



Zooplankton Diversity of Sevsak Stream (Elazığ-TURKIYE)

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

The zooplankton and its seasonal distribution of Sevsak Stream has been investigated in 2021. A total of 31 zooplankton species have been recorded in the stream. Among the zooplankton, 19 species belong to Rotifera, 9 species to Cladocera and 3 species to Copepoda. In every season, zooplankton species were recorded in various abundance. Highest number of taxa was recorded in spring. In this season also, an increase occurred in the individual numbers of species. *Keratella cochlearis*, *Polyarthra dolichoptera* and *Cyclops vicinus* were the most recorded species in the stream. As in the other aquatic habitat, rotifera group was determined as the most recorded species in terms of taxa and number of individuals.

Keywords: Zooplankton; rotifera; copepoda; cladocera; sevsak stream.

1. INTRODUCTION

Rotifera, Cladocera and Copepoda are the largest groups of zooplankton in freshwater environment, 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-fed fish species and young periods of demersal-fed fish [1,2].

In addition, zooplankton species are also used to determine water quality, trophic status of the lake and water pollution. With the increasing importance of zooplanktonic organisms, studies

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on Rotifera, Cladocera and Copepoda, which constitute an important part of zooplankton community in our country as well as in the world, have been started. Zooplankton of stagnant waters has great attention by the scientists in Turkey but studies on the streams are relatively few. By some of these studies, the rotifers of Gümüldür Stream [3], diversity of Rotifera in Tigris River [4], the Rotifers and its seasonal variations of Fırat River [5], the rotifers and its seasonal variations of Zikkım Stream [6], the rotifers of Asi River [7], the zooplankton of some rivers in Mediterranean Region [8], the Copepoda and Cladocera fauna of Asi River [9], the Rotifera fauna of Euphrates River basin [10] zooplankton structure of Karaman Stream [11] zooplankton succession of the Asi River [12] were assessed. This study aim is to identify the zooplankton and its seasonal composition in Sevsak Stream, where no previous relevant data are available.

2. MATERIALS AND METHODS

Hazar Lake, which is an important water source, within the borders of Elazığ province, 22 km from the city center. It is a tectonic lake. Its average depth is 93 m, its maximum length is 20 km, It has a maximum width of 5.4 km and an altitude of 1248 m. The streams feeding the Hazar Lake are called "fur streams" together with Sevsak Stream, Zikkım Stream,

Kürk Stream, Behramaz Stream and Mogal Stream. Sevsak Stream is located in the north east of the lake. The stream born from the high hills is poured into the lake through a channel after passing the state highway. Sevsak Stream is a small stream and can dry out completely in the hot months of some years [13,14,15]. Sampling stations in Sevsak Stream is given in Fig. 1.

Zooplankton samples were collected from three stations seasonally by using Hydro-Bios plankton net (25 cm in diameter, 100 cm in length, with a 55- μ m mesh size) between January-December 2021 and immediately fixed with a 4% solution of formalin. Samples were taken from stagnant or slow-running, vegetation-rich areas of the stream basin. Before examination under microscope samples was mixed then poured to a zooplankton counting chamber and then identified under a binocular microscope (Nikon) and counted under an inverted microscope (Leitz). To identify zooplankton species, various identification guides and literature were used [16-22].

Some physicochemical parameters, such as water temperature, electrical conductivity, pH, dissolved oxygen were also measured on-site simultaneously with the sampling time by using Oxi 315i/SET and Lamotte (pH 5-WC) brand digital instruments.



Fig. 1. The map showing sampling stations in Sevsak Stream

3. RESULTS AND DISCUSSION

During the study 31 zooplankton species have been recorded in the stream. Among the zooplankton 19 species belong to Rotifers, 9 species to Cladocera and 3 species to Copepoda. The list of the species and their seasonal distribution was given in Table 1.

As shown in the Table 1 in spring in every station the highest number of species were recorded. The highest number of taxa was recorded in the second station of spring period (18 species), the least number of taxa was recorded in the first station of the stream in winter. *K. cochlearis* and

P. dolichoptera from Rotifera were determined in 10 samplings. *C. retikulata* from Cladocera and *C. vicinus* from Copepoda were recorded the dominant species. *C. lacustris* recorded only the last stations. *D. forcipatus*, *T. tetractis* recorded only in one sampling. In every season zooplankton species have been identified from the stream.

