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DIVERSITY OF PLANKTON COMMUNITIES FROM LAKE ZORENI (TRANSYLVANIA, ROMANIA)

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SUMMARY. The present paper represents the first record of phytoplankton and microcrustacean taxa from Lake Zoreni, located in the Transylvanian Plateau, Romania. The scarcity of the data about the lake could be explained by the fact that it was formed only about 40 years ago, due to land slides. More than 180 algal taxa and 15 microcrustacean species were identified in May, July and October 2012 in Lake Zoreni, from two sampling sites characterized by different habitat conditions with respect to macrophyte abundance. Species richness and diversity of both phytoplankton and microcrustaceans differed depending on the season and sampling site. Based on indicator values of numerous algal, cladoceran and copepod taxa, the lake can be included in a moderate water quality class, with moderate loads of decomposing organic matter. An on-going process of eutrophication was identified in the lake, caused either by natural processes or by human activities.

Keywords: diversity indices, ecological status, microcrustaceans, phytoplankton, species richness.

Introduction

Planktonic organisms, living suspended in the water, form one of the most important pelagic communities, next to the nekton. Freshwater phytoplankton, as primary producer level, contains cyanobacteria and algae, while zooplanktonic communities can be herbivorous or carnivorous, including protozoans, rotifers, and crustaceans (copepods and cladocerans) (Lampert and Sommer, 2007). Pelagic food webs depend on planktonic communities. On the one hand, phytoplankton represents the most important primary producers in areas where macrophytes cannot survive due to water depth. On the other hand, zooplanktonic primary and secondary consumers

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(filter-feeders and predators) are an essential trophic pathway for the transfer of organic carbon from phytoplankton to fish (Suthers and Rissik, 2009). Moreover, some species of phytoplankton or zooplankton can indicate the health of the environment they live in, showing the trophic state or the amount of decomposing organic matter existing in the system (Zelinka and Marvan, 1961; Sládeček, 1973).

Lake Zoreni is located in the upper Fizeş catchment area, in the center of the Transylvanian Plateau, at 335 m a.s.l. (Floca *et al*., 1998). It is a natural water body, formed in 1975 due to a massive land slide. It has a total surface of 1.5 ha; it is 227 m long and 106 m wide, with a more or less continuous belt of reed and rush along the shore line. A few trees are present on the banks. Human impacts are not severe in Lake Zoreni; they are mostly represented by runoffs from the agricultural and pasture fields near the lake, and probably fish stocking.

The data included in the present paper represent the first study on planktonic communities from Lake Zoreni. No previous species lists of algae or microcrustaceans were found from the area, probably due to the young age of the lake. Thus, the present research represents an important insight on plankton qualitative structure and diversity, but also on the lake's current state of health, in terms of trophicity and saprobity.

Materials and methods

The samples were collected in May, July and October 2012 from two sampling sites located in different areas of the lake (Fig. 1). The first sampling site, Z1 (Fig. 2, left), from the north-western part of the lake (46°47'48.2"N; 24°04'38.7"E), was characterized by poor submerged vegetation in all three sampling seasons, while the second sampling site, Z2 (Fig. 2, right) (46°47'45.9"N; 24°04'44"E) was situated near the eastern bank of the lake, in an area with a rich submerged vegetation. The autumn samples, however, were impossible to collect from the exact location of Z2. The following code is used to denominate the sampling sites for the present paper: Z1-MM.YY, where Z1 is the sampling site, MM is the sampling month and YY is the sampling year. Thus, Z1-05.12 represents the first site, sampled in May 2012.

Qualitative phyto- and zooplankton samples were taken using a 20 µm and a 55 µm mesh net, respectively. All samples were collected from the banks and they were preserved in 4% formaldehyde. Identifications were made to the species level in case of algae (Ettl and Gärtner, 1988; Komárek and Anagnostidis, 2005; Krammer and Lange Bertalot, 1986; Popovsky and Pfiester, 1990; Wolowski, 2005), cladocerans (Negrea, 1983; Negrea, 2002) and copepods (Damian-Georgescu, 1963; Einsle, 1993; Pleşa and Müller, 2002). Several physical and chemical parameters were measured in the field in all sampling occasions, using portable meters (Consort P902 for pH and YSI 52 for dissolved oxygen and water temperature).

