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SYSTEMATIC ANALYSIS OF ZOOPLANKTON IN ZUFRUN CREEK (İSKENDERUN/TÜRKIYE)

ABSTRACT

A total of 50 zooplankton species were identified in the study, comprising 32 rotifers, 11 copepods, and 7 cladocerans. Of the 10 families within Rotifera, Lecanidae was identified as possessing the greatest species diversity, with 7 species. According to the frequency index, 12 species were classed as constant, 19 species as common, 14 species as occasional, and 5 species as uncommon. Among the intense species observed at all sample dates, *Lepadella patella* and *Trichocerca taurocephala* were determined to have the greatest frequency (100%). In Cladocera, *Chydorus sphaericus*, *Coronatella rectangula*, *Oxyurella tenuicaudis,* and *Pleuroxus aduncus* documented in 8 samplings had the highest frequency (53%) seen in the same periods within Cladocera. On the other side, *Epactophanes richardi* exhibited the largest dispersion (93% frequency) among copepods (found in 14 samplings). *Kostea wockei*, which has an Afrotropical, Neotropical, and Palearctic distribution and has not been documented from our country before, is a new record for Turkish inland waters.

Keywords: Zufrun Creek, Rotifer, Cladocer, Copepod, New Record

1. INTRODUCTION

Zooplankton, which comprises the second link of the food chain in aquatic environments, is a key step in the transition of energy from producers to consumers [1]. As a vital element of the food web in water bodies, zooplankton plays an important role in the construction and functioning of aquatic ecosystems [2 and 3]. This assemblage of planktonic organisms facilitates the self-purification of various aquatic habitats and constitutes a fundamental food source for numerous fish species [4 and 5]. Zooplankton serve a vital function as effective filter feeders on phytoplankton and as a food supply for other invertebrates, fish larvae, and fish [6]. In natural ecosystems, they meet the nutritional demands of invertebrates and fish and are indicator organisms that determine the water character, pollution, and eutrophication condition of the waters they are in [7 and 8]. Zooplankton abundance and composition are intimately related to water quality and display a growing and declining pattern depending on the trophic levels of the waters. Various contaminants influence freshwater ecosystems by causing habitat degradation and loss of biodiversity, and by severely compromising the functioning and services of aquatic ecosystems [9]. Eutrophication similarly influences zooplankton composition by transitioning from bigger species, such as Calanoid copepods, to smaller species, especially rotifers [10]. Zooplankton play a critical role in the pelagic food web by transmitting photosynthetic energy at higher trophic levels, and the status of zooplankton, especially in the first

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feeding stage of fish larvae, and in later stages, can regulate the yearly catch rate of commercial fish stocks.

Streams sustain zooplankton by providing them with a complex habitat and so contribute to their high biodiversity [11 and 12]. Two categories affect plankton abundance in streams: variables affecting the transit of organisms into streams and factors affecting the growth and reproduction of organisms in the stream [11]. Plankton often flows from stagnant waters to streams by channels and seepage [13]. The destiny of plankton in the stream channel depends largely on the ability of the organisms to grow and reproduce. Plankton density can grow downstream in some big streams, indicating that populations may be rising [14]. Conversely, increases may fluctuate periodically and according to the flow, or may not transpire at all [11]. Consequently, research on zooplankton is of paramount significance. Water flow, which modifies the hydromorphology of the river, has a major effect on lotic ecosystems [6]. Although the zooplankton of still waters has been thoroughly studied in Türkiye, studies on streams are comparatively scarce. This study was done to evaluate the zooplankton fauna of Zufrun Creek, which is located in Suçıkağı area of İskenderun district of Hatay province and has not been examined before.

2. RESEARCH SIGNIFICANCE

This study was carried out to determine the zooplankton fauna of Zufrun Creek located in İskenderun district of Hatay province, which has not been studied for zooplankton until now. The zooplankton and their distribution in Zufrun Creek were not studied before. This study is the first research on zooplankton in the Zufrun Creek. It is aimed 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 Creek.

3. MATERIALS AND METHODS

Zufrun Creek originates from the İskenderun Suçıkağı Village, links to the flood prevention canal passing through the city and flows approximately 8 km before emptying into the sea (İskenderun Bay). Since the creek, which is fed by spring water, is used for garden irrigation, its waters cannot reach the canal, especially during hot periods. On the creek where fish are fed, there are two trout ponds and one fish restaurant. Zooplankton sampling was carried out 15 times between October 2024 and April 2025 from two sites, namely the top section (36°33'47"N, 36°12'46"E) and the bottom part (36°33'51"N, 36°12'40"E) of the fish ponds. Sampling was carried out with a plankton net with a 60 μm mesh size, 30 cm mouth diameter, and 1 m length. Sampling was carried out from the flowing area of the water for around 25-30 minutes by keeping the plankton net motionless. In addition, sampling was gathered from the pond, among plants, and from litter leaves. Samples were placed in 500 ml plastic vials and stored with 4% formaldehyde. Dissolved oxygen, water temperature, and conductivity were determined on-site using digital measuring devices (oxygen and temperature: YSI Model 52 oxygen meter; conductivity: YSI Model 30 salinometer). Zooplankton samples were examined using an inverted microscope and a binocular microscope (Olympus CH40). Approximately 20 cc of each sample was sub-sampled, and species were identified in petri plates. This technique was done at least 3 times to identify all species present. Soyer's [15] frequency index (%F) was used to express the frequency of zooplankton species identified from plankton samples in the research area. The results were divided into groups of constant (F≥76%), common (76%>F≥51%), occasional (51%>F≥26%) and rare (F<25%) (Table 2). Zooplankton were identified using the keys Scourfield and Harding, Dussart, Damian-Georgescu, Smirnov, Ruttner-Kolisko, Kiefer and Fryer, Koste, Negrea, Reddy, Borutsky, Nogrady and Pourriot, Segers, De Smet, Smirnov, and Dussart and Defaye [16-30].

