

Flora of Lake Shirokoe and its environs of the Birsky district of the Republic of Bashkortostan

N. Minina*

Birsk branch of the Federal State Educational Institution of Higher Education "Ufa University of Science and Technology", Ufa, Russia

Abstract. The article presents an analysis of the flora of Lake Shirokoe and its surroundings of the Birsky district of the Republic of Bashkortostan. It is shown that the flora is represented by 72 species of plants, of which: 8 species of trees, 1 species of shrubs, 2 species of semi-shrubs, 64 species of herbaceous plants. A total of 32 families, 64 genera and 72 species are represented. The most representative family is the Asteraceae, which includes 14 species. Of the small ones, 19 families with 1 species have been registered. Analysis of the flora of Lake Shirokoe shows that its composition is characterized by the predominance of hemicroptophytes - 25 species (34.7%) and cryptophytes - 17 species (23.6%). The least represented are therophytes (9.72%). Phanerophytes are also present in the flora (12.5%). These spectra of life forms belong to the moderately cold zone. The analysis of algae of the lake is carried out. It is represented by 14 species from two divisions (Diatomeae and Chlorophyta). The analysis of phytoplankton of the lake was carried out. It is represented by such species as: *Navicula oblonga* Kutz, *Navicula menisculus* Schum, *Navicula viridula* Kutz, *Navicula elegans* Schum, *Cocconeis pediculus* Ehrenberg, *Nitzschia sigmoidea* Nitzsch, *Melosira varians* C.Agardh, *Pinnularia gibba* Ehrenb, *Surirella bifida* Kütz, *Asterionella formosa* Hassall. An indicator species of pure water (*Melosira varians* C.Agardh) was found in water samples.

1 Introduction

The existence of the biosphere and man has always been based on the use of water. Humanity has constantly sought to increase water consumption, exerting a huge multilateral impact on the hydrosphere. It has long been known that in order to preserve beauty and harmony in natural communities bearing recreational or anthropogenic load, it is necessary to maintain the stability of these communities. The stability of the habitat of a reservoir depends on the state of ecological equilibrium in it between living organisms and an ecotope - an abiotic habitat, which is characterized by a set of parameters, the so-called abiotic environmental factors that directly or indirectly affect living organisms. The ecological balance of the reservoir is based on the richness of its biota and, consequently, on the diversity of ecological food chains in it. The higher the biodiversity of a reservoir, the more completely

* Corresponding author: mnn27@mail.ru

the biogenic substances formed both inside the reservoir and arriving into it decompose, the higher its buffering - resistance to external influences that violate the habitat [1,2].

The study of the flora of the surroundings of water bodies shows the general ecological condition of this object and its environmental sustainability. There are quite a variety of methods for studying flora that allow for a more accurate assessment of biological resources [3]. The flora of certain regions and the surroundings of reservoirs in Bashkortostan is actively studied

Flora is a historically formed set of plant species growing in a certain territory. One of the most important features of each flora is its systematic structure, i.e. the representatives of different systematic groups included in the flora in certain quantitative ratios, usually characteristic of different botanical and geographical areas. Changes in these ratios in space are one of the most important characteristics of flora. One of the most important stages of the knowledge of the local flora is the identification of its species composition, both as a whole and in its individual parts. Finding out the position of the flora we are studying in the phytocoria system and comparing it with other similar flora is an integral and necessary element for cognition. In addition, the results of comparing the floras allow us to more objectively judge the current and historical trends of their dynamics [4].

Observations show that prolonged human economic activity has contributed to a significant change in natural conditions in various territories. This was ultimately reflected in the change in the hydrological regime of rivers and lakes. Environmental conditions in many water bodies have deteriorated sharply. There are also aggravations of water management situations, deterioration of water use conditions due to the lack of scientifically sound principles of nature management in the catchment area due to the combined impact of various sectors of the national economy. Thus, there is a need to study the influencing factors, substantiate and implement measures for optimal water use and protection of water complexes in catchments [5,6]. One of these lakes, which are subjected to intense anthropogenic impact, is Lake Shirokoe. The purpose of this work is to study the ecological state of Lake Shirokoe in the Birsky district of the Republic of Bashkortostan.

