PHYTOPLANKTON COMMUNITY AND SAPROBIOLOGICAL CHARACTERISTICS OF LAKE LUDAŠ DURING THE SPRING SEASON

D. Branković and Lj. Budakov

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Abstract. This paper deals with the results on examinations of phytoplankton community and saprobiological characteristics of the Lake Ludaš, during the period from March to May (the spring), in the year of 1992. A hundred and eighteen species, varieties and forms of Cyanophyta, Pyrrophyta, Xantophyta, Bacillariophyta, Euglenophyta and Chlorophyta were recorded. All the examined samples were dominated by Chlorophyta. Bacillariophyta ranked the second place, while Xantophyta were present only in one of the samples with only one species. The density of phytoplankton community was changeable and varied from $0.85x10^3$ to $115.73x10^3$. Saprobity index, after Pantle and Buck, varied from 2.2 to 2.6, pointing out to ß-, ß-α- and α–mesosaprobity.

Key words: bioindicators, density of algae, phytoplankton, saprobity.

D. Branković, Lj. Budakov, Institute for nature protection of Serbia, Department in Novi Sad, Petrovaradinska tvrdjava 3, Novi Sad, Yugoslavia

Introduction

The Lake Ludaš is a protected area located in the northern part of Vojvodina Province - the north of Serbia, 12 km off Subotica. It is surrounded with the settlements Ludaš, Backi Vinogradi, Hajdukovo, Nosa, as well as single farms. The Lake Ludaš is a typical lowland lake and belongs to the aeolian type of lakes. The surface area of this lake is 330 ha. Two parts can be distinguished in the Lake Ludaš: the northern part, which is about 2 km wide and 1-1.2 m deep, and the southern part, which is narrower (200 m) and deeper (1.5-1.8 m) (Djukić et al.,l991).

The Lake Ludaš is supplied with the groundwaters, with the Kereš stream waters, and since 1981 it has been supplied with partly cleared waters from II section of the Lake Palić which flow into the northern part of the Lake Ludaš through the Palić-Ludaš Canal, causing higher nutrient loading of this part of the lake.

A few years ago, an irrigation system was built in the southern region of the Lake. During the watering periods, functioning of the system caused the withdrawal of lower quality waters from the northern into the southern part, so the quality of waters of the northern and the southern part became gradually equal (Djukić et al.,1991). Taking these facts into consideration, the aim of our examinations was to recognize the phytoplankton community and saprobiological characteristics of the whole Lake Ludaš as well as its parts during the spring season.

Material and methods

The samples for qualitative and quantitative analyses of phytoplankton were taken on three sampling sites in the Lake Ludaš towards the end of March, the begining of April and the middle of May in the year of 1992. During algological and saprobiological investigations, standard limnological methods were used (Hribar, 1978). Qualitative composition of the phytoplankton community was shown as a proportional participation of different algal groups in total number of taxa. Density of the phytoplankton community was shown as a number of individuals per 1 cm^3, while relative abundance (quantitative composition) was shown as a proportional participation of algal groups in the total number of algae. Saprobity index was calculated after Pantle and Buck (1955) on the basis of phytoplankton indicator species.

Results

A hundred and eighteen species, varieties and forms of Cyanobacteria, Pyrrophyta, Xantophyta, Bacillariophyta, Euglenophyta and Chlorophyta were recorded during the investigation period. [illegible]ophyta were represented with 53 taxa (44.9%), Bacillariophyta with 31 (26.3%), Euglenophyta with 14 (11.9%), Cyanobacteria with 13 (11.0%), Pyrrophyta with 6 (5.1%) and Xantophyta with only 1 taxa (0.8%).

The results of qualitative analysis of phytoplankton (Fig. 1) show that Chlorophyta was dominant group during the spring season. Bacillariophyta ranked the second place and were followed by Euglenophyta, Cyanobacteria and Pyrrophyta. Xantophyta were present with only one species in only one sample.

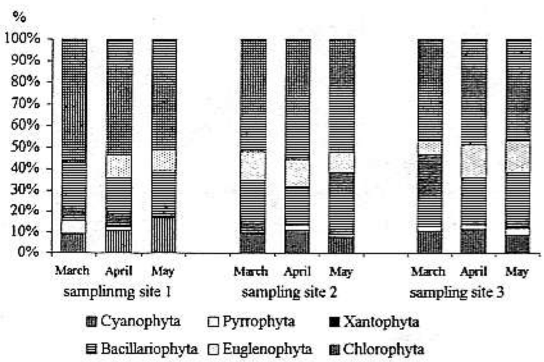

Fig. 1 Qualitative composition of the phytoplankton community (in %).

Density oft the phytoplankton community (Table 1.) varied from 0.85x10^3 ind/cm^3 on the sampling site 2 in March, to 115.73x10^3 ind/cm^3 on the sampling site 3 in May.

By relative abundance (Fig. 2), Chlorophyta represented a dominant phytoplankton group. Relative abundance of Chlorophyta varied from 45.3 to 55.4 %. They reached such high relative abundance thanks to massive development of the genera *Scenedesmus, Ankistrodesmus, Tetraedron, Crucigenia, Golenkinia* and *Pediastrum*.

Bacillariophyta represent another characteristic group of the Lake Ludaš phytoplankton community. Their relative abundance varied from 20.4 to 36.4 %. The genera *Stephanodiscus, Nitzschia, Ciclotella* and *Melosira* were the most abundant.

