WETLAND ALGAL COMMUNITIES FROM BALTA MICĂ A BRĂILEI NATURE PARK (ROMANIA)

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ABSTRACT

The present paper aims to characterize the algal communities from Balta Mică a Brăilei Nature Park in terms of their species richness and their ability to reflect the water quality of the aquatic ecosystems they live in. Thirteen shallow floodplain lakes, both permanent and temporary, were considered for the present study, with 16 sampling occasions in 2012 and 2013. More than 300 algal taxa were identified, with the green algae (Chlorophyta) being the dominant phyla in almost all the sampling sites. The trophicity and the organic pollution reached high values in 2012, probably due to low water levels caused by drought. Spring floods from 2013 led to lower trophicity and saprobity levels in all sampled water pools.

RÉSUMÉ: Les communautés d'algues du Parc Naturel Balta Mică à Brăilei (Roumanie).

Le présent article vise à caractériser les communautés d'algues du Parc Naturel Balta Mică à Brăilei, en fonction de leur richesse en espèces et de leur capacité à refléter la qualité des écosystèmes aquatiques. Treize lacs peu profonds, permanents ou temporaires, ont été considérés pour la présente étude, avec 16 occasions d'échantillonnage en 2012 et 2013. Plus de 300 taxons d'algues ont été identifiés; les algues vertes (Chlorophyta) ont été dominantes dans presque tous les sites d'échantillonnage. La trophicité et la pollution organique ont enregistré des valeurs élevées en 2012, probablement en raison de faibles niveaux d'eau causés par la sécheresse. Les inondations du printemps 2013 ont conduit aux niveaux inférieurs de trophicité et de pollution organique dans les tous les lacs échantillonnés.

REZUMAT: Comunitățile algale din Parcul Natural Balta Mică a Brăilei (România).

Lucrarea de față are ca scop caracterizarea comunităților algale din Parcul Natural Balta Mică a Brăilei din punctul de vedere al bogăției specifice, luând în considerare și informațiile valoroase pe care aceste comunități le pot aduce în ceea ce privește calitatea apei în ecosistemele acvatice în care trăiesc. Treisprezece lacuri, atât permanente cât și temporare, au fost luate în considerare pentru prezentul studiu, cu 16 prelevări în 2012 și 2013. Peste 300 de taxoni algali au fost identificați, algele verzi (Chlorophyta) fiind grupul dominant la majoritatea stațiilor de prelevare. Troficitatea și saprobitatea lacurilor considerate, calculate pe baza a trei indici specifici comunităților algale, au avut niveluri ridicate în lunile de prelevare din 2012, datorită secetei prelungite care a dus la scăderi drastice ale nivelului apei în lacuri, dar mai reduse în aprilie și iunie 2013, datorită inundațiilor care au condus la creșteri semnificative a volumului de apă din zona inundabilă.

INTRODUCTION

Algae inhabit most freshwater environments, playing a core role in aquatic food webs, being one of the three major groups of photosynthetic organisms, along with macrophytes and bacteria. Algae are also important in relation to human use of natural resources, because they respond quickly to any changes in the status of their environment, whether natural or human-induced (Suthers and Rissik, 2009). Thus, algal bioindicators of water quality are particularly important in terms of eutrophication and saprobity (the amount of decomposing organic matter existing in the system) (Bellinger and Sigee, 2010). In fact, the current European legislation in the field of water policy, the Water Framework Directive (2000/60/EC), aims to maintain and improve the water quality of EU water bodies, and indicates phytoplankton, macrophytes and phytobenthos as quality elements for the classification of ecological status in lakes.

Wetlands comprise a range of aquatic habitats, from peat lands to shallow lakes, not exceeding six m in depth, according to the Ramsar Convention on Wetlands of International Importance (1971). Due to their shallow depth, wetlands are not usually stratified, with the photic zone extending to the sediments (Moore, 2008). Thus, wetland algal communities are both planktonic and benthic, because the free-floating and rooted macrophytes that usually dominate wetlands provide a rich substratum for epiphytic algae (Bellinger and Sigee, 2010).

Balta Mică a Brăilei Nature Park ("Small Island of Brăila" in the annotated Ramsar list of wetlands of international importance, www.ramsar.org) represents a group of wetlands located on the Lower Danube, South-East Romania, stretching between kilometers 176 and 238 of the river Danube, just upstream of Brăila, at an altitude ranging between three and nine m a.s.l. (Dimitriu et al., 2009). The area includes temporary or permanent floodplain lakes, marshes, connecting canals, islands, the Danube arms and the river itself, covering a total area of 17,586 ha. The natural hydrological conditions are maintained by human activity in Balta Mică a Brăilei area. In fact, the region represents a mixture of inter-connected terrestrial and aquatic ecosystems, with no strict boundaries between them, but strongly dependent on seasonal floods (Stănescu et al., 2009). The Nature Park is an important conservation area: in 2001, the area was declared a Wetland of International Importance (Ramsar site no. 1074) and since 2008 it has been included in Natura 2000 networks, both as a Site of Community Importance (SCI) and as a Special Area for Bird Protection (SPA) (Brînzan, 2013).

Despite the major ecological value of Balta Mică a Brăilei, few scientific works regarding algal communities have been published from the region. We focused on articles from the wetland itself, and not from the Danube River, since the present paper deals solely with the floodplain lakes within the Nature Park. However, the previous literature is either old (Antonescu et al., 1952, from Cărăuș, 2012), or dealing with macroscopic algae like Characeae (Ionescu – Țeculescu, 1966/1967, from Cărăuș 2012), or unpublished (Adamescu, personal communication). A total number of 176 planktonic algal species are mentioned on the official website of the Nature Park (www.bmb.ro).

That is why the present paper represents an important update on the algal flora from the Balta Mică a Brăilei area, aiming to: 1) characterize the algal communities from the region; 2) describe the algal species richness from 13 floodplain lakes; and 3) assess the water quality from the sampling sites based on ecological indices.

MATERIALS AND METHODS

The samples were collected in 2012 (June, July and September) and in 2013 (April and June), from 13 sampling sites on 16 occasions, with Lakes Lupoiu, Curcubeu and Bordeiele being sampled twice (Tab. 1). L1 is the sampling site; DD is the day, MM the month and YY the year of the samplings. Thus, L1_14.06.12 represents lake Japșa, sampled in 14th of June 2012, for the example L1_DD.MM.YY.

The characteristics of the sampled lakes depend mainly on the regional climatic variations. Thus, extended drought periods were recorded in 2012, which clearly influenced the water volume from the floodplain lakes: for example, the mean July temperature in 2012 was 26-28°C, with 4-6°C deviation against the multiannual mean from 1961 to 1990, with precipitation volumes not exceeding 10-20 mm in the Balta Mică a Brăilei area (data source: National Meteorological Administration, www.meteoromania.ro). These factors led to drastic drops of the water levels in all water bodies from the region. On the other hand, catastrophic floods took place in the upper and middle stretches of the Danube in spring 2013, with consequences on the water discharge of the river in the Balta Mică a Brăilei region (data source: National Institute of Hydrology and Water Management, www.inhga.ro). In fact, if we consider the mean Danube discharge values at Vadu Oii, Constanța County, just upstream of the Nature Park, we can divide the sampling periods into two categories: 1) months with low discharge values (June, July and September 2012, with discharges of 6,870, 4,340 and 3,040 m^3/sec., respectively); and 2) months with high discharge values (April and June 2013, with 12,220 and 8,900 m^3/sec., respectively) (data source: National Institute of Hydrology and Water Management, www.inhga.ro).

Seven sampling sites were located in the southern region of the Nature Park: lakes Japșa, Sbenghiosu, Lupoiu, Jigara, Curcubeu, Gâsca and Cortele (L1-L7); one site was located in the central area: lake Cucova (L8); while five sites were situated in the northern area: Lakes Lupu, Bordeiele, Stan, Iezerul Morilor and Chiriloaia (L9-L13) (Tab. 1; Fig. 1).

Most of the water bodies included for sampling were permanent shallow lakes, rich in submerged, emerged and floating vegetation; often connected with each other and with the Danube River or its arms. In a study conducted in the summer of 2008, Stănescu et al. (2009) characterized these permanent water pools as shallow, with a maximum water depth of 150 cm and an average depth of 85 cm; with smooth, indefinite shorelines created from alluvia transported inwards and outwards during floods. The largest lakes in terms of their surface were the following: lake Curcubeu (296 ha), lake Lupoiu (272 ha), lake Jigara (244 ha), lake Gâsca (203 ha) and lake Cucova (236 ha) (Stănescu et al., 2009).