Semi-quantitative estimations were carried out for microcrustaceans, by calculating the relative percentage abundance. A number of individuals was counted in each sample and the percentage of the species present was calculated. Based on these data, the Shannon-Wiener diversity and the equitability were estimated for microcrustaceans (Washington, 1984).

Figure 1. Location of Lake Zoreni (in the East part of the Cluj County), with the two sampling sites (Z1 and Z2)

Figure 2. Aspects of the two sampling sites: Z1 on the left and Z2 on the right, in spring 2012

Several trophic and organic pollution indices based on phytoplankton community were considered (Willén, 2000). The first one, 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 1 indicate oligotrophic conditions, values between 1 and 3 mesotrophic conditions and values exceeding 3 eutrophic conditions. The β eutrophic index according to Oltean (1977) is calculated as follows: I_{β}= [(C+Py) logN] / (Ch+V+T+D+P+E+Cy); where N – the total number of taxa; C – Centrales; Py – Pyrophyta

(Dinophyta); Ch – Chrysophyta; V - Volvocales; T - Tetrasporales; D – Desmidiales; P – Chlorococcales; E – Euglenophyta and Cy – Cyanoprokaryota. This index can only be used for ecosystems where water blooms are observed. The I_β values are inverse proportional to the water trophic level. The organic pollution index calculated at the species level (Palmer, 1969) represents the sum of the indicator values of the species tolerant to organic load. Values not exceeding 15 indicate low organic pollution; values between 15 and 19 show moderate pollution and values greater than 20 represent high organic pollution. The biotic index based on cladocerans represents the ratio between large cladocerans (C_l) and the density of all cladoceran species (C_t) (Moss *et al.*, 2003). The values of this index indicate five water quality classes, according to the Water Framework Directive 2000/60/EC of the European Parliament and of the Council: when the values are lower than 0.2, the water quality is bad or poor; when the values vary between 0.2 and 0.5, the water quality is moderate; if they exceed 0.5, the water quality is good or high.

Results and discussion

Physical and chemical parameters measured in Lake Zoreni are presented in Table 1. pH values were neutral in almost all seasons. Water temperatures recorded normal values for the different periods of sampling, while dissolved oxygen saturation ranged from 55% to more than 100% (Table 1).

Table 1.

Physical and chemical parameters measured in the two sampling sites from Lake Zoreni in three different seasons

Sampling date	Sampling site code	pH	Dissolved oxygen (mg/l)	Dissolved oxygen saturation (%)	Water temperature (^{0}C)
19.05.2012	Z1-05.12	7.00	6.50	68.30	17.70
	Z2-05.12	7.00	6.47	70.00	19.20
23.07.2012	Z1-07.12	7.00	3.27	41.20	26.10
	Z2-07.12	7.00	8.60	108.30	27.40
12.10.2012	Z1-10.12	6.50	4.45	55.20	13.90
	Z2-10.12	7.00	4.44	55.10	13.70

A total of 181 phytoplankton taxa was identified in the two sampling sites from Lake Zoreni, belonging to six phyla: Bacillariophyta (34.25% of all taxa); Chlorophyta (33.15%); Euglenophyta (20.44%); Cyanoprokaryota (7.18%); Dinophyta (4.42%) and Chrysophyta (0.55%) (Table 2). Most algal species are true planktonic, and characteristic to shallow ponds: *Aphanocapsa elachista, Oscillatoria tenuis, Acanthosphaera zachariasii, Actinastrum hantzschii, Closterium acutum, Coelastrum astroideum, Kirchneriella lunaris, Scenedesmus arcuatus, Staurastrum chaetoceras, Treubaria schmidlei, Lepocinclis steinii, Stephanodiscus neoastraea* etc. There are also several benthic forms, due to the bank sampling: *Caloneis amphisbaena,*

Fragilaria capucina var. *vaucheriae*, *Navicula gregaria*, *Navicula viridula*, *Nitzschia paleacea*. More than 100 species are cosmopolitan but 20 taxa are halophylous, probably due to the salt diapir fold characteristic to the western Transylvanian Plateau.

