DEAN
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HKU Marine Scientists Reveal Giant Clam Feeding Strategy Could Determine Their Future Survival

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Image 1: The giant clam Tridacna gigas in a coral reef habitat. As one of the largest and fastest-growing giant clam species, it depends strongly on symbiotic algae that provide energy through photosynthesis.
Image credit: Isis Guibert

Giant clams (*Tridacna gigas*), members of the family *Tridacnidae* and among the most striking inhabitants of tropical coral reefs, are being driven towards extinction. Over-harvesting for the jewellery and aquarium trade, as well as for food, together with habitat loss and pollution, has severely reduced their populations. Climate change is now compounding these threats, making the situation even more precarious for these vulnerable animals.

There are many species of giant clams in the wild. Some are disappearing faster than others, but the reasons for these differences are not yet fully understood. Other species appear plentiful, yet it remains unclear how far into potential decline they may actually be, and such species may therefore be inadequately protected.

A research team from the Swire Institute of Marine Science (SWIMS) and the School of Biological Sciences of The University of Hong Kong (HKU) has helped address this question by developing an innovative mathematical model that allows conservationists to easily assess feeding strategies of different giant clam species. This knowledge can help conservationists to predict the future vulnerability of different giant clam species and identify those in need of timely protection.

Understanding feeding strategies in giant clams

Giant clams have two feeding methods. As animals, they eat organic matter by filtering it from the surrounding water. At the same time, they also rely on photosynthesis, much like plants do: symbiotic "partner" algae living inside the clam harvest sunlight and share the resulting energy with their hosts.

To determine how much each species relies on these two energy sources, SWIMS researchers used chemical analysis to identify the unique nutritional pathways of six giant clam species. By measuring natural variations in carbon and nitrogen isotopes in both the clams and their symbiotic algae, and integrating these data into a mathematical model they developed — HERS (Host Evaluation: Reliance on Symbionts) — the team quantified how strongly each species depends on photosynthesis versus filter-feeding.

Comparing these values across species showed that giant clams occupy different positions along a nutritional spectrum, with each species adopting a distinct feeding strategy. The fastest-growing and largest clams were found to rely more heavily on their symbiotic algae partners for energy. While this method may support rapid growth, it may also increase vulnerability. A strong dependence on light-harvesting symbionts could increase vulnerability to climate change, as these algae are sensitive to rising sea temperatures. Moreover, larger body size may further heighten exposure to over-harvesting, as such clams are more easily targeted.

These findings suggest that differences in feeding strategy may be vital for assessing extinction risk, offering conservationists a new framework for prioritising protection efforts.

"Giant clams are not just iconic reef residents, they are ecosystem engineers who play a crucial role in the health and resilience of coral reefs," said Dr Isis GUIBERT, Postdoctoral Researcher at SWIMS and lead author of the study. "Understanding how these nutritional strategies differ among species is key to anticipating their future under environmental change."

"Our findings highlight that the very traits which make these clams so impressive also put them at greater risk," explained Professor David BAKER, Interim Director of SWIMS and corresponding author of the study. "By revealing these hidden vulnerabilities, we can better focus conservation efforts where they are needed most."

"Our approach also sets the stage for future research on other symbiotic reef species, such as corals," Professor Baker added. "It's a step forward in understanding and protecting marine biodiversity."

This work, led by Professor David Baker and Dr Isis Guibert, was carried out in collaboration with researchers including Dr Cecilia Conaco and Dr Patrick Cabaitan from the University of the Philippines, Diliman, as well as Dr Ronnie Estrella, Director of the Semirara Marine Hatchery and Laboratory.

For more details, please refer to the journal paper "*Trophic niche partitioning in giant clams*" published in *Communications Biology:* https://doi.org/10.1038/s42003-025-09313-z

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Image 2: Close-up of the mantle of a giant clam (Tridacna gigas) in its natural reef habitat. The colourful tissue contains symbiotic algae that perform photosynthesis and supply energy to the host.
Image credit: Isis Guibert.

Image 3: Dr Isis Guibert preparing samples for analysis at the Semirara Marine Hatchery and Laboratory as part of the giant clam research project.
Image credit: Ronnie Estrella.

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