Lake Japșa (L1) was the only temporary water pool from the 13 sites included in the present study. These temporary water bodies from the Balta Mică a Brăilei area usually become marshes in drought periods, having a shallower depth compared to permanent pools, not exceeding 100 cm, with a mean depth of 55 cm (Stănescu et al., 2009).

The altitude differences between the floodplain lakes included in this study were minimal. In fact, the mean slope of the water surface was about 0.02‰ in the 83 km long Danube sector between Hârşova and Brăila (which includes our study area), meaning a drop of two cm in the water level for each river kilometer, when going downstream (Dimitriu et al., 2009). More importantly, the reference value of the Danube low water level was deeper compared to its floodplain lakes, so the general tendency of the waters in this area was to flow towards the stream beds of the Danube and its arms (Stănescu et al., 2009).

The samples were collected using a 30 µm mesh size phytoplankton net, and preserved in 4% formaldehyde. Several physical and chemical parameters were also measured at each site, using portable meters (Consort P902 for pH and YSI 52 for dissolved oxygen and water temperature). Identifications were made to the species level (Ettl and Gärtner, 1988; Komárek and Anagnostidis, 2005; Krammer and Lange, 1986; Popovsky and Pfiester, 1990; Wolowski, 2005).

Table 1: The sampling sites located in the Balta Mică a Brăilei Nature Park.

Sampling site code	Lake name	Sampling date	GPS coordinates	Maximum depth (m)
L1_14.06.12	Lake Japşa	14.06.2012	N 44°48'06.5" E 27°50'17.5"	0.60
L2_19.07.12	Lake Sbenghiosu	19.07.2012	N 44°49'30.3" E 27°54'38.7"	1.50
L3_18.07.12	Lake Lupoiu	18.07.2012	N 44°50'43.8" E 27°56'07.1"	0.70
L3_22.06.13		22.06.2013		2.00
L4_21.07.12	Lake Jigara	21.07.2012	N 44°50'03.3" E 27°52'18.8"	1.50
L5_13.06.12	Lake Curcubeu	13.06.2012	N 44°51'09.5" E 27°54'21.4"	0.65
L5_22.06.13		22.06.2013		2.00
L6_13.06.12	Lake Gâsca	13.06.2012	N 44°51'17.6" E 27°53'33.6"	0.70
L7_20.07.12	Lake Cortele	20.07.2012	N 44°52'09.2" E 27°54'45.2"	1.30
L8_15.06.12	Lake Cucova	15.06.2012	N 45°00'42" E 27°54'40.7"	1.00
L9_29.04.13	Lake Lupu	29.04.2013	N 45°07'38.5" E 27°57'12"	3.50
L10_26.09.12	Lake Bordeiele	26.09.2012	N 45°10'13.2" E 27°58'04.1"	0.30
L10_28.04.13		28.04.2013		3.80
L11_27.04.13	Lake Stan	27.04.2013	N 45°10'40.6" E 27°58'19.5"	3.00
L12_28.04.13	Lake Iezerul Morilor	28.04.2013	N 45°10'04.3" E 27°57'14.6"	2.50
L13_27.04.13	Lake Chiriloaia	27.04.2013	N 45°11'45.1" E 27°58'21.5"	3.00

Principal Component Analysis (PCA), one of the most frequently used multivariate data analysis methods (Jolliffe, 2002), was performed in order to visualize the sampling sites depending on several variables: water temperature, dissolved oxygen, pH, maximum depth and the Danube River discharge values.

The non-parametric Mann-Whitney test (Lehmann, 1975) was used to determine if the algal species richness differed in the lakes sampled in 2012 compared to those sampled in 2013. The similarity between the algal communities from the sampling sites was calculated using the Jaccard index (Washington, 1984), which only uses qualitative data (presence/absence of the taxon).

Several trophicity and organic pollution indices based on phytoplankton community were considered (Willén, 2000). The first one, the trophic index according to Heinonen (1980) is calculated as the ratio between the number of species indicating eutrophic conditions and the number of species indicating oligotrophic conditions. Values lower than eight indicate oligotrophic waters. The second trophicity index, the compound index, represents the number of species of Cyanoprokaryota, Chlorococcales, Centrales and Euglenophyta divided by the number of species belonging to Order Desmidiales (Nygaard, 1949). Values below one indicate oligotrophic conditions, values between one and three mesotrophic conditions and values exceeding three eutrophic conditions. The organic pollution index calculated at the genus level (Palmer, 1969) represents the sum of the indicator values of the genera tolerant to organic load. Values not exceeding 15 indicate low organic pollution; values between 15 and 19 indicate moderate pollution and values greater than 20 represent high organic pollution.

Statistical analyses were performed using PAST software version 2.14-2012 and XLSTAT software – evaluation version 2013.5.

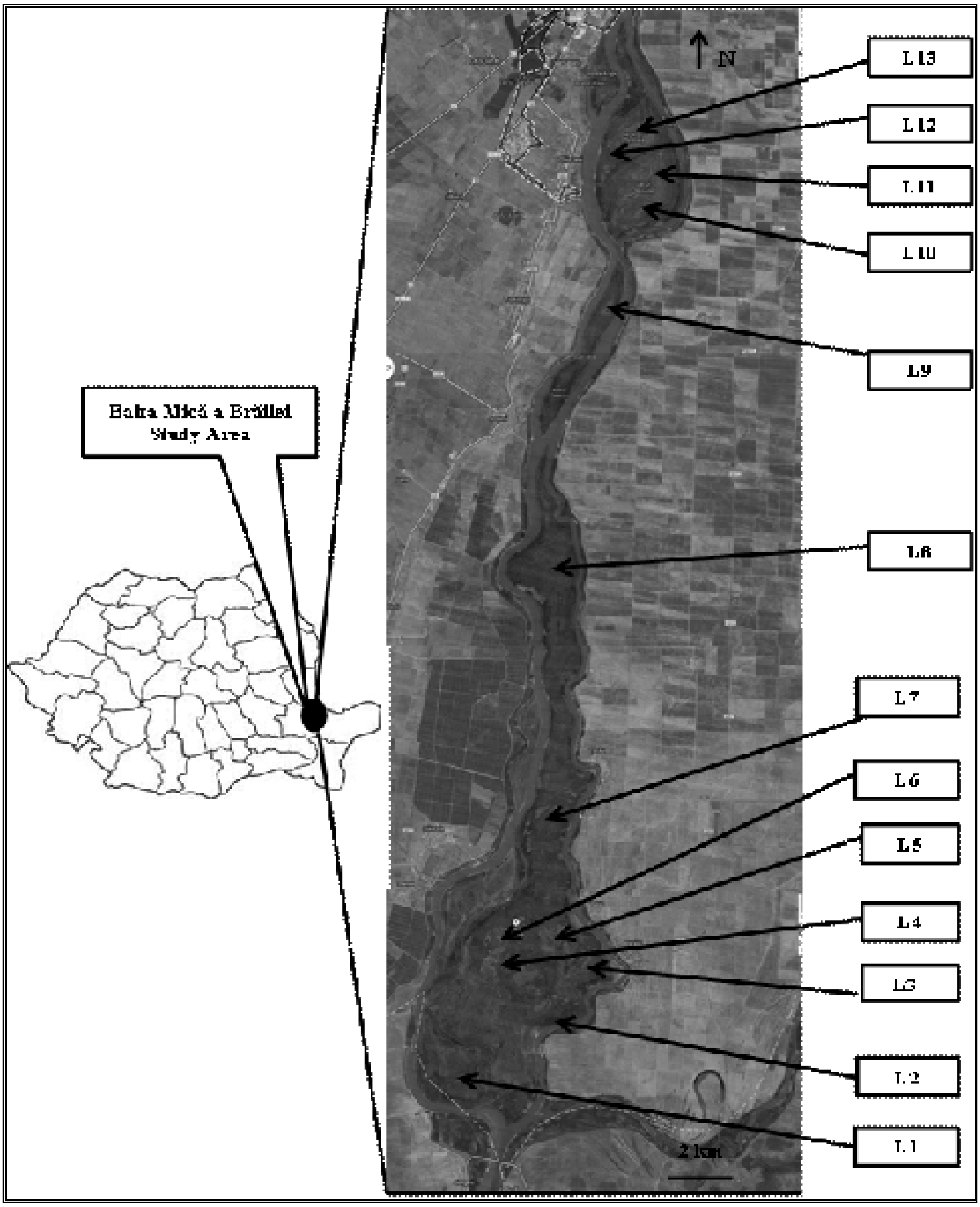

Figure 1: Location of the 13 floodplain lakes from the Balta Mică a Brăilei Nature Park, considered for this study (abbreviation of the sampling sites and occasions as in table 1) (Google Earth, 2013).