4. RESULTS AND DISCUSSION

Water temperature fluctuated between 13.50°C (April 11) and 16.70°C (October 29), with a mean value of 15.44±1.05°C (Table 1). The dissolved oxygen concentration varied from 8.62 mg L^{-1} (April 24) to 9.93 mg L^{-1} (November 12), with a mean value of 9.40±0.44 mg L^{-1} (Table 1). The conductivity value was 423.34±6.78 µS cm^{-1} on average, with a range of 412.6 µS cm^{-1} on April 11 to 438.5 µS cm^{-1} on December 25 (Table 1).

Table 1. Distribution of Temperature, Electrical Conductivity, and Dissolved Oxygen levels

Sampling Time			Temp(C°)	Cond (µS/cm)	Dis Oxy (mg/L)
2024	October	16	16.0	430.0	9.63
		22	16.1	429.9	9.59
		29	16.7	426.4	9.78
	November	05	16.6	425.6	8.75
		12	16.5	422.4	9.93
		27	14.0	421.3	9.59
	December	04	14.8	416.6	9.78
		11	15.9	417.0	8.75
		17	14.6	418.5	9.71
		25	14.7	438.5	9.33
2025	January	07	15.3	421.2	8.91
	March	14	16.2	416.3	9.30
		27	14.3	428.3	9.36
	April	11	13,5	412.6	9.92
		24	16.4	425.3	8.62
Average			15.44±1.05	423.34±6.78	9.40±0.44

A total of 50 species were discovered, of which 32 species were Rotifera (64%), 11 species were Copepoda (22%), and 7 species were Cladocera (14%) (Table 2). With seven species, the Lecanidae family was the most prevalent among the rotifers, out of the ten families that were found. Notommatidae, Lepadellidae, and Dicranophoridae came next with five different species each. The Brachionidae family comprised three species, while the Trichotriidae and Trichocercidae families each included two species. The families Euchlanidae, Philodinidae, and Testudinellidae were each represented by one species. Three families of Cladocera were documented, with the Chydoridae including five species, whereas the two families, Daphnidae and Bosminidae, each included one species (Table 2). Within the five families of Copepoda, the Cyclopidae comprised five species, the Canthocamptidae included three species, and the remaining families (Diaptomidae, Phyllognathopodidae, Parastenocarididae) each contained one species (Table 2).

Table 2. Zooplankton taxa of Zufrun Creek

ROTIFERA		
Notommatidae	*Cephalodella gibba* (Ehrenberg, 1830)	*C. ventripes* (Dixon-Nuttall, 1901)
	C. forficula (Ehrenberg, 1830) *Notommata* sp.	*C. misgurnus* Wulfert, 1937
Lepadellidae	*Colurella adriatica* Ehrenberg, 1831	*Lepadella patella* (Müller, 1773)
	C. obtusa (Gosse, 1886)	*L. ovalis* Müller, 1786
	C. uncinata Mueller 1773	
Euchlanidae	*Euchlanis dilatata* Ehrenberg, 1832	
Brachionidae	*Keratella cochlearis* (Gosse, 1851)	*K. serrulata* (Ehrenberg, 1838)
	K. tecta (Gosse, 1851)	
Lecanidae	*Lecane closterocerca* (Schmarda, 1859)	*L. lunaris* (Ehrenberg, 1832)
	L. hamata (Stokes, 1896)	*L. flexilis* (Gosse, 1886)
	L. inermis (Bryce, 1892)	*L. stenroosi* (Meissner, 1908)
	L. luna (Müller, 1776)	
Trichocercidae	*Trichocerca taurocephala* (Hauer, 1931)	*T. porcellus* (Gosse, 1851)
Dicranophoridae	*Paradicranophorus hudsoni* (Glasscott, 1893)	*Dicranophorus secretus* Donner, 1951
	Kostea wockei (Koste, 1961)	*Encentrum uncinatum* (Milne, 1886)
	Proales similis de Beauchamp, 1907	
Philodinidae	*Dissotrocha hertzogi Hauer*, 1939	
Testudinellidae	*Testudinella patina* (Hermann, 1783)	
Trichotriidae	*Trichotria pocillum* (Müller, 1776)	*T. tetractis* (Ehrenberg, 1830)
CLADOCERA		
Daphnidae	*Ceriodaphnia reticulata* (Jurine, 1820)	
Bosminidae	*Bosmina longirostris* (Müller, 1776)	
Chydoridae	*Chydorus sphaericus* (Müller, 1776)	*Oxyurella tenuicaudis* (Sars, 1862)
	Coronatella rectangula (Sars, 1862)	*Pleuroxus aduncus* (Jurine, 1820)
	Leydigia leydigi (Schödler, 1863)	
COPEPODA		
Cyclopidae	*Acanthocyclops viridis* (Sars, 1863)	*Paracyclops fimbriatus* (Fischer, 1853)
	Diacyclops sp.	*Tropocyclops prasinus* (Fischer, 1860)
	Microcyclops rubellus (Lilljeborg, 1901)	
Diaptomidae	*Arctodiaptomus similis* (Baird, 1859)	
Canthocamptidae	*Epactophanes richardi* Mrázek, 1893	*Bryocamptus zschokkei* (Schmeil, 1893)
	Bryocamptus minutus (Claus, 1863)	
Phyllognathopodidae	*Phyllognathopus viguieri* (Maupas, 1892)	
Parastenocarididae	*Kinnecaris xanthi* Bruno & Cottarelli, 2015	