Table 1. Density of the phytoplancton community (x1000 ind/cm^3)

sampling site	1	2	3
March	9.54	0.58	19.76
April	32.43	14.37	27.62
May	48.32	54.26	115.73

Algae from the Cyanophyta group were less important member of the Lake Ludaš phytoplankton community, being present from 9.0 to 24.5 %. The species *Microcystis aeruginosa* Kutz., *Oscillatoria tenuis* Ag. and *Spirulina maior* Kutz. were most abundant.

In the Euglenophyta group, relative abundance of which varied from 0 to 12.7 %, the species *Euglena acus* Ehr., *E. viridis* Ehr. and *Lepocinclis ovum* (Ehr.) Lemm. were of the highest relative abundance.

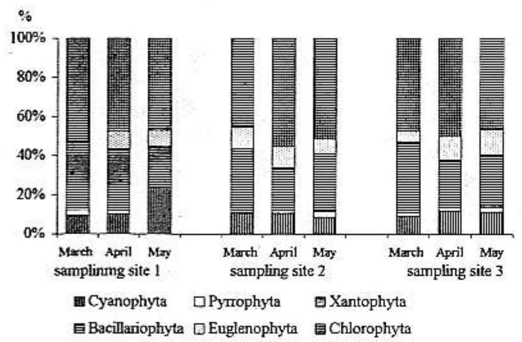

Fig. 2 Quantitative composition of the phytoplankton community (in %).

Indicators of the most polluted waters, such as *Euglena acus* Ehr., *E. viridis* Ehr., of α-mesosaprob degree, such as *Oscillatoria tenuis* Ag., *Cyclotella meneghiniana* Kutz., *Nitzschia palea* (Kutz.)W.Sm., *Stephanodiscus hantzschii* var. *pusilus* (Grun.)Krieg., *Lepocinclis ovum* (Ehr.)Lemm., *Cosmarium botrytis* Menegh. and of ß-mesosaprob degree, such as *Microcystis aeruginosa* Kutz., *Golenkinia radiata* Chod., species of the genera *Pediastrum* and *Scenedesmus* were recorded. Indicators of the oligosaprob degree were not recorded.

Saprobity index, calculated on the basis of phytoplankton species as indicators, is given in Table 2. It varied from 2.2 to 2.6.

Table 2. Saprobity index after Pantle and Buck

sampling site	1	2	3
March	2.3	2.2	2.2
April	2.5	2.2	2.2
May	2.6	2.2	2.4

Discussion

In the lake Ludaš during the spring season in the year of 1992, 118 taxa (species, varieties and forms) of algae were recorded, which differed regarding the literature data (Seleši, 1981; Djukić et al., 1991). Seleši (1981) recorded 100 taxa during the spring season in the 1970-1981 sampling period, while Djukić et al. (1991) recorded 61 taxa in the period of 1981-1990.

There were some insignificant differences in qualitative composition of algae between our and the literature data. In respect to Seleši (1981), the proportional participation of Cyanophyta, Xantophyta, Euglenophyta and Chlorophyta was almost the same. The proportional participation of Pyrrophyta was 3.1% higher, while the proportional participation of Bacillariophyta was 4.7% lower.

Differences in the total number of taxa and in the proportional participation of some groups of algae between our and the literature data could be explained by different sampling spots and number of samples, as well as by expressive anthropological influence resulting in unstability of this water ecosystem.

Concerning the monthly and sampling spot variation in both qualitative and quantitative composition of the phytoplankton community (Fig. 1 and Fig. 2), the only noticed regularity was domination of Chlorophyta and subdomination of Bacillariophyta in all the samples. Any other regularity was not noticed, which could also be explained by the ecosystem unstability as a consequence of anthropological influence.

The density of phytoplankton community (Table 1.) varied from $0.85x10^3$ ind/cm^{3}l to $115.73x10^3$ ind/cm^3. The smallest number was recorded in March on the sampling site 2 and the highest number in May on the sampling site 3. The noticed regularities were the number of algae increasing towards the end of the spring and generally the highest number on the sampling site 3 through all those months.

Bioindicators of polysaprob, α-mesosaprob, and ß-mesosaprob degree were recorded, while indicators of the oligosaprob degree were not, which corresponds to the literature data. Namely, on the basis of the investigation in the period of 1978-1987, Djukić et al. (1988) recorded that the polysaprobic and eutrophic species almost disappeared from the bottom fauna of this Lake, and concluded that this Lake was gradually transformed from an eupolytrophic into a dystrophic lake.

As shown in Table 2., the saprobity index varied from 2.2 to 2.6, pointing out to ß-mesosaprob, ß-α-mesosaprob, and α-mesosaprob degree. The saprobity index was somewhat higher in the northern part of the Lake, pointing out a higher nutrient loading in this part of the Lake. This is understandable because partly cleared waste waters of Subotica and the waters from the Kereš stream, which are of poor quality, flow into the northern part of the Lake. Our results correspond to the results recorded by Djukic et al. (1991), and were given on the basis of phytoplankton, periphyton, zooplankton and zooperiphyton indicator species, and to the results recorded by Gajin et al. (1992), and were given on the basis of bacterioplankton.

Investigations of a lot of authors (Božinović et al., 1990; Djukić et al., 1988; Djukić et al., 1991; Gajin et al., 1992; Maletin and Budakov, 1983; Pujin, 1988; Ratajac, 1988; Seleši, 1981; Seleši, 1988) pointed out the poor quality of the Lake Ludaš waters and unstability of this ecosystem as a consequence of intensive human influence

Apart from the poor water quality, and on the basis of these investigations, it could be concluded that the quality of waters in the northern and southern part of the Lake Ludaš became gradually indentical, which probably resulted from functioning of the irrigation system, as well as disappearance of the reed belt between the northern and the southern part of the Lake.

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