2 Materials and research methods

Lake Shirokoe is located within the limits of the Pribelsky uvalisto-undulating plain, in the zone of the Northern forest-steppe. It is located in the lower reaches of the Belaya River (Fig. 1). The nearest settlement is the village of Starobazanovo. The length of the lake is about 500 meters, and the width is 170 meters.



Fig. 1. Lake Shirokoe.

To determine plants, a higher plant determinant was used [7,8,9,10,11].

When determining phytoplankton, the collected material is previewed under a microscope in a living state on the day of collection to note the qualitative state of algae before the onset of changes caused by the storage of living material or the fixation of samples. In the future, the collected material continues to be studied in parallel in a live and fixed state. In order to keep the collected material alive, it should be protected in every possible way from overheating, contamination with fixators, and start studying as soon as possible.

Algae in the living state, depending on their size and other features, were studied using a binocular stereoscopic magnifier or using a light microscope of various brands using different eyepiece and lens systems, in transmitted light or by phase contrast, in compliance with the usual rules of microscopy by the hanging drop method. A small drop of the test liquid is applied to a clean cover glass, after which the cover glass, the edges of which are covered with paraffin, paraffin oil or vaseline, is applied drop down on a special slide with a hole in the middle so that the drop does not touch the bottom of the hole. Such a drug can be studied for several months, keeping it in between work in a wet chamber.

Preparations are prepared for microscopic examination of algae: a drop of the liquid under study is applied to the slide and covered with a cover glass. If the algae live outside the water, they are placed in a drop of tap water or watered glycerin. With prolonged study of the drug, the liquid under the cover glass gradually dries up, and it should be added. To reduce evaporation, a thin layer of paraffin is applied along the edges of the cover glass [12]. An algae determinant was used for the determination [13]

3 Discussion

As a result of the research, the following higher plants were identified: trees of 8 species (*Tilia cordata* Mill.; *Salix caprea* L.; *Acer negúndo* L. and others); shrubs 1 species (*Corylus avellana* L.); semi-shrubs 2 species (*Rubus fruticosus* L.; *Rubus idaeus* L.); 64 species (*Schoenoplectus lacustris* L.; *Convolvulus arvensis* L.; *Tanacetum vulgare* L. and others).

We have studied the taxonomic composition of the flora of Lake Shirokoe and its coast. The data is given in Table 1.

Table 1. Taxonomic composition of flora.

Taxon	Number of taxos, pcs.
Family	32
Genus	64
Species	72

In total, the flora is represented by 32 families, 64 genera and 72 species. We have studied the systematic composition of the flora, the data are given in Table 2.

Table 2. Systematic composition of flora.

№	Family	Number of species, pcs.
1	<i>Asteraceae</i>	14
2	<i>Gramineae</i>	6
3	<i>Fabaceae</i>	6
4	<i>Rosaceae</i>	5
5	<i>Plantaginaceae</i>	3
6	<i>Salicaceae</i>	3
7	<i>Brassicaceae</i>	3
8	<i>Ranunculaceae</i>	3
9	<i>Betulaceae</i>	2
10	<i>Caryophyllaceae</i>	2
11	<i>Hydrocharitaceae</i>	2
12	<i>Malvaceae</i>	1
13	<i>Urticaceae</i>	1
14	<i>Polygonaceae</i>	1
15	<i>Cyperaceae</i>	1
16	<i>Boraginaceae</i>	1
17	<i>Cannabaceae</i>	1
18	<i>Aceraceae</i>	1
19	<i>Fagaceae</i>	1
20	<i>Laniaceae</i>	1
21	<i>Convolvulaceae</i>	1
22	<i>Equisetaceae</i>	1
23	<i>Hypericaceae</i>	1
24	<i>Cenopodiaceae</i>	1
25	<i>Aristolochiaceae</i>	1
26	<i>Araceae</i>	1
27	<i>Nypahaeaceae</i>	1
28	<i>Ulmaceae</i>	1
29	<i>Ranunculaceae</i>	1
30	<i>Campanulaceae</i>	1
	Total species	72

