

Article

Environmental Factors Controlling Zooplankton Communities in Thermokarst Lakes of the Bolshezemelskaya Tundra Permafrost Peatlands (NE Europe)

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Abstract: Environmental physical and chemical factors controlling the abundance and biodiversity of zooplankton in permafrost-affected lakes are poorly known yet they determine the response of aquatic ecosystems to on-going climate change and water warming. Here, we assess the current status of zooplankton communities in lakes of the Bolshezemelskaya Tundra (permafrost peatlands of NE Europe), and provide new information about the composition and structure of zooplankton. The results demonstrate that the structure of zooplankton communities is influenced by the morphometric features of lakes and the degree of lake overgrowth by macrophytes. According to the level of quantitative development of zooplankton, most tundra lakes were of the oligotrophic type with an average wet biomass of up to 1 g/m³. The largest number of species was observed in zooplankton communities of small thaw ponds with an area of up to 0.02 km² and overgrown with macrophytes. The analysis of factors that influence the formation of the lake zoocenosis demonstrated that the species composition and quantitative characteristics of zooplankton are chiefly controlled by pH and water mineralization. A comparison of the results obtained with the literature data on the lakes of this region collected 60 years ago suggests that the ecosystems of these lakes are in a stable state. Overall, these new insights will improve our knowledge of factors controlling the zooplankton spatial dynamics in unique but quite abundant thermokarst lakes of NE European Tundra, subjected to on-going climate warming.

Keywords: permafrost; subarctic; thermokarst lakes; zooplankton; species composition; trophic structure

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1. Introduction

The influence of various local anthropogenic and global factors including climate change on the diversity of biota in aquatic ecosystems of the Arctic and subarctic is among the most important research directions [1–3]. These ecosystems are extremely sensitive to climate change and anthropogenic impact [4–6]; as a result, they are highly vulnerable to ongoing environmental changes [7]. Climate change and increased anthropogenic pressure are very likely to change the characteristics of Arctic freshwater ecosystems and modify their biotic parameters. However, inland aquatic systems of the Arctic and Subarctic are diverse in their type, chemical, physical and biotic indicators, so that they may exhibit variable response to climate changes. In this regard, the temperature is among the most important factor affecting zooplankton communities, notably the species structure and quantitative indicators of zooplankton [7–9]. A close correlation between zooplankton

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