

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 *Rotifera* fauna have been conducted in Lake Karagol (Ustaoglu, 1986), Lake Kus Ustaoglu and Balik, 1990);

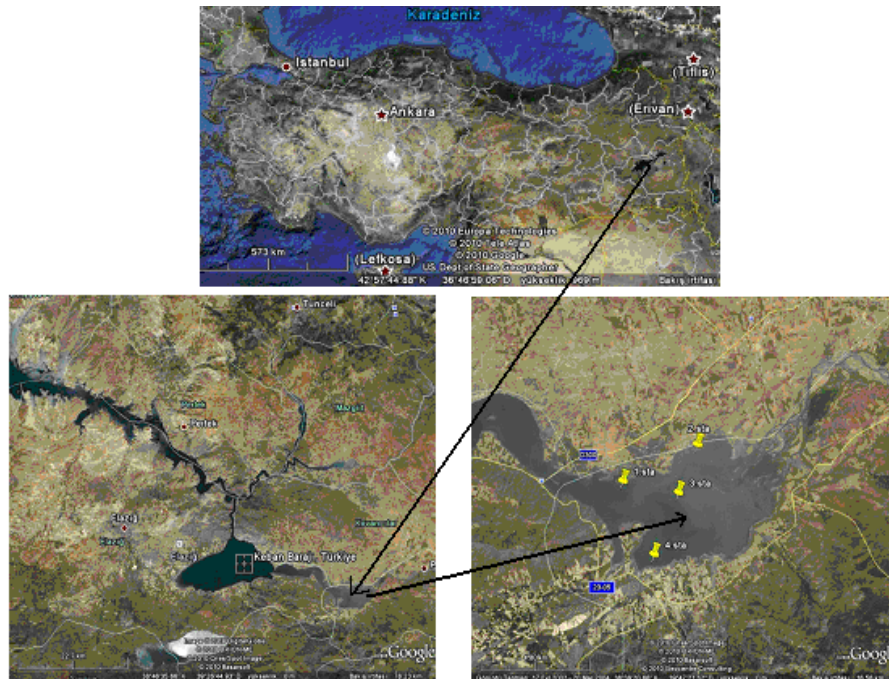


Fig. 1: Keban Dam Lake and Guluskur Bay and the sampling stations

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 distribution of *Rotifer* species in Guluskur bay during first sampling period

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

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 weather 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 distribution of rotifer species in Guluskur Bay during second sampling period

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

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

Parameters	1996								1997								1998							
	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
Secchi 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)

Parameters	2008											
	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
Secchi 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 sampling 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 Cemisgezdek 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.

REFERENCES

- Altindag, A. and S. Ozkurt, 1998. A study on the zooplankton fauna of the dam lake kunduzlar and catoren (kirka-eskisehir). *Doga Turk. J. Zool.*, 22: 323-333.
- Bekleyen, A., 2001. A taxonomical study on the Rotifera Fauna of Devegeçidi Dam Lake (Diyarbakir-Turkey). *Turk. J. Zool.*, 25: 251-255.
- Bekleyen, A., 2003. Taxonomical study on the zooplankton of goksu dam lake (diyarbakir). *Turk. J. Zool.*, 27: 95-100.
- Carlin, B., 1943. Die planktonrotatorien des motalastrom zur taxonomie und okologie der planktonrotatorien. *Medd. Luds. Univ. Limnol. Inst.*, 5: 226-226.
- Cossins, A.R. and K. Bowler, 1987. *Temperature Biology of Animals*. Chapman and Hall, New York, pp: 339.
- Edmondson, W.T., 1959. *Rotifera in Fresh Water Biology*. 2nd Edn., John Wiley and Sons Inc., New York, pp: 420-499.
- Ipek, N. and S. Saler, 2008. The rotifera fauna of seli stream (Elazig-Turkey) and their analyses with some bioindexes. *Ege Univ. Su Urun. Derg.*, 25: 211-215.
- Kolisko, R.M., 1974. *Planktonic Rotifers Biology and Taxonomy Biological Station. Lunz of The Austrian Academy of Science, Stuttgart*, pp: 974.
- Koste, W., 1978. *Die Radertiere Mitteleuropas I. Textband*, Berlin, pp: 673.
- Saler, S. and B. Sen, 2001. The seasonal changes of rotifers in zikkim stream flows into Hazar Lake. *Ulusal Su Urunl. Semp.*, 1: 261-271.
- Saler, S. and D. Sen, 2000. A taxonomical study on rotifera fauna of cip dam lake (elazig) Firat universitesi. *Fen Muhendislik Bilimleri Derg.*, 12: 329-339.
- Saler, S. and D. Sen, 2002. The seasonal changes of rotifers (rotatoria; Aschelminthes) of tadim pond (Elazig-Turkey). *Fen Muhendislik Bilimleri Derg.*, 14: 235-240.
- Saler, S., 2004. Observations on the seasonal variation of rotifera fauna of Keban Dam Lake (Cemisgezdek region). *Sci. Eng. J. Firat Univ.*, 16: 695-701.
- Tellioglu, A. and D. Sen, 2002. A taxonomical study on the rotifera fauna of Hazar Lake (Elazig). *Su Urunl. Derg.*, 19: 205-207.
- Ustaoglu, M.R. and S. Balik, 1987. Rotifer fauna of akgol (Selcuk-Izmir). *Proceeding of the 8th Ulusal Biyoloji Kongresi, (UBK'87)*, Izmir, pp: 614-626.
- Ustaoglu, M.R. and S. Balik, 1990. Zooplankton of kus golu (Bandirma). *Zooplankton of kus golu (Bandirma) Proceeding of the 5th Ulusal Biyoloji Kongresi, (UBK)*, Izmir, pp: 11-18.
- Ustaoglu, M.R., 1986. Zooplankton of the karagol (Yamanlar-Izmir). *Biol. Gallo-Hellenica*, 20: 259-266.