

Fish camouflage sends mixed messages to aggro males

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Dr Kelley and student Sam Lostrom capturing rainbowfish using a seine net in Karijini National Park. Credit: Jordan Iles.

Colour-changing fish have only one skin, but they use it to communicate social status, attract mates, avoid predators and more. So what happens when those functions collide?

By manipulating [skin colour](#) changes, UWA's Dr Jennifer Kelley studied the social function of [skin](#) colour in 126 western rainbowfish (*Melanotaenia australis*), captured from the Fortescue River in the Pilbara.

These [fish](#) change colour to match their environment, altering melanin levels in their skin over several days.

"If you put a fish on a black background, it darkens its skin; if you put a fish on a white background, it lightens its skin," Dr Kelley says.

It's a survival mechanism that helps the fish avoid predators.

However, like many species, large males also use dark colouring to display dominance over smaller males.

To determine the impact of social function on ability to change colour for camouflage, Dr Kelley's team experimented with different combinations of dark and light backgrounds for large and small males in the presence of a female.

She found smaller fish that darken their colour to match their surroundings end up bullied by bigger fish.

"If you increase your darkening, you're falsely saying, 'hey, look at me, I'm so big,' and the [dominant males](#) don't like that," she says.

The Loser Effect

Subsequent experiments indicated that males who were subordinate in a first interaction were less likely to darken their skin for camouflage, even when dominant in a second interaction.

"That was a completely unexpected result," says Dr Kelley.

"It's called the Loser Effect, and it's been shown in other animals.

"If you win one thing, you're more likely to win another.

"If you're a loser, you're more likely to lose again."

The results indicate that standing up to bigger fish is perhaps more dangerous than standing out to predators, at least in the lab.

The exact mechanism behind skin colour regulation is unknown, but "almost certainly linked to hormones," says Dr Kelley.

While it's easier to study guppies or zebrafish, Dr Kelley says she's more interested in understanding native fishes.

"The fish in this study are common, but we don't really know anything about them," she says.

Since their use of skin colour depends on their environment, an influx of mud, algae, or rainfall could change the signals fish are able to send with their skin.

"This could have huge implications for their ecology," Dr Kelley says.

"There are loads of functions of [colour patterns](#) that we're still trying to figure out...I think it's very exciting."

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