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Ahmet Bozkurt
Iskenderun Technical University, ahmet.bozkurt@iste.edu.tr,
Hatay-Türkiye
Rüstem Soydur
Iskenderun Technical University, rustem.soydur@gmail.com,
Hatay-Türkiye

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ORCID ID	0000-0001-6673-550X	0009-0003-9499-0956
Corresponding Author	Ahmet Bozkurt	

DETERMINATION OF CHANGES IN THE ZOOPLANKTON FAUNA OF SABUN STREAM (DÜZİÇİ/OSMANİYE) DURING THE FALL AND WINTER SEASONS

ABSTRACT

In this study, the zooplankton fauna of the Sabun Stream, located within the boundaries of Düziçi District in Osmaniye Province, was investigated through weekly sampling during the autumn and winter periods from October 2025 to January 2026. A total of 47 zooplankton species were identified, the vast majority belonging to the Rotifera group. Among the Rotifera, the families Notommatidae, Lecanidae and Lepadellidae were particularly prominent in terms of species diversity. Certain species from the genera *Cephalodella*, *Lecane*, *Colurella,* and *Lepadella* were consistently present throughout all sampling periods. In contrast, species such as *Leydigia leydigi*, *Alona guttata*, *Eucyclops speratus*, *Paracyclops fimbriatus,* and *Phyllognathopus viguieri* were observed in only a limited number of sampling periods and were classified as rare components. Significant fluctuations in the weekly distribution of the zooplankton community were observed. Total abundance values were largely determined by the dominance of rotifers. The highest zooplankton density was recorded in November. The number of species varied depending on the sampling time, reaching maximum levels at the end of December and the beginning of January. Examination of species abundance values showed that certain rotifer species played a decisive role in shaping the community structure by reaching high individual numbers. The study found that water temperature varied over time and that this variation affected zooplankton distribution. No significant difference was observed between stations in terms of species diversity and abundance. Therefore, the assessments were generally considered together.

Keywords: Sabun Stream, Rotifer, Cladoceran, Copepod, Systematic

1. INTRODUCTION

Freshwater ecosystems are highly valuable habitats because of the significant biological diversity they support, despite their limited water volume. These systems provide essential living environments for numerous species of invertebrates, fish, and plants across various tropical and temperate regions [1]. However, human-induced pressures such as water pollution, altered flow regimes, habitat destruction, and the spread of invasive species pose serious threats to freshwater biodiversity and are causing many species to become threatened [1]. Although urban stream ecosystems offer ecological and social benefits through water supply, flood control, and recreational services, urbanisation, pollution, and high population density can negatively impact these ecosystem services [2]. When climate change is also

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considered, the ecosystem services provided by river systems are further at risk. A modelling study in the Himalayan basin has shown that infrastructure management and climate scenarios can significantly affect the water regime and ecosystem services [3].

In aquatic ecosystems, zooplankton forms a key trophic link between phytoplankton and fish communities, playing a critical role in the transfer of matter and energy to higher trophic levels [4 and 5]. Zooplankton communities, comprising the Rotifera, Cladocera, and Copepoda groups, are reliable bioindicators for determining water quality due to their rapid response to changes in trophic structure and pollution levels [6]. Furthermore, freshwater metazooplankton contributes to the organic carbon and dissolved organic matter cycles by regulating phytoplankton growth, providing an important regulatory mechanism for the protection of water quality and the biological filtration of drinking water [4]. By recycling nutrients, including nitrogen (N) and phosphorus (P), zooplankton acts as a buffer in the ecosystem’s nutrient cycle and contributes to the transport of nutrients to higher trophic levels [4]. In freshwater ecosystems, changes in nutrient levels and temperature can significantly affect the biomass, diversity, and size structure of zooplankton communities [7]. Zooplankton also make a significant contribution to the nutrient cycle within the ecosystem, particularly in eutrophic reservoirs, by effectively recycling nutrients; they influence the availability of nutrients such as phosphorus and shape the size structure of the phytoplankton community [8]. Furthermore, factors such as species body size, feeding strategies, and resilience traits, alongside the structure and functional diversity of zooplankton communities, can be considered bioindicators due to their strong relationship with environmental factors in freshwater ecosystems under land-use pressure [5]. This study was conducted to identify the zooplankton fauna of the Sabun Stream, located in the Yenice Haruniye neighbourhood of Düziçi district, Osmaniye province, where no previous studies had been carried out. Thus, it represents the first study on rivers within the borders of Osmaniye province and makes a significant contribution to the understanding of river zooplankton fauna.