RESULTS AND DISCUSSIONS

Physico-chemical factors

The main physical and chemical parameters were recorded at each site (Tab. 2). pH values were circum-neutral, typical for most surface freshwater systems. Water temperatures recorded normal variations, higher in summer and lower in spring. The quantity of oxygen dissolved in water, on the other hand, was more variable, ranging from minimum values of three or four mg/L in small, shaded lakes (L7 – lake Cortele and L1 – lake Japșa), to maximum values of 10 or 11 mg/L caused by lower temperatures and spring mixing, in the sites sampled in April 2013.

The sampling lakes from Balta Mică a Brăilei Nature Park were aggregated in the Principal Component Analysis (PCA) biplot based on five physical and chemical parameters: the water temperature, maximum depth measured in situ, the Danube mean water discharge recorded in the sampling months at Vadu Oii (Constanța County), dissolved oxygen and the pH (Fig. 2). Three groups were distinguished on axis F1, based on the first three parameters: 1) one including the lakes with maximum depth, high discharge, but low water temperatures, sampled in April 2013 (left in Fig. 2); 2) the second one including the lakes with minimum depth, low discharge, but high water temperatures, sampled in June, July and September 2012 (right in Fig. 2); and 3) the third one (middle in Fig. 2) with intermediate values.

Species richness

The algal communities recorded a heterogeneous structure, with planktonic and benthic taxa, which represented a typical situation for shallow floodplain lakes (Bellinger and Sigee, 2010). A total number of 315 algal taxa from seven phyla were identified in the sampling sites. Chlorophyta (green algae) was the dominant phylum, with 42% of all taxa, followed by Bacillariophyta (28%), Euglenophyta (20%), Cyanophyta (6%) and Xanthophyta, Chrysophyta and Dinophyta, each with less than 2% (Tab. 3).

In fact, most freshwater shallow lakes are dominated by green algae and diatoms, with the first usually peaking in summer and the latter in spring and autumn (Bellinger and Sigee, 2010). However, in the Danube Delta, similar floodplain lakes located less than 150 km away from Balta Mică a Brăilei Nature Park in straight line show a slightly different hierarchy of the dominant algal phyla in terms of species number: Bacillariophyta was the most numerous group, followed by Chlorophyta and Cyanophyta (Török, 2011). This difference was caused by the fact that no running waters, usually dominated by diatoms, were sampled in the present paper.

Most of the sampled Chlorophyta taxa were planktonic, since only 17 out of the total number of 135 were true benthic species. However, in the lakes sampled in April and June 2013, during the river floods, green algae recorded a minimum number of species, ranging between one and six, because of their incapacity to remain in the water column during floods.

Diatoms dominated the algal communities from the lakes sampled during the spring floods, in April 2013, as number of taxa. The presence and composition of epiphytic diatom communities are used to detect floods in sediment records (Wiklund et al., 2010). The majority of diatom species from Balta Mică a Brăilei Nature Park was represented by forms attached to substratum, since only 20 out of the total number of 87 diatom species were true planktonic. For example, in lake Chiriloaia (L13_27.04.13), 23 out of 29 diatom taxa were benthic, so they could be either brought by the Danube, or taken from the lake sediment due to the flood.

In contrast, Euglenoids were absent from the lakes sampled in April 2013, due to the high water volume and high water current that made their survival in the water column impossible. This absence could be also explained by the lower levels of organic matter present in the water, caused by the spring floods.

Similarly, a low number of Cyanophyta species was in April 2013, caused also by increases in water level, a similar situation to that cited in Mihaljević and Stević (2011).

Eleven algal taxa were listed for the first time in Romania: *Coccomonas elliptica*, *Coccomonas platyformis*, *Euglena obtusa*, *Goniochloris spinosa*, *Phacus agilis* var. *inversa*, *Phacus asymmetricus*, *Phacus sesquitortus*, *Scenedesmus lefevre* var. *manguinii*, *Staurastrum paradoxum* var. *reductum*, *Trachelomonas wislouchii* and *Trachelomonas woycickii*. Most of these species were identified in lake Sbenghiosu (L2_19.07.12), probably because of the diversity of sampled microhabitats: both open water and shallow regions with macrophytes.

Table 2: Physical and chemical parameters measured in Balta Mică a Brăilei Nature Park (abbreviation of the sampling sites and occasions as in table 1).

Sampling site code	Water temperature (°C)	Dissolved oxygen (mg/L)	pH
L1_14.06.12	24.60	4.44	–
L2_19.07.12	25.30	6.20	7.50
L3_18.07.12	25.80	7.35	7.50
L3_22.06.13	23.20	6.00	7.30
L4_21.07.12	29.30	7.67	7.50
L5_13.06.12	29.00	7.50	8.00
L5_22.06.13	23.70	6.00	7.90
L6_13.06.12	30.60	7.15	8.00
L7_20.07.12	26.20	3.10	7.50
L8_15.06.12	27.60	6.30	7.00
L9_29.04.13	16.60	8.00	–
L10_26.09.12	30.10	6.48	7.00
L10_28.04.13	18.00	10.50	–
L11_27.04.13	16.30	8.00	–
L12_28.04.13	17.30	7.25	–
L13_27.04.13	16.70	11.25	6.50

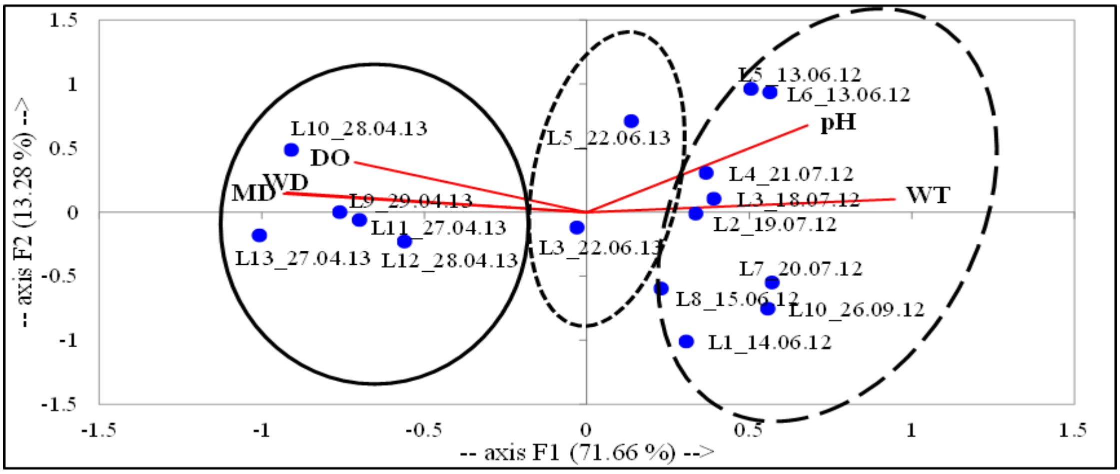

Figure 2: Principal Component Analysis (PCA) biplot of the sampling sites and their aggregation based on: dissolved oxygen – DO (mg/L); maximum depth measured in situ – MD (m); the pH; the Danube mean water discharge recorded in the sampling months at Vadu Oii, Constanța County – WD (m^3/sec.) and the water temperature – WT (°C) (abbreviation of the sampling sites and occasions as in table 1) (axes F1 and F2: 84.94%).

Table 3: List of algal taxa identified in the 13 floodplain lakes from Balta Mică a Brăilei area in 2012-2013 (**1**: L1_14.06.12; **2**: L2_19.07.12; **3**: L3_18.07.12 and L3_22.06.13; **4**: L4_21.07.12; **5**: L5_13.06.12 and L5_22.06.13; **6**: L6_13.06.12; **7**: L7_20.07.12; **8**: L8_15.06.12; **9**: L9_29.04.13; **10**: L10_26.09.12 and L10_28.04.13; **11**: L11_27.04.13; **12**: L12_28.04.13; **13**: L13_27.04.13; abbreviation of sampling sites and occasions as in table 1).