Table 2.

List of phytoplankton taxa found in the three sampling seasons from Lake Zoreni

Sampling date → **Taxa ↓**	**19.05.2012**	**23.07.2012**	**12.10.2012**	**Sampling date →** **Taxa ↓**	**19.05.2012**	**23.07.2012**	**12.10.2012**
Phylum Cyanoprokaryota							
Ord. Chroococcales							
Aphanocapsa elachista	-	+	+	*Gomphosphaeria compacta*	+	-	-
Merismopedia elegans	+	+	+	*Snowella lacustris*	-	+	+
Woronichinia compacta	+	+	-				
Ord. Oscillatoriales							
Oscillatoria amphibia	-	+	+	*Oscillatoria lacustris*	+	-	-
Oscillatoria limnetica	-	+	+	*Oscillatoria planctonica*	+	+	+
Oscillatoria tenuis	-	-	+	*Spirulina major*	-	-	+
Ord. Nostocales							
Anabena variabilis	-	+	-	*Cylindrospermum stagnale*	-	+	-
Phylum Chrysophyta							
Ord. Chromalinales							
Chrysococcus rufescens	+	+	+				
Phylum Euglenophyta							
Ord. Euglenales							
Euglena acus	-	+	+	*Euglena agilis*	+	-	-
Euglena caudata	+	+	-	*Euglena deses*	-	+	-
Euglena ehrenbergii	+	-	-	*Euglena geniculata*	-	+	-
Euglena limnophila	+	+	-	*Euglena limnophila* var. *swirenkoi*	-	+	-
Euglena oblonga	+	+	+	*Euglena oxyuris*	+	+	+
Euglena spathirhyncha	-	-	+	*Euglena texta*	+	+	+
Euglena variabilis	+	-	+	*Lepocinclis caudata*	+	-	-
Lepocinclis ovum	+	+	-	*Lepocinclis playfairiana*	+	-	-
Lepocinclis steinii	+	-	-	*Lepocinclis truncata*	-	+	-
Phacus acuminatus	+	+	-	*Phacus agilis*	-	+	-
Phacus curvicauda	-	-	+	*Phacus granum*	-	+	-
Phacus helicoides	+	+	+	*Phacus longicauda*	+	+	+
Phacus orbicularis	+	+	-	*Phacus parvulus*	+	-	-
Phacus pleuronectis	+	+	-	*Phacus pyrum*	-	+	+
Phacus tortus	+	+	+	*Strombomonas acuminatus*	-	+	+
Trachelomonas granulosa	+	+	+	*Trachelomonas hispida*	-	+	+

