AQUATIC RESEARCH
E-ISSN 2618-6365

Aquatic Research 8(4), 272-285 (2025) • https://doi.org/10.3153/AR25027 *Research Article*

Rotifers´ assemblage and seasonal distribution in two shallow lagoons in Türkiye

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Cite this article as:
Korucu, K.V., Tugaytimur, T., Emir Akbulut, E. C. (2025). Rotifers' assemblage and seasonal distribution in two shallow lagoons in Türkiye. *Aquatic Research*, 8(4), 272–285. https://doi.org/10.3153/AR25027

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Submitted: 06.08.2025
Revision requested: 02.10.2025
Last revision received: 10.10.2025
Accepted: 10.10.2025
Published online: 19.10.2025

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ABSTRACT

In this study, temporal variations in rotifer abundance, biomass, and size structure were determined and compared across samples collected between 2014 and 2016 from two shallow lagoons in different climate zones. Paradeniz Lagoon is a high-salinity ecosystem (around 31‰), located in the Mediterranean Sea Region, on the south coast of Turkey, and formed within the delta of the Göksu River. Uzungöl Lagoon is a low-salinity ecosystem (≤ 1‰) located in the Kızılırmak Delta, in the north of Turkey. Key environmental parameters, particularly temperature, salinity, conductivity, dissolved oxygen, and chlorophyll *a*, were determined in interactions with rotifer assemblages. Rotifera were the dominant group in the zooplankton of slightly saline Uzungöl Lagoon; mainly, *Keratella cochlearis*, *K. quadrata*, *Polyarthra vulgaris*, *Filinia longiseta*, *Notholca acuminata*, and *Brachionus calyciflorus* accounted for more than 70% of the rotifer community. In the saline Paradeniz Lagoon, rotifers *Synchaeta pectinata* and