

Letter from  
RAJA AMPAT

## Seas of Change

GREG WRENN

RAJA AMPAT IS A REMOTE Indonesian archipelago of more than 600 islands scattered over an area roughly the size of Switzerland. Most of its islands are a steamy wilderness of rainforests and worn limestone peaks, but some are dry, flat, and ringed with pristine sandy beaches. Rare birds of paradise call out in the morning, and the bays shimmer with phosphorescent plankton at night. The archipelago's 50,000 inhabitants, living in widely dispersed villages, depend for their survival on fishing, pearl farming, and increasingly tourism.

Each year, for weeks at a time, I live here, documenting reefs that have remained astoundingly healthy, even as the earth warms and coral elsewhere bleaches and dies. In my native Florida, the reefs have mostly crumbled, the coral cover down to less than 10 percent of what it was. Scientists there have recently discovered that seawater, increasingly acidic from dissolved CO<sub>2</sub>, is slowly eating away at what little coral remains some 40 years earlier than expected. Between 2014 and 2016, on Australia's Great Barrier Reef, 1,500 miles southeast of Raja Ampat, more than 90 percent of the coral has bleached, and in the northern section, more than two-thirds of it is now dead. The process is simple to replicate: put an eggshell in vinegar and watch it disintegrate. And the future promises more of the same. As famed scientist and coral expert Charlie Veron has said, "There is no hope of reefs surviving to

even midcentury in any form that we now recognize. ... This is the path of a mass extinction event, when most life, especially tropical marine life, goes extinct."

Yet, for now, a single reef in Raja Ampat has



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more species of fish and coral than the entire Caribbean. Despite warming water temperatures, it has displayed such hardiness that Mark Erdmann, a scientist with Conservation International, suggested to me that “in 40 or 50 years, maybe in the next 10 or 20, you are going to see people actually harvesting corals from Raja Ampat to reseed other places on the planet that have already succumbed to bleaching.” The archipelago lies at the center of the Coral Triangle, an area encompassing Indonesia, the Philippines, and Papua New Guinea that is so ecologically important that it

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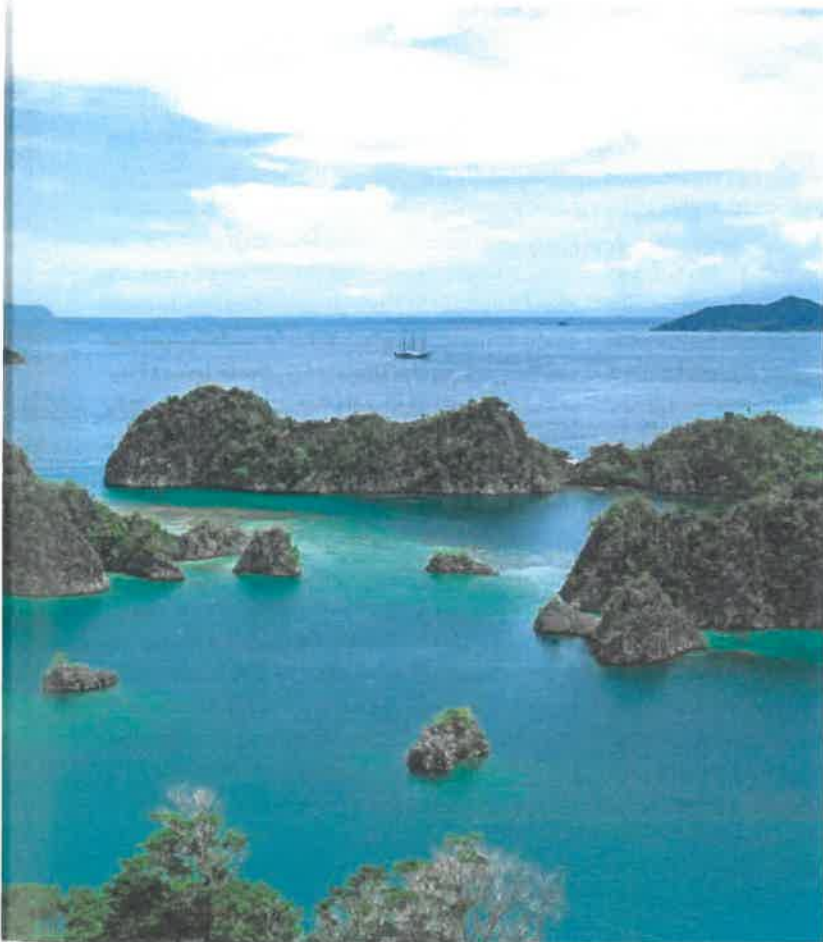
has come to be known as the “Amazon of the Seas.” Black mantas, Raja Ampat walking sharks, and Wayag shrimp gobies are found nowhere else but in these islands. Living here, too, is an astounding 75 percent of all known hard coral

