

Evolutionary Puzzle in Fish 'Explosion'

By Jamie Talan

STAFF WRITER

Scientists exploring the rift lakes of Africa have netted a scientific mystery that raises questions about the current view of evolution.

In the deep waters of Lake Victoria and other lakes that cover the underwater valley that stretches across eastern Africa, biologists have found hundreds of species of cichlid, a tropical freshwater fish.

Using genetic testing, scientists have shown that all of the species have evolved from common ancestors within the past 200,000 years. What scientists call "explosive evolution" has taken place far too fast and created far too many species to be explained by current theory.

"These species are so similar genetically that they contain much less genetic variation than is found in the human population," said Axel Meyer, a molecular biologist at the State University at Stony Brook, who led the project. The findings were reported in the British journal *Nature* in October.

Scientists probed the genes and found that while the fish differ dramatically in shape and color, genetically they are almost identical. What's more, the speed of differentiation suggests that the fish mutated 100 times faster than they should have according to accepted theory.

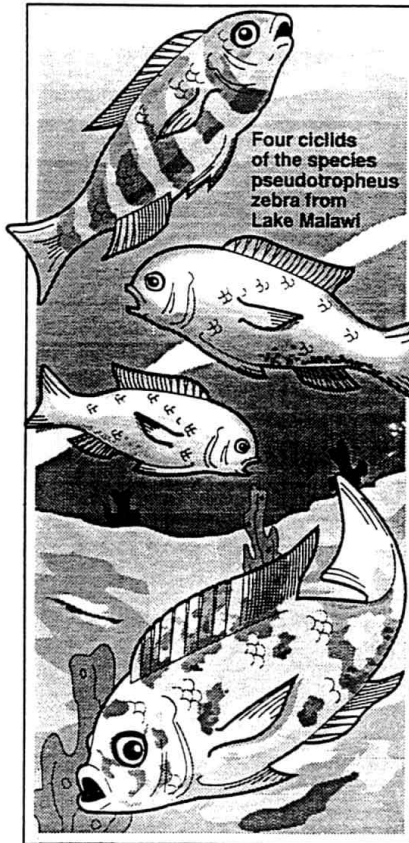
According to that theory, new species develop when genes are somehow altered, creating mutations. As mutations in a species accumulate, the organisms become less closely related to each other and to their common ancestor. Classic evolution theory says that different species compete with each other and that the fittest survives.

But in the lakes of the Great Rift Valley, hundreds of species seem to be coexisting rather than replacing each other.

That these fish changed so rapidly in appearance raises several questions: Can many competing species arise in the same environment without being protected by some natural, geographic barrier to block competition? Did the flourishing of the species take place at the same time, or was Lake Victoria divided at different times throughout history? Are cichlids exceptional and peculiar? If so, why?

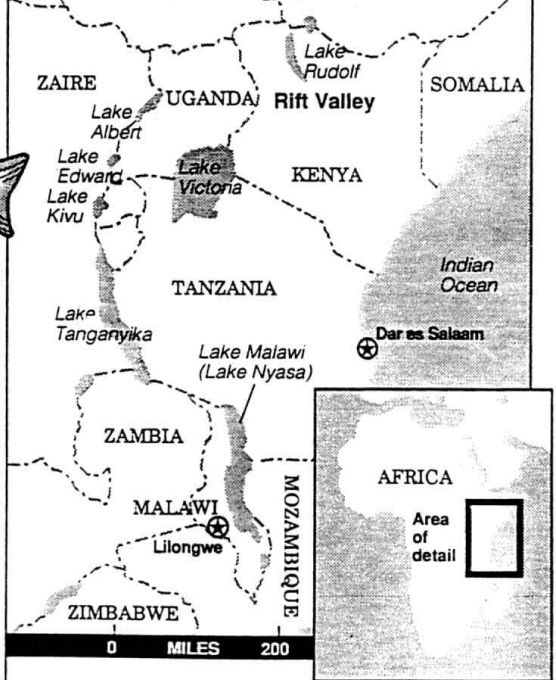
There have been other examples of explosive evolution but none so dramatic. Charles Darwin, the author of the theory of evolution, described 16 species of finches in the Galapagos Islands that evolved over 2 million years, a finding that pales beside the 500 species of cichlids that live in the African rift lakes.

Melanie L. J. Stiassny, assistant curator of fish at the American Museum of Natural History, also has an interest in cichlids and is trying to figure out the traits that have made the cichlid family so successful. She said that cichlids are found in freshwater lakes in South America, Africa, Madagascar and southern India, and that the oldest cichlid fossils are about 15



Evolution's New Wave

Cichlid fish found in the deep waters of Lake Victoria and other East African lakes provide evidence of what scientists call "explosive evolution" -- changes that have taken place far too fast and created far too many species to be explained by current theory.



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million years old. The modern species differ dramatically from one another in bones, color and behaviors, she said. She believes that the Meyer study is the strongest evidence to date of explosive evolution.

The key to gathering that evidence is the explosion in genetic testing. Scientists agree that genetic-testing techniques have revolutionized the study of evolution. Before scientists could collect and analyze DNA — the genetic material of life — traditional evolutionists based their analyses on classifying different species by anatomical traits.

The genetic work was carried out at the University of California at Berkeley, where Meyer worked with evolutionary scientist Allan C. Wilson. Wilson is well known for his work analyzing DNA snippets in the mitochondria, the cell's energy warehouse. Wilson and his colleagues have done studies suggesting that humans all evolved from one ancestor in Africa.

Meyer also used genetic techniques to study two other fish species with very similar behaviors living in separate lakes, Lake Victoria and Lake Malawi. The two species share the same bizarre way of killing snails by twisting their bodies until the flesh pops out. Scientists found it hard to believe that the same behavior could have arisen more than once.

But according to the DNA studies, the two species

did evolve independently. "All the species in a lake were more closely connected to one another than species in the other African rift lakes," Meyer said.

The use of genetic testing techniques also has led Meyer to question the standard history of how creatures moved from water to land. Meyer has genetic evidence that suggests that the first creatures to live on land evolved from lungfishes, and not from coelacanths, a family of fish that once were thought to have died out 80 million years ago. In 1936, a coelacanth was found in the waters off the Comorya Islands, near East Africa. Two others have been found since.

Today, six species of lungfish exist. About 400 million years ago, the creatures with primitive lungs and gills were everywhere.

Meyer collected tissue from each creature, extracted DNA, analyzed it and compared it with the genetic material from a number of land-roving animals with four legs.

"Based on the study, we saw that frogs were more similar to lungfishes than to coelacanths," Meyer said. Lungfish are found mostly in fresh waters.

"If my hypothesis is correct, you can build a picture of the fish that crawled on land," Meyer said. "It probably had lungs already." His study was published last month in the *Journal of Molecular Evolution*.