The most representative family is the *Asteraceae*, which includes 14 species. 5-6 species are included in the families *Gramineae*, *Fabaceae*, *Rosaceae*. 2-3 species are included in the families *Plantaginaceae*, *Betulaceae*. Of the small ones, 19 families with 1 species have been registered, for example: *Equisetaceae*, *Ranunculaceae*.

We used K. Raunkier's system in the analysis of life forms. The data is given in Table 3.

Table 3. Life forms of the flora by Raunkier.

Life forms	Number of species, pcs.
Hemicryptophytes	25
Cryptophytes	17
Therophytes	14

Continuation of Table 3.

Life forms	Number of species, pcs.
Hamefits	7
Phanerophytes	9
Total species	72

Analysis of the flora of lake Shirokoe and the surrounding area shows that its composition is characterized by the predominance of hemicryptophytes - 25 species (34.7%) perennial herbaceous plants with aboveground shoots dying off by winter, whose renewal buds are on the soil surface, protected by dead leaves, for example: *Achillea millefolium* L. Cryptophytes - 17 species (23.6%) of perennial herbaceous plants, in which the buds of renewal are laid on rhizomes, tubers, bulbs and are underground (geophytes) or underwater (hydrophytes), for example: *Nymphaea alba* L., etc. Hamefits - 14 species (19.4%) small shrubs, semi-shrubs and herbaceous plants (creeping forms), whose renewal buds are located on slightly rising above the soil, for example: *Rubus idaeus* L. Another predominant life form are therophytes - 7 species (9.72%) annual plants experiencing unfavorable seasons in the form of seeds. In the forest zone are mainly represented by weeds of fields, for example: *Taraxacum officinale* L. Phanerophytes are also present in the flora - 9 species (12.5%) (Perennial plants, buds, whose renewals are located high above the soil level. The unfavorable period is transferred openly.) For example: *Betula pendula* L. et al.

According to the spectrum of life forms, this flora belongs to the moderately cold zone according to the Raunkier method [14].

We have given an analysis of ecological groups in relation to water (Table 4), according to which the following groups of plants are distinguished: hydrophytes, mesophytes, aerohydathophytes, hydrophytes.

Table 4. Ecological groups in relation to the water flora.

Ecological group	Number of species, pcs.
Mesophytes	48
Hydrophytes	13
Hydatophytes	7
Aerohydathophytes	4
Total species	72

In the flora of lake Shirokoe and the surrounding area the broad and adjacent territories are dominated by mesophytes of 48 species (67%) of plants of temperate habitats, for example: *Trifolium repens* L.

The flora also contains hydrophytes - 13 species (18%) of plants completely submerged in water, only flowering above water, for example: *Nymphaea alba* L., etc. Aerohydathophytes - 4 species (6%) of plants whose leaves float on the surface of the water, and stems and roots in the water, for example: *Nuphar luteum* L., etc. Hydatophytes - 7 species (10%) of aquatic plants, wholly or mostly submerged in water, for example: *Sagittaria sagittifolia* L. and others.