Lepadella patella and *Trichocerca taurocephala* were the most often observed rotifers across all sampling periods, with *Cephalodella gibba* (discovered at sampling number 14) coming in second (Table 2). Among the Cladocera, *Chydorus sphaericus*, *Coronatella rectangula*, *Oxyurella tenuicaudis*, and *Pleuroxus aduncus*, which were documented in eight samples, exhibited the most extensive habitat distribution, followed by *Ceriadaphnia reticulata* and *Bosmina longirostris* (documented in six samples). Conversely, *Epactophanes richardi* exhibited the most extensive distribution among copepods, identified in 14 sampling instances, followed by *Acanthocyclops viridis*, which was discovered in 9 sampling instances (Table 2). Some zooplankton species had a limited range and were only discovered in 3 sampling times: *Lepadella ovalis*, *Lecane stenroosi* (Rotifera), *Leydigia leydigi* (Cladocera), *Diacyclops* sp. and *Phyllognathopus viguieri* (Copepoda) (Table 2). The majority of zooplankton species, totaling 40, were documented in November. This was followed by April 24 with 39 species, November 5, with 35 species and December 25 and April 11 with 33 species.

Table 3. Presence and absence of zooplankton according to sampling times in Zufrun Creek (-: Absent, +: available)

	Sampling Time															
Years	2024										2025					
Months	Oct			Nov			Dec				Jan	Mar		Apr		
Sampling days	16	22	29	05	12	27	04	11	17	25	07	14	27	11	24	F%
ROTIFERA																
Notommatidae																
Cephalodella forficula	+	+	+	+	-	-	+	+	+	-	+	+	+	+	+	80
C. gibba	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	93
C. misgurnus	+	+	+	+	+	+		+	+	+	+	+	+	-	+	87
C. ventripes	+	+	+	+	+	+	+	-	-	+	+	+	+	+	+	87
Notommata sp.	+	+	+	+	+	+	-	+	+	+	+	-	-	-	-	67
Lepadellidae																
Colurella adriatica	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	87
C. obtusa	+	+	+	+	+	+	+	-	-	+	-	+	-	-	+	67
C. uncinata	+	-	-	+	+	-	-	-	+	+	-	+	-	-	+	47
Lepadella patella	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	100
L. ovalis	-	-	-	-	-	-	-	-	+	+	-	-	-	-	+	20
Euchlanidae																
Euchlanis dilatata	+	-	-	-	+	+	+	+	+	+	+	+	+	+	+	80
Brachionidae																
Keratella cochlearis	-	+	-	-	+	+	-	+	-	+	+	-	+	+	+	60
K. tecta	+	+	-	+	-	+	+	-	+	+	-	+	+	+	+	73
K. serrulata	+	+	-	+	-	-	+	-	-	-	+	+	-	+	+	53
Lecanidae																
Lecane closterocerca	+	+	-	+	+	+	-	+	+	-	+	-	+	+	+	73
L. hamata	+	-	+	-	-	+	-	+	+	+	+	-	+	-	+	60
L. inermis	+	+	-	+	+	-	+	+	+	+	-	+	+	+	+	80
L. luna	+	+	+	+	+	+	-	-	-	+	+	-	-	+	+	67
L. lunaris	+	+	+	+	+	+	+	+	+	+	+	+		+		87
L. flexilis	-	+	-	-	-	-	+	-	-	+	-	+	+	+	+	47
L. stenroosi	-	+	-	-	-	-	-	-	-	+	-	-	-	-	+	20
Trichocercidae																
Trichocerca taurocephala	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	100
T. porcellus	-	-	-	-	+	-	-	-	-	+	-	-	+	+	+	33
Dicranophoridae																
Dicranophorus secretus	+	-	-	+	+	-	-	+	+	+	-	-	+	+	+	60
Encentrum uncinatum	-	+	-	-	+	+	+	-	-	+	-	-	+	-	-	40
Paradicranophorus hudsoni	-	+	+	+	+	-	-	-	-	-	+	-	+	+	+	53
Kostea wockei	-	-	-	-	+	-	-	+	-	+	-	-	-	+	+	33
Proales similis	-	-	-	+	+	-	+	+	+	-	+	-	+	-	-	47
Philodinidae																
Dissotrocha hertzogi	+	+	+	+	+	+	+	+	-	+	+	-	-	-	+	73
Testudinellidae																
Testudinella patina	-	-	-	+	+	-	-	-	+	+	-	-	-	-	+	33
Trichotriidae																
Trichotria pocillum	+	+	+	+	+	-	-	+	+	+	-	+	+	+	+	80
T. tetractis	+	+	+	-	+	-	-	-	+	+	-	+	+	-	-	53
CLADOCERA																
Bosminidae																
Bosmina longirostris	-	+	-	+	+	-	-	-	-	-	+	-	+	-	+	40
Daphnidae																
Ceriodaphnia reticulata	-	-	-	+	+	-	-	-	-	-	-	+	+	+	+	40
Chydoridae																
Chydorus sphaericus	+	+	-	+	+	-	-	-	-	-	-	+	+	+	+	53
Coronatella rectangula	+	+	-	+	+	-	-	-	+	-	-	+	-	+	+	53
Leydigia leydigi	-	-	-	-	+	-	-	-	-	-	-	-	+	-	+	20
Oxyurella tenuicaudis	+	+	-	-	+	-	-	-	-	-	+	+	+	+	+	53
Pleuroxus aduncus	+	+	-	+	+	-	-	-	-	-	-	+	+	+	+	53
COPEPODA																
Cyclopidae																
Acanthocyclops viridis	-	-	+	-	-	-	+	+	-	+	+	+	+	+	+	60
Diacyclops sp.	-	-	+	-	-	-	+	-	-	-	+	-	-	-	-	20
Microcyclops rubellus	-	-	+	+	+	-	-	-	+	+	+	-	-	+	+	53
Paracyclops fimbriatus	+	-	-	+	+	-	-	-	+	+	-	-	+	+	+	53
Tropocyclops prasinus	-	-	-	+	+	-	-	-	-	-	-	+	-	+	-	27
Diaptomidae																
Arctodiaptomus similis	-	+	+	+	+	-	-	-	-	+	-	+	+	-	-	47
Canthocamptidae																
Epactophanes richardi	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	93

