How sea star wasting disease transformed the West Coast's ecology and economy

Rebecca Vega Thurber, Professor of Ecology Evolution and Marine Biology; Director of the Marine Science Institute, University of California, Santa Barbara

As sea stars disappeared, the purple sea urchin population exploded, increasing an astonishing 10,000% from 2014 to 2022.

The urchins ate through kelp forests. The resulting loss of kelp canopy and the understory foliage below it reverberated across the whole ecosystem, affecting the tiniest of zooplankton and giants like gray whales, all of which are linked in the complex kelp forest food web of who eats who.

Ecological cascades – a succession of changes across an ecosystem when habitats are disturbed – can occur when critical populations disappear or change in other significant ways.

Removing the kelp alters light levels below, leading to changes such as turf algae growth in place of filter-feeding invertebrates such as clams and scallops. Turf algae also make it harder for kelp to regrow, exacerbating the problem.

The loss of kelp also resulted in fewer mysids, a zooplankton that relies on kelp for habitat and which makes up a majority of gray whales' diets. Thus, as urchin populations went up and kelp disappeared, gray whales also had less food.

Kelp forests provide food for many species and safety for young fish.

Katie Davis

How California learned to embrace the urchin

The loss of sunflower sea stars to wasting disease has not only altered the kelp ecosystem, but it has also altered the landscape of Pacific fisheries, potentially forever.

When I started research on purple sea urchins in 2001, there were not enough specimens in the whole of the Monterey Bay for me to collect and use for my studies. In fact, I had to order my animals from an East Coast distributor.

Mostly there were red sea urchins, Strongylocentrotus fransiscanus, highly prized for their large and delicious gonads and sold as “uni” to American and Asian markets.

But with the recent purple sea urchin boom, Strongylocentrotus purpuratus, a new and unexpected market on the west coast has blossomed – taking these kelp killers out of the sea and onto plates in restaurants around America.

Sea urchin on the menu in Japan. The orange-yellow uni are the creature’s gonads.

Sung Ming Whang/Flickr, CC BY

This pivot from reds to purple urchins by fishers and the aquaculture industry took time and creativity. Purple sea urchins tend to be small and lack the rich gonads that make the reds so profitable. To adjust their flavor, texture and size, innovators turned to harvesting these animals

from the sea by hand and then moving them to land-based facilities – called "urchin ranches" – where they fatten up by eating seaweeds.

The results have been remarkable. In Santa Barbara, a thriving industry now raises these animals for the culinary market, where the artisanal urchins go for $8 to $10 a pop. In one example, an abalone aquaculture program used its expertise and facility to profit from this new abundance.

Innovative ways to solve kelp decline

You might be asking yourself if we can just eat our way out of this crisis.

It's not a new idea. The invasion of Pacific lionfish into Florida coasts, the Gulf of Mexico and parts of the Caribbean was slowed down by local divers and recreational fishing groups teaming up to hunt and then market lionfish to restaurants.

It is unlikely that purple sea urchin ranching will make much of a dent in the population, but numerous projects are currently aimed at both recovering kelp forests and keeping the monetary benefits of the urchin boom flowing to the local economy simultaneously. The ingenuity to flip a bad outcome into a productive local aquaculture industry has been so popular that even state agencies are now funding local innovators to expand purple urchin ranching, assisting both the local environment and the local economy.

Purple sea urchins have taken over stretches of sea floor off California and ate down the kelp, leaving little behind.

Ed Bierman via Wikimedia Commons, CC BY

Scientists, state agencies and conservation groups are working on sunflower sea star restoration efforts and kelp recovery programs, and are considering other ways to reduce the urchin population.

One option is to increase otter populations in places like Northern California and Oregon, where they were once abundant. Otters can eat upward of 10,000 urchins per year. But the approach is controversial in Southern California. A similar conservation effort failed before, and there are concerns about the effects a bigger otter population would have on local fisheries, including the now-depleted black abalone.

So where do we go from here?

As the world's appetite for farmed seafood has expanded, groups like Urchinomics and their investors are using this edible calamity to promote kelp restoration, create jobs and boost local economies.

In a way, sea star wasting disease and the precipitous kelp declines inadvertently created a mutually beneficial alignment of conservation, local artisanal fishing and land-based aquaculture.

A sunflower star (blue) with other sea stars (orange) and a sea anemone off the central California coast.
Ed Bierman via Wikimedia Commons, CC BY

In the long term, additional marine heat waves, like the one occurring in 2025, and their associated marine diseases and subsequent habitat losses, require global actions to reduce climate change. Future outbreaks like sea star wasting disease are almost certain to emerge.

Yet, it has also been found that some of the harms of urchin population growth can be lessened when sections of ocean are protected. For example, in some California marine protected areas where urchin predator diversity was high, the impacts of sea star wasting disease and its ecological cascade were reduced. In other words, in areas where there was limited fishing, as sea star numbers dropped, the urchin population was at least partially kept in check by those legally protected predators.

This finding suggests that along with global carbon reductions, local conservation and human innovations – like those bringing purple uni to our plates – can help prevent some ecological cascades that harm our increasingly threatened marine resources.

Rebecca Vega Thurber does not work for, consult, own shares in or receive funding from any company or organization that would benefit from this article, and has disclosed no relevant affiliations beyond their academic appointment.