Abstract

Lake Magadi, an alkaline hypersaline lake in Kenya, is one of the most extreme water bodies known. Although its water temperatures often exceed 40°C, a particular lineage of 'dwarf' tilapia, *Alcolapia grahami*, has evolved remarkable adaptations to survive in this hostile environment. Magadi tilapia exists in small fragmented populations in isolated lagoons within Lake Magadi and its satellite Lake, Little Magadi. In spite of the potential this tilapia holds for understanding evolutionary processes in stressful environments, few genetic studies have focused on this species. We examined the genetic diversity and spatial genetic relationships of Magadi tilapia populations using microsatellite and mitochondrial markers. High levels of genetic variation were found to be supporting the hypothesis that *A. grahami* populations represent remnants of a much larger fish population that inhabited paleo-lake Orolonga. In contrast to previous studies, we found a well-supported genetic structure of *A. grahami* consisting of three differentiated genetic clusters (a) Little Magadi, (b) Fish Spring Lagoon and (c) Rest of Magadi. Given the importance of this species to the Magadi ecosystem and its potential evolutionary significance, the three genetic clusters should be considered as separate gene pools and conservation strategies aimed at protecting the species based on these clusters are recommended.