Bryocamptus minutus	-	-	+	+	-	-	-	-	-	+	-	-	-	+	-	27
B. zschokkei	-	-	-	+	+	-	-	-	+	-	+	-	+	+	+	47
Phyllognathopodidae																
Phyllognathopus viguieri	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	13
Parastenocarididae																
Kinnecaris xanthi	-	-	-	+	+	-	-	-	-	-	+	-	-	+	-	27
Total number of species	28	30	22	35	40	18	19	20	24	33	26	26	30	33	39	

The results were classed as constant (F≥76%), common (76%>F≥51%), occasional (51%>F≥26%), and unusual (F<25%).

When examined according to the frequency index, 12 species (F≥76%) were categorized as constant, 19 species (75%>F≥51%) were classed as common, 14 species (50%>F≥26%) were classified as occasionally and 5 species (F<26%) were classified as rare. *Lepadella patella* and *Trichocerca taurocephala* had the highest frequency (100%) across all sampling intervals among these dense species. *Cephalodella gibba* and *Epactophanes richardi* (93%), *Cephalodella ventripes*, *C. misgurnus*, *Colurella adriatica*, *Lecane lunaris* (87%), *Cephalodella forficula*, *Euchlanis dilatata*, *Lecane inermis*, *Trichotria pocillum* (80%), *Keratella tecta*, *Lecane closterocerca*, and *Dissotrocha hertzogi* (73%) are additional zooplanktonic organisms commonly observed (Table 2).

Figure 1. *Kostea wockei*. A: Habitus (Bar 50 µm), B: Trophi (10 µm)

Genus *Kostea* De Smet, 1997
Kostea wockei (Koste, 1961)
Syn.: *Paradicranophorus wockei* Koste, 1961 [79]

Kostea wockei (Koste, 1961), a new record for Turkish inland waters, was first designated *Paradicranophorus wockei* by Koste [31], but was later included in the new genus *Kostea* by De Smet [32] due to major changes in body and trophic morphology. *K. wockei*, having an Afrotropical, Neotropical, and Palearctic distribution [33], has been recorded as a coastal rotifer, usually occupying sandy and muddy strata of both stagnant and flowing waters [22 and 32].

K. wockei, as depicted in Figure 1A Body fusiform; 3-4 pairs of symmetrically arranged, hook-shaped lateral processes; numerous pseudosegments; posterior end of body markedly wrinkled. Rostrum wide and bluntly trilobed. Foot exceedingly short, aligned with the body axis. Toes exhibit mild swelling at the base and are sharply tapered. Movement transpires through serpentine or peristaltic contractions. Hook-shaped processes function as a grasp during these actions. Length ranges from 195 to 435 µm, with the foot tip measuring 36 to 48 µm [32] (Figure 1A).

Trophies depicted in Figure 1B are substantial in size. Rami are robust, each featuring broad, incurved apical and preuncinal teeth. Fulcrum short, roughly 1/3 as long as ramus, rod-shaped in ventral view, broadly trapezoidal in lateral view. Manubrium elongated, nearly double the length of the incus, robust, rod-like, with the posterior half slightly bent and asymmetrically buttoned at the rear. Trophi dimensions: 38-44 µm; ramus: 10-12 µm [32] (Figure 1B).

Temperature impacts aquatic species' reproduction, feeding, and metabolism by increasing biological activity in the water and speeding up biochemical activities. Temperature is a crucial environmental factor influencing biodiversity and zooplankton density in aquatic ecosystems [34 and 35], and it has been documented to exert a significant positive impact on zooplankton diversity and abundance [36 and 37]. While analogous results are partially observed in this investigation, the duration is inadequate to substantiate these findings.

The concentration of dissolved oxygen fluctuates based on the trophic state and thermal conditions of the lakes [38]. Research indicates that hypoxic circumstances might influence the growth, reproduction, and dispersal of zooplankton, with findings suggesting that dissolved oxygen concentrations below 5 mg L^{-1} in freshwater may restrict zooplankton growth, contingent upon species [39]. The study region, characterized by a stream with waterfalls and elevated water flow, had elevated oxygen levels. The dissolved oxygen levels measured (8.62–9.93 mg L^{-1}) exceeded 5 mg L^{-1}. The dissolved oxygen levels in the stream appear conducive to zooplankton existence.

Conductivity, a critical water quality parameter, has been shown to have a significant correlation with zooplankton diversity, abundance, and distribution, while an inverse relationship exists between conductivity and zooplankton species diversity [40 and 41]. Generally, conductivity rises in areas with inadequate water supply due to evaporation when water temperature escalates. Pollution, along with industrial and anthropogenic waste, typically exhibits elevated conductivity, hence augmenting the conductivity of lakes and rivers [42]. The conductivity ranges from 412.6 to 438.5 µS cm^{-1}, which is conducive to zooplankton existence [40].

