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Diversity and Ecology of Algal Communities from the Regional Landscape Park "Slavyansky Resort", Ukraine.

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ABSTRACT

We revealed 238 species and infraspecific taxa of algae and cyanobacteria in phytoplankton communities in lakes of the Regional Landscape Park "Slavyansky Resort", Ukraine during 2007-2013 of the total 352 known in the region assigned to nine taxonomic Divisions with Bacillariophyta, Cyanoprocaryota, and Chlorophyta prevailing. The bio-indication methods applied for the first time characterizes the aquatic environments as slightly alkaline, medium-enriched with oxygen, temperate, clear to moderately polluted, of Water Quality Classes II-III, eutrophic, but with photosynthetic algal nutrition attesting to insignificant concentration of toxic substances despite a considerable anthropogenic impact. The algal diversity is depressed with salinity of the lakes. The statistical analysis defines two clusters, the northern with perennial lakes Ripne, Veysove, Garache, and Slipne, and southern of partially drained lakes Levadne, Chervone, and Lake. Aridity is a major factor of water chemistry inflicting high salinity and depletion of species diversity. Historically salinity might have played a leading role in shaping the algal communities of the region.

INTRODUCTION

The algal diversity research in the Regional Landscape Park "Slavyansky Resort" dates from the second half of XVII century but the flora is poorly studied so far relative to general level of algological research in the country [1,2]. In 2007 we started an extensive monitoring in order to assess climatic and anthropogenic impacts on the lakes phytoplankton species diversity and ecological characteristics [3].

Initially we worked out a species inventory that is here used as a basis for inter-lake floristic comparisons, bio-indication of environmental variables and analysis of the diversity trends in response to climatic influence and the levels of anthropogenic pollution, using the statistical approaches linking structural and functional aspects of lacustrine communities [4].

State of knowledge

Studies of the species composition of algae were conducted sporadically since the second half of the 17th century by many scientists [1,2,5]. Since the mid-20th century, researchers have turned their attention to identifying the role of microorganisms involved in the formation of therapeutic mud lakes and in the circulation of substances in lakes in general [1,2,5]. Modern systematic lists of planktonic algae are presented by NM Lyalyuk and VN Klimyuk [3].

MATERIALS AND METHODS

Description of study site

Regional landscape park "Slavyansky Resort" was created in 2006. The purpose of its creation was for the preservation and thoughtful use of unique natural complexes and artificial plantations of parkland, and the development of recreation. The park is located in the northeastern part of the city Slaviansk in Ukraine. Its area is 431 hectares and includes three resorts, extensive park, a seasonal ornithological reserve "Priozernyy", and natural “monuments” of national importance, lakes Ripne and Slipne, which are sources of unique therapeutic mud and brine (Given the Belgium Grand Prix award in 1907) [6] (Figure 1).

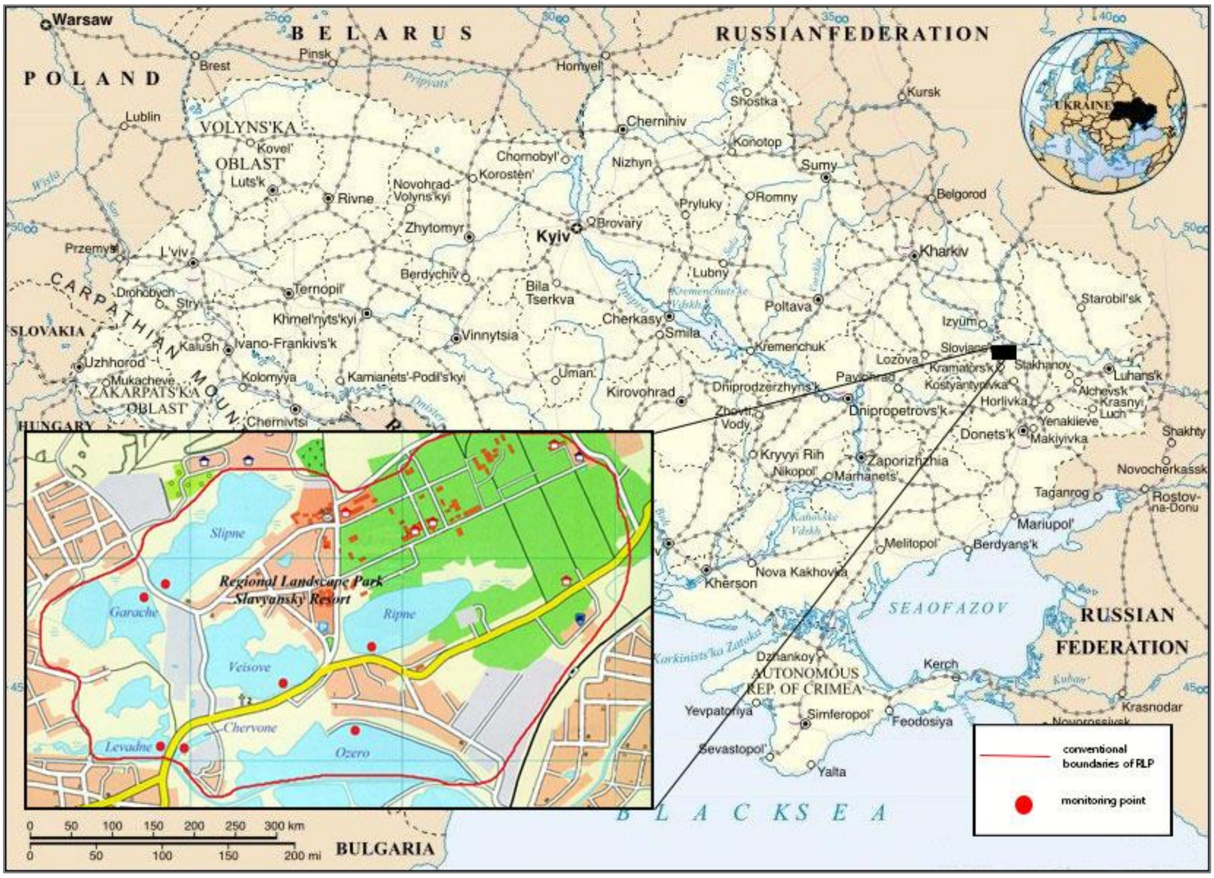

Figure 1: Study site in the Regional Landscape Park "Slavyansky Resort"

Just inside the park are seven perennial lakes (Ripne, Veysove, Garache, Slipne, Levadne, Chervone, and untitled lake (hereinafter – Lake) and many temporary pools. The studied lakes are mostly of thermokarst origin, small, and shallow. These lakes are insulated from each other and periodically dry up. They are briefly interconnected in spring. Sediments of the lakes are diverse varying from sand to medical mud. Water is slightly yellow or colorless with pH 6.3–8.0, and conductivity is 1.31–11.26 mSm/cm. Depth of the lakes is negligible (about 0.5–2.5 m) and only in lake Ripne does it reach 8.5 m. They form a unique community of organisms, including algae, which are the basis for the formation of therapeutic mud. In lake Ripne there is industrial fishing for mud and brine mud baths for the Slavyansky Resort – one of the oldest mud-bath resorts of Ukraine.

The water bodies are subjected to an intense recreational load, since most of the banks are designated for swimming and relaxing. Aquatic macrophyte vegetation is abundant, serving as part of the staple diet and habitat of protected species of birds.

The park has an area of 134 hectares. There are more than 110 species of trees and shrubs. The flora of the park is represented by three species of medicinal plants, which are listed in the Red Book of Ukraine. Lakeshores serve as nesting locations for a large number of birds, including species of the Red

Book of Ukraine: *Himantopus himantopus* Linnaeus and *Tadorna ferruginea* Pallas. Also, there are 11 bird species in the local avifauna, which were placed on the list of rare and endangered species in Europe.

MATERIALS AND METHODS

Material for this work comes from samples collected monthly during 2007-2013 in lakes Ripne, Veysove, Garache, Slipne, Levadne, Chervone, and Lake. Phytoplankton samples were collected in the littoral and profundal zones of the lakes. A sample volume was 2 L and concentrated by an accumulation on membrane filters "Vladipor» No 7, or a 10–20 L sample, concentrated using a plankton net number 77. Algae studied in live and fixed (4% formaldehyde solution) states, using light microscopes MBI-3 and Micros MC 50 (Austria) with magnification of 40X–90X (with immersion). Permanent slides were made for the study of diatoms [7]. Determination of algal species was performed using international series determinants of marine and freshwater algae. A systematic list based on a system adopted in «Algae of Ukraine» [1, 2] and «Cyanoprokaryota» [8]. Species not found in «Algae of Ukraine» were added according to the classification adopted in the database at www.algaebase.org.

The ecological characteristics of algal species were obtained from the database compiled for freshwater algae of the world from multiple analyses of algal biodiversity by S.S. Barinova et al. [9], with additions of C. Ter Braak [10] and H. van Dam [11], according to substrate preference, temperature, oxygenation, pH, salinity, organic enrichments, N-uptake metabolism, and trophic states. The ecological groups were separately assessed according to their significance for bio-indications. Species that respond predictably to environmental conditions were used as bio-indicators for particular variables of aquatic ecosystems, the dynamics of which are related to environmental changes. The statistical methods are those recommended by V. Heywood [4] for the development of floristic and taxonomic studies. Polynomial trend lines are functions that describe general trends. A standard deviation line cut off the groups with the majority of indicator species. The GRAPHS program [12] was used in comparative floristic approaches for calculating similarity of algal communities in the studied lakes.

RESULT AND DISCUSSION

We studied 121 phytoplankton samples from seven lakes of the Regional landscape park "Slavyansky Resort" collected in May-November 2007, March-November 2008, and April 2012 – June 2013.

Altogether 334 species of algae (352 species and infraspecific taxa) from nine taxonomic Divisions (Cyanoprocaryota, Euglenophyta, Chrysophyta, Dinophyta, Xanthophyta, Cryptophyta, Bacillariophyta, Chlorophyta, and Charophyta), 38 Orders, 71 Families, and 137 Genera (Table 1) have been revealed including the original data (238 species and infraspecies), the data from the workbooks of the Slavyansk hydro-geological regime-operational station (134 species and infraspecies), and data from references (47 species and infraspecies, of which 40 species and infraspecies were only found in the recent references [1, 2]).

The plankton communities were dominated by Bacillariophyta species (49.43%), Cyanoprocaryota (18.47%) and Chlorophyta (17.9%), which constitute a significant majority of the species list that was cut off by the standard deviation line (Fig. 2a). Namely, the importance of these three taxonomical Divisions for flora of the Ukraine is a feature [1, 2, 15], reflecting a common regional features of algal flora.

