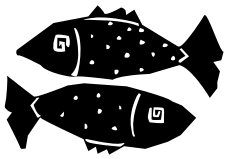

ScienceWatch – One Fish Two Fish

Until Darwin published his theory of evolution people believed that the number of species in the world was immutable, the same since the earth was created as described in Genesis. Today we know new species can and do form – see – *ScienceWatch – You Go Your Way And I'll Go My Way* (March, 2006). Scientists have been able to show that speciation occurs once a portion of the original population somehow gets physically separated (*allopatric speciation*) from the rest (*ibid*). For example, birds blown from the mainland to an island by a storm can accumulate genetic differences, which prevent them from interbreeding with those back on the mainland, resulting in two species.

However, in the case where all the group members live side by side (*sympatric speciation*) scientists have had more difficulty showing speciation. Sympatric speciation could take place if some individuals begin mating amongst themselves and not with others of the species. If this tendency occurs long enough for genetic differences to arise that prevent interbreeding between the groups, two species would result. Although it is common to see two closely related species living together, scientists could never rule out the possibility that one evolved somewhere else at an earlier time and later came to live along side its cousin. Now an article in the February 9, 2006 issue of *Nature* presents a clear-cut example of sympatric speciation.

Axel Meyer and his colleagues at the University of Konstanz in Germany have studied two species of fish, the Midas cichlid (*Amphilophus citrinellus*) and the Arrow cichlid (*A. zaliosus*), living in Lake Apoyo, a crater lake in Nicaragua. The lake is deep, about 200m (600 ft.), and was formed when a collapsed volcano filled in with rainwater about 20,000 years ago. While similar in appearance, the two species differ in several important ways. The Midas cichlid has a deeper body and bigger jaws than the longer, narrower Arrow cichlid, which has an elongated jaw. These differences imply that the two species eat different foods and analysis of stomach contents showed that the Midas cichlid feeds primarily on algae and other plant material growing on the lake bottom along the shore, while the Arrow cichlid feeds mostly on insects at the surface.

DNA analysis from over 100 specimens from Lake Apoyo showed that, while the two species are closely related and have diverged little from each other, they do not share many DNA sequences with other cichlid species in nearby lakes. This is strong evidence to show that colonization of Lake Apoyo occurred only once and that no genetic exchange has occurred since then. Moreover, a detailed comparison of genes from both species showed that they do not exchange genetic material, *i.e*., they are reproductively isolated even though they live together. This is further confirmed by differences in courtship behavior, which block the rare attempts at heterospecific mating.

Amphilophus species in other lakes resemble the Midas cichlid more than the Arrow cichlid, so Meyer believes the former is the ancestral form that may have blown into the lake on a hurricane. Once there, the deep lake provided two different habitats, a plant-laden bottom and an insect-filled surface. This allowed the deeper-bodied form to flourish, but also fostered the formation of a second, more slender body type because

slender fish could swim more easily through open water to catch insects. Moreover, offspring of matings among slender fish became even more slender. This enabled them to obtain more food in the open water, which translated into greater reproductive success for them. Meyer believes that it took 10,000 years or less for these favored matings to yield two groups, which developed different mating behaviors and eventually became reproductively isolated from each other. Clearly the old saying, "You are what you eat", operates on all levels of life.

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