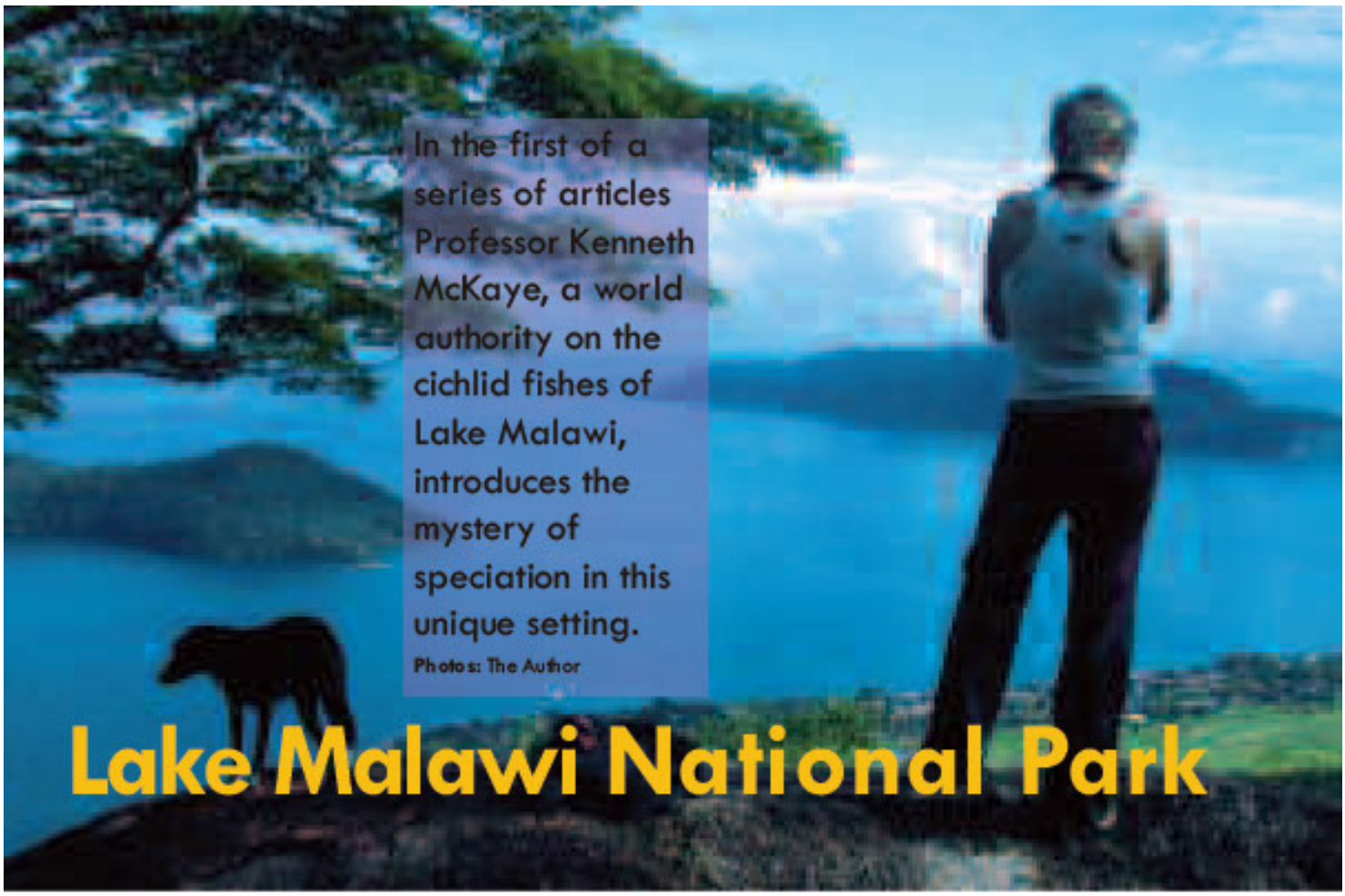
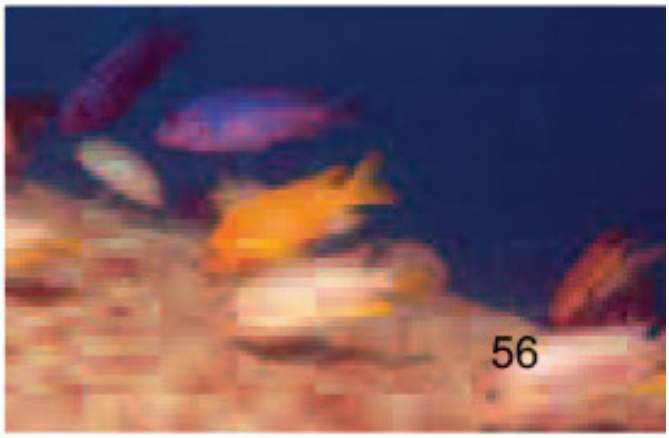


In the first of a series of articles Professor Kenneth McKaye, a world authority on the cichlid fishes of Lake Malawi, introduces the mystery of speciation in this unique setting.

