

FISHERIES RESEARCH BOARD OF CANADA

Translation Series No. 2897

The Benthos of small lakes of the Kuito Lake Group

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Original title: O Bentose Malykh Vodoemov Kuitinskoi Gruppy

From: Trudy Korel'skogo Otdeleniya GosNIORKh. (Proceedings of the Branch of GosNIORKh), 5(1) : 196-201, 1967

Translated by the Translation Bureau(YK)
Multilingual Services Division
Department of the Secretary of State of Canada

Department of the Environment
Fisheries and Marine Service

Freshwater Institute
Winnipeg, Man.

1974



CLIENT'S NO. N ^o DU CLIENT —	DEPARTMENT MINISTÈRE Environment	DIVISION/BRANCH DIVISION/DIRECTION Office of the Editor Fisheries Service	CITY VILLE Ottawa
BUREAU NO. N ^o DU BUREAU 165323	LANGUAGE LANGUE Russian	TRANSLATOR (INITIALS) TRADUCTEUR (INITIALES) YK	JAN 30 1974

Trudy Karel'skogo otdeleniya GosNIORKh (Publications of the Karelian Branch of the State Scientific Research Institute of Lake and River Fisheries), Vol. 5, No. 1, 1967, pp 196-201 (USSR)

The Benthos of Small lakes of the Kuito

Lake Group

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UNEDITED TRANSLATION

For information only

TRADUCTION NON REVISEE

Information seulement

This paper is part of broad research conducted by the Karelian division of GosNIORKh in the summer of 1963 to establish the lakes that are suitable for the fishing industry and fish-breeding. Until now the benthic fauna of small lakes of Northern Karelia has hardly been studied and, for this reason, information on their food supply has not been given in the literature. This paper deals with the benthos of lakes Mal'viainen and Okhtan"yarvi, located in the northern part of the Karelian ASSR and belonging to the Kuito group of lakes.

Collection of benthos samples on lakes Mal'viainen and Okhtan"yarvi took place from August 30th to September 8th 1963. / ^{Species} Composition determination of molluscs was done by B.M. Aleksandrov; that of Ostracoda, by A.A. Yarvekyul'g, and that of Chironomidae, caddis-flies, may-flies, and larvae of beetles, by this author.

Lake Mal'viainen. The lake's water surface is 9.62 km². The shoreline is very indented. Maximum depth is 16 m, prevailing depths are in the range of 6-8 m. The bottom along the littoral is often rocky or rocky, sandy. Sandy bottom extends to a depth of 4 m. Beyond this isobath a silty bottom prevails which is predominantly of a grey-green or brown color. A significant part of the bottom contains ore formations. Water temperature (August) reached 21° on the surface, 17.5° at a depth of 5 m, and 9.9° at the bottom, 12 m. Transparency, by the method of the Secchi disc, was 4.5-5.7 m; the color of the water was yellowish-green. The water was slightly acid (pH 6.2-6.4). In the north-east Lake Mal'viainen connects through a sound to Lake Okhtan"yarvi.

Higher water plants occur in limited quantity. Only rare thickets of the following are encountered: reed, horsetail, pondweeds, bur reed, sedge, and quillwort.

The benthic fauna of lake Mal'viainen is varied and includes forms of a number of different benthic groups. It is based on Chironomidae, the most widespread, which is represented by 23 forms of larva. In the second place are the molluscs of the genus Pisidium. Seven species of this genus were encountered. In addition to the omnipresent Pisidium, mollusc species of the Limnaeidae, Planorbidae, and Valvatidae are also encountered. Worms are represented by Oligochaeta, Nematoda, leeches, Nematomorpha, and Turbellaria. Microbenthic crustaceans are found everywhere in the lake, e.g., Cladocera, Ostracoda and cyclopoids, Ostracoda predominating. Another inhabitant of the lake is a representative of a relict crustaceans, Pontoporeia affinis, which is characteristic of many lakes of Northern Karelia (Upper, Middle, and Lower Kuito, Gerd, 1935; Topozero, Aleksandrov, 1958, and others).

In addition to the already mentioned benthic elements, Lake Mal'viainen is also inhabited by mayflies, caddis flies, and, of the aquatic arachnids, water mites, ticks, Halacarids and oribatids. On the littoral of the lake bryozoans Cristacella mucedo and sponges occur frequently.

