Scientists get a line on lineage of fish family

By Alexandra Witze

If Charles Darwin had gone montoring in some East African lakes instead of tripping off to the Galapagos Islands, scientists might be talking today about Darwin’s cichlids instead of Darwin’s finches.

After all, biologists are now learning as much about the process of evolution from the cichlid family of fishes as Darwin did from his songbirds.

The finches helped prompt Darwin to formulate his theory of evolution by natural selection, years after his 1835 visit to the Galapagos. Darwin had noticed that finches on different islands evolved into highly adapted forms, each with a specially shaped beak to eat only insects, seeds or leaves.

The cichlids (pronounced seck-eelids) of Africa are at least as specialized. In three particular lakes, more than 1,000 separate species of cichlids dwell — an astonishing example of an evolutionary explosion.

Biologists have been fascinated ever since they discovered the explosive radiations of the African cichlids almost a hundred years ago. The wildly diverse fish are a prime subject for scientists studying how and why species evolve.

These bony, perchlike fish also live in the waters of Central and South America, Madagascar and Asia. But in East Africa, lakes Victoria, Malawi and Tanganyika harbor the greatest variety of cichlid species anywhere.

Axel Meyer, an evolutionary biologist at the State University of New York at Stony Brook, described the cichlids’ diversification in the August issue of Trends in Ecology and Evolution.

Lake Malawi alone is home to more cichlid species (at least 400 and possibly as many as 1,000) than any other lake in the world. There are more cichlid species in Lake Malawi than there are fish species in the freshwaters of North America and Lake Tanganyika, only 200 miles away, harbors about 170 different species; another 200 miles farther, Lake Victoria contains more than 300 species.

One reason the cichlids have been so successful in diversifying is that the different species have squeezed into almost every possible ecological niche. Different cichlids have specialized to a point that seems ridiculous.

Cichlids have two sets of jaws that help them develop unique hunting strategies. Their front jaws operate separately from the set of jaws in the back of their throat. The front jaws can capture prey in any manner of Please see DIVERSE on Page 9D.

DNA gives clues about species’ past

By Alexandra Witze

Traditionally, studying evolution meant digging for fossils. Scientists compared pieces of bone, feathers and fleas to figure out how life changed over time.

Today, the digging is more high-tech. Instead of fossils, researchers investigate the family of life using tiny fragments of DNA.

Studies of DNA are revealing surprises about how species evolved and how they are related, providing data to help conserve endangered species and even offer clues in understanding certain diseases.

"In the next 10 years, we should be able to get a very good picture of the evolution of life that we haven’t been able to do in the 130 years since Darwin," said S. Blair Hedges, a researcher at the Institute of Molecular Evolutionary Genetics at Pennsylvania State University.

Using new molecular tools to delve into the evolutionary past, scientists are redrawing the branches on the family tree of life. One recent study, for example, challenges the accepted notion that the kinds of bees that share highly advanced social behavior must be related to each other. Another paper has traced the ancestry of a widely diverse family of African fish to a single founding population in an old lake.

Other studies at elevation in the molecular level may help remove arguments about life in the distant past. New studies are fueling the debate about what kinds of fish crowded out of the ocean 400 million years ago and evolved into the first land-walking vertebrate.

Some molecular research aims toward planning for the future. Recent studies may help scientists decide whether conserving endangered species such as the Florida panther and the red wolf, is worthwhile, genetically speaking. By figuring out how closely related the living animals are, scientists can tell whether a species is already doomed to extinction through inbreeding because of its small gene pool.

Research has even focused on the evolution of bacteria and viruses. A new study traced the lineage of the bacterium that causes the venereal disease chlamydia. Understanding how Chlamydia trachomatis develops may lead to a vaccine that can curb the bacterium’s future changes.

All this work has prompted the number of scientific journals devoted solely to molecular evolution to jump from one in the 1970s to 20 or so in the past few years.

Molecular studies are becoming popular because looking at fossils doesn’t always show everything about the relationships between organisms, biologists say. Fossils reveal only the morphology, or form and structure, of an animal or plant. Molecular research doesn’t disprove everything either, but it can be an important piece in the puzzle of determining the history of life.

"It is almost impossible to study the evolutionary derivations of hac- Please see MOLECULAR on Page 9D.