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THE ROTIFERS OF VAYA LAKE

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Abstract: The Vaya Lake is a Ramsar site, a protected area in the Bulgarian legislation and part of the European ecological network Natura 2000. It is part of the 'Via Pontica' bird migration route. At the same time it is situated near Bourgas city – comparatively big harbor and industrial center. The lake is shallow, holo-polimictic water basin.

The aim of the present investigations was to determine the qualitative structure of the rotifer complex of Vaya Lake in the changed conditions of the lake due to the anthropogenic impact and to compare the results with previous research data. The study was carried out during the summer and autumn seasons of four consecutive years: 2004, 2005, 2006 and 2007. A comparison of nowadays obtained results with results for the period 1953-1957 was made. All samples were collected from the central part of the lake. In result of the provided investigations thirty five rotifer taxa belonging to 18 genera were recorded in Vaya Lake during the both investigated periods. During the period 2004-2007 – 28 rotifer taxa were established. Common for the two periods of research is just one taxa. The increasing number of the Rotifers and mainly these, that prefer eutrophic waters, indicates advanced eutrophication in the basin. The Jaccard similarity index was used for comparing the similarity into rotifer complexes. Similarity was too low – 3%, which indicates continuous changes into the rotifer complex. All types of results show the general negative trend in the evolutional development of the Vaya Lake with increasing of eutrophication.

INTRODUCTION

Most of the rotifer species occur mainly in freshwater habitats while in marine and mixohaline (brackish) water a few species are typical (Wallase et al., 2000;

Fontaneto et al., 2008; Kobaiashi et al., 2009). On the other side rotifers are also known as good indicators for the quality of inhabiting waters, and their presence may estimate precisely some long-term changes in the lake.

Faunistic studies on the zooplankton from Black sea coastal lakes were carried out from the beginning of the last century by Valkanov (1936) and Zashev and Angelov (1957-1958). The aim of the present investigation was to determine the qualitative structure of the rotifer complex of Vaya Lake in the changed conditions of the lake due to anthropogenic impact and to compare the results with previous research data.

MATERIALS AND METHODS

The study was carried out during the summer and autumn seasons of four consecutive years: 2004, 2005, 2006 and 2007. Samples were obtained with a plankton net 55 μm mesh size. Qualitative samples were taken from the water surface layer trawling Apstein plankton net. The Jaccard index is used for comparing similarity into rotifer complexes. The calculation was made with statistical package PAST version 2.17C (Hammer et al., 2001).

RESULTS AND DISCUSSION

Thirty five species of Rotifera belonging to 18 genera were recorded in the entire period (Table 1). The majority of these, (five species, 18%) belonged to the genus *Brachionus*, followed by *Keratella* (four species, 14%). During the period 2004-2007 twenty eight rotifer taxa were established in the Lake. Twelve of these species were observed only in one sample during the summer of 2005.

Most of the species – /15/, found in Vaya Lake are euryhaline – organisms that inhabits salt and fresh water in the same time. The freshwater complex was dominated by eight newly recorded in the Vaya Lake species, followed by strictly haline four species, recorded during the period of 1956-1957. Finally, as haloxsenous were recognized *Brachionus diversicornis* (Daday, 1883), *Filinia passa* (Müller, 1786) and *Pompholix complanata* (Gosse, 1851), the last three species inhabits the freshwater but accidently may be occurred in brackish or seawater (Fontaneto et al., 2008).

The obtained result is related to lack of connection of the lake with the sea and corresponded with the received data published by Kaya et al. (2010). The authors concluded that temperature and salinity were the main factors affecting species richness of planktonic rotifers. Salinity was the abiotic factor which regulates the zooplankton structure of the Kyliya branch of the Danube delta. With the increase salinity species richness decreased (Zorina-Sakharova et al., 2014). On the contrary, our study shows a reverse result, the rotifer species richness increased with the decreasing salinity in the lake.

However, the changes of species structure were depended on many other abiotic and biotic interactions. One of them undoubtedly is common phytoplankton blooms in Vaya Lake (Zashev and Angelov, 1957-1958; Petrova-Karajova, 1974; Stoyneva, 2003). At the same period of investigation (2004-2007) the toxic thermophile species *Cylindrospermopsis raciborskii* (Cyanoprokaryota) was detected in Vaya Lake for the first time (Dimitrova et al., in press). On the other side of the establishment of toxic species should be combined with a chemical and genetic analysis (Bouvy et al., 2001).The presence of such phytoplankton blooms and the presence of newly found species *Keratella tropica* (Apstein, 1907) are significant evidences of climate change and the advanced process of eutrophication in the lake.

