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Diatom assemblage responses to changing environment in the conspicuously eutrophic Kiuruvesi lake route, central-eastern Finland

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Lakes and their water quality have been affected by anthropogenic actions for centuries. The most intensive changes have often occurred since the mid-19th century. Industrialization, modern agriculture, forest ditching and artificial lowering of water level are examples of these changes that have usually resulted in the deterioration of lake water quality. Many organisms, such as diatoms, are sensitive to these changes in their environmental conditions. Therefore, a marked species turnover is often seen between the pre and post human impact diatom assemblages. This turnover can be rapidly assessed simultaneously from many lakes by using multivariate methods and top-bottom sampling.

Our study area consists of three adjacent lake routes in the grass cultivation and dairy production area of central-eastern Finland, where slash-and-burn cultivation and artificial water level lowering were common practice during the past centuries. The centermost Iisalmi lake route is particularly interesting because of the conspicuously eutrophic lakes in its Kiuruvesi subroute. We used the top-bottom approach to sample pre and post human impact samples from 47 lakes (50 sampling sites) located in the three lake routes. In addition, stratigraphic samples from the long cores of three lakes (one larger central basin and two small upstream lakes) in the Kiuruvesi subroute were studied in more detail. Multivariate methods were used to assess diatom assemblage change within the long cores and between the pre-disturbance and modern samples.

The results indicate that most study lakes have undergone a marked shift in their diatom assemblages since the onset of human impact in the area. The lake routes are characterized by differing pre-impact diatom assemblages. However, human influence has reduced their natural variation. Similar diatom species are common in the modern samples of the heavily impacted lakes in all three lake routes. The detailed examination of the diatom assemblage turnover in the three Kiuruvesi route lakes portrays different trajectories in each lake. The central basin has changed less than the upstream lakes. Two of the lakes have assemblage change trajectories that suggest increased nutrients, electrical conductivity, and pH. Unexpectedly, one of the upstream lakes shows an opposite trajectory, which might result from lowering water depth and improved living conditions for benthic diatoms.