Go Fish

BY JEFFREY KLUGER

When it comes to evolving, the African cichlid doesn't dawdle. In Lake Victoria 200 species have appeared in less than 750,000 years.

ONE THING YOU CAN say about evolution is that it takes its own sweet time. In at least one place, however, it appears that evolution has hit the fast-forward button: a recent study of Africa's Lake Victoria suggests that dozens and dozens of new species of fish have been popping into existence in spans of thousands—rather than millions—of years.

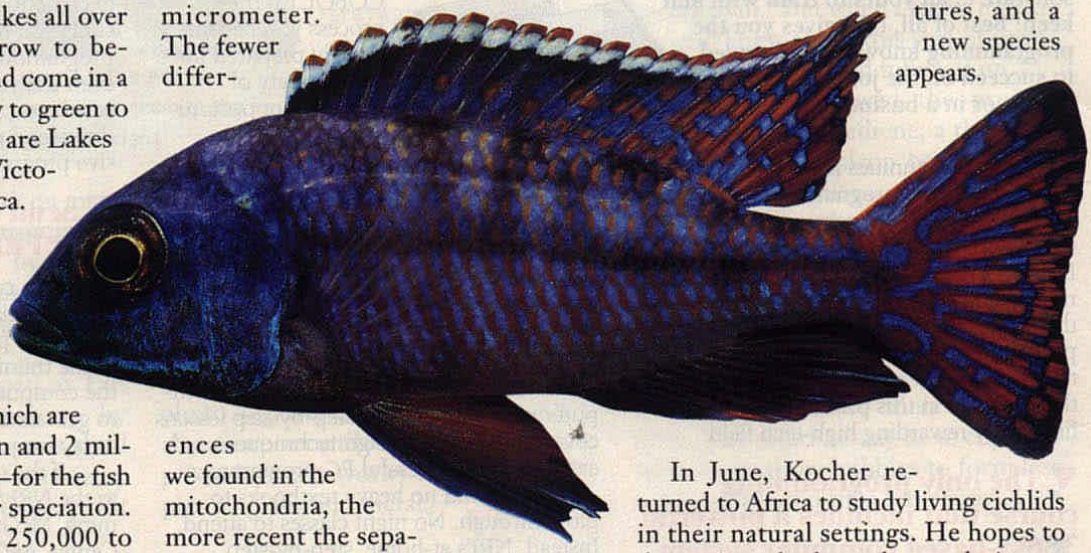
The prolific fish in question are African cichlids, found in lakes all over the continent. Cichlids grow to between two and six inches, and come in a palette of colors from yellow to green to blue. Three cichlid hotbeds are Lakes Malawi, Tanganyika, and Victoria, all in southeastern Africa. Each is home to at least 200 species, most distinguished by differences in the jaw, lips, and head.

So many different cichlids is not surprising in Tanganyika and Malawi, which are old enough—up to 4 million and 2 million years old, respectively—for the fish to have had ample time for speciation. Victoria, however, is only 250,000 to 750,000 years old, and seemingly too young to have spawned such variety. Did the fish migrate into the lake at a time when it was linked by streams to other nearby lakes, or could 200 different species have arisen in as little as a quarter-million years?

"Victoria is a puzzle," says evolutionary biologist Axel Meyer of the State University of New York at Stony Brook. "How can you have so many species appear in so little time?" This past year Meyer, University of New Hampshire zoologist Thomas Kocher, and several other researchers began investigating 14 species of Victoria cichlids, looking for differences in DNA by which they might reveal the fishes' family tree.

Cells store their DNA in two places: the nucleus and the mitochondria—sausage-shaped organelles that help regulate metabolism—and it was the mitochondria that Meyer and his colleagues needed to look at. Mitochondrial DNA mutates about ten times faster than nuclear DNA, keeping a far more accurate record of when species diverge and how far apart they move.

"Nuclear DNA lets you measure an organism with a yardstick," says Kocher. "Mitochondrial DNA lets you use a micrometer. The fewer differences we found in the mitochondria, the more recent the separation into species would be."



The researchers found not just few genetic differences but almost none at all. In species after species, an average 99.5 percent of the mitochondrial DNA was identical. "This is an incredibly low differentiation among species," says Kocher. "In fact, it's less than you usually find between two members of a single species." The finding left little doubt that these animals indeed arose from one ancestor and did so within the thus-far brief life of Lake Victoria.

CICHLIDS COME IN MANY COLORS—AND EVEN MORE SPECIES.

Even as the study answered this question, it helped raise another: What was it that was driving so much speciation? Kocher suggests some answers: "Cichlids have an interesting adaptation in the throat," he says. "The fish have developed unusually strong pharyngeal muscles that allow them a lot of latitude in processing food—from crushing mollusks to mashing algae." When it becomes evolutionarily advantageous for cichlids to adapt to another kind of food, they already have the muscular hardware to handle it. All they need to do is evolve specialized jaw and mouth structures, and a new species appears.

In June, Kocher returned to Africa to study living cichlids in their natural settings. He hopes to determine whether other evolutionary prods such as sexual selection could account for the rapid speciation. Cichlids have a complex mating system: to attract females, the males build bowers, piles of sand whose shape varies from species to species. Females who show a preference for a certain shape of bower could segregate a species into two populations in which differences could be amplified.

"It's not just specific foods that trigger speciation," Kocher says, "but specific behaviors. We want to see those behaviors at work." D

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