UC SANTA BARBARA

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The Culprit Identified

Since 2013, millions of sea stars native to the Pacific coast of North America from Baja California to southern Alaska have succumbed to a mysterious wasting disease in which their limbs pull away from their bodies and their organs exude through their skin — a disease researchers say could trigger an unprecedented ecological upheaval under the waves.

Now, a team of researchers, including UC Santa Barbara's Kevin Lafferty, has identified the likely culprit as the Sea Star Associated Densovirus (SSaDV), a type of parvovirus commonly found in invertebrates. In a study published today in the Proceedings of the National Academy of Sciences, scientists present a genomic and experimental analysis of the newly discovered virus prevalent in symptomatic sea stars.

"I was diving off the UCSB campus in January and came across hundreds of sea stars that were contorted and disintegrating," said co-author Lafferty, a specialist in marine diseases. "It looked like a battlefield. I've seen no sea stars since.

"Even though they were across the country, scientists at Cornell started pulling together a group of colleagues to figure out what was going on, and their discovery of the virus was as mysterious as it was unprecedented," added Lafferty, a principal investigator (PI) at the Marine Science Institute, an adjunct faculty member in the Department of Ecology, Evolution and Marine Biology and a marine ecologist with the Western Ecological Research Center of the United States Geological Survey.

“There are 10 million viruses in a drop of seawater, so discovering the virus associated with a marine disease can be like looking for a needle in a haystack,” said lead author Ian Hewson, a professor of microbiology at Cornell University. “Not only is this an important discovery of a virus involved in a mass mortality of marine invertebrates, but this is also the first virus described in a sea star.”

Hewson suggests that the virus has been smoldering at a low level for many years. It was present in museum samples of sea stars collected in 1942, 1980, 1987 and 1991 and may have risen to epidemic levels in the past few years due to sea star overpopulation, environmental changes or mutation of the virus. Seawater, plankton, sediments and water filters from public aquariums, sea urchins and brittle stars also harbored the virus.

The research lays the groundwork for understanding how the virus kills sea stars and what triggers outbreaks. The stakes are high, according to the investigators. As voracious predators on the ocean floor, sea stars are keystone species that have a large role in maintaining diversity in their ecosystems.

“It’s the experiment of the century for marine ecologists,” said co-author Drew Harvell, a Cornell professor of ecology and evolutionary biology. “It is happening at such a large scale to the most important predators of the tidal and subtidal zones. Their disappearance is an experiment in ecological upheaval the likes of which we’ve never seen.”

Both the National Science Foundation (NSF) and Cornell University’s David R. Atkinson Center for a Sustainable Future provided rapid response funds to Hewson and his co-PI Ben Miner of Western Washington University.

“The recent outbreak of sea star wasting disease on the U.S. West Coast has been a concern for coastal residents and marine ecologists,” said David Garrison, program director in the NSF’s Division of Ocean Sciences. “This study, supported as a rapid response award, has made a significant contribution to understanding the disease.”

Geographically diverse samples of diseased stars were provided by committed citizen scientists, research aquariums and academic institutions on the West Coast, facilitated by Harvell’s NSF-funded Research Coordination Network for the Ecology of Marine Infectious Disease.

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.