2. RESEARCH SIGNIFICANCE

This study was carried out to determine the zooplankton fauna of Sabun Stream located in Düziçi district of Osmaniye Province, which has not been studied on zooplankton until now. The zooplankton and its distribution in Sabun Stream were not studied before. This study is the first research on zooplankton in the Sabun Stream. It is hoped that this study will contribute to future studies on zooplankton.

Highlights:

- Identification of zooplankton species.
- Determination of the variation of zooplankton species.
- Determination of species richness and diversity of species recorded in the Stream.

3. MATERIALS AND METHODS

Zooplankton samples were collected weekly from 4 October 2025 to 10 January 2026 at two stations on the Sabun Stream in the Düziçi district of Osmaniye province (Station 1: 37°16'50.01"N, 36°27'38.97"E; Station 2: 37°16'52.01"N, 36°27'57.62"E) (Figure 1). The Sabun Stream, which originates in the Amanos Mountains, flows through a narrow, deep gorge with a base width narrowing to as little as 8-10 meters in places, before reaching the plateau from the mountainous region [9]. Upon entering the plain, it continues through a deep valley, first reaching the Ceyhan

River and then the Aslantaş Dam [10]. The Sabun Stream reaches its lowest flow rate of 0.5 m³/s in August; however, with increased rainfall beginning in October, a high flow rate of 8.8 m³/s is observed by March. This river, approximately 44 km long, has a 20-kilometer section within the Düziçi Plain [10 and 11].

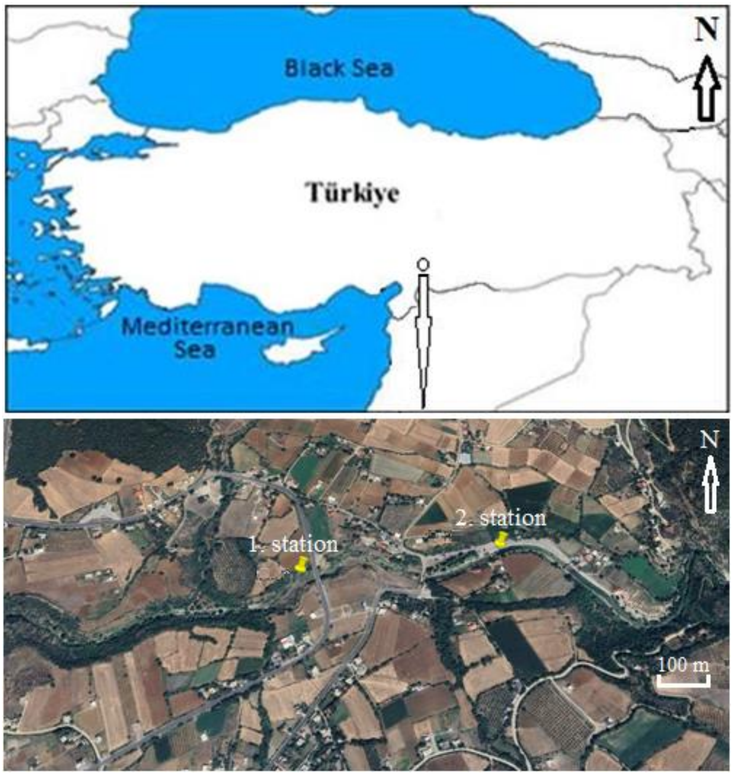

Figure 1. Study area and sampling stations

For systematic analyses, zooplankton samples were collected by holding a plankton net - with a mesh size of 60µm, a mouth diameter of 30cm, and a length of 1 meter - stationary in the flowing water for 45 minutes, and then transferring the samples to 500 ml plastic bottles. For quantitative analyses, 50 litres of water were collected using a 10-litre bucket, filtered through the plankton net, and the resulting samples were collected in 200 ml containers. The zooplankton samples were preserved in 4% formaldehyde. Among the physicochemical properties, temperature (°C) was measured using a portable Kumtel (Model HDFT-01) SCT. Zooplankton species were examined and identified using an inverted microscope and a binocular microscope (Olympus CH40). For quantitative analysis, all collected samples were placed in a Petri dish with parallel lines drawn on the base and counted, and the zooplankton abundance in 50 litres of water was determined. Soyer's [12] frequency index (%F) was used to express the frequency of zooplankton species identified from plankton samples in the study area. The results were categorised as constant (F≥76%), common (76%>F≥51%), occasional (51%>F≥26%), and rare (F<25%) (Table 2). The identification of zooplankton was accomplished using the following keys [13-24].