Table 2. continued

Trachelomonas oblonga	+	-	-	*Trachelomonas planctonica*	-	+	-
Trachelomonas pulcherrima	-	+	-	*Trachelomonas volvocina*	-	+	+
Trachelomonas volvocinopsis	-	+	+				
Phylum Dinophyta							
Ord. Gymnodiniales							
Gymnodinium paradoxum	+	+	+				
Ord. Peridiniales							
Ceratium furcoides	-	+	+	*Peridiniopsis cunningtonii*	+	+	+
Peridiniopsis elpatiewskyi	-	+	-	*Peridinium aciculiferum*	-	+	+
Peridinium bipes	+	+	-	*Peridinium cinctum*	+	+	+
Peridinium umbonatum	+	+	-				
Phylum Bacillariophyta							
Ord. Centrales							
Cyclotella ocellata	+	+	+	*Cyclotella meneghiniana*	-	+	+
Stephanodiscus neoastraea	-	-	+				
Ord. Penales							
Acanthoceras zachariasii	-	-	+	*Achnanthes minutissima*	+	+	+
Amphipleura pellucida	+	+	+	*Amphora libyca*	-	-	+
Amphora montana	-	+	-	*Amphora pediculus*	-	+	+
Bacillaria paradoxa	-	-	+	*Caloneis amphisbaena*	+	-	+
Caloneis silicula	-	+	-	*Cocconeis pediculus*	-	-	+
Cocconeis placentula	+	+	+	*Cylindrotheca gracilis*	-	-	+
Cymatopleura solea	+	+	+	*Cymbella affinis*	-	-	+
Cymbella caespitosa	+	-	-	*Cymbella cistula*	+	-	+
Cymbella cymbiformis	-	-	+	*Cymbella minuta*	+	+	+
Cymbella silesiaca	-	+	-	*Cymbella tumida*	-	+	+
Diatoma tenuis	+	+	+	*Epithemia adnata*	+	+	+
Fragilaria capucina var. *vaucheriae*	+	-	+	*Fragilaria crotonensis*	+	+	+
Fragilaria pulchella	+	-	-	*Fragilaria ulna*	-	+	+
Fragilaria ulna var. *acus*	-	+	+	*Gomphonema parvulum*	-	+	+
Gomphonema truncatum	+	-	+	*Gyrosigma nodiferum*	+	+	+
Mastogloia smithii var. *lacustris*	+	+	+	*Navicula capitata*	-	+	-
Navicula capitatoradiata	-	-	+	*Navicula cincta*	-	+	+
Navicula cuspidata var. *ambigua*	-	-	+	*Navicula cryptocephala*	-	-	+
Navicula gregaria	-	+	-	*Navicula lanceolata*	-	+	-
Navicula radiosa	+	+	+	*Navicula tripunctata*	-	+	-
Navicula viridula	-	+	+	*Nitzschia constricta*	-	+	+
Nitzschia dissipata	-	-	+	*Nitzschia flexa*	+	-	-
Nitzschia fruticosa	-	-	+	*Nitzschia hungarica*	-	+	+
Nitzschia levidensis	-	-	+	*Nitzschia linearis*	+	-	+
Nitzschia littoralis	+	+	-	*Nitzschia palea*	-	+	+

Table 2. continued

Nitzschia paleacea	+	+	+	*Nitzschia reversa*	-	+	+
Nitzschia sigma	-	+	-	*Nitzschia sociabilis*	-	-	+
Nitzschia tryblionella	-	-	+	*Pinnularia viridis*	-	-	+
Rhoicosphenia abbreviata	+	-	-	*Rhopalodia gibba*	+	+	+
Surirella linearis	-	-	+				
Phylum Chlorophyta							
Ord. Chaetophorales							
Elakathrothrix gelatinosa	+	-	-				
Ord. Chlorococcales							
Acanthosphaera zachariasii	-	+	+	*Actinastrum hantzschii*	-	+	+
Botryococcus braunii	+	+	+	*Closteriopsis acicularis*	-	-	+
Closteriopsis longissima	-	-	+	*Coelastrum astroideum*	+	+	+
Coelastrum microporum	+	+	+	*Coelastrum sphaericum*	+	+	+
Crucigenia tetrapedia	-	-	+	*Dictyosphaerium pulchellum*	-	+	+
Kirchneriella lunaris	+	-	-	*Lagerheimia genevensis*	-	-	+
Monoraphidium contortum	+	+	+	*Oocystis borgei*	+	+	-
Oocystis lacustris	+	+	+	*Oocystis marsonii*	+	-	-
Oocystis parva	+	+	-	*Pediastrum boryanum*	+	+	+
Pediastrum boryanum var. *longicorne*	+	+	-	*Pediastrum duplex*	-	+	+
Pediastrum tetras	+	-	-	*Radiococcus planktonicus*	+	+	+
Scenedesmus abundans	-	-	+	*Scenedesmus acutus*	-	+	+
Scenedesmus arcuatus	+	-	+	*Scenedesmus acuminatus*	-	-	+
Scenedesmus communis	+	+	+	*Scenedesmus ellipticus*	+	-	+
Scenedesmus opoliensis	-	+	+	*Tetraëdron caudatum*	+	+	+
Tetraëdron minimum	+	+	+	*Treubaria schmidlei*	-	+	-
Westella botryoides	-	+	+				
Ord. Volvocales							
Chlorogonium elongatum	-	+	-				
Ord. Zygnematales							
Closterium acutum	+	+	+	*Closterium acutum* var. *linea*	-	+	-
Closterium acutum var. *variable*	-	-	+	*Closterium leibleinii*	+	-	-
Closterium moniliferum	+	+	+	*Cosmarium abbreviatum* var. *planctonicum*	+	-	-
Cosmarium bioculatum	-	+	-	*Cosmarium botrytis*	-	+	+
Cosmarium contractum	-	+	+	*Cosmarium pseudopyramidatum*	+	-	-
Cosmarium regnelii	-	-	+	*Cosmarium subcostatum*	-	-	+
Cosmarium subprotumidum	+	-	-	*Mougeotia calcarea*	+	-	-
Mougeotia scalaris	+	-	-	*Mougeotia* sp.	+	+	+
Spirogyra gracilis	+	-	-	*Spirogyra* sp.	+	+	+
Staurastrum chaetoceras	-	-	+	*Staurastrum cingulum*	+	+	-
Staurastrum manfeldtii	-	-	+	*Staurastrum paradoxum*	-	+	+
Staurastrum tetracerum	+	+	+	*Staurastrum tetracerum* var. *triradiata*	-	+	-
Staurodesmus incus	-	+	-				

