

Study finds cloudy waters may drive African fish to develop bigger eyes

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The African Blue-Lips cichlid. Credit: The Ohio State University

Variations in water quality can impact the development of the visual system of one species of African fish, suggests a new study.

The research, led by Jai Tiarks, a recent graduate alum in environment and natural resources at The Ohio State University, found that age was a deciding factor in whether fish could successfully cope with new conditions in their underwater environment.

The study in the Blue Lips cichlid, a species native to swamps and lakes of Uganda, showed that the eyes and pupil size of young fish raised in cloudy water grew larger than those of fish raised in clear water. This phenomenon happened regardless of the environment each brood's parents originated from.

The [study](#) was recently published in the *Journal of Experimental Biology*.

Vision is a vital sense for many creatures, as being able to navigate their surroundings well gives them an edge when it comes to holding onto their spot in the food chain. But when an ecosystem is bombarded with new environmental stressors, most organisms in the [animal kingdom](#) have three ways they respond to the negative outcomes.

Those choices, said Tiarks, are to adapt, move to another location, or die out.

"Cichlids are known for filling a huge diversity of different ecological niches and being able to adapt to changes in their environment," they said. "That has driven a lot of interest from an evolutionary standpoint, especially for the timescale that this adaptation occurs."

To learn more about how and when these adaptations occur, researchers raised half of a brood of fish in tanks with clear water and placed the other half in tanks with cloudy water.

Researchers then measured the diameter of the eye and pupil of both the young fish and adult cichlids in the experiment, determining younger

populations had indeed gained traits that allowed them to grow larger eye structures in response to cloudy waters.

"When the cichlids were young, they had this huge plasticity and were able to alter their physiology in order to cope with the turbid environmental conditions," Tiarks said. "But when we looked at the fish that were older, they didn't have that same flexibility."

The study also makes note of an overall difference in the pattern of eye and brain sizes between young and old fish. Originally, the team expected to find that fish reared in murky water would exhibit larger brains than those reared in clear water, since having bigger eyes doesn't mean much if the brain doesn't evolve to process that visual information.

Instead, digital photographs of their biological systems revealed that older fish had bigger brains and optic lobes relative to their length and brain mass compared to the relative sizes of those structures in younger fish. This could indicate that similar to mammals, fish experience different sensory demands at various stages throughout their lives.

It's still unclear if many of these changes are brought on by outside environmental variables like the amount of oxygen in the water or [physical changes](#), like sexual maturation.

The issue of growing up in clear versus murky water is a real one for the Blue Lips cichlid, especially with changing ecosystems in their African habitat.

Deforestation is one of the leading causes of rising habitat destruction and murkiness in rivers and lakes. When trees are cut down, the stability of the nearby soil is uprooted, leading to deposit of sediment into nearby aquatic systems, said Tiarks.

"Anytime there's a storm, all of that soil, sediment and vegetation that was held in place by trees isn't held in place anymore," they said. "It all ends up in whatever body of water is nearest, and it's a direct stressor to our field sites and the populations that live there."

Studies like this one suggest that as human-induced environmental change continues to worsen, certain animal populations like [fish](#) may be able to persist even in less-than-ideal habitats.

To Tiarks, this phenomenon offers some measure of hope that humans' negative influence on the environment isn't as life-altering for all species as it currently seems.

"We are causing and driving changes within these fishes' systems," said Tiarks. "But holding on to examples of species that can actually cope with the changes happening around them is a good reminder of how powerful and flexible nature is."

More information: J. H. Tiarks et al, Turbidity drives plasticity in the eyes and brains of an African cichlid, *Journal of Experimental Biology* (2024). [DOI: 10.1242/jeb.246708](https://doi.org/10.1242/jeb.246708)

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