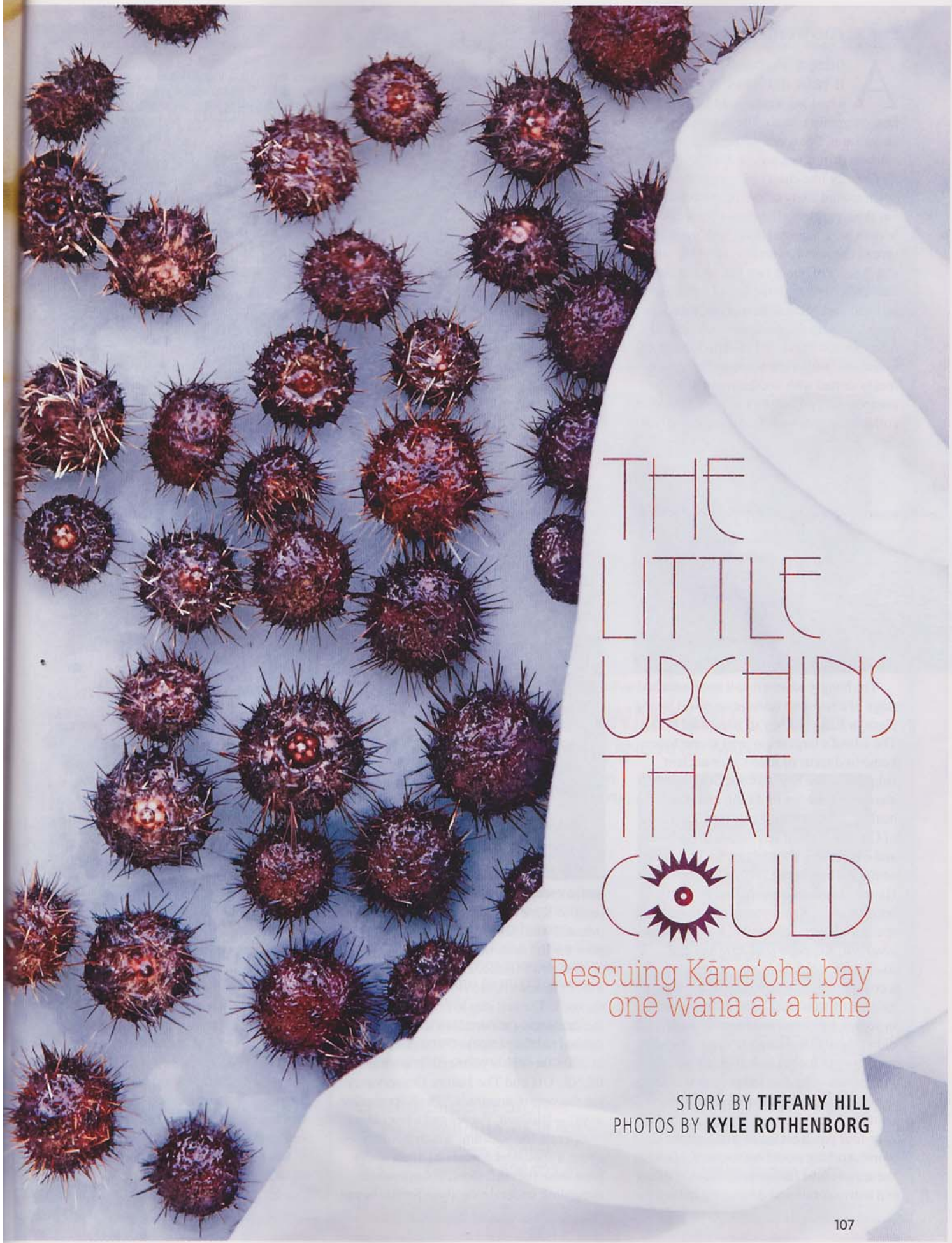

THE LITTLE URCHINS THAT COULD

Rescuing Kāne'ohe bay one wana at a time

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Andrew Purves is making it rain urchins. Outfitted in a hooded wetsuit and long-blade fins, he gently tilts a white plastic tray underwater. Spiny red urchins the size of marbles drift down onto Kāne'ohe bay's reef No. 29 like cherry blossoms floating down toward a city sidewalk. Purves scoops out the stragglers clinging to the tray's bottom with a gloved hand, making sure to spread the juvenile urchins onto the coral at a density of about two per square meter. Purves, a diver with the state Department of Land and Natural Resources, then swims back to the motorboat where reef restoration supervisor Jono Blodgett hands him another tray. It's not long before the reef is dotted with six thousand new pompon-shaped hāwa'e maoli, or Hawaiian collector sea urchins. Their mission: to eat.

