

In a sea of fish diversity, scientist finds six new species of cichlids

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The new species *L. rubidorsalis* is named for the brilliant red fin on the middle of its back. Credit: Credit: Michael Pauers

In 2018 and 2020, Michael Pauers traveled 8,500 miles to go fishing in Lake Malawi, but not with a pole and lure. He and his research

colleague, Titus Phiri, were collecting and describing cichlids—best-known as a popular aquarium fish—with the aim of finding new species in the wild.

As Pauers, an associate professor in the UWM College of General Studies, sifted and winnowed in the lake waters, a blue specimen with a red dorsal fin caught his eye. Other [cichlids](#) sport that color combination, he said, but this one stood out.

"It was gorgeous. I could not believe just how bright and saturated the colors were," Pauers said. It was one of six new cichlid species in the genus *Labeotropheus* that he and Phiri found, with the help of professional divers, on the trips. They named it *rubidorsalis*.

Cichlids represent the most diverse adaptations of vertebrates in the world, and most of them—some 2,000 species and probably more—live in the freshwater African Great Lakes. There are so many species that categorizing them, a field called taxonomy, is ever-changing.

Pauers and Phiri, a research scientist with the Malawi Department of Fisheries, are interested in why there are so many species and why new ones are popping up all the time. But they're also interested in cataloging the full spectrum of them, which are spread across 73 genera. The cichlid genus that Pauers studies, *Labeotropheus*, is found only in Lake Malawi, along with 600 other species exclusive to the lake.

Filling out a genus

When Pauers was in [graduate school](#) at UWM, there were only two known species of *Labeotropheus*. By the time he described three new ones in 2016–17, he was on the faculty of his alma mater. His discoveries then marked the first time in 60 years that species had been added to the genus.

Then, he and Phiri described six more species they collected during the 2020 expedition. They published their findings in the journal *Ichthyology & Herpetology* in May. Pauers now has been involved in identifying nine of the 11 known species in this genus.

And the scientists who find a [new species](#) get to name them—within the scientific guidelines, of course.

After examining one of his first specimens of a new species, he had trouble naming it, finally deciding on *Labeotropheus simoneae* in honor of his daughter, Simone. "Someone at my daughter's school mentioned that she had very rosy cheeks," he said. "And that is one of the distinguishing features of that fish."

Labeotropheus is unique because the fish feeds on algae that it scrapes off the rocks with its bottom jaw. To do this, it rests its bulbous nose on the rock while feeding. The mouth is very straight in this genus, forming the shape of "a half of a rectangle," said Pauers.

The huge lake's habitat variety is responsible for the cichlid's unparalleled diversity, Phiri said. Cichlids live in both shallow and deep water and have a wide array of diets, made possible by a second set of jaws set farther back in its throat, he said.

"My theory is that the lake is very old, and its formation had been gradual, creating different habitats over time," Phiri said. "The cichlid adapted to the various niches, forming different species that are very closely related to each other."

What makes a species new?

Many of the differences in the new species Pauers and Phiri found are in coloration, but they also found variation in body shape, and in the

numbers of teeth and scales. The pair also put cichlids under the microscope and measure their [physical features](#), an arduous task that few other scientists are doing.

In many cases, the distinctions are so slim, it could be a single feature separating one species from another. Complicating matters is the fact that females and males of the same species look different.

But taxonomy is complex, and adaptations don't necessarily give rise to a new species, Pauers said.

Scientists investigate whether the physical adaptations are linked to behavior, when determining a new species. And the variations in color patterns among the newly discovered species are associated with mating, Pauers said.

When females prefer to mate only with members of their own species, the color pattern of the males is a sign to females that a potential mate is suitable. Also, males are more likely to be aggressive to males of their own species because they recognize them as rivals, he said.

"So, they've already specialized anatomically," he said. "And that's leading to its behavior also diversifying."

With a new species, those differences also show up in their genes. "We just got a look at the 'whole genome' of our finds—not looking at the genes of any particular trait—and we have evidence for very distinct genetic separation among the new species," Pauers said.

No substitute for the real thing

To keep up with categorizing cichlids, scientists have moved some of the species from one genus to another or from the formerly huge genus

Haplochromis to an entirely new genus over the decades. After studying the Labeotropheus with existing specimens for nearly 20 years, Pauers was convinced there were more species, and determined to see them in their environment.

One aspect of the research that comes alive when experienced in person, he said, is how the cichlid's ecology informs their adaptability. For example, the team found three new species of Labeotropheus within a short distance from each other. "I thought, 'what could be keeping these species separate when there are no physical barriers?'" Turns out, habitat depth played a role.

Pauers has contributed around 500 cichlid specimens to the Milwaukee Public Museum following his trips. He and Phiri also have deposited specimens in the Field Museum in Chicago and the South African Institute of Aquatic Biodiversity in Makhanda, South Africa.

Specimens are essential to logging the changing taxonomy of the cichlids, he said.

"These are measuring sticks by which other scientists are comparing their specimens, if they think they found something that hasn't been discovered before."

More information: Michael J. Pauers et al, Six New Species of Labeotropheus (Cichliformes: Cichlidae) from the Malaŵian Shore of Lake Malaŵi, Africa, *Ichthyology & Herpetology* (2023). [DOI: 10.1643/i2021055](https://doi.org/10.1643/i2021055)

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