

California's Underwater Forests Are Being Eaten by the 'Cockroaches of the Ocean'

By [Kendra Pierre-Louis](#), Oct. 22, 2018

ALBION, Calif. — Early on a gray summer Saturday, an unusual assemblage — commercial fishermen, recreational boaters, neoprene-clad divers — gathered for a mission at Albion Cove, a three-hour drive north of San Francisco.

“Our target today is the purple urchin,” said Josh Russo, a recreational fishing advocate who organized the event. “The evil purple urchin.”



Josh Russo, left, organized a group of divers and boaters to remove purple urchins from Albion Cove. Credit Gabriella Angotti-Jones/The New York Times

Five years ago, assigning wickedness to the purple urchin, a shellfish the size of a plum with quarter-inch spikes, would have been absurd.

That was before the urchins mowed down Northern California's kelp forests.

The underwater forests — huge, sprawling tangles of brown seaweed — are in many ways just as important to the oceans as trees are to the land. Like trees, they absorb carbon emissions and they provide critical habitat and food for a wide range of species. But when climate change helped trigger a 60-fold explosion of purple urchins off Northern California's coast, the urchins went on a feeding frenzy and the kelp was devoured.

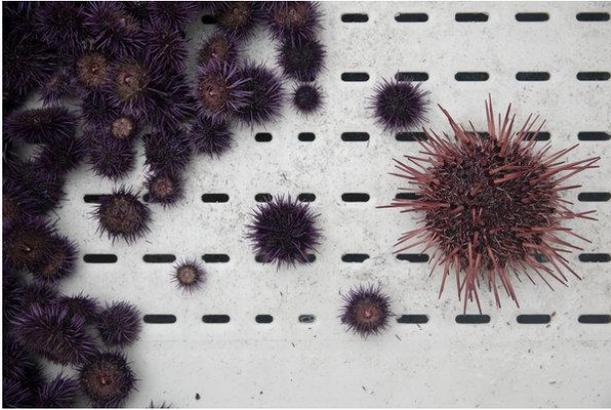
“It would be like one of those beautiful deciduous forests turned into a desert,” said Gretchen Hoffman, a professor of marine ecology at the University of California, Santa Barbara. “But in the matter of five years.”



Gary Trumper, a commercial urchin diver, on his boat Not Again. Credit Gabriella Angotti-Jones/The New York Times



Mr. Trumper's boat docked on a day when the waters were too choppy for diving. Credit Gabriella Angotti-Jones/The New York Times



A red urchin, right, was accidentally caught during the Albion Cove event. It sat in a basket with purple urchins. Credit Gabriella Angotti-Jones/The New York Times

The dangers extend far beyond this inlet: Kelp forests exist along the cooler coastlines of every continent but Antarctica. And they are under threat both from rising ocean temperatures and from what those warmer waters bring.

Already, Maine's forests of sugar kelp, a source of the sweetener mannitol, have experienced temperature-linked declines. And in Tasmania, kelp forests have succumbed to a purple urchin outbreak. Here in Albion, they're trying to avoid a similar fate.

Without kelp, livelihoods lost

The divers went to work, scraping purple urchins off the bottom of the cove, hoping it would allow the kelp, which has declined 93 percent in Northern California, to grow back.

Cynthia Catton, an environmental scientist with the California Department of Fish and Wildlife, and a small team of interns sat on a boat counting the urchins that divers hauled to the surface, to get a sense of how they were faring.

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Cynthia Catton, left, an environmental scientist, supervised a team of interns. Credit Gabriella Angotti-Jones/The New York Times

The story of the kelp's disappearance is the story of an interwoven food system breaking down, and in the process threatening people's livelihoods. Some of the first people to sound the alarm about the purple urchins, Dr. Catton said, were commercial red urchin harvesters.

One of them is Gary Trumper, who has harvested red urchins for more than 30 years. Red urchins, larger than purple urchins, are commercially viable because people eat them — or more specifically, their gonads. The delicacy is better known to sushi aficionados as uni.

But the increasing purple urchin population outcompeted the red urchins for the available kelp. Without kelp, the red urchins starved.

That cut the value of Northern California's commercial red urchin fishery from \$3.6 million in 2013 to less than \$600,000 in 2016. Many harvesters have moved on. "It's probably 10 or 15 guys left doing it in the harbor," Mr. Trumper said, sitting in a bar near the slip in Fort Bragg where he docks his boat. "But there used to be probably 100."

Those still working are taking bigger risks, going out farther to dive in deeper waters for their catch. In the old days, Mr. Trumper dove between 10 and 50 feet.

"Now we're going 70 to 110 feet," he said.

Diving that deep is more dangerous, said Mr. Trumper, who knows the risks of his profession. In 1987 he was part of an [urchin diving crew whose boat capsized](#); three people died. At deeper depths, Mr. Trumper and other urchin divers risk decompression sickness, which can be deadly.

