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Red Fish, Blue Fish, One Fish Becomes Two Fish

By Chandra Shekhar
ScienceNOW Daily News
1 October 2008

Beauty, as the saying goes, is in the eye of the beholder--and some fish have taken this idea to the extreme. Cichlids in Lake Victoria prefer males of different colors, which apparently led to separate species of blue and red cichlids. Researchers say the phenomenon provides evidence that differences in sensory perception--not just geography--can spark speciation.

The fish in question live in Lake Victoria, which borders Uganda, Kenya, and Tanzania. It's a diverse environment with water tending to be bluish near the surface and reddish deeper down. That disparity is reflected in cichlids in some regions of the lake; evolutionary ecologist Ole Seehausen of the University of Bern in Switzerland and colleagues have found that males in shallow water tend to be blue during the mating season, whereas males in deep water typically take on a reddish cast. Females of both species are yellowish, but they prefer to mate with either blue or

Competing colors. Blue male cichlids (*top*) live close to the surface of Lake Victoria, whereas red males dwell in deeper water.

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red males.

How did this happen? The team speculated that, over time, cichlid eyes adapted to either the bluish or the reddish ambient light, depending on where they lived. And indeed, when co-authors Yohey Terai and Norihiro Okada of the Tokyo Institute of Technology in Japan analyzed the fishes' retinas, they found that retinal pigments in shallow-water cichlids were more sensitive to blue wavelengths than those of their deep-water counterparts, which were tuned to red. As a result, females in shallow water would have an easier time noticing blue males, and deep-water females would have favored red males, the team reports in tomorrow's issue of *Nature*.

The males, for their part, would have evolved their colorations to suit the female taste. "Once this happens, these two groups no longer interbreed and so become new species," says study co-author Karen Carleton, an evolutionary biologist at the University of Maryland, College Park.

That adds a twist to the traditional view of how species form. Researchers usually link speciation to some sort of physical barrier, such as a river or mountain, which divides populations and causes them to evolve independently. What's more, the new study hints at how human activity could impact speciation, says Carleton: Water pollution, for example, could destroy the color gradients like those in Lake Victoria that spurred the evolution of the blue and red cichlids.

Trevor Price, an evolutionary ecologist at the University of Chicago in Illinois, says that the authors make a compelling case for speciation driven by sensory changes. However, he's not fully convinced that this can happen within a single population, as the authors suggest. He points out that the blue cichlids could have evolved in a different part of the lake and then spread into the range of the red ones, or vice versa. Nevertheless, Price says, the finding that the fishes' retinal pigments evolve to match the visual environment "is really cool."

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