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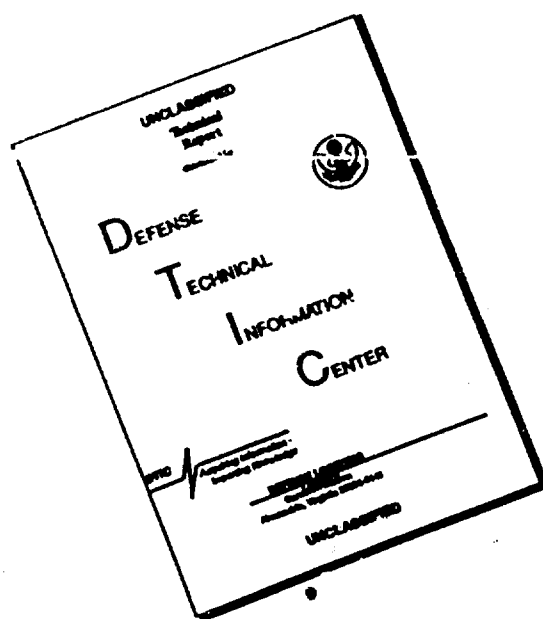
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The Condition of the Phytobenthos of the Novosibirsk Reservoir
with a Normal Head

pp 85-90

G. D. Levadnaya

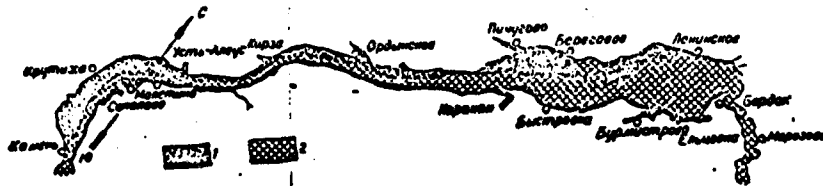
In the present work the results of observations of the condition of the phytobenthos of the Novosibirsk Reservoir in 1959 -- the first year of its complete flooding -- are given. The selection of samples of the bottom and of encrustations was made during monthly trips between the end of May and October 1959 over the entire stretch from the city of Kamen' to the dam. In July, a trip was made along the shoals of the entire reservoir territory.

In all, 120 samples of the bottom and 60 of encrustations were examined. Among the latter were encrustations from stumps, stumps with roots, floating trees, rafts, submerged plants and objects introduced into the water by man: poles of wooden bridges, landings, buoys, underwater parts of a cutter. Floating filamentous algae were also collected. In addition, about 100 intestines of tendipedid water larvae were examined: the presence of algae was demonstrated in them. A cell count was made by the five-plus system. For the purpose of determining the species of diatoms permanent preparations were made using a medium with a high index of refraction, 1.68. Some of the samples were concentrated with cadmium iodide with a specific gravity of 2.65. Empty valves of diatoms were counted separately.

In accordance with its hydrological regime the reservoir is divided into three parts, of which the upper and middle have a river regime to a certain degree; the lower part, expanded, is lake-like. From the mouth of the Karakan River to the dam the latter portion was filled in 1957; the middle portion (from the city of Kamen' to the Ust'-Aleus River) was completely flooded only in 1959.

Upper Part of the Reservoir

The upper part of the reservoir includes the race portion of the Ob' and the flooded expanded flood-plain about five-six kilometers wide formed at the site of extensive meadows. In this area samples were taken at the former race opposite the village of Sokolovo, on the left-bank area of the flood-plain, opposite the villages of Krutikha and Maslyakha at three stations as well as on the flood-plain of the Ust'-Aleus River, 500 kilometers from the mouth; on the right bank, above and below Sokolovo Village and opposite the village of Maletino (see the map-sketch).



Map Sketch of Nobosibirsk Reservoir. 1. Depth less than five meters;
2. Depth over five meters.

