

Abalone diving is banned, and work goes on to restore the giant sea snail on California's coast

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Daniel Swezey, a project scientist at the UC Davis Bodega Marine laboratory and lead scientist with The Cultured Abalone Farm, carefully removes a large wild red abalone from a holding tank at the UC Davis Coastal and Marine Sciences Institute's Bodega Marine Laboratory in Bodega Bay, California Thursday March 25, 2021. Stephen Lam / The Chronicle

April used to be the beginning of abalone diving season, when Bay Area families would head up the Sonoma-Mendocino coast to harvest the creatures, whose delicate flavor seems to capture all the mysteries of the sea.

The gigantic mollusk has turned out to be too delicious for its own good. Overfishing and disease led to the collapse of many abalone populations in the 20th century, and a series of environmental catastrophes led the state to ban recreational diving for red abalone in 2018, a moratorium recently extended to 2026.

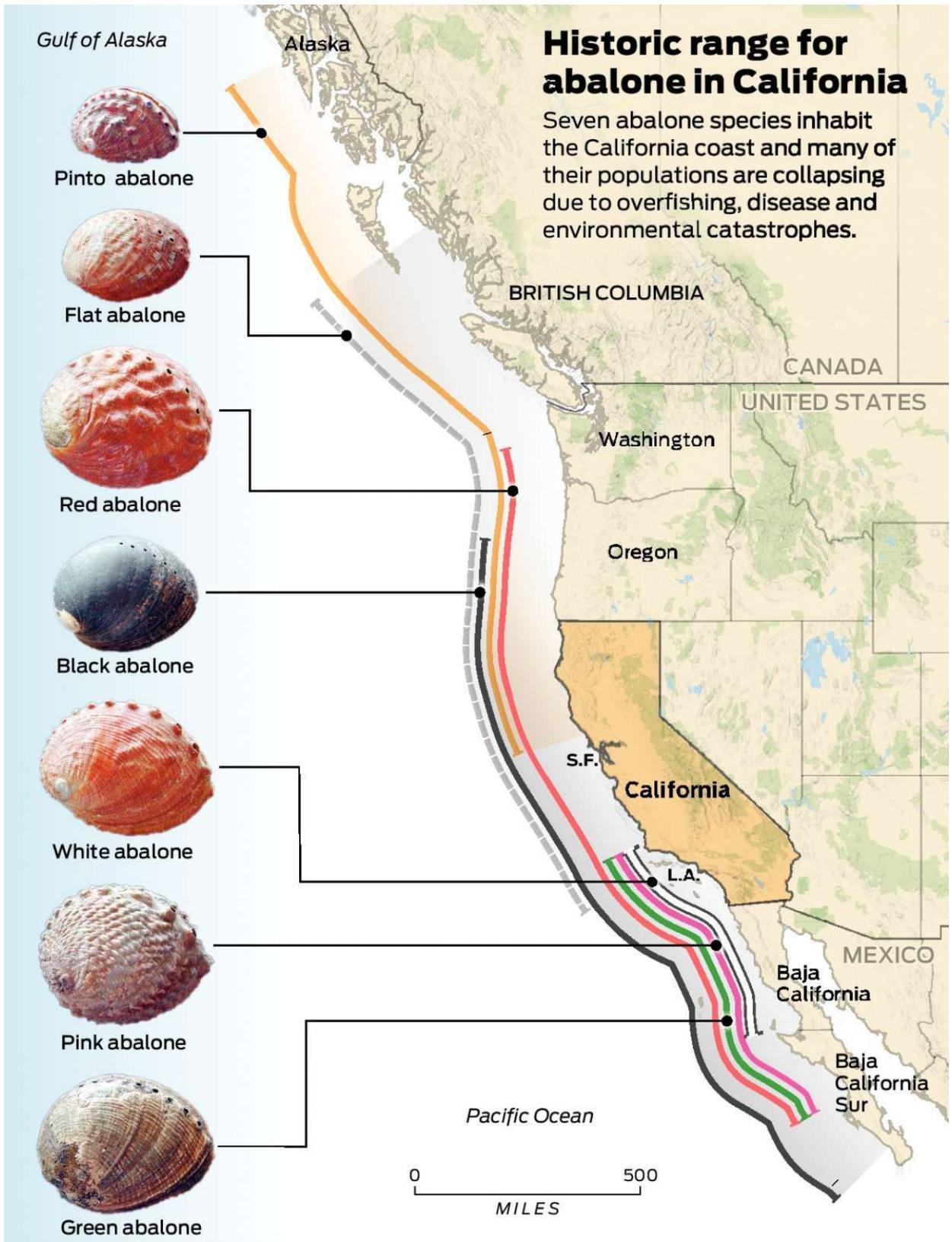
But researchers are working on restoring native abalone species that once filled the state's tide pools and littered its beaches with huge mother-of-pearl shells. The center of that research is in the Bay Area, at the UC Davis Bodega Marine Laboratory in Bodega Bay. There scientists have been breeding endangered white abalones so they can be reintroduced to their native Southern California and are researching how both native and farmed abalone may adapt to the ocean acidification that comes with climate change.

