

## HUMAN IMPACT RECORDED IN THE THREE ALPINE LAKES (THE TATRA MOUNTAINS, POLAND): RECENT ENVIRONMENTAL CHANGES BASED ON SUBFOSSIL DIATOMS AND CLADOCERA REMAINS.

Elwira Sienkiewicz & Michał Gąsiorowski

Institute of Geological Sciences, Polish Academy of Sciences, Research Centre at Warsaw

The high mountainous regions of Europe are relatively natural ecosystems; however, there are certain signs of human-induced disturbances that have occurred over the last century. Most lakes in the Tatra Mts. are oligotrophic with water that is cold, well-oxygenated and poor in nutrients. Recently, in certain lakes, an increase in the trophic state was observed. One of the main reasons for the trophic increase in the mountain areas is tourism development; the number of visitors, the location and exploitation of mountain hostels by tourists are all of potential importance. We studied sediments from three lakes: the Morskie Oko (MOK), the Przedni Staw Polski (PSP) and the Czarny Staw Gąsienicowy (CSG), with respect to changes in diatom and Cladocera species composition, because both groups are good indicators of higher productivity in lakes. Year-round shelters exist on the shores of the MOK and the PSP lakes; the CSG Lake was selected as a reference site. Over the last few decades, significant alterations in trophic status, i.e., changes from oligotrophy to mesotrophy, were observed in the lakes located close to the shelters. The lake situated a greater distance from the mountain hostels has been oligotrophic for hundreds of year and is still so today. The recorded trends depict a clear correlation of changes in diatom flora with the increase of tourism in the region over the last few decades, including the following: (1) Diatom-inferred total phosphorus (DI-TP) increased markedly in the lakes with mountain hostels build on their shores; (2) DI-TP decreased in the third lake, and the only symptom of higher productivity in the lake was an increase in the total organic carbon. The cladoceran communities did not present such a clear relationship to the trophic state of the studied lakes. The major factor driving changes in the zooplankton composition of the lakes appears to be fish predation pressure. The chydorid and bosmina resting eggs (ephippia) index did not indicate a correlation with changes in the trophic state; however, the index did indicate a correlation with climate oscillations – the highest production of ephippia is found in sediments deposited during the Little Ice Age.