species, in addition to 57 different species of mantis shrimp, some of which, other divers have warned me, easily shatter camera lenses and scuba masks with their clubs.

No wonder international scientists have raced to protect these reefs. In collaboration with village chiefs and provincial and national governments, they have helped institute

no-take zones in marine protected areas (MPAs). The ban on large-scale commercial fishing is enforced by armed patrol boats that shoot violators on sight, sinking their vessels, as well as by local villagers, who, with advice from scientists like Erdmann, keep watch over adjacent waters and confront poachers whenever possible. For centuries, Erdmann told me, the people of Raja Ampat exercised marine tenure—they saw themselves as not only the owners of the reefs but also their protectors. Then came the

*Decades from now, one scientist speculates, Raja Ampat’s reefs might be used to reseed others that have succumbed to coral bleaching.*



annexation of Papua by the Indonesian government in 1963. Fishermen from Indonesian islands farther afield, such as octopus-shaped Sulawesi, began raiding the reefs more frequently. “They’d go for two-month expeditions and just rape the place of sharks” for the shark fin trade, Erdmann said. When he and his colleagues first came to Raja Ampat in 2002, they found villagers eager to reclaim their tenurial rights. Erdmann and other scientists helped organize MPAs, training local young people to serve as park administrators. Similar MPAs in other parts of Indonesia, such as Bunaken National Park off Sulawesi, hired managers from Jakarta with master’s degrees in marine biology, leaving locals without much influence. “We have felt pretty strongly that doesn’t lead to a lasting solution,” Erdmann told me. “Those people are typically outsiders. They are not necessarily well respected or embraced by local communities, and every chance they get, they’re going to go back to their wife and family ... in Jakarta.”

Raja Ampat’s 4,500 square miles of locally administered MPAs have succeeded beyond anyone’s expectations. Over the past decade, the reef environment, especially within protected areas, has rebounded, with fish up to 10 times more plentiful than before. “In 2001, 2002,” Erdmann said, “when we first started doing surveys, you almost didn’t ever see a shark.” Now blacktip sharks are abundant, as are manta rays—species worth far more to villagers alive, due to tourism, than dead and sold to China for wedding soup or dubious miracle cures for erectile dysfunction.

Still, the larger changes taking place elsewhere in the world have not passed by this archipelago completely. Nowhere is that more evident than below the surface, where for the past several years, I have been checking up on the health of the coral reefs. According to field observations by Conservation International, Raja Ampat has so far escaped widespread bleaching. But what

I found on two staggered visits to a particular reef makes clear that, even in this remote and relatively healthy slice of ocean, no part of the marine world is unaffected by human activity.

### December 2015

Hours before the winter solstice, while snorkeling on a reef off Gam Island, between Yenbeser and Batu Lima, I have an especially vivid encounter with a shark. El Niño, it seems, has heated the first foot of water so much that it’s downright hot, even through my wetsuit. I snorkel past the rubble and grasses in the shallows, over the healthiest coral imaginable, to a drop-off, stopping at a huge coral mound, which looks like tiny pieces of butcher paper carefully crumpled into blossoms and pillars, packed together into a dense heap.

There, sleeping in a hollow, is a young tasseled wobbegong shark: brownish, well camouflaged, usually nocturnal. It’s a flat cartilaginous fish that pumps water over its gills with its

*Raja Ampat has so far escaped widespread bleaching, but even here the ill effects of human activity are being felt.*

cheeks instead of having to swim endlessly until death. Whiskers like cedar tree branchlets line the whole front edge of the head. These dermal lobes, as they are called, are not sensitive like those of a catfish. Rather, they are meant to attract prey. As the shark matures, it will grow more and more of them, fake worms that draw in hungry fish.