In the race portion (depth eight-10 meters) the bottom is sandy with very little silt deposition; in the surface layers occasional *Melosira granulata* (Ehr.) Ralfs, *M. varians* Ag. and empty diatom valves were found. The extensive left-bank section below the flood plain is chiefly shallow water (depth one-two meters). The bottom is filled up with ooze, with a mass of decaying submerged meadow vegetation. In places here black current bushes have been preserved under the water; stumps of felled trees are encountered. Among them growths of cane, pondweed, water smartweed and a mass of star duckweed appeared. Large floating accumulations are created here by *Cladophora fracta* Kütz., the branches of which are covered chiefly with two species of epiphytes -- *Gomphonema olivaceum* (Lyngh) Kütz. and *Diatoma vulgare* var. *productum* Grun. Homogeneity of the infestations is associated with conditions favoring the development of a small combination of species, which evidently suppresses the development of the other algae (1). Less often, accumulations of other filamentous algae were noted: *Spirogyra* sp., *Mougeotia* sp., *Zygnema* sp. The superficial layers of the bottom, represented by ooze-covered plant residues, were inhabited by a considerable number of diatoms -- *Navicula radiosa* Kütz., *N. cuspidata* Kütz., *Pinnularia microstauron* (Ehr.) Cl., *P. streptoraphe* Cl., *Cymatopleura solea* (Breb.) W. Sm and others. By the concentration method here a total of 36 species and varieties of diatom algae were found. Tendipedid larvae collected in the *Cladophora* accumulations -- *Ablabesmya* from the *monilis* group and *Cricotopus* from the *silvestris* group -- constantly contained diatomaceous algae, colonizing its coenoses, in their intestines.

The section of the left-bank flood plain opposite the Ust'-Aleus River (depth two-three meters) is of the same nature. Here, half-submerged willow bushes were preserved; there were pondweed, water smartweed, and star duckweed. In the midst of the water vegetation there were large accumulations of *Cladophora*. On the inundated flood plain of the Ust'-Aleus River (depth 40-50 centimeters, width about 300 meters) small patches of pondweed and *Salvinia* appeared. The remains of meadow vegetation on the bottom were covered by ooze and a layer of *Cladophora*. The growths of *Cladophora* contained a mass of tendipedid larvae. On opening the intestines of the larvae of *Glyptotendipes* from the gripekoveni group and *Cricotopus* from the silvestris group pieces of *Cladophora* were found with a considerable number of epiphytes -- *Gomphonema olivaceum* (Lyngb) Kütz., *G. constrictum* Ehr., *G. parvulum* (Kütz.) Grun, *G. augur* Ehr., *Epithemia sorex* Kütz., *E. zebra* var *porcellus* (Kütz.) Grun and others.

The right-bank flood plain of the upper part of the reservoir occupies a narrow coastal strip. Above the village of Sokolovo (depth one-1.5 meters) no algae were found in the superficial layers of the ooze; only empty valves of diatomaceous epiphytes were found. Below the village of Sokolovo on the flooded section along the main bank (depth 10-15 centimeters, width about 100 meters) there was a solid matting of *Cladophora* with a few epiphytes -- *Cocconeis pediculus* Ehr., *C. placentula* Ehr. Below, in the region of the village of Maletino (depth 1.3 meters) accumulations of *Spirogyra* were observed; islets of water smartweed and *Salvinia* were noted. On the bottom, amid the ooze-covered dead meadow vegetation frequently *Melosira varians* Ag., *Navicula rhynchocephala* Kütz., *Surirella angustata* Kütz. were encountered. In all, after a concentration 60 species and varieties of diatomaceous algae were found. Occasional desmid algae were obtained.

Middle Part of the Reservoir

The middle part of the reservoir, extending from the Ust'-Aleus River to the Karakan River, is the narrowest, has a shape like a river and has very small inundated flood-plain areas. Samples of the bottom were taken in the race portion -- opposite Ordynskoye Settlement and at four points on the left bank flood-plain (between the Kirza and former Orda rivers as well as in the mouth of the Kirza River, on inundated forest-felling areas and in a lake at the village of Sharap). The bottom of the race portion opposite Ordynskoye Settlement is silt-covered sand in which no algae were found. Only in September were various filaments of *Melosira* encountered. No algae were found in the intestines of *Tendipes semireductus* or *T. plumosus* larvae, although they were filled with

ooze.

