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Seasonal variation in methane consumption and in the diversity of methanotrophs in the littoral zone of a boreal lake

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The atmospheric concentration of methane (CH_4) has increased by approximately 150% since pre-industrial times because of increased CH_4 emissions and decreased CH_4consumption. Methane oxidizing bacteria, methanotrophs, consume CH_4 for their carbon and energy needs and thus play a significant role in reducing CH_4 emissions and decelerating global warming. In wetlands, for example, methanotrophs can consume as much as 90% of the CH_4 produced.

In freshwater lakes, even 70% of the total release of CH_4 from the lakes can originate from the littoral wetland. Globally, wetlands are responsible for 44% of methane emissions. In boreal region, where lakes are abundant in landscape, it is important to understand how different seasons affect CH_4 oxidation activity and are there changes in the diversity of methanotrophs over seasons? This study belongs to the research consortium METHECO (Eurodiversity programme of European Science Foundation), where the activity and diversity of methane oxidising bacteria are studied in various European ecosystems.

The activity and diversity of methanotrophs were studied in a littoral wetland of the shallow hyper-eutrophic Lake Kevätön in east-central Finland. The study area has a gradient with moisture and vegetation. Sediment sampling for CH_4 oxidation activity and diversity studies of methanotrophs were performed over four seasons: autumn, winter, spring and summer. Samples were taken from three sampling points with different distance from the shoreline (2m; 8m; 17m) and sediment cores were separated to layers 0-2cm, 2-10cm, 10-20cm and 20-30cm. Methane oxidation potential was analyzed with flask experiments and diversity of methanotrophs with *pmoA*-microarray.

Methane was oxidized in all seasons. In the wettest area (nearest to the shoreline) the highest activity occurred in autumn, while in drier areas CH_4 oxidation was most active in spring time. In winter time the activity of methanotrophs was not significantly decreased. Methane oxidation activity was always the highest in the organic surface layer (0-10 cm) and the activity decreased with depth. According to the first *pmoA*-microarray results, methanotroph community structure is significantly changing over seasons.