HONDURAS DISSERTATION/THESIS PROJECT

HO26 Reefs at war: the disruptive impact of Damselfish

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Damselfish are a common family (Pomacentridae) of small fish that live on coral reefs throughout the tropics. They are well known for their aggressive defence of their territories, and they are not afraid to attack fish many times larger than themselves, or even to attack SCUBA divers if they happen to get too close! What makes this group of fish even more interesting is that some species actively farm algae. To do this, they kill small areas of coral and then tend to the algal garden that grows in its place. These farms then form their primary food source.

While the idea of tiny fish tending to tiny gardens might sound cute, in reality it is an ecological problem. There is an age-old war taking place on coral reefs between groups of benthic organisms competing for one of the ecosystem's most limited resources - space. Scleractinian (hard) corals are the ecosystem architects of coral reefs, responsible for the complex 3D structures that support these hyperdiverse communities, but they grow incredibly slowly. Macroalgae (seaweed) grows much faster, and is ready to exploit any free space on the reef. Coral reefs naturally exist in water with extremely low nutrients (oligotrophic), which is one of the reasons behind the picture postcard clear blue water, and this limits the growth potential of macroalgae. Any macroalgae that does grow is then kept under control by populations of herbivores. These two mechanisms help to maintain coral dominance and allow the ecosystem to thrive. However, increases in nutrient concentrations (e.g. from fertiliser or sewage runoff) and loss of herbivores (e.g. from overfishing or disease) can shift the balance in the favour of macroalgae, and this phenomenon is called a phase shift, turning coral reefs into algal reefs.

The damselfish problem is even more complex. Although they feed on macroalgae, which in other circumstances would be good for the reef, their farming methods mean they are increasing the cover of algae at the expense of corals, rather than reducing it. Their aggressive behaviour also prevents other herbivores, that would normally have a more beneficial impact, from feeding within their territories. To make matters worse, because of their small size damselfish generally aren't of interest to fishers, but their larger predators (e.g. Graysby groupers) are commercially valuable, meaning damselfish numbers are often allowed to explode, which further increases the overall negative impacts they are having.

This project will take place on the Banco Capiro reef system in the Honduran mainland bay of Tela. This is a fascinating reef system, because it boasts one of the highest levels of hard coral cover anywhere in the Caribbean. The area has historically been heavily fished, meaning there are likely very few damselfish predators and thus an ideal reef for damselfish to dominate. One of the primary drivers of such high levels of coral is an unusually dense population of the sea urchin herbivore *Diadema antillarum*. This species was all but wiped out throughout the Caribbean by a disease in the 1980s, and Banco Capiro is home to one of the last surviving healthy populations of this species. Previous research has shown damselfish to alter the distributions of *D. antillarum* through their

aggressive behaviour, and so increases in damselfish numbers could threaten both the *D. antillarum* population density but also the long-term health of the coral community.

This project will seek to explore the role of damselfish on such a unique reef, and estimate the level of threat they pose to the future health of the Banco Capiro reef system. This is of particular importance as the reef has recently been designated a Marine Protected Area (MPA) by the Honduran government. Students could conduct detailed surveys of the damselfish communities and overlay these onto similar surveys of *D. antillarum*. The presence and spatial coverage of algal farms could also be recorded. More ambitious projects could incorporate a behavioural element to this research by quantifying aggressive interactions by the damselfish, or could even remove damselfish from certain areas of reef to monitor any immediate ecological benefits.

Recommended Reading

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