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Invasive European algae threatens Pacific Coast

Algae responsible for ravaging Mediterranean identified in San Diego

Dunk your head underwater in the northern Mediterranean Sea and a vision of green will greet your salt-stung eyes. Rippling fronds of emerald shag cover the rocks as far as you can see. Its waving arms are soothing; its brilliant color strikingly beautiful.

Peer closer, and a disturbing fact starts to hit: *nothing else grows here.* Where once there were bustling communities of fish and lobsters, colorful coral and bright anemones, this plant grows in a monoculture, like corn in an Iowa field.

Now this invasive plant has been found growing in a San Diego area estuary that is markedly similar to Elkhorn Slough. Scientists are taking drastic steps to halt its spread, fearing it could conquer stretches of the Pacific coast just as it did the Mediterranean.

What's strangling the Spanish, French and Italian rivieras is an unusually aggressive type of *Caulerpa taxifolia,*a common saltwater algae. The Mediterranean plants all stem from *C. taxifolia*originally cultured in Germany's Stuttgart Aquarium, where it learned to adapt to colder water and to grow much larger than the wild strain.

*C. taxifolia*is widely available in stores that sell supplies for home aquariums, and researchers fear that saltwater fish hobbyists who use it for decoration may set of devastating infestations by emptying their tanks into bays, lagoons or storm drains.

European scientists first spotted this sea monster off Monaco in 1984, but ignored it. A decade later, the unstoppable dynamo had choked out marine flora and fauna along the Mediterranean shores of France, Spain and Sicily. It is now sending tendrils into the Croatian Adriatic. If the Mediterranean invader turns out to be a new species, scientists have half-seriously suggested naming it *C. godzilla.*

Genetic studies on the San Diego plants have not yet been completed, but scientists suspect the worst. The invader is flourishing in the colder waters of California and has the long fronds of the Mediterranean clone.

The California invasion was discovered by biologists restoring eelgrass beds in a lagoon 20 miles north of San Diego, in the suburb of Carlsbad. The San Diego Power and Electric Company had contracted biologist Rachel Woodfield of Merkel and Associates to replant eelgraass in Agua Hedionda Lagoon as mitigation for dredging.

"We were surveying the success of that when we came across this algae. The diver brought it to me because i'm the algae person in the office," said Woodfield. The diver

reported the mysterious plant had taken over several thousand square feet of the lagoon, muscling out all other plants in its way.

When Woodfield first laid eyes on the sample, her heart started to beat a little faster. "We've all heard how bad *Caulerpa*is, and we were sure freaked out to see it here," she said. Just to be sure, she sent off a sample to experts, who confirmed her worst fears. A slew of state and federal agencies as well as other experts met immediately to address the problem.

One of those experts was Andrew Cohen, who directs a program on biological invasions for the San Francisco Estuary Institute. In 1998, Cohen drafted a petition to the U.S. Department of the Interior urging a ban on the importation of *C. taxifolia*after hearing about the damage it had caused to the Mediterranean. More than 100 scientists signed the document, which also asked the federal government to change the way it regulates exotic organisms.

Instead of permitting most organisms to be impmorted except a few named on a "dirty list," the biologsts recommended a more stringent "clean list" that would exclude the vast majority of unknown species. The petition resulted in a ban on the seaweed in 1999, but in no changes to federal importation laws on exotics.

Cohen says he isn't sure how the algae will behave in the colder and rougher Pacific.

"We have some educated guesses from its behavior in the Mediterranean as to how far north it might go. But those limits haven't been tested and it hasn't gotten out to make its way up the Atlantic shores of Europe yet," Cohen said. "Whether or not it gets up here, the issues are very much alive for the Monterey Bay."

All the same, U.S. biologists aren't taking any chances. Over the years, *C. taxifolia*has demonstrated a tenacious resistance to all efforts to kill it. The plant has survived in 50-degree aquariums for more than three months, will regenerate from the smallest piece broken off the parent plant, and can survive up to 10 days out of water if kept moist. The plant also produces a chemical in its tissues that makes it unpalatable to wood-be diners.

Woodfield experienced the plant's stubborn refusal to die first-hand while orchestrating the plant's eradication from Agua Hedionda.

"I tried many potent herbicides, algicides and exclusion from light. It's been over a month now, and it's doing great," Woodfield said. The only reliable poison she's found has been concentrated chlorine bleach.

Accordingly, she's building kill chambers out of pvc pipe and plastic side panels held down by sandbags. Scientists will dump chlorine into ports at the surface, cover the chamber and wait for as long as it takes. The treatment will also kill native species, but biologists say a cure is well worth the treatment.

Woodfiled believes the area will have to be monitored for up to 10 years to ensure the alien is really gone.

The San Diego biologists got lucky; the circumstances of its discovery read like a textbook case for exotic invader awareness. Scientists had already been alerted about the plant, and government officials were eager to avoid a Mediterranean-scale debacle. The alga was also found in a sheltered lagoon basin almost a mile from the ocean, an area easily cut off from rough ocean waves that could sabotage removal efforts. Lastly, the lagoon's owners, the San Diego Power and Electric Company, were eager to do whatever was necessary to eliminate the plant, and are paying for its removal with the hope of federal reimbursement

down the line.

"I think we stand a good chance of eradicating this one, but only because the circumstances were so special," Cohen said. Usually, "once it's introduced, it's too late."

Southern California government agencies plan to distribute brochures to divers, fishermen and recreational boaters asking anyone who sees *C. taxifolia*in the wild to contact authorities.

Local marine biologists say they are keeping a close watch on Monterey Bay to ensure the alien alga doesn't gain a foothold here.

"I would think we're susceptible," said Kerstin Wasson, research coordinator for the Elkhorn Slough National Estuarine Research Reserve. Compared to San Diego, "our water temperatures aren't significantly different." She said slough waters drop only to about 55 degrees in winter, the same as conditions in Agua Hedionda. Both wetlands also have natural eelgrass beds, as well as power plants that pump in the heated water *C. taxifolia* prefers.

According to Wasson, invaders are already a distressing problem for the slough. She recently conducted a modest search for slough invaders, not expecting to find many because Moss Landing is not a major international port. To her horror, she racked up an average of one species for every two hours she spent looking, and eventually stopped the study with no end in signt. The 55 species on her list include a Japanese snail that she estimates numbers a billion individuals in slough waters.

"Local boats go from the Moss Landing Harbor to San Francisco Bay, get invaders on their hulls and bring them back. Or the larvae swim naturally down here. So the effects of shipping reverberate to nearby, seemingly pristine places like Elkhorn Slough," Wasson said.

Under no circumstances should anyone dump the contents of a fish tank down the sewer or into a local body of water; survivors could be hardy enough to cause an ecological disaster. "If you have to dispose of it, bleach it or flush it down the toilet; the sewer treatment will do a number on it," Woodfield said.

Ironically, the fact that Californians are now on the alert for the alga gives Wasson hope that Elkhorn Slough and the Monterey Bay National Marine Sanctuary can avoid the scourge.

"We can't go pick up a billion Japanese horn snails, but if *Caulerpa taxifolia*showed up here, we might be able to get the very first patch and remove it like they are in San Diego. By knowing what you had to start with and monitoring to see how it changes, you stand a chance of eradicating it while you can," Wasson said.

--Kathleen Wong