Short communication

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Analysis of long-term dynamics of the plankton community of Lake Baikal

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ABSTRACT. Analysis of long-term observations after plankton community of Lake Baikal has demonstrated the tendencies of the increase of the temperature of water for the upper 50 m layer for the last 70 years, of water transparency and chlorophyll *a* concentration during the season of the open water for the last 40 years. Analysis of the dynamics of the dominant species of phytoplankton has shown the increase of number of non-endemic small-cell species of diatom algae *Synedra acus* some increase of the number of endemic species *Gymnodinium baicalense* with simultaneous tendency of decrease of the number of endemic large-cell species of under-ice developing diatom algae. Analysis of dynamics of number of zooplankton has demonstrated that the number of copepods, of endemic under-ice as well as non-endemic year-round rotifers are decreasing, while the number of cladocers, and non-endemic rotifers, developing during end of summer and autumn increases during the last 70 years. We have fulfilled comparative analysis of the results of our monitoring observations of Lake Baikal plankton and the results for other lakes of the World and we are to conclude that the observed trends can be explained by Global, particularly Climate, Change.

Keywords: Lake Baikal, Global Change, Climate Change, plankton, water temperature, water transparency, chlorophyll *a*, phytoplankton, zooplankton, endemic species

1. Introduction

Lake Baikal is situated in the middle of Eurasia, and is rather far from industrially or agriculturally developed regions and was relatively safe from human influence until XX century. Ecological monitoring of Lake Baikal plankton community is fulfilled since 1945 (Kozhov, 1963; Kozhova and Izmest'eva, 1998) and now presents an example of the longest raw of lake plankton observation in the World.

Recent research is an attempt to find trends in Lake Baikal plankton community influenced by Global Change. We analyzed the long-term dynamics of dominant species of phytoplankton and practically all species of net zooplankton (copepods, cladocerans, rotifers).

2. Methods

Plankton samples have been collected at one stationary point ("Point #1") situated in the Southern Baikal in the vicinity of Bolshie Koty settlement. Sampling station coordinates are 51°52'48'' N, 105°05'02'' E, distance to shoreline 2,7 km, depth 800 m. Samples were taken weekly-biweekly all the year round since 1945, excluding two brakes per year – during ice melting and freezing, when the sampling point is inaccessible both by ship as well as by walking. Phytoplankton was sampled with 10 L Van Doorn bottle from the depths of 0, 5, 10, 25, 50, 100, 150, 200, 250 m, fixed with Utermöhl solution since 1973. Before 1973 phytoplankton was fixed with formalin that lead to elimination of too tiny forms of algae. Zooplankton was sampled with closing net (37.5 cm in diameter, 100 μm mesh) from the layers 0-10, 10-25, 25-50, 50-100, 100-150, 150-200, 200-250 m. Samples were enumerated at the species level (for phyto- and zooplankton) and age stage (for zooplankton) with light microscope (about 500 forms of phytoplankton and 800 forms of zooplankton). Temperature of water was measured with mercury thermometer retrieved with Van Doorn bottle at depths of 0, 5, 10, 25, 50, 100, 150, 200, 250 m, samples for chlorophyll a were collected at these depths too.

We operated with 0-50 m weighted averages for biotic (algae and zooplankton density, chlorophyll concentration) and abiotic (temperature for correlation analysis) parameters as 0-50 is the layer of the lake Baikal, where the most production processes take place. For the algae we've used the maximum density observed

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in the year as it is the real parameter reflecting the possibilities of algae species under current conditions.

3. Results and discussion

Analysis of long-term observations after plankton community of Lake Baikal has demonstrated the tendencies of the increase of the temperature of water for the upper 50 m layer for the last 70 years, of water transparency and chlorophyll *a* concentration during the season of the open water for the last 40 years. Analysis of the dynamics of the dominant species of phytoplankton has shown the increase of number of non-endemic small-cell species of diatom algae *Synedra acus* Kützing, some increase of the number of endemic species *Gymnodinium baicalense* Antipova with simultaneous tendency of decrease of the number of endemic large-cell species of under-ice developing diatom algae *Aulacoseira baicalensis* (Wislouch) Simonsen, *Aulacoseira islandica* (O. Müller) Simonsen, *Stephanodiscus meyerii* Genkal et Popovskaya, *Cyclotella minuta* (Skvortzov) Antipova. Analysis of dynamics of number of zooplankton has demonstrated that the number of copepods (both endemic *Epischura baikalensis* Sars as well as non-endemic *Cyclops kolensis* Liljenborg), of endemic under-ice (*Synchaeta pachypoda* Jaschnov, *Synchaeta pachypoida* Kutikova et Vassiljeva, *Notholca grandis* Voronkov, *Notholca intermedia* Voronkov, *Collotheca* sp.) as well as non-endemic year-round (*Kellicottia longispina* Kellicot, *Keratella quadrata* Muller, *Keratella cochlearis* Gosse, *Filinia terminalis* Plate) are decreasing, while the number of cladocers (*Daphnia longispina* O.F. Müller and *Bosmina longirostris* O.F. Müller), and non-endemic rotifers (*Synchaeta stylata* Wierzejski, *Conochilus unicornis* Rousselet, *Euchlanis dilatate dilatate* Ehrenberg, *Euchlanis dilatate unisetata* Leydig, *Asplanchna priodonta priodonta* Gosse, *Asplanchna herricki* Guerne, *Bipalpus hudsoni* Imhof, *Collotheca mutabilis* Hudson, *Synchaeta* sp., *Synchaeta* sp. sp., *Polyarthra* sp.), developing during end of summer and autumn increases during the last 70 years.

We have fulfilled comparative analysis of the results of our monitoring observations of Lake Baikal plankton and the results for other lakes of the World and we are to conclude that the observed trends can be explained by Global, particularly Climate, Change.

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