Effects of water level regulation on aquatic insects in reservoirs

Christianne Dalsbotten Solvåg, NTNU

Email corresponding author: christianne.d.solvag@ntnu.no

ABSTRACT: Hydropower with reservoirs is a renewable and flexible way of producing energy and will become increasingly important as the energy grid is decarbonised to combat climate change. Unfortunately, the development and operation of hydropower can also have severe negative environmental impacts, and it is imperative to understand and potentially mitigate these effects. A natural lake experiences environmental variability, e.g. in the form of fluctuations in water level and temperature, and the organisms living in the lake are adapted to tolerate or respond to these patterns of fluctuation. When a lake is regulated for hydropower purposes, this changes the patterns of environmental variation. The water level fluctuations can increase in amplitude, as well as show altered frequency and timing. This can affect organisms living in the lake, and organisms in the littoral zone may be especially susceptible for changes in the water level fluctuations.

The aim of this project is to find out how changes in water level fluctuations affect the phenology of invertebrate species in the littoral zone, and if different life history traits may contribute to explaining why some species are more affected than others. A selection of regulated and unregulated lakes in Trøndelag, Norway, will be surveyed to investigate 1) differences in species composition of aquatic insects between regulated and unregulated lakes, 2) if these differences are correlated with life history traits, and 3) if the phenology or life history traits are different within species that are observed in both types of lakes. This will be complemented by a theoretical optimisation model and simulations, to assess which mechanisms and environmental variables are important and likely to cause the observed results. By including options for different models of hydrology, climate change, electricity mixes and environmental constraints on hydropower operation, the theoretical model could predict species responses in a range of scenarios for present and future operational use of hydropower. Understanding the details of how different patterns of environmental variation affect organisms living in reservoirs, might help us to identify suitable mitigating measures to minimize trade-offs between conserving biodiversity and other aspects of hydropower management.