

was mainly inhabited by ultramicrobacteria related to the LD12-lineage of Alphaproteobacteria and to Actinobacteria; the latter group preferred the shallow regions. Cytophaga-Flavobacteria, in particular a population related to *Fluviicola* sp., were more frequent in and below the layer of maximal *P. rubescens* abundances. Betaproteobacteria on the other hand were highly abundant in the epi- and hypolimnion, but not in the *P. rubescens* layer. Four betaproteobacterial subpopulations with contrasting longitudinal and/or vertical habitat preferences were distinguished: Putatively methylotrophic bacteria of the LD28 lineage (beta IV) preferentially inhabited the hypolimnion, *Polynucleobacter acidiphobus* was found throughout the epilimnion, *Limnohabitans* (R-BT065) more in the shallow regions of the lake, and *Polynucleobacter necessarius* ssp. *asymbioticus* only in hypoxic waters. Our results stress the potential importance of spatial niche differentiation in freshwater bacterioplankton. This variability should be taken into account, e.g., in studies of seasonal community changes derived from single sampling locations and depths.

## **Influence of atmospheric modes of variability on the limnological characteristics of large lakes south of the Alps: a new emerging paradigm**

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Many distinct climate anomalies related to each other over large distances were identified both in the northern and southern hemispheres. Among these, the North Atlantic Oscillation was identified as the most important teleconnection index in the North Atlantic region, with important effects on lacustrine ecosystems in Central and Northern Europe. By converse, no measurable effects were shown on the limnological characteristics of the deep lakes south of the Alps. Recent studies carried out in Lake Garda showed a strong impact on the local climate and limnology of the southern Alpine district of two distinct modes of atmospheric oscillations relevant for the Mediterranean area, namely the East Atlantic pattern (EA) and the Eastern Mediterranean Pattern (EMP). Positive and negative EA, and negative and positive EMP phases are connected with the development of mild and harsh winters, respectively. In this work we analysed the impact of EA and EMP on the largest lakes located at the southern flanks of the Alps (Garda, Iseo, Como, Lugano and Maggiore). The results showed an extended impact of EA and EMP on the winter air temperatures, thermal structure and deep mixing dynamics. In turn, harsh winters and deeper spring mixing depths in lakes Garda, Iseo and Como had a strong and positive influence on the replenishment of epilimnetic phosphorus at spring overturn. Owing to the lower differences in the content of total phosphorus (TP) in the surface and hypolimnetic layers, the effects of a deep mixing on the epilimnetic replenishment of nutrients in Lake Maggiore were less distinct. In Lake Lugano, maximum surface TP fertilisation was observed only during the largest negative (positive) phases of EA (EMP), but without a clear relationship in the whole data range. The implications for the development of phytoplankton will be discussed in relation to the climatic fluctuations and mixing dynamics.

## **Aquatic-terrestrial trophic interactions. The response of bats to emerging aquatic insects from Lake Constance**

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Emerging aquatic insects can constitute important diet sources for numerous terrestrial consumers. Bats, particularly opportunistic species, can take advantage of pulses of emerging aquatic insects, especially when other food resources are less abundant. On the other side, they can potentially be a significant mortality factor for insect populations. The aquatic subsidies into the terrestrial systems may have significant seasonal fluctuations. Using floating emergence traps, we investigated the seasonal variations of emerging aquatic insects from the littoral zone of Lake Constance, Germany, during July to October 2011 and April to June 2012. At the same time the activity of bats, close to the lakeshore, was estimated by recording the ultrasound echolocation calls of bats using a passive recorder. Significant seasonal differences were found in the number and the taxa of emerging