Ecological analysis showed that the identified species were confined mostly to benthos inhabitants; among the dominant groups were also plankton-benthic inhabitants (which were marked by the trend line), these groups both are cut off by the standard deviation line (Table 1, Figure 2b). Despite the fact that the samples were plankton, they are collected in shallow lakes subject to anthropogenic and wind mixing, which leads to the separation of periphyton and benthic forms, in contrast to deep water bodies, where the benthic species are rare in plankton [15].

Salinity indicators represent 228 species belonging to five ecological groups (Table 1, Figure 3a). Oligohalobes-indifferents dominated and cut off by standard deviation line, but the top of the trend line also indicates the importance of the group halophiles. The presence of salt-water preferred groups of indicator species (oligohalobes-halophiles, and even mesohalobes and polyhalobes) reflects the diversity of mineralization from lake to lake and throughout the seasons. Drying, as one of the main factors of increasing salinity in lakes [16, 17], leads to the change diversity of algae and therefore is one of the climatic factors involved of algal flora formation [18]. However, climate impacts on water bodies generally aligns habitat with a predominance of fresh waters.

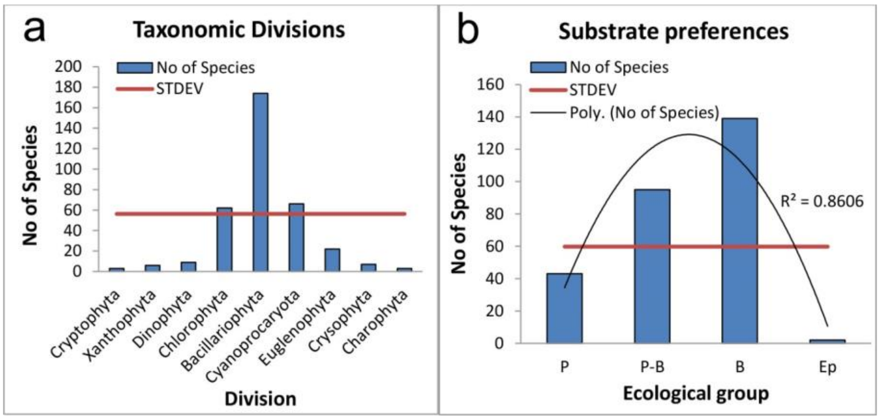

Figure 2: Distribution of species over taxonomic Division and habitat preference of ecological groups in the studied lakes

The alkaliphilic and indifferent indicator groups are prevailing in the lakes communities among the pH indicators, at which point the standard deviation and trend lines (Table 1, Figure 3b). They amounted to more than 85% of the total number of indicators of acidification. Thus, we can to conclude that algal communities of the studied lakes are not indicated of air pollution that can lead to acidification. Moreover, anthropogenic impact leads to alkalization of water in the lakes, thereby countering the negative impacts of acidification.

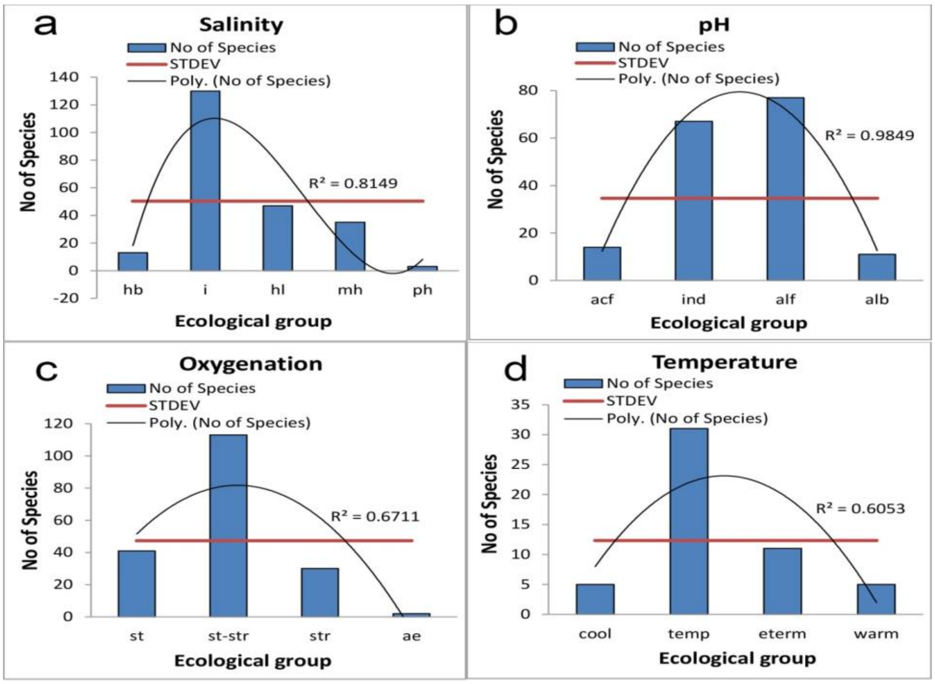

Figure 3: Distribution of species-indicators to ecological groups of salinity, pH, Oxygenation, and Temperature preferences in communities of studied lakes

The bio-indication analysis showed that in relation to water oxygen saturation and the water mass moving predominated species-indicators of slightly stirred and medium oxygen-rich waters (Table 1, Figure 3c). This result is consistent with the habitat – shallow lakes with wind stirring.

Among indicators of temperature, the most significant was moderate temperature (temperate) group of indicators, that is cut off the standard deviation and trend lines (Table 1, Figure 3d). Bio-indication of water temperature is not yet developed enough [9], however, other estimates on this factor in the region [15] also show moderate temperature interval as regional climatic norm in fresh waters.

In determining the Water Quality Class the standard deviation line cut off only indicators groups II and III Class (Table 1, Figure 4a). Thus, bio-indication of organic pollution related mostly to anthropogenic impacts, shows that, despite the high recreational load, lake waters have quite satisfactory water quality.

The autotrophs are prevailing among indicators of nutrition type and relative to the amount of nitrogen-containing organic compounds. They develop at low concentrations of nitrogen-containing organic compounds and/or withstand the increase in the concentration of nitrogen-containing organic compounds, and cut off by standard deviation line (Table 1, Figure 4b). They are representing about 90 percent of the total number of indicators of nutrition. This shows that anthropogenic load takes place, but have not significant values of toxic substances, so the algae have the opportunity to nutrition direct through photosynthesis but not by heterotrophic way.

We assessed the trophic level of the lakes as well as the intensity of anthropogenic impact on ecosystems of studied lakes by bioindication methods. As a result of evaluation the trophic status was identified seven groups of indicators. Stood out the group most eutrophic species, that cut off by standard deviation line (Table 1, Figure 4c) as well as indicated by the top of the trend line. Thus, the relatively high trophic level – eutrophic, confirmed indication of the Water Quality Class as well as algal species type of nutrition, and leads to the conclusion about non-toxic anthropogenic pollution of the studied lakes.

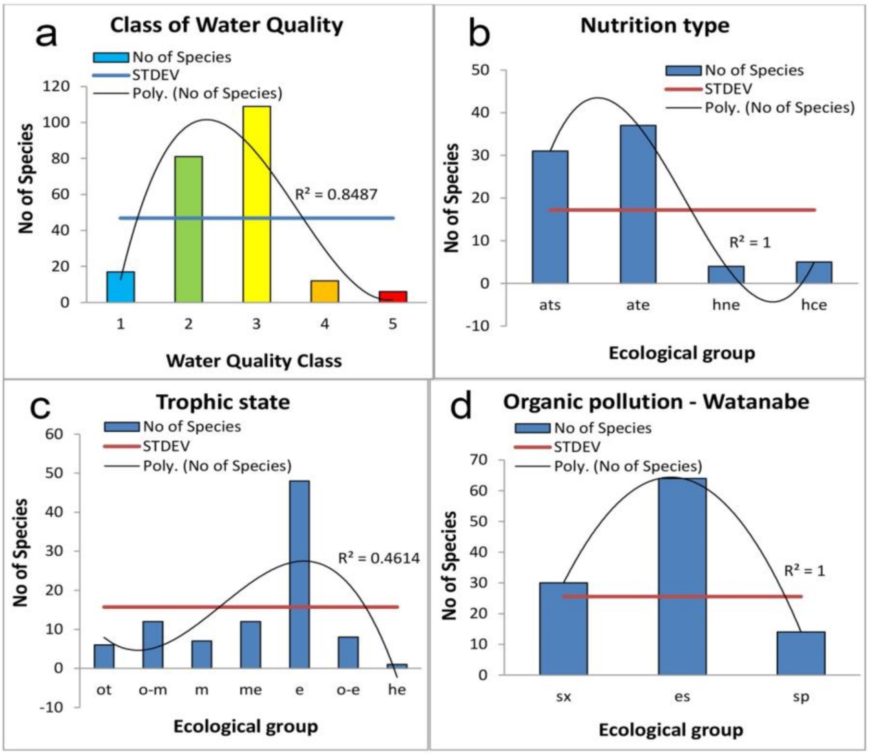

Figure 4: Distribution of species-indicators to Class of Water Quality under EU Standard coloring, ecological groups of nutrition type, trophic state, and organic pollution according to Watanabe in communities of studied lakes

We found significance of clear and middle-polluted water indicators that are cut off by standard deviation line (Table 1, Figure 4 d) in determining the level of organic pollution according to Watanabe [13]. Saprophiles accounted for only about 13% of the total number of indicators of organic pollution. That led us to conclude that water in studied lakes is clean enough or moderately polluted.

In order to identify groups of lakes, similar in algal population diversity, similarity dendrogram was constructed by the Ward method based on Sorensen-Czekanowski indices (Figure 5). It is evident that at over 40% similarity the algal flora of the lakes are divided into two major clusters. The first includes communities of the lakes Ripne, Veysove, Garache, Slipne, relating to the northern part of the Park. The second combines communities of the Levadne, Chervone and Lake in south part of the park.