SAMPLING SITES (→)/ALGAL TAXA (↓)	1	2	3	4	5	6	7	8	9	10	11	12	13
Phyllum Cyanophyta (Cyanoprokaryota)													
Anabaena elliptica Lemmermann, 1898			+		+								
Anabaena flos-quae rébisson ex Bornet and Flauhault, 1886						+							
Anabaena variabilis Kützing, 1843	+	+	+	+	+	+	+	+		+			
Arthrospira jenneri Stizenberger ex Gomont, 1892		+					+						
Lyngbya kuetzingii Schmidle, 1897								+					
Merismopedia glauca (Ehrenberg) Kützing, 1845		+			+								
Merismopedia tenuissima Lemmermann, 1898		+											
Oscillatoria agardhii Gomont, 1892							+						
Oscillatoria amphibia Agardh C., 1827		+		+						+			
Oscillatoria formosa Bory de Saint-Vincent ex Gomont, 1892												+	
Oscillatoria limnetica Lemmermann, 1900					+				+	+			
Oscillatoria limosa Agardh C., 1812					+					+			
Oscillatoria planctonica Woloszynska 1912				+									
Oscillatoria tenuis Agardh C., 1892	+	+	+		+						+	+	
Oscillatoria utermoehliana Elenkin, 1949										+			
Phormidium molle Gomont, 1892								+					
Snowella lacustris (Chodat) Komárek and Hindák, 1988					+	+							
Phyllum Euglenophyta													
Euglena acus (Müller O. F.) Ehrenberg, 1830	+	+	+	+	+	+	+	+	+				
Euglena agilis Carter H. J., 1856								+		+			
Euglena caudata Hübner, 1886								+					
Euglena charkowiensis Svirenko D. O., 1913							+	+					
Euglena contabrica Pringsheim E. G., 1956								+					
Euglena cuneata Pringsheim E. G., 1956				+	+			+					
Euglena deses Ehrenberg, 1834							+			+			
Euglena deses f. *intermedia* Klebs G. A., 1883		+											
Euglena ehrenbergii Klebs G. A., 1883		+				+	+			+			
Euglena gracilis Klebs G. A., 1883								+					
Euglena limnophila Lemmermann, 1898							+	+					
Euglena oblonga Schmitz F., 1884								+		+			
Euglena obtusa Van Goor, 1925								+					
Euglena oxyuris Schmarda, 1846		+	+		+								
Euglena proxima Dangeard P. A., 1901	+				+				+				
Euglena repulsans Schiller J., 1952	+												
Euglena spathirhyncha Skuja, 1948		+											

Table 3 (continued): List of algal taxa identified in the 13 floodplain lakes from Balta Mică a Brăilei area in 2012-2013 (**1**: L1_14.06.12; **2**: L2_19.07.12; **3**: L3_18.07.12 and L3_22.06.13; **4**: L4_21.07.12; **5**: L5_13.06.12 and L5_22.06.13; **6**: L6_13.06.12; **7**: L7_20.07.12; **8**: L8_15.06.12; **9**: L9_29.04.13; **10**: L10_26.09.12 and L10_28.04.13; **11**: L11_27.04.13; **12**: L12_28.04.13; **13**: L13_27.04.13; abbreviation of the sampling sites and occasions as in table 1).

Euglena spirogyra Ehrenberg, 1832	+	+			+								
Euglena texta (Dujardin) Hübner, 1886	+	+	+		+	+							
Euglena tripteris (Dujardin) Klebs G. A., 1883		+			+								
Euglena variabilis Klebs G. A., 1883								+		+			
Euglena velata Klebs G. A., 1883							+						
Euglena viridis (Müller O. F.) Ehrenberg, 1830		+		+									
Lepocinclis marssonii Lemmermann, 1904		+											
Lepocinclis ovum Lemmermann, 1901		+	+	+						+			
Phacus acuminatus Stokes, 1885				+			+	+					
Phacus agilis Skuja, 1926			+	+			+						
Phacus agilis var. *inversa* Bourrelly P., 1947		+											
Phacus alatus Klebs G. A., 1886	+												
Phacus anomalus Fritsch F. E. and Rich M. F., 1929				+						+			
Phacus asymmetricus Prescott, 1944			+										
Phacus cochleatus Pochmann, 1942	+												
Phacus glaber (Deflandre) Pochmann, 1931		+								+			
Phacus helicoides Pochmann, 1948		+											
Phacus hispidulus (Eichwald) Lemmermann, 1910		+		+									
Phacus longicauda Dujardin, 1841		+	+				+					+	
Phacus monilatus Stokes, 1910		+											
Phacus nordstedtii Lemmermann, 1904		+											
Phacus orbicularis Hübner K., 1886	+		+		+								
Phacus parvulus Klebs G. A., 1883							+						
Phacus pleuronectes (Müller O. F.) Nitzsch ex Dujardin, 1841			+		+								
Phacus pyrum (Ehrenberg) Archer W., 1871				+									
Phacus sesquitortus Pochmann, 1942			+										
Phacus suecicus Lemmermann, 1904							+						
Phacus tortus (Lemmermann) Skvortzov, 1928	+	+			+								+
Phacus trypanon Pochmann, 1942		+											
Strombomonas acuminata (Schmarda) Deflandre, 1930		+		+	+			+					
Strombomonas deflandrei (Roll Y. V.) Deflandre, 1930					+								
Trachelomonas abrupta Svirenko, 1914	+												
Trachelomonas armata Stein F., 1878	+	+	+		+	+		+		+			
Trachelomonas bacillifera Playfair, 1915					+								
Trachelomonas caudata Stein, 1878								+					
Trachelomonas hexangulata Svirenko, 1914		+											
Trachelomonas hispida (Perty) Stein F. 1878		+	+	+	+	+		+		+			

Table 3 (continued): List of algal taxa identified in the 13 floodplain lakes from Balta Mică a Brăilei area in 2012-2013 (**1**: L1_14.06.12; **2**: L2_19.07.12; **3**: L3_18.07.12 and L3_22.06.13; **4**: L4_21.07.12; **5**: L5_13.06.12 and L5_22.06.13; **6**: L6_13.06.12; **7**: L7_20.07.12; **8**: L8_15.06.12; **9**: L9_29.04.13; **10**: L10_26.09.12 and L10_28.04.13; **11**: L11_27.04.13; **12**: L12_28.04.13; **13**: L13_27.04.13; abbreviation of the sampling sites and occasions as in table 1).

Trachelomonas intermedia Dangeard P. A., 1902	+												
Trachelomonas oblonga Lemmermann, 1899							+	+					
Trachelomonas planctonica Svirenko, 1914							+						
Trachelomonas pulcherrima Playfair, 1915										+			
Trachelomonas scabra Playfair, 1915				+									
Trachelomonas verrucosa Stokes A., 1887		+											
Trachelomonas volvocina (Ehrenberg) Ehrenberg, 1834				+			+	+		+			
Trachelomonas volvocinopsis Svirenko, 1914		+	+		+	+							
Trachelomonas wislouchii Skvortzov, 1917		+	+										
Trachelomonas woycickii Koczwara, 1914		+											
Phyllum Dinophyta													
Gymnodinium paradoxum Schilling A. J., 1891								+		+			
Peridinium aciculiferum Lemmermann, 1900						+							
Peridinium cinctum (Müller O. F.) Ehrenberg, 1832								+					
Phyllum Chrysophyta													
Chrysococcus rufescens Klebs, 1893							+	+					
Dinobryon bavaricum Imhof, 1890						+							
Dinobryon cylindricum Imhof O. E., 1887								+					
Dinobryon sertularia Ehrenberg, 1834			+		+	+				+	+	+	
Phyllum Bacillariophyta													
Achnanthes bioretii Germain, 1957	+												
Achnanthes helvetica (Hustedt) Lange-Bertalot, 1989										+			
Achnanthes hungarica (Grunow) Grunow in Cleve and Grunow, 1880		+	+										
Achnanthes lanceolata van Heurck H., 1880		+	+										+
Achnanthes minutissima Kützing, 1833			+							+			
Amphora libyca Ehrenberg, 1840			+							+			+
Amphora ovalis (Kützing) Kützing, 1844												+	
Amphora pediculus (Kützing) Grunow ex Schmidt A., 1875	+	+	+		+		+	+		+			
Amphora veneta Kützing, 1844	+	+			+	+	+			+			+
Anomoeoneis sphaerophora Pfitzer E., 1871				+				+					
Asterionella formosa Hassall, 1850									+	+	+		+
Aulacoseira granulata (Ehrenberg) Simonsen, 1979		+		+		+			+				
Caloneis silicula (Ehrenberg) Cleve, 1894		+	+	+		+		+		+			
Cocconeis pediculus Ehrenberg, 1838		+											
Cocconeis placentula Ehrenberg, 1838										+			
Cyclotella atomus Hustedt, 1937												+	

