

Scientists find likely culprit behind mysterious sea star deaths

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In the slippery tide pools of Point Fermin in Los Angeles' San Pedro neighborhood, there are sticky green sea anemone, hard-shelled limpets, barnacles shaped like mini-volcanoes and small octopuses hiding between gaps in the rocks.

Noticeably missing from this coastal menagerie are the icons of the rocky intertidal zone - the sea stars.

Not long ago, as many as 80 orange and purple sea stars could be found at Point Fermin, say biologists who have been monitoring the spot for more than a decade. But over the past 18 months, scientists from southern Alaska to Baja California have witnessed the largest die-off of sea stars ever recorded. Their armored bodies seem to simply disintegrate in the face of a mysterious sickness dubbed sea star wasting disease.

The outbreak is particularly troubling to biologists because sea stars are a keystone species that plays an important role in controlling the numbers of other creatures in their ecosystem.

"If they are missing for a long time, you can expect to see changes in the other animals that live up and down the coast," said Gordon Hendler, curator of echinoderms at the Natural History Museum of Los Angeles.

Researchers believe they know what's behind the disease that has decimated sea star populations all along the Pacific coast. Through a

combination of microbiology and old-fashioned detective work, they deduced that the likely culprit is a virus similar to one found in cockroaches and sea urchins.

Twenty species of sea stars, or starfish, have been affected by the wasting disease. The deaths all follow the same grotesque pattern.

First, the sea star's legs begin to curl up. Then lesions appear on its body. Next, its legs start to crawl away from the central disk and rip off. Finally, the entire animal disintegrates until all that is left is a pile of mush on the ocean floor.

Scientists say it is almost as if the victims melt.

"We've had epidemics before, but nothing like this," said Richard Ambrose, a marine biologist at the University of California, Los Angeles who surveys intertidal zones in Los Angeles, Ventura and Santa Barbara counties. "At some of our sites we saw sea stars with lesions one week, and by the time we came back a few weeks later, all the sea stars were gone."

Cornell University microbial oceanographer Ian Hewson had been following the massive die-off from the other side of the country since it began in June 2013, but it wasn't until October that he first suspected a small infectious agent might be responsible. That's when he heard that sea stars living in a Vancouver, British Columbia, aquarium had started to succumb to the disease.

The water in the aquarium came from the ocean, but it was put through a sand filtration system before entering the sea star tank. Whatever was killing the sea stars had to be small enough to make it through the filtration system, Hewson reasoned.

Then he heard from scientists in Seattle that sea stars were doing just fine in an aquarium where the ocean water was treated with ultraviolet light. This led him to believe that whatever was harming the sea stars in Vancouver could be killed by ultraviolet light and was not simply an environmental contaminant, he said.

So Hewson and his research team sampled bacteria from healthy sea stars and from others showing signs of the disease. They compared the microorganisms but didn't see any major differences.

Next they turned to viruses. They took tissue samples from sick sea stars and injected them into healthy ones. Within eight to 17 days, the formerly hearty sea stars were showing symptoms of the disease.

The researchers also subjected some of the tissue samples to heat, to kill any viruses that might be present. When these treated samples were injected into healthy sea stars, nothing happened. This convinced the researchers that the infection was transmitted by a virus.

They cataloged the viruses in the sea stars and found that the animals that were sick had a higher concentration of a densovirus than the ones that were healthy. The results were published this month in the *Proceedings of the National Academy of Sciences*.

Hewson and his colleagues stopped short of saying the densovirus is the definitive cause of the sea star wasting disease. To do that, they'd have to isolate the virus, make a culture of it, inject that into a sea star that had never been exposed to any pathogens and show that the sea star became sick.

"We suspect it is the culprit, and there is a strong association between the virus and the sickness," said Peter Raimondi, a marine biologist at the University of California, Santa Cruz who worked on the study with

Hewson.

The discovery of the probable root cause of the disease is an important step to understanding why the sea stars are dying, scientists say. But many questions remain.

Members of the research team found traces of the densovirus in sea star specimens that have been in the Natural History Museum's collection since 1942. This suggests the virus has been in the marine system for at least 72 years.

"It's not like an exotic viral particle that has come and wreaked havoc," Raimondi said. "This is a viral species that has been around for a while. So the question becomes: 'Why now? Why is it so broadly virulent?' "

And the discovery sheds no light on why the virus has spread in such a seemingly random fashion along the coast, decimating all the sea stars in some sites while leaving adjacent sites untouched for months or more.

"We don't understand the dynamics of the pathogen in the marine environment, what has actually triggered the outbreak, or how the virus is transmitted to sea stars," said Ambrose, who was not involved in the study

This ignorance means scientists don't yet know enough to predict how the outbreak might progress, or when it might subside.

But there is a glimmer of hope. At a few sites along the Pacific coast, researchers have spotted large numbers of juvenile sea stars in areas where the population had been wiped out.

At Point Conception in Santa Cruz, Raimondi's team found hundreds of colorful [sea star](#) babies no bigger than a thumbnail. They were clinging

to mussels and algae, and piled on top of each other in the tide pools.

"We saw more juveniles than we had in the past 15 years put together," he said.

There weren't any sea stars babies at Point Fermin, or anywhere else in Los Angeles County. But members of Ambrose's intertidal survey team counted 38 juveniles about 40 miles up the coast in Ventura County last week. A few days later, they found 20 healthy sea stars of various ages at Mussel Shoals on the border of Ventura and Santa Barbara counties.

Nobody can say for certain what this means. It's possible the sea stars are on their way to recovery, but it's also possible that the virus affects young sea stars differently than it affects adults.

"It's something we can't answer until they're older," Hewson said.

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