Rotifera was found as the dominant group in terms of number of species and individuals. The ratio of species possessed by zooplankton groups was calculated as Rotifera 61.3%, Cladocera 29% and Copepoda 9.7%.

Table 1. The seasonal distribution of zooplankton in Sevsak Stream

	Seasons											
	Winter			Spring			Summer			Autumn		
	Stations											
	1	2	3	1	2	3	1	2	3	1	2	3
Rotifera												
<i>Asplanchna priodonta</i> Gosse, 1850		+		+	+	+		+	+		+	+
<i>Brachionus angularis</i> Gosse, 1851					+	+	+		+		+	
<i>Brachionus calyciflorus</i> Pallas, 1766				+				+			+	+
<i>Colurella obtusa</i> (Gosse, 1886)												
<i>Dicranophorus forcipatus</i> (O.F.Müller, 1786)				+								+
<i>Euchlanis dilatata</i> Ehrenberg, 1832					+	+		+	+	+	+	+
<i>Kellicottia longispina</i> (Kellicott, 1879)								+	+			
<i>Keratella cochlearis</i> (Gosse, 1851)	+		+	+	+	+	+	+		+	+	+
<i>Keratella quadrata</i> (Müller, 1786)					+	+		+	+		+	
<i>Lecane bulla</i> (Gosse, 1886)				+	+							
<i>Lecane closterocerca</i> (Schmarda, 1859)	+							+				
<i>Lecane flexilis</i> (Gosse, 1886)		+			+			+				
<i>Lecane luna</i> (O.F.Müller, 1776)					+		+					
<i>Lecane lunaris</i> (Ehrenberg, 1832)				+		+						
<i>Lepadella ovalis</i> (O.F.Müller, 1786)				+	+							
<i>Notholca squamula</i> (O.F.Müller, 1786)				+	+			+		+		
<i>Polyarthra dolichoptera</i> Idelson, 1925	+		+		+	+	+	+	+	+	+	+
<i>Synchaeta oblonga</i> Ehrenberg, 1831						+	+					
<i>Trichotria tetractis</i> (Ehrenberg, 1830)					+							
Cladocera												
<i>Bosmina longirostris</i> (O.F.Müller, 1785)		+	+		+		+					
<i>Chydorus sphaericus</i> (O.F. Müller, 1776)					+							+
<i>Ceriodaphnia reticulata</i> (Jurine, 1820)				+	+	+	+	+	+			+
<i>Coronetella rectangula</i> Sars, 1862					+		+					+
<i>Cornigerius lacustris</i> (Spandl 1923-1924)			+			+			+			+
<i>Daphnia longispina</i> O.F. Müller 1875			+	+	+	+		+				+
<i>Diaphanosoma lacustris</i> Korinek, 1981							+	+				
<i>Macrothrix laticornis</i> (Fischer, 1851)						+					+	
<i>Pleuroxus aduncus</i> (Jurine, 1820)		+						+		+		
Copepoda												
<i>Acanthopodiaptomus denticornis</i> (Wierzejski, 1887)		+	+	+							+	
<i>Cyclops vicinus</i> Uljanin, 1875	+		+	+	+				+		+	+
<i>Nitokra hibernica</i> (Brady, 1880)						+			+		+	
Total	4	5	6	11	18	13	9	14	10	6	10	11

Table 2. Some physical and chemical parameter values of Sevsak Stream

Parameters	Winter			Spring			Summer			Autumn		
	Stations											
	1	2	3	1	2	3	1	2	3	1	2	3
El. Conductivity (µS/cm)	315	302	320	298	302	296	345	344	352	302	305	329
pH	7.1	7.0	7.2	7.3	7.6	7.3	7.6	7.3	7.4	7.2	7.4	7.6
Dissolved oxygen (mg/L)	8.9	8.3	8.0	9.2	8.9	8.9	6.9	7.1	6.9	7.6	7.2	6.9
Temperature °C	5.5	7.2	8	9	11	11.5	16	14	12	12	12	13

In the stream pH values were changed between 7.1-7.6, dissolved oxygen 6.9-9.2 mg/L, electrical conductivity, 298-345 µS/cm and temperature 5.5.-16 °C (Table 2).

