

Rainbow of Cichlid Fish Colors Is Disappearing

By CAROL KAESUK YOON

In recent years, hundreds of the fast-evolving fish species known as cichlids that swim in Africa's Great Lakes have been going extinct under the stresses of pollution and introduced predators. Now researchers report that even more of these colorful little fish are being driven out of existence by an entirely unexpected problem: a curious glitch in their love lives.

A study in the current issue of the journal *Science* found that deforestation and farming have caused the lake water to grow so murky that female cichlids, which use the distinctive coloration of males to choose mates of their own species, have literally been left in the dark about the hues of the males they encounter.

Unable to tell blue from red from yellow, females are mating willy-nilly, and species are mixing in chromatic chaos. As a result, what was once a vast array of distinctly colored species is becoming a muddle of fewer species whose males are a pack of dingy and difficult to distinguish fellows.

Biologists said they were surprised to see that something that seems so subtle — how well females can see the colors of courting males — could lead to the large scale loss of species. Researchers said the new work called for a second look at where else humans might be altering the delicate, and often hard-to-fathom sensory world of other species.

"The really mind-boggling thing about this paper," said Dr. Michael J. Ryan, an animal behaviorist at the University of Texas at Austin, "is that by making it harder to communicate, you can actually cause a species to go extinct. That really stunned me. This study is more than novel; it's unique."

Dr. John A. Endler, an evolutionary biologist at James Cook Univer-

sity in Queensland, Australia, said: "It's so new that no one's really thought about it before."

Ole Seehausen, Dr. Jacques van Alphen and Dr. Frans Witte, all at the University of Leiden in the Netherlands, conducted the study with cichlids in Lake Victoria. While the cichlids of the African Great Lakes are noteworthy for their speedy evolution and their myriad shapes, colors and habits, those of Lake Victoria stand out in particular. Thought to have evolved hundreds of new species in 12,000 years, the lake's cichlids are considered to be among the most quickly evolving creatures in the world.

It was already known that a major threat to the cichlids of Lake Victoria was the Nile perch, an introduced species known to be a voracious predator. But the team of re-

In cloudy water, confused fish breed indiscriminately.

searchers also found evidence that many species were going extinct in habitats not frequented by the perch.

For these fish, researchers said, the problem appeared to be the murk.

In a survey of 22 sites in Lake Victoria, researchers found that the better the light was in any given part of the lake, the greater the number of cichlid species found in that area and the more colorful the males, which Mr. Seehausen says can range across "all the colors of the rainbow." But where turbid water made it hard to distinguish colors, males were dull and species were few.

The key, researchers said, seemed to be what happens to females in

such troubled waters. In the laboratory, with the proper light, females consistently chose the distinctively colored males of their own species over those of other species. However, when researchers simulate the clouded water of Lake Victoria, blocking out the light needed by females to see differences in the brightness and hues of the males, females are effectively blindfolded. They mate indiscriminately, often choosing males of another species.

In Lake Victoria itself, researchers say, females appear to be similarly unable to tell one male from another. Without the evolutionary pressure of choosy females, males are losing their bright colors. Once-distinct species are interbreeding, and the once-dazzling array of species has degenerated into one or a few rather drab species.

These species have been considered distinct because in normal clear-water conditions, they do not interbreed. The species are so newly evolved that if they make mistakes during courtship and hybridize, they can produce fertile, healthy offspring.

Mr. Seehausen said the water of Lake Victoria and nearby lakes has become murky, in part, because of erosion from deforestation. And nutrients have run off farms into the water, causing microscopic plants known as phytoplankton to multiply, further clouding the lakes in a process known as eutrophication.

For behavioral biologists, the work opens up new questions. In the past, researchers have studied both the signals that males send to females and the sensory systems of females that perceive those signals.

But the new study suggests that the environmental background itself, not just the males and females in it, can affect courtship.