This research is the first zooplankton investigation in Zufrun Creek, which is nourished by spring water. This study discovered 50 zooplankton species, with Rotifera constituting 64% of the total. Numerous studies indicate that rotifers prevail in both abundance and quality in the majority of stagnant aquatic environments, including lakes, ponds, reservoirs, and wetlands [43 and 44]. Segers [45] noted that rotifers inhabit nearly all varieties of freshwater environments, including huge lakes, small ephemeral ponds, intermediate and capillary waters, acidic mineral lakes, soda lakes, hyperoligotrophic mountain lakes, and sewage ponds.

Species identified as effective indicators of eutrophic conditions and pollution include *L. lunaris*, *K. cochlearis*, *K. tecta*, *L. patella*, *C. forficula*, *Trichocerca porcellus*, *Trichotria tetractis*, *B. longirostris*, *C. sphaericus*, and *Paracyclops fimbriatus* [17, 46-50]. Species identified as indications of oligotrophy include *K. serrulata*, *E. uncinatum*, and *C. rectangula*. The genera *Brachionus*, *Lecane*, *Trichocerca*, and *Keratella* have been proposed as target taxa for enhanced monitoring of water quality and conservation strategies in aquatic ecosystems [51].

The abundance of ten eutrophication indicator species and three oligotrophication indicator species in Zufrun Creek suggests that the stream is at risk of eutrophication. The minimal presence of eutrophication indicator species suggests that the stream is presently at a considerable distance from this risk. The majority of detected species are prevalent, cosmopolitan taxa previously documented in this region [52, 53, 45 and 54]. Nearly all species in the study are documented as being extensively spread and cosmopolitan.

Cephalodella ventripes, *Keratella serrulata*, *K. cochlearis* and *C. gibba* are acidic in nature, while *L. bulla* and *L. flexilis* are alkaline [28 and 55]. *L. luna*, *C. adriatica*, *L. patella*, *T. patina*, *K. cochlearis*, *Cephalodella gibba*, *C. misgurnus*, *P. similis*, and *Chydorus sphaericus* are euryhaline [28, 56, 57, 58 and 59]. *C. gibba*, *C. adriatica*, *E. dilatata*, *K. cochlearis*, *K. tecta*, *L. closterocerca*, *L. flexilis*, *L. luna*, *L. patella*, *C. sphaericus*, and *Acanthocyclops viridis* have been documented to withstand a broad spectrum of conductances [60, 56, 61 and 62].

This investigation identified certain species (*L. hamata*, *L. flexilis*, benthic *L. inermis*, *L. patella*, *C. forfigula*, *D. hertzogi*, *C. pelagica*) exclusively inside plant environments. Numerous studies indicated that the same species were predominantly located in coastal flora and, to a lesser degree, in plankton [22, 63, 27, 64, and 65].

Certain species in the study (*K. cochlearis*, *K. tecta*) have been documented as broadly distributed, predominantly inhabiting pelagic environments, with lesser occurrences on vegetation and benthic substrates [66, 20, 67, 68, 69, 70, and 54].

All species identified in the study, except *Kostea wockei*, are cosmopolitan species exhibiting high ecological valence, observed in our country and this region [71-78]. The number of zooplankton species was not determined; however, it was noted that all species in the samples were present in minimal quantities, with approximately 50-60 individuals identified in each 20 cc sample. Consequently, no observations could be performed regarding the zooplankton except for the species diversity present in the creek.

5. CONCLUSION AND SUGGESTIONS

The zooplankton species in the dam lake comprise cosmopolitan, extensively distributed species that endure a broad spectrum of conductivity, salinity, and alkalinity. Rotifera constituted the predominant group, succeeded by Copepoda and Cladocera. The predominant families were Lecanidae (Rotifera), Cyclopoidae (Copepoda), and Chydoridae (Cladocera). Despite the great quantity of eutrophication indicator species (10 species), the individual count was found to be exceedingly low. Conversely, *Kostea wockei*, exhibiting considerable habitat adaptability, is a recently recorded rotifer in Turkish inland waters.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

FINANCIAL DISCLOSURE

The authors received no financial support for the research.

