are normally rare (fewer than one sea star per 5,382 square feet [500 m²]). At the abundances we witnessed, they were preventing recovery of this reef system from the losses sustained during the 2016 coral bleaching event. The starfish were rapidly consuming all of the newly settled and juvenile cauliflower corals (*Pocillopora* spp.) and staghorn, digitate, and table corals (*Acropora* spp.).

CORAL RESTOCKING

Our greatest effort to date has involved the creation of large coral nurseries. Using small coral fragments and recruits rescued from sand and rubble habitats, sand extraction sites, construction areas, colonies infested with coral-eating snails (*Drupella*), and corals affected by disease, we are growing large, bushy colonies that can be transplanted onto degraded reefs. If the reefs are hit by another El Niño event, our corals are more likely to tolerate high seawater temperatures because the fragments we use come from colonies that survived the high water temperatures seen on these reefs in 2016.

To maximize survival and growth rates, all of our coral fragments are grown on ropes suspended above the bottom. This avoids possible predation by *Acanthaster*, *Culcita*, or *Drupella*, prevents potential burial by sand, and minimizes competition with algae, while also exposing the corals to greater water flow. Over the last year, we have established nurseries on three atolls in the Maldives and have more than 10,000 corals in culture. In early

In a high school workshop, Andy Bruckner explains the impacts of Crown-of-Thorns Starfish.



Cushion Starfish removed from one small (98-foot/30-m) section of shallow reef habitat following an outbreak of these animals.

2018, we plan to begin transplanting the largest of these corals onto the reefs.

Our nurseries are the first step toward the recovery of Maldivian reefs from the devastating 2016 coral bleaching event. But we are only just beginning. We hope to expand these nurseries throughout the country and into other tropical areas that require similar help. To achieve this, resorts with corporate responsibility to protect the environment need to invest more in reef conservation, even if this doesn’t translate into direct financial gain.

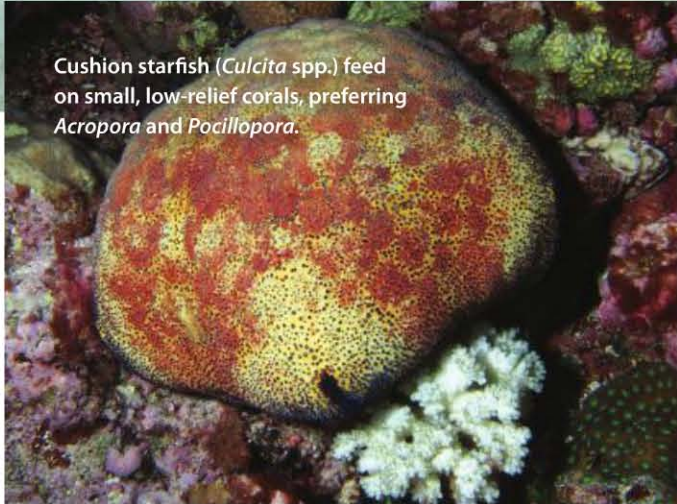
FRAME CULTURE FOLLIES

Coral gardening is simple and relatively inexpensive, but too many resorts continue to support traditional “Adopt

Jetty construction on a fringing reef. Tourism brings dollars but also new threats to the reefs.



Cushion starfish (*Culcita* spp.) feed on small, low-relief corals, preferring *Acropora* and *Pocillopora*.



a Coral Frame” programs. 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. Although they 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 are also attaching entire colonies to the frames in a weak attempt to show guests that the coral frame they sponsored is growing quickly. Detaching entire healthy colonies from reefs for use on these frames is often advised at the highest management level.

Given the large losses of corals these reefs sustained last year, it is entirely inappropriate to remove whole col-

Rope culture of *Acropora* spp. corals by Coral Reef CPR. Fragments 2–5 cm long were attached to the ropes 9 months earlier and have increased 30–50X.



onies from the reef, especially because it will limit their lifespan. With a bit of effort, one can find hundreds of fragments that have broken off larger colonies naturally (or have been broken by divers and snorkelers standing on the reef) and are lying in the sand. These can be further subdivided into small (0.8–2 inch/2–5 cm) fragments that are attached to ropes and will grow into a large colony within a year.

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. 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. §

Andrew Bruckner, Ph.D., is a former coral ecologist for NOAA, former chief scientist for the six-year *Global Reef Expedition*, and currently director of the non-profit *Coral Reef CPR*, based in Sandy Spring, Maryland. **Georgia Coward** is a British fisheries biologist and program manager of *Coral Reef CPR* in the Maldives.

RESOURCES

- International Year of the Reef (IYOR)
<https://www.icriforum.org/about-icri/iyor>
- Coral Reef CPR
<http://www.coralreefcpr.org/>

A series of natural islands at the edge of Baa Atoll. The islands in the foreground are uninhabited. Out of 1,190 islands in the Maldives, roughly 70 percent have not yet been developed.

