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Long Term Changes in *Rotifera fauna* of Guluskur Bay (Keban Dam Lake Elazig Turkey)

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Abstract: *Rotifera* species and their seasonal variations were investigated together with some physical and chemical parameters of water. Samples were taken monthly between October 1996-September 1998 and January 2008-December 2008 revealed some chemical and physical characteristics. In the first sampling period 27 *Rotifer* species and in the second sampling period 24 *Rotifer* species were recorded. In both sampling periods increases were occurred in individual and taxon numbers of rotifers in spring and summer seasons. In the first and second sampling periods *Keratella cochlearis* and *Polyarthra vulgaris* were the most abundant species. The purpose of this investigation was to describe the species composition of rotifera and to compare two sampling periods' results in order to determine how structure of rotifer populations has changed in past 10 years. In comparison with two sampling periods, some changes have been taken place in the composition of rotifers. The high species richness of rotifers; particularly members of the genera Brachionus suggested that the lake probably eutrophicated.

Key words: Long-term changes, *Rotifera fauna*, *Keratella cochlearis*, dam lake, Guluskur Bay, Turkey

INTRODUCTION

The eastern part of Turkey is known to have large number of small ponds, rivers, streams, lakes and dam lakes. Although, several investigations have been made documenting the rotifer faunas of Turkey, some habitats from eastern Turkey have not been yet completely investigated. Some of the studies in Turkey on *Rotifer fauna* have been conducted in Lake Karagol (Ustaoglu, 1986), Lake Kus Ustaoglu and Balik, 1990);

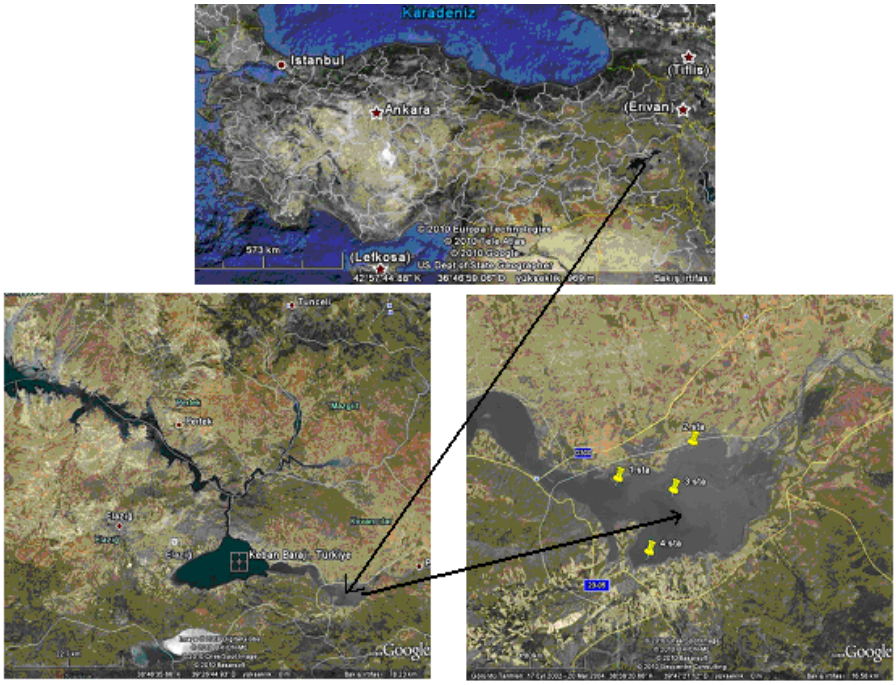

Fig. 1: Keban Dam Lake and Guluskur Bay and the sampling stations

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Lake Akgol, Lake Marmara (Ustaoglu and Balik, 1987) Gumuldur Stream (Ustaoglu, 1986); Kunduzlar and Catoren Dam Lakes (Altindag and Ozkurt, 1998) Cip Dam Lake, Zikkim Stream, Tadim Pond (Saler and Sen, 2001, 2002), Euphrates River (Saler *et al*., 2000); Lake Hazar (Tellioglu and Sen, 2002); Keban Dam Lake (Saler, 2004); Devegecidi Dam Lake, Goksu Dam Lake (Bekleyen, 2001, 2003); Seli Stream (Ipek and Saler, 2008). However no previous study on the *Rotifera fauna* of Keban Dam Lake Guluskur Bay has been reported. The present study was conducted to identify the Rotifera fauna and to determine the distribution and changes of the *Rotifer* species during along time period in Keban Dam Lake Guluskur Bay.