The starfish and ‘The Blob’

The trouble began with the starfish. Sunflower starfish, whose appendages can span more than three feet, normally eat purple urchins, helping to limit their numbers.



A sunflower starfish near Monterey, Calif., a rare sight in 2017. Credit Patrick Webster

But in 2013, the starfish [mysteriously began dying](#). There isn't scientific consensus on why, but Drew Harvell, a professor of ecology and evolutionary biology at Cornell University, said she thought a virus was at least partly to blame and that warmer waters exacerbated its effects.

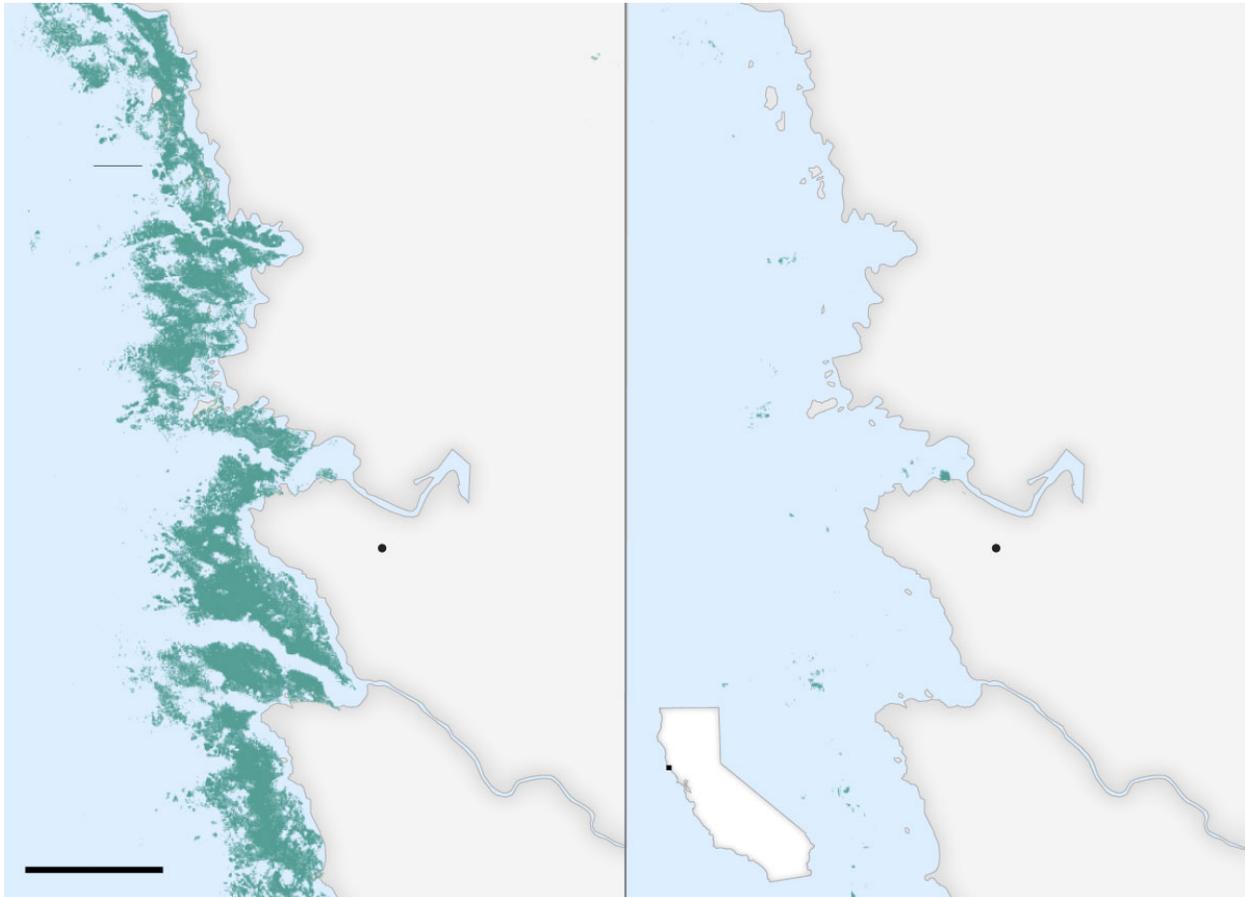
Sea otters, another predator of purple urchins, were hunted to near extinction in Northern California by 19th-century fur traders. Their numbers haven't rebounded.

Around the same time as the starfish began dying, a mass of warm water appeared hundreds of miles off Alaska, British Columbia, Washington and Oregon. By 2014 that warm water had moved toward land, stretching from Southeastern Alaska down to Mexico.

The marine heat wave was hotter than anything humans had recorded dating back to the late 1800s. Researchers and locals called it “The Blob.” It would last into 2016.

California's Vanishing Kelp Forests

The most recent aerial surveys of northern California's kelp forests show the extent of the kelp's decline, before and after a marine heat wave.