The littoral strip, up to a depth of 6m having homogeneous greyish-green watery silt rich in plant detritus, with large amounts of cladoceran chitin, has the highest concentration of benthic population. A basic position is occupied in this biotope by pelophilic forms of Chironomidae (Cryptochironomus gr. vulneratus, Sergentia longiventris), and also by Procladius, which is ecologically adapted to the most varied biotopes. The habitats of larvae of Tendipedini gen.? 1. minuta and Orthoclaadiinae gr. zalutschicola are associated with silt of coarse detritus. In this biotope an important position is occupied by Pisidium (Pisidium nitidum, P. casertanum, P. hibernicum). Here is also encountered Valvata piscinalis var. borealis. Other benthic groups that are widespread are oligochaetes Hydrachnellae, ostracods (Candona candida, C. sarsi, C. protzi), cyclopoids, cladocerans, and closer to shore, leeches (Helobdella stagnalis).

Forms characteristic of reed beds are Allochironomus and Ordella horaria.

On the silty bottoms of the shallow part of the lake chironomids predominate in the numbers (54%) and biomass (72%) of the benthos. The most important among them are the pelophilic forms ← Orthoclaadiinae gr. zalutschicola, Tendipedini gen.? 1. minuta, and also Procladius.

On the silty, sandy bottom of the sub-littoral, in addition to the forms already indicated, the following representatives of

Chironomidae are encountered: Polypedilum gr. scalaenum, Stictochironomus histris and, of the higher crustaceans, a relict, Pontoporeia affinis.

The biotopes described above are the richest in benthos both quantitatively and qualitatively (20.0 kg/ha in biomass and 18.5 mil. specimens/ha in population density). Their thermal and gas conditions as well as the characteristics of the lake bed are favorable to the development of aquatic organisms. Regarding food availability for benthos-eating fish, the littoral strip is the area richest in benthic invertebrates.

At depths of 6 to 16 m and on soft silt the bottom population density is somewhat decreased. Here the most important position is occupied by the chironomids Micropectra gr. praecox and Chironomus f. l. salinarius. On silt with coarse detritus Psectrocladius gr. psilopterus, P. gr. septentrionalis, and P. medius are widespread. Protanypus and Procladius gr. bathyphila, forms characteristic of lakes with a significant content of oxygen and a low concentration of humic matter (Lipina, 1928), are common at maximum depths. The sandy, silty bottoms of deep regions are inhabited by Polypedilum gr. scalaenum and the members of aquatic arachnids Oribatei and Halacaridae.

The second place in the deepwater beds of silt or sandy silt is occupied by Pisidium (Pisidium lilljeborgi, P. subtruncatum, P. conventus). A characteristic species among these is Pisidium conventus. Other benthic elements that are widespread here are oligochaetes, benthic cladocerans, ostracods (Candona candida, C. sarsi), cyclopoids, and Hydrachnellae.

Metriocnemus gr. marcidus and Pisidium conventus are the main fauna of ore-bearing, brown bottoms. This region is characterized by uniformity in the composition of biota and a low population density. Procladius, Orthocladiinae gr. zalutschicola, Procladius gr. bathyphila are encountered in small numbers. In addition to Pisidium conventus, Pisidium lilljeborgi is encountered here in small numbers. Of other benthic groups the oligochaetes, nematodes, cladocerans and ostracods occur rarely. In this depth zone the benthic biomass decreases with increasing depth; the presence of an ore crust on the silt has a similar effect. For instance, the biomass at the maximum depth is 0.3 kg/ha, while the biomass on ore-bearing silt is 5.4 kg/ha.

Data on population densities and biomass of benthic fauna of Lake Mal'viainen are summarized in Table 1.

The average biomass of the benthos of the lake is 9.36 kg/ha, and the average population density is 9.58 mil. specimen/ha.

It should be noted that the biomass of the benthos of Lake Mal'viainen is somewhat higher than that of the larger lakes of Northern Karelia: Engozero (5.8 kg/ha, Sokolova, 1959), Pyaozero (3.6 kg/ha; Aleksandrov, 1959), Topozero (2.2 kg/ha; Aleksandrov, 1959), Middle Kuito (1.1 kg/ha; Gerd, 1935), Lower Kuito (0.7 kg/ha; Gerd, 1935), Upper Kuito (6.8 kg/ha; Gerd, 1935); yet, it is significantly lower than the benthos biomass of some small lakes of Southern Karelia, e.g., Munozero (42.5 kg/ha; Gordeeva-Pertseva, 1959); finally, it is similar to that of Urosozero (9.97 kg/ha; Gordeev, 1959).