Table 1. Presence (+) or absence (–) of rotifer species during the two investigated periods. Calcification of the rotifers distinguished into four categories: euryhalyne, halyne, haloxsenous and freshwater are followed Fontaneto et al. (2008)

№	Rotifera	period	period	Categories:
		1953-1957	2003-2007	
1.	*Anuraeopsis fissa* (Gosse, 1851)	-	+	euryhalyne
2.	*Asplanchna sieboldi* (Leydig, 1854)	-	+	freshwater
3.	*Brachionus plicatilis* (Müller, 1786)	+	-	halyne
4.	*Brachionus calyciflorus* (Pallas, 1776)	+	+	euryhalyne
5.	*Brachionus angularis* (Gosse, 1851)	-	+	euryhalyne
6.	*Brachionus diversicornis* (Daday, 1883)	-	+	haloxsenous
7.	*Brachionus urceus* (Linnaeus, 1758)	-	+	euryhalyne
8.	*Cephalodella catellina* (Müller, 1786)	-	+	euryhalyne
9.	*Colurella adriatica* (Ehrenberg, 1831)	-	+	euryhalyne
10.	*Encentrum* (s.str.) *marinum* (Dujardin, 1841)	-	+	euryhalyne
11.	*Filinia terminalis* (Plate, 1886)	-	+	euryhalyne
12.	*Filinia passa* (Müller, 1786)	-	+	haloxsenous
13.	*Hexarthra fennica* (Levander, 1892)	+	-	halyne
14.	*Hexarthra* sp.	-	+	-
15.	*Keratella cochlearis* (Gosse, 1851)	-	+	euryhalyne
16.	*Keratella quadrata* (Carlin, 1943)	-	+	euryhalyne
17.	*Keratella tecta* (Gosse, 1851)	-	+	freshwater
18.	*Keratella tropica* (Apstein, 1907)	-	+	euryhalyne
19.	*Notholca bipalium* (Müller, 1786)	+	-	halyne
20.	*Notholca striata* (Müller, 1786)	+	-	euryhalyne
21.	*Polyarthra vulgaris* (Carlin, 1943)	-	+	freshwater
22.	*Polyarthra dolichoptera* (Idelson, 1925)	-	+	freshwater
23.	*Polyarthra rem*ata (Skorikov, 1896)	-	+	freshwater
24.	*Ptygura melicerta* (Ehrenberg, 1832)	-	+	euryhalyne
25.	*Ptygura* sp.	+	-	-
26.	*Pompholix complanata* (Gosse, 1851)	-	+	haloxsenous
27.	*Proales* sp.	-	+	-
28.	*Synchaeta* sp.	+	-	-

29.	*Testudinella clypeata typica* (Müller, 1786)	+	-	halyne
30.	*Testudinella parva* (Ternetz, 1892)	-	+	freshwater
31.	*Testudinella emarginula* (Stenroos, 1898)	-	+	freshwater
32.	*Testudinella* sp.	-	+	-
33.	*Trichocerca* (D.) *pusilla* (Jennings, 1903)	-	+	euryhalyne
34.	*T. capucina* (Wierzejski & Zacharias, 1893)	-	+	euryhalyne
35.	*Lecane opias* Harring et Mayers, 1926	-	+	freshwater

Considerable changes in the faunistic composition of Rotifera are indicated by the low value of the Jaccard similarity index – only 3%. At the same time the number of species increased approximately four time.

Cluster analysis (Fig. 1) described the similarity in species composition between the two investigated periods. The analysis included 35 taxa and 28 of them are newly registered in Vaya. Seven species out of the eight in the past are absent.

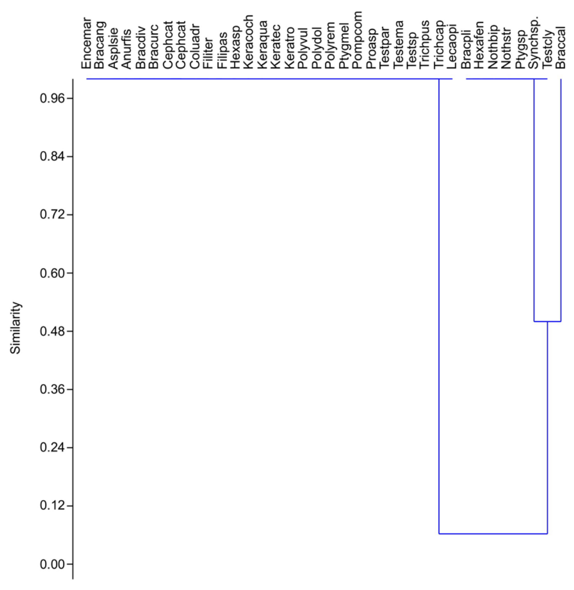

Figure 1. Cluster analysis after Jaccard (1901). Min. Y: -0.03 Corr. coph: 0.97.

Only *Brachionus calyciflorus* (Pallas, 1776) was common for the two investigated periods. The last species is common for such eutrophic and polluted waters like reservoir Mandra and purification lagoons of Luck Oil refinery, that are situated nearby (Topalova et al., 2009). According to Dimoff (1967) the same species was in the dominant complex of the zooplankton of Vaya Lake. In the period 1966 - 1967 the rotifers were described as the main source of the zooplankton biomass – up to 70% in the lake. Unfortunately, in this recent pilot study quantitative data of rotifers are not available yet.

CONCLUSIONS

The established results show that the composition of living in the lake rotifers has changed. The Jaccard similarity was only 3% between this study and the previous data from the nineteen fifties years. On the basis of the rotifer composition it can be assumed that the Vaya Lake was changed due to intensive eutrophication process and anthropogenic impact, but the data are still scarce to allow accurate assessment of the environment. Nevertheless, it can be presumed that the lake changed its trophic status from eutrophic to hypertrophic. So the obtained results can be useful for the future environmental management plans of this important coastal wet zone.

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