4. RESULTS

A total of 47 zooplankton species were identified in the study, comprising 39 species from 13 families of Rotifera, 5 species from 2 families of Copepoda, and 3 species from 1 family of Cladocera. Rotifera was the most dominant group (82.98%), followed by Copepoda (10.64%) and

Cladocera (6.38%). Within Rotifera, the highest number of species (9) was found in the Notommatidae family, followed by the Lecanidae family (8 species) and the Lepadellidae family (6 species). Three species were identified from the Trichocercidae family, while two species each were identified from the Trichotriidae, Dicranophoridae, Brachionidae, and Philodinidae families. The families with the fewest species - Euchlanidae, Ituridae, Mytilinidae, Proalidae, and Lindiidae - were each represented by a single species (Table 1). Four species from the Cyclopidae family within the order Copepoda and one species from the Phyllognathopodidae family were identified. Within the order Cladocera, only the Chydoridae family was represented, with three species identified (Table 1).

Table 1. Zooplankton species in Sabun Stream

Main groups	Family	Species
Rotifera	Brachionidae	*Brachionus calyciflorus* Pallas, 1766
		Keratella tecta (Gosse, 1851)
	Notommatidae	*Cephalodella catellina* (Müller, 1786)
		C. forficula (Ehrenberg, 1830)
		C. gibba (Ehrenberg, 1830)
		C. ventripes (Dixon-Nuttall, 1901)
		Eothinia elongata (Ehrenberg, 1832)
		Eosphora najas Ehrenberg, 1830
		Monommata longiseta (Müller, 1786)
		Notommata glyphura Wulfert, 1935
		N. pseudocerberus Beauchamp, 1907
	Lecanidae	*Lecane closterocerca* (Schmarda, 1859)
		L. flexilis (Gosse, 1886)
		L. hamata (Stokes, 1896)
		L. luna (Müller, 1776)
		L. lunaris (Ehrenberg, 1832)
		L. stenroosi (Meissner, 1908)
		L. bulla (Gosse, 1886)
		L. inermis (Bryce, 1892)
	Lepadellidae	*Colurella adriatica* Ehrenberg, 1831
		C. colurus (Ehrenberg, 1830)
		C. obtusa (Gosse, 1886)
		C. uncinata (Müller, 1773)
		Lepadella patella (Müller, 1773)
		L. acuminata (Ehrenberg, 1834)
	Lindiidae	*Lindia torulosa* Dujardin, 1841
	Philodinidae	*Dissotrocha aculeata* (Ehrenberg, 1832)
		D. hertzogi Hauer, 1939
	Proalidae	*Proales similis* de Beauchamp, 1907
	Trichocercidae	*Trichocerca porcellus* (Gosse, 1851)
		T. taurocephala (Hauer, 1931)
		T. tigris (Müller, 1786)
	Trichotriidae	*Trichotria tetractis* (Ehrenberg, 1830)
		T. pocillum (Müller, 1776)
	Dicranophoridae	*Dicranophorus epicharis* Harring & Myers, 1928
		Kostea wockei (Koste, 1961)
	Euchlanidae	*Euchlanis dilatata* Ehrenberg, 1832
	Ituridae	*Itura myersi* Wulfert, 1935
	Mytilinidae	*Lophocharis salpina* (Ehrenberg, 1834)
Cladocera	Chydoridae	*Alona guttata* Sars, 1862
		Coronatella rectangula (Sars, 1862)
		Leydigia leydigi (Schödler, 1863)
Copepoda	Cyclopidae	*Eucyclops speratus* (Lilljeborg, 1901)
		Macrocyclops albidus (Jurine, 1820)
		Microcyclops rubellus (Lilljeborg, 1901)
		Paracyclops fimbriatus (Fischer, 1853)
	Phyllognathopodidae	*Phyllognathopus viguieri* (Maupas, 1892)

Table 2. Abundance and sampling times of zooplankton species [1 (04.10.2025), 2 (10.10.2025), 3 (18.10.2025), 4 (25.10.2025), 5 (01.11.2025), 6 (07.11.2025), 7 (14.11.2025), 8 (21.11.2025), 9 (29.11.2025), 10 (06.12.2025), 11 (13.12.2025), 12 (19.12.2025), 13 (27.12.2025), 14 (02.01.2026), 15 (10.01.2026)].