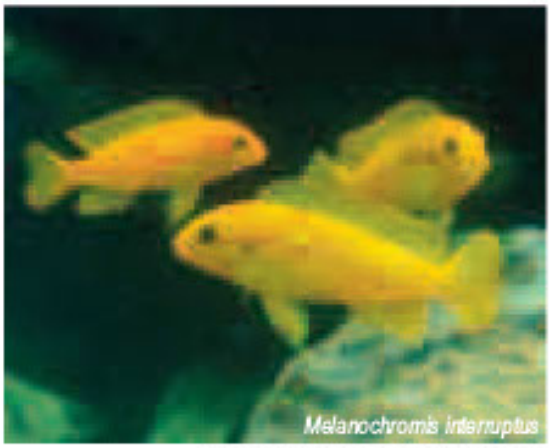
Photos: The Author

Lake Malawi National Park

Searching for the source of the Nile River in 1861, explorers David Livingstone and John Kirk collected fishes that are as intriguing to scientists today as that mythical spring. Fishes from Livingstone's Zambezi Expedition labelled "from Lake Nyasa" were deposited in the British Museum of Natural History. These fishes are now identified as being from the cichlid family, part of a species flock with at least 50 times more species than the Galapagos finches that Charles Darwin studied in developing his theory of evolution by natural selection. In lakes Malawi (Nyasa), Tanganyika, and Victoria more species of fish exist than in any other lakes in the world. The exact number is unknown. Estimates suggest that Lake Malawi has more than 1,000 species and new species are being continually discovered in all the lakes. Many of the brightly coloured fish are now known to be complexes of reproductively isolated sibling species. Cichlid fishes in these lakes offer extraordinary opportunities to investigate speciation, an evolutionary process that leads to diversity, because they are the World's most spectacular examples of speciation and adaptive radiation within any vertebrate family. Since the time of Darwin, the origin of species has been a central focus of scientific study. The process of speciation generally involves the isolation of different populations of an original ancestral species. As time passes, populations change genetically and retain or assume characteristics that are most suited to their living conditions. The populations become so different that they are incapable of interbreeding and evolve into different species. Species are often restricted to small regions within each lake. Linking currently studied species to the earlier collected specimens can prove difficult. Debate is focused upon the manner in which cichlid speciation has taken place. The quest for an understanding of the origin of species began in England in 1859, under the auspices of the royal Geographic Society. Its members, including Darwin and the three great African explorers - David Livingstone, Richard Burton, and John Speke - were to revolutionize the way the Victorian age viewed the world. 1859 saw major scientific contributions by the fellows of the Society. Darwin published the *Origin of Species by Means of Natural Selection and* Livingstone first encountered Lake Nyasa (Malawi), thought to be another possible beginning of the Nile. In 1861, he



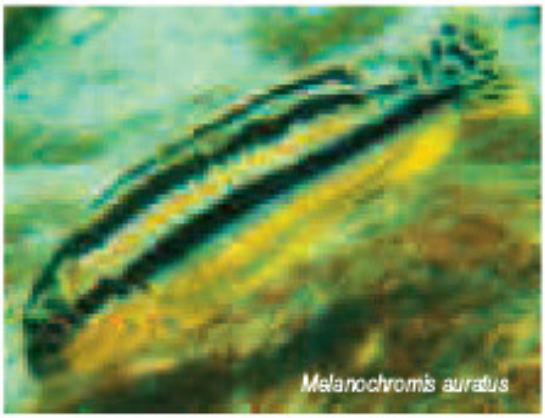
and Kirk were the first to collect cichlid fishes in the Africa Great Lakes and return them to Europe. One curious little fish that they collected is an individual from a species named for Livingstone (*Metriaclima livingstoni*). It belongs to a specialized group of closely related species that occurs throughout the lake. They inhabit snail shells for protection while living over open sand and can change sex from female to male when males are in short supply - a phenomenon that has piqued the interest of the scientific community. Cichlids are perch-like fishes that occur not only in tropical freshwaters of Africa, but also parts of Asia, the Amazon, throughout Central America, and as far north as Texas. Although Cichlidae species are confined to tropical and subtropical regions, the family contains more species than any other fish family. Lake Malawi's 1000 fish species make it the most species-rich lake in the world. More than 95 percent of these species belong to the Cichlidae family. All but two occur nowhere else in the world. The five Great Lakes of North America combined have fewer than 200 species from about 30 families. More freshwater species exist in Lake Malawi alone than are found in all the lakes in Canada, the United States, Mexico, and Central America combined. Lake Malawi's, fishes live in every possible habitat - weeds, rock, sand, mud, open water, and riverine outlets. The feeding adaptations of these fishes are their most spectacular specialisations Cichlids have evolved a great diversity of feeding adaptations. They exploit all available sources of food including phytoplankton, zooplankton, soft bottom deposits, algae on the surface of rocks, algae that grow upon other submerged plants, molluscs, insects and benthic arthropods, fish scales, fish fins, fishes, and fish eggs, embryos and larvae. In future articles we will explore and describe some of the most amazing behaviour and adaptations in the animal kingdom; why Lake Malawi National Park became the first freshwater underwater park in the world and a UNESCO World Heritage Site. We will examine how HEEED, a Malawian NGO (www.heeedmalawi.org), one of the leading organizations in the country at the forefront of conserving this rich region, is attempting to improve the education and livelihood of the people living adjacent to the lake. Not only is Lake Malawi a biological wonderland, it is an important food source, a tremendous tourist attraction and generator of foreign currency, but most importantly, the Lake's water is the most important resource of all. The conservation of this body of water and the fauna within it is one of the top priorities of World Conservation agencies and stewardship of this World Heritage Region is all of our responsibility.


Melanochromis interruptus


Metriaclima "livingstoni"

One curious little fish can change sex from female to male


Metriaclima zebra


Melanochromis auratus