NEWS EVOLUTION

Study of 17,000 years of fish fossils reveals rapid evolution

Cichlid fishes weren't the first to colonize Lake Victoria—but they won the speciation race anyway

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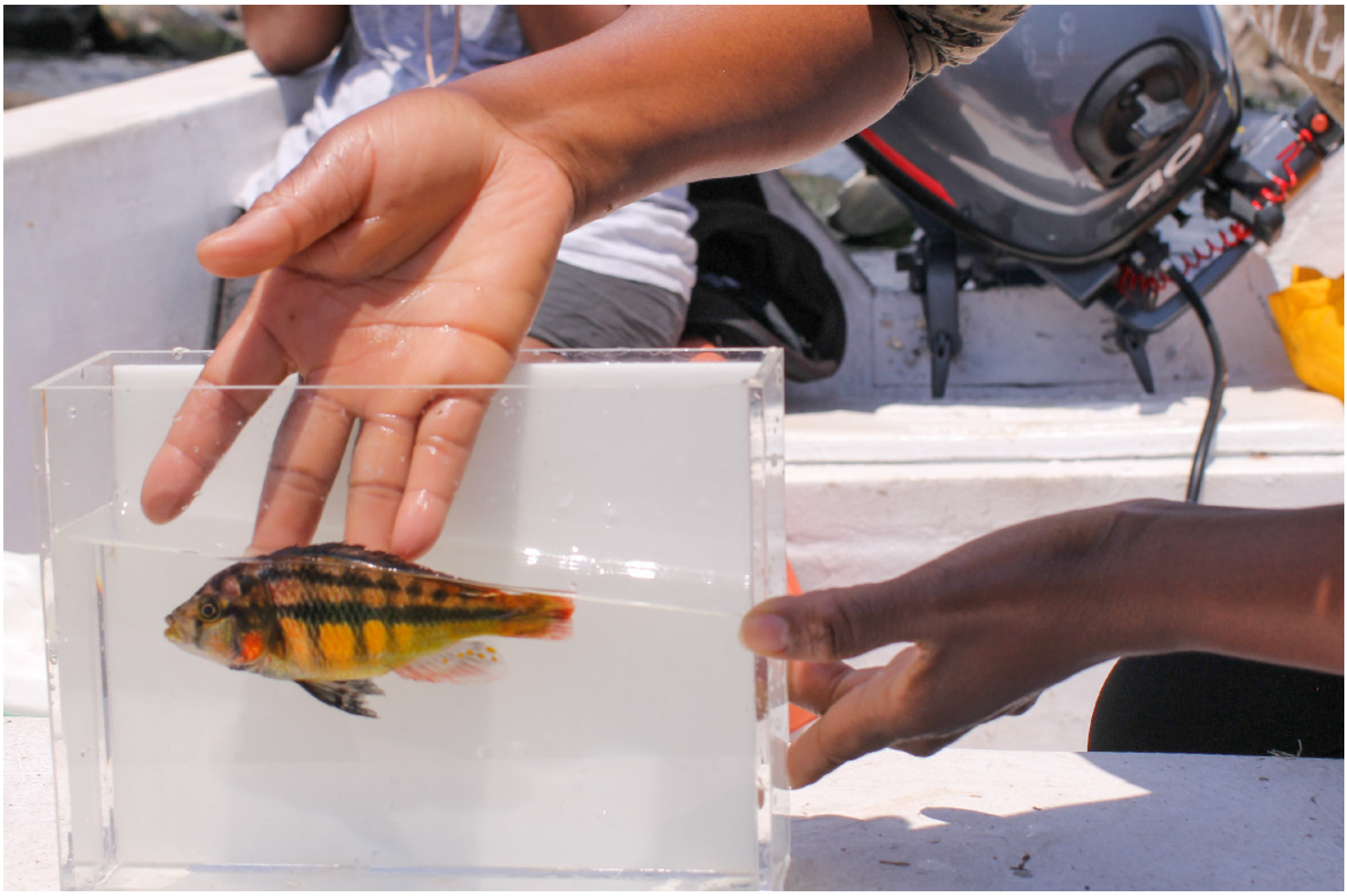

Researchers collected the rock kribensis (*Paralabidochromis sauvagei*) as part of ongoing work to understand the rapid evolution of cichlid fish in Lake Victoria. NARE NGOEPE

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When a new island or lake appears, the plants and animals that get there first have a leg up on later arrivals and are more likely to diversify into new species—or so evolutionary biologists have long assumed. But a study of fossils from East Africa's Lake Victoria shows that it takes more than arriving early to win the speciation race. Although several kinds of fish colonized this lake around the same time, only cichlids took off, forming 500 species in less than 17,000 years, the team reports today in *Nature*.

