



Can native Hawaiian oysters restore the waters of Pu'uloa?

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CLEAR WATER REVIVAL

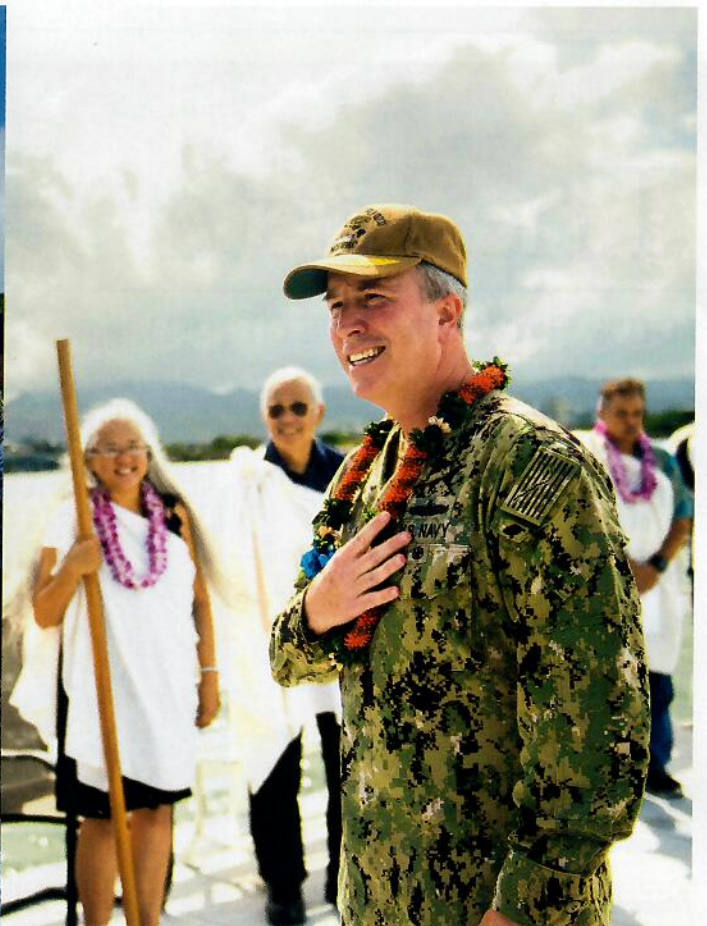
It's a sunny June morning, and a cardboard box that arrived on an early flight from Hilo is being opened at the end of a pier on Ford Island in Pearl Harbor. It contains about three hundred baby Hawaiian oysters, *Dendostrea sandvicensis*, a species that once flourished here but is now rare. Spawned in a hatchery at the University of Hawai'i at Hilo, these little filter feeders are part of a pilot study aimed at finding good sites in the harbor for *Dendostrea* to live. They are forerunners in an effort to clean up the harbor by taking advantage of oysters' natural ability to remove sediment, heavy metals, bacteria and other pollutants from water. None of the spat—the term for juvenile oysters—is bigger than a lentil, but if all goes well they will grow to be about two inches in diameter—and hundreds of thousands more will follow.

When the first Polynesians sailed into Pearl Harbor's clover-shaped trio of bays, they found a bountiful estuary fringed with oyster reefs. The reefs provided safe havens for *Dendostrea* and other oyster species, including the pearl oysters that inspired the name Pearl Harbor, a place early Hawaiians



called Pu'uloa. In the nineteenth century, deforestation, cattle grazing, sugar growing and other land-use changes sent untold quantities of silt into the harbor, smothering the reefs and decimating the oysters. By the beginning of the twentieth century, the indigenous oysters of Pu'uloa were all but wiped out. The babies in this box could help turn back the clock.

The group behind this undertaking, O'ahu Waterkeeper, was inspired by the Billion Oyster Project, which is putting one billion oysters into the Hudson River estuary to clean up the waters around New York City. A billion is probably more oysters than Pearl Harbor needs, but the goal is the same, says O'ahu Waterkeeper's program director, Marian Phillipson. "The



Pu'uloa was once prime habitat for native oysters—the reason its English name is Pearl Harbor. At top, a ceremony marks the first planting of lab-bred native oysters into Pu'uloa. Above left, Kehaulani Lum (seen also on the title page) chants an oli. Above right, Rear Admiral Brian Fort speaks at the ceremony; the oyster planting effort is being undertaken with the support of the US Navy.

ultimate goal is to reestablish the oyster reefs that will allow Pearl Harbor's oysters to take care of themselves," she says.