Spec. Sampling Times	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Av	SD	F%
Rotifera																		
Brachionus calyciflorus											7					7		6.7
Keratella tecta		5														5		6.7
Cephalodella catellina					3	5	14	19	4	6					6	8	5.98	46.7
C. forficula							7			5	6			8	17	9	4.83	33.3
C. gibba	5	3	20	4	8	3	5	28	6	19	4	7	4	6	7	9	7.49	100
C. ventripes	7	12	8	6	3	5	4	61	6	7	25	4	5	7	28	13	15.33	100
Eothinia elongata		8			6		8		4	3			7			6	2.10	40
Eosphora najas						6		19		7	4	21	6	5	6	9	6.71	53.3
Monommata longiseta		5		7					4	6	8	6	9	7	4	6	1.72	60
Notommata glyphura	24		6		5	6	4	28	7	9						11	9.36	53.3
N. pseudocerberus											21	19	28	18	8	19	7.19	33.3
Lecane bulla		8			7											8	0.71	13.3
L. closterocerca	4	7					5	3	8	4		6	8	6		6	1.80	60
L. flexilis	18	24	7	5	4	6	8	82	7	6	26	42	17	21	19	19	20.26	100
L. hamata	5	9	6			7	5	4		8	9	6	7			7	1.71	66.7
L. inermis				4											8	6	2.83	13.3
L. luna	8	23	9	7	9	8	6	72	7	26	8	21	81	42	23	23	23.91	100
L. lunaris	8	9	7	9	8	7	7	79	9	8	24	76	90	56	65	31	32.08	100
L. stenroosi	6	29	9	7	6	8	8	66	9	6	5	7	22	7	9	14	15.94	100
Colurella adriatica	20	26	4	21	24	36	9	90	9	28	81	79	84	77	83	45	32.85	100
C. colurus						5	23		21		8	7		9		12	7.76	40
C. obtusa		4	7				8	6	7	9	18	6	24	4	5	9	6.32	73.3
C. uncinata	7	27	5	8		7	9	80	5	23	4	21	7	23	26	18	19.86	93.3
Lepadella acuminata								8			7		6	3	7	6	1.92	33.3
L. patella	7	5	8	4	7	19	9	18	5	6	87	7	22	18	79	20	26.26	100
Lindia torulosa					6								4	11	7	7	2.94	26.7
Dissotrocha aculeata		12			5									7		8	3.61	20
D. hertzogi		10			4							7	5	4		6	2.55	33.3
Proales similis								4			13	7	6	3	17	8	5.50	40
Trichocerca porcellus						9	7	4	6	7	5	15	7	14	11	9	3.72	66.7
T. taurocephala	4	10	6	4	5	7	5	17	4	6	4	4	7	6	9	7	3.44	100
T. tigris			5	6		3	7	16	5	5	32	4	7	5	6	8	8.12	80
Trichotria tetractis	18	22	5	5	3	6	26	68	7	22	7	5	8	6	9	14	16.59	100
T. pocillum					21		23	3	5	17	19	12	17	32	4	15	9.35	66.7
Dicranophorus epicharis	6	36	5	9	7	5	7	81	9	15	6	4	7	3	8	14	20.21	100
Kostea wockei		9							8	4	8	5	4	7	6	6	1.92	53.3
Euchlanis dilatata	18	5	8	7	3	6	21	64	4	37	26	22	17	38	7	19	16.97	100
Itura myersi							5			4						5	0.71	13.3
Lophocharis salpina		6			4		7	29		6	4	6	4	7	8	8	7.48	66.7
Avrage	10	13	7	7	7	8	10	38	7	11	17	16	18	15	18			
SD	6.7	9.5	3.6	4.1	5.46	7.31	6.36	31.7	3.5	8.8	21	20	24	17	22			
Cladocera																		
Alona guttata			7	5												6	1.41	13.3
Coronatella rectangula					6										5	6	0.71	13.3
Leydigia leydigi		3	5													4	1.41	13.3
Avrage		3	6	5	6										5			
SD			1.4															
Copepoda																		
Eucyclops speratus		4	6	3				4	3	5	7	5	4	6		5	1.34	66.7
Macrocyclops albidus											4		6			5	1.41	13.3
Microcyclops rubellus												3				3		6.7
Paracyclops fimbriatus	4		3		3		7		6	5	9	4	3	7		5	2.08	66.7
Phyllognathopus viguieri					3			5								4	1.41	13.3
Avrage	4	4	5	3	3		7	5	5	5	7	4	4	7				
SD			2.1					0.71	2.1		2.5	1	1.5	0.7				
General average	10	12	7	7	7	8	9	35	7	11	16	15	17	15	17			
General SD	6.7	9.5	3.4	4	5.22	7.31	6.25	31.8	3.4	8.7	20	19	23	17	21			
Number of species	17	26	21	18	24	20	27	27	26	30	31	30	32	32	29			