DECLARATION OF ETHICAL STANDARDS

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

REFERENCES

[1] Sharma, S., Siddique, A., Singh, K., Chouhan, M., yas, A.V., Solnki, C.M., Sharma, D., Nair, S., and Sengupta, T., (2010). Population dynamics and seasonal abundance of zooplankton community in Narmada River (India). Researcher 2:1-9.
[2] Lampert, W. and Sommer, U., (1997). Limnoecology: The Ecology of Lakes and Streams; Oxford University Press: North York, ON, Canada. 400p.
[3] Moss, B., (1988). Ecology of Freshwater; Wiley-Blackwell: Hoboken, NJ, USA, 352 p.
[4] Sharma, R.C., (2020). Habitat ecology and diversity of freshwater zooplankton of Uttarakhand Himalaya, Indian Journal of Tropical Biodiversity, 5: 188–196.
[5] Shurganova, G.V., (2007). Dynamics of Species Structure of Zooplanktocenoses during Their Formation and Development (by the Example of Reservoirs in the Middle Volga: Gorki and Cheboksary); Extended Abstract of Doctoral (Biol.) Dissertation; Cyberleninka: Nizhny Novgorod, Russia, p. 48.
[6] Deksne, R., Škute, A., and Meinerte, A., (2011). Seasonal changes in zooplankton community of the Daugava River. Acta Biologica niversitatis Daugavpiliensis 11 (1): 61-75.
[7] Berzins, B. and Pejler, B., (1987). Rotifer occurrence in relation to pH. Hydrobiologia, 147: 107-116. https://doi.org/10.1007/bf0002573.
[8] Gannon, J.E. and Stemberger, R.S., (1978). Zooplankton (Especially Crustaceans and Rotifers) as Indicators of Water Quality, Transactions of the American Microscopical Society, 97(1): 16-35. doi:10.2307/3225681.
[9] Vörösmarty, C.J., Mcintyre, P.B., Gessner, M.O., Dudgeon, D., Prusevich, A., Green, P., Glidden, S., Bunn, S.E., Sullivan, C.A., Reidy Liermann, C., and Davies, P.M., (2010). Global threats to human water security and river biodiversity. Nature 467: 555–561.
[10] Marneffe, Y., Descy, J.P., and Thome, J.P., (1996). The zooplankton of the lower river Meuse, Belgium: Seasonal changes and impact of industrial and municipal discharges. Hydrobiologia, 319:1-13.
[11] Hynes, H.B.N., (1970). The Ecology of Running Waters. University of Toronto Press, Toronto, 555 pp.
[12] Wetzel, R.G., (1975). Limnology. W.B. Saunders Company 743 p.
[13] Moghraby, A.J., (1977). A study on diapause of zooplankton in a tropical river - The Blue Nile. Freshwater Biology, 7(3):207-212. https://doi.org/10.1111/j.1365-2427.1977. tb01669.x
[14] Greenberg, O.W., (1964). Physical Review Letters, 13: 598-602. https://doi.org/10.1103/PhysRevLett.13.598.
[15] Soyer, J., (1970). Bionomie benthique du plateau continental de la côte catalane française. III. Les peuplements de Copépodes Harpacticoides. Vie et Milieu, 21: 337–511.
[16] Scourfield, D.J., and Harding, J.P., (1966). Fresh-Water Biology As. Sci. Publ. New York.
[17] Dussart, B., (1969). Les Copepodes des eaux continentals d'Europe occidentale. Tome II: Cyclopoides et Biologie. N. Boub,e & Cie, Paris, 292 pp.

[18] Damian-Georgescu, A., (1970). Fauna Republicii Socialiste Romania, Crustacea. Vol. IV. 11 Copepoda, Harpacticoida. Bucharest: Academiei Republicii Socialiste Romania 249 pp.
[19] Smirnov, N.N., (1974). Fauna of U.S.S.R. Crustacea. Vol I, No: 2, Chydoridae. I.P.S.T. Jerusalem, 644 p.
[20] Ruttner-Kolisko, A., (1974). Plankton rotifers. Biology and taxonomy. English translation of Die Binnengewasser v. 26, part 1. 146 p.
[21] Kiefer, F. and Fryer, G., (1978). Das zooplankton der binnengewässer, 2 Teil. Stuttgart: Schweizerbart'sche Verlagsbuchhandlung 380 p.
[22] Koste, W., (1978). Rotatoria. Die Raedertier Mitteleuropas, Ein Bestimmungwerk Begründet von Max Voigt. Überordnung Monogononta. Gebraider Borntraeger, Berlin, Stuttgart 673 p.
[23] Negrea, T., (1983). Fauna Republici Socialiste Romania. Vol.4, 12. Crustacea Cladocera. Academia Republici Socialiste Romania, Bucuresti. 399 pp.
[24] Reddy, R., (1994). *Phyllodiaptomus praedictus* n. sp. (Copepoda, Calanoida) from Thailand. Hydrobiologia, 273: 101-110. https://doi.org/10.1007/BF00006852.
[25] Borutsky, E.V., (1964). Fauna of U.S.S.R: Crustacea. Freshwater Harpacticoida. Israel Program for Scientific Translations Limited.
[26] Nogrady, T. and Pourriot, R., (1995). Family Notommatidae. In: Rotifera. Volume 3: The Notommatidae and the Scaridiidae. In: T. Nogrady. Guides to the identification of the microinvertebrates of the continental waters of the world. Amsterdam. SPB Academic Publishing, (8):248.
[27] Segers, H., (1995). The Lecanidae (Monogononta), in T. Nogrady (ed.) Rotifera 2, Vol. 6 of Guides to the Identification of the Microinvertebrates of the Continental Waters of the World, H.J. Dumont (ed.) (The Hague: SPB Academic), 226 pp.
[28] De Smet, W.H., (1996). Rotifera 4: The Proalidae (Monogononta). In Nogrady T., & H. J. Dumont (ed.s), Guides to the identification of the microinvertebrates of the continental waters of the World 9. SPB Academic, The Hague, The Netherlands.
[29] Smirnov, N.N., (1996). Cladocera: The Chydorinae and Sayciinae (Chydoridae) of the World. Guides to the Identification of the Microinvertebrates of the Continental Waters of the World No 11 SPB Academic Publishing, Amsterdam, 195 pp.
[30] Dussart B.H. and Defaye, D., (2001). Copepoda. Introduction to the Copepoda. In: Dumont HJF (ed) Guides to the identification of the microinvertebrates of the continental waters of the world, vol 16, 2nd edn. Backhuys, Leiden, 344 pp.
[31] Koste, W., (1961). Paradicranophorus wockei nov.spec., ein Rädertier aus dem Psammon eines norddeutschen Niederungsbaches. Zoologischer Anzeiger, 167:138-141.
[32] De Smet, W.H., (1997). The Dicranophoridae (Monogononta). Vol. 5. SPB Academic Publishing, Amsterdam, 344 pp.
[33] Bertani, I., Segers, H., and Rossetti, G., (2011). Biodiversity down by the flow: new records of monogonont rotifers for Italy found in the Po River. Journal of Limnology 70(2): 321-328.
[34] Herzig, A., (1987). The analysis of planktonic rotifer populations: A plea for long-term investigations, Hydrobiologia, 147: 163-180.
[35] Sharma, P., Pandey, S., Meena, B.S., and Singh, N.P., (2007). Knowledge and adoption of livestock feeding practices in Jhansi district of Bundelkhand. Indian Journal of Dairy Sciences, 60(1):63-67.

