Ecological Life Sciences
ISSN: 1308 7258
Article ID: 5A0180

Status : Research Article
Received: 13.07.2022
Accepted: 25.10.2022

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DOI	http://dx.doi.org/10.12739/NWSA.2022.17.4.5A0180		
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ZOOPLANKTON OF BEHRAMAZ STREAM (ELAZIĞ-TÜRKİYE)

ABSTRACT

In order to investigate the zooplankton of Behramaz Stream, that is one of the most important streams feeding Hazar Lake, monthly zooplankton samples were taken from the stream in January-December 2014. During the research, 48 zooplankton species belonging to 3 groups were identified, 32 species of which belong to Rotifera, 12 species of Cladocera and 4 species of Copepoda. The distribution of zooplankton species according to groups consisted of 66.7% Rotifera, 25% Cladocera and 8.3%. *Cyclops vicinus*, from Copepoda the most recorded species in the study, was observed for 9 months. *The other most recorded species, K. longispina and P. dolichoptera,* from the Rotifera were observed for 7 months. While species were observed in the stream, it was determined that there was an increase in the number of zooplankton species and individuals in the summer and spring months. The months when zooplankton are recorded the least are winter. Species richness index calculations were made with the data obtained from the stream. The month with the highest Shannon Wiener value was June (*H'*= 2.48). Similarly, the Margalef richness index was recorded at its highest value (M= 4.28) in the same month. Even in the period when the species richness index in the stream was the highest, it could not exceed the *H'*= 2.5 value, which represents the medium level of species richness. It can be said that Behramaz Stream is poor in terms of species according to the species richness index data.

Keywords: Zooplankton, Diversity, Species Richness Index, Behramaz Stream, Elazığ

1. INTRODUCTION

Rotifera, Cladocera and Copepoda are the largest groups of zooplankton, which are the main links of the food chain in the aquatic environment. Species diversity and abundance in unit volume provide information about the biological characteristics of reservoirs and ponds. Zooplanktonic organisms constitute the main food source of fish in freshwater sources and they constitute the main food of many pelagic-feeding fish species and young periods of demersal-fed fish [1]. Zooplankton has a special place due to its role as nutrient for fish larvae and aquatic invertebrates. The species composition and abundance values of zooplanktonic species are excellent tools for interpreting the trophic level in a water body, since they are very sensible to environmental variables such as nutrients. And they can be observed in wide range of water bodies from temporary water bodies to great reservoirs [2 and 3]. In addition, zooplankton species are also used to predict water quality, trophic status of the lake and water

How to Cite:
Saler, S., Çelik, B., and Yüce, S., (2022). Zooplankton of Behramaz Stream (Elazığ-Türkiye). Ecological Life Sciences, 17(4):212-219, DOI: 10.12739/NWSA.2022.17.4.5A0180.

pollution. With the increasing importance of zooplanktonic organisms, researches on Rotifera, Cladocera and Copepoda, which constitute an important part of zooplankton in our country as well as in the world, have begun. Although, great afford has been done on the zooplankton, most of the studies deal with lentic system; lotic habitats seem to be neglected [4, 5, 6, 7, 8, 9, 10, 11, 12 and 13]. There is no zooplankton record from Behramaz Stream. In this study it was aimed to present a faunistic report on zooplankton of Behramaz Stream.

2. RESEARCH SIGNIFICANCE

The zooplankton and its distribution of Behramaz Stream was not studied before. This study is the first research on zooplankton in the Behramaz Stream. It is aimed that this study will contribute to future studies on zooplankton.

Highlights:

- Identification of the zooplanktonic groups their species.
- Determination of the variation of zooplankton species.
- Determination of species richness and diversity of species recorded in the stream

3. MATERIALS AND METHODS

Behramaz Stream borns from Hazar Mountain. It passes between Maden and Hazar mountains and flows through Behramaz Plain. The stream pours to Hazar lake from the west side of the lake [14]. Three stations have been chosen in the stream (Figure 1). Zooplankton samplings have been made monthly between January-December 2014 period.

Figure 1. Behramaz Stream and sampling stations

Zooplankton samples were taken from the stream every month with a standard 55 µ plankton net. From the areas where water samples could not be taken with the plankton net, samples were taken with a water bottle and then samples were filtered and preserved in 4% formaldehyde. Species identifications and counts were made with Leitz brand inverted microscope and relevant literature was used for diagnosis [15, 16, 17, 18, 19, 20 and 21]. pH values were measured by a Lamotte (pH 5-WC) model pH meter, dissolved oxygen and temperature values by an Oxi 315i/SET oxygen-meter. Species richness and species diversity values were calculated using Margalef and Shannon Wiener index [22]. Shannon Wiener species richness indexes (H'), Margalef diversity index (D) values were calculated for zooplankton. Shannon-Wiener index (H') value was presented as;

$$H' = - \sum pi \, (\ln)pi$$

where pi is the relative abundance of each species Margalef diversity index (D) was presented as

D = S-1/lnN where
S = Number of species in the sample
Ln = Natural Naperian logarithm
N = Total number of individuals in the sample

4. FINDINGS AND DISCUSSIONS

During the research, 48 zooplankton species belonging to 3 groups were identified, 32 species of which belong to Rotifera, 12 species of Cladocera and 4 species of Copepoda. The distribution of zooplankton species according to groups consisted of 66.7% Rotifera, 25% Cladocera and 8.3% (Figure 2).

