

Food-web fluctuations in the sediment record of Lake Mývatn

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Lake Mývatn in northern Iceland is a wildlife sanctuary also known for its scenic volcanic landscape. Since 1977 the main components of its food web have been monitored. The monitoring has revealed extreme fluctuations with an amplitude of several orders of magnitude for some species. ‘Good years’ with plenty of food for fish and waterfowl alternate with ‘poor years’ when there is little food for most of the vertebrates. There is evidence that the cycles are driven by internal dynamics of the food web but not by external factors like climate. The most likely factor is the interaction between the chironomid larvae on their food resources (diatoms and decaying organic matter). Modelling of such systems indicates that their behaviour may abruptly change from a stable state to a wildly fluctuating one.

Lake sediments contain a record of the former ecological situation in a lake. The techniques used to extract this record form the basis of *palaeoecology*.

The aim of the current project is to use palaeoecological methods to look for the food web cycles in the fossil sedimentary record of Lake Mývatn. If successful, the record can be extended centuries back in time and it should be possible to measure key variables that test hypotheses about the drivers of the food web fluctuations.

In 2004 two sediment cores were taken from a sheltered bay (Syðrivogar) in Mývatn in order to locate sediment with the finest time resolution possible. We used a freeze core technology where the waterlogged sediment is frozen *in situ* with dry ice, preserving the finest details of the sediment structure. The sediment in the cores turned out to be visually laminated, with alternating light and dark bands, also revealed by X-ray photography. The laminations were successfully correlated between the two cores. The work so far has concentrated on the nature of these laminations by analyzing sedimentological variables and the density and species composition of diatoms, chironomids and Cladocera. Dating is based on tephrochronology.

The biological and sedimentological analyses show a cyclic downcore change of water content, loss on ignition, sand and diatom content in both sediment cores. The dark laminae are dominated by organic material and the light laminae are rich in diatoms. It is not yet clear if the laminae are annual or represent longer periods (about decades). If decadal they could be created by food web cyclicality or by a cyclic weather pattern, possibly the North Atlantic Oscillation (NAO). If they turn out to be annual, the sediment of the Syðrivogar Bay should contain a unique record of past food-web fluctuations in Lake Mývatn.

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