Keban Dam Lake is particularly interesting as the dam lake is known the largest artificial reservoir of Turkey. Guluskur Bay region of the dam lake was located in the east part of the dam lake and is known to have a wide variety of freshwater fishes but no work on its *Rotifera fauna* has been carried out in this area. Two big villages located nearby the bay and dense fishing activities were recorded in this region (Fig. 1).

MATERIALS AND METHODS

Rotifera was sampled monthly from 4 different stations between October 1996-September 1998 and January 2008-December 2008. Sampling period between October 1996-September 1998 was evaluated as first sampling period and January 2008-December 2008 as second sampling period. Samples were collected with a 55 pore sized Hydro-Bios plankton net and specimens were preserved 4% formaldehyde solution. The taxonomical investigations of samples were performed according to the key given by Edmondson (1959), Kolisko (1974) and Koste (1978). Some physical and chemical characteristics as water temperature, sechii disk depth, pH, dissolved oxygen, salinity and total hardness of water of research area were investigated *in situ* and given in tables as the averages of all stations.

RESULTS AND DISCUSSION

In Guluskur bay of Keban dam Lake in the first sampling period 27 *Rotifer* species, in the second sampling period 24 *Rotifer* species were recorded (Table 1 and 2). The identified rotifer species and their monthly distributions were shown in Table 1 and 2. As shown in the Table 1 and 2 some differences on the species diversity have been occurred. The differences between the identified species could be the results of some changed physical and chemical parameters of the study area and the sampling interval (Table 3 and 4).

In two sampling periods most of the identified *Rotifer* species are cosmopolitan as *B. urceolaris*, *B. plicatilis*,

Table 1: Monthly distrubution of *Rotifer* species in Guluskur bay during first sampling period

	1996									1997											1998			
Species	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
B. calcyflorus	-	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-	+	+	+	+	+	-
B. urceolaris	-	-	-	-	-	-	+	-	+	+	+	+	+	-	-	-	-	-	-	-	+	+	+	-
B. plicatilis	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-
K. cochlearis	+	+	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	+	-	+	+	+	+	+
K. quadrata	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	-
N. squamula	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+	+	+	+	+	-
K. longispina	-	-	-	-	-	-	+	+	+	+	+	-	-	-	-	-	-	-	+	+	+	-	-	-
T. tetractis	-	-	-	-	-	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	+	+	-	-
C. adriatica	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. uncinata	-	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-	+	+	+	+	+	+
L. costata	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	-	-	+	+	+	+	+	-
L. ovalis	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-
L. patella	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. luna	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-
L. lunaris	-	-	-	-	-	-	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
L.cornuta	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	-
L. pyriformis	-	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-	+	+	+	+	+	-
C. gibba	-	-	-	-	+	-	-	+	+	+	+	+	+	-	-	-	-	+	+	+	+	+	-	-
C. forficula	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
A. saltans	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-
S, pectinata	-	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-	-	+	+	+	+	+	-	-
P. vulgaris	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
P.dolicoptera	-	-	-	-	-	+	-	+	+	+	+	-	+	-	-	-	-	-	-	+	+	-	-	-
A. priodonta	-	-	+	-	-	+	+	-	+	+	-	+	+	-	-	-	-	+	+	-	+	+	-	+
A. hyalinus	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
H. senta	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. terminalis	-	-	+	+	-	+	+	-	+	+	+	-	-	-	-	+	+	-	-	-	-	+	+	-
P. roseola	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-