The water temperature in Sabun Stream ranged from a minimum of 8.8°C at Station 1 (2 January 2026) to a maximum of 20.6°C at the same station (1 October 2025). The average temperature ranged from a minimum of 11.10±1.13°C to a maximum of 20±0.85°C (Table 3).

Table 3. Temperature and sampling dates [1 (4 October 2025). 2 (10 October 2025). 3 (18 October 2025). 4 (25 October 2025). 5 (1 November 2025). 6 (7 November 2025). 7 (14 November 2025). 8 (21 November 2025). 9 (29 November 2025). 10 (6 December 2025). 11 (13 December 2025). 12 (19 December 2025). 13 (27 December 2025). 14 (2 January 2026). 15 (10 January 2026)]

	Sampling time Temperature (°C)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 St	20.6	19.8	19.1	17.4	17.9	17.1	15.1	16.3	13.1	12	12.9	11.3	13.3	8.8	10.3
2 St	19.4	18.2	17.2	17	17.3	15.9	14.8	15.9	12.9	13	13.9	13.3	14.6	10.9	11.9
Ave.	20	19	18.15	17.2	17.6	16.5	14.95	16.1	13	12.5	13.4	12.3	13.95	9.85	11.1
SD	0.85	1.13	1.34	0.28	0.42	0.85	0.21	0.28	0.14	0.71	0.71	1.41	0.92	1.48	1.13

Although sampling was conducted at two different stations, the stations were not assessed separately, as species diversity and abundance at both locations were virtually identical. According to the frequency index, 14 species (F≥76%) were classified as common, 12 species (75%>F≥ 51%) as widespread, 9 species (50%>F≥26%) as occasional, and 12 species (F<26%) as rare. Among the abundant species, *Cephalodella gibba*, *C. ventripes*, *Lecane flexilis*, *L. luna*, *L. lunaris*, *L. stenroosi*, *C. adriatica*, *L. patella*, *T. taurocephala*, *T. tetractis*, *D. epicharis*, and *E. dilatata* were present at all sampling times and had the highest frequency (100%). *C. uncinata* (93%), *T. tigris* (80%), *C. obtusa* (73.3%), *L. hamata*, *T. porcellus*, *T. pocillum*, *Lophocharis salpina*, *E. speratus*, and *P. fimbriatus* (66.7%) were common zooplanktonic organisms found in most sampling periods (Table 2). Species with low frequency values, found in a limited number of sampling periods, included *B. calyciflorus, K. tecta, and M. rubellus* (frequency values 6.7%). *L. bulla*, *L. inermis*, *I. myersi*, *A. guttata*, *C. rectangula*, *L. leydigi*, *M. albidus*, and *P. viguieri* (frequency values 13.3%) were identified as rare components within the community.

Total zooplankton abundance fluctuated throughout the sampling periods. Overall abundance values were largely determined by the dominance of rotifers, while the quantities of cladocerans and copepods had no significant effect. The highest zooplankton density was recorded during the eighth sampling period, on 21 November 2025, with an average of 35 individuals (ind.) per 50 litres. This was followed by the 13th and 15th periods (27 December 2025 - 10 January 2026) with an average of 17 ind., the 11th period (13 December 2025) with an average of 16 ind., and the 12th and 14th periods (19 December 2025 - 2 January 2026) with an average of 15 ind. Abundance analyses showed that some species reached quite high average ind. counts. *C. adriatica* had the highest abundance, with an average of 45 ind. per 50 litres. This species was followed by *L. lunaris* (31 ind.), *L. patella* (26 ind.), *L. luna* (23 ind.), *L. flexilis* (19 ind), and *C. ventripes* (13 ind.).