Even though benthos population density and biomass per unit area are relatively low for Lake Mal'viainen, on the whole this is

1. Таблица 1
2. Средние показатели численности и биомассы бентоса оз. Мальвиайнен

3. Название групп	4. Численность		5. Биомасса	
	6. млн. экз/га	%	7. кг/га	%
Chironomidae	4,76	49,9	5,84	62,7
Pisidium	1,71	18,0	1,84	19,9
Valvatidae	0,02	0,2	0,15	1,6
Oligochaeta	0,29	3,0	0,19	2,1
Pontoporela	0,05	0,5	0,15	1,5
Hirudinea	0,09	0,9	0,47	5,0
Ephemeroptera	0,02	0,2	0,10	1,1
Hydrachnellae	0,25	2,6	0,14	1,5
Cladocera	0,39	4,0	0,12	1,3
Cyclopoida	0,69	7,0	0,16	1,7
Ostracoda	1,24	13,0	0,16	1,7
8. Прочие группы	0,07	0,7	0,04	0,4
9. Всего	9,58	100,0	9,36	100,0

1. Table 1
2. Average population densities and biomass of the benthos of Lake Mal'viainen
3. Names of groups
4. Population density
5. Biomass
6. mil. specimen/ha
7. kg/ha
8. Other groups
9. Total

compensated to a certain extent by the lake's rather significant total reserves. Local accumulations of benthos and the quality of its composition are also important in the food picture.

Lake Okhtan"yarvi. The lake surface is 22.99 km². The lake is spring-fed. Maximum depth is 25 m and depths of 8 m prevail. The littoral strip of the bottom is predominantly rocky or rock-sandy. Sandy bottom is prevalent up to a depth of 5 m and in the eastern part of the

lake it occupies a significant part of the area. All the deep regions of the lake are covered with silty deposits. The largest part of the silt contains ore formations. The lake water has a greenish-yellow color and a transparency of up to 6.0 m, and is slightly acid (pH 6.0-6.2).

Macrophytes very seldom occur in the lake. There is an occasional occurrence of thickets of reeds, horsetail, pondweed, and others.

The benthic fauna of Lake Okhtan"yarvi, although quite varied, is sparse. The benthos is composed primarily of aquatic insects, molluscs, crustaceans, and worms. The lake is also inhabited by relict crustaceans like Pallasea quadrispinosa and Pontoporeia affinis, which are peculiar to many bodies of water in Northern Karelia.

The leading position in the benthic population is occupied by chironomids (12 forms), which are widely distributed over the lake. The molluscs are significantly fewer in numbers than the chironomids. Five Pisidium species were encountered. Sphaerium is encountered solitarily. In coastal strips, Limnaeidae and Planorbidae are found.

Distribution of organisms in Lake Okhtan"yarvi, as in Mal'viainen, depends on the topography and composition of the bottom.

The fauna of the littoral strip is quite varied and represents about 75% of the benthos biomass of the lake. In littoral strips with silt containing ore formations, the benthic population is characterized by a limited variety of forms. The basis of this biotope consists of a few chironomids (Procladius, Protanypus), nematodes, and oribatids. Represented in smaller numbers are Pisidium (Pisidium lilljeborgi), oligochaetes, Hydrachnellae, and cyclopoids. The benthic biomass amounts here to 4.3 kg/ha and the population density to 5.5 mil. specimen/ha.

Sandy, silty bottom covered with an ore crust, having negligible expanse and occurring primarily along the western shore is characterized by a very low population density in comparison with the biotope described above. The following are encountered solitarily: chironomids (Procladius, Tendipedini gen.? minuta), Pisidium (Pisidium lilljeborgi), nematodes, oligochaetes, ostracods, (Candona rostrata, C. protzi). Their total biomass amounts to 0.94 kg/ha with a population density of 2.86 mil. specimen/ha.

The population of organisms of the shallow benthic regions with sandy bottom, encountered primarily along the eastern shore, together with sparse thickets of reeds and pondweed, is somewhat better developed. Its biomass is 8.2 kg/ha and the population density is 11.2 mil. specimen/ha. Here is found the relict diminutive crustacean Pallasea quadrispinosa. The basis of the population of this biotope consists of chironomids and oligochaetes. Taken together they have a biomass of 5.3 kg/ha and population density of 8.6 mil. specimen/ha. The forms representing the chironomids are characteristic of littoral strips (Tanytarsus gr. lauterborni, Cryptochironomus gr. vulneratus, Limnochironomus tritonus), and are also widely distributed in the lake (Metriocnemus gr. marcidus and Procladius). Among these Limnochironomus gr. tritonus occupies a dominating position. Molluscs are represented here by Pisidium conventus. Some of the other members of the benthic fauna of these regions of the bottom are: nematodes, benthic cladocerans, Hydrachnellae and, in reed beds, the larvae of beetles (Chrysomelidae).

