



## **Reefs Need Parrotfish!**

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A seaweed-seeking parrotfish is grinding into a coral with its fused, beak-like teeth. Each time it hits the coral, I can hear it from ten feet (3 m) away. Any coral a parrotfish ingests returns as fine sand. Enough parrotfish, over centuries, largely built the tropics' coral-sand beaches. Yes, those lovely beaches: parrotfish poop.

Now, people using fish traps, spear-guns, nets, and hooks have drastically changed fish populations. In many places they've pretty much fished-out groupers and snappers. And in many others, they've also been catching too many parrotfishes.

But parrotfish turn out to be really important for reefs. Parrotfishes' fused teeth made them uniquely capable of grazing by scraping. There are now dozens of kinds of parrotfishes living around coral reefs worldwide.

But, "There was absolutely nothing like them 'til the Eocene, which started about 55 million years ago," says Bob Steneck of the University of Maine. There still isn't anything else like parrotfishes. Surgeonfish graze algae, too, but they nip it; parrotfish really scrape it away.

Fossilized reefs show that before parrotfish, reefs were mound-like and seaweed-dominated. When parrotfish evolved in the Eocene, modern reefs appeared. Parrotfishes have been scraping reefs virtually seaweed-free ever since.

And here's the thing: without parrotfish, seaweed would smother corals. The world's reefs would likely become mound-like and seaweed-dominated for the first time in 55 million years. Corals probably don't care whether seaweed gets removed by fish, urchins, or a guy with a brush. What matters is, the reef must be frequently scrubbed, or algae will grow into bushy, coral-killing seaweeds. And on most of the world's reefs what scrubs them most and scrubs them best is: parrotfish.

Fast-forward to now. On many reefs, people have caught too many fish. Many reefs no longer have enough grazing fishes to suppress the seaweed that is always trying to grow. And especially when corals die from coral bleaching or other causes, without enough grazing fish, seaweed sprouts on all that dead coral. "And the reefs just flip," says professor Steneck. What had been high-rise coral reefs become seaweed rubble mounds.

So let's review: Where fishermen catch too many seaweed-eating parrotfish, seaweed blooms. Where seaweed blooms, it kills coral. Expanding seaweed creates a death spiral that Bob Steneck calls "the Coral Garden of Evil." Keeping the seaweed in check creates a positive life spiral for a reef, the Garden of Good.

In the 1970s, live coral covered more than half the surface of most Caribbean reefs. By the early 2000s, live coral cover had plunged to 10 percent on most Caribbean reefs. Those reefs had plenty of other problems. But with enough parrotfish, young corals would still have had weed-free space for potential recovery. And other surviving corals would not have been killed by seaweed overgrowth. How can we be so sure? Because of two things. The best surviving reefs in the Caribbean surround the island of Bonaire—where spear-guns are banned, parrotfish remain pretty abundant, and, consequently, there's very little seaweed compared to neighboring islands and the rest of the region. And, because of what happened in the west-Pacific island nation of Palau.

In the late 1990s, unnaturally hot water caused coral "bleaching" that killed most of the corals on Palau's reefs. But instead of getting smothered with seaweed, those reefs rebounded. One big reason: Palau doesn't allow export of many of its reef fishes—including parrotfishes.

So many fish are doing so much grazing that they continually scour every surface. Palau's coral gardens are harsh, harsh places for seaweed. Most "seaweed" never gets tall enough even to be called fuzz; it doesn't last as long as a daisy in a herd of goats. Bob Steneck, and Peter Mumby of the University of Exeter in England, have analyzed video showing that Palau's grazing fishes—surgeonfishes, rabbitfishes, and especially parrotfishes—deliver up to 100 bites *per square meter* of seafloor, *per hour*.

Those fish are why seaweed didn't just grow like wildfire and take over Palau's reefs when almost all the coral bleached and died. The fish are why baby corals regained their foothold and have flourished. Because Palau decided not to let their fish get exported—and because their own human population is small compared to their vast reefs—they now have the fish, boatloads of paying tourists, and the highest coral-recovery rate ever recorded.

So far, Palau has defended itself against export markets for its fish. Instead it draws a different distant market here: the tourism that lets Palau keep the goose and the golden eggs. Let's hope Palau has the wisdom to keep things that way.

Once upon a time, a magic tree grew in the yard of an old Palauan woman. This tree had a big hollow branch, and through that branch came a continual stream of water and fish. The generous woman let anyone come, and a constant procession of people held their baskets under the tree, filling them with fish for their villages. But some envied the woman and coveted the tree. One night, they came with their adzes and chopped the tree down and took it to their own village. It never produced another fish. Turns out, that hollow branch had an underground connection to the sea. So, don't mess with what works. Don't ruin a good thing. If you take all, you get nothing. Greed of a few—starves everyone.

How many parrotfish does a reef need? More than most reefs now have. Reefs need enough fish to work overtime to suppress algae after something goes wrong for

