

# Integrating records of aquatic change: existing evidence and missing data

## Abstracts



## DEEP LAKES SOUTH OF THE ALPS

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The large subalpine lakes (Garda Iseo, Como, Lugano and Maggiore) concentrate around 80% of all Italian lake waters. Due to their location at the Alpine margin in the most densely populated and productive region in Italy they play a crucial socio-economic role as water resource for drinking, agriculture, industry, tourism, hydroelectric production, biodiversity conservation. They are exposed to steadily increasing human impact and, as their catchments extend into the glacial Alpine range, they are particularly exposed to global warming effects. Italian subalpine lakes share many morphological, physical and ecological characteristics, which justify their inclusion as a separate typology in the Italian LTER network. Despite these lakes have been extensively investigated since the early 20<sup>th</sup> Century, their regular monitoring started only in the 1980s in relation to eutrophication issues, which still represents the major cause of deterioration of these lakes.

Limnological surveys indicate a coherent response by subalpine lakes to the nutrient enrichment in the 1960s–1970s, while the recent development is quite heterogeneous. Past and ongoing palaeolimnological studies confirmed the pronounced coherence of the lakes' secular evolution. Even after the end of the Little Ice Age and till the 1960s these lakes were very oligotrophic and extremely inert toward climatic variability. The successive nutrient increase was accompanied by the displacement of oligotrophic by meso- to eutrophic planktonic taxa (especially diatoms, cyanobacteria, cladocera). As regards, for instance, the planktonic diatoms, the dominant small centric taxa were partially substituted by colony-forming, pennate species. Ongoing palaeolimnological studies confirm the differences in the recent evolution of the lakes within a secular perspective, which is partly due to locally differences in the current lake management and restoration measures. However, the incomplete lake's re-oligotrophication and return to the original status is also hindered by superimposed effects of climate change, as outlined, for example, by the coherent response of the subalpine lakes to the warm early 2000s. Current sediment studies are also contributing at outlining the impact of hydroelectric exploitation on the lakes' ecological evolution.