[36] Rossetti, G., Viaroli, P., and Ferrari, I., (2009). Role of abiotic and biotic factors in structuring the metazoan plankton community in a lowland river. River Research and Applications, 25(7):814-835. https://doi.org/10.1002/rra.1170.
[37] Dorak, Z., (2013). Zooplankton abundance in the lower Sakarya River Basin (Turkey): Impact of environmental variables. Journal of Black Sea/Mediterranean Environment, 19(1):1-22.
[38] Viet, N.D., Bac, N.A., and Huong, H.T.T., (2016). Dissolved oxygen as an indicator for eutrophication in freshwater lakes. In Proceedings of International Conference on Environmental Engineering and Management for Sustainable Development, Hanoi, 690 p.
[39] Karpowicz, M., Ejsmont-Karabin, J., Kozłowska, J., Feniova, I., and Dzialowski, A.R., (2020). Zooplankton community responses to oxygen stress. Water, 12(3):706.
[40] Estlander, S., Nurminen, L., Olin, M., Vinni, M., and Horppila, J., (2009). Seasonal fluctuations in macrophyte cover and water transparency of four brown-water lakes: implicationsfor crustacean zooplankton in littoral and pelagic habitats. Hydrobiologia, 620:109-120. https://doi.org/10.1007/s10750-008-9621-8.
[41] Tavsanoglu, U.N., Maleki, R., and Akbulut, N., (2015). Effects of Salinity on the Zooplankton Community Structure in Two Maar Lakes and One Freshwater Lake in the Konya Closed Basin, Turkey. Ekoloji 24(94):25-32.
[42] Wetzel, R.G., (1983). Limnology, 2nd edition. Saunders College Publishing. 760 p.
[43] Ismail, A.H. and Adnan, M.A.A., (2016). Zooplankton composition and abundance as indicators of eutrophication in two small man-made lakes. Tropical Life Sciences Research, 27(1):31-38. https://doi.org/10.21315/tlsr2016.27.3.5.
[44] Dorak, Z., Köker, L., Gaygusuz, Ö., Gürevin, C., Akçaalan, R. and Albay, M., (2019). Zooplankton biodiversity in reservoirs of different geographical regions of Turkey: composition and distribution related with some environmental conditions. Aquatic Sciences and Engineering, 34(1):29–38.
[45] Segers, H., (2007). Annoted checklist of the rotifers (Phylum Rotifers) with notes on nomenclature, taxonomy and distribution. Zootaxa, 1564:1-104.
[46] Voigt, M. and Koste, W., (1978). Rotatoria Überordnung Monogononta. 1. Textband, 650, II. Tafelband, 234, Gebrüderssontrager, Berlin.
[47] Pesce, G.L. and Maggi, D., (1983). Ricerche faunistiche in acque sotterranee Freatiche della grecia meridionale ed insulare estato attuale delle conoscenze sulla stigofauna di grecia. Natura, Milano, 74(1–2):15–73.
[48] Hansen, A.M. and Jeppesen, E., (1992). Changes in the Abundance and Composition of Cyclopoid Copepods Following Fish Manipulation in Eutrophic Lake Vaeng, Denmark. Freshwater Biology, 28(2):183-93.
[49] Shah, J.A. and Pandit, A.K., (2013). Relation between physicochemical limnology and crustacean community in Wular lake of Kashmir Himalaya. Pakistan Journal of Biological Science, 16(19). https://doi.org/10.3923/pjbs.2013.976.983.
[50] Heneash, A.M.M. and Alprol, A.E., (2020). Monitoring of Water Quality and Zooplankton Community in Presence of Different Dietary Levels of Commercial Wood Charcoal of Red Tilapia. Journal of Aquaculture Research & Development, 11:6. doi:10.35248/2155-9546.20.11.592.