A crowd has gathered on the pier for a ceremony to mark this small first step in Pearl Harbor's oyster revival. Rear Admiral Brian Fort, then Pearl Harbor's top commander and one of the oysters' friends in high places, gives a speech. So does Polynesian Voyaging Society president Nainoa Thompson, who encountered the Billion Oyster Project while sailing around the world aboard *Hōkūle'a*, a replica Hawaiian voyaging canoe. And so does Robert F. Kennedy Jr., president of the Waterkeeper Alliance, the umbrella organization under which O'ahu Waterkeeper functions.

After the speeches the spat are put into the water just two hundred yards from the wreck of the USS *Arizona*. To protect them from crabs and other threats, they are first put into mesh bags, and then the bags go into plastic cages, which are then suspended a few feet beneath a floating dock at the end of the pier. A group of Hawaiian cultural practitioners drops 'ulu (breadfruit) and kukui nut branches into the water after them, an offering to Kāneku'ana, the

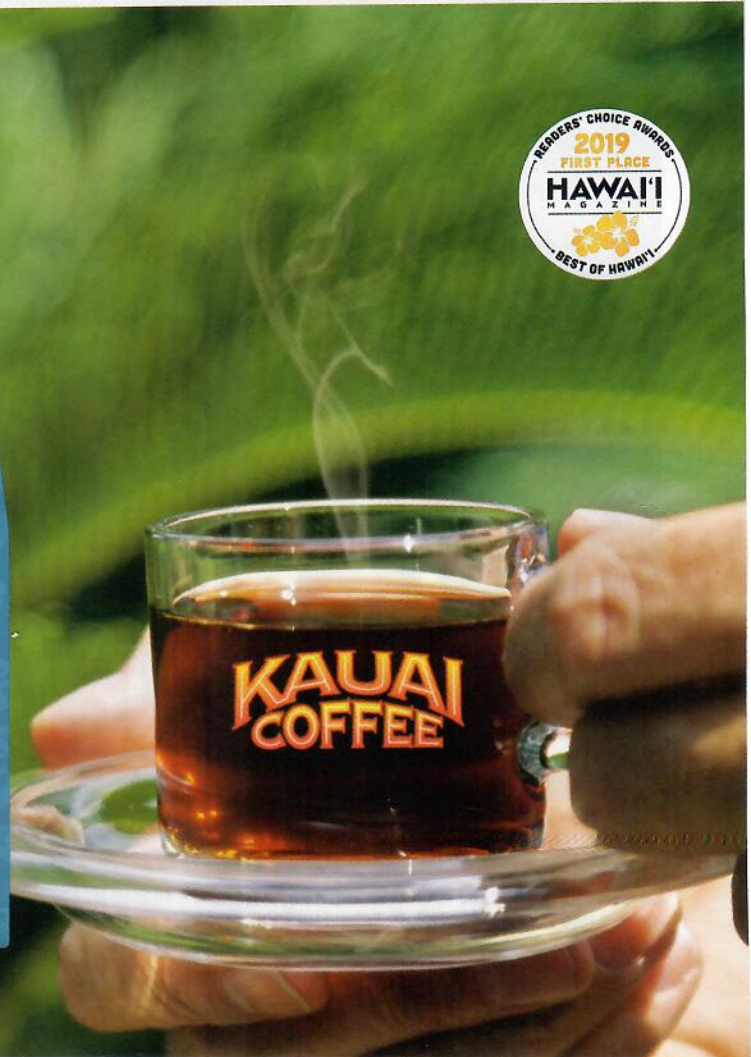


During the worldwide voyage of the Hawaiian sailing canoe *Hōkūle'a*, navigator Nainoa Thompson (seen above left talking with Robert F. Kennedy Jr.) encountered the Billion Oyster Project in New York, which aims to clean the Hudson River by planting oysters. Similarly, it's hoped that planting native oysters help to clean Pu'uloa, which might in turn create improved habitat for the oysters. On the facing page, top: A map of fishponds around Pu'uloa. Bottom left: Cages containing juvenile oysters (bottom right) are lowered into the water.

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mo'o, or water spirit, who is said to have presided over Pu'uuloa. The old stories say it was Kānekua'ana who brought the oysters from Tahiti to Pu'uuloa.

Kehaulani Lum performs an oli, or chant, written for the occasion. She is joined by her brother, Winston Lum Jr., who is deaf and chants in sign language. It's a form of communication fit for the occasion, given the special name the early Hawaiians gave oysters: ka i'a hāmau leo, or "the fish that silences voices." When gathering oysters you should not speak, Kehaulani Lum explains, otherwise the oysters will hear you coming and you won't find them.

