

BENM 2021**International Scientific and Practical Conference "Biotechnology, Ecology, Nature Management"****ANALYSIS OF CHANGES IN THE HYDROCHEMICAL,
HYDROBIOLOGICAL AND GEOECOLOGICAL STATE OF
BORISOV POND**

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Abstract

This study is a planned continuation of the complex analysis of the Borisov pond water, which began on May 26, 2019. The purpose of the spring-summer study was to identify the causes of abnormal mortality of higher aquatic organisms, the main purpose of this study was to test the hypothesis about the normalization of the hydrochemical and hydrobiological state of Borisov pond. In this work, based on the results of research on the algoflora of the Borisov ponds, a diverse algae community was established. The most numerous groups in the pond were: diatoms algae and cyanobacteria. Also, the nature of the composition of organisms-indicators of saprobity has undergone a change, and, as a consequence, a general change in the saprobity of the reservoir. In spring, the saprobity of the Borisov pond can be characterized as transitioning from α to β -mesasaprobic. The saprobity of the pond in the autumn-winter period was characterized as β -oligosaprobic, with a large bias in β -mesasaprobicity.

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1. Introduction

Borisov Pond is a culturally significant object of the Tsaritsyno Park, as well as a popular recreational place for both the local population and people living in the surrounding areas. Thanks to this, there are beach areas, as well as water sports facilities on the territory of the pond, there are many shops with food and drinks (Galimzyanova, 2015).

Thus, the possible ecological degradation of the Borisov pond is a culturally and economically unprofitable prospect, which is a prerequisite for a more detailed and active monitoring of this reservoir.

2. Purpose of the Study

1. Taking water samples from the Borisov pond;
2. Carrying out organoleptic research at the place of collection of samples;
3. Analysis of collected samples using laboratory equipment
4. Obtaining results and their analysis;

3. Research Methods

Borisovsky pond is an artificial flowing water body, which is part of a reach of three ponds, separated by dams. The Gorodnya River is the inflowing and outflowing watercourse. The filling of the pond, in addition to the river, is carried out by atmospheric precipitation and partial underground waters of sources (Kiselev, 1956; Nikiforov-Nikishin et al., 2019; Nomokonova, 2009). The area of the reservoir is 0.86 km², the coastline, including the islands, is 6.9 km, the average depth is 2.5 meters.

The reservoir is located on the territory of the Orekhovo-Borisovo Severnoe and Moskvorechye-Saburovo districts, bordered by the Brateevo district. Since 1998, it has been part of a specially protected area, the natural-historical park "Tsaritsyno" (On project proposals for the establishment ...; Voloshko & Safronova, 2015).

Hydrobiological work was carried out in accordance with RD 52.18.833-2015 Procedure for observing and assessing the state of surface water bodies to determine the impact of industrial facilities and industries of I hazard class (Belyakova et al., 2006).

Bioindication according to GOST 17.1.387-82 "Classification of water quality in reservoirs and streams by hydrobiological and microbiological indicators" became the main method for determining the state of water in Borisov pond (Guiry & Guiry, 2019; Hollerbach, et al., 1956).

Water sampling was carried out along the entire perimeter of the pond and at two points at the source of the Gorodnya River, the main strategy was to maintain a constant distance between the points of 250 m, thus the first point is located near the Lower Tsaritsyn Dam, the last (7) 300 meters from this dam with the other side (Figure 1). Samples were taken according to GOST 31861-2012 Water. General requirements for sampling.



Figure 1. Sampling chart

Since the autumn period is rainy for the Moskovsky district, some of the samples were taken within a short time after the rain, which could affect the final hydrochemical indicators, to one degree or another could affect the number of certain species, but all other indicators are normal (Table 1) (Shitikov et al., 2003).

Table 1. Meteorological indicators

Collection date	Air temperature (° C)	Pressure (mmHg)	Humidity (%)
October, 8	10	745	84
October, 15	7	747	85
October, 22	4	750	83
October, 29	4	744	84
November, 5	3	747	86

4. Findings

In the autumn phytoplankton of Borisovsky pond, 6 divisions, 10 classes, 20 orders, 33 families, 41 genera and 62 species were identified.

In terms of the number of species, the dominant position was occupied by the division Chlorophyta, which comprised 33.9% of the total number of species. The richest were the families Scenedesmaceae and Hydrodictyaceae, including 7 and 6 species, respectively.

This was followed by the divisions Bacillariophyta and Euglenophyta, which contained 30.6 and 21% of the total number of microalgae species.

The divisions Cyanoprokaryota, Ochrophyta, and Chrysophyta, which included 9.7, 1.6, and 3.2% of all phytoplankton species, turned out to be the smallest in terms of the species composition (Table 2) (Clasen & Bernhard, 1982; Protasov, 2010; Siver & Hamer, 1989).

