

The Color of Evolution: How One Fish Became Two Fish

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(PhysOrg.com) -- Ever since Darwin discovered that species can evolve, scientists have wondered how new species form. Answering this question is the key to understanding the diversity of all of life. A group of colorful fishes in Africa's Lake Victoria have been the focus of scientific efforts to unravel how new species form. This lake contains more than 500 species of cichlids, which play a leading role because of their rapid speciation and remarkable diversity. Still, the mechanisms involved in the rapid appearance of new cichlid species have remained elusive to scientists.

Now a new study highlighted on the cover of the journal *Nature* (October 1, 2008) suggests that species of Lake Victorian cichlids

became new species after changes in how they see led to changes in the mates that they selected. The group of biologists, which is led by Ole Seehausen of the University of Bern in Switzerland, and includes Karen Carleton of the University of Maryland, say that the phenomenon provides evidence that differences in sensory perception contribute to the development of new species.

For many years, scientists have linked evolution to the environment and suggested that new species arise when populations become geographically isolated from one another, thus forcing them to adapt differently. The idea that organisms living right next to each other can separate into two new species has been proposed, but difficult to prove.

The waters of Lake Victoria, which borders Uganda, Kenya, and Tanzania, are murky and red light penetrates deeper than blue light. In the shallow waters, the male fish tend to be green to blue, and in the deeper waters, the male fish are marked by a brilliant red. "These fish specialized to different microhabitats," Carleton explains, "which in this case is different depths. The visual system then specialized to the light environment at these depths and the mating colors shifted to match. Once this happened, these two groups no longer interbred and so became new species."

Carleton's previous research had identified long and short wavelength sensitive variants in one of the genes responsible for tuning the fish's vision to different depths. For this new study, the researchers sequenced hundreds of fish captured in the wild and showed that these visual variants segregate with depth and male color, supporting the idea that these fish have specialized to inhabit these micro niches.

The study is also significant because it shows the importance of lighting in the environment to the survival of the fish species, and the detrimental impact of pollution on biodiversity.

"With human activity contributing run off and algal growth in Lake Victoria, the water has been getting more turbid," Carleton says. "With very turbid water, the species can't distinguish each other anymore and so interbreed, leading to a loss of biodiversity."

Carleton's contribution to this study adds to a substantial body of research conducted by faculty in the College of Chemical and Life Sciences' Department of Biology that is seeking to understand animal communication and sensory systems and their role in speciation. Much of this research will be highlighted at the university's Bioscience Research and Technology Review Day 2008 on November 12. This year's program is organized under the theme of "Evolution and 21st Century Science" to coincide with the observance of Charles Darwin's 200th birthday.

Provided by University of Maryland

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