As a result of our research, the composition of algae in this lake was studied. The analysis was carried out in the fall. The bulk of algae is represented by 11 species from the *Diatomeae*. List of genera:

Navicula - the leaves have the shape of a boat, their ends are pointed, beak-shaped or head-shaped. They are common in all types of reservoirs: *Navicula oblonga* Kutz.; *Navicula menisculus* Schum.; *Navicula viridula* Kutz.; *Navicula elegans* Schum;

Cocconeis - linear, elliptical cells. The ends are rounded. The average field is large, often elongated. Freshwater species, often found at the bottom of reservoirs: *Cocconeis pediculus* Ehrenberg;

Nitzschia - the shape of the cells is rod-shaped, linear. The ends of the cells are head-shaped or wedge-shaped. Common in lakes and rivers in the muddy bottom, many move: *Nitzschia sigmoidea* Nitzsch.;

Melosira cells have a square or rectangular shape. Mainly inhabitants of fresh water bodies: *Melosira varians* C.Agardh;

Pinnularia - cells are usually large, the ends are rounded. The sashes are somewhat expanded. These are usually well-mobile inhabitants of silt: *Pinnularia gibba* Ehrenb., *Surirella bifida* Kütz., *Asterionella formosa* Hassall.

Based on the results obtained and, based on literary sources, we made the following conclusion: lake Shirokoe is a relatively clean reservoir. Since algae-indicators of clean water (*Melosira varians* C.Agardh) were present in the water samples, albeit in small quantities, but at the same time algae-indicators of dirty water (*Pinnularia*) are present, which indicates contamination of the lake in several of its sections.

Diatoms form the bulk of the composition of producers in the reservoir, they are the beginning of the food chain. They feed on invertebrates, some fish. The massive development of diatoms can affect the quality of water, cause the death of fish larvae, clogging their gills.

Representatives of the *Chlorophyta* were also found in lake Shirokoe, represented by 2 genus (*Spirogyra* spp. and *Chlorella*, represented by 1 species - *Chlorella vulgaris* Beij).

4 Conclusion

The analysis of the fauna and flora of Lake Shirokoe and the adjacent territory is carried out. The flora is represented by 72 species of plants, of which: trees of 8 species, shrubs of 1 species, herbaceous plants of 64 species and algae of 2 species. A total of 32 families, 64 genera and 72 species are represented. The most representative family is the *Asteraceae*, which includes 14 species. Of the small ones, 19 families with 1 species have been registered, for example: *Equisetaceae*, *Ranunculaceae*. Analysis of the flora of lake Shirokoe shows that its composition is characterized by the predominance of hemicroptophytes - 25 species (34.7%), for example: *Achillea millefolium* L. Cryptophytes - 17 species (23.6%), for example: *Nymphaea alba* L. Hamefitites - 14 species (19.4%), for example: *Rubus fruticosus* L. Therophytes - 7 species (9.72%), for example: *Taraxacum officinale* L. Phanerophytes are also present in the flora - 9 species (12.5%), for example: *Betula pendula* L., etc. These spectra of life forms belong to the moderately cold zone.

The analysis of phytoplankton of the lake was carried out. It is represented by such species as: *Navicula oblonga* Kutz, *Navicula menisculus* Schum, *Navicula viridula* Kutz, *Navicula elegans* Schum, *Cocconeis pediculus* Ehrenberg, *Nitzschia sigmoidea* Nitzsch, *Melosira varians* C.Agardh, *Pinnularia gibba* Ehrenb, *Surirella bifida* Kütz, *Asterionella formosa* Hassall. The water samples contain, albeit in small quantities, algae-indicators of pure water (*Melosira varians* C.Agardh).

In the vicinity and in the water of Lake Shirokoe, plants indicators of purity were noted *Nymphaea alba* L.; *Nuphar luteum* L.; *Lemna trisulca* L.; *Populus tremula* L.; *Polygonum aviculare* L.; *Stellaria media* L.; *Plantago major* L.; spp. *Spirogyra*); *Chlorella vulgaris* Beij.; *Melosira varians* C.Agardh.

Thus, as a result of the conducted research, it is shown that Lake Shirokoe Birsky district of the Republic of Bashkortostan is a relatively clean reservoir

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