The population of deep regions is considerably sparser and more varied in composition (biomass - 3.2 kg/ha, population density - 3.5 mil. specimen/ha). These areas are inhabited by oxybiotic, cryophilic forms of chironomids (Prodiamesa gr. bathyphila, Protanypus, Stictochironomus

histrío), and by Pisidium conventus, a species characteristic of deep water bodies receiving little warmth.

The benthic fauna of watery, dark-brown or greenish-brown silt in the deep zone is represented mainly by chironomids (Procladius, Prodiamesa gr. bathyphila, Sergentia longiventris, Stictochironomus histrío) and pisidioms (Pisidium conventus, P. hibernicum, P. casertanum). Of the other benthic groups the following are encountered here: ostracods (Candona rostrata, C. candida), oligochaetes, cladocerans, nematodes and hydrachnids. A larva of the caddis-fly Neuronia sp. was encountered at a depth of over 15 m. The fauna of these biotopes is richer both qualitatively and quantitatively (biomass - 4.6 kg/ha, population density - 5.8 mil. specimen/ha), than that of regions with bottoms containing ore formations.

Deep regions with sandy, silty bottoms of small area have low population densities. The benthos of this biotope includes deepwater forms of chironomids (Stictochironomus gr. histrío, Prodiamesa gr. bathyphila), as well as the widespread (throughout the lake) Procladius and Metriocnemus gr. marcidus. Pisidium (Pisidium nitidum) and oligochaetes occur here in similar quantity. Of the other benthic fauna groups Sphaerium (Sph. corneum) is encountered here solitarily.

Strips of silty, ore-bearing bottom occupy a large part of the area of deep regions of L. Okhtan"yarvi. The fauna of this biotope is very weak numerically, and its composition is homogeneous. The basis of the benthos of these areas consists of small numbers of chironomids (Procladius, Metriocnemus gr. marcidus), Pisidium (Pisidium conventus), representatives of oligochaetes, nematodes, and ostracods (Candona candida). The biomass of the benthos of deep regions with ore-bearing silt bottoms is very low, 1.8 kg/ha. The iron ore-bearing silts of lakes Mal'viainen

and Okhtan"yarvi occupy wide areas up to 40% of the area of the bottom). This is reflected appreciably in the general benthic biomass indices for the two lakes and is one of the explanations for their low overall productivity.

1. Таблица 2
2. Средние показатели численности и биомассы бентоса оз. Охтанъярви

3. Название групп	4. Численность		5. Биомасса	
	6. млн. экз/га	%	7. кг/га	%
Chironomidae	1,54	31,5	2,17	49,5
Pisidium	0,81	16,5	0,74	16,8
Sphaerium	0,02	0,2	0,61	14,0
Oligochaeta	0,44	8,0	0,18	4,1
Pallasea	0,02	0,2	0,23	5,2
Ostracoda	0,49	10,0	0,10	2,3
Hydrachnellae	0,10	4,9	0,05	1,1
Nematodes	0,90	18,1	0,07	1,6
Cyclopoida	0,37	7,1	0,07	1,6
Coleoptera	0,05	1,0	0,04	0,9
Trichoptera	0,02	0,2	0,11	2,5
Прочие группы 8.	0,14	2,3	0,02	0,4
9. Всего	4,90	100,0	4,39	100,0

1. Table 2
2. Average values for population density and biomass for L. Okhtan"yarvi
3. Name of group
4. Population density
5. Biomass
6. mil. specimen/ha
7. Kg/ha
8. Other groups
9. Total

From the data given above, it follows that the lake areas richest in food for fish are littoral strips amidst rare thickets of macrophytes.

Data on the biomass and population density of the benthos of L. Okhtan''yarvi is given in Table 2.

The average biomass and population density of the benthos of L. Okhtan''yarvi are 4.39 kg/ha and 4.9 mil specimen/ha respectively.

The quantitative indices of the benthos in L. Okhtan''yarvi are lower than those of L. Mal''viainen, which is due, apparently, to greater flow rate, higher ore content of the bottom, depths of the lake, and other conditions.

Despite its fairly diverse composition, the benthos of L. Okhtan''yarvi occurs only in small quantities per unit area. However, allowance should also be made for the large area of the lake which has a considerable compensating effect on the total food resources for bottom-feeding fish. Furthermore, in other seasons of the year the biomass may increase, due to the larvae of aquatic insects.

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