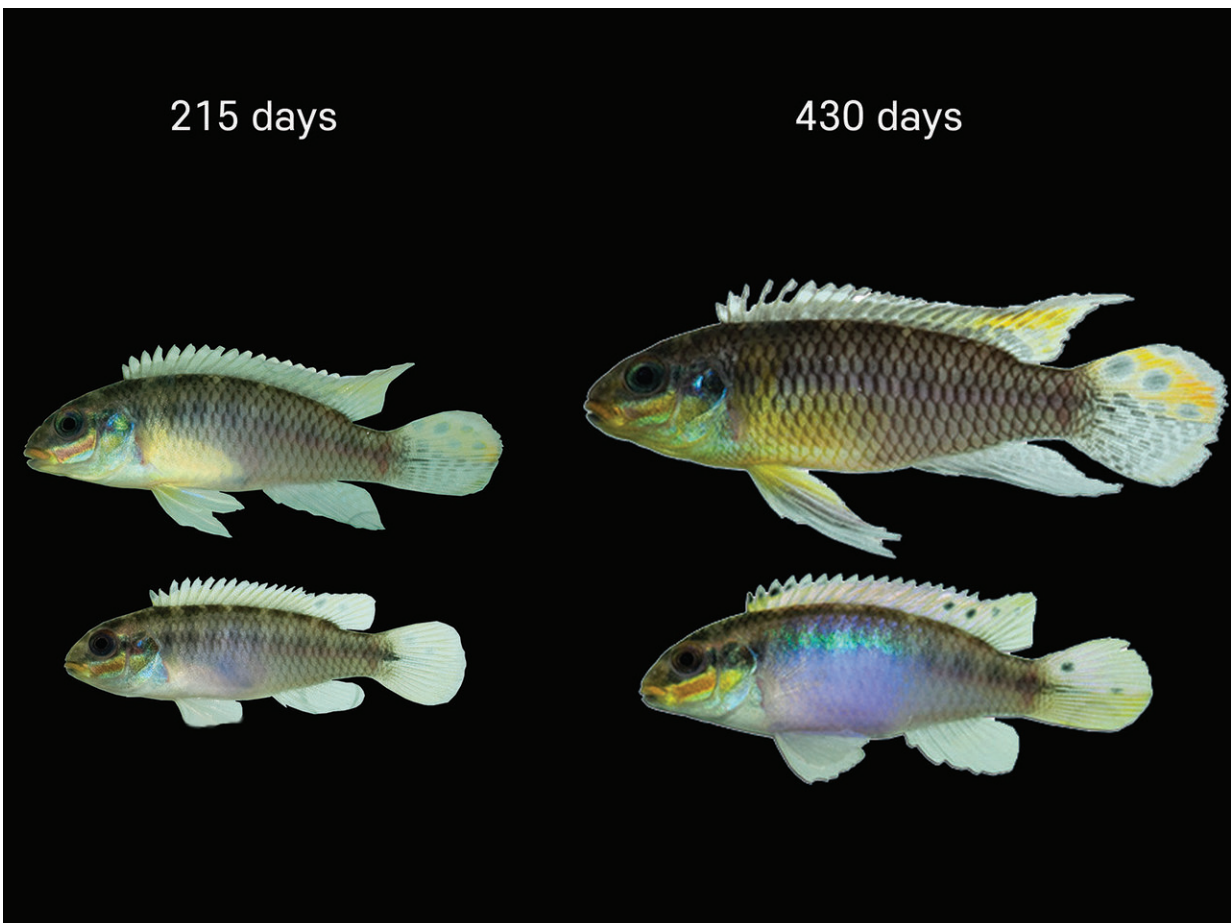


In a threatening environment, male cichlids delay the development of their striking color

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Cichlids usually develop conspicuous coloration after about 200 days at the onset of sexual maturity. But this is delayed in animals that feel threatened by predators. Credit: Dr. Dr. Denis Meuthen/Uni Bonn

Male cichlids that are constantly threatened by predators grow faster and postpone the full expression of conspicuous breeding coloration for longer. This is shown by a study by biologists from the University of Bonn. Thereby, the animals reduce their risk of becoming prey. However, at the peak of their sexual maturity the animals give up their retarded breeding coloration: Even under risky conditions, they then vie for their potential sexual partners with magnificent colors. The article appears in the journal *The American Naturalist*.

The African cichlid *Pelvicachromis taeniatus* certainly boasts magnificent [coloration](#): In the females, a purple belly and a blue-green shimmering side stripe signal the onset of [sexual maturity](#). The males however garner attention from potential sexual partners with bright orange and yellow shades. The striking coloration (evolutionary biologists also speak of "ornaments") has a significant disadvantage: It also catches the eye of potential predators. Biologists of the research group of Prof. Dr. Theo C.M. Bakker at the Institute of Evolutionary Biology and Animal Ecology at the University of Bonn have therefore investigated how the presence of predators affects the appearance of the fish.

To do so, they raised two groups of fish and observed them over a two-year period. In one of the two groups, they regularly added an extract obtained from conspecifics to the water. "When cichlids fall prey to a predator, alarm substances are released," explains Dr. Denis Meuthen, who has since moved to the University of Saskatchewan in Canada. "These alert other members of the same species of the imminent danger. The fish extract we used also contained such alarm substances."

Body size and paleness as life insurance

In all other aspects, the fish were kept under identical conditions. The researchers then took photographs of the cichlids at six different times

during development and compared these with each other. The images revealed some differences between the two groups: The males grew faster in the supposed presence of predators. They also developed larger eyes and the spines of their dorsal fins were longer.

"We assume that the animals reduce their risk of ending up as a [predator](#)'s meal this way," explains Dr. Timo Thünken. "Predatory fish have more difficulty catching larger prey with spiny fins and have problems swallowing them. Additionally, large eyes may help detect predators faster."

There was also another discovery: At the beginning of their sexual maturity, the males were more discreetly colored than their counterparts from the tank without alarm signals. This too was probably an adaptation to the supposedly increased risk of being eaten.

Surprisingly however, the differences were only present in males. The reason for this may be a consequence of the way of life of this cichlid species: The females deposit their eggs in breeding caves and care for them intensively. The males on the other hand tend to stay outside the caves and defend the surrounding area against rivals and egg predators. "They are therefore far more exposed and more likely to fall prey to an enemy," explains Thünken.

However, courtship coloration development was delayed in males. At approximately one year age, the animals from both groups had the same conspicuous color. "The ornaments are important social signals," explains Meuthen. "Towards one's own sex, conspicuous coloration is a signal of dominance. At the same time it attracts females looking for a mate." In other words: Less conspicuous males may live longer—but they often stay single.

More information: Denis Meuthen et al. Neglected Patterns of

Variation in Phenotypic Plasticity: Age- and Sex-Specific Antipredator Plasticity in a Cichlid Fish, *The American Naturalist* (2018). [DOI: 10.1086/696264](#)

Provided by University of Bonn

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