

Volunteers and scientists are racing to save Northern California's disappearing undersea forest ecosystem.

# KELP'S HEROES

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PHOTOGRAPHS BY MARCO MAZZA

**T**HE MORNING OF SUNDAY, September 30th is clear along California's North Coast, the air balmy to the point of mugginess, the Pacific an unruffled sheet—perfect weather for a dive. In twos and threes, divers congregate by the boat launch at Ocean Cove, a rocky crescent moon of a beach with a blufftop campground along Highway 1 in Sonoma County north of Jenner. They've come from the outer fringes of the Bay Area, as far as Suisun City and Bethel Island. They wriggle into wetsuits and chat, shaking off sleepiness or, for some, hangovers from the previous night's revelry. Although a festive air permeates the group, they're not here just for fun. They're on a mission of destruction and salvation.


The all-volunteer crew, organized by the Watermen's Alliance, a union of California spearfishing clubs, has gathered at Ocean Cove to remove as many purple sea urchins as they can from this speck of the Pacific. Over the past six years, purple urchin populations up and down the coast have exploded and nearly razed the once-lush forests of bull kelp, eating the wavy fronds, gnawing the hardy stalks (aka "stipes") down to the holdfasts—the part of the kelp that anchors it to the rock—and then, finally, consuming the holdfasts, too. This has had disastrous consequences for the many forms of life that call the kelp forests home, depriving them of food, breeding grounds and shelter. In the face of this sweeping and relatively quick ecological change, scientists, fisheries managers, conservationists, and recreational and commercial divers are frantically hunting for a way to give the kelp a fighting chance at recovery.

The urchin-removal weekend at Ocean Cove is one such effort. Over two days, 75 divers will descend on the idyllic sheltered launch and haul up from the sea 2,050 gallons—approximately 7,000 pounds—of purple urchins. Behind the effort is Josh Russo, president of the Watermen's Alliance. A tall, genial man with salt-and-pepper hair and mirthful eyes, he wanders the shore, wel-

coming new arrivals and keeping tabs on volunteers. He watches as divers forage on the bottom, stuffing as many purple urchins into their dive bags as they can. He radios the kayakers who are ferrying the bulging dive bags to shore. He checks on Cynthia Catton and Laura Rogers-Bennett, two scientists from the California Department of Fish and Wildlife (CDFW), who are collecting data from each diver's haul. He coordinates the gaggle of volunteers who dump the urchins into 49-gallon trash cans and pulverize them with clam shovels, long-handled sledgehammers, and metal rods. The sound—like eggs being crushed whole—becomes the cove's white noise.

Russo has orchestrated similar urchin-removal days up and down the North Coast. In July the group was in Albion, in November they will be in Caspar. This is their second visit to Ocean Cove; they first held an urchin-removal day here in May. "You'll notice a lower density [compared to May] in the area we're working," Russo says. While that lower density of purple urchins is good for morale, it's too early to say whether it is due to the group's earlier efforts—or whether it will be enough to save this slice of ocean from full-blown ecosystem collapse.

**N**OT SO LONG AGO, giant forests thrived along the coast of Northern California. These were not redwood groves or oak woodlands but underwater forests of kelp, a greenish-brown marine alga. Fond of cold, nutrient-rich water, bull kelp, an annual species, grows from a reef or other rocky base close to shore, stretching upward toward the surface where sunlight penetrates the Pacific's depths and fuels the algae's growth.



THE LEAF-LIKE BLADES OF BULL KELP (*NEREOCYSTIS LUETKEANA*) ABSORB NUTRIENTS AND SUNLIGHT. AN AIR-FILLED BLADDER, CALLED A "FLOAT," HELPS HOLD THE ALGA UPRIGHT IN THE WATER.





Kelp forests are as intricate an ecosystem as woodlands on dry land. For instance, in a state of balance, a purple urchin would live on the rocks and holdfasts at the forest's floor, eating bits of kelp that detach and drift down to the bottom. Abalone larvae or some other nascent invertebrate might find shelter under the spines of urchins. The presence of predators such as sea otters (which once ranged up and down the California coast but are now found only between San Mateo and Santa Barbara counties), and sunflower sea stars (which recently died off in huge numbers)—would keep the urchins in check. The kelp forest is not only a source of food and hunting grounds, but also a form of shelter—a place to dodge a predator or take refuge from the turbulent waves of winter storms. If strong enough, these storms can uproot the kelp from its rocky home, but under healthy conditions the forest typically regrows quickly, as much as 10 inches per day.