Table 3 (continued): List of algal taxa identified in the 13 floodplain lakes from Balta Mică a Brăilei area in 2012-2013 (**1**: L1_14.06.12; **2**: L2_19.07.12; **3**: L3_18.07.12 and L3_22.06.13; **4**: L4_21.07.12; **5**: L5_13.06.12 and L5_22.06.13; **6**: L6_13.06.12; **7**: L7_20.07.12; **8**: L8_15.06.12; **9**: L9_29.04.13; **10**: L10_26.09.12 and L10_28.04.13; **11**: L11_27.04.13; **12**: L12_28.04.13; **13**: L13_27.04.13; abbreviation of the sampling sites and occasions as in table 1).

Trachelomonas intermedia Dangeard P. A., 1902	+				+								
Trachelomonas oblonga Lemmermann, 1899	+	+						+		+			
Trachelomonas planctonica Svirenko, 1914									+	+		+	+
Trachelomonas pulcherrima Playfair, 1915	+												
Trachelomonas scabra Playfair, 1915	+	+	+			+			+	+			
Trachelomonas verrucosa Stokes A., 1887													+
Trachelomonas volvocina (Ehrenberg) Ehrenberg, 1834													+
Trachelomonas volvocinopsis Svirenko, 1914									+			+	
Trachelomonas wislouchii Skvortzov, 1917		+			+	+					+		+
Trachelomonas woycickii Koczwara, 1914										+			
Phyllum Dinophyta										+			
Gymnodinium paradoxum Schilling A. J., 1891										+		+	+
Peridinium aciculiferum Lemmermann, 1900										+			
Peridinium cinctum (Müller O. F.) Ehrenberg, 1832					+	+						+	+
Phyllum Chrysophyta	+			+			+			+			
Chrysococcus rufescens Klebs, 1893		+			+	+							
Dinobryon bavaricum Imhof, 1890					+			+		+			
Dinobryon cylindricum Imhof O. E., 1887							+	+					
Dinobryon sertularia Ehrenberg, 1834											+		+
Phyllum Bacillariophyta	+						+						+
Achnanthes bioretii Germain, 1957			+										
Achnanthes Helvetica (Hustedt) Lange-Bertalot, 1989												+	
Achnanthes hungarica (Grunow) Grunow in Cleve and Grunow, 1880			+		+				+		+	+	+
Achnanthes lanceolata van Heurck H. (1880)	+	+	+				+		+	+	+		+
Achnanthes minutissima Kützing, 1833	+												
Amphora libyca Ehrenberg, 1840										+			+
Amphora ovalis (Kützing) Kützing 1844			+		+				+	+			
Amphora pediculus (Kützing) Grunow ex Schmidt A., 1875			+										
Amphora veneta Kützing, 1844										+			+
Anomoeoneis sphaerophora Pfitzer E., 1871	+	+		+	+	+	+			+	+		+
Asterionella formosa Hassall, 1850			+										
Cyclotella atomus Hustedt, 1937										+			

Table 3 (continued): List of algal taxa identified in the 13 floodplain lakes from Balta Mică a Brăilei area in 2012-2013 (**1**: L1_14.06.12; **2**: L2_19.07.12; **3**: L3_18.07.12 and L3_22.06.13; **4**: L4_21.07.12; **5**: L5_13.06.12 and L5_22.06.13; **6**: L6_13.06.12; **7**: L7_20.07.12; **8**: L8_15.06.12; **9**: L9_29.04.13; **10**: L10_26.09.12 and L10_28.04.13; **11**: L11_27.04.13; **12**: L12_28.04.13; **13**: L13_27.04.13; abbreviation of the sampling sites and occasions as in table 1).

Cyclotella cyclopunctata Håkansson and Carter J. R., 1990									+	+	+	+	+
Cyclotella distinguenda Hustedt, 1928										+			
Cyclotella meneghiniana Kützing, 1844	+					+				+		+	+
Cyclotella pseudostelligera Hustedt, 1939	+		+			+				+			+
Cymatopleura solea (Brébisson) Smith, 1851		+											
Cymbella affinis Kützing, 1844	+	+					+						
Cymbella aspera (Ehrenberg) Cleve, 1894		+						+					
Cymbella helvetica Kützing, 1844	+	+	+										
Cymbella minuta Hilse in Rabenhorst, 1862		+								+			
Cymbella simonsenii Krammer in Krammer and Lange, 1985									+				
Cymbella tumida van Heurck, 1880		+					+	+					+
Diatoma monoliformis (Kützing) Williams D. M., 2012	+												
Diatoma tenuis Agardh C., 1812					+								
Diatoma vulgaris Bory de Saint-Vincent, 1824	+												
Didymosphenia geminata (Lyngbye) Schmidt M. in Schmidt A., 1899							+			+			+
Diploneis eliptica (Kützing) Cleve, 1894		+											
Epithemia adnata (Kützing) Brébisson, 1838										+			
Fragilaria capucina Desmazières, 1830		+											
Fragilaria capucina var. *vaucheriae* (Kützing) Lange-Bertalot, 1980	+												+
Fragilaria crotonensis Kitton, 1869						+				+			
Fragilaria pulchella (Ralfs ex Kützing) Lange-Bertalot, 1980							+						+
Fragilaria tenera (Smith W.) Lange-Bertalot, 1980		+											
Fragilaria ulna (Nitzsch) Lange, 1980		+	+	+	+	+		+					
Fragilaria ulna var. *acus* (Kützing) Lange-Bertalot, 1980					+				+				
Fragilaria bidens Heiberg, 1863	+	+			+	+						+	+
Gomphonema acuminatum Ehrenberg, 1832									+				
Gomphonema augur Ehrenberg, 1840	+	+								+			
Gomphonema clavatum Ehrenberg, 1832		+					+						
Gomphonema olivaceum (Hornemann) Brébisson, 1838						+							
Gomphonema parvulum (Kützing) Kützing, 1849											+		
Gyrosigma acuminatum (Kützing) Rabenhorst, 1853	+	+	+		+	+		+	+		+	+	+

Table 3 (continued): List of algal taxa identified in the 13 floodplain lakes from Balta Mică a Brăilei area in 2012-2013 (**1**: L1_14.06.12; **2**: L2_19.07.12; **3**: L3_18.07.12 and L3_22.06.13; **4**: L4_21.07.12; **5**: L5_13.06.12 and L5_22.06.13; **6**: L6_13.06.12; 7: L7_20.07.12; **8**: L8_15.06.12; **9**: L9_29.04.13; **10**: L10_26.09.12 and L10_28.04.13; **11**: L11_27.04.13; **12**: L12_28.04.13; **13**: L13_27.04.13; abbreviation of the sampling sites and occasions as in table 1).