The microcrustacean community includes only 15 species: 11 cladocerans (Phylum Arthropoda, Subphylum Crustacea, Class Branchiopoda, Subclass Phyllopoda, Ord. Diplostraca, Subord. Cladocera) and 4 cyclopoid copepods (Phylum Arthropoda, Subphylum Crustacea, Class Maxillopoda, Subclass Copepoda, Ord. Cyclopoida), together with copepod immature stages (copepodites and nauplii) (Table 3). Many microcrustaceans are cosmopolitan (like *Chydorus sphaericus* or *Eucyclops serrulatus proximus*). Most species are true planktonic, some are neustonic (*Scapholeberis mucronata*) and some are benthic (*Disparalona rostrata* or *Macrothrix laticornis*). Some species prefer habitats with rich macrophytes, so they are present only in the second sampling site Z2 (*Alona guttata* and *Macrocyclops albidus*). An empirical evaluation of the frequency of appearance was also performed for all microcrustacean taxa identified in the sampling sites, on a ranking scale ranging from *r* (rare) to *d* (dominant) (Table 3).

Table 3.

List of microcrustacean taxa, together with nauplii and copepodites in the two sampling sites from Lake Zoreni
(*r* – rare; *s* – sporadic; *c* – common; *d* – dominant; ♀ – females; ♂ – males)

Sampling site codes → **Taxa ↓**	**Z1-05.12**	**Z2-05.12**	**Z1-07.12**	**Z2-07.12**	**Z1-10.12**	**Z2-10.12**
Cladocera						
Alona guttata Sars 1862	-	*s*,♀	-	*c*,♀	-	-
Alona rectangula Sars 1862	*c*,♀	*s*,♀	*c*,♀	*c*,♀	*c*,♀	*s*,♀
Bosmina longirostris (O.F.Muller 1776)	*c*,♀	*r*,♀	*c*,♀	*s*,♀	*r*,♀	*c*,♀
Ceriodaphnia pulchella Sars 1862	*c*,♀	*c*,♀	*s*,♀	*s*,♀	*r*,♀	*s*,♀
Chydorus sphaericus (O.F.Muller 1776)	*c*,♀	*d*,♀	-	-	*c*,♀	*c*,♀
Daphnia cucullata Sars 1862	-	-	*s*,♀	-	-	*r*,♀
Disparalona rostrata (Koch 1841)	-	-	-	-	-	*s*,♀
Macrothrix laticornis (Jurine 1820)	-	-	-	-	*r*,♀	*s*,♀
Moina micrura Kurz 1875	-	-	*r*,♀	-	-	*r*,♀
Scapholeberis mucronata (O.F.Muller 1776)	-	*d*,♀	*c*,♀	*c*,♀	*s*,♀	-
Simocephalus vetulus (O.F.Muller 1776)	*s*,♀	*c*,♀	-	*s*,♀	*c*,♀	*s*,♀
Copepoda						
Acanthocyclops robustus Sars 1863	*c*,♀♂	*s*,♀	-	-	-	-
Eucyclops serrulatus proximus (Lilljeborg 1901)	-	*s*,♀	-	-	-	-
Macrocyclops albidus (Jurine 1820)	-	*s*,♀	-	*r*,♀	-	-
Thermocyclops oithonoides (Sars 1863)	*r*,♂	-	*s*,♀♂	-	*s*,♀♂	*c*,♀♂
copepodites	*d*	*c*	*c*	*c*	*c*	*d*
nauplii	*d*	*c*	*d*	*d*	*c*	*d*