K. cochlearis, *T. tetractis*, *C. uncinata*, *L. lunaris*, *L. ovalis*, *C. gibba*, *C. forficula*, *A. saltans*, *P. vulgaris*, *A. sieboldi*, *F. terminalis* and *F. longiseta* (Koste, 1978). In the first sampling period Brachionidae (7 species) was found as the richest family followed by Colurellidae and Lecanidae (4 species) families. In the second sampling period as in the first sampling period Brachionidae (6 species) has taken the first place followed by Colurellidae and Lecanidae (3 species) (Table 1, 2). Members of these three families are commonly found in the plankton of lakes and ponds are able to adapt various physical and chemical environments (Kolisko, 1974). In the first sampling period the most rotifer taxon were recorded in 1997's may with 20 species followed by 18 species in july. In the second sampling period as in the first sampling period the most number of rotifer species recorded in May 2008. In both sampling periods winter months had got lowest species diversity.

It is clear that rotifer species diversity increased gradually from spring to summer months. On the other hand when the whether began to get colder, a decrease was occurred. This diversity patterns greatly depend on water temperature and food supply provided within water. In both sampling period of Guluskur Bay the rotifer diversity patterns were showed a great accordance with this formation. Increases in species diversities were occurred in spring and summer months whereas decreases were occurred in autumn and winter. In both sampling period in Guluskur Bay rotifer species were recorded in all seasons. The seasonal fluctuations in rotifer abundance relatively were related with temperature variations.

It has been demonstrated that abundance of rotifers closely follows temperature variations because temperature has a major influence on their reproductive rate, feeding, movement and longevity (Kolisko, 1974; Cossins and Bowler, 1987) In present study in both sampling periods the most diverse composition was recorded in spring-summer months when the temperature conditions are optimal for their development (Table 1, 4). Carlin (1943), regards the following rotifers as summer forms S. *pectinata, A. saltans, F. longiseta.*

These three species were occurred in Guluskur Bay in warm seasons. Many of the rotifer species are common in both sampling periods. But *B. plicatilis*, *L. ovalis*, *L.*

Table 2: Monthly distrubution of rotifer species in Guluskur Bay during second sampling period

	2008											
Species	J	F	M	A	M	J	J	A	S	O	N	D
B. calcyflorus	-	-	-	-	-	+	+	+	-	-	-	-
B. urceolaris	-	-	-	+	+	+	+	-	-	+	+	-
K. cochlearis	-	-	+	+	+	+	+	+	+	+	+	-
K. quadrata	-	-	-	-	+	+	-	-	-	-	-	-
N. squamula	+	+	-	+	+	-	-	-	-	-	-	-
K. longispina	-	-	+	+	+	+	-	-	-	-	-	-
T. tetractis	-	-	+	-	-	+	-	-	-	-	-	-
C. adriatica	-	-	-	-	+	-	-	-	-	-	-	-
C. uncinata	-	+	-	+	+	+	+	-	-	-	-	-
L. costata	-	-	-	-	+	+	-	-	-	-	-	-
L. lunaris	-	-	+	+	+	+	-	+	-	-	-	-
L. cornuta	-	-	+	+	+	+	-	+	-	-	-	-
L. pyriformis	-	-	-	+	+	-	+	+	-	-	-	-
C. gibba	-	-	+	+	-	+	+	-	+	-	-	-
C. forficula	-	-	+	-	-	+	+	-	+	-	-	-
A. saltans	-	-	+	+	+	-	-	-	-	-	-	-
S. pectinata	-	-	-	-	-	+	-	-	-	-	-	-
P. vulgaris	-	+	+	+	+	+	+	+	+	+	+	+
P.dolicoptera	-	-	+	+	+	+	+	-	-	-	-	-
A. priodonta	-	+	+	+	+	+	+	-	+	-	-	-
H. fennica	-	-	-	+	+	-	-	-	-	-	-	-
F. terminalis	-	-	-	+	+	-	-	+	-	-	-	-
F. longiseta	-	-	+	+	-	-	-	-	-	-	-	-
P. roseola	-	-	-	-	+	+	+	-	-	+	-	-