Thus, the basis of the taxonomic composition is determined by algae of the divisions Chlorophyta, Bacillariophyta, and Euglenophyta, which makes it possible to outstrip the character of phytoplankton as diatom-chlorophytic with a significant participation of euglena algae.

Table 2. Taxonomic composition of Borisov pond, autumn 2019

Phylum	Quantity					% of the total
	Classes	Orders	kind	kin	form	
Cyanoprokaryota	1	4	6	6	6	9,7
Bacillariophyta	3	6	11	15	19	30,6
Chlorophyta	3	7	11	13	21	33,9
Euglenophyta	1	1	2	4	13	21,0
Ochrophyta	1	1	1	1	1	1,6
Chrysophyta	1	1	2	2	2	3,2
Total	10	20	33	41	62	100

The distribution of the species composition was traced evenly along the entire perimeter of the Borisov pond, with the exception of points located at the source of the river. Gorodnya, where only 35 taxa with a rank below the genus were found (56.4% of the total number of species).

In terms of tameness to habitat, a significant proportion of algae found in phytoplankton (43 species or 69.4% of the total species composition) were truly planktonic, 12 species were truly benthic (or 19.4% of the species composition), plankton-benthic were 5 species (or 8.1% of the total species composition), one species each to littoral and parasitic (1.6% of the total species composition).

In relation to globality, most of the species (29 or 46.8% of the total species composition) were indifferent, 8 (or 12.9% of the total species composition) species were halophilic and one species belonged to mesoglobic and homophobic (1.6 % of the total species composition). The halo of other species (23 or 37.1% of the total species composition) was not determined.

In relation to pH, 24 phytoplankton species were classified as indifferent (or 38.7% of the total species composition), 1 species (or 1.6% of the total species composition) was classified as acidophiles, 5 species (or 8.1% of the total species composition) composition) to alkalibionites, 6 species (or 9.7% of the total species composition) to aclkaphiles, for the remaining 24 species (or 38.7% of the total species composition), the ratio to pH was not determined (Juttner, 1981).

According to saprobic analysis, 40 species-indicators of saprobity were found in the phytoplankton of Borisov pond, of which the majority are β -mesosaprobies (17 species or 27.4% of the total species composition). A-mesosaprobies included 3 species (or 4.8% of the total species composition), oligosaprobies included 7 species (or 11.3% of the total species composition), oligo- β -mesosaprobies included 6 species (or 9.7 % of the total species composition), 6 species belonged to α - β or β - α - mesosaprobies (or 9.7% of the total species composition), 1 species belonged to α -polysaprobic (or 1.6% of the total species composition) (Table 3).

Table 3. Ecological and geographical characteristics of the phytoplankton of Borisov pond, autumn 2019

Index	Number of species	% of the total
	Habitat	
Planktonic	43	69,4

Benthic	12	19,4
Plankton-benthic	5	8,1
Littoral	1	1,6
Parasitic	1	1,6
Attitude to hauliness		
Indifferent	29	46,8
Halophilic	8	12,9
Mesogalobic	1	1,6
Halophobic	1	1,6
There is no data	23	37,1
Relationship to pH		
Acidophiles	1	1,6
Indifferent	24	38,7
Alkalibionts	5	8,1
Alkaliphiles	6	9,7
There is no data	24	38,7
By saprobity index		
β -mesasaprobies	17	27,4
α - β -mesasaprobies	2	3,2
α -polysaprobies	1	1,6
oligo- β -mesasaprobies	6	9,7
α -mesasaprobies	3	4,8
oligosaprobies	7	11,3
β - α -mesasaprobies	4	6,5
There is no data	22	35,5

The saprobity index according to Pantle-Bukh was 1.59, attributing the Borisov pond to a β -oligosaprobic reservoir with a class II pollution level (slightly polluted), this is also evidenced by the hydrochemical regime of the pond, the study of which was carried out by us in the same period (Ashurova & Skorobogatova, 2019; Kopyrina, 2018).

5. Conclusion

According to the information given above, one can judge about a radical change in the hydrochemical, hydrobiological and geoecological state of Borisov pond in the period of spring-autumn 2019. First of all, it is worth noting a change in the ratio of the generic composition with its large leveling and a change in the absolute dominance of blue-green algae, which led to a change in the nature of the pond to ditatom-chlorophytic, opposite to chlorophytic in the spring.

Also, the nature of the composition of organisms-indicators of saprobity has undergone a change, and, as a consequence, a general change in the saprobity of the reservoir. In spring, the saprobity of the Borisov pond can be characterized as transitioning from α to β -mesasaprobic. The saprobity of the pond in the autumn-winter period was characterized as β -oligosaprobic, with a large bias in β -mesasaprobicity.

In addition, the habitat of microalgae in the reservoir underwent a significant change, from the dominance of benthic forms to Planktonic ones, which characterizes a decrease in the organisms of filter feeders traditionally attached to various substrates.

Thus, in the autumn period, Borisov pond was classified as a pollution class II water body, which means a complete stop of degradation.

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