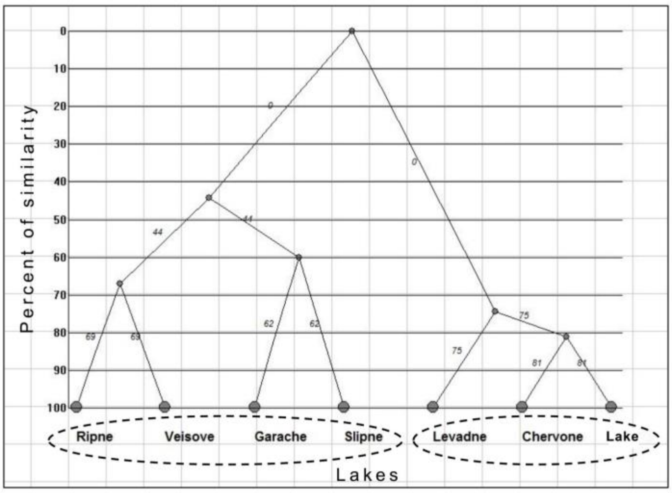

Figure 5: Dendrogram of similarity the species lists of studied lakes

The natural history of the algal flora formation in the studied lakes leaves its mark on their floristic composition. The algal communities of the lakes, even those close to each other located, have their own characteristics, the so-called floristic face. Species composition of algae formed under the influence of nutrition source, morphometry, the chemistry and history of the use of each of the lakes. In order to reveal the historical connection of all lakes floras in the Park was built dendrite, which show measure of overlapping of the lists of the floras lakes. In Figure 6 seen that the percentage of the floras intersection is sufficiently high. However, the communities of algae in studied lakes can be divided into two floristic cores separated in the figure by the dashed line. The thickness of connection lines is proportional to the similarity of the floras. It is seen that the first core basically has the Chervone Lake flora (southern lakes group), and the second – the Veysove Lake (northern group of lakes). Location the lakes on the map of the Landscape Park shows that the first group included lakes Chervone, Levadne and Lake – small, partially drying up during the year, located in relative proximity to each other with floristic center in the lake Chervone. The second group represents the lakes Veysove, Garache, Ripne and Slipne – deeper, perennial, and is also closely located to each other with the floristic center in the lake Veysove. In the first group of lakes due to partial drying during the year there is a significant fluctuation of salinity, which is reflected in the species composition.

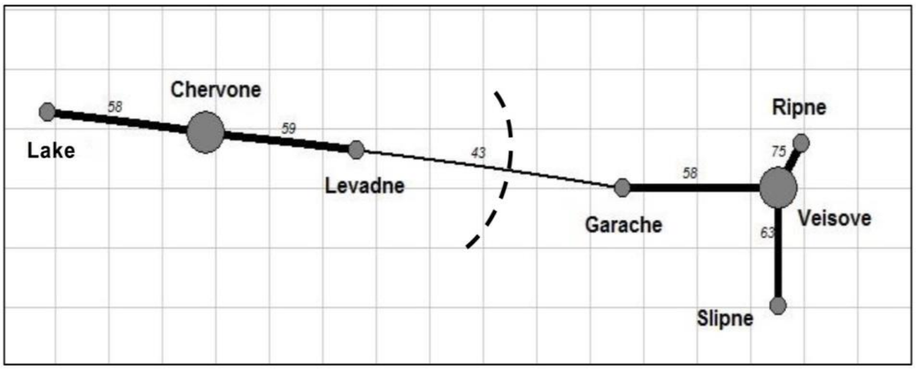

Figure 6: Dendrite of overlapping of the species lists of studied lakes

In general, lakes differ significantly in mineralization. Thus, the average conductivity of water in the lakes of the northern group was as follows: Ripne – 9.5 ± 1.6 mSm/cm, Veysove – 10.8 ± 0.2 mSm/cm, Garache – 9.3 ± 2.1 mSm/cm, Slipne – 6.6 ± 1.1 mSm/cm; in the lakes of the southern group: Levadne – 8.0 ± 3.1 mSm/cm, Chervone – 6.7 ± 3.6 mSm/cm, Lake – 11.0 ± 0.2 mSm/cm. In the part of the waters prevail sulfides, sulfates and chlorides, which affect the lakes mud, which in its composition classified as the type of sludge, middle mineralized sulfide, sulfate-chloride, sodium-lake muds according to the classification of the Central Research Institute of Balneology and Physiotherapy [19].

When comparing Slaviansk lakes and lakes in Kazakhstan with similar water conductivity was observed regular decrease in the number of species in the flora of lakes with increasing conductivity (Figure 7) [17]. So, in our lakes, for the period February–June 2013 in most low-mineralized lake Slipne was determined 75 algal taxa, whereas in the most saline lake – the Lake in the same period – only 31 taxa.

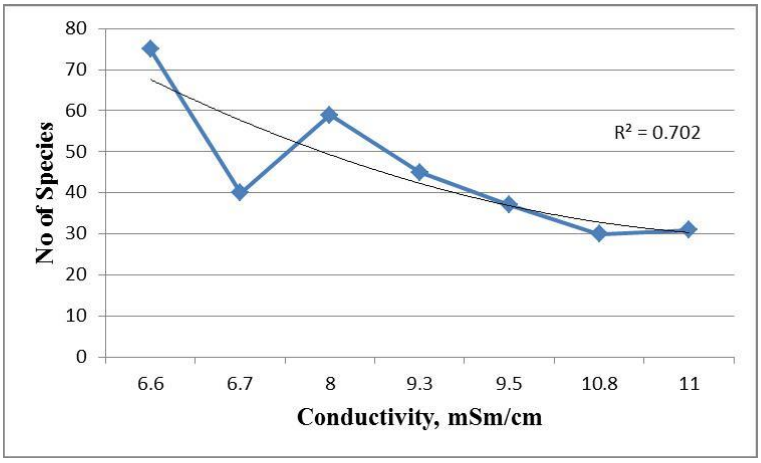

Figure 7: Relationships between species number in algal community and conductivity of the water in the Slavyansky Park lakes.

As a result, the number of freshwater species was higher as a whole, therefore, they contribute greatly to number of indicator species and trend of increasing the contribution of indicator groups show of mostly freshwater at the general characteristics of studied lakes. In this regard, for the Slavyansk Park lakes and lakes in Kazakhstan there is a similar distribution of the dominant groups of indicator species with oligohalobes-indifferents as the dominant group and fairly represented oligohalobes-halophiles and mesohalobes [17]. Therefore, in the florogenetic process two floristic cores of the lakes revealed the historical role of the chemistry of water in the lakes, which in turn is a function of periodic drying [16, 17, 18].

Table 1: Diversity and ecological preferences of phytoplankton in the Slaviansky Park lakes

Taxa	1	2	3	4	5	6	7	8	Hab	T	Oxy	Sal	pH	D	S	Het	Tro
Cyanoprocaryota																	
Anabaena bergii Ostenf. f. *bergii*	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Anabaena bergii Ostenf. f. *minor* (Kisselev) Kossinsk. in Elenkin	–	–	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Anabaena flos-aquae Bréb. in Bréb. et Godey	–	–	–	+	–	–	–	–	P	–	st	i	–	–	b	–	–
Anabaena knipowitschii Ussatsch.	–	–	+	+	–	–	–	–	–	–	–		–	–	–	–	–
Aphanisomenon flos-aquae (L.) Ralfs	–	+	–	+	–	–	–	–	P	–	–	hl	–	–	b	–	–
Aphanothece bachmannii Komárk.-Legn. et Cronberg	–	+	–	+	–	–	–	–	P	–	–	i	–	–	–	–	–
Aphanothece clathrata W. West et G.S. West	–	–	–	+	–	–	–	–	P	–	–	hl	–	–	b	–	–
Chroococcus cohaerens (Bréb.) Nägeli	–	–	+	+	–	–	–	–	B, S	–	–	hb	–	–	–	–	–
Chroococcus minimus (Keissl.) Lemmerm.	+	+	+	+	–	–	–	–	P	–	–	hl	–	–	–	–	–
Chroococcus turgidus (Kütz.) Nägeli f. *turgidus*	+	–	–	+	–	–	–	–	P-B	–	–	hl	alf	–	o	–	–
Geitlerinema amphibium (Agardh ex Gomont) Anagnostidis	+	+	+	+	+	–	–	–	P-B, S	–	st-str	hl	–	–	o-a	–	–
Geitlerinema tenue (Anisimova) Anagnostidis	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Gomphosphaeria virieuxii Komárek et Hindák	–	–	–	+	–	–	–	–	P	–	st	–	–	–	–	–	–
Jaaginema kisselevii (Anisimova) Anagnostidis et Komarek	–	+	+	+	–	–	–	+	–	–	–	–	–	–	–	–	–
Jaaginema neglectum (Lemmermann)	–	+	+	+	–	–	–	–	P-B,	H_2S	st-str	–	–	–	a	–	–

