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Competition and top-down control as potential factors controlling microbial diversity in aquatic networks

Abstract

One of the major goals of aquatic ecology is to understand the suite of local and regional processes, which govern community assembly and biodiversity patterns in aquatic networks. In the last years, the significance of microbial diversity for carbon and nutrient cycling in streams, rivers and lakes has progressively been unveiled. A number of studies suggested that species sorting according to environmental conditions constrain microbial diversity in habitats with long retention times such as lakes, while mass effects support microbial diversity in habitats with short water retention times, such as streams. Competitive interactions, dispersal dynamics and interactions with other trophic levels might contribute to microbial diversity patterns; however, experimental evidence for the importance of such mechanisms is missing as yet.

The overall objective of the proposed research is therefore to disentangle the mechanisms potentially driving microbial diversity in aquatic ecosystems. Specifically, the following hypotheses will be tested:

(i) Competitive interactions govern community assembly in habitats with long water retention times which is reflected in the community's phylogenetic structure
(ii) the diversity of potential bacterivores influences bacterial diversity and
(iii) in the absence of dispersal, microbial communities show proliferation of typical freshwater taxa.

Using an experimental approach, the diversity of bacteria and small eukaryotes from aquatic habitats differing in retention time under different dispersal regimes will be monitored using microcosms. Data on microbial diversity and community composition will be obtained by Illumina sequencing of the 16S (bacteria) and 18S (eukaryotes) rRNA gene. The phylogenetic structure and the degree of phylogenetic clustering will be used to assess the role of competition between microbial species and potential interactions between different trophic groups. The proposed research is meant to better integrate microbial ecology – itself embedded in a cutting-edge methodological entourage – with ecological theory and will equally contribute to microbial ecology and general aquatic ecology.