The problem is, conditions have been far from healthy over the last six years. In place of lush forests, the oceanic equivalent of clear cuts now dominates the coastline. Red urchins and red abalone, two other significant populations that eat kelp, are starving at alarming rates, outnumbered by millions of purple urchins that fill the wastelands they created. The purple urchins have eaten the kelp. They've eaten the other marine algae. Now they've moved on to the

crustose coralline algae—the hard, pink, stone-like algae that coats the rocks. These purple urchins have been nicknamed “zombies” simply for doing what they evolved to do—persist in a half-life long after they've eaten all available food, not growing and maybe not even producing gonad material but also not starving or dying.

Trouble began for Northern California's kelp forests in late 2013 when the “warm blob,” a mass of above-average-temperature water fueled by our warming climate, settled in the Northeast Pacific. The blob hovered off the coast into 2016, making it “the first we've experienced at that intensity and duration,” Rogers-Bennett says. It fueled California's multiyear drought and deprived kelp of the icy upwelling and nutrients it needs, making the algae more susceptible to being nibbled down to the rocks.

Around the same time, the purple urchin population exploded along hundreds of miles of coastline. Purple urchins are native to California's ocean and are just one of many species that feed on kelp—but as their numbers grew and grew, they ate voraciously until, in short order, there was little kelp left. Rogers-Bennett estimates that Northern California's kelp forests are now more than 90 percent smaller than they were in 2014. “That's had huge consequences for the ecosystem,” she says.

Reef Check, a nonprofit that uses volunteers worldwide to perform underwater monitoring, has been collecting data in California's coastal waters since 2006. “[The North Coast] went from having hundreds of kelp plants on a 30-meter-long, 2-meter-wide band transect to zero,” says Dan Abbott, Reef Check's central coast regional manager. At the same time, the



LEFT: A RED ABALONE GRAZES NEXT TO RED AND PURPLE SEA URCHINS ON PINK CRUSTOSE CORALLINE ALGAE. TOP: KELP-DEPENDENT RED ABALONE ARE STARVING AS SEA URCHINS TAKE OVER. CENTER, BOTTOM: THE NATURAL ENEMIES OF URCHINS, SEA STARS, LIKE THE GIANT SPINED AND OCHRE SEA STARS SHOWN HERE, ARE MAKING A SLOW COMEBACK AFTER A MASSIVE DIE-OFF THAT BEGAN IN 2013.

group documented the switch from “just a couple” of purple sea urchins on a band transect to “hundreds or even thousands.”

The CDFW's widely accepted explanation of Northern California's purple urchin boom points to a 2013 die-off of sea stars from Alaska to Mexico. Sea stars—in particular the many-limbed sunflower stars—prey on urchins and other invertebrates. After the sea star population took a nosedive, urchins were left in many areas without a significant predator, giving them room to take over.

Abbott explains that sea stars were keeping urchins in check not by eating them but through a simpler tactic: fear. “One thing that studies have shown is that there's a big behavioral change in sea urchins,” Abbott says. “They will flee from sunflower stars and hide and move out of areas, move into deeper water.” He compares this to the dynamic between wolves and elk in Yellowstone National Park: After wolves were hunted out of the park, the elk had fewer natural predators and, therefore, less incentive to move around. They overgrazed willows, aspens and cottonwoods, with deleterious effects on the habitat and other creatures that relied on the trees. Once wolves were reintroduced, their very presence kept elk on the move, thereby reducing their impact on the ecosystem.

But not all scientists are confident that the widespread disappearance of sea stars—due to a wasting disease, likely fueled by increased ocean temperature—is driving the purple urchin boom. “We try and generate a narrative that links those things together, and I'm not convinced they actually are,” says Jim Watanabe, a biologist at Stanford University's Hopkins Marine Station in Monterey. Watanabe's skepticism comes from the fact that he saw urchin populations increasing on his survey plots at Hopkins before the sea star die-off in 2013. Based on their size, the urchins he documented were likely between two and four years old, meaning their boom would have begun several years before the sunflower stars began disappearing.

Regardless of why purple urchin populations have spiked so high in recent years, their effect on kelp forest ecosystems in the Pacific is clear: The red abalone population has dwindled so quickly that in 2018 the California Fish and Game Commission (CFGC) closed the recreational abalone diving season for the first time in history, then later extended the closure through April 2021. Commercial catch of red urchins, which are larger than the purples and whose gonads (called “uni”) are considered a delicacy, has dropped significantly every year during this crisis, with just over 4 million pounds harvested in 2017, compared to 13 million pounds in 2013. Water temperatures have returned to normal, but along most of the coastline, urchin barrens—stretches where purple urchins have eaten the kelp forest down to bare rock—have become an “alter-





native stable state,” as Rogers-Bennett puts it.