Other animals were found in the sampling sites: worms (rotifers, nematodes, oligochaets); insect larvae (mayflies, true flies, aquatic butterflies) and other crustaceans (ostracods).

Species richness is a measure of community diversity, and refers to the number of taxa present in the sampling sites considered for the present study. As shown in Fig. 3 and 4, species richness is higher in the first sampling site (Z1) in all three sampling seasons in case of phytoplankton, and in the second sampling site (Z2) for microcrustaceans. The lower number of phytoplankton taxa in Z2 is explained by the massive development of macrophytes, that compete with algae for nutrients and light. In autumn 2012, the smaller difference between the number of taxa from Z1 and Z2 (7, compared to 16 in spring and 24 in summer) is due to the fact that many epiphytic diatoms were identified then in Z2. For microcrustaceans, the presence of macrophytes offer a more heterogeneous habitat, with more hiding places, and thus a higher species richness.

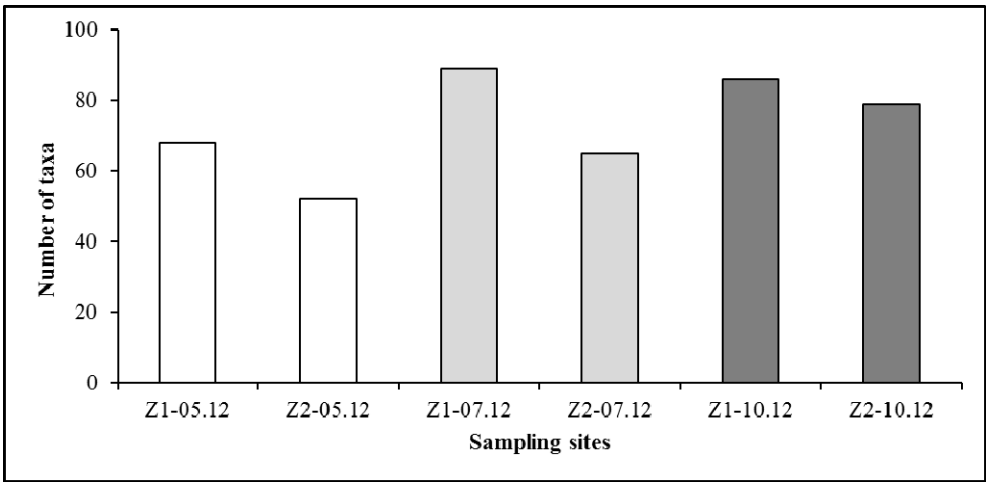

Figure 3. Number of phytoplankton taxa identified in the two sampling sites from Lake Zoreni in 2012

The Shannon – Wiener diversity index and the equitability were calculated for microcrustaceans alone, from the relative abundance estimations (Fig. 5). These indices take into consideration nauplii and copepodites as well, since the development stages of copepods represent a high percentage of the microcrustacean community, ranging from 57% to 94%. However, this high percentage leads to low values of diversity and equitability, showing an unbalanced community. Similar to the species richness, the microcrustacean diversity indices record higher values in the second sampling site (Z2), because of the more heterogeneous habitat created by macrophytes,

except for the samples taken in autumn 2012. This can be explained by the high percentage of nauplii and copepodites discussed above, but also by the fact that the location of Z2 was impossible to reach in October 2012, thus no macrophytes were characteristic to the actual sampling location in that season.