“The cultural and economic and ecological importance of abalone can't be overstated,” said Kristin Aquilino, who heads the lab's white abalone project. “Overfishing is what caused white abalone to be on the brink of extinction. So I think that we have a responsibility to fix that.”

Aquilino jokingly refers to the lab as an abalone fertility clinic, where researcher Sara Boles is pioneering techniques to use ultrasound equipment designed for human breast exams to divine the gastropods' reproductive readiness, which happens in the spring.

“Predicting when they're ready to reproduce — that's the holy grail,” said Daniel Swezey, another project scientist at the lab.

Seven abalone species inhabit the California coast, suctioned to rocks with a muscular foot, their tentacles quivering like a fringed skirt under oval shells. They have been a source of food for native people for more than 10,000 years and became part of a commercial fishery in the Gold Rush era.



Source: Marinebio.net, Photos by Genny Anderson

John Blanchard / The Chronicle

In addition to the white and red species, black, pink and green abalones were also commercially fished (two other native species, pinto and flat abalones, were not). Overharvesting caused their populations to collapse starting in the mid-20th century, leading to the end of all commercial fishing by 1997. By then, all that was left was the recreational fishery for red abalone north of the Golden Gate. While scientists estimate that each species of abalone in California once numbered in the millions, the legal catch of red abalone dropped to about 240,000 annually in its last few years.

The closure of that last fishery in 2018, which cut off an estimated \$15 million to \$25 million spent annually at businesses frequented by abalone divers, according to the Fish and Game Commission, was in response to environmental disruption.

Most current threats to abalones are climate-related: Marine heat waves are partly responsible for the near disappearance of the kelp forest on the North Coast, the red abalone's food source. An explosion of purple sea urchin, which devoured the remaining kelp, was another factor.

In recent months, the endangered black abalone became an unwitting victim of last year's Dolan Fire, when resulting mudslides on the Big Sur coast buried thousands of them, biologists embarked on a huge rescue effort. They packed up survivors in coolers and transferred them to a makeshift rehab facility, where they're staying until it's safe to return them to the Big Sur coast.

Abalones are found on almost every continent, and worldwide their biggest looming threat from climate change is ocean acidification, which happens as the ocean absorbs carbon dioxide from the atmosphere. The lower-pH water makes it difficult for them to grow hard shells.

In the lab, Swezey and Boles created the ocean acidification conditions expected to exist in 10 to 20 years to see how both farmed and wild red abalone from the Mendocino coast will fare. In a study published last fall, they found that the wild ones survived better because they've already been conditioned by the more acidic water that comes from marine upwelling in their area.

Swezey, also a scientist at a commercial abalone farm near Santa Barbara, said future restoration efforts will have to focus on which animals are the hardiest and what enables them to tolerate acidification.

Coaxing abalone to reproduce in the wild or in a lab is not easy. In the ocean, the giant marine snails aren't very prolific when their numbers drop and they become less densely populated. Males and females do what's called broadcast spawning, sending their eggs and sperm out into the water, and need to be within a few meters of each other.

In the lab or at abalone farms, humans must try to first create the right conditions for abalones to become reproductive, through diet, water temperature and light, and then have to predict when the males and females are ready to spawn. Aquilino was disappointed last month when none of the two dozen animals she thought were ready spawned.

"It happens from time to time that they don't cooperate," she said. "Maybe they were feeling the pandemic stress." They'll give it another go later this month.

Captive breeding of white abalone began in 2001, when it became the first marine invertebrate to receive endangered species status. Scientists at the Channel Islands Marine Resource Institute bred over 100,000 juveniles, but most perished from a disease called withering syndrome.

Recovery efforts moved to Bodega Lab in 2011, which now breeds about 20,000 juveniles a year. The goal is to increase to 100,000, Aquilino said.

Last year, they introduced 1,000 captive-bred abalone in Southern California. They won't know how successful they were for three to five years, when they grow larger.

Figuring out the best spots for introducing abalone is an area that Todd Braje, a professor of anthropology at San Diego State University also affiliated with the California Academy of Sciences, researches from a historical perspective.

Braje studied archaeological shell middens, or abalone trash piles up to 12,000 years old left behind by the Chumash tribe and their ancestors, on the northern Channel Islands, for a study he published in 2019. After determining where abalone fishing was most intensive based on the location of middens, he compared that to maps of the most popular commercial fishing grounds from the 19th and 20th century.

He found three specific locations where people from each era fished for abalone, which led to a surprisingly upbeat conclusion — that they'd also make the best places to start bringing back black abalone because historically that's where the species was most abundant.

“Through those 10,000 years there's been tremendous changes in climate, along with other pressures like fishing. Black abalones seemed to do well through all of that,” he said, even though that's where they were fished the most. “Let's start reseeded in these spots first, because they seem to be the most resilient.”

It's a small sign of hope for the state's beloved giant sea snail, after all it's been through.

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