The most varied algal flora was recorded on the inundated forest-felling areas (depth of two meters) at the village of Sharap. In the accumulations of filamentous algae and among the remains of ooze-covered vegetation on the bottom various Chlorococcaceae were found -- species of the genera *Pediastrum*, *Scenedesmus* as well as *Coelastrum microporum* Naeg., *Dictyosphaerium pulchellum* Wood., *Oocystis parva* W. and W. and others; desmids -- species of the genera *Cosmarium*, *Staurastrum*, *Micrasterias* sp., *Closterium* sp.; diatoms -- *Navicula radiosa* Kütz., *Synedra ulna* (Nitzsch) Ehr., *Gomphonema acuminatum* var. *coronatum* (Ehr.) W. Sm., *G. constrictum* var. *capitatum* (Ehr.) Cl.; blue-green algae -- *Phormidium molle* (Kütz.) Gom, *Gomphosphaeria lacustris* Chod.

Lower Part of the Reservoir

Considerable depths are characteristic of the lower lake-like portion of the reservoir -- in the race portion as deep as 24 meters; in the area above the flood-plain, as deep as 15 meters. The most extensive shallow-water area (first year of rise of the water) was located on the left bank above the village of Beregovoye. In addition, shoal areas in the form of a narrow coastal strip rim almost the entire lower part of the reservoir, whereby some of them were filled only in 1959.

Samples were taken in 1959 along two transverse sections: 1) the village of Bystrovka to the village of Beregovoye; 2) the mouth of the Yel'tsovka River to the village of Leninskoye. In addition, samples were taken in shallow-water areas at the village of Beregovoye, village of Bystrovka, near the village of Burmistrovo, the village of Sosnovka and below the mouth of the Yel'tsovka River.

A study of the bottoms of the lower part during the period of filling of the reservoir (2) showed the absence of phytobenthos both in the race section and in the section above the flood-plain on the inundated land (meadows, islands, orchards, marshes, and flood-plains of rivulets), where only *Melosira* and empty diatom valves were encountered. Benthos forms were found only at places of filled lakes. In 1959, as before, only *Melosira* was found in the bottom of the race portion; the number of its cells increase toward the autumn.

In the inundated flood-plain section at the village of Bystrovka (depth 10-12 meters) there are very occasional diatoms in the summer and autumn: *Cymatopleura solea* (Breb) W. Sm., *Melosira varians* Ag., *Rhopalodia gibba* (Ehr.) O. Müll, *Epithemia Zebra* (Ehr.) Kütz. The intestinal contents of *Tendipes semireductus*, and *T. plumosus* larvae collected here were poor in algae. *Melosira granulata* (Ehr.) Ralfs and

empty diatom valves were constantly present. The former Lake Kur'ya is somewhat distinct; here, despite the considerable depths (13-15 meters), the following diatoms were found: *Navicula radiosa* (Kütz.), *Pinnularia microstauron* (Ehr.) Cl., *Cymbella turgida* (Greg.) Cl., *Surirella ovata* Kütz. *Tendipes semireductus* larvae collected in the ooze of Lake Kur'ya and in the former flood-plain of the Irmen' River also contained diatoms -- *Gomphonema constrictum* Ehr., *G. parvulum* (Kütz.) Grun., *Navicula rhynchocephala* Kütz., *Cymbella prostrata* (Berkley) Cl., *Cocconeis pediculus* Ehr.

A considerable area is occupied by the shallow-water area located above the village of Beregovoye, where the bottom soil is permeated by plant roots and is covered with silt deposits. In June-July here *Cladophora fracta* Kütz. develops en masse; epiphytic on it in large numbers are *Diatoma vulgare* var. *productum* Grun. and *Gomphonema olivaceum* (Lyngb.) Kütz. Less often, *Cocconeis pediculus* Ehr. and *Rhoicosphenia curvata* (Kütz.) Grun. are encountered. Bottom-plankton diatoms are constantly present. Inhabitants of *Cladophora* accumulations -- larvae of *Endochironomus* from the *tendens* group, or *Cricotopus* from the *silvestris* group -- contain species of *Cladophora* with epiphytes in their digestive tracts.