Melosira varians Agardh C., 1827										+			
Navicula capitata Ehrenberg, 1838												+	+
Navicula capitatoradiata Germain, 1981	+												
Navicula cincta (Ehrenberg) Ralfs in Pritchard, 1861							+						+
Navicula cryptotenella Lange-Bertalot in Krammer and Lange-Bertalot, 1985								+			+	+	+
Navicula cuspidata (Kutzing) Kutzing, 1844	+	+	+	+	+	+	+	+		+			
Navicula cuspidata var. *ambigua* (Ehrenberg) Cleve, 1894											+		
Navicula decusis Østrup, 1910												+	
Navicula gregaria Donkin, 1861													
Navicula kotschyi Grunow, 1860											+		
Navicula placentula Kützing, 1844		+	+	+			+						
Navicula pupula Kützing, 1844							+						
Navicula pygmaea Kützing, 1849							+						
Navicula tripunctata (Müller O. F.) Bory de Saint-Vincent in Bory de Saint-Vincent, 1822										+			
Navicula veneta Kützing, 1844													
Navicula viridula (Kützing) Ehrenberg, 1838	+	+	+	+	+	+				+	+		+
Neidium ampliatum (Ehrenberg) Krammer							+						
Nitzschia acicularis (Kützing) Smith W., 1853		+	+				+			+			
Nitzschia amphibia Grunow, 1862		+	+			+							
Nitzschia calida Grunow, 1880			+	+		+							
Nitzschia disipata (Kützing) Grunow, 1862								+					
Nitzschia hungarica Grunow, 1862				+									
Nitzschia levidensis Grunow in Heurck, 1881					+								
Nitzschia linearis Smith W., 1853			+										
Nitzschia palea (Kützing) Smith W., 1856		+	+							+			
Nitzschia reversa Smith W., 1853						+							
Nitzschia subacicularis Hustedt in Schmidt et al., 1922													+
Pinnularia microstauron (Ehrenberg) Cleve, 1891					+								
Pinnularia rupestris Hantzsch in Rabenhorst, 1861			+										
Pinnularia viridiformes Krammer Gaiser and Johansen, 2000				+									
Melosira varians Agardh C., 1827		+											
Rhoicosphaenia abbreviata (Agardh C.) Lange-Bertalot, 1980											+		

Table 3 (continued): List of algal taxa identified in the 13 floodplain lakes from Balta Mică a Brăilei area in 2012-2013 (**1**: L1_14.06.12; **2**: L2_19.07.12; **3**: L3_18.07.12 and L3_22.06.13; **4**: L4_21.07.12; **5**: L5_13.06.12 and L5_22.06.13; **6**: L6_13.06.12; **7**: L7_20.07.12; **8**: L8_15.06.12; **9**: L9_29.04.13; **10**: L10_26.09.12 and L10_28.04.13; **11**: L11_27.04.13; **12**: L12_28.04.13; **13**: L13_27.04.13; abbreviation of the sampling sites and occasions as in table 1).

Coccomonas elliptica Conrad		+											
Coccomonas platyformis Jane, 1944		+											
Coelastrum astroideum De Notaris, 1867			+		+	+	+			+			
Coelastrum pseudomicroporum Korshikov, 1953							+						
Coelastrum sphaericum Nägeli, 1849							+						
Coenococcus planctonicus Korshikov, 1953					+						+	+	
Coenocystis planctonica Korshikov, 1953					+								
Cosmarium botrytis Meneghini ex Ralfs, 1848					+			+					
Cosmarium botrytis var. *tumidum* Wolle, 1884			+										
Cosmarium formosulum Hoff, 1888	+												
Cosmarium granatum Brébisson ex Ralfs, 1848					+								
Cosmarium moniliforme Ralfs, 1848			+										
Cosmarium punctulatum Brébisson, 1856	+							+					
Cosmarium punctulatum var. *subpunctulatum* (Nordstedt) Børgesen, 1894						+							
Cosmarium subprotumidum Nordstedt, 1876						+							
Crucigenia pulchra (West) Komárek							+						
Crucigenia quadrata Morren, 1830							+						
Crucigenia tetrapedia Kuntze, 1898							+						
Crucigeniella apiculata (Lemmermann) Komárek, 1974						+	+			+			
Crucigeniella rectangularis (Nägeli) Komárek, 1974					+								
Dictyosphaerium chlorelloides (Nauman) Komárek and Perman, 1978					+								
Dictyosphaerium pulchellun Wood H. C., 1873		+	+	+		+							
Dictyosphaerium tetrachotomum Printz, 1914						+							
Didymocystis fina Komárek, 1975							+						
Elakatothrix gelatinosa Wille, 1898		+											
Eudorina elegans Ehrenberg, 1832	+				+			+				+	
Eutetramorus tetrasporus Komarek, 1983					+								
Golenkinia radiata Chodat, 1894				+		+							
Golenkiniopsis longispina (Korshikov) Korshikov, 1953		+	+										
Gonatozygon brebisonii Bary, 1858			+										
Gonium pectorale Müller O. F., 1773	+	+	+			+		+		+			
Granulocystis chlamydomonadoides Hindak, 1980			+										
Kirchneriella aperta Teiling, 1912				+									
Kirchneriella contorta (Schmidle) Bohlin, 1897							+						

Table 3 (continued): List of algal taxa identified in the 13 floodplain lakes from Balta Mică a Brăilei area in 2012-2013 (**1**: L1_14.06.12; **2**: L2_19.07.12; **3**: L3_18.07.12 and L3_22.06.13; **4**: L4_21.07.12; **5**: L5_13.06.12 and L5_22.06.13; **6**: L6_13.06.12; **7**: L7_20.07.12; **8**: L8_15.06.12; **9**: L9_29.04.13; **10**: L10_26.09.12 and L10_28.04.13; **11**: L11_27.04.13; **12**: L12_28.04.13; **13**: L13_27.04.13; abbreviation of the sampling sites and occasions as in table 1).

Kirchneriella irregularis (Smith G. M.) Korshikov, 1953							+			+			
Kirchneriella lunaris Möbius K., 1894								+					
Kirchneriella obesa (West) West and West G. S., 1894						+		+					
Kirchneriella subcapitata Korshikov, 1953							+						
Lagerheimia genevensis Chodat, 1895						+							
Lagerheimia longiseta (Lemmermann) Printz, 1914		+											
Lagerheimia subsalsa Lemmermann, 1898						+	+						
Lagerheimia wratislaviensis Schröder, 1897		+		+			+						
Micractinium pusillum Fresenius, 1858			+	+			+						
Micractinium quadrisetum Smith G. M., 1916		+	+			+							+
Monoraphidium arcuatum (Korshikov) Hindák, 1970		+				+	+			+			
Monoraphidium contortum (Thuret) Komárková-Legnerová in Fott, 1969		+		+	+	+	+	+		+			
Monoraphidium convolutum (Corda) Komárková-Legnerová, 1969							+						
Monoraphidium griffithii (Berkeley) Komárková-Legnerová, 1969		+	+	+	+	+				+			
Monoraphidium irregulare (Smith G. M.) Komárková-Legnerová, 1969		+					+						
Monoraphidium pusillum (Printz) Komárková-Legnorová, 1969							+						
Mougeotia sp. Agardh C. A., 1824								+					
Nephrocytium agardhianum Nägeli, 1849						+							
Oocystis borgei Snow J. W., 1903					+								
Oocystis lacustris Chodat, 1897			+		+	+	+						
Oocystis marssonii Lemmermann, 1898						+							
Oocystis parva West and West G. S., 1898						+							
Pandorina charkoviensis Korsch, 1923			+							+			
Pandorina morum (Müller O. F.) Bory de Saint-Vincent in Lamouroux, Bory de Saint-Vincent and Deslongschamps, 1824	+	+	+	+	+	+		+	+	+	+	+	+
Pediastrum boryanum Meneghini, 1840					+		+				+	+	+
Pediastrum boryanum var. *cornutum* (Raciborski) Sulek in Fott, 1969	+				+								
Pediastrum boryanum var. *longicorne* Reinsch, 1867						+				+			
Pediastrum duplex Meyen, 1829	+	+	+	+	+	+	+			+			
Pediastrum simplex Meyen, 1829						+	+						
Pediastrum tetras Ralfs, 1845		+	+		+		+						