Anagnostidis et Komarek									S								
Jaaginema perfilievii (Anisimova) Anagnostidis et Komarek	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Jaaginema pseudogeminatum (Schmid) Anagnostidis et Komarek	–	+	–	–	–	–	–	–	P-B, S	warm	st-str	–	–	–	–	–	–
Jaaginema subtilissimum (Kutzing ex De Toni) Anagnostidis et Komarek	+	+	+	+	–	–	–	+	P-B	H_2S	st	–	–	–	a	–	–
Jaaginema woronichinii (Anisimova in Elenkin) Anagnostidis et Komarek	–	–	–	+	–	–	–	+	B, Ep	–	st	mh	–	–	–	–	–
Leptolyngbya komarovii (Anisimova) Anagnostidis et Komarek	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Leptolyngbya terebrans (Bornet et Flahault ex Gomont) Anagnostidis et Komarek	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Leptolyngbya thermarum (Voronichin) Anagnostidis et Komarek	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Leptolyngbya woronichinii (Anisimova) Anagnostidis et Komarek	–	–	–	–	–	–	–	+	P-B	–	st-str	mh	–	–	–	–	–
Limnothrix planctonica (Woloszynska) Meffert	–	–	–	+	–	–	–	–	P	–	–	i	–	–	o-b	–	–
Lyngbya aerugineo-coerulea Gomont f. *aerugineo-coerulea*	–	–	–	–	+	–	–	–	P-B, S	–	st-str	–	–	–	–	–	–
Lyngbya aestuarii (Mert.) Liebm. f. *aestuarii*	–	–	+	–	–	–	–	–	P-B, S	–	–	ph	–	–	o	–	–
Lyngbya maior Meneghini ex Gomont	+	+	+	+	+	–	–	+	–	–	–	–	–	–	b	–	–
Lyngbya salina Kutz.	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Merismopedia glauca (Ehrenb.) Kütz.	+	–	+	+	–	–	–	–	P-B	–	–	i	ind	–	o-a	–	–
Merismopedia major (G.M. Sm.) Geitler in Pascher	–	–	+	+	+	–	–	–	P	–	–	i	–	–	o-b	–	–
Merismopedia minima Beck	–	+	+	+	–	–	–	–	B, S	–	–	–	–	–	–	–	–
Merismopedia punctata Meyen in Wiegmann	+	+	+	+	+	–	+	–	P-B	–	–	i	ind	–	o-a	–	–
Merismopedia tenuissima Lemmerm.	–	–	–	+	–	–	–	–	P-B	–	–	hl	–	–	b-a	–	–
Microcystis aeruginosa (Kütz.) Kütz.	–	+	–	+	–	–	–	–	P	–	–	hl	–	–	o-a	–	–
Microcystis flos-aquae (Wittr.) Kirchn. in Engler-Prantl	+	+	–	+	–	–	–	–	P	–	–	i	–	–	o-a	–	–
Microcystis pulverea (Wood) Koval.	+	+	–	+	–	–	–	–	P-B, S	–	–	i	–	–	o-b	–	–
Microcystis wesenbergii (Komárek) Komárek in N.V. Kondrat.	–	–	–	+	–	–	–	–	P	–	–	–	–	–	o-a	–	–
Oscillatoria angusta Koppe f. *crassa* Anissimova in Elenkin	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Oscillatoria angustissima W. West et G.S. West	–	–	–	–	–	–	–	+	P-B	–	str	–	–	–	x-b	–	–
Oscillatoria annae Goor	–	+	–	+	–	–	–	–	P-B, S	–	st	–	–	–	–	–	–
Oscillatoria komarovii Anissimova in Elenkin	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Oscillatoria limosa J. Agardh ex Gomont f. *limosa*	+	+	+	+	–	–	–	–	P-B	–	st-str	hl	–	–	b	–	–
Oscillatoria profunda Kirchn. in Schroeter et Kirchner f. *recta* Anissimova in Elenkin	–	–	–	–	–	–	–	+	B	–	st	–	–	–	–	–	–
Oscillatoria quadripunctulata Bruhl et Biswas f. *crassa* (Anissimova) Elenkin	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Oscillatoria tambi Woron. f. *anissimovae* Elenkin	–	–	+	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Oscillatoria terebriformis J. Agardh ex Gomont f. *pseudogrunoviana* Elenkin et Kossinsk. in Elenkin	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Phormidium ambiguum Gomont ex Gomont	+	+	+	+	+	–	–	–	B, S	eterm	st-str	i	ind	–	b	–	–
Phormidium ambiguum Gomont f. *maius* Lemmerm.	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Phormidium boryanum Kütz.	+	+	–	+	–	–	–	–	P-B, S	warm	st-str	–	–	–	–	–	–
Phormidium laetevirens (Crouan ex Gomont) Anagnostidis et Komarek	+	+	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Phormidium tambii (Voronichin) Anagnostidis et Komarek	+	+	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Phormidium terebriforme (Agardh ex Gomont) Anagnostidis et Komarek	–	–	+	–	–	–	–	–	B, S	eterm	st-str	–	–	–	b-p	–	–
Phormidium tergestinum [Kutzing]	–	–	+	–	–	–	–	–	B, S	–	st-str	i	–	–	b-a	–	–

Anagnostidis et Komarek																	
Planktothrix agardhii (Gomont) Anagnostidis et Komarek	–	–	–	+	–	–	–	–	P-B	–	st	hl	–	–	b-o	–	–
Planktothrix compressa (Utermohl) Anagnostidis et Komarek	+	–	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Plectonema golenkinianum Gomont f. *anissimovianum* Elenkin	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Pseudophormidium golenkinianum (Gomont) Anagnostidis	–	–	–	–	–	–	–	+	B	–	–	ph	–	–	–	–	–
Pseudophormidium pauciramosum (Anisimova) Anagnostidis	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Rhabdoderma lineare Schmidle et Lauterborn in Schmidle	–	+	–	–	–	–	–	–	P	–	–	hb	–	–	x-b	–	–
Rhabdogloea elenkinii (Y.V. Roll) Komárek et Anagn.	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Romeria gracilis Koczw. in Geitler	+	+	–	+	–	–	–	–	P	–	st-str	–	–	–	b	–	–
Snowella lacustris (Chodat) Komárek et Hindák	+	+	+	+	–	–	–	–	–	–	–	–	–	–	b	–	–
Spirulina major Kütz. ex Gomont	+	+	–	–	+	+	–	–	P, S	–	st	ph	–	–	a	–	–
Spirulina subsalsa Oersted ex Gomont	–	+	+	+	+	–	–	–	B	–	st-str		–	–	o-b	–	–
Woronichinia compacta (Lemmerm.) Komárek et Hindák	+	–	–	+	+	–	–	–	–	–	–	–	–	–	–	–	–
Euglenophyta																	
Collacium sideropus Skuja	+	–	–	+	–	–	–	–	Ep	–	st	–	–	–	b-a	–	–
Euglena acus Ehrenb. var. *acus*	+	–	+	+	–	–	–	–	P	eterm	st	i	ind	–	b	–	–
Euglena acus Ehrenb. var. *longissima* Deflandre	–	–	–	+	–	–	–	–	P-B, Ep	eterm	st-str	–	–	–	–	–	–
Euglena acus Ehrenb. var. *minor* Hansg.	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Euglena adhaerens Matv.	–	–	+	–	–	–	–	–	B	–	st	oh	acf	–	o-b	–	–
Euglena caudata Hubner var. *caudata*	–	–	–	+	–	–	–	–	P	–	st-str	mh	ind	–	a	–	–
Euglena clara Skuja	–	–	–	+	–	+	–	–	P-B	eterm	st-str	mh	–	–	o	–	–
Euglena gracilis G.A. Klebs f. *gracilis*	–	–	+	+	–	–	–	–	P-B	eterm	st	oh	ind	–	x-b	–	–
Euglena oxyuris Schmarda f. *oxyuris*	+	+	+	+	–	–	–	–	P-B	–	st-str	mh	ind	–	b-a	–	–
Euglena oxyuris Schmarda f. *lata* (Christjuk) T.G. Popova	+	–	+	–	–	–	–	–	P-B	–	st	–	–	–	–	–	–
Euglena oxyuris Schmarda f. *major* (Woron.) T.G. Popova	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Euglena slavjanskiensis Proschk.-Lavr.	–	–	–	–	–	–	–	+	P-B	–	st	mh	–	–	–	–	–
Euglena texta (Dujard.) Hubner var. *texta*	–	–	+	+	–	–	–	–	P	eterm	st-str	–	ind	–	b	–	–
Euglena vermicularis Proshk.-Lavr.	–	–	–	–	–	–	–	+	B, Ep	–	st	hl	ind	–	–	–	–
Euglena viridis Ehrenb. f. *viridis*	+	+	+	+	–	–	–	–	P-B, S	eterm	st-str	mh	ind	–	i	–	–
Phacus brevicaudatus (G.A. Klebs) Lemmerm.	–	–	–	+	–	–	–	–	P	eterm	st-str	hl	–	–	b	–	–
Phacus curvicauda Svirenko	–	–	–	+	–	–	–	–	P-B	–	st	i	ind	–	b	–	–
Phacus swirenkoi Skvortsov	–	–	–	+	–	–	–	–	–	–	st-str	–	ind	–	–	–	–
Strombomonas acuminata (Schmarda) Deflandre	–	–	–	+	–	–	–	–	P	–	st-str	i	ind	–	b	–	–
Trachelomonas curta Da Cunha f. *curta*	–	–	–	+	–	–	–	–	–	–	–	–	–	–	b	–	–
Trachelomonas granulata Svirenko	+	+	–	+	–	–	–	–	P	–	st-str	–	ind	–	–	–	–
Trachelomonas volvocina Ehrenb. var. *volvocina*	+	+	–	+	–	–	–	–	B	eterm	st-str	i	ind	–	b	–	–
Dinophyta																	
Amphidinium rostratum Proshk.-Lavr.	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Gymnodinium olivaceum Skvortzov	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gymnodinium paradoxum A.J. Schill.	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gymnodinium uberrimum (G.J. Allman) Kof. et Swezy	+	–	+	+	–	–	–	–	–	–	–	–	–	–	x-b	–	–

Peridiniopsis oculatum (F. Stein) Bourr.	+	–	–	+	+	–	–	–	P	–	st	–	–	–	–	–	–
Peridinium bipes F. Stein	–	–	–	+	–	–	–	–	P	–	st-str	oh	–	–	o	–	–
Sphaerodinium cinctum (Ehrenb.) Wołosz.	–	–	–	–	–	–	–	+	P	–	st-str	–	–	–	o	–	–
Woloszynskia neglecta (A.J. Schill.) R.H. Thomps.	–	–	–	+	–	–	–	–	P	–	st	–	–	–	o-b	–	–
Woloszynskia pascheri (Süchl.) Stosch	+	+	–	+	+	–	–	–	P	–	st	–	–	–	b-o	–	–
Crysophyta																	
Chromulina flavicans (Ehrenb.) Buetschli	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Chrysococcus rufescens G.A. Klebs var. *rufescens*	+	+	–	+	–	–	–	–	P	–	–	hb	–	–	o-b	–	–
Dinobryon cylindricum O.E. Imhof var. *cylindricum*	–	+	–	–	–	–	–	–	P	–	–	i	–	–	o-b	–	–
Ochromonas triangulata Vysotsky	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Pedinella hexacostata Vysotsky	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Pseudokephyrion schilleri (J. Schiller) W. Conrad	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Wyssotzkia biciliata (Vysotskiy) Lemmerm.	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Xanthophyta																	
Botrydiopsis arhiza Borzi	+	–	–	–	–	–	–	–	B, S	–	–	–	–	–	o	–	–
Characiopsis aquilonaris Skuja	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Characiopsis falx Pascher	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Chlorarkys simplex Pascher	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Ophiocytium cochleare (Eichw.) A. Braun	–	–	–	–	–	–	–	+	P-B	–	–	oh	–	–	o-b	–	–
Vischeria stellata (Chodat) Pascher	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Cryptophyta																	
Cryptomonas caudata Massart	–	–	–	+	–	–	–	–	P	–	–	i	–	–	–	–	–
Cryptomonas marssonii Skuja	+	–	–	+	–	–	–	–	P	–	st-str	i	–	–	b-o	–	–
Cryptomonas ovata Ehrenb.	–	–	–	+	–	–	–	–	P	–	st-str	hl	–	–	b-a	–	–
Bacillariophyta																	
Achnanthes brevipes C. Agardh var. *brevipes*	+	+	+	+	+	+	+	+	B	–	–	hl	alf	–	–	–	–
Achnanthes brevipes C. Agardh var. *intermedia* (Kütz.) Cleve	+	+	+	+	–	+	+	–	B	–	st	mh	–	–	–	–	–
Achnanthes coarctata (Bréb. in W. Sm.) Grunow in Cleve et Grunow	+	+	–	–	–	–	–	–	B	–	ae	–	neu	–	o-a	–	–
Achnanthes elliptica (Cleve) Cleve-Euler	+	–	–	–	–	–	–	–	B	–	st-str	i	alf	sx	o	ats	o-m
Achnanthes longipes C. Agardh	+	+	+	–	–	–	–	–	B	–	–	hl	–	–	–	–	–
Adlafia bryophila (J.B. Petersen) Lange-Bert. in Moser et al.	+	+	+	–	–	–	+	–	B	–	str	hb	neu	es	b-a	ats	m
Adlafia minuscula (Grunow in Van Heurck) Lange-Bert. in Lange-Bert. et Genkal var. *minuscula*	+	+	+	+	+	+	+	–	B	–	–	i	alf	es	b-a	–	ot
Amphiprora kjellmanii Cl. var. *striolata* (Grun.) Cl.	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Amphora coffeaeformis (C. Agardh) Kütz. var. *coffeaeformis*	+	+	+	+	–	–	–	–	B	–	st-str	mh	alf	–	a	ate	e
Amphora commutata Grunow in Van Heurck	+	+	+	+	–	+	+	–	B	–	–	hl	–	–	–	–	e
Amphora holsatica Hust.	+	+	+	+	+	+	–	–	P	–	st-str	hl	–	–	–	–	–
Amphora ovalis (Kütz.) Kütz.	+	+	–	+	–	–	–	–	B	temp	st-str	i	alf	sx	a-b	ate	e
Amphora pediculus (Kütz.) Grunow in A.W.F. Schmidt et al. var. *pediculus*	+	+	–	–	–	–	–	–	B	temp	st	i	alf	sx	o-a	ate	e
Amphora veneta Kütz.	+	+	–	+	–	–	–	–	B	–	st-str	i	alf	es	o	ate	e
Anomoeoneis sphaerophora (Kütz.) Pfitzer var. *sculpta* (Ehrenb.) O. Müll.	–	–	–	+	–	–	–	–	P-B	warm	st-str	hl	alb	–	x-b	ate	e
Bacillaria paradoxa J.F. Gmel. in Linne	+	–	–	+	–	–	–	–	P-B	–	–	mh	ind	es	o	ate	e
Caloneis amphisbaena (Bory) Cleve	–	–	+	–	–	–	–	–	B	–	st-str	hl	alf	–	o	ate	e