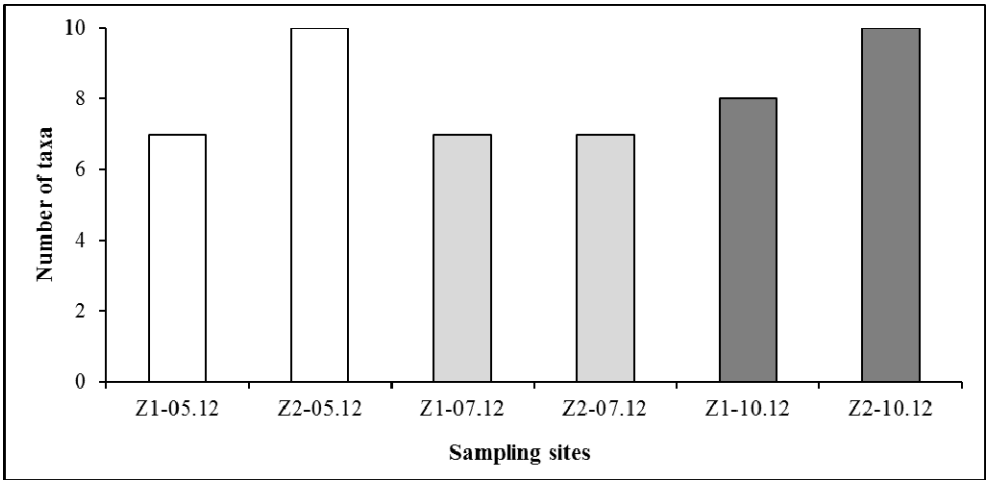

Figure 4. Number of microcrustacean taxa identified in the two sampling sites from Lake Zoreni in 2012 (nauplii and copepodites omitted)

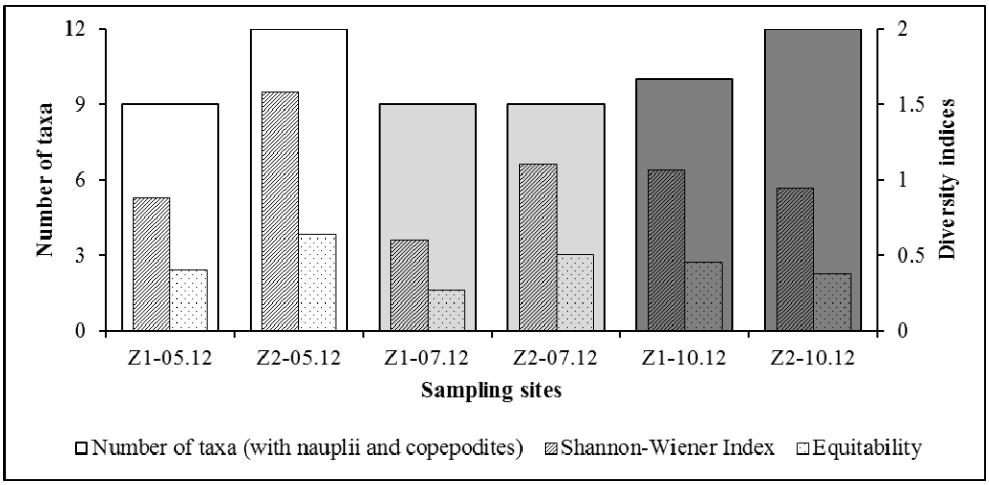

Figure 5. Number of microcrustacean taxa (nauplii and copepodites included) and the diversity indices calculated (the Shannon-Wiener index and the equitability)

The ecological status of Lake Zoreni was assessed based on phytoplankton and microcrustaceans, considering trophicity, saprobity and biotic indices (Table 4). From the 46 algal taxa that have an indicator value for lake trophicity, more than half (25) indicate eutrophic conditions, while 5 microcrustacean species are characteristic to eutrophic waters. The two trophicity indices based on phytoplankton support this: for example, almost all values of the compound index exceeded 3, indicating eutrophic waters. The water blooms in Lake Zoreni were caused by algae belonging to Dinophyta, so the β eutrophic index (Olteanu, 1977) was calculated. The smaller the index values, the higher the trophicity (Table 4). All these data depict Lake Zoreni in an on-going eutrophication process, caused by natural phenomena (soil characteristics, lake morphometry etc.) but also by human pressures (land use around the lake, fish stocking etc.).