The hungry hāwa'e maoli are the second stage of a two-part restoration effort taking place in Kāne'ohe bay in Windward O'ahu. The island's largest bay was at one time home to dozens of loko i'a, or ancient fishponds. The bay was one of the most abundant fisheries on O'ahu and boasted a healthy, vibrant reef ecosystem. Like most of O'ahu's reefs, it fell victim to pollution and overfishing throughout the twentieth century. Then in the 1970s a University of Hawai'i aquaculture experiment went horribly awry: Researchers introduced three species of alien seaweed—*Kappaphycus alvarezii*, *Kappaphycus striatum* and *Eucheuma denticulatum*—to develop a commercial industry for carrageenan, a gelatinous substance used as an emulsifier in yogurt, ice cream and more. The seaweed didn't grow fast enough to create a viable market—as it does in Indonesia and the Philippines—and so the project was abandoned. But it did grow fast enough to damage Kāne'ohe bay's fringing reef and fifty-four patch reefs. To make matters worse, nothing would eat the stuff, allowing the seaweeds to further proliferate, choking out native corals and destroying habitat for native species. Many of the once vibrant reefs of Kāne'ohe had become algae-infested wastelands; the prognosis was poor for the reefs that remained.

How to save the reefs of Kāne'ohe bay in two not-so-easy steps: First, vacuum invasive algae off the coral with a contraption dubbed the "Supersucker" (left). Then introduce thousands of young hāwa'e maoli, or native sea urchins (opening page) to stop the algae from growing back; here, reef restoration technician Andrew Purves does just that.

But now science, a little ingenuity and a lot of teamwork are slowly rehabilitating the reefs. The first step to ridding the bay of the smothering seaweed is a large vacuum dubbed the "Supersucker." It was developed in 2005 through a partnership among DLNR, UH and The Nature Conservancy, but the state maintains it. "The Supersucker guys"—Blodgett, Purves and a few others—operate the vacuum, which hoovers about a thousand pounds of algae every hour from the reef. Coral colonies once struggling under dense algae forests began to recover, developing a few spindly branches. In 2013 the Supersucker guys uprooted almost 95,000 pounds of algae. To date they've vacuumed five patch reefs and part of the fringing reef, totaling more than 125,000 square meters. The crew donates the algae to six Windward farms, where it's used as fertilizer. "It's great because something bad in the ocean is something good on land," says Blodgett, who grew up and still resides in Kailua. The work is "tedious," adds Purves, "but it's also rewarding to go underwater and see the difference we're making."

But this is only half the battle. Once sucked, the algae will grow back—unless something eats them first. That's where the

urchins come in. Hāwa'e maoli are ideal for the job: They're native to Hawai'i, they don't eat coral like other urchin species do, they stay put (unlike transplanted herbivorous fish) and they have few natural predators. Most important, they like to eat the invasive seaweed and can squeeze into coral crevices to get every bite.

Hāwa'e maoli, it soon became clear, were a natural part of the solution. The only problem? There were no hāwa'e maoli in Kāne'ohe bay.

Fifteen miles from the bay, David Cohen dashes around inside the Anuenue Fisheries Research Center on Sand Island. The center has become known for its urchin hatchery, which is housed in a greenhouse building. The wind bellows inside, quaking the white plastic corrugated walls and roof, but Cohen takes no notice. He's making his morning rounds, checking the urchin tanks, pausing to scrub a submerged PVC pipe. Many think of urchins, known locally as wana (pronounced "vana"), as spiny, dangerous creatures to avoid when snorkeling. But Cohen thinks of them as his "babies"; that's what he calls them. He propagates them from wriggling, microscopic larvae, feeds them, houses them and, once they're ready for release, carefully tucks them in damp, cut-up pillowcases to keep them wet for the ride out to Kāne'ohe.

This hatchery is an aquaculturist's magnum opus, and while Cohen's humble about it ("I couldn't have done it without

Aquaculturist David Cohen and technician Sean Louie inspect young hāwa'e maoli at the Anuenue Fisheries Research Center on Sand Island. Cohen and his team aim to breed 250,000 urchins a year by 2015. At that rate, Cohen estimates, within ten years there will enough urchins in the bay to prevent invasive algae from growing back—which might give native coral a chance to flourish.

all the people trying before me, learning from them and just the help from everyone around me," he says), he is nevertheless known around here as *the* urchin guy. Ironically, Cohen says he'd never grown an urchin before coming to Anuenue, but having been an aquaculturist for twenty-eight years, raising hāwa'e maoli wasn't out of his wheelhouse. The Brooklyn native had grown clams, oysters, shrimp and scallops commercially, and before becoming the urchin guy he was raising tropical fish on O'ahu for export to the Mainland.