Table 3: Some physical and chemical parameters of Guluskur Bay during first sampling periods (averages of all stations)

	1996							1997											1998					
Parameters	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Temperature	18.1	10.0	8.1	9.2	11.2	7.2	23.3	22.7	22.4	22.4	25.1	16.9	16.2	14.5	8.0	9.8	14.6	14.1	20.5	23.6	21.8	26.2	24.6	19.4
Sechii disk dept	81.0	70.0	68.0	55.0	64.0	78.0	59.0	63.0	78.0	85.0	95.0	125.0	130.0	96.0	85.0	91.0	86.0	83.0	65.0	69.0	82.0	96.0	112.0	145.0
pH	7.9	8.0	7.7	7.8	7.8	8.5	8.6	8.1	8.2	9.4	9.2	8.5	8.1	7.9	8.2	7.7	8.3	8.2	8.1	8.1	8.0	8.0	8.0	7.9
Dissolved oxygen (mg L^{-1})	7.7	9.6	11.1	11.8	10.5	11.2	6.3	6.6	8.1	8.4	8.2	7.8	7.2	8.0	10.3	6.9	6.9	4.7	5.4	5.8	7.0	6.4	7.6	7.5
Salinity (%)	1.2	1.0	0.2	0.2	0.3	0.6	0.9	0.6	0.6	0.6	0.7	1.0	0.9	1.0	0.9	0.9	0.1	0.1	0.5	0.6	0.7	0.7	0.7	0.2
Total hardness (mg L^{-1})	16.6	17.5	18.0	21.0	21.0	25.8	13.7	15.7	16.2	10.2	11.5	10.2	11.5	12.5	16.4	17.9	18.7	18.9	14.3	16.0	13.8	9.9	16.6	9.4

Table 4: Some physical and chemical parameters of guluskur bay during second sampling periods (averages of all stations)

	2008											
Parameters	J	F	M	A	M	J	J	A	S	O	N	D
Temperature	6.3	8.2	11.2	17.4	20.3	21.4	22.3	24.2	18.9	17.2	15.5	9.2
Sechii disk dept	69.0	75.0	88.0	75.0	80.0	85.0	63.0	83.0	85.0	105.0	90.0	84.0
pH	7.8	7.9	7.5	8.2	7.9	8.2	8.4	8.2	8.1	7.6	7.9	7.2
Dissolved oxygen (mg L^{-1})	9.8	8.5	8.2	5.2	6.3	6.2	4.6	4.7	5.8	7.2	7.3	7.9
Salinity (%)	0.3	0.3	0.4	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.8	0.9
Total hardness (mg L^{-1})	23.2	22.0	26.3	17.9	16.7	16.2	15.3	11.6	19.8	25.6	28.6	19.7

patella, *L. luna*, A hyalinus and *H. senta* were only identified in the first sampling period. Among the species recorded in the second sa mpling period *C. adriatica*, *L. lunaris*, *H. fennica* and *F. longiseta* were not observed in the first sampling period. In both sampling periods *K. cohlearis* and *P. vulgaris* were the dominant species.

These two species were also recorded as the dominant species in Cip Dam Lake and Cemisgezek region of Keban Dam Lake (Saler, 2004). The presence of Brachionus, Filinia and Polyarthra in the lake indicates that this lake is eutrophic (Koste, 1978). In Guluskur Bay species belonging to these three genera were recorded in all seasons. Especially *Polyarthra vulgaris* was dominant species among others.

CONCLUSION

In this study, inventories of rotifers are important for evaluating environmental changes and understanding functional properties of freshwater ecosystems. Their community structure not only allows estimates of the level of pollution but also can indicate the trend of general conditions over time. This should require continuous long-term observations of this important component of ecosystems. Continuous studies of plankton communities should become an inalienable feature in the management of Keban Dam Lake, due to ability of both phytoplankton and zooplankton assemblages to rearrange their relative composition and growth in reply to changing conditions.

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