As concerns the lake saprobic state, 65 from the total of 181 phytoplankton species; and 13 from the total of 15 microcrustacean species indicate a certain saprobic condition (Sládeček, 1973; Rott, 1997) (Fig. 6). The highest number of phytoplankton and microcrustacean taxa indicated oligosaprobic - β-mesosaprobic waters, showing relatively clean waters, with lower concentrations of decomposing organic matter. The organic pollution index at the species level (Palmer, 1969) (Table 4) recorded higher values for the summer and autumn samples, following the accumulation of organic matter in the lake during the growing season.

Table 4.

The indices used to assess the ecological status of Lake Zoreni based on phytoplankton and microcrustaceans (the two values indicate index figures for the first sampling site, Z1; and for the second one, Z2)

Sampling dates → **Indices ↓**	**19.05.2012**	**23.07.2012**	**12.10.2012**
The compound trophicity index (Nygaard, 1949)	5.4; 2.9	5.4; 5.3	9.3; 3.4
The β eutrophic index (Olteanu, 1977)	0.2; 0.3	0.3; 0.2	0.3; 0.2
The organic pollution index at the species level (Palmer, 1969)	4; 4	24; 23	29; 27
The cladoceran biotic index (Moss *et al*., 2003)	0.3	0.2	0.5

The biotic index based on the number of large cladocerans versus the total number of cladocerans (Table 4) indicated moderate water quality in all sampling seasons, confirming the findings on lake trophicity and saprobic status.

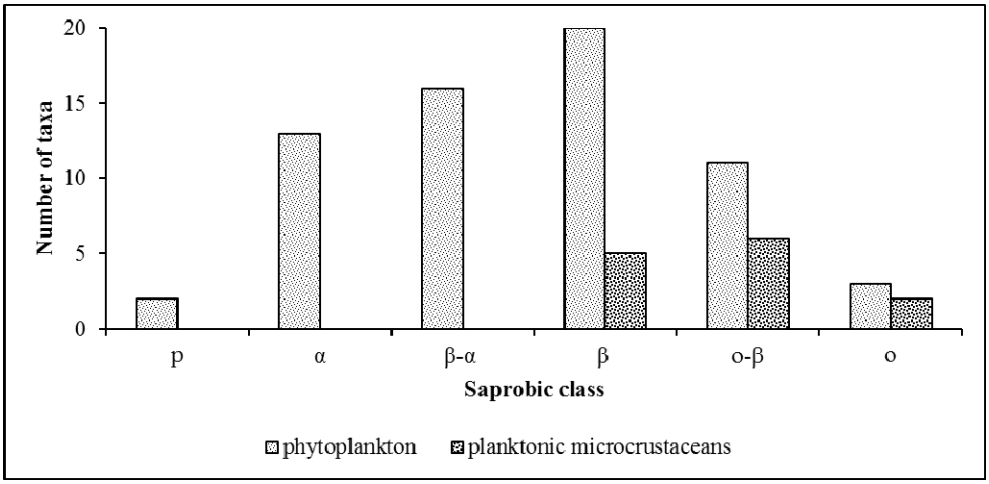

Figure 6. Number of phytoplankton and microcrustacean species, indicators of a certain saprobic condition: polisaprobic (p); α- mesosaprobic (α); β-α mesosaprobic (β-α); β-mesosaprobic (β); oligo- β-mesosaprobic (o-β); oligosaprobic (o)

Conclusions

To conclude, phytoplankton species richness increased in the open water areas, while microcrustaceans recorded a higher number of taxa in regions with rich submerged macrophytes. The diversity of microcrustaceans was generally low, due to the high percentage of nauplii and copepodites present in all sampling seasons. The findings of the present paper show that Lake Zoreni has a moderate water quality, with an on-going process of eutrophication despite its young age. Decomposing organic matter builds up in the ecosystem during the growing season, but the lake has relatively clean waters from this point of view, as shown by saprobic indicator values of phytoplankton and microcrustaceans.

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