No one knows how long this alternative stable state will persist; on Watanabe’s plots, there’s no sign that urchins are becoming any less abundant. “Every year since 2015, we see good numbers of small (young) urchins, suggesting that recruitment (and survival) has continued,” he explains. But fear that a kelpless coast could become the new normal is pushing people to do anything and everything they can to reverse the conditions—hence why all eyes are trained on the urchins. “Urchins are not invasive—they’re a natural component of the kelp forest ecosystem,” Abbott says. “But in terms of mitigating their effect, it’s a little bit like an invasive species.”

**O**N SHORE, Ocean Cove is buzzing with energy. Dive bags stuffed full of purple urchins of all sizes have piled up near the dozen or so volunteers who take turns shaking the bags’ contents into the trash cans. The crushing is ceaseless. The air close to the group smells vaguely like the sea and old socks, and every now and then a jet of water arcs out of one of the smashed invertebrates. When the trash cans are just more than half full, volunteers muscle them into the flatbed of a truck that drives them up the boat launch and to the campground where they will be dumped and mixed with compost.

An effort like this is only possible because the CFGC adopted an emergency regulation in April 2018 to increase the number of purple urchins divers can take from the ocean in Sonoma and Mendocino Counties. Before the regulation, divers were limited to 35 urchins per day and purples were generally taken for research purposes; their gonads, are too small to be commercially appealing. Once the emergency regulation went into effect, divers were allowed to take 20 gallons per day, roughly 15 times more, though, as before, they must find some use for whatever they harvest.

On that September weekend, many divers managed to reach the 20-gallon limit, all through volunteer labor. But efforts are also underway to involve commercial urchin divers in restoring Northern California’s kelp forests—both to speed up the pace of removal and to help divers who have taken a hit economically as the red urchins have suffered. The Watermen’s Alliance raised more than \$130,000.00 last year to fund commercial diving and had nine boats in the water “any diveable day” between January and August, Russo says. For all his work around kelp restoration, Russo has been nominated for the Red Cross’s Hero of the Year award.

Cynthia Catton, the second CDFW environmental scientist present at Ocean Cove, also leads the Kelp Ecosystem and Landscape Partnership for Research on Resilience (KELPRR). The partnership brings together

scientists, regulatory agencies, commercial and recreational divers, and the general public to focus on restoring kelp forests and finding commercial markets for purple urchins. The coalition is exploring whether purple urchins can be gathered and raised to a larger size in tanks on land before their uni is harvested, as well as whether the calcium-rich shells can be used in commercial composting. “One of the ways that we feel like we can really effect change is if we create a new fishery,” says Sheila Semans, executive director of Fort Bragg’s Noyo Center for Marine Science, one of KELPRR’s partners.

Developing a market for purple urchins would help defray the costs of culling. Fundraising and volunteer enthusiasm has been impressive—the Watermen’s Alliance has planned more urchin eradication days in 2019—and Semans is also exploring grants and government funding. But neither passing the hat nor writing grants is as stable in the long run as true market demand for the spiny purple invertebrates, and everyone involved knows that it will take a hefty sum of money to make a dent in the urchin population.

**A**LL THE ENERGY at Ocean Cove almost masks the Sisyphean nature of the task at hand. This is one small cove along hundreds of miles of urchin-overrun coastline—and, if it isn’t routinely cleared, it will likely soon be overrun again. “I don’t think there’s really anybody who thinks that divers removing or smashing urchins is really a long-term solution to this problem,” Abbott says of this type of work. “The scale is just so, so vast.”

All involved—whether they’re crushing “the purps” or studying long-term solutions—would agree with this sentiment, yet it stops none of them from trying. Rather than attempt to right this ecological wrong along the entirety of Northern California’s coast, their goal is to create oases for kelp by ridding select coves of purple urchins in the hopes that when conditions are right for a natural recovery, kelp will have a head start and can spread out from these pockets.

And simply doing something, even though it may be a drop in the bucket, is its own form of healing. “I have people in my office regularly sitting here crying,” Semans says. “Salty old guys who would yell at probably any manager about fisheries regulations that are here saying, ‘I don’t know what to do.’” Divers, scientists and fisheries managers watched helpless and horrified as the crisis unfolded. Doing something to give the kelp forest ecosystem a fighting chance is a way of pushing back against that grief.

That comes through at Ocean Cove in September. From the crushers laughing and joking while pounding relentlessly at the harvested urchins, to the divers thanking Russo for the opportunity to pitch in, to the curious onlookers drifting down from the campground to see what would motivate such a large group of people to give up their weekend, the mood is productive and hopeful. Rogers-Bennet and Catton sit a bit apart from the rest of the group, weighing, counting and measuring the urchins as they come in. Catton pauses in this work to take in the scene. “It’s that sense of community and working together towards a solution that’s motivating,” she says, a smile on her face. “It’s inspiring.” **WH**