

LIMNOLOGICAL CHARACTERISTIC OF THE GLACIAL LAKES OF THE NORTH OF THE KOMI REPUBLIC (RUSSIA) AS A WATERFOWL HABITAT

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INTRODUCTION

Limnological study of lakes situated in latitude 66,5 North in the Komi Republic, where a lot of waterfowl species are nesting and also concentrating during the season passage, is very important for conservation of waterfowl habitat limnological base. We wanted to determine parameters of some qualitative and quantitative ecosystem characteristics of the four lakes: Pysey-ti, Vozey-ti, Evsya-ti, Siatey-ti. Mentioned lakes belong to the Kolva Basin and they are situated at a distance is 7 up to 80 km from each other. These are residual reservoirs of the big lake-land glacial reservoirs (Kolvinskoe lake) existed in the late-quaternary period. They are situated in the interpillow hollow of of postglacial ridge (Kvasov, 1975).

MATERIALS AND METHODS

Water sample selection for hydrochemical analysis was held from the 5 of September to the 5 of October according to the general method: one station is in the middle of the lake, two station on the coast, the samples were taken additionally in different lake points from the surface for determination of pesticides, bichromatic acidification, coloration. Water samples were taken by Ruthner's bathometer. The hydrochemical material consisted of 60 samples. The hydrobiological material was collected during the period of time from July 5 to the October 5, 1990. Zooplankton was gathered by Jady's quantitative net, kapron sieve N62 was used for the net cone. Zoobenthos was gathered with the help of Peterson's bottom-scoop 1/40 m. Benthos samples were washed through the washer made of kapron net N40. In each lake 13

zooplankton and zoobentos sampler were gathered according to the general scheme: 3 stations in different plots - 3 samples in each one and one station - 4 samples in the middle of the lake. Each sample was processed separately. Mean arithmetical index is introduced in the article. Hydrobiont determination was conducted up to the species, excluding some systematic groups. Zooplankton biomass calculation was made with use of individual balance tables (Mordulhai-Boltovskoy, 1954; Yukhneva, Koynova, 1973). Collection, processing and calculation of the hydrobiological material was committed according to the generally accepted method. That is why the determination of the quantitative and qualitative lake ecosystem characteristics is of great interest. Peaceful and raptorial species production was calculated from the mean seasonal populational biomass and P/B during the season for the given species (Zaica, 1972; Slepukhina, 1977). Seasonal specific production index is taken from the literature about the lakes of the similar latitude zone (Karelia, Siberia) (Alimov, Pohinogenova, 1975; Kuzmenko, 1976; Sadyrin, 1984). Ration of raptorial invertebrate animals was calculated proceeding from the quantities of the daily rations in % from the body weight (Sadyrin, 1978; Sokolova, 1980) according to equation

$$Cr = Cr - B t,$$

using quantities of the daily rations in accordance to the species or groups. Pure zooplankton and zoobenthos production was calculated according to the following equation

$$P_{\text{pure}} = Pr + Pp - Cr,$$

where Pr - raptorial's, Pp - production of peacefuls, Cr - raptorial's ration (Shushkina, 1966). Truthhel difference of the selective means was determined (Rokitsky, 1967). During discussion of the results of morphoedaphic index was used:

$$MEI = \frac{S_i}{H}$$

where S_i - general mineralization, H - mean lake depth (Kitaev, 1984).

RESULTS

The territory of the Kolvinskaya lowland where the lakes are situated, serves a nesting place for some duck species. Number of the nesting ducks consist of 70-300 individuals/100 km (Mineyev, 1987). Number of the mass nesting species on the given territory consists %: *Clangula hyemalis* L. - 45-67 %, *Melanitta nigra* L. - 9,3-15 %, *Aythya marila* L. - 6-12,3 %, *Anas penelope* L. - 5,6-8,3 %. Anser fabalis Lat. concentrates during the autumn passage. The reservoirs belong to the most biggest glacial continental lakes on the north of the Komi Republic (Table 1).

Table 1: Morphometrical data and hydrochemical classification of lakes

Lake	Area (ha)		Depth (m)		Water volume mln. m ³	Classification of waters in accordance to Alekhin, 1953.
	Total	Overgrowned (%)	Mean	Maximum		
Siattey-ti	170	0,85 (0,5)	4,2	9,0	4,25	C ₁ ^{Ca} 0,34 0,03
Evsya-ti	180	3,50 (2,0)	5,6	26,7	13,32	C ₁ ^{Ca} 0,29 0,03
Pysea-ti	266	7,98 (3,0)	8,4	23,8	11,97	C ₁ ^{Ca} 0,30 0,028
Vozey-ti	610	18,30 (3,0)	13,0	47,0	62,70	C ₁ ^{Ca} 0,34 0,031

The distinctive feature of studied lakes is a poor overgrownness by the high water plants. Waters of all studies lakes (Table 1) belong to hydrocarbonateclass of calcium group, the type of small mineralization between lakes is not great. There are no distinctive differences of biogenic element concentration in the water, for example: concentration of general nitrogen varies in the interval of 0,1 to 0,34 mg/l.; mineral phosphor from 0,002 up to 0,006 mg/l. According to the summed nitrogen the most eutrophic lakes are Evsya-ti and Pysey-ti, according to the sum of biogenic elements the first place is take by the Evsya-ti lake, the most oligotrophic lake is Vozey-ti. In spite of the general genesis, there are distinct differences between lakes in some biogenic elements: in accordance of summed iron index lake Siattey excels all the others in 3-13 times, in the waters of lake Evsya-ti flint concentration is 1,4 mg/l,

that exceeds concentration in other lakes in 3-4 times. There is low concentration of seenimed iron in lake Vozey-ti from 0,001 up to 0,04 mgr/l. Such index fluctuations in abiotic environmental factors should influence on the development of organic life in the lakes, that exactly what we saw while analysing zooplankton and zoobenthos communities (Table 2).

