



Sub-fossil cladoceran remains from the sediment of the lakes in Arctic Siberia, Russia: relationship to physical and chemical variables

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The lakes examined in this study are located on the catchment area of Anabar river in the north-west part of Yakutia (Russia), just west of the Lena River. All presented samples and data were obtained in frame of a joint Russian–German expedition to Yakutia in summer 2007. The study sites included 35 lakes that were distributed along a broad north–south transect across northwest Yakutia, Russia, ranging from latitude 71°50′ to 73°39′. This transect captures considerable changes in geology, vegetation, and climate. The studied lakes are shallow thermokarst lakes with maximal depths of about 10 m (mean 4.27 ± 0.76). The waters were dominated by Ca–Mg, Fe and HCO_3 , but the ion concentration was generally low in all studied waters.

From the initial 35 localities, only 31 contained a sufficient number of cladoceran remains for reasonable quantification. From these, a total of 28 cladoceran taxa representing 14 genera were identified, comprising predominantly littoral chydorid species. Species richness (i.e. the total number of taxa per lake) ranged between 5 (07-SA-05, 07-SA-14, 07-SA-18) and 20 (07-SA-24), with a mean of 9, and was not significantly correlated with any of the measured environmental variables.

With forward selection and Monte Carlo permutation tests (999 permutations), RDA identified a minimal subset of four environmental variables that explained a significant ($p \leq 0.05$) amount of the variation in the species data. These variables are T_{July} , water depth, SO_4^{2-} , Si^{4+} . RDA axis 1 ($\lambda = 0.174$) and axis 2 ($\lambda = 0.157$) were both significant and explained almost all of the relationships between the cladoceran taxa and measured environmental variables (85.8%).

Distributions of the cladoceran taxa, however, revealed major shifts in abundance in relation to the temperature along our transect. Constrained cluster analysis (CONISS), based on the structure of cladoceran community, disclosed three groups of lakes in the tundra and forest-tundra zones of the north-western part of Yakutia. Frontiers of divisions, separated on the basis structure of sub fossil cladoceran assemblages along a temperature gradient completely coincided with landscape zoning on the basis vegetative communities (typical tundra, southern tundra, forest-tundra).