Nearer to the dam, along the section between the Yel'tsovka River and the village of Leninskoye the phytobenthos is exceedingly poor. On the ooze-covered plant remains in the Chemskiye swamps, opposite the village of Leninskoye (a depth of 14 meters) the diatoms are still heterogeneous, although they are encountered in small numbers -- *Synedra ulna* (Nitzsch.) Ehr., *S. acus* Kütz., *Diatoma vulgare* Bory, *Eunotia lunaris* Ehr. (Grun.), *Pinnularia viridis* (Nitzsch.) Ehr., *Navicula radiosa* Kütz. In the intestines of the *tendipedids* found here -- *Tendipes plumosus* and *T. semireductus*, *Glyptotendipes* from the *gripekoveni* group -- algae are rare in the spring and summer; in September-October there are many *Melosira granulata* (Ehr.) Ralfs; from time to time, *Fragilaria crotonensis* Kitt. and *Melosira varians* Ag.

On the shoal strip of the right-bank flood-plain at the village of Burmistrovo and below the mouth of the Yel'tsovka River in July-beginning of August the active development of *Cladophora fracta* Kütz. was observed with the epiphytes *Gomphonema olivaceum* (Lyngb.) Kütz., *Diatoma vulgare* Bory, *Cymbella cistula* (Hemp.) Grun., *C. lanceolata* (Ehr.) V. H., which were also found in opening up *Cricotopus* larvae from the *silvestris* group.

Berdskiy Zaliv

In Berdskiy Zaliv samples were taken below the railroad bridge,

at the mouth of the inlet opposite the villages of Rechkunovka, Morozovo and below the city of Iskitim. The bottom was sandy with a silt deposit. At a depth of from four to 13 meters the algae are very sparse. Below the railroad bridge occasional *Navicula radiosa* Kütz., *Synedra ulna* (Nitzsch.) Ehr., *Melosira granulata* (Ehr.) Ralfs, *Epithemia sorex* Kütz., *Fragilaria crotonensis* Kitt. were found. The intestines of the *Tendipes semireductus* and *T. plumosus* larvae collected here contain occasional plankton diatoms and their empty valves.

Seasonal Periodicity of the Encrustations

Observations of the development of encrusting organisms were made chiefly in the coastal shallow-water portion of the reservoir at various places. The data obtained give a certain idea of the seasonal periodicity of the encrusting organisms in Novosibirsk Reservoir.

At the end of May, on stumps with roots in Berdskiy Zaliv, below the railroad bridge and at the village of Morozovo shoots of *Stigeoclonium* were found in very small numbers, *Gomphonema olivaceum* (Lyngb.) Kütz., *Cymbella ventricosa* Kütz., *C. affinis* Kütz., *Synedra ulna* (Nitzsch.) Ehr. were noted. From time to time, *Cladophora* filaments were obtained.

At the end of June-July on the left-bank flood-plain of the upper part of the reservoir there were luxurious developments of floating colonies of *Cladophora* with epiphytes among the bushes -- *Diatoma vulgare* var. *productum* Grun., *Gomphonema olivaceum* (Lyngb.) Kütz., *Cocconeis pediculus* Ehr. The growths of *Cladophora* on the small open shallow-water areas of the lower part of the reservoir above and below the mouth of the Yel'tsovka River were carried to the bushes by the wind, encircling their branches. On the stumps with roots at the villages of Sokolovo, Novo-Kamenka and Burmistrovo, on poles of the wooden bridge across the Ust'-Aleus River green layers of *Ulothrix zonata* Kütz. were removed. The portion of the landing at the village of Bystrovka in contact with the water and stumps with roots at Yelbanskaya Sopka [mud volcano] were covered with a brown film consisting of diatoms -- *Gomphonema olivaceum* (Lyngb.) Kütz., *Cymbella prostrata* (Berkley) Cl., *C. aspera* (Ehr.) Cl., *C. affinis* Kütz., *Diatoma vulgare* Bory. Here frequently bottom forms were obtained -- *Navicula gracilis* Ehr., *N. rhynchocephala* Kütz., *Nitzschia dissipata* (Kütz.) Grun. In July the constant presence of a small number of Chlorococcaceae was characteristic on the shoal areas both in the *Cladophora*-diatom biocoenosis on the flood-plain opposite the village of Krutikha and above the village of Beregovoye and in the encrustations of stumps and stumps with roots. The blue-green algae (*Lyngbya kuetzingii* (Kütz.)