As in Figure 3 Rotifera and Cladocera showed their maximums in May, in November the number of Copepoda individuals were increased. Especially in this month, an explosion in the number of *A. denticornis* from Copepoda was observed. *The most observed Copepepoda species C. vicinus was observed in 7 months.K. longispina* and *P. dolichoptera* from Rotifera were also observed in 7 months. Spring and summer months have got an importance for showing zooplankton maximums. In June 16 species were recorded. This value was the highest number of species observed in the stream.

In January only 3 species were recorded (Table 2). *K. longispina* is a widespread, common planktonic rotifer that can become very abundant. This species is abundant in hot seasons. In Behramaz Stream this species was observed in spring, summer and autumn. One of the important species recorded in the stream is *P. dolichoptera*. Important factors in the distribution of *Polyarthra* species are water temperature and dissolved oxygen level. These species are cold stenotherm species and usually appear in spring, autumn and a small amount in winter [2]. It appeared in the stream in winter, spring and autumn period. The periods when copepod species are observed intensively are spring, summer and early autumn when the water temperature rises. During the winter months, a rapid decrease is observed in their density [23]. In littoral regions of all kinds of water environments such as rivers, lakes, small water bodies, marshes, *C. vicinus* is a common planktonic species [24]. In lotic habitats it occurs in every season and abundant especially in early spring and autumn. In Behramaz Stream this species observed in every seasons.