After the ceremony, in the shade of the trees at the foot of the pier, Lum tells me a story from the nineteenth century about Kānekua'ana and the i'a hāmau leo of Pu'uuloa: An old woman gathering seaweed along the shore found some oysters and put them in her basket. She hid them under some seaweed because gathering oysters was kapu (forbidden) at the time. The konohiki, headman of the area, caught her breaking the kapu and made her put the oysters back. The woman was contrite,

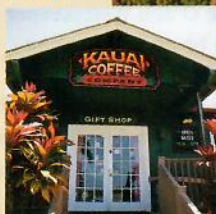
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Clear Water Revival



Kehaulani Lum and Rhiannon Chandler-Īao at Loko Pa'aiau, one of the three remaining fishponds surrounding Pu'uloa. Chandler-Īao is executive director of WaiWai Ola Waterkeepers, the Hawai'i chapter of a nationwide organization founded by Robert F. Kennedy Jr. that's devoted to preserving aquatic and marine habitats. In addition to Pu'uloa, Chandler-Īao hopes to plant oysters in Kāne'ohe bay and even in the severely polluted Ala Wai Canal.

but the konohiki wouldn't let it rest. He followed her home demanding a gold coin, all the money the woman had. After begging for leniency, the woman finally gave the bullying konohiki the money.

Kānekua'ana watched it all unfold. She felt the konohiki was right to put the oysters back but went too far in demanding money. The affair so disturbed Kānekua'ana that she vowed to take the i'a hāmau leo back to Tahiti. And the Pu'uloa oyster population hasn't been the same since. "The i'a hāmau leo is *so* sensitive," Lum says. "This is a fish that is aware of you. You make all kinds of problems, it will go away."

Rhiannon "Rae" Chandler-Īao greets me at a café near the University of Hawai'i at Mānoa with an enormous hug before we sit down to drink coffee and talk about her vision for oysters in Hawai'i, which is as expansive as her embrace. In 2016, while she was still a law student at UH concentrating on Native Hawaiian rights and environmental issues, Waterkeeper Alliance recruited her to launch a Waterkeeper group in Hawai'i. She is now a lawyer and the executive director of WaiWai Ola Waterkeepers Hawaiian Islands, the statewide body set up to oversee smaller watershed-based programs. O'ahu Waterkeeper is the first program to be up and running.

Since becoming a Waterkeeper, Chandler-Īao has been building partnerships. In addition to working with the Navy on the Pearl Harbor initiative, she

has worked out an agreement with Marine Corps Base Hawaii to put oysters into its waters at Kāne'ohe bay. She's working with Nainoa Thompson to develop a "native oyster garden" at UH's Marine Education Training Center on Sand Island, home base for the *Hōkūle'a*. She's working with the National Oceanic and Atmospheric Administration, the Office of Hawaiian Affairs and the Polynesian Voyaging Society to develop a clean water curriculum depicting oysters as the superheroes of bioremediation.

She's also encouraging the City and County of Honolulu, the state Harbor Division and the US Army Corps of Engineers to put oysters into the Ala Wai Canal. She's already recruited the yacht clubs at the Ala Wai Small Boat Harbor to hang oyster cages from their docks, and she envisions a day when homeowners along the water in Hawai'i Kai and Kailua's Enchanted Lake neighborhood will care for cages of oysters in their backyards.

None of these oysters will ever be fit to eat, but Chandler-Īao expects that the oyster farmers in Hawai'i who are now raising non-native species will welcome the natives. At the oyster bars of the future, you will be able to slurp the sweet, nutty flavor of Hawaiian oysters on the half shell. And she predicts other benefits. Eroding beaches might be buttressed with bags of discarded oyster shells from restaurants to help reclaim sand. Jewelry stores will carry strings of authentic Hawaiian pearls.

“We’re putting these species into mass production,” Chandler-‘Āao says. “People are going to jump on this.”

But as much of a booster of Hawaiian oysters as she is, Chandler-‘Āao is quick to admit their limitations and acknowledge that, more than anything, she sees them as a vehicle to get people talking about complex wastewater and storm water issues upstream. “We’re going to put an enormous amount of oysters in the water, and they’re going to make a small difference in certain areas,” she says. “But the oysters aren’t going to solve all of our problems. They will become the thing that gets us to the table so we’re able to talk to people about the actual sources of water pollution.”

Equipped with a paint scraper and the proper permits, invertebrate specialist Maria Haws slogs through the mud of Pearl Harbor’s West Loch searching for an ancient oyster reef with her feet. I try to keep up, sinking in muck up to my knees and hoping not to face-plant in the water, which would be an inadvertent violation of the Navy’s rule against putting your face into Pearl Harbor.

“I think I found it,” Haws shouts cheerfully once her feet find solid ground beneath mud only ankle deep. Some of the great masses of Hawaiian oysters that grew here made the substrate she’s standing on, one generation settling upon the shells of another, century after century. There are still oysters here, but nothing like there used to be.

