

Jurassic Park from a Swiss lake?

March 12 2009



Daphnia Galeata

Ecological changes caused by humans affect natural biodiversity. For example, the eutrophication of Greifensee and Lake Constance in the 1970s and 1980s led to genetic changes in a species of water flea which was ultimately displaced. Despite the fact that water quality has since been significantly improved, this species has not been re-established. This was demonstrated by researchers from Eawag and from two German universities (Frankfurt and Konstanz), who analysed genetic material from Daphnia eggs up to 100 years old.

Evolutionary biologist Nora Brede explains, animatedly: “In the laboratory, we were able to revive [resting eggs](#) over 40 years old isolated from Greifensee sediment.” For Eawag, this Jurassic Park-style method has a serious purpose: it makes it possible to determine retrospectively which Daphnia [species](#) was dominant in the lake around 1960, and

whether the species that prevailed in the 1970s and 1980s became more tolerant of pollutants. Daphnia, which are crustaceans, can produce diapausing (resting) eggs - e.g. when food supplies are inadequate - which develop into a [living organism](#) when environmental conditions subsequently become more favourable. As these eggs are deposited in datable layers of [anoxic sediments](#), their DNA can be analysed even after the passage of 100 years or more.

What makes this biological archive particularly interesting is the fact that conditions in the lake have undergone dramatic changes since 1960. In the 1970s and 1980s, inputs of phosphate detergents and fertilizer runoff led to eutrophication, with the development of [algal blooms](#), including toxic cyanobacteria (blue-green [algae](#)). Fish died as a result of [oxygen depletion](#). As reported in the latest edition of the [Proceedings of the National Academy of Sciences](#), the results of the genetic analysis of Daphnia eggs indicate that genetic diversity was also affected by the excessive nutrient levels. At the beginning of the 20th century, only one species of [water flea](#) (*Daphnia hyalina*) occurred abundantly in the two lakes studied. As eutrophication developed, this was displaced by another species (*Daphnia galeata*). In the transitional periods before and after peak nutrient inputs, hybrids also developed. However, although the lakes are now once again much cleaner (thanks to major efforts in the urban wastewater management sector), the original species has yet to recover.

According to Nora Brede, “This demonstrates that anthropogenic changes, such as eutrophication, can have major and not fully reversible effects on animal species.” In addition, the research project also showed how rapidly evolutionary processes can unfold in the animal kingdom. Brede comments: “In a mere 50 years, there have been measurable changes in the genome structure of a species, which is amazing, given that this is an extremely short period on the timescale of the Earth’s history.”

Biological archives such as the resting eggs of Daphnia in lake sediments are a valuable tool for investigating how organisms respond to changes in the ecosystem. Together with its partners, Eawag is therefore making the most of these opportunities to study and gain a better understanding of evolutionary processes. Research is focusing in particular on the question of how quickly plants and animals adapt genetically to the alterations in temperature associated with global climate change.

More information: Brede, N., C. Sandrock, D. Straile, P. Spaak, T. Jankowski, B. Streit & K. Schwenk. 2009. The impact of human-made [ecological changes](#) on the genetic architecture of Daphnia species. *Proceedings of the National Academy of Sciences of the USA*. Link: [PNAS](#)

Provided by Swiss Federal Institute of Aquatic Science and Technology

Citation: Jurassic Park from a Swiss lake? (2009, March 12) retrieved 25 April 2024 from <https://phys.org/news/2009-03-jurassic-swiss-lake.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