By 2009 the group comprising DLNR, The Nature Conservancy and UH was serious about combating the alien algae. The Supersucker team was already hard at work. "The Supersucker-plus-urchins is

something we knew we could do now to stop these algae from spreading, to start saving these reefs in the bay," says Eric Conklin, the director of marine science at The Nature Conservancy. But how to get enough hāwa'e maoli into the bay before the algae regrew, wiping out the Super-sucker's gains? Before Cohen, researchers at UH had tried growing hāwa'e maoli in a laboratory, but it turns out that raising captive urchins requires a larger and more complex system than can be set up in a lab. It was up to Cohen to figure out exactly how to do it. There were already large-scale urchin hatcheries in Australia and Okinawa, and while Cohen got some assistance from the Aussies, in many ways he created a

method of his own, with a couple of false starts along the way. "He has an amazing capability to do this; he set it up right from the beginning," says Cynthia Hunter, director of the UH Marine Option program and one of the researchers who had tried and failed to raise the urchins on campus.

When Cohen started at the center in 2009, the dusty greenhouse floor was lined with eight empty tanks where catfish and moi, a local food fish, were once raised. This past year, Cohen added six new tanks, and the hatchery crew is making room for twenty more. All are or soon will be bustling with young urchins.

The four-person hāwa'e maoli team begins its work by spawning thirty adult urchins plucked from O'ahu's south shore. Twenty-four hours later the team will count the larvae in plastic beakers—no easy task when they look like a cloud of plankton. "You know in Kailua bay when there's a storm coming in and you can see the squalls?" Cohen asks. "They look like little squalls." The hatchery staff then transfers between eight hundred thousand and one million larvae into special tanks in a small, climate-controlled room inside the greenhouse hatchery. (Temperatures inside the building can reach 120 degrees.) Twenty-three days later the larvae are ready to move into the large tanks in the main hatchery area. At four months old, the hāwa'e maoli head for the bay.

Cohen describes his first months at the hatchery as a "weird, long year." The biggest challenges were perfecting both the larvae tanks and the process for growing phytoplankton, the young urchins' food. Yet by August 2010 he had his first success-

ful larval rearing, transferring the majority of the larvae into the larger settling tanks. In January 2011 divers released the first five thousand urchins into the bay. The urchins are now released year-round; by the end of 2013, Cohen and the urchin team had raised 150,000. They're hoping to reach 200,000 before the middle of this year, and the next big goal is to hit 250,000 urchins per year by the end of 2015. Then the next milestone will be doubling that, Cohen says.

Cohen rattles these numbers off from his modest office in a trailer outside the hatchery. On the wall hangs the "sea urchin hugger" bumper sticker his wife made him. (He also has an "I brake for sea urchins" sticker and "Mayor of Sea Urchin City" T-shirt.) He has these numbers memorized because it's his job, but perhaps more so because he's proud of them. "There are real moments," he says, "when you can sit back and say, 'OK, this is working.'"

More than four years in, Cohen has hit his stride in the hatchery, and the team is producing more urchins than ever. Once the reefs have been vacuumed, hāwa'e maoli need to be deployed within one to two months or too much algae will have grown back for them to nibble away at it. So far, so good: Every patch reef that's been vacuumed and then had urchins deployed is now at 3 to 5 percent algae coverage, down from 80 to 90 percent. But every reef needs a lot of urchins. "The largest reef we're working on right now is thirty thousand square meters, so that reef alone needs sixty thousand urchins," says Blodgett.

It's too soon to tell whether Kāne'ohe bay's reefs will once again flourish; alien algae isn't the only problem. But researchers who study coral in the bay are seeing new growth, the first step toward rehabilitation. Others are looking at what effect the urchins' introduction might be having on other species. The released urchins are thriving, and although they aren't reproducing on their own—Cohen thinks they don't have a chemical cue telling them to spawn—they are at least keeping the reefs clean, like little gardeners weeding their plots. Cohen estimates that at 250,000 urchins released into the bay per year, it will take eight to ten years before there are enough urchins grazing the reefs of Kāne'ohe to keep the invasive algae at bay—that's about 2.5 million urchins.

"We try not to look at the whole elephant," Cohen chuckles. He's serious, but the urchin guy is also confident that he'll get there. HH