[51] Ceirans, A., (2007). Zooplankton indicators of trophy in Latvian lakes. Acta Universitatis Latviensis, 723:61-69.
[52] Keppeler, E.C., (2003). Comparative study of the zooplankton composition of two lacustrine ecosystems of southwestern Amazonia. Acta Scientiarum, 25:467–477.
[53] Keppeler, E.C. and Hardy, E.R., (2004). Vertical distribution of zooplankton in the water column of Lago Amapá, Rio Branco, Acre, Brazil. Revista Brasileira de Zoologia, 21(2):169-177. https://doi.org/10.1590/S0101-81752004000200002.
[54] Santos, M., Moita, M.T., Bashmachnikov, I., Menezes, G.M., Carmo, V., Loureiro, C.M., Mendonça, A., Silva, A.F., and Martins, A., (2013). Phytoplankton Variability and Oceanographic Conditions at Condor Seamount, Azores (NE Atlantic). DeepSea Research II 98 (PA):52–62.
[55] Rybak, J.I. and Bledzki, L.A., (2010). Slodkowodne skorupiaki planktonowe. Klucz do oznaczania gatunków. Warsaw, Poland: Warsaw University Press (in Polish).
[56] De Ridder, M. and Segers, H., (1997). Rotifera Monogononta in six zoogeographical regions after publications between 1960 and 1992. Studiedocumenten van het Koninklijk Belgisch Instituut voor Natuurwetenschappen, 88:481 pp.
[57] Fontaneto, D., Ficetola, G.F., Ambrosini, R., and Ricci, C., (2006). Patterns of diversity in microscopic animals: are they comparable to those in protists or in larger animals? Global Ecology and Biogeography, 15:153–162.
[58] Jersabek, C. and Bolortsetseg, E., (2010). Mongolian rotifers (Rotifera, Monogononta) a checklist with annotations on global distribution and autecology. The Academy of Natural Sciences of Philadelphia, 159:119-168. https://doi.org/10.1635/053.159.0108
[59] Defaye, D. and Dussart, B.H., (2011). World Directory of Crustacea Copepoda III - Harpacticoida IV - Gelyelloida. Backhuys Publishers, Margraf Publishers GmbH. 450 pp.
[60] Arcifa, M.S., Castilho, M.S.M., and Carmouze, J.P., (1994). Composition et évolution du zooplancton dans une lagune tropicale (Brésil) au cours d´une période marquée par une mortalité de poissons. Revue d'hydrobiologie tropicale, 27:251 263.
[61] Baribwegure, D. and Segers, H., (2001). Rotifera from Burundi: the Lepadellidae (Rotifera: Monogononta). Hydrobiologia, 446/447: 247-254.
[62] Pattnaik, B.S., (2014). Determination of rotifer distribution to trophic nature of ponds. Indian Journal of Applied Research, 4(4):25-26. https://doi.org/10.15373/2249555X/APR2014/5.
[63] Hingley, M., (1993). Microscopic Life in Sphagnum. Illustrated by Hayward, P. and Herrett, D. Naturalists' Handbook 20. Richmond Publishing Co. Ltd., Slough, England, 64 p.
[64] De Manuel Barrabin, J., (2000). The rotifers of Spanish reservoirs: ecological, systematical and zoogeographical remarks. Limnetica, 19:91-167.
[65] Kuczynska-Kippen, N., (2000). Seasonal changes of the rotifer community in the littoral zone of a polymictic lake. Verhandlungen des Internationalen Verein Limnologie, 27:2964-2967. https://doi.org/10.1080/03680770.1998.11898216.
[66] Hutchinson, G.E., (1967). A treatise on limnology. Vol. 2. Wiley, New York. 1,115 pp. Jacobs, J. 1961. Laboratory cultivation of the marine copepod Pseetdodieptomnus coroaeetuos Williams. Limnology and Oceanography, 6:443-446.
[67] Margalef, R., Planas, D., Armengol, J., Vidal, A., Prat, N., Guiset, A., Toja, J., and Estrada, M., (1976). Limnología de los

embalses españoles. Dirección General de Obras Hidráulicas. Ministerio de Obras Públicas. Madrid, 422 pp.
[68] Braioni, M.G. and Gelmini, D., (1983). Rotiferi Monogononti. Guida per il Riconoscimento Delle Specie Animali Delle Acque Interne Italiane, Consiglio Nazionale Delle Ricerche, 179 pp.,
[69] Koste, W. and Shiel, R.J., (1986). Rotifera from Australian inland waters. I. Bdelloidea (Rotifera: Digononta) Australian Journal of Marine and Freshwater Research, 37: 765-792.
[70] Koste, W. and Shiel, R.J., (1987). Rotifera from Australian inland waters. II. Epiphanidae and Brachionidae (Rotifera: Monogononta) Invertebrate Taxonomy, 7:949-1021.
[71] Ustaoğlu, M.R., Altındağ, A., Kaya, M., Akbulut, N., Bozkurt, A., Özdemir Mis, D., Atasagun, S., Erdoğan, S., Bekleyen, A., Saler, S., and Okgerman, H.C., (2012). A Checklist of Turkish Rotifers. Turk J Zool. 36(5):607-622. doi: 10.3906/zoo-1110-1.
[72] Ustaoğlu, M.R., (2015). An Updated Zooplankton Biodiversity of Turkish Inland Waters. LimnoFish. 1(3):151-159. doi: 10.17216/LimnoFish-5000151941.
[73] Bozkurt, A., (2004). Akdeniz Bölgesindeki bazı akarsuların zooplankton (rotifer, kladoser ve kopepod) faunası üzerine ilk gözlemler. Türk Sucul Yaşam Dergisi, 2(3):65-70.
[74] Bozkurt, A. and Tepe, Y., (2011). Zooplankton composition and water quality of Lake Gölbaşı (Hatay-Turkey). Fresenius Environmental Bulletin, 20:166–174.
[75] Bozkurt, A. and Güven, S.E., (2010). Zooplankton succession of the Asi River (Hatay-Turkey). Journal of FisheriesSciences.com., 4(4):337-353. https://doi.org/10.3153/jfscom.2010037.
[76] Bozkurt, A., Bozça, M., and Kaya, D., (2018). Zooplankton Fauna of Two Streams in Hatay (Turkey). 13th International Symposium on Fisheries and Aquatic Sciences, 378 p.
[77] Bozkurt, A., (2017). First record of *Epactophanes richardi* Mrázek, 1893 (Copepoda, Harpacticoida, Camptocamptidae) for Turkish inland waters. Turkish Journal of Fisheries and Aquatic Sciences, 17(1):25-29. https://doi.org/10.4194/1303-2712v17_1_04.
[78] Bozkurt, A., (2022). Investigation of groundwater zooplankton fauna from water wells in Yayladağ district of Hatay Province in Turkey. Marine and Life Sciences, 4(1):63-70. https://doi.org/10.51756/marlife.1073388.
[79] Serafım-Júnior, M., Bonecker, C.C., Rossa, D.C., Lansac-Tôha, F.A. and Costa, C.L., (2003). Rotifers of the upper Paraná river flood plain: additions to the checklist. Brazilian Journal of Biology, 63(2):207-212. http://dx.doi.org/10.1590/S1519-69842003000200005.