Source: California Department of Fish and Wildlife | By Nadja Popovich/The New York Times

“Human-caused global warming made it much more likely to get as extreme as it did,” said Nathan Mantua, a physical scientist at the National Oceanic and Atmospheric Administration and an author of a study linking The Blob to climate change. Over 90 percent of the heat trapped on Earth because of the greenhouse gases emitted by humans [has been absorbed by the ocean, increasing its temperature.](#)

But kelp prefers cooler waters. The bull kelp found off Northern California release spores in the fall; over the winter, the spores grow into tiny alfalfa-like plants that Dr. Hoffman said look a bit like the character Baby Groot from “Guardians of the Galaxy.”

“We don’t know very much about them because they’re very mysterious,” Dr. Hoffman said. “But we’ve done a little work

on them and they do not like high temperatures.”

The Blob also slowed the process of upwelling, in which cooler waters and nutrients move from deeper in the ocean up to the surface.

That choked off a critical supply of nourishment for the kelp. “It’s like having your garden run out of fertilizer,” Dr. Mantua said.

“A warmer ocean generally is not as productive,” said Sonke Mastrup, a program manager at the California Department of Fish and Wildlife. “It can’t hold as much oxygen.”

Under the combination of higher temperatures and less nutrients, the kelp began to die off.

Changing behaviors

In the absence of predators and with dwindling food supplies, the purple urchins have gone on a rampage, said Mark Carr, a population ecologist at the University of California, Santa Cruz.



Farther south on California's coast near Monterey, purple urchins are eating southern sea palm. The reef is abundantly covered with brittle stars, which would have been eaten by sunflower starfish. Credit Patrick Webster

“They just line up like a horde of crazy individuals and storm across the reef, literally removing all algae,” he said. (Kelp and other seaweeds are algae.)

This year, they have even eaten through hard, encrusted pink algae on the surfaces of rocks, which scientists didn't expect to see, said Laura Rogers-Bennett, a marine ecologist based at the Bodega Marine Laboratory.

“The impacts underwater this year have been more devastating than what we've seen in the past,” she said. “The perfect storm of events has been getting worse and worse over time, with 2018 being the worst we've seen.”

The purple urchins will likely stick around. “They're like cockroaches of the ocean,” Dr. Mastrup said. “They can endure starvation conditions much longer than most of the other critters.”

Even the remaining red urchins have begun adapting. While they are normally vegetarian, at deeper depths they are turning carnivorous and eating barnacles. “Which is like, one of the most bizarre story lines,” Dr. Catton said.

Traditions become memories

Other species have not fared as well.

This year, for the first time, California state fishery managers closed the region's recreational red abalone fisheries for the entire season. The abalone, edible sea snails that are a prized delicacy, also depend on kelp for food.

The state is likely to close the abalone fisheries for the next two seasons as well. A 2013 report found that more than 31,000 people visited the fisheries each year, contributing \$44 million to the sparsely populated communities nearby.

Those who have free-dived for abalone say they love the buttery taste, but that flavor alone isn't why they do it.

“It's about the experience of seeing everything that's out there,” said Brandi Easter, a recreational diver from Humboldt County, Calif. “The anemones, the algae, the fish, the starfish, on and on.”

Absent kelp to anchor the ecosystem, most of these things are also disappearing.

And without abalone, the restaurants, campgrounds, hotels and businesses that depend on those visitors are struggling.



Blake Tallman in his dive shop in Fort Bragg. “The abalone thing is so crazy,” he said. “So many people come, people from all over.” But this year, the fishery was closed. Credit Gabriella Angotti-Jones/The New York Times

“We’re way slower,” said Blake Tallman, who owns a dive shop in Fort Bragg. Mr. Tallman inherited the store from his father, whose picture hangs on the wall alongside abalone shells the size of basketballs.

Locals worry that rockfish — like sculpin, rock cod and red snapper — may be next. They spawn in the kelp forest. Worldwide, 100 species of rockfish rely on kelp, said Rebecca Johnson, who leads the California Academy of Sciences Citizen Science program.

Saving the kelp

In an attempt to bring back the kelp, Mr. Russo has raised more than \$120,000 from grants and individual divers to organize culling events like the one at Albion Cove.

The goal, said Dr. Catton, is to create kelp oases: places where kelp can safely rebound, free from purple urchins. The worry is that if too much time passes there won’t be any kelp to seed future generations.

“There’s a group of people who believe they can change the trajectory here of what is going on in nature,” Dr. Mastrup said. “I am hopeful but skeptical.”

There is at least one place in Northern California where visitors can still see what the bull kelp forests used to look like. The California Academy of Sciences in San Francisco has a 100,000-gallon saltwater tank, designed to mirror the Northern California coast, where you can see abalone, urchins both purple and red, sunflower starfish and bull kelp bobbing near the surface.

It is beautiful, but it feels like a time machine.

Kendra Pierre-Louis is a reporter on the climate team. Before joining The Times in 2017, she covered science and the environment for Popular Science. [@kendrawrites](https://twitter.com/kendrawrites)