MOLECULAR ARCHIVES OF CLIMATIC HISTORY

Exploring patterns of genomic differentiation in endemic species radiations of ancient lakes (MOLARCH)

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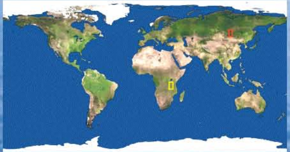

Lake Tanganyika

Photos of fieldwork by Stephan Koblemuller, Christian Sturmbauer & Erik Verheyen, photos of ostracod & shrimp provided by Koen Martens & John O'Brien

Context

Little is known about the evolutionary response of species to global climate change because time scales are too long to be directly studied. Recent studies on endemic faunas from ancient freshwater lakes suggests that climate-induced environmental changes can be reconstructed by analyzing genetic patterns in these faunas.

These evolutionary responses appear to coincide with climate driven lake level-fluctuations and to be concentrated within narrow periods of time. It remains unclear to what extent such changes occur simultaneously across taxonomic groups and ecological guilds.

Hypotheses

To test how patterns of evolutionary diversification agree with three hypotheses:

- the 'turnover pulse' hypotheses, predicting speciation pulses across major taxa that coincide with times of major lake level changes
- the 'ecological locking' hypothesis, predicts simultaneous speciation pulses but not necessarily at times of major lake level changes
- the 'individual response' hypothesis, predicts no correlation of speciation pulses across taxa.

Project aims

- To detect temporal patterns of diversification for selected invertebrate and vertebrate species assemblages of lakes Baikal and Tanganyika, to establish how Pleistocene climate changes affected speciation and extinction rates in these lakes.
- To use patterns of genetic diversity to infer changes in population sizes in response to past climate induced changes in the ecosystems.
- To use simulation studies and ecological models to explore the potential of mtDNA sequence data as a means to predict effects of global change on lacustrine faunas.

Approach

- These hypotheses will be tested based on mtDNA sequences from selected endemics (fish, crustaceans) of Lakes Baikal and Tanganyika.
- Combined with palaeo-climatic information, these phylogenies will allow to test the effects of global climatic induced changes on the general dynamics of diversification, loss of variation, adaptive radiations and speciation events.
- Computer simulations in various ecological scenarios will be used to investigate whether real sequence data can be used to measure the impact of climate changes on these faunas.

Fieldwork

The two first of four expeditions sampled ostracods, fishes, shrimps and amphipods in lakes Baikal and Tanganyika (August & September 2006).

Lake Baikal

Photos above watersurface: Risto Väinölä, below watersurface Juergen Kolb.

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