var. *amphisbaena*																	
Caloneis molaris (Grunow) Krammer in Krammer et Lange-Bert.	+	+	+	+	–	–	–	–	B	–	str	i	neu	es	–	–	–
Caloneis silicula (Ehrenb.) Cleve	–	–	+	+	–	–	–	–	B	–	st	i	alf	sp	x	ats	me
Caloneis sublinearis (Grunow in Van Heurck) Krammer	+	+	–	+	–	–	–	–	P-B	–	st-str	hb	–	–	–	–	–
Campylodiscus clypeus Ehrenb.	+	+	+	+	–	–	–	–	B	temp	–	mh	alb	–	b	–	e
Campylodiscus hibernicus Ehrenberg	+	–	–	+	–	–	–	–	B	–	–	i	ind	–	o	–	e
Catacombas gaillonii (Bory) D.M. Williams et Round	–	+	+	–	+	+	+	–	–	–	–	–	–	–	–	–	–
Cavinula cocconeiformis (W. Greg. ex Grev.) D.G. Mann et Stickle in Round, Crawford et Mann	+	+	–	+	–	–	–	–	B	–	str	i	ind	es	o	ats	o-m
Chaetoceros muelleri Lemmerm.	–	+	+	+	+	+	+	–	P-B	temp	st-str	hl	alb	–	o	–	e
Cocconeis pediculus Ehrenb.	+	+	+	+	–	–	–	–	B	–	st-str	i	alf	sx	o-a	ate	e
Cocconeis placentula Ehrenb. var. *placentula*	+	+	+	+	+	+	–	–	P-B	temp	st-str	i	alf	es	o-b	ate	e
Cosmioneis pusilla (W.Sm.) D.G. Mann et Stickle in Round, Crawford et Mann	+	+	–	+	–	–	–	–	B	–	–	hl	ind	sp	o-b	–	–
Craticula cuspidata (Kütz.) D.G. Mann in Round, Crawford et Mann	–	+	–	+	–	–	–	–	B	temp	st	i	alf	es	o	–	–
Craticula halophila (Grunow in Van Heurck) D.G. Mann in Round, Crawford, Mann	+	+	+	+	+	+	+	–	B	–	st-str	mh	alf	es	–	–	–
Ctenophora pulchella (Ralfs ex Kütz.) D.M. Williams et Round	–	–	+	+	+	+	–	–	–	–	–	–	–	–	o	–	–
Cyclotella meneghiniana Kütz.	+	+	+	+	+	+	–	–	P-B	temp	st	hl	alf	sp	o-a	hne	e
Cyclotella stelligera (Cleve et Grunow) Van Heurck	+	–	+	+	+	+	–	–	P-B	–	st	i	ind	es	x	–	–
Cylindrotheca closterium (Ehrenb.) Reimer et F.W. Lewis	+	+	+	+	+	+	+	–	B	–	–	mh	–	–	–	–	–
Cymbella affinis Kütz. var. *affinis*	–	+	–	+	–	–	–	–	B	temp	st-str	i	alf	sx	b-o	ats	e
Cymbella amphicephala Nägeli in Kütz. var. *amphicephala*	–	–	–	+	–	–	–	–	B	–	str	i	ind	sx	o-b	ats	o-m
Cymbella helvetica Kütz. var. *helvetica*	+	–	+	+	–	–	–	–	B	–	str	i	alf	–	o-a	–	–
Cymbella laevis Nägeli in Kütz.	+	+	–	+	–	–	–	–	B	cool	–	i	ind	sx	–	–	–
Cymbella pusilla Grunow in A.W.F. Schmidt et al.	+	+	+	+	–	–	+	–	B	–	–	mh	alf	es	–	–	–
Cymbella tumida (Bréb.) Van Heurck var. *tumida*	–	–	–	+	–	–	–	–	B	temp	str	i	alf	sx	x	ats	me
Cymbella tumidula Grunow in A.W.F. Schmidt et al.	+	+	+	+	+	+	+	–	B	–	str	i	alf	–	o	ats	–
Diatoma anceps (Ehrenb.) Kirchn.	+	+	+	+	–	–	–	–	P-B	cool	st-str	hl	alf	sx	b	–	–
Diatoma elongatum (Lyngb.) C. Agardh	–	+	+	+	+	+	–	–	P-B	–	–	hl	ind	sx	o-b	–	–
Diatoma vulgare Bory var. *vulgare*	+	+	–	+	–	–	–	–	P-B	–	st-str	i	ind	sx	b-a	ate	me
Diploneis elliptica (Kütz.) Cleve	+	+	–	–	–	–	–	–	B	temp	str	i	alf	sx	o-a	ats	m
Diploneis interrupta (Kütz.) Cleve	+	–	+	–	–	–	–	–	B	–	–	mh	ind	–	–	–	–
Encyonema elginense (Krammer) D.G. Mann in Round, Crawford et Mann	–	+	–	+	–	–	–	–	B	–	st	hb	acf	sx	–	–	–
Encyonema neogracile Krammer	+	+	–	–	+	–	–	–	B	–	str	hb	ind	sx	b	ats	o-m
Encyonema perpusilla (A. Cleve) D.G. Mann in Round, Crawford et Mann	+	+	–	+	–	–	–	–	B	–	str	hb	acf	–	o	ats	ot
Encyonema prostrata (Berk.) Kütz.	+	+	–	+	–	–	–	–	B	–	str	i	alb	es	o-a	ats	e
Encyonopsis microcephala (Grunow in Van Heurck) Krammer	+	+	+	+	–	–	–	–	B	–	str	i	alf	es	b	ats	me
Entomoneis paludosa (W. Sm.) Reimer in Patrick et Reimer var. *paludosa*	+	–	–	+	–	–	+	–	B	–	–	hl	neu	–	o	–	–
Entomoneis paludosa (W. Sm.) Reimer in Patrick et Reimer var. *subsalina* (Cleve) Krammer in Lange-Bert et Krammer	+	+	+	+	+	+	+	–	B	–	–	hl	–	–	–	–	–
Epithemia adnata (Kütz.) Bréb. in Bréb. et P. Godey	–	–	–	+	–	–	–	–	B	temp	st	i	alb	sx	b-a	ats	me
Epithemia argus (Ehrenb.) Kütz. var. *argus*	+	+	–	+	–	–	–	–	P-B	–	st-str	i	ind	es	o	–	m

