

Corals under attack summon friendly fish

Chemical alarm enlists gobies to trim toxic seaweed.

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Coral threatened by toxic seaweeds emit a chemical cry for help that summons fish to eat away the danger.

When *Acropora nasuta* corals come into contact with the toxic seaweed *Chlorodesmis fastigiata*, they release a chemical that brings out “inch-long bodyguards” in the form of gobies, fish that live in the crevices and crannies of the coral, says Mark Hay, of the Georgia Institute of Technology in Atlanta. Hay and his colleague Danielle Dixon found that gobies were summoned within minutes of seaweed contact.

Working in the waters off Fiji, the researchers observed that corals with resident gobies saw a 30% decline in the seaweed's abundance after three days, whereas no change was seen in control corals over the same period. The fishes' stomach contents indicated that one species of goby (*Gobiodon histrio*) ate the seaweed, whereas a second species (*Paragobiodon echinocephalus*) merely trimmed it back. *G. histrio* seemed to gain an added benefit in return, by becoming more toxic to predators after eating the seaweed. Their study is published today in *Science*¹.

To test whether the corals were actively alerting their residents to the threat, Dixon and Hay exposed gobies to water from a selection of locations. Water from around the seaweed itself failed to generate any response in the two goby species. But seawater taken from points where the seaweed was in contact with coral caused the gobies in 20 separate coral colonies to move towards that source. When the experiment was re-run with a related coral species, no response was seen, which Hay likens to knowing that it is your burglar alarm going off, and not your neighbour's.

Have-a-go gobies

Other residents of the corals were not so good at neighbourhood watch. Damselfish exposed to the odour simply abandoned their coral homes within 48 hours. Hay says the damselfish seem to think “The neighbourhood is going to hell, we're out of here. But the gobies both come out and trim the algae.”

Although the researchers cannot rule out the possibility that the fish are picking up on a chemical the corals might release in response to any kind of stress, Hay says “the balance of the evidence is it could well be a signal that the coral is sending” to the gobies.

Gobies often spend their entire lives on the same coral colony and Hay likens the relationship to that seen between ants and acacia trees, in which the plants provide spaces for the insects to live and in return are ferociously defended by them. Many other land plants are known to release signals when under attack from herbivorous pests that attract predators of the pests.

Finding the links

But teasing out such links is difficult. “The sensory basis for ecological interactions remains enigmatic, especially in marine habitats,” says Richard Zimmer, who studies chemical signalling between organisms at the University of California, Los Angeles. “This research by Dixon and Hay bridges the gap” between cause — in this case the chemical signal — and the effect on the ecosystem.

Thomas Breithaupt, who researches the sensory ecology of aquatic animals at the University of Hull, UK, says that chemical signals are hugely important in aquatic ecosystems, but that they are relatively unexplored.

“Compared to terrestrial systems, there's still very little knowledge of chemicals moderating these interactions in aquatic environments,” he says. “Dixon and Hay did a great job of showing how important chemicals are. It's one of those examples where we really get an interesting insight into a snapshot of ecology of a coral reef.”



Danielle Dixon

Gobies rescue the coral they live on from toxic seaweed after responding to a chemical cue.

References

1. Dixon, D. & Hay, M. *Science* **338**, 804–807 (2012).