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Polyedriopsis spinulosa (Schmidle) Schmidle, 1899		+		+									
Pseudotetrastrum punctatum (Schmidle) Hindák, 1977		+											
Pteromonas pseudoangulosa L. Péterfi, 1965		+											
Scenedesmus aculeolatus Reinsch, 1877							+						
Scenedesmus acuminatus (Lagerheim) Chodat, 1902		+	+	+		+	+			+			
Scenedesmus acutus Meyen, 1829				+			+						
Scenedesmus apiculatus (West and West G. S.) Chodat, 1926		+											
Scenedesmus arcuatus Lemmermann, 1899		+				+		+		+			
Scenedesmus bicaudatus Dedusenko, 1925							+						
Scenedesmus communis Hegewald E., 1977							+			+		+	+
Scenedesmus dimorphus (Turpin) Kützing, 1834					+								
Scenedesmus gutwinskii var. *heterospina* Bodrogsközy										+			
Scenedesmus intermedius Chodat, 1926		+								+			
Scenedesmus lefevrei var. *manguinii* Lefèvre and Bourrelly, 1941		+											
Scenedesmus longispina Chodat R., 1913								+					
Scenedesmus obtusus Meyen, 1829				+	+		+						
Scenedesmus opoliensis Richter P. G., 1897		+	+	+		+	+			+			
Scenedesmus quadricauda (Turpin) Brébisson in Brébisson and Godey, 1835	+	+	+	+	+	+	+						
Scenedesmus regularis Svirenko, 1924						+	+						
Scenedesmus sempervires Chodat, 1913		+	+										
Scenedesmus spinosus Chodat, 1913							+						
Scenedesmus subspicatus Chodat, 1926							+						
Schizochlamys gelatinosa Braun A. in Kützing, 1849								+					
Schroederia setigera (Schröder) Lemmermann, 1898		+					+						
Schroederia spiralis (Printz) Korshikov, 1953							+			+			
Selenastrum bibraianum Reinsch, 1866		+	+			+							
Selenastrum gracile Reinsch, 1866			+			+							
Siderocelis ornata (Fott) Fott, 1934		+					+						
Sphaerellopsis ordinata Skuja H., 1964		+											
Spirogyra sp. Link, 1820								+					
Staurastrum inflexum Brébisson, 1856					+	+							
Staurastrum manfeldtii Delponte, 1878					+	+							
Staurastrum paradoxum Meyen ex Ralfs, 1848								+					

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Staurastrum paradoxum var. *reductum* Coesel, 1996						+							
Stigeoclonium lubricum Kützing, 1845												+	
Temnogametum sinense Jao C. C. and Hu H. J., 1978	+												
Tetraedron caudatum (Corda) Hansgirg, 1888		+	+				+						
Tetraedron acutum Playfair					+								
Tetraedron enorme (Ralfs) Hansgirg, 1888		+											
Tetraedron limneticum Borge, 1900		+											
Tetraedron longispinum (Perty) Playfair		+	+										
Tetraedron minimum (Braun A.) Hansgirg, 1888		+	+	+			+			+			
Tetraedron muticum (Braun A.) Hansgirg, 1888					+								
Tetraedron regulare Kützing, 1845		+											
Tetraedron triangulare Korshikov, 1953										+			
Tetraedron trigonum (Nägeli) Hansgirg, 1888		+											
Tetrastrum elegans Playfair, 1917							+						
Tetrastrum heteracanthum (Nordstedt) Chodat, 1895		+											
Tetrastrum peterfii Hortobagyi, 1967		+		+									
Tetrastrum staurogeniiforme (Schröder) Lemmermann, 1900										+			
Tetrastrum triangulare Komárek, 1974		+				+							
Treubaria setigera (Archer) Smith G. M., 1933			+										
Treubaria triappendiculata Bernard C., 1908						+							
Westella botryoides (West) De Wildeman, 1897					+	+		+					

Lake Sbenghiosu recorded the highest species richness, with a total of 109 taxa (Fig. 3). A higher number of taxa were identified in June, July and September 2012, compared to April and June 2013 (Mann-Whitney test $U = 0$; $p = 0.00017$; $n_1 = 9$; $n_2 = 7$). This is probably due to the differences in the Danube River discharge from one year to another: in 2013, drastic discharge increases led to a high volume of water entering the floodplain lakes, washing and reducing the algal species number, thus influencing the species richness.

A low similarity was recorded between the algal communities from the 13 sampling sites from Balta Mică a Brăilei Nature Park, even if most of the sampling lakes were located not far away from each other and some were even inter-connected through canals (Fig. 4). The Jaccard similarity percentage did not exceed 30%, probably due to the high diversity of microhabitats characteristic to the 13 sampling lakes, mainly depending on the characteristic macrophytes (submerged, emerged or natant).

Three clusters were clearly separated, similar to those distinguished in the PCA biplot (Fig. 2): lakes sampled in June 2013, the ones sampled in April 2013 and those sampled in 2012. The only sampling site that did not fit into one of these was lake Japşa – L1 (Fig. 4), due to its temporary character (lake Japşa was a shallow flooded area inside the Vărsătura Island).

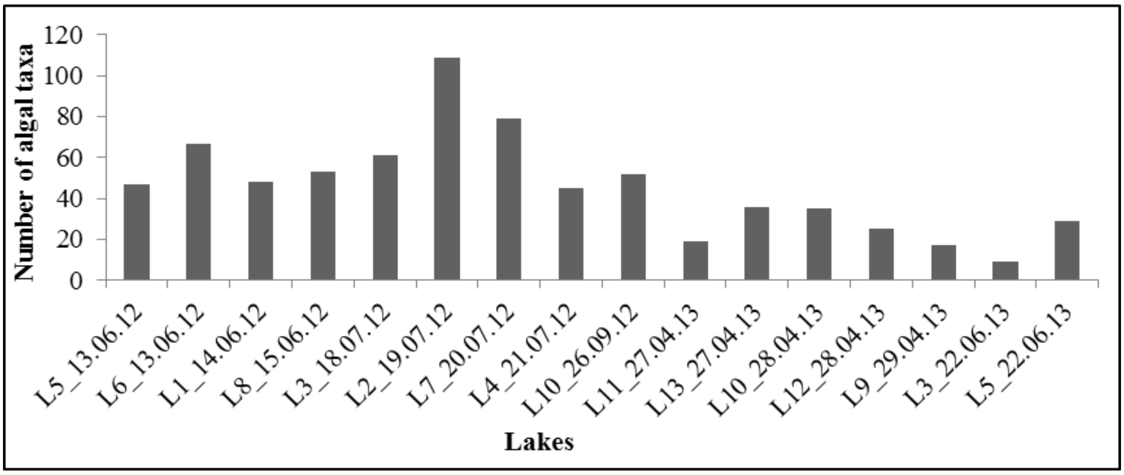

Figure 3: Number of algal taxa from the 13 lakes (16 sampling occasions) from Balta Mică a Brăilei Nature Park, arranged in chronological order (abbreviation of the sampling sites and occasions as in table 1).

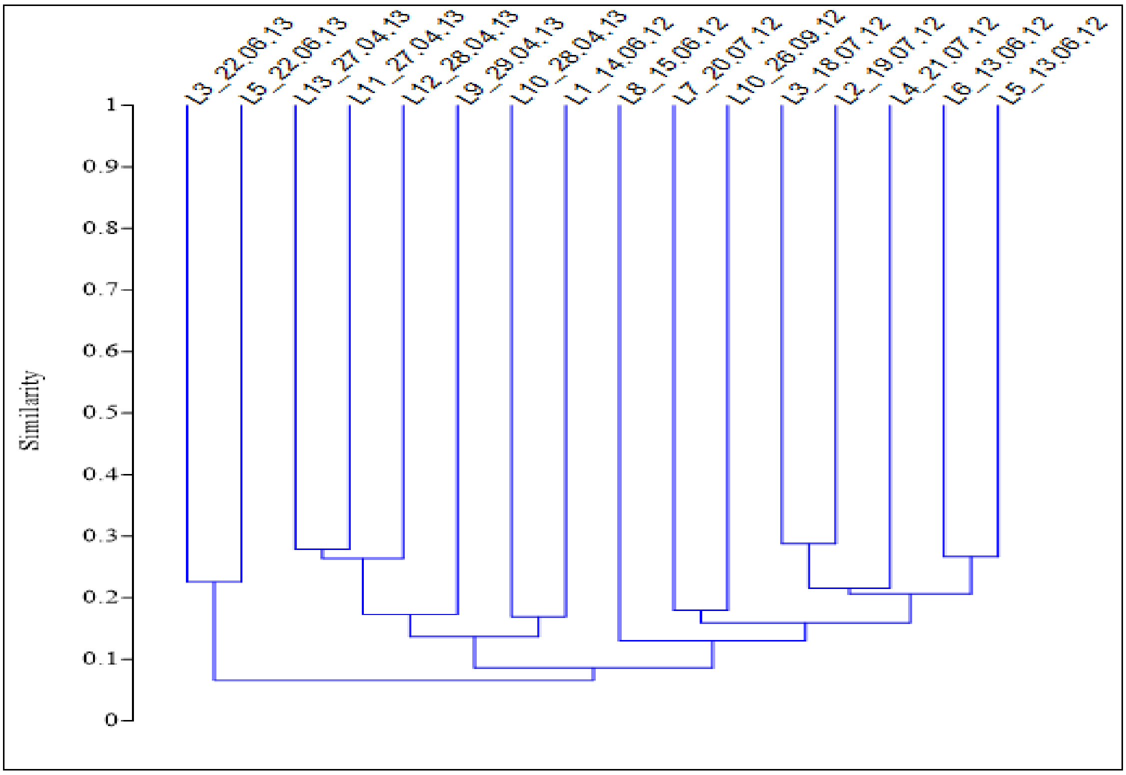

Figure 4: Jaccard similarity between the algal communities of the considered lakes from Balta Mică a Brăilei Nature Park (abbreviation of the sampling sites and occasions as in table 1).

