ENGLISH ABSTRACT

Oxygen gradients are ubiquitous in the environment and contain a wide range of ecological niches, holding high microbial diversity, which contribute to important processes in elemental cycling. In this thesis two different ecosystems harboring gradients of oxygen were studied.

Microbial communities of temperate freshwater lakes

Water columns of temperate freshwater lakes are great examples of ecosystems that experience many fluctuations especially in temperature and oxygen concentrations, both temporally and spatially. The seasonal variation in microbial communities in surface water is relatively well known, but often overlooked in bottom waters. In the study presented here, multivariate statistics and co-occurrence network analysis were combined to unravel groups of bacteria with similar ecological niches. This was investigated across surface and bottom water in two similar lakes during an event of summer stratification. Three major groups of taxa were identified with different dynamics according to overall environmental niches. One group abundant in the surface waters during stratification, contained members of the ubiquitous *Actinobacteria* and known lake cosmopolitans of *Proteobacteria*. Another group was strongly defined by hypoxic/anoxic conditions in the bottom waters during stratification. The last group seemed to be associated to oxygen gradients in the bottom waters and was exploiting depositing organic matter from the surface.

Microbial activity in soils flooded with seawater

As a consequence of climate change induced sea-level rise and storm surges, coastal soil experiencing flooding with seawater is progressively common. Considering the different coastal soil ecosystems in existence, knowledge on responses of biogeochemistry, microbial activity and community is very limited. The primary aim of the studies presented here, was to gain insights in soil organic carbon degradation and microbial activity in the agricultural soils permanently flooded with seawater by managed realignment at Gyldensteen (Denmark). The major short-term responses to flooding (1-2 months) were accelerated organic carbon degradation and microbial activity, together with a clear shift in microbial community composition and metabolome fingerprints. Furthermore, the soil went anoxic with a steep oxygen gradient in the surface and sulfate reduction became a predominant respiration pathway. While in the longer term (1 year), microbial activity was decreased significantly due to plant derived refractory organic matter, which is very hard to degrade under anoxic conditions. Suggesting that the majority of the organic matter is preserved, making soils flooded with seawater a minimal carbon source in a long-tern climate perspective.