The wobbie’s corkscrew tail features false eyes that also serve as lures. I watch as the shark waves it, mimicking a distressed fish, and causing a huge cloud of bluestreak fusiliers to come in for a closer look. The fusiliers, along with butterflyfish and damsels, partially block my view when, suddenly with a loud pop, the shark lunges and snaps its jaws. For a moment, I see the pasty tan insides of the mouth, the rows of sharp teeth, but the attack happens so fast that I can’t tell if the wobbie has gotten a fish.

The duplicitous tail is the most beautiful part of this wobbegong—its name believed to have



*The pink, avocado, and tan branches of staghorn coral. Here they are nothing special, but in our warming century, "seeing them feels like a miracle."*

interstellar dust, lit by brown dwarves, turns the sky a resplendent beige. It is a page from an atlas, alive, furling, sweet in the mouth, bitter in the belly. I am drunk on its beauty.

Around the shark crowd the branches of staghorn coral. Thick as walking sticks, they have the long, lightly curved points of a deer antler. The pink, avocado, and tan branches are as common as ferns in a lush redwood forest. In our rapidly warming century, seeing them feels like a miracle, but in Raja Ampat they are nothing special. Neither is it unusual from the perspective of geological time. For thousands of years, abundant, healthy staghorn was a given, seeming to go on forever along fringe reefs that swarmed with sharks and sea cows, turtles and barracuda.

I clear my ears and dive down to look more closely: the coral is pitted, looking at once slimy and furry, as if coated in thin, wet antler velvet. In each little indentation lives a polyp, a millimeter-long anemone taking calcium carbonate from seawater and turning it into a limestone home.

derived from an Australian Aboriginal word meaning "shaggy beard" or "living rock." Its skin is like a star chart from another galaxy, where

Especially at night, when its six or 12 tentacles reach out to grab zooplankton and stuff them into its mouth, the coral is a living rock. This animal, though, gets most of its calories from plants within it, helpful algae called zooxanthellae. Their chlorophyll, using light from the sun and carbon dioxide, makes sugars for the polyps, explaining why the coral's mucousy branches reach upward to catch as much light as possible. Imagine eating one potato a day and getting the rest of your energy from sunlight: an easy, low-cost life of sunbathing and abundant vitamin D.

Sheltered in the staghorn are fish like moon and bird wrasses, damsels, and sergeants. A cloud of blue-green and yellow chromis above one coral colony whooshes down between the branches for protection from predators like grouper, moray eels, and scorpionfish. On one branch is an orange worm inching along. Many different species of shrimp and crabs are here, though they are more often seen at night. A pale blue starfish with a missing arm hugs a branch. *Crunch crunch* fills my ears—I turn to see thousands of pink, green, and black parrotfish rushing past, stopping now and then to nibble on coral.

Remember this stream of fish, I tell myself, etch the coral and the shark into your mind's eye, hold these memories close like the philosopher's



stone for when you are an old man and the ocean is not the same. Share them with anyone who will listen and believe. This December afternoon in Raja Ampat changes me in ways that will take time to understand—beauty, if it deserves the name, does that.

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**December 2016**

A year later, I take a longboat back to the same reef. The shark is gone, as are most of the fusiliers. A few small parrotfish wing past me, along with some surgeonfish and foxface rabbitfish. The coral mound has begun to bleach, the butcher paper white and torn. And the swaths of staghorn coral? Some colonies are now as white as skeletons, while many others look charred black or furry green—the coral underneath, smothered by algae, is dead. Some branches remain alive, but from the base of each one, slime is working its way up. Like an ogre's terrible snot, algae fill the spaces between the branches. As a result, there are fewer chromis and damselfish, because they have fewer places to hide. I kick as fast as I can to get a more comprehensive look at the reef. In many places, algae the color of AstroTurf has replaced coral. Huge table corals, many of them toppled, exhibit ominous sections of green, black, and white, instead

of the usual camel- or chestnut-brown. They, too, are dying—corals that took decades or centuries to form.