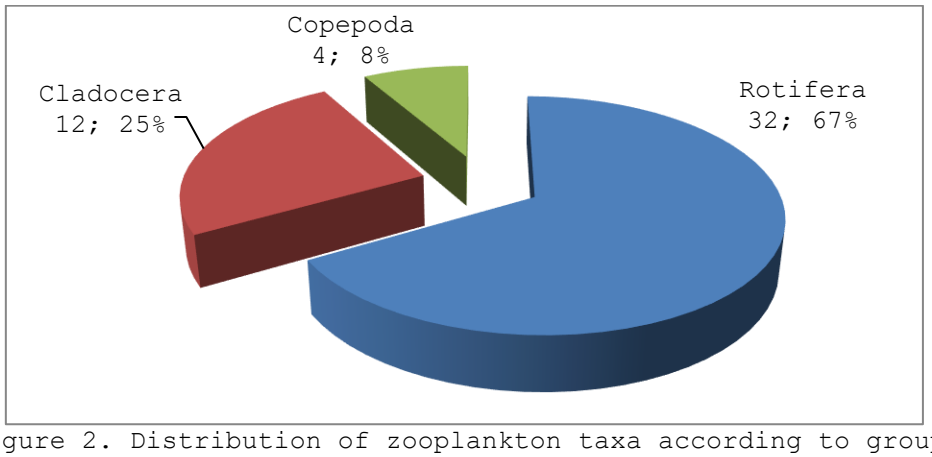

Figure 2. Distribution of zooplankton taxa according to groups

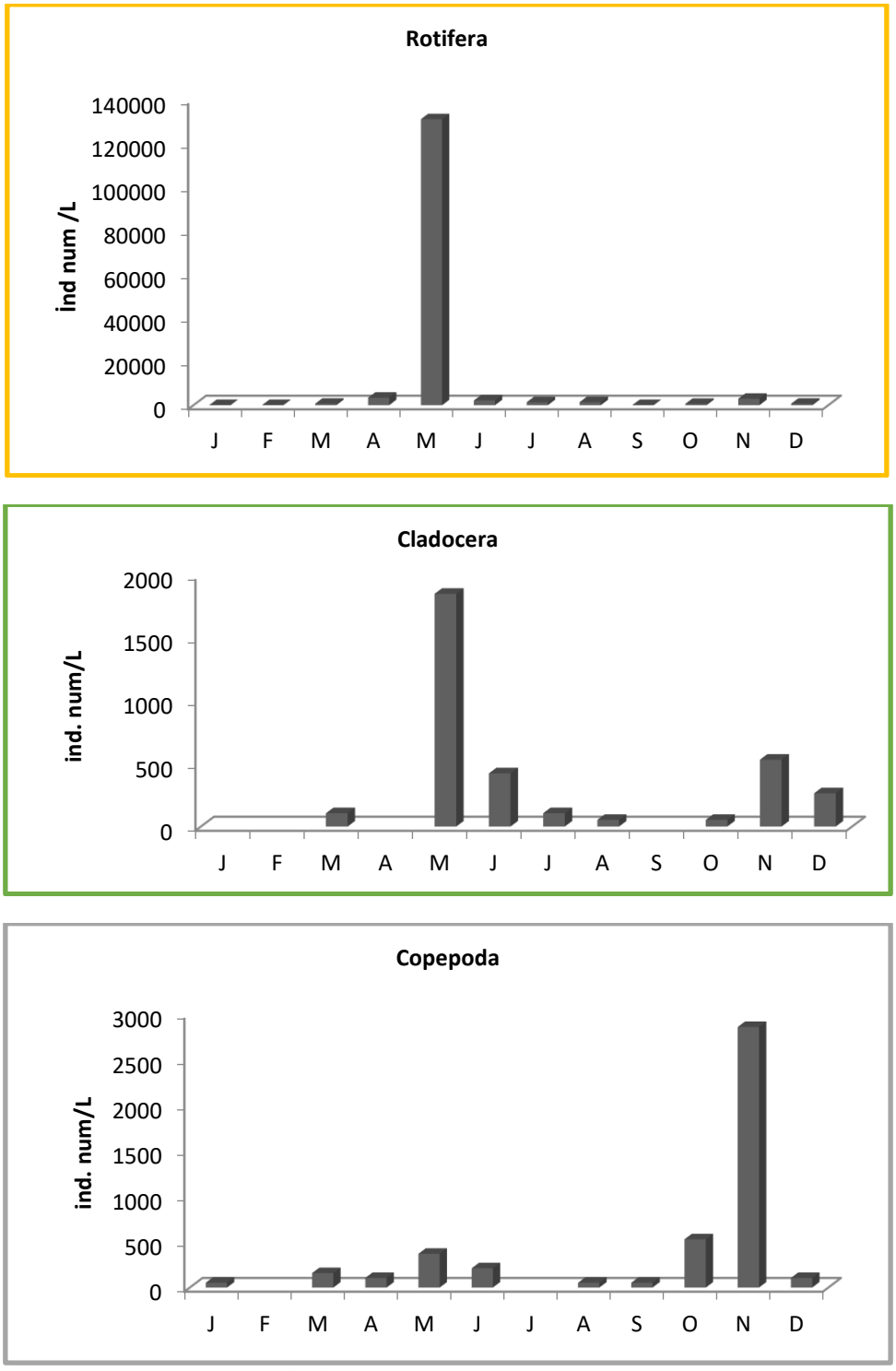

Figure 3. Monthly individual numbers of zooplankton as to groups

Table 2. Monthly distribution of zooplankton

ROTIFERA	J	F	M	A	M	J	J	A	S	O	N	D
Ascomorpha saltans Bartsch, 1870						+		+				+
Asplanchna priodonta Gosse, 1850	+				+	+	+				+	+
Brachionus calyciflorus Pallas, 1766				+								
B.plicatilis Müller, 1786												+
B.quadridentatus Hermann, 1783	+	+	+					+				
Cephalodella catellina (Müller, 1786)			+	+				+				
C.forficula (Ehrenberg, 1830)						+						
Colurella colurus (Ehrenberg, 1830)			+					+		+		+
Dicranophorus grandis (Ehrenberg, 1832)												+
Encentrum saundersiae (Hudson, 1885)					+							
Euchlanis dialatata Ehrenberg, 1832					+						+	+
Filinia terminalis (Plate, 1886)							+					
Habrotrocha bidens (Gosse, 1851)							+					
Hexarthra intermedia (Wiszniewski, 1929)							+					
Kellicottia longispina (Kellicott, 1879)			+	+	+	+	+	+	+			
Keratella quadrata (Müller, 1786)				+	+			+		+		
Lecane bulla (Gosse, 1886)					+	+		+				
L.closterocerca (Schmarda, 1859)					+	+						
L flexilis (Gosse, 1886)					+							
L.luna (Müller, 1776)					+	+		+		+		
L.lunaris (Ehrenberg, 1832)				+	+	+						
L.ohioensis (Herrick, 1885)							+			+		
Lepadella ovalis (Müller, 1786)						+	+	+		+		
Notholca acuminata (Ehrenberg, 1832)									+			
Notholca squamula (Müller, 1786)		+				+						
Notommata crytopus Gosse, 1886										+		
Philodina roseola Ehrenberg, 1832										+		
Polyarthra dolichoptera Idelson, 1925	+	+	+	+					+	+	+	+
Synchaeta oblonga Ehrenberg, 1832								+				
S.verrucosa (Nipkow, 1961)												
Trichocerca similis (Wierzeski, 1893)								+				
Trichotria tetractis (Ehrenberg, 1830)						+						
CLADOCERA	J	F	M	A	M	J	J	A	S	O	N	D
Coronatella rectangula(Sars, 1861)						+	+					+
Bosmina longirostris Müller, 1785					+						+	+
Chydorus sphaericus Müller 1785						+					+	
Chydorus ovalis Kurz, 1874											+	
Cornigerius lacustris (Spandly, 1923)			+									
Daphnia galeata Sars, 1864											+	
D.longispina (Müller, 1776)					+			+			+	+
D.magna (Stratus, 1820)											+	
Diaphanosoma lacustris Korinek, 1981					+							
Macrotrix laticornis Fıscher, 1851					+	+	+					
Moina micrura Kurz, 1874											+	
Pleuroxus aduncus (Jurine, 1820)										+		
COPEPODA	J	F	M	A	M	J	J	A	S	O	N	D
Acanthopdiaptomus denticornis (Wierzejski, 1887)				+	+	+					+	
Cyclops vicinus Uljanin, 1875		+	+	+	+					+	+	+
C.strenuus Fischer, 1851										+		
Nitokra hibernica (Brady, 1880)						+						