Epithemia sorex Kütz. var. *sorex*	–	–	–	+	–	–	–	–	B	temp	st	i	alf	sx	o-a	ats	e
Eunotia praerupta Ehrenb. var. *praerupta*	–	–	–	+	–	–	–	–	B	cool	st-str	hb	acf	sx	b	ats	o-m
Eunotia sudetica O. Müll.	+	–	–	–	–	–	–	–	P-B	–	str	i	acf	sx	o-b	ats	o-m
Eunotia tenella (Grunow in Van Heurck) A. Cleve	–	–	–	+	–	–	–	–	B	–	str	hb	acf	es	o-b	ats	ot
Fallacia pygmaea (Kütz.) Stickle et D.G. Mann in Round, Crawford et Mann	–	–	–	+	–	–	–	–	B	–	st-str	mh	alb	es	b-o	hne	e
Fragilaria capucina Desm. var. *capucina*	+	+	–	+	–	–	–	–	B	–	–	i	neu	es	o	–	m
Fragilaria capucina Desm. var. *amphicephala* (Kütz.) Lange-Bert. ex Bukht.	+	–	–	–	–	–	–	–	B	–	–	i	alf	sp	x	–	o-m
Fragilaria crotonensis Kitton	+	–	+	+	–	–	–	–	P	–	st	hl	alf	es	a-b	ate	m
Fragilaria tenera (W. Sm.) Lange-Bert.	+	+	+	+	–	–	–	–	–	–	str	hb	acf	sx	o	ats	o-m
Fragilaria vaucheriae (Kütz.) Boye-Pet. var. *capitellata* (Grunow in Van Heurck) R. Ross	–	+	–	+	–	–	–	–	B	–	–	–	–	sx	–	–	–
Fragilarioforma virescens (Ralfs) D.M. Williams et Round var. *virescens*	–	+	–	+	–	–	–	–	P-B	–	st	i	neu	es	o	ats	o-m
Gomphoneis olivaceum (Horn.) Daw. et Ross et Sims	+	–	–	+	+	–	–	–	B	–	st-str	i	alf	es	b-a	ate	e
Gomphonema acuminatum Ehrenb. var. *acuminatum*	+	+	–	+	–	–	–	–	P-B	–	st	i	alf	es	x-b	ats	e
Gomphonema angustatum (Kütz.) Rabenh. var. *angustatum*	–	+	+	+	–	–	+	–	P-B	–	st-str	i	alf	es	b	–	–
Gomphonema constrictum Ehr. var. *capitatum* (Ehr.)	+	–	–	+	–	–	–	–	B	temp	–	i	alf	sx	b	–	–
Gomphonema parvulum Kütz.	–	+	–	+	–	–	–	–	B	temp	str	i	ind	es	x	hne	e
Gomphonema parvulum Kütz. var. *micropus* (Kütz.) Cl.	–	+	+	+	–	–	–	–	B	–	str	i	ind	es	–	–	–
Gomphonema productum (Grunow in Van Heurck) Lange-Bert. et E. Reichardt	–	–	–	+	–	–	–	–	B	–	str	i	alf	es	b	ate	o-m
Gyrosigma acuminatum (Kütz.) Rabenh. var. *acuminatum*	+	+	–	+	–	–	–	–	B	cool	st-str	i	alf	–	o-x	ate	e
Gyrosigma peisonis (Grunow) Hust. in Pascher	–	+	–	–	–	–	–	–	B	–	st-str	mh	alf	es	o	–	me
Gyrosigma spenceri (J.T. Quekett) Griffith et Henfr.	+	–	+	–	+	+	–	–	B	–	–	mh	alf	es	o	–	–
Hantzschia amphioxys (Ehrenb.) Grunow in Cleve et Grunow var. *amphioxys*	–	+	+	–	–	–	–	–	B	temp	st-str	i	neu	es	b-o	ate	o-e
Hantzschia amphioxys (Ehrenb.) Grunow in Cleve et Grunow var. *capitata* O. Müll.	–	+	–	–	–	+	+	–	B	–	st-str	i	alf	–	a	ate	o-e
Hantzschia spectabilis (Ehrenb.) Hust.	–	–	–	+	–	–	–	–	B	–	–	hl	neu	–	x-o	–	–
Hantzschia virgata (Roper) Grunow in Cleve et Grunow var. *virgata*	+	+	+	+	–	–	+	–	B	–	–	mh	–	–	–	–	–
Hantzschia vivax (W. Sm.) Perag. in Temp. et Perag	–	–	–	+	–	–	–	–	B	–	–	hl	alb	–	–	–	–
Hippodonta capitata (Ehrenb.) Lange-Bert., D. Metzeltin et A. Witkowski	+	–	–	+	–	–	–	–	B	temp	st-str	hl	alf	es	o-b	ate	me
Hippodonta hungarica (Grunow) Lange-Bert., D. Metzeltin et A. Witkowski	–	–	–	+	–	+	–	–	B	–	st-str	i	alf	es	b-o	–	–
Karayevia clevei (Grunow in Van Heurck) Bukht. var. *clevei*	+	+	+	–	–	–	–	–	B	–	st-str	i	alf	sx	b-p	–	–
Luticola cohnii (Hilse in Rabenh.) D.G. Mann in Round, Crawford et Mann	+	+	+	+	+	+	–	–	B	–	ae	i	ind	es	o	–	–
Luticola mutica (Kütz.) D.G. Mann in Round, Crawford et Mann	+	+	+	–	–	–	+	–	B, S	–	st-str	i	ind	sp	o	ate	e
Mastogloia smithii Thwaites in W. Sm. var. *lacustris* Grunow	–	+	–	+	–	–	–	–	B	–	str	hl	alf	–	o	ats	e
Mayamaea atomus (Kütz.) Lange-Bert.	+	+	–	–	–	–	–	–	B	–	–	i	–	es	o	–	–
Navicula amphibola Cleve	+	+	+	–	–	–	–	–	B	cool	str	i	ind	–	o	ats	o-m
Navicula angusta Grunow	+	+	+	+	–	–	–	–	B	–	str	hl	acf	sx	o	ats	ot
Navicula capitatoradiata H. Germ.	+	+	+	+	+	+	–	–	P-B	–	st-str	i	alf	–	b	ate	e
Navicula cari Ehrenb.	+	–	–	–	–	–	–	–	P-B	–	–	i	ind	es	b-a	–	o-e
Navicula cocconeis Ehrenberg	+	+	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Navicula crucicula (W. Sm.) Donkin	+	+	–	+	–	+	–	–	B	–	–	mh	ind	–	–	–	–
Navicula digitoradiata (W. Greg.) Ralfs in A. Pritch	–	–	–	–	–	+	–	–	B	–	–	mh	alb	es	–	–	–

Navicula gregaria Donkin	+	+	+	+	+	+	+	–	B	–	–	mh	alf	es	x-b	ate	e
Navicula kotschyi Grunow var. *kotschyi*	+	+	+	–	–	–	–	–	B	warm	st-str	i	acf	–	o	–	–
Navicula krasskei Hustedt	–	+	–	–	–	–	–	–	B	–	str	hb	acf	–	o	ats	o-m
Navicula lanceolata (C. Agardh) Ehrenb. var. *lanceolata*	+	+	+	+	–	–	–	–	B	–	st-str	i	alf	es	x-b	ate	e
Navicula oblonga (Kütz.) Kütz. var. *oblonga*	–	+	+	+	–	–	–	–	B	–	st-str	i	alf	sx	b	ate	e
Navicula protracta Grunow in Cleve	+	+	+	+	+	+	+	–	B	–	st-str	mh	ind	es	x-b	ate	e
Navicula radiosa Kütz.	+	+	–	–	+	–	–	–	B	temp	st-str	i	ind	es	o	ate	me
Navicula rotaeana (Rabenh.) Grun.	+	+	–	+	–	+	–	–	B	–	st	i	acf	–	b-o	–	–
Navicula salinarum Grunow in Cleve et Grunow f. *salinarum*	+	+	+	+	–	–	–	–	B	–	st-str	mh	neu	–	b	ate	e
Navicula scutum (Schum.) Van Heurck	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Navicula subtilissima Cleve	+	+	+	+	+	+	+	–	B	–	st	i	acf	sx	o	ats	ot
Navicula tripunctata (O.F. Müll.) Bory	+	+	+	+	–	–	–	–	B	–	st-str	i	ind	es	b	ate	e
Navicula veneta Kütz.	+	+	+	+	+	+	+	–	B	–	–	hl	alf	es	x-o	ate	e
Navicula vulpina Kütz.	+	+	–	+	–	–	–	–	B	–	str	i	alf	–	o	ats	me
Nitzschia acicularis (Kütz.) W. Sm. var. *acicularis*	+	+	–	+	–	–	–	–	P-B	temp	–	i	alf	es	o-b	hce	e
Nitzschia amphibia Grunov	+	+	+	+	+	+	+	–	P-B, S	temp	st-str	i	alf	sp	o	hne	e
Nitzschia communis Rabenh.	+	+	+	–	–	–	–	–	P-B	–	st-str	i	alf	sp	o	hce	e
Nitzschia commutata Grunow in Cleve et Grunow	+	+	–	–	–	–	–	–	B	–	–	mh	–	–	–	–	–
Nitzschia frustulum (Kütz.) Grunow in Cleve et Grunow var. *frustulum*	–	–	–	+	–	–	–	–	B	temp	st-str	hl	alf	sp	b	hce	e
Nitzschia hantzschiana Rabenh.	+	+	+	+	–	–	+	–	B	–	str	i	alf	es	o-x	ats	m
Nitzschia intermedia Hantzsch ex Cleve et Grunow f. *intermedia*	+	+	–	+	–	–	–	–	B	–	–	i	ind	es	a-b	–	e
Nitzschia lanceolata W. Sm.	–	–	–	+	–	–	–	–	–	–	–	hl	alf	–	–	–	e
Nitzschia linearis W. Sm. var. *linearis*	+	+	–	–	–	–	–	–	B	temp	st-str	i	alf	es	x	ate	me
Nitzschia obtusa W. Sm.	+	–	–	–	–	–	–	–	B	–	–	mh	–	es	b	–	–
Nitzschia palea (Kütz.) W. Sm. var. *palea*	+	–	–	–	–	–	–	–	P-B	temp	–	i	ind	sp	b-a	hce	he
Nitzschia paleacea (Grunow in Cleve et Grunow) Grunow in Van Heurck	+	+	+	+	–	–	+	–	P-B	–	st-str	i	alf	es	b	hce	e
Nitzschia pusilla (Kütz.) Grunow emend. Lange.-Bert.	+	+	–	+	–	–	–	–	P-B, S	–	st-str	i	neu	es	x	ate	o-e
Nitzschia reversa W.Sm f. *reversa*	+	+	+	+	+	+	–	–	P	–	–	hl	–	–	–	–	–
Nitzschia scalpelliformis (Grunow in Van Heurck) Grunow in Cleve et Grunow	–	–	–	–	–	–	–	+	B	–	–	hl	–	sp	–	–	–
Nitzschia sigmoidea (Nitzsch) W. Sm.	–	+	–	–	–	–	–	–	P-B	–	st-str	i	alf	–	o	ate	e
Nitzschia sublinearis Hust. in A.W.F. Schmidt et al.	–	–	–	+	–	–	–	–	P-B	–	–	i	alf	es	o-b	–	–
Nitzschia subtilis (Kütz.) Grunow in Cleve et Grunow	+	+	–	–	–	–	–	–	B	–	–	i	ind	es	o	–	–
Nitzschia tryblionella Hantzsch in Rabenhorst	+	+	–	–	–	–	–	–	B	–	st-str	hl	alf	–	o	ate	e
Nitzschia umbonata (Ehrenb.) Lange.-Bert.	+	+	–	–	–	+	–	–	P	–	st-str	–	–	es	b-o	–	–
Nitzschia vermicularis (Kütz.) Hantzsch in Rabenh.	+	+	–	+	–	–	–	–	B	–	str	i	alf	–	o	–	o-e
Nitzschia vitrea G. Norman var. *vitrea*	+	+	+	+	–	+	–	–	P-B	–	–	mh	alf	–	o-b	–	e
Petroneis humerosa (Bréb. in W. Sm.) Stickle et D.G. Mann in Round, Crawford et Mann	+	+	–	–	–	–	–	–	B	–	–	mh	–	–	–	–	–
Pinnularia appendiculata (C. Agardh) Cleve var. *intermedia* (Manguin) P. Tsarenko comb. Nova	+	–	–	–	–	–	–	–	–	–	–		–	–	–	–	–
Pinnularia lata (Bréb.) W. Sm.	–	–	–	+	–	–	–	–	B	–	str	i	acf	–	o	–	ot
Pinnularia viridis (Nitzsch) Ehrenb.	+	+	–	+	–	–	–	–	P-B	temp	st-str	i	ind	es	o-x	ate	o-e
Placoneis elginensis (W. Greg.) E.J. Cox var. *exigua* (W. Greg.) P. Tsarenko comb. nova	+	+	–	+	–	–	–	–	B	–	str	i	alf	es	x-o	ats	e