*"A hawksbill turtle glides above rubble that used to be living reef. The moment is beautiful and ugly. It fills me with wonder and dread."*

In just this short amount of time, the reef has become unrecognizable—an ecosystem seemingly in the process of unraveling. Erdmann had reassured me that, in his experience, Raja Ampat's reefs, when they do bleach, quickly bounce back and that certain coral species here can temporarily withstand temperatures of up to an astounding 99 degrees Fahrenheit. But for how long? Had the sustained high temperatures of El Niño been too much even for Raja Ampat's hardy coral? Most reefs elsewhere in the world were bleaching or dying. Why should this one be any different? As I soar over the reef, confronting its distress, I wonder if Erdmann's vision of Raja Ampat resurrecting other dead reefs is merely wishful thinking. How can a reef in the year 2060 be reseeded if the water is simply too hot and acidic?

I think back to a photograph two Australian tourists had shared with me. It showed a villager holding up an enormous, bright-red fish by its lower jaw: a mature twinspot snapper. The fish, which feeds primarily on smaller reef fish, was

nearly half as tall as the Papuan man displaying it. Why were foreign tourists being served one of this reef's largest remaining predators? After all, overfishing, still a problem in parts of Raja Ampat, tends to cause harmful algae blooms. Coral and microalgae live in a delicate balance: the algae are always growing, but grazers such as parrotfish, rabbitfish, and surgeonfish keep it in check. The overfishing of apex predators, like snapper, ripples down the food chain with disastrous effects, contributing to the decline of coral and the rise of algae and coral diseases.

Still, even if eating snapper in Raja Ampat is not unlike dining on grilled cheetah while on safari in the Serengeti, these are the villager's ancestral waters, not mine, and he was trying to do right by these rich, white Australian tourists, his honored guests. The money they spend might enable him to send his children to school or pay his family's medical bills, allowing him some tenuous sense of economic security in a country with virtually no social safety net. But in the coming decades, whether the man believes it or not, rising sea levels will flood his coastal village. Where will he and his family go then? What leaders are imagining the inundated future of his reef-bound culture and making relocation plans?

Raja Ampat's local population has grown by a third over the past decade, and each year about 15,000 tourists come to visit, up from just a few in the early 1990s, when the first dive resort opened. A paved highway around the main island of Waigeo is planned, as is an international airport. Tourists will expect to eat fresh fish—and indeed, most days I've been here, my hosts have offered it to me, sometimes open-water fish like tuna or mackerel, sometimes reef fish. And I've eaten it every time. How many hundreds of thousands of fish is that each year, not to mention the thousands of fish caught illegally and sold on the mainland? As fisheries around the world collapse, will the Raja Ampat's MPAs become a target for increasingly sophisticated poachers?

What has happened to most other reefs, I fear, is slowly happening here because of population

growth and climate change. Even if we stopped emitting carbon today, we have by now committed ourselves to centuries of warming, rising, and acidifying seas. The reefs here may be among the last to go, but they will go, their departure perhaps hastened by runoff produced by the palm oil and logging companies that are eyeing Raja Ampat's virgin rainforests. Or maybe they'll be ushered along by the inevitable accidents that accompany the tourist trade: in March 2017, a luxury cruise ship ran aground of Kri Island, destroying three acres of reef. What legacy will I have left from all of my travels and genuine concern other than the release of more carbon into the atmosphere? That's three tons of CO<sub>2</sub>—96 square feet of melted Arctic ice—for every round-trip flight I take to visit the reef and document its decline.

#### May 2017

I return to Raja Ampat on a liveaboard boat with seven other tourists. The global mass-bleaching event has subsided, El Niño having given way to cooler Pacific temperatures. I befriend an elderly couple from Orange County, California, who are repeating the same itinerary they had followed a decade ago. They tell me they are skeptical of climate change. We snorkeled with a dozen manta rays, a mating pair of rare seahorses, and a banded sea snake in an epic battle with a spotted eel, but at most stops the couple is disappointed. "The colors aren't the same," the woman says. "So much dead reef. Too much plastic floating around." Off Yenbuba village, the water is thicker with fish than I've ever seen, but most of the coral is dead. Without it, the fish will die, too. Diving down to the bottom, I look up at the late-afternoon sun shining through the water as if it wants to be a beacon of hope. A hawksbill turtle glides above rubble that used to be living reef. The moment is beautiful and ugly. It fills me with wonder and dread. "There was a bad storm," our Indonesian guide says later. "And the ocean is changing—everything, everything is changing." ●