The distinctive separation between these clusters indicates the importance of the flood pulses, meaning that the structure of algal communities from Balta Mică a Brăilei Nature Park was highly dependent on the water-level fluctuations of the Danube, ranging from extreme low flows to maximum ones. In fact, pelagic food chains in river floodplain systems are primarily under hydrological control (Schiemer et al., 2006). Thus, in order to maintain the biodiversity of the wetland, the connectivity between the river and its floodplain lakes must be preserved, together with a variable flow regime and a sufficient spatial scale (Opperman et al., 2010).

Water quality

Water quality of the 13 sampling lakes from Balta Mică a Brăilei Nature Park area was assessed in terms of trophicity and organic pollution (saprobity), using three main indices.

Water trophicity was evaluated by the trophic index Heinonen (1980) and the compound index (Nygaard, 1949). The first one was impossible to calculate in lakes Jigara and Bordeiele (L4_21.07.12 and L10_26.09.12), because no oligotrophic species were found. The compound index was not estimated in lake Cortele (L7_20.07.12), due to the absence of species belonging to the Order Desmidiales.

In the other lakes, both indices indicated eutrophic waters in summer and autumn 2012, probably due to the nutrient concentration in the floodplain lakes, caused by the extended drought period from 2012, characterized by a lack of precipitation and high temperatures, which led to increased water evaporation (Fig. 5). On the other hand, the trophicity level dropped in 2013, probably due to changes in hydrological conditions: the high water levels from April and June 2013 washed out some of the nutrients from the lakes.

The organic pollution index showed a similar status, with strong organic pollution in 2012, due to high quantities of decomposing organic matter accumulated during summer and autumn in the water pools. In 2013 however, organic pollution was relatively low, because of the spring flush, which washed away the organic matter, facilitating its mineralization (Fig. 5).

Water bloom caused by Euglenophyta was detected in lake Sbenghiosu in July 2012. Indeed, euglenoids are known to be dominant in eutrophic lakes, where organic pollution is high (Tas and Gonulol, 2007; Bellinger and Sigee, 2010).

The lower trophic and saprobic levels shown by the lakes from Balta Mică a Brăilei Nature Park in the period of high water levels from April and June 2013 are in accordance with other findings from the middle Danube River stretch. For example, Mihaljević et al. (2010) showed that the extreme flooding of the Danube from 2006 represented a stressor that led to the transition from turbid, eutrophic-hypertrophic conditions to a clear water state in the floodplain lake Sakadaš (Kopački Rit Nature Park, Croatia).

CONCLUSIONS

A total number of 315 algal taxa were identified through sampling 13 lakes from the Balta Mică a Brăilei Nature Park in 2012 and 2013, with 11 taxa cited for the first time in Romania. The algae identified were both planktonic and benthic forms, due to the shallow depth of the sampled water pools. During high water level periods (mostly April 2013), diatom species were numerous while green algae, euglenoids and blue-greens recorded drastic decreases in species number.

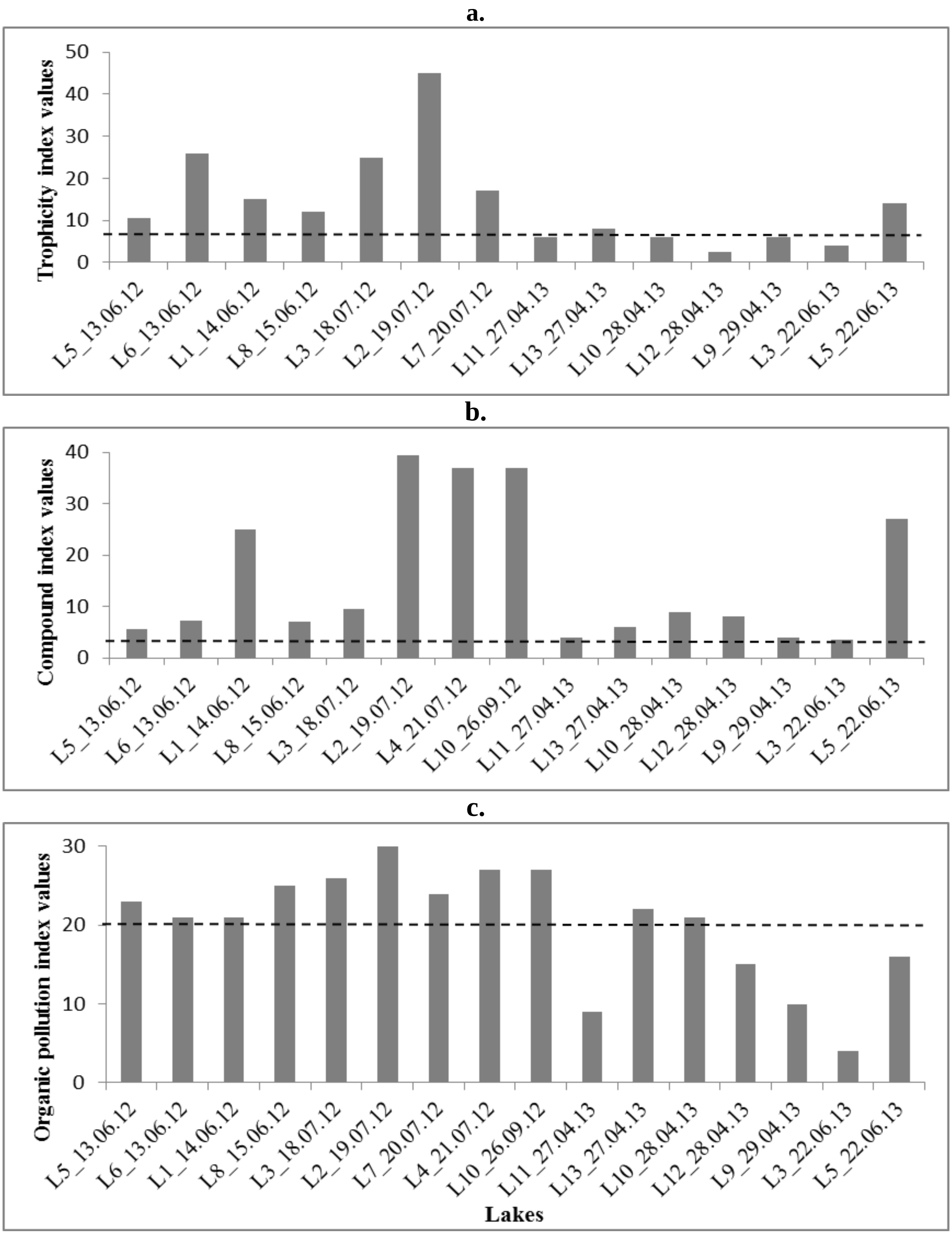

Figure 5a, b, c: Values of the trophicity and organic pollution indices (a, b, c), calculated for the sampling lakes from Balta Mică a Brăilei Nature Park, arranged in chronological order (dashed line: threshold values of the indices; abbreviation of the sampling sites and occasions as in table 1).

The sampled lakes demonstrated great diversity in terms of microhabitats, with a corresponding diversity in algal community composition, even for lakes located quite close together.

Algal communities are dependent on the flood pulse events, and so is the trophicity and organic pollution of all the lakes from the Balta Mică a Brăilei Nature Park. The Danube brings nutrients during the spring floods; they concentrate in summer, when the lakes are isolated from the river and its arms, leading to increases in trophicity. Spring floods also wash out the decomposing organic matter accumulated in the water pools from the area, leading to accelerated mineralization and lower organic pollution. In fact, trophicity and saprobity of the sampling lakes were higher in 2012 compared to 2013, due to this flood pulse cycle.

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