Sampling times influenced the number of species, and results varied accordingly. The highest number of species was observed during the 13th and 14th sampling periods (32 species), followed by the 11th period (31 species), the 10th and 12th periods (30 species), and the 15th period (29 species).

5. DISCUSSION

When the composition and temporal dynamics of the zooplankton community in Sabun Stream are considered together, it is clear that the system displays the characteristics of a typical lotic ecosystem, yet is distinctly shaped by the influence of microhabitats of littoral and periphytic origin. The fact that 39 out of 47 taxa belong to the Rotifera, and that the families Notommatidae, Lecanidae, and Lepadellidae are particularly dominant in terms of species richness, aligns with the rotifer dominance frequently reported in riverine environments. The rotifers’ short life cycle, capacity for parthenogenetic reproduction, and ability to respond rapidly to variable environmental conditions give this group an advantage, particularly in hydrodynamically unstable systems such as streams [25 and 26]. In this context, the structure observed in the Sabun Stream indicates a zooplankton community that is drift-fed and periphytic in origin, rather than planktonic.

At the family and genus levels, the high representation of taxa such as *Lecane*, *Colurella*, *Lepadella*, *Cephalodella*, and *Notommata*, characterised by high species and individual numbers, indicates that the system supports a high diversity of microhabitats. Members of the Lecanidae are generally found in microhabitats associated with epiphytic and benthic surfaces, rich in organic matter and characterised by low flow velocity; members of the Lepadellidae and Colurellidae are similarly concentrated in periphytic and detrital environments [16 and 25]. The consistent presence of species such as *C. adriatica*, *L. lunaris*, *L. luna*, and *L. patella* at 100% frequency in the Sabun Stream suggests that these species can be considered indicator species with broad ecological tolerance, eurytopic characteristics, and the ability to utilise habitat continuity. It is known that the *L. lunaris* and *L. bulla* complex is particularly widespread in conditions rich in organic matter and in mesotrophic-eutrophic environments [27]. This suggests that the situation may be related to increased nutrient salt inputs and organic matter accumulation in the Sabun Stream during certain periods.

The high abundance and prevalence of species from the Notommatidae family (e.g. *C. ventripes*, *C. gibba*, *N. glyphura*) suggest that microfaunal predation and trophic interactions are active within the system. Members of this family are generally predatory or omnivorous and feed on protozoa and small rotifers [25]. Consequently, the dominance of this group in the Sabun Stream indicates that the producer level is well-established and that trophic networks within the microzooplankton are also well-developed. When assessed in terms of the system’s energy transfer efficiency, this situation suggests that a linking mechanism operates between the microbial cycle and the classical planktonic food chain.

The fact that the Cladocera group is represented solely by the Chydoridae family, and that the number of species remains quite limited, reflects the hydrodynamic selection pressure frequently observed in streams. Members of the Chydoridae are generally benthic and epiphytic in lifestyle and have developed substrate-dependent life strategies [28]. The low frequency of species such as *A. guttata*, *C. rectangula,* and *L. leydigi* in the Sabun Stream suggests that this group is restricted to limited areas where suitable microhabitats are present. Conversely, the absence of pelagic cladocerans indicates that current velocity and instability of the water column act as limiting factors for these organisms.

Within the Copepoda group, the higher frequency of Cyclopidae members (particularly *E. speratus* and *P. fimbriatus*) (66.7%) suggests that these taxa have a broad environmental tolerance. Cyclopoid copepods are generally widespread in mesotrophic-eutrophic systems and form an important intermediate link in the food web by feeding on detritus, bacteria, and small planktonic organisms [29]. Therefore, the presence of this group in the Sabun Stream indicates that the system is not entirely oligotrophic but has a certain level of nutrient input and organic productivity. Conversely, the low frequency (13.3%) of species such as *M. albidus* and *P. viguieri* suggests that these species have more specific habitat requirements. Species belonging to the order Cyclopoida (*Eucyclops*, *Macrocyclops*, *Microcyclops*, and *Paracyclops*) are predominantly concentrated in littoral zones, microhabitats associated with macrophytes, and benthic-pelagic transition zones [29 and 30]. The presence of these species suggests that habitat complexity is high within the study area and that macrophyte development, in particular, plays a decisive role in the ecosystem structure. Furthermore, many members of these genera can be actively found at the sediment-water interface, including in hyporheic zones [31]. This indicates that, in the system under investigation, not only the surface water column but also the microhabitats within the sediment provide suitable conditions for zooplankton.