“The paper uses a very smart [way] to find a clear answer to a longstanding question, which is why certain groups of organisms are more successful at forming many species over a short period of time,” says Claudius Kratochwil, an evolutionary developmental biologist at the University of Helsinki who was not involved with the work. The findings suggest opportunity and versatility matter more than primacy, adds George Turner, an evolutionary biologist and cichlid fish expert at Bangor University who was also not involved.

Most cases of adaptive radiation, wherein one species gives rise to many more, took place over millions of years, making it nearly impossible for scientists to figure out why that one colonizing species became so successful. But the extreme diversity within a group of fish called cichlids began to arise a mere 17,000 years ago, when the modern version of Lake Victoria began to fill where today the borders of Uganda, Kenya, and Tanzania meet. Now 500 species strong—each inhabiting a particular niche within the lake—this group’s evolution represents “the most rapid radiation event known among vertebrates,” says Nare Ngoepe, an evolutionary biologist at the University of Bern.

To dig deeper into the origin of this diversity, Ngoepe worked with Bern ichthyologist Ole Seehausen and his team to identify 7000 fossilized fish teeth found in four cores extracted from the lake bottom as part of an interdisciplinary effort to reconstruct the lake’s history from sediments, pollen, and other core contents.

Early in the lake’s history, several types of fish—particularly cyprinoids, a group that includes carp and barbs—were found in its relatively shallow waters. “[Cyprinoids] were the dominant group for at least 1000 years,” Ngoepe says. Then, as the lake got deeper over time, it seems only cichlids took advantage of the deeper waters, whereas other fish remained in the shallows. Cichlids soon became the lake’s dominant fish, rapidly diversifying into ever more species and outcompeting other fish that also had an early advantage at colonizing the lake.

“[Ngoepe] has quite a neat and elegant way to see the whole picture,” Kratochwil says. “Cichlids did not have a head start.”

More likely, cichlids were able to diversify so rapidly because of their adaptability, Turner says. These fish have a second set of jaws inside their mouths, which can readily evolve to use new food sources. Cichlids of one species can generally breed successfully with those from other species, a situation that can lead to offspring with a unique set of traits. Females can also be fussy about their mates, and such picky sexual selection can accelerate their evolution.

The work “adds further evidence to the idea that evolution can take place very quickly” in certain circumstances, says Martin Genner, an evolutionary biologist at the University of Bristol who was not involved with the work.

As a next step, Ngoepe plans to study the teeth further to understand what these cichlids were eating during these thousands of years of rapid evolution. “Their tooth structures hold vital clues about the types of food they feed on,” she says, and can further explain why these fish were so successful.

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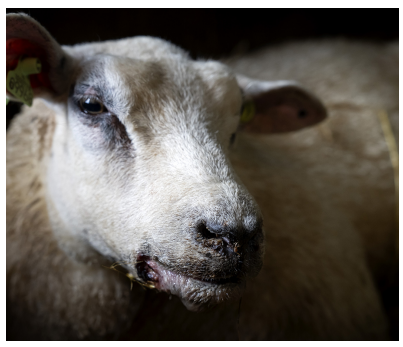

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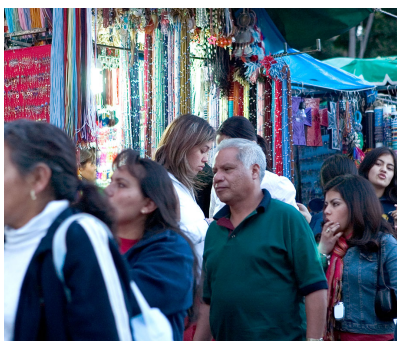

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