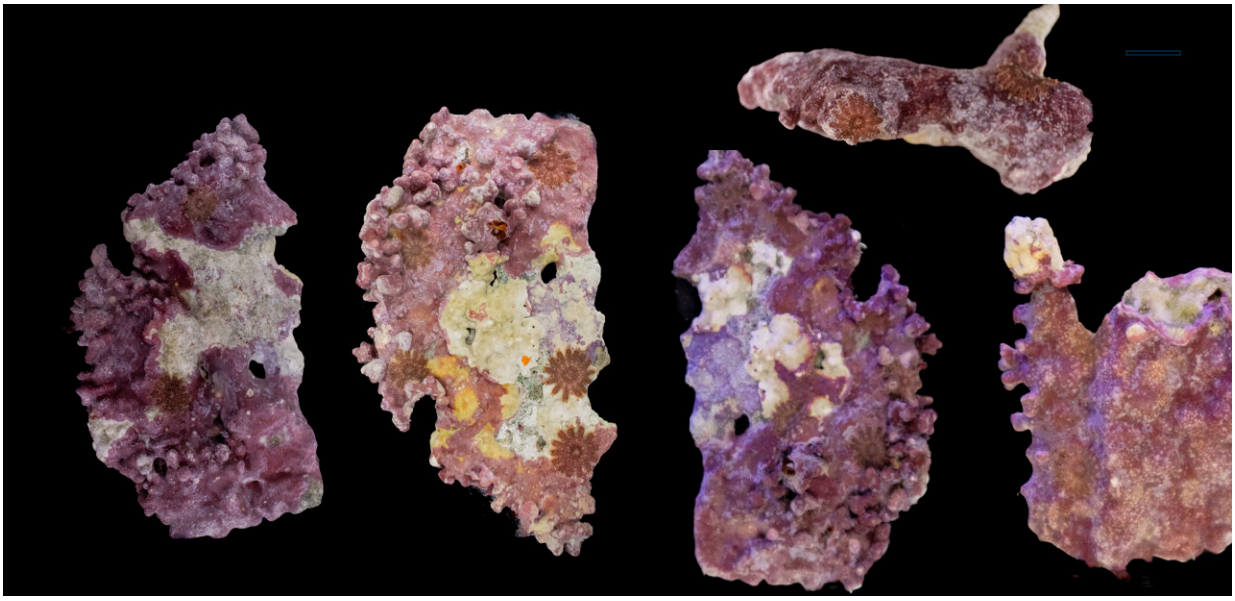
Crown-of-thorns starfish thrive in degraded coral habitats

September 9 2024



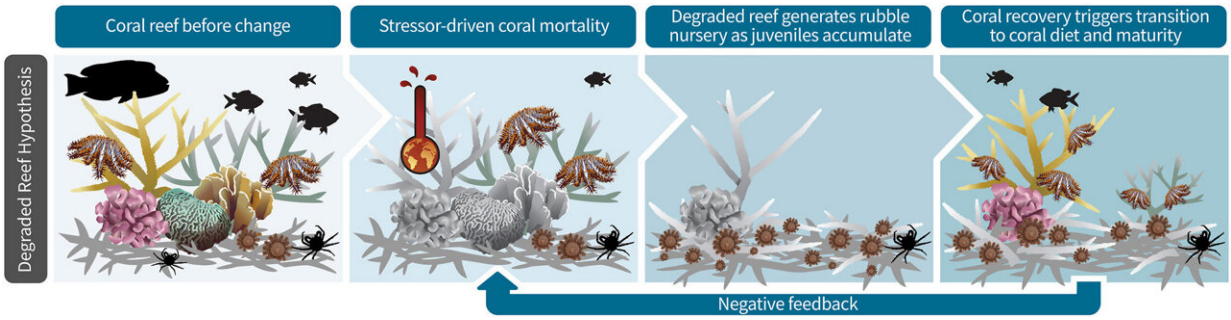
Crown-of-thorns starfish on coral rubble in the laboratory. Credit: The University of Sydney

Research into one of the most persistent coral predators on the Great Barrier Reef has revealed a troubling paradox in reef ecosystems: the crown-of-thorns starfish (COTS) appears to thrive in the very conditions of coral degradation it helps create.

