



# CAN-112-Sponges Choking Reefs-Caribbean

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## Sponges and Algae Are Choking the Caribbean's Coral Reefs



According to at least one leading expert. Some scientists aren't convinced the sponge apocalypse is at hand.

A barrel sponge grows on a coral reef off Belize. Human impacts on the Caribbean may be favoring the growth of sponges over corals.

PHOTOGRAPH BY BRIAN SKERRY, NATIONAL GEOGRAPHIC CREATIVE

By Erik Vance

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COZUMEL ISLAND, MEXICO

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Descending into the clear blue water of the Colombia Reef, off Cozumel in Mexico, there are two ways to look at what greets you. One is as a fantastic, calming world of peace and harmony, so different from our hectic lives on shore. The soft corals sway in the current, colorful fish swim lazily by, and turtles float happily above. But this is a mirage. The reality is more like a war zone. It's every critter for itself: The angelfish eat the corals, some of which strike back with tiny harpoons; the barracudas eat the angelfish, which hide behind sponges. And the sponges, says [Joseph Pawlik](#), are secretly plotting to take over the whole reef.

Pawlik, an ecologist and leading sponge expert at the University of North Carolina in Wilmington, has surveyed Caribbean reefs for decades. The recent evidence, he says, suggests [the battle of the reefs has become somewhat lopsided](#). The sponges have banded together with another major player, the algae, to push out the corals and achieve reef domination—thereby adding another grave threat to one of the world's most important ecosystems.

"They are taking the space," Pawlik says. "That's the most important commodity. Once they have the real estate it's not going to go backwards."

But reef science, like the reefs themselves, is a bit of a war zone these days. Everyone agrees that Caribbean reefs, [like reefs all over the warming and acidifying ocean](#), are in trouble. Other experts say, however, that Pawlik's vision of a Caribbean sponge apocalypse is itself a mirage.

## CORAL REEFS 101

### THE IMPORTANCE OF PREDATORS

On a normal, healthy Caribbean coral reef, anywhere from 30 to 100 percent of the surface should be covered by coral. Seaweed and other algae should be a fraction of that, and sponges should be lucky to achieve 10 percent coverage.

The algae and sponges would happily expand, of course—but they're constantly trimmed back by sea urchins and sea turtles, respectively, and limited by a lack of resources. Turtles are so voracious that [many sponges have developed complex chemical defenses](#) against them; sponges that aren't so equipped must hide between stinging corals for protection.

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For millennia this was the way of life on reefs from Florida to Ecuador. But [humans eventually changed this](#)—first, as early as the 17<sup>th</sup> century, by capturing and eating lots of sea turtles. Then in the 1980s, a devastating episode of [coral bleaching](#) began, and sea urchins also died by the ton. Most scientists today attribute both calamities to infectious microbes brought from other parts of the world by cargo ships and discharged in their ballast water.

In any case, the loss of urchins made things worse for the corals. "Suddenly you lose the primary herbivore in the system that was basically scouring the reef of seaweeds," says Pawlik. "Then you free up all the real estate when the corals die – you've got the worst possible situation." In just a few years, the algae went from a minor player to a dominant one on many reefs.

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With overfishing driving sea turtle populations to all-time lows, sponges too were released from their predators. It was then, Pawlik says, that they and the algae struck up a bargain.

## A WINNING TEAM

Algae bathed in sunlight can produce more sugar than they need; often it just bleeds into the water. Sponges, meanwhile, crave sugar and excrete plenty of the nitrogen and other nutrients that algae need. Together, Pawlik says, they become an unstoppable force.

At some of his Caribbean study sites, Pawlik has watched sponges climb to 15 or 20 percent of the reef cover. That may not sound impressive until you remember that, unlike corals, which live in a thin layer on the surface of the reef, sponges are massive. In terms of biomass, Pawlik says, it's likely that sponges have become the dominant animal on Caribbean reefs. They're not coral reefs anymore; they're algae-sponge reefs.

"Once the real estate was freed up and their predators were gone, they came out like gangbusters. And then they worked up this association with all the seaweeds..." Pawlik says. "This is the rise of the sponges."

Sponges aren't all bad; they play a crucial role in filtering water and concentrating nutrients for all kinds of animals. But they don't build the stony reef. In fact, some of them actively pull it apart.

"While corals build the reef, sponges do, in part, break down reefs. And having a balance between those two is important," says [Jasper de Goeij](#), an ecologist at the University of Amsterdam who first described the algae/sponge relationship. In Pawlik's view, this loss of balance in the Caribbean could be devastating for its future.

## CORALS AND VILLAINS?

De Goeij, for his part, isn't convinced that sponges are taking over Caribbean reefs yet, saying many more surveys need to be done. Other experts flatly deny Pawlik's claims and worry about casting sponges as villains.

[Janie Wulff](#), a sponge specialist at Florida State University who has studied Caribbean reefs since the 1970s, sees no increase in sponges and says that sponges actually benefit corals. She blames the increase of algae on human pollution. We should focus on that, she says, before blaming sponges for the condition of Caribbean corals.

"There are still no data showing that sponges are actually surging in abundance," Wulff writes in an email. "What about a much simpler explanation of sponges overgrowing corals and reefs: humans are dumping ever greater amounts of nutrients into coastal waters." Pawlik counters that many remote reefs off Curaçao or Saint Lucia have gone spongey even though they're not polluted.

Wulff insists that sponges are just as threatened as corals; Pawlik says they're flourishing in a human-dominated world. How can such a basic question be in dispute? One reason is sponges haven't been studied nearly as much as corals. Many of their basic functions are still mysterious.

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## BEAUTY ABIDES

Floating above the Colombia Reef, the views are breathtaking, with bright oranges and yellows and purples everywhere. Most of those colors, though, come not from corals but from sponges living on dead coral. It's hard not to perceive a competitive dynamic.

There are the obvious barrel sponges, which stick out like cannons from some kind of ancient ship. There are smaller, spindly sponges, misshapen globular ones, and encrusted sponges that look like someone poured brightly colored caramel all over the reef—and that even experienced divers sometimes mistake for corals. There are even sponges living on other sponges. Once you start looking for them, and know what to look for, sponges become all you can see.

De Goeij says that what you see on a reef like this may actually underestimate the sponges' success. Many sponges are hidden from view under overhangs—or even burrowing into the reef itself. De Goeij has seen dead reefs crack like an egg, hollowed out by encrusting sponges.

“They bore themselves into the coral,” he says. “Sometimes you see a large piece of coral, and if you smash it the whole inside of the coral is covered by excavating sponges.”

Diving in Cozumel is not all bad news, however. Sea turtles, it seems, are everywhere these days. Hawksbill turtles are protected now, and as their numbers have risen, they've found rich feeding grounds—an upside to the rise of the sponges.

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