Ecological diversification through divergent selection is thought to be a major force during the process of adaptive radiations. However, the large sizes and complexity of most radiations such as those of the cichlids in the African Great Lakes make it impossible to infer the exact evolutionary history of any population divergence event. The genus Alcolapia, a small cichlid lineage endemic to Lakes Magadi and Natron in East Africa, exhibits phenotypes similar to some of those found in cichlids of the radiations of the African Great Lakes. The simplicity within Alcolapia makes it an excellent model system to investigate ecological diversification and speciation. We used an integrated approach including population genomics based on RAD-seq data, geometric morphometrics, and stable isotope analyses to investigate the eco-morphological diversification of tilapia in Lake Magadi and its satellite lake Little Magadi. Additionally, we reconstructed the demographic history of the species using coalescent simulations based on the joint site frequency spectrum. The population in Little Magadi has a characteristically upturned mouth - possibly an adaptation to feeding on prey from the water surface. Eco-morphological differences between populations within Lake Magadi are more subtle, but are consistent with known ecological differences between its lagoons such as high concentrations of nitrogen attributable to extensive guano deposits in Rest of Magadi relative to Fish Springs Lagoon. All populations diverged simultaneously only about 1,100 generations ago. Differences in levels of gene flow between populations and the effective population sizes have likely resulted in the inferred heterogeneous patterns of genome-wide differentiation. 