46-O Different performances of independent sediment biological proxies in tracking ecological transitions and tipping points in a small sub-alpine lake since the little ice age.

Monica Tolotti [1] - Andrea Lami [2] - Nico Salmaso [1] - Handong Yang [3] - Manuela Milan [4]

IASMA Research And Innovation Centre, Edmund Mach Foundation, S. Michele all'Adige, Italy [1] - Institute For Ecosystem Study , ISE CNR, Verbania, Italy [2] - Environmental Change Research Centre (ECRC), University College London, London, United Kingdom [3] - Department of Ecology and Environmental Science, Umeå University, Umeå, Sweden [4]

A comparative study of independent geochemical and biological proxies was carried out on a short (83 cm) sediment core collected in 2011 from the deepest point of a small subalpine Lake Ledro (Trentino, N-Italy). The aim of the study was to compare the capability of subfossil photosynthetic pigments, diatoms and Cladocera in tracking lake ecological transitions and tipping points related to major environmental perturbations occurred during the last three centuries, i.e. after the culmination of the Little Ice Age in the Alpine region. The comparison was performed by applying Non Metric Multidimensional Scaling (NMDS) coupled with vector fitting. The secular ecological evolution of Lake Ledro was compared with paleoecological reconstructions provided by a recent sediment investigation of Lake Garda, the largest Italian subalpine lake, which is located only a few km SE from Lake Ledro.
The results outlined a pronounced sensitivity of Lake Ledro to hydrological variability throughout the whole time span considered, but especially during the 18th and 19th centuries, and revealed two major stages in the lake ecological evolution, which were mainly controlled by climate related hydrological variability and lake nutrients, respectively. The strong response to hydrological variability is intrinsic for the lake and depends on its peculiar catchment size and morphology.
These results highlight that responses of biological proxies to different natural and human stressors may differ in type, timing and magnitude, and that they are indirectly modulated by lake size, which controls the lake response to climate-related physical perturbations. The three biological proxies showed comparable capabilities in tracking ecological tipping points of Lake Ledro related to both lake hydrology and nutrient variability, while only diatoms demonstrated a certain capability to track changes in water temperature of this lake. Pigments were a less reliable proxy for the reconstruction of trophic evolution of Lake Garda. Conversely, in Lake Garda Cladocera responded more clearly to temperature changes, and diatoms showed a strong response to lake nutrient level, and an indirect response to climate related changes in lake thermal dynamics.
The comparison of the secular evolution of two close subalpine lakes of different size confirmed that lake sensitivity to environmental perturbations is strongly dependent on lake size and morphology, and that planktonic organisms respond to climate variability mostly in an indirect way. This stresses the necessity for lake management strategies to take into account not only the present exploitation of lakes and climate change, but also the lake-specific sensitivities to local forcings.

46-O Disentangling the competing roles over millennial timescales of climate, land use and natural ecosystem dynamics on lake-water carbon cycling in the Swedish boreal landscape.

Richard Bindler, Carsten Meyer-Jacob, Sofia Ninnes, Erik Myrstener, Johan Rydberg, Christian Bigler

Dept. of Ecology and Environmental Science, Umeå Unviersity, Umeå, Sweden

Over the past 30 years environmental monitoring programs in Scandinavia and elsewhere have recorded increasing concentrations of total organic carbon (TOC) in many northern lakes. Hypotheses for this 'brownification', which has implications for drinking water quality and aquatic ecosystem functioning, include recovery from acidification, modern land management and climate change. However, singular focus on recent trends and ongoing processes overlooks the imprint on lake-water quality imposed by long-term human impacts at larger landscape scales. As shown in research on lake acidification, aquatic biodiversity and metal pollution, lake-water quality in Swedish lakes has changed in response to human impacts not only over decadal but also over centennial to millennial timescales.
Research on long-term changes in TOC has focused principally on remote systems largely defined as natural or undisturbed; however, we suggest the evidence from some of these 'remote' areas indicates that lake-water TOC declined over the past 500–2000 years in conjunction with the widespread utilization of the landscape that was characteristic for much of Scandinavia. This historical land use included slash-and-burn agriculture, small-scale