Schmidle) were found in small numbers in the encrustations of the stumps with roots on the flood-plain at the villages of Krutikha and Ust'-Aleus and below the mouth of the Yel'tsovka River.

In September at the village of Krutikha and in the middle of October opposite the village of Burmistrovo on the shores Cladophora was abundant on the stumps with roots, stumps and logs. Here Stigeoclonium sp. bushes were encountered. Diatoms were developed quite well on the shoal areas of the entire reservoir territory: on the flood-plain opposite the village of Maslyakha, on the poles of the bridge at the Ordynskoye Settlement, and on the landing at the village of Bystrovka. Here Navicula gracilis Ehr., Cymbella affinis Kütz., C. tumida (Breb.) V. H. and others were the most frequent. Below the railroad bridge Diatoma vulgare var. productum Grun. attains a mass development. On the stumps with roots at the village of Burmistrovo and the under-water portions of a cutter a considerable number of Cymbella skabitzschevskiy Tschist. was found. The more active development of the blue-green alga Lyngbya kuetzingii (Kütz.) Schmidle was found on the landing at the city of Kam-en', on bridge poles at the village of Ordynskoye, on stumps with roots below the railroad bridge over the Berd'.

In the race upper portion of the reservoir encrustations were collected in July and September from the buoys opposite the village of Sokolovo; in the lower part, opposite the village of Burmistrovo and below the Yel'tsovka River. The part of the buoy in contact with the water opposite the village of Sokolovo in July was covered with a bright green luxurious coat, consisting of Cladophora fracta Kütz. and occasional diatoms. In the lower part, the composition of the algae was more varied. Cymbella affinis Kütz. was developed en masse; less often, Diatoma vulgare var. productum Grun., Gomphonema olivaceum (Lyngb.) Kütz., Cymbella aspera (Ehr.) Cl. were encountered. In the second half of September Diatoma vulgare var. productum Grun., Cymbella skabitzschevskiy Tschist. were prevalent; Cymbella affinis Kütz. was encountered less often. Large strands of Stigeoclonium tenue Kütz. were noted.

The encrusting organisms of the upper part of the reservoir were of a less uniform nature than in the lower part. The qualitative composition of the encrusting organisms of the race portion was the same essentially as the composition of the encrusting organisms along the shore, but the diatoms Cymbella affinis Kütz. and C. skabitzschevskiy Tschist. were better developed on the buoys than on the shallow-water areas.

Conclusion

In 1959, after the filling of the Novosibirsk Reservoir to its

planned level, the bottoms of the former race portion of the Ob' River and the inundated flood-plain areas continued to be filled up. The development of phytobenthos corresponded to areas of the shore strip (depth one-two meters) protected against the waves. At depths of more than 3.5 meters (both in the race portion and in the area above the flood-plain) the phytobenthos was represented by various specimens of diatoms. Reduction of the number of algae with increase in the depth, where the lighting conditions become poorer, has been noted by a number of authors for other reservoirs (3, 4).

The shallow-water areas, where algal vegetation is most intensely developed, are located chiefly on the left-bank upper portion of the reservoir. They can be used for the breeding of young fish. A promising forage cereal -- *Zizania latifolia* -- capable of displacing the wild water weeds -- should be planted here. Experimental plantings of it on shallow-water areas have been begun successfully by workers of the Central Siberian Botanical Garden.

Observations of algal encrustations in 1959 showed that their total production is small, but collections of encrustations from random objects (landings, buoys, stumps with roots, stumps, under-water portions of a cutter) show that the encrusting organisms develop quickly and quite abundantly.

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the Siberian Department of the Academy of Sciences USSR, Novosibirsk

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