This work, from Professor Maria Byrne at the University of Sydney and marine science researcher Dr. Kennedy Wolfe, sheds light on the

interactions between coral health and the population dynamics of COTS, offering critical insights for conservation efforts.

Professor Byrne from the School of Life and Environmental Sciences at the University of Sydney said, "This research reinforces our understanding that resilient species have the upper hand when adjusting to altered habitats. Unfortunately, in the case of the Great Barrier Reef, one of these resilient species—the crown-of-thorns starfish—is one of its most persistent coral predators."



Graphic: explaining the degraded reef hypothesis. Credit: Wolfe & Byrne/The University of Sydney

Coral reefs, often referred to as the "rainforests of the sea," are vital ecosystems that support a diverse array of marine life. However, these ecosystems are under severe threat from various stressors, including climate change, pollution and overfishing. Among the most significant challenges are outbreaks of COTS, which can decimate coral populations and lead to widespread reef degradation.

The study, published in the *Marine Environmental Research* journal, proposes a "degraded reef hypothesis," to better understand how COTS

remain so persistent, despite extensive efforts to manage their impact.

The degraded reef framework explains how the loss of live coral, which crown-of-thorns starfish feed off, paradoxically benefits juvenile COTS. As live coral diminishes, these starfish accumulate in rubble habitats, which serve as juvenile nurseries.

This accumulation of juveniles-in-waiting can promote a pulsed emergence of COTS as they transition into coral-eating adults when corals start to recover. This exacerbates the cycle of coral loss and reef degradation.

"Our previous research has shown that juvenile COTS can wait for just the right moment to emerge in large numbers; sometimes up to six years," Professor Byrne said.

Professor Maria Byrne and Ph.D. student Matt Clements on a crown-of-thorns

starfish survey on the Great Barrier Reef, Australia. Credit: The University of Sydney

Professor Byrne and Dr. Wolfe's research emphasizes that the very conditions that lead to coral degradation—such as heat waves, cyclones and pollution—create favorable environments for COTS to thrive. This resilience poses a significant challenge for reef management and conservation strategies, as efforts to restore coral health may inadvertently support the proliferation of these destructive starfish.

"Our findings reveal a critical feedback loop in reef ecosystems," said Dr. Wolfe, who started his research career as a Ph.D. student at the University of Sydney.

"COTS populations may thrive as coral reefs degrade, leading to further coral loss. This cycle not only threatens corals but also the range of species that depend on healthy reefs for survival," he said.

Professor Byrne said, "This feedback loop explains repeated outbreaks on the Great Barrier Reef, despite exhaustive management through manual culling."

These findings underscore the need for a multifaceted approach to coral reef conservation that addresses the root causes of degradation while also considering broad ecological dynamics at play.

Professor Byrne said, "Effective management strategies must account for the resilience of crown-of-thorns starfish and their ability to exploit degraded habitats. These coral predators are a symptom of ongoing environmental impact."

By understanding the relationship between coral health and COTS populations, conservationists can develop targeted interventions that mitigate the impacts of these starfish. This may include habitat restoration efforts that focus on enhancing coral resilience, as well as strategies to manage nutrient runoff and sedimentation.

This latest study adds to the impressive work that Professor Byrne and her team have undertaken, which has improved our understanding of how the crown-of-thorns starfish is able to persist as a pest species on the Great Barrier Reef.

More information: Kennedy Wolfe et al, Dead foundation species create coral rubble habitat that benefits a resilient pest species, *Marine Environmental Research* (2024). DOI: 10.1016/j.marenvres.2024.106740

Provided by University of Sydney