Haws is director of the Pacific Aquaculture and Coastal Research Center at UH Hilo, which is breeding the spat for the Waiwai Ola Waterkeepers’ oyster projects. She’s here collecting broodstock—parents to be. The scraper she carries is for separating specimens from the rocks and mangrove roots to which they’ve cemented themselves. The permits allow her to do this without violating state law or being arrested by the Navy for wading around in its restricted waters.

After finding the muddy reef, Haws’ feet go to work feeling around for loose rocks. When she finds one she fishes it out of the water and flips it over to check for oysters. She finds several Eastern oysters, *Crassostrea virginica*, one of the species introduced to Pearl Harbor in the nineteenth century with the unrealized hope of revitalizing the fishery after the indigenous oysters crashed. Eastern oysters are larger and can pump more water than Hawaiian oysters, and Waterkeepers plans to use them

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Maria Haws (above) wades in the muddy waters of Pearl Harbor's West Loch in search of native oysters for breeding stock. Haws is the director of the Pacific Aquaculture and Coastal Research Center at the University of Hawai'i Hilo, where the spat (juvenile oysters) are being bred. WaiWai Ola Waterkeepers has secured funding for Haws to breed 250,000 oysters in the next two years.



have grown at all. The situation inside the smaller oysters' cage is more encouraging. Only a handful of them have died, and the rest have roughly doubled in size. "This looks good!" Haws says. "You've had very good survival!"

So why the wildly different outcomes? Haws says there are lots of possibilities. A microclimate variation from one side of the pier to the other might explain it. Or maybe there was some variation in the conditions of their spawning tanks back in Hilo. And then there's the awful thought the oysters failing to thrive are those that sat outside their cooler for an extra half-hour during the ceremony.

Oysters thrive in the intertidal zone, where a low tide can leave them high and dry for hours. Some types can live for weeks out of the water if properly chilled and moistened. But the trip from Hilo to Honolulu would have put some stress on this bunch, and that extra half-hour in the sun during the speeches might have pushed the larger spat too far. In other words, maybe the talking was too much for the i'a hāmau leo. "That's one hypothesis," Haws says. "But we just don't know."

In any case, the small spat are now larger than the big ones. And they're thriving, which means they, at least, are in a good spot. The next steps are to keep monitoring the cages and to introduce more oysters to other sites in Pearl Harbor over the next five years. "We'll continue to bulk up the population and see what the impacts are," Chandler-Īao says. "That's the plan." **HH**

to help improve conditions for *Dendostrea* to flourish. Sterilized specimens will be used so they don't end up outcompeting the native species. Into Haws' collection bag go the *Crassostrea*.

"Oh, look what we've got here!" says Haws after dredging up a rock the size of a hardcover dictionary and finding a *Dendostrea* on the bottom. The muddy shelled creature blends in convincingly with the surrounding rock, easy to miss even when you're holding its rock in your hands.

Many years ago Haws figured out how to breed *Dendostrea* and ran growth trials in Hilo bay and at He'eia fishpond on O'ahu. She proved that the species can be produced in a hatchery and survive outside of it. But she didn't have funding to continue, so she set the work aside. Then, in 2017, Chandler-Īao called. She had found Haws' name high in a Google search for "native Hawaiian oysters." Now Haws has funding from Waiwai Ola Waterkeepers to produce 250,000 oysters over two years—the first wave in Hawai'i's oyster revival. Most will be *Dendostrea*, but some are to be *Pinctada margaritifera*, the black-lip pearl oyster. *Pinctada* has proven tricky to breed, but Haws is on the case. "We're

going to learn a lot of stuff about these species by doing this," Haws says.

Two weeks after the ceremony at Pearl Harbor, a group of oyster people returns to the pier. It includes Haws, who is here to train the Navy's natural resources team to clean the cages and gather data. The spat haven't been checked on since they went into the water, and nobody is sure what they will find inside the cages. Haws, who has seen outplantings like this go awry, says, "It's not unusual to come back and find five hundred dead." Chandler-Īao lingers as the group walks to the end of the pier. "I'm afraid to look in the cages," she says. "What if they're all ...?"

The tradewinds are brisk, and Haws is concerned that some of the spat might blow away if the cages are opened at the end of the pier. So the cages are carried to the shelter of trees at the foot of the pier. The original set of three hundred oysters was made up of two groups, one of them with slightly older and larger spat. When Haws empties the older spat into a tray for counting, it's clear that the last two weeks have not been kind to them. More than half are dead, and the survivors don't seem to



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October / November 2019
www.hanahou.com

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