

The invisibility cloak of filefish



Few sensations beat the smell of fresh coffee in the morning, beckoning you from bed and directing you to the kitchen. But in a diner, all is lost. The sharp recognizable coffee odour is swallowed in a sea of sensations from dozens of coffee cups at dozens of tables, and I am distracted by other

smells (bacon mainly). By blending in with their surroundings, prey animals camouflage themselves in much the same way. They hide in plain sight, and for these species, not being seen, heard or smelled is a matter of life and death. But how do prey animals ensure a convincing match with their surroundings? An exciting new paper by an international team of researchers led by Rohan Brooker in *Proceedings of the Royal Society* found that for some fish the answer lies in their diet.

Harlequin filefish live in coral reefs where they feed on coral polyps of one particular genus. The problem is, they are not alone. The reef is a busy place and while the filefish focus on eating coral, other bigger fish focus on finding and eating them. Previous work from Brooker and his colleagues found that filefish visually mimic their coral prey to escape predation, but here they posited that filefish also use another form of crypsis mediated by chemicals and olfaction. Chemicals travel easily in water and predatory fish are known to sniff out prey.

To determine whether filefish avoid detection using chemical crypsis, the researchers established two groups of fish and fed each one an exclusive diet of one of two corals. They then gave coral-eating crabs a choice, based on odour alone, between their favourite coral and a fish from either of the two treatment groups. When the crabs were given their favourite coral and a fish reared on their less-preferred coral, they unambiguously chose the coral. However, when the crab could choose between coral and a filefish fed on the same coral, they found that the crabs couldn't always tell the two apart.

Incredibly, a filefish that had eaten coral smelled enough like the real thing to trick a true connoisseur!

But what about the fish that matter most: predators? They too failed to take the bait. When predatory cod were placed in a tank with coral and filefish fed on the same coral, the cod swam about lazily. But when faced with filefish fed on the alternative coral, the predator picked up pace and went on the prowl. And finally, when cod were confronted with two fish, one odour-matching the background coral and the other not, the cod made a bee-line for the mismatched filefish expecting a meal. Meanwhile, the matching filefish basked in safety.

Although the mechanisms of filefish chemical mimicry remain elusive, the benefits of doing so are immediately evident. Equally, they suggest an impressive flexibility in multimodal camouflage. First, filefish hide by matching the colours and shape of their coral diet. Second, they coat themselves in compounds that render them effectively invisible to their predators. If filefish can engineer this trick with other food items, it would permit safe passage across the reef. Furthermore, like a chef preparing the perfect curry, filefish could potentially mix and match the food they eat to maximize the efficacy of their protective cloak.

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Brooker, R. M., Munday, P. L., Chivers, D. P. and Jones, G. P. (2015). You are what you eat: diet-induced crypsis in a coral-feeding reef fish. *Proc. R. Soc. B* **282**, 20141887.

Daniel E. Rozen
University of Leiden
 d.e.rozen@biology.leidenuniv.nl