In recent years, many studies [23-37] showed that rotifers are the dominant group in running waters. The reason is that rotifers are less affected than other groups by the deterioration of water quality and display better adaptation to these conditions [1]. The importance of rotifers increases in comparison to cladocerans when the abundance of the latter is low [38]. Furthermore, rotifers are known as an opportunistic species in extreme conditions [39]. Within the last decade, because of the degradation of water quality of many wetlands for a variety of reasons (pollution, eutrophication, etc., and the effect of global warming), rotifers have become dominant species in many aquatic habitats [40]. In line with that finding, this study identified that most of the zooplankton species belonged to phylum Rotifera.

There are also zooplankton studies carried out in previous years in other streams flowing into the Hazar Lake, such as the Sevsak Stream. In Kürk Stream *Keratella cochlearis* from Rotifera *Cyclops vicinus* from Copepoda and *Ceriodaphnia reticulata* from Cladocera were took the first places according to frequency of occurrence [27]. In Behramaz Stream *Kellicottia longispina*, *K. cochlearis* and *C. vicinus* were recorded as dominant species [29]. In Hoşrük Stream [41] *Polyarthra dolichoptera* from rotifers has been detected in 10 months and is the most common species among all zooplankton species. *Cyclops vicinus* from Copepoda was the second dominant species observed for 9 months.

A one-year comprehensive zooplankton survey was conducted in Lake Hazar. As a result of the survey, 52 zooplankton species were found in the lake. In Hazar Lake *Brachionus quadridentatus* *Keratella quadrata* and

Synchaeta verrucosa has been most recorded Rotifera species. *Cyclops vicinus* from Copepoda was observed every month. *Alona rectangula*, *Cornigerus lacustris* and *Diaphanosoma lacustris* from Cladocera were the most abundant cladoceran species [42]. In Sevsak Stream Species from Ketatella e.g. *K. cochlearis* and *K. quadrata* have been investigated. *K. cochlearis* was observed every season, this species was recorded in all samples except 2 samples. *C. lacustris* and *D. lacustris*, which are brackish water species, are organisms belonging to the lake and have been recorded in small amounts at the last stations in the stream.

The common species in Hazar Lake and the streams flowing into the lake (Kürk, Behramaz Hoşrük Streams) *K. cochlearis*, *P. dolichoptera* and *C. vicinus* species [27,29,41]. These species have also been recorded in Sevsak Creek. In Hoşrük Stream [41], a total of 28 zooplankton species were recorded. Among these species, 18 species belong to Rotifera, 8 species to Cladocera and 2 species to Copepoda. In Kürk Stream [27] 9 species from Rotifera, 2 species from Cladocera, 2 species from Copepoda were identified. Another common finding is that rotifers are the most common species of all zooplankton in these wetlands. In addition, in these studies, it was reported that the most abundant zooplankton species in terms of the number of species and the number of individuals were in spring and summer. This finding is consistent with the zooplankton distribution of the Sevsak Stream.

Cornigerus species are endemic to the Ponto-Caspian, with the exception of *Cornigerus lacustris*, which is endemic to freshwater Lake Hazar in the Euphrates basin [43]. This species was recorded only in the last station next to Hazar Lake. This species living habitat known as Hazar Lake. The fact that the species was found at the last station connected to the lake indicates that this species is not a species belonging to

this stream. This species was not recorded in the researches carried out before in the Hoşrük Stream [41] Zikkim Stream [37] and Behramaz Stream [29] which spills into the lake. In Hazar Lake *C. lacustris* was found every month [42].

The QB/T index shows the rate of the number of *Brachionus* to the number of *Trichocerca*. The Q index is evaluated in three groups for the lake's trophic state, that Q=1 means oligotrophy, Q = 1.0-2.0 means mesotrophy, and Q>2 means eutrophy. In this study, Sevsak Stream was determined (2 species of *Brachionus*, *B. angularis* and *B. calyciflorus* and 1 species of *Trichocerca*, *T. tetractis*) QB/T 2/1=2. According to this, the Sevsak Stream showed mesotrophic property.

4. CONCLUSION

The zooplankton species found during the research are important as they are the first record for Sevsak Creek. In line with the findings, we can state that the stream is in a mesotrophic state. Hazar Lake has got a blue flag. Sevsak Stream, which is one of the streams pouring into the lake, should be protected in order not to be affected by pollutants and not to pollute the lake.

Fresh water is one of the indispensable riches for human life. It should be our first duty to protect them. Both authorities and citizens should protect the natural resources around them.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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