Researchers agree that the same kind of interference seen in murky water could easily be taking place in

A seemingly subtle change leads to a large scale loss.

other environments. For example, in birds, which often rely heavily on songs in courtship, noise from a factory or highway could conceivably disrupt communications.

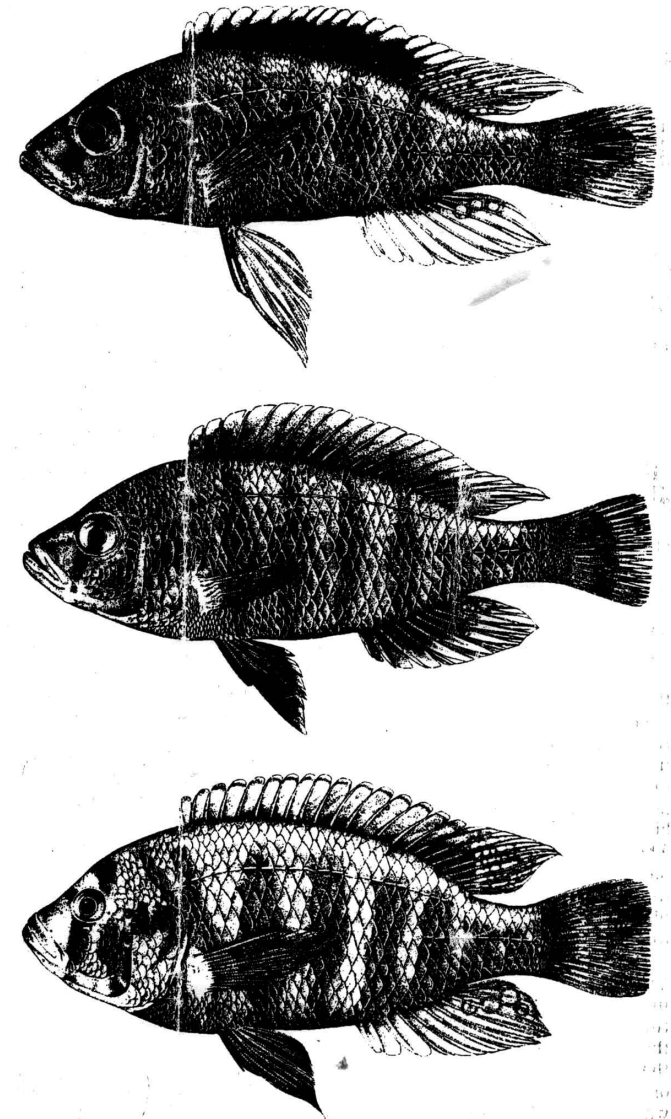
Dr. Endler already has evidence that light can be important in mate choice in guppies. He and his colleagues found that a female's choice of a mate was highly dependent on the nature of the light in which she saw him. Not surprisingly, Dr. Endler and colleagues have found that males tend to seek out and show themselves in their best light.

While researchers continue to track down causes of the extinction of cichlids in these lakes, which are considered to be among the best natural laboratories for the study of evolution, the outlook is bleak.

Not only does the Nile perch continue to devour cichlids, but the perch has also led to increased deforestation, said Dr. Axel Meyer, an evolutionary biologist and cichlid specialist at the University of Konstanz in Germany. To smoke the perch, fishermen cut down trees, adding to the problem of erosion and clouding of the lakes.

With deterioration unchecked, Mr. Seehausen suggests that Lake Victoria, which has already lost 60 percent of its species in the last 10 years, could easily lose 60 percent of what remains in the next 10 years.

"It's a super study," Dr. Meyer said, "but against the backdrop of this tragic situation. This very diverse evolutionary theater is threatened with closing, with extinction happening right in front of our eyes."



Drawings by E. A. Zwennes

When murky water blocks the light needed to discern color variations in three kinds of cichlid fish (top to bottom, black and orange nyererei, blue nyererei and zebra nyererei), the normally bright males develop dull colors, and the females are unable to find appropriate mates.