The combined assessment of the species *E. speratus*, *M. albidus*, *M. rubellus*, *P. fimbriatus*, and *P. viguieri* identified in this study has enabled a comprehensive interpretation of the ecological structure, trophic organisation, and habitat heterogeneity of the study area. The species composition obtained carries a meaningful environmental signal, particularly regarding the ecological tolerances and feeding strategies of the Cyclopoida and Harpacticoida groups.

Given the trophic position of cyclopoid species, *M. albidus*, in particular, is known to act as a top-level control mechanism within the zooplankton community due to its predatory nature [32]. In contrast, species such as *M. rubellus* and *P. fimbriatus* exhibit a more omnivorous feeding strategy, feeding on microzooplankton [33]. This indicates that both secondary consumers and organisms at lower trophic levels coexist in Sabun Stream, and that the trophic structure is balanced.

The presence of *P. viguieri*, a member of the Harpacticoida order, clearly demonstrates the importance of the system's benthic and interstitial components. As these species generally feed on detritus and bacterial production, this indicates that the microbial cycle is robust within the system and that detritus-based energy flow plays a significant role [34]. In this context, it is clear that Sabun Stream is not merely a system reliant on autotrophic production, but that heterotrophic processes are also prominent.

When the trophic levels of the species are considered together, it is clear that the system has a multi-layered food web structure. Members of the Cyclopoida generally act as secondary consumers, feeding on protozoa, rotifers, and small zooplankton, while members of the Harpacticoida predominantly follow a detritivore-microbivore feeding strategy [30]. This indicates that both the classical food chain, based on autotrophic production, and the detritus-based microbial cycle operate simultaneously. Consequently, it is understood that the system's energy flow is not limited to phytoplankton production, but that processes based on organic matter recycling are also significant.

When temperature data and zooplankton dynamics are considered together, the increase in species richness despite a gradual decrease in temperature from approximately 20°C to 10°C can be explained by the fact that different species have different thermal optima and broad thermal tolerance ranges, as seen in rotifers [35]. Therefore, the increase observed in the Sabun Stream can be attributed to the emergence of cold-water-tolerant species as temperatures fall and to increased species overlap. Additionally, the increased input of organic matter into river systems during the autumn-winter transition and the relative stabilisation of hydraulic conditions can positively affect zooplankton diversity [36].

An assessment of the community's indicator characteristics suggests that Sabun Stream generally exhibits a mesotrophic character, although organic matter inputs have an impact at the local scale. In particular, the presence of species such as *B. calyciflorus* and *K. tecta* is frequently described in the literature as indicative of eutrophic and nutrient-rich environments [27]. The low frequency of these species suggests that occasional increases in nutrient loads within the system result in only temporary effects. In contrast, the prevalence of *Lecane*, *Colurella*, and *Trichocerca* species is considered indicative of a more periphytic and heterogeneous habitat structure.

6. CONCLUSION AND SUGGESTIONS

Consequently, it has been demonstrated that the zooplankton community of the Sabun Stream: (i) is dominated by Rotifera, (ii) is characterised by the predominance of littoral-periphytic families, (iii) exhibits a limited but ecologically significant presence of Chydoridae, and (iv) has a Copepoda composition dominated by Cyclopidae, reflecting a typical river zooplankton structure. Considering the ecological characteristics of the species, it is evident that the system is shaped not only by physicochemical parameters but also by microhabitat diversity, organic matter dynamics, and trophic interactions. In this context, the study demonstrates once again that zooplankton is not merely a biological component but also a powerful bioindicator of the trophic status and ecological integrity of river ecosystems.

CONFLICT OF INTEREST

The authors declare that they have no potential conflict of interest.

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DECLARATION OF ETHICAL STANDARDS

The authors of the article declare that the materials and methods used did not require ethics committee approval and/or regulatory approval.

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