Journal of Limnology 2007 vol.66 N1, pages 40-53

Limnological characteristics of lakes in the lowlands of Central Yakutia, Russia

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Abstract

The physico-chemical characteristics of 47 lakes from two regions in the lowlands of Central Yakutia (Vilyuysk and Yakutsk), Eastern Siberia were analysed. The aims of this study were (i) to classify the lakes according to their ionic compositions and their nutrient concentrations, (ii) to quantify environmental gradients representing the main directions of variation in the measured variables, and (iii) to explore the relationship between the investigated lakes and their spatial positions. Most of the study lakes are shallow, thermokarst lakes that are slightly alkaline to alkaline. The lakes are predominantly oligotrophic, with some mesotrophic and a few eutrophic exceptions in the study region Vilyuysk. There are four hypertrophic lakes in the study region Yakutsk which are strongly affected by anthropogenic inputs and, in one case, additionally by inputs of water birds. Most part of the variance in the data is represented by major ion concentrations and related variables such as electrical conductivity. There were clear differences in these variables between the lakes of both study regions partly due to regional differences in the climate-induced negative water balance (i.e. evaporation exceeds precipitation). The statistical analysis has shown that a significant part of the variance can be attributed to the type of vegetation in the lake's catchment (11%), to the longitude (7.6%) and to local spatial differences in the lake water chemistry (2.8%). Hypothesis testing indicated that there are significant differences in the mean values of many variables according to vegetation type and to the region where the lakes are located. However, the hypothesis of spatial autocorrelation in the data had to be rejected. The results presented here have important implications for ongoing and future limnological and paleoenvironmental studies in Yakutia. The exploratory analysis has shown that the physico-chemical characteristics of Central Yakutian lakes are mainly influenced by vegetation and climate driven changes that provides the basis for paleoenvironmental studies.

Keywords

Alkaline lakes, Central Yakutia, Lakes, Physico-chemical characteristics, Salinity, Siberia