Table 2: Indices of the mean number and lake zooplankton biomass (July-September, 1990)

Lake	Coast line		Pelagial		Level of significance (P) of the head of selective means	
	sp/m ³	g/m ³	sp/m ³	g/m ³	according to numbers	according to biomass
Siattey-ti	5850	1,30	3100	0,83	0,05	0,05
Evsya-ti	138630	5,31	103149	3,20	0,05	0,05
Pysea-ti	6998	0,19	4998	0,13	0,10	doubtful
Vozey-ti	6251	0,50	4809	0,17	0,10	0,05

Analysis of the material showed that the coastal zooplankton; a little bit richer than the plankton of pelagial. The difference is statistically proved in most cases (Table 2). All the lakes during investigation had the common complex of dominants in numbers and in biomass of zooplankton species.

Among *Rotatoria Asplanchna priodonta* Cosse, *Conochilus unicornis* Rous were dominating; among *Calanoidae- Mesocyclops leuckarti* Claus + *M. oithonoides* Sars, *Rosmina obtusirostris* Sars were dominating.

The richest species diversity of zooplankton was found in lake Pysey-ti (19 species), in other lakes species diversity is smaller (8-13 species). In the coast of lakes species diversity is bigger than in pelagial. Differences in composition of benthos is much more considerable, than in zooplankton. In different lakes the first is taken by the different groups of invertebrates. According to biomass the dominating invertebrate in Lake Evsey-ti - *Oligochaeta*, in Lake Pysey-ti - larva of *Ephemeroptera*, in Lake Vozey-ti - *Oligochaete*, in Lake Siattey-ti - *Mollusca*. The dominating group mollusks from the Siattey lake is represented by the following species: *Euglesa rosea* Schol., *Sphaerium corneum* L., *Planorbarius corneus* L., *Lymnaea ovata* Dr. In Lake Pysey-ti the dominating larvas of *Ephemeroptera* in their biomass

are *Baetis sp.*, *Chironomidae* - *Stotochironomus pictulus* (Mg.), *Potthastia gaedi* (Meig.), *Trichoptera* - *Molanna angustata* Curt.

Numbers and biomass of benthos is considerably higher in the coast line, benthos is much more richer in Lake Siattey-ti biomass in twice less (approximately) in Lake Pysey-ti (Table 3).

Table 3: Indices of numbers and lake biomass zoobenthos (July-September 1990)

Lake	Coast line		Pelagial		Level of significance (P) of the head of selective means	
	sp/m ²	g/m ²	sp/m ²	g/m ²	according to numbers	according to biomass
Siattey-ti	20800	3,12	10500	0,87	0,05	0,01
Evsya-ti	7920	18,61	160	0,78	0,01	0,01
Pysea-ti	7400	5,06	2840	0,18	0,01	0,01
Vozey-ti	5680	35,00	305	1,60	0,01	0,01

In the productivity of lakes there are considerable differences. According to the production indices Lake Siattey-ti is separated. This is the only one among the studied lakes, where benthos production in the littoral zone and in the whole reservoir is much bigger than zooplankton production. According to the productive indices of zooplankton and zoobenthos Lake Pysey-ti is regarded as the most productive one, it corresponds in a good way with its hydrochemical characteristic and morphometry.

The most productive Lake Vozey-ti is a highly eutrophic reservoir. Taking into consideration the calculations pure zooplankton and zoobenthos production during the season consists according to lakes: Pysesy-ti - 4,64; Evsya-ti - 1,08; Siattey-ti - 0,45; Vozey-ti - 0,39 t/ha. Contribution of the littoral zone into the total production of forage reserve-compiled (%): Pysey-ti - 19,6; Evsya-ti - 5,5; Siattey-ti - 70,8; Vozey-ti - 14,5.

According to morphoedaphic index (Ryder, 1965) expected quantity of zooplankton and zoobenthos biomass is lower than real (Table 4).

Table 4: Zooplankton and zoobenthos biomass and M_{EI} correlation

Lake	H	Si H	Prognosed biomass		Real biomass	
			zooplankton g/m ³	zoobenthos g/m ²	zooplankton g/m ³	zoobenthos g/m ²
Siattey-ti	4,2	7,1	1,07	3,57	0,34	18,30
Evsya-ti	5,6	4,2	0,82	3,98	6,90	1,99
Pysea-ti	8,4	3,2	0,90	4,00	4,26	9,69
Vozey-ti	13,0	2,3	0,70	3,50	0,16	2,62

DISCUSSION

Estimating lake investigation according to one of the indices for waterfowl habitats quantitative and qualitative composition of forage reserve, it is possible to come to the certain prognostic estimates. For this is not enough to make comparison of forage reserve of the lakes with the feeding spectrum of the waterfowl species living there. Lake Siattey-ti is optimal as a habitat for *Melanitta nigra*, *Aythya marila*. Feeding spectrum consist of mollusk from 25 % - 50 % according to the general feeding clot. Lake Pysey-ti is a good habitat for *Clangula hyemalis*, *Anas penelope* and also for *Anas crecca*. Feeding larvas of *Trichoptera*, *Chironomidae*, *Ephemeroptera* compiling from 36 up to 73 % from the total feeding clot, and also vegetative parts of plants (Mineyev, 1987). Availability of the organisms used as fodder for waterfowl is high in Lake Siattey-ti, Lake Pysey-ti, where there is a wide littoral zone, and as a results of it, production of the littoral zone compiles from 20 u to 70 % from the total lake zooplankton and zoobenthos production. The lakes obtain considerable potential resources for increasing the species of the birds.

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