Placoneis gastrum (Ehrenb.) Meresch.	+	+	–	–	–	–	–	–	B	–	–	i	ind	sx	x-o	–	–
Placoneis placentula (Ehrenb.) Mereschk. var. *placentula*	+	+	–	+	–	–	–	–	B	temp	st-str	i	alf	sx	x-b	ate	e
Placoneis placentula (Ehrenb.) Mereschk. var. *jenisseyensis* (Grunow in Cleve et Grunow) Bukht.	+	–	–	+	–	–	–	–	B	–	–	i	alf	–	–	–	–
Placoneis placentula (Ehrenb.) Mereschk. var. *rostrata* (Mayer) P. Tsarenko comb. nova	+	+	+	–	–	–	–	–	B	–	–	i	alf	–	–	–	–
Planothidium hauckianum (Grunow) Round et Bukht. var. *rostrata* (Schulz) Bukht.	+	+	–	–	–	–	–	–	B	–	–	hl	alf	es	–	–	–
Planothidium lanceolata (Bréb. in Kütz.) Round et Bukht.	+	–	–	–	–	–	–	–	P-B	warm	st-str	i	alf	sx	o-x	–	–
Pseudostaurosira brevistriata (Grunow in Van Heurck) D.M. Williams et Round	+	+	+	–	–	–	–	–	P-B	–	st-str	i	alf	–	x-o	ats	o-e
Rhoicosphenia abbreviata (C. Agardh) Lange-Bert.	+	+	–	+	–	–	–	–	P-B	–	st-str	i	alf	es	x-o	ate	e
Rhopalodia gibba (Ehrenb.) O. Müll. var. *gibba*	–	–	+	+	–	–	–	–	B	temp	–	i	alb	es	x-o	–	–
Rhopalodia gibberula (Ehrenb.) O. Müll. var. *gibberula*	–	–	–	–	–	+	–	–	B	temp	str	mh	ind	es	–	–	–
Rhopalodia musculus (Kütz.) O.Müll.	+	+	+	–	–	–	–	–	P-B, S	–	–	mh	alb	–	x	–	–
Rhopalodia operculata (C. Agardh) Håk.	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Sellaphora pupula (Kütz.) Mereschk. var. *pupula*	+	+	–	+	–	–	–	–	B	eterm	st	hl	ind	sp	o-x	–	–
Sellaphora pupula (Kütz.) Mereschk. var. *rostrata* (Hust.) P. Tsarenko comb. nova.	+	+	+	+	–	+	+	–	B	temp	–	hl	ind	–	b	–	–
Stauroneis phoenicenteron Ehrenb. var. *phoenicenteron*	+	–	–	–	–	–	–	–	B	temp	st-str	i	ind	es	x-o	ate	me
Staurophora salina (W. Sm.) Mereschk.	–	+	–	–	–	–	–	–	B	–	–	mh	–	–	–	–	–
Surirella bifrons Ehrenb.	+	–	–	–	–	–	–	–	P-B	–	st	i	ind	es	o-a	–	e
Surirella brebissonii Krammer et Lange.-Bert. var. *kuetzingii* Krammer et Lange.-Bert.	–	+	+	+	–	+	–	–	B	–	st-str	i	alf	–	b-a	ate	e
Surirella brightwellii var. *baltica* (Schum.) Krammer in Lange-Bert. et Krammer	+	–	–	+	+	+	+	–	B	–	–	hl	–	–	–	–	–
Surirella capronii Bréb. et Kitton	+	+	–	+	–	–	–	–	P-B, S	–	st	i	ind	–	x	–	me
Surirella striatula Turpin var. *striatula*	+	+	+	–	–	–	–	–	P-B	temp	–	mh	alf	–	–	–	e
Synedra acus Kütz.	+	+	–	+	–	–	–	–	P	–	st-str	i	alb	es	b	–	–
Synedra acus Kütz. var. *radians* (Kütz.) Hust.	–	–	–	+	–	–	–	–	B	–	–	i	alf	sx	o	–	–
Synedra capitata Ehrenb.	+	–	–	–	–	–	–	–	B	–	–	i	alf	es	b-o	–	–
Synedra pulchella (Ralfs) Kütz. var. *naviculacea* Grun.	–	–	+	–	–	–	–	–	–	–	–	–	–	sx	–	–	–
Synedra ulna (Nitzsch) Ehrenb.	+	+	+	+	–	–	–	–	P-B	temp	st-str	i	alf	es	b-o	ate	o-e
Synedra ulna (Nitzsch) Ehr. var. *aequalis* (Kütz.) Hust.	+	–	–	+	–	–	–	–	B	–	–	i	alf	sp	b	–	–
Synedra ulna (Nitzsch) Ehr. var. *amphirhynchus*	–	–	–	+	–	–	–	–	B	–	–	i	alf	es	–	–	–
Synedra ulna (Nitzsch) Ehr. var. *biceps* (Kütz.) Schönf.	–	+	–	–	–	–	–	–	B	temp	–	i	alf	–	x-b	–	–
Tabularia fasciculata (C. Agardh) D.M. Williams et Round	+	+	+	+	+	+	+	–	B	–	–	mh	ind	es	b-a	–	–
Tryblionella angustata W. Sm. var. *angustata*	+	–	–	–	–	–	–	–	B	–	–	–	–	–	b-p	–	–
Tryblionella apiculata Grunow in Cleve et Grunow	+	+	–	–	–	–	–	–	B	–	–	mh	alf	es	o-a	–	–
Tryblionella circumsuta (Bailey) Ralfs in A. Pritch.	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tryblionella gracilis W. Sm. var. *gracilis*	–	+	–	–	–	–	–	–	B	–	–	hl	alf	–	a-b	–	–
Tryblionella hungarica (Grunow) D.G. Mann in Round, Crawford et Mann var. *hungarica*	+	+	+	+	+	+	+	–	P-B	–	–	mh	alf	sp	a-b	–	–
Tryblionella victoriae Grunov	–	–	–	–	+	–	–	–	B	–	–	hl	–	sp	b	–	–
Undatella lineolata (Ehrenb.) P. Tsarenko comb. Nova	–	+	–	–	–	–	–	+	B	–	–	hl	–	–	–	–	–
Urosolenia eriensis (H.Sm.) Round et R.M. Crawford in Round	–	–	–	–	+	–	–	–	B	–	str	hl	acf	–	–	ats	m

Chlorophyta																	
Acutodesmus acuminatus (Lagerh.) P. Tsarenko in Tsarenko et Petlovany	–	+	–	+	–	–	–	–	P-B	–	st-str	i	ind	–	b	–	–
Acutodesmus dimorphus (Turpin) P. Tsarenko in Tsarenko et Petlovany	–	+	+	+	–	–	–	–	–	–	–	–	–	–	b	–	–
Acutodesmus obliquus (Turpin) P. Tsarenko in Tsarenko et Petlovany	–	–	–	+	–	–	–	–	P-B, S	–	st	i	–	–	b-p	–	–
Acutodesmus pectinatus (Meyen) P. Tsarenko in Tsarenko et Petlovany var. *pectinatus*	+	+	–	+	–	–	–	–	P-B	–	st-str	–	–	–	–	–	–
Acutodesmus wisconsinensis (G.M. Sm.) P. Tsarenko in Tsarenko et Petlovany	–	–	–	+	–	–	–	–	P	–	st	–	–	–	–	–	–
Ankistrodesmus spiralis (W.B. Turner) Lemmerm.	–	–	–	+	–	–	–	–	P	–	–	–	–	–	b	–	–
Ankyra judayi (G.M. Sm.) Fott var. *judayi*	+	+	+	–	–	–	–	–		–	–	–	–	–	b	–	–
Ankyra ocellata (Korschikov) Fott	+	+	+	–	–	–	–	–	Ep	–	–	oh	–	–	–	–	–
Botryococcus terribilis Komárek et Marvan	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Carteria globosa Korschikov in Pascher	+	+	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Chlamydomonas ovata P.A.Dangeard	–	+	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Chlamydomonas reinhardtii P.A. Dang.	+	–	–	–	–	–	–	–	P-B	–	st-str	oh	–	–	a	–	–
Chlorangiopsis epizootica (Korschikov) Korschikov	–	–	–	–	–	–	–	+	B	–	–	–	–	–	b	–	–
Chlorangiopsis rotatoriorum (Proschk.-Lavr.) Petlov. et P. Tsarenko inTsarenko et Petlovany	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Chlorella vulgaris Beijer. f. *vulgaris*	+	+	+	+	–	–	–	–	P-B, pb,S	–	–	hl	–	–	a	–	–
Chlorotetraedron incus (Teiling) Komárek et Kovaček	–	–	–	+	–	–	–	–	P-B	–	st-str	i	–	–	b	–	–
Cladophora siwaschensis C. Meyer	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Closteriopsis acicularis (G.M. Sm.) J.H. Belcher et Swale	–	–	–	–	+	–	–	–	P-B	–	st-str	i	–	–	o-a	–	–
Coelastrum astroideum De Not.	+	–	–	+	–	–	–	–	P	–	st-str	–	–	–	b	–	–
Coenococcus planctonicus Korschikov	–	–	+	+	+	–	–	–	P	–	–	–	–	–	–	–	–
Crucigenia fenestrata (Schmidle) Schmidle	–	–	–	+	–	–	–	–	P-B	–	st-str	–	–	–	b	–	–
Crucigenia tetrapedia (Kirchn.) West et G.S. West	–	–	–	+	–	–	–	–	P-B	–	st-str	i	ind	–	o-a	–	–
Desmodesmus armatus (Chodat) E. Hegew. var. *armatus*	–	–	–	+	–	–	–	–	P-B	–	st-str	–	–	–	o-a	–	–
Desmodesmus bicaudatus (Dedus.) P. Tsarenko	–	–	+	+	–	–	–	–	P-B	–	st-str	–	–	–	b	–	–
Desmodesmus communis (E. Hegew.) E. Hegew. var. *communis*	+	+	+	+	+	–	–	–	P-B	–	st-str	i	ind	–	b	–	–
Desmodesmus intermedius (Chodat) E. Hegew.	–	–	–	+	+	–	–	–	P-B	–	st-str	–	–	–	b	–	–
Desmodesmus lefevrei (Deflandre) An, Fridl et E. Hegew.	–	–	–	+	–	–	–	–	–	–	–	–	–	–	b	–	–
Desmodesmus protuberans (F.E. Fritsch et Rich) E. Hegew.	–	–	–	–	+	–	–	–	P-B	–	st-str	–	–	–	–	–	–
Desmodesmus spinosus (Chodat) E. Hegew.	–	–	–	+	–	–	–	–	P-B	–	st-str	–	–	–	o-b	–	–
Dictyosphaerium chlorelloides (Naummann) Komárek et Perm.	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Dictyosphaerium pulchellum Wood	+	+	–	+	+	–	–	–	P-B	–	st-str	i	ind	–	b	–	–
Dictyosphaerium subsolitarium van Goor	–	+	–	+	–	–	–	–	P	–	–	–	–	–	o-a	–	–
Dunaliella minuta W. Lerche	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Dunaliella salina (Dunal) Teodor.	+	+	+	+	+	+	+	–	P	–	st	–	–	–	–	–	–
Golenkinia radiata Chodat	–	–	+	+	–	–	–	–	P-B	–	st-str	i	–	–	o-a	–	–
Hyaloraphidium contortum Pascher et Korschikov ex Korschikov var. *tenuissimum* Korschikov	+	–	+	+	+	–	–	–	P-B	–	–	i	–	–	b	–	–
Maleochloris sessilis Pascher	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Monoraphidium arcuatum (Korschikov) Hindák	–	–	+	+	–	–	–	–	P-B	–	st-str	–	–	–	b	–	–
Monoraphidium contortum (Thur.) Komárk.-Legn.	+	+	+	+	–	–	–	–	P-B	–	st-str	–	–	–	b	–	–

Monoraphidium griffithii (Berk.) Komárk.-Legn.	+	+	–	+	–	–	–	–	P-B	–	st-str	–	–	–	b	–	–
Monoraphidium irregulare (G.M. Sm.) Komárk.-Legn.	–	–	–	+	–	–	–	–	P-B	–	st-str	–	–	–	–	–	–
Monoraphidium komarkovae Nygaard	–	–	–	+	–	–	–	–	P-B	–	st	–	–	–	–	–	–
Monoraphidium minutum (Nägeli) Komárk.-Legn.	+	+	+	+	+	–	–	–	P-B	–	st-str	–	–	–	b-a	–	–
Nephrochlamys allanthoidea Korschikov	–	–	–	+	–	–	–	–	P-B	–	st-str	–	–	–	b	–	–
Oocystis borgei J. Snow var. *borgei*	+	+	–	+	–	–	–	–	P-B	–	st-str	i	ind	–	b-o	–	–
Oocystis elliptica West	+	–	–	–	–	–	–	–	P-B	–	st-str	–	–	–	–	–	–
Oocystis lacustris Chodat	+	+	–	+	–	–	–	–	P-B	–	st-str	hl	–	–	b-o	–	–
Oocystis rhomboidea Fott	–	+	–	+	–	–	–	–	–	–	–	–	–	–	o-a	–	–
Pedinomonas salina Proschk.-Lavr. et Anisimova in Proschk.-Lavr.	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Phacotus lenticularis (Ehrenb.) Diesing	–	–	–	+	–	–	–	–	P	–	st	–	–	–	b	–	–
Pseudoschroederia robusta (Korschikov) E. Hegew. et Schnepf	+	+	+	+	–	–	–	–	P-B	–	st-str	i	–	–	o-a	–	–
Radiococcus planctonicus J.W.G. Lund	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Scenedesmus ellipticus Corda	–	–	–	+	–	–	–	–	P-B, S	–	st-str	–	–	–	o-b	–	–
Tetraedron minimum (A. Braun) Hansg. var. *minimum* f. *minimum*	+	+	+	+	+	–	–	–	P-B	–	st-str	i	–	–	b	–	–
Tetraselmis arnoldii (Proschk.-Lavr.) R.E. Norris et al.	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Tetraselmis contracta (N. Carter) Butcher	–	–	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Tetrastrum staurogeniaeforme (Schröd.) Lemmerm.	–	–	–	+	–	–	–	–	P-B	–	st-str	i	–	–	b	–	–
Ulothrix tenerrima (Kütz.) Kütz.	+	–	+	+	+	–	+	–	B	–	–	i	–	–	o-a	–	–
Ulothrix zonata (Weber & Mohr) Kützing	+	–	–	–	–	–	–	–	P-B	–	st-str	i	ind	–	–	–	–
Ulothrix zonata (Weber et Mohr) Kütz. var. *inaequalis* (Kütz.) Rabenh.	+	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ulotrix flacca (Dillwyn) Thur. in Le Jolis	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Ulva intestinalis L. var. *crispa* (Roth) C. Agardh	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ulva procera (Ahlner) Hayden et al.	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–
Charophyta																	
Cosmarium botrytis Meneghini ex Ralfs	–	–	–	+	–	–	–	–	P	–	st-str	i	ind	–	b	–	–
Cosmarium laeve Rabenh. var. *laeve*	–	–	–	+	–	–	–	–	B	–	st-str	hb	ind	–	o-a	–	–
Spirogyra porticalis (O.F.Müller) Dumortier	+	+	–	+	–	–	–	–	B	–	–	–	–	–	o-b	–	–
Total taxa	181	178	120	223	59	40	31	47									

Note. Lakes: 1 – Ripne, 2 – Veisove; 3 – Goryache; 4 – Slipne; 5 – Levadne; 6 – Chervone; 7 – Lake; 8 – References data. Ecological types (Hab): B – benthic; S – soil; pb – phycobiont; P-B – planktic-benthic; P – planktonic; Ep – epiphytic. Temperature (T): warm – warm; cool – cool; temp – temperate; eterm – eurythermic; H_2S – sulfides. Streaming and oxygenation (Oxy): st – standing water; str – streaming waret; st-str – standing-streaming. Salinity (Sal): ph – polyhalobe; mh – mesohalobe; oh – oligohalobe; i – oligohalobious-indifferent; hl – oligohalobious-halophilous; hb – oligohalobious-halophobous. Acidity (pH): ind – indifferent; neu – neutrophil; alf – alkaliphil; alb – alkalobiont; acf – acidophil. Saprobity [13] (D): sx – saproxen; sp – saprophil; es – eurysaprob. Saprobity [14] (S): (x – xenosaprob; x-o – xeno-oligosaprob; o-x – oligo-xenosaprob; x-b – xeno-betamesosaprob; o – oligosaprob; o-b – oligo-betamesosaprob; x-a – xeno-alphamesosaprob; b-o – beta-oligosaprob; o-a – oligo-alphamesosaprob; b – betamesosaprob; b-a – beta-alphamesosaprob; a-o – alpha-oligosaprob; a – alphamesosaprob; a-b – alpha-betamesosaprob; p – polysaprob; p-a – poly-alphamesosaprob; a-p – alpha-polysaprob; b-p – beta-polysaprob. Nitrogen uptake metabolism (Het)[11]: ats – nitrogen-autotrophic taxa, tolerating very small concentrations of organically bound nitrogen; ate – nitrogen-autotrophic taxa, tolerating elevated concentrations of organically bound nitrogen; hne – facultatively nitrogen-heterotrophic taxa, needing periodically elevated concentrations of organically bound nitrogen, hce – obligately nitrogen-heterotrophic taxa, needing continuously elevated concentrations of organically bound nitrogen. Trophic state (Tro)[11]: ot – oligotraphentic; o-m – oligo- to mesotraphentic; m – mesotraphentic; me – meso-eutraphentic; e – eutraphentic; he – hypereutraphentic; o-e – oligo- to eutraphentic (hypereutraphentic).

CONCLUSION

The phytoplankton communities of studied lakes were dominated by algae from Bacillariophyta Cyanoprocaryota, and Chlorophyta taxonomic Divisions, reflecting a common regional feature of algal flora. In general, flora of the lakes can be assessed as a rich, consisting of 334 species of algae (352 species and infraspecific taxa) from nine Divisions, the majority of which (238 species and infraspecies) is the contribution of our study during 2007-2013.

Ecological analysis showed that most of algae are benthic and plankton-benthic, despite the fact that we select only the plankton. This is probably due to the separation of periphytonic forms in the shallow lakes as a result of anthropogenic and wind water mixing.

The bioindication methods that were first time implemented showed that the water of the lakes is slightly alkaline, medium enriched with oxygen and moderate range of temperature.

Assess the impact on the flora salty water was important because this salts composition is used for spa. It turned out that in salinity indicators are dominated oligohalobes-indifferents, and also important group was oligohalobes-halophiles, which prevails over a variety of salt-preferring species, dominant only in lakes Chervone and Lake.

Bio-indication organic pollution shows that, despite the high recreational load, water quality in the lakes is quite satisfactory, II and III Classes; the water is clean enough or moderately polluted. Algal species in studied lakes used of photosynthesis, whereas mixotrophes number was insignificant, that reflects the natural, non-toxic environment, despite the significant anthropogenic load.

The lakes have sufficiently high trophic level – eutrophic, confirmed by bioindication of organic pollution, Class of Water Quality, and photosynthetic type of algal nutrition.

Since flora of studied lakes formed over a long historical period, we evaluated diversity floras in the lakes, by statistically calculating the similarity measure and the intersection of their species composition. It turned out that the similarity of the floras of the northern group of lakes (perennial lakes Ripne, Veysove, Garache, and Slipne) and southern group of lakes (partially/periodically drying lakes Levadne, Chervone, and Lake) allows us to consider the flora of the lake Veysove as a center of core of floristic composition of the northern group of perennial lakes and flora of the lake Chervone as a center of southern group. It should be noted that aridity factor influenced to the lakes water chemistry, which led to salinization and depletion of species composition on the one hand, and the other reflected on the process of floristic genesis, dividing the lakes in present time into two divergent groups.

Our study not only revealed a high diversity of algae in the lakes system of the Park, but also for the first time implemented bioindication and comparative floristic approaches show the importance of natural processes of aridity affecting the lakes water chemistry and the floristic composition of algae. Despite the high recreational load bioindication data show sufficient stability of lake ecosystems at present stage, which is necessary to study and protect its flora with further monitoring the water quality.

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