UC SANTA BARBARA

THE Current

March 16, 2026

Sonia Fernandez

UCSB students discover new crab egg predator

After a year and a half of remote work and learning, UC Santa Barbara undergraduate students Sophia Lecuona Manos, Gabrielle Plewe, Carson Gadler and doctoral student Zoe Zilz returned to campus in late 2021 eager for some on-campus, hands-on research, an opportunity that was lost when COVID shut down universities and other public institutions in early 2020.

Little did they know that routine lab instruction in the class of parasitologist Armand Kuris would do more than make up for lost time — it would lead to the discovery of a new crab egg predator and a highly regarded paper in one of the field's preeminent journals. It also turned them, along with new undergraduate Jaden Orli, into world experts on the newly discovered crab egg predator.

"It was surreal," said Lecuona. The discovery of this egg predator — a tiny crustacean called a nicothoid copepod — has major implications for local Santa Barbara- area crab fisheries, she noted; and the experience of finding and identifying this creature changed the course of her career for the better. "It gave me experiences that I wouldn't have at that point that I could take into grad school," said Lecuona, who has just completed a master's degree in coastal resource management at UCSB's Bren School of Environmental Science & Management.

The researchers' work is published in the journal Ecology.

Nicothoid copepods have long been known to prey on crab egg broods, a strategy that, unlike true parasitism, does not target the host body, but her reproductive output.

“This matters ecologically because unlike a parasite that might weaken its host gradually, an egg predator strikes at the next generation directly,” said Orli, the paper’s lead author.

Research published as far back as the 19th century documents the presence of copepods infesting crab broods, the spherical sub-millimeter-scale crustaceans taking up residence there for the latter half of their life cycles to feed on the eggs. Throughout the 20th century, various researchers continued to publish their observations of these creatures in crab egg broods, noting their strange habit of appearing and disappearing.

“In the 1930s in France, they found these copepod predators that hadn’t been seen before,” Kuris said. “Two French researchers, Bloch and Gallien, wrote three papers that describe the species and give some important biological notes. And in their 1936 paper, they say, basically, ‘we can’t find it anymore.’ At that time it was reported in a part of England that’s about 100 kilometers from where they were working on the French coast.”

In the 1950s, a German researcher noted the presence of these copepods on the German coast and around the island of Heligoland in the North Sea, mentioning at the end of his paper that they had become hard to find. Another population was found concurrently on the coast of England in Norfolk, but by the 1970s they couldn’t be found again.

So when one of Kuris’s students reported a moving “egg” that was bigger than the rest of the eggs they were examining in the lab, for Kuris that meant only one thing.

“Even before looking, I said to myself, ‘My G-d, that’s a nicothoid copepod,’” he said. The telltale globular body, that of an adult female, was found on the brood of a yellow rock crab (*Metacarcinus anthonyi)*, a local species. This was the first observation of the nicothoid copepods off the Pacific Coast of the United States.

From there it was a scramble to characterize the egg predator, an effort that fell largely to the undergrads, guided by Zilz as their graduate mentor.

“Gabi, Jaden and Carson and I were like, ‘Yeah that would be amazing. That sounds like so much fun,’” Lecuona said.

What followed was two years of crab collecting from local waters, thanks to help from local fishers, placing the crabs into a campus seawater lab that flows directly from the ocean, seeking out these copepods and observing them throughout their lifecycles.

“Some of these crabs were so highly infested,” said Plewe. “Their gills were just covered in juvenile nicothoids.” They were also found on two other commercially important local crab species, Pacific rock crab (*Romaleon antennarium*) and red rock crab (*Cancer productus*).

What they uncovered was an organism that could spend its entire life on the broods of female crabs that hold their eggs outside their bodies.

“Its life starts as an egg, which hatches into a larva called a nauplius,” Orli explained. “At this stage, it is tiny, barely developed and can’t really swim. It then molts repeatedly, gradually gaining more appendages and body segments, until it becomes a copepodid — a fast-swimming juvenile that looks more comparable to a ‘normal’ copepod.”

In all their searches, the researchers found only female nicothoid copepods on both female and male crabs, with the male crabs possibly acting as reservoirs for some free-swimming copepod juveniles before the male crab comes in contact with a female. Female adult copepods will nestle into the developing egg brood of a crab and are virtually immobile for the rest of their lives, laying eggs in tight synchrony with the crab’s egg-laying cycle. If she is separated from the crab from this point onward, the nicothoid will die within 24 hours.

“The crab eggs all develop in unison,” Kuris said. “In a matter of six to eight weeks, depending on temperature, they’ll all hatch within a day,” after which the crab sweeps away all the shells and other debris, including, presumably, any nicothoids.

From that point, the juveniles hanging out in other places like the crabs’ gills come to their bare pleopods (where their eggs are laid) in a continuous cycle of infestation, according to Plewe.

“At some point in our second year of counting we had the opportunity to look into autoinfection,” she said. “And it was incredible to see the juvenile nicothoids come out during another oviposition.”

Though they do not feed on the adult crabs, there are some very real consequences of the presence of these egg predators.

“Unlike the worms we typically study in this class, the copepods are partial egg feeders,” Kuris explained. In arthropods — creatures with an exoskeleton like insects and crustaceans — development is highly determined, he continued, meaning that unlike other animals, including humans, the fate of each embryonic cell is fixed.

“You can take from an early human embryo and it repairs. That’s how we get identical twins,” Kuris said. “But with these things, if you take some part of even a very early embryo, you end up with essentially a developmental monster, something that is missing body parts or just dies there.” And this, in addition to autoinfestation, and a rapid 20-day life cycle, has serious implications for local crab fisheries, he said.

“The team found it on three different rock crabs that are commercial species, but we don’t know about the Dungeness crab,” Kuris said. Dungeness are officially regulated by the state, making them difficult to study, he explained. “We are worried.”

The undergraduate student-led research and documentation garnered some high praise from the journal’s editors:

“The life cycles of organisms is natural history's greatest theoretical contribution to ecology. Your discovery of a previously unknown copepod parasitizing the egg masses of rock crabs, your detailed description of its life cycle, and your careful follow-up to your initial serendipitous observation fall within the best tradition of natural history. This paper opens up many new avenues of research on the ecology and population dynamics of these copepods that will be of great interest to the conservation and management of crabs. A very nice paper.”

“In my roughly 180-publication experience no other editor has ever lavished such praise,” Kuris said.

For the team members, who are currently the world experts on this newly discovered copepod, the experience was a life-changer. Getting a taste of the research and the writing process has given them the confidence and the chops to pursue advanced studies and scientific careers.

But the work isn't over yet. There are so many questions yet to answer: Where are the male nicothoids? Will these, like the nicothoids found in the Atlantic, mysteriously disappear? Where did they come from and how did they get here?

"Among the authors, we do not actually agree," Kuris said. "There are only two possibilities. One is that they were always here in such low abundance that nobody ever saw them — maybe on another species of crab that we never looked at. Or that it's an introduced species, but there's nothing closely related described from Pacific waters."

There are currently some follow up efforts to deepen our knowledge of these egg predators, including efforts to further confirm that this is indeed a new species and learn more about crab egg mortality. The team has passed the baton to another group of student researchers.

"There are significantly more things to be done," Kuris said.

Tags
Ocean and Beaches

Media Contact
Sonia Fernandez
Senior Science Writer
(805) 893-4765
sonia.fernandez@ucsb.edu

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.