Table 3. Values of Shannon Wiener Species Richness Index (*H'*) and Margalef Diversity Index (D) at Behramaz Stream

	J	F	M	A	M	J	J	A	S	O	N	D
H'	1.09	0.69	1.90	1.02	**0.64**	**2.48**	1.84	2.46	1.09	1.92	1.90	2.36
D	1.82	1.44	2.00	**1.18**	1.87	**4.28**	2.40	3.36	1.82	2.87	2.19	3.67

The highest Shannon Wiener Species Richness Index (*H'*) was recorded in June (*H'*=2.48), *the lowest value in* May (*H'*=0.64). Margalef Diversity Index (D) values were changed between 1.18-4.28 (Table 3).

Table 4. Monthly values of some water parameters in Behramaz Stream

	J	F	M	A	M	J	J	A	S	O	N	D
Tem °C	**7.1**	10.1	17.1	14.8	16.4	**18.7**	17.6	13.8	13.2	12.8	12.1	8.5
Dis Ox mg/L	**12.3**	11.9	11.1	12.1	12.1	12.2	9.1	8.3	8.5	8.1	8.1	**7.9**
pH	**7.8**	8.2	8.5	8.2	**8.6**	8.2	8.3	8.5	**8.6**	8.1	8.1	7.9

The values of water temperature changed with 7.1-18.7°C, dissolved oxygen value 7.9-12.3mg/L and pH 7.8-8.6.

Rotifera recorded as the most important group in terms of species numbers and richness in Behramaz Stream. This finding showed an accordance with other stream's zooplankton profiles as Zıkkım Stream [7], Kars River [29], Karaman Stream [12], Peri Stream [25], Kürk Stream [26], Delice River [27], Meriç River [28]. In Behramaz Stream zooplanktonic species reached their maximums in spring months. In many of the studies as in Fırat River [6] Peri Stream [25], Ohi Stream [30], Murat River [31] zooplankton species and individual numbers have been showed their maximums in spring months. From Hazar Lake 52 zooplankton species were recorded [32], 35 zooplankton species were same with Behramaz Stream. In the lake Rotifers are the most important group in terms of frequency of occurrence, number of individuals and species richness as in Behramaz Stream. In the lake *B. quadridentatus K. quadrata* and *S. verrucosa* has been most recorded Rotifera species, *Cyclops vicinus* from Copepoda *C. rectangula, C. lacustris* and *D. lacustris* from Cladocera were the most abundant cladoceran species. These species were also recorded in Behramaz Stream, but they were not determined as the dominant species. As in the stream the most intense period of zooplankton species has been recorded in spring. In winter in the number of individuals and species diversity, reductions have been observed in the lake. It has been observed that there is a decrease in the number of zooplankton species and individuals in winter months.

In Behramaz Stream zooplankton species were recorded in every month samplings. The highest Shannon Wiener species richness index value has been calculated in June with *H'*=2.48. In addition, June was the sampling period with the highest Margalef richness index value with M=4.28. Considering the index results, it can be stated that Behramaz Stream is poor in terms of species richness. It can also be concluded that the stream has a low trophic level.

ACKNOWLEDGEMENT

This research was published as summary at the Ecology 2017 Symposium.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

FINANCIAL DISCLOSURE

The authors did not receive any financial support in conducting this study.

DECLARATION OF ETHICAL STANDARDS

The authors of this article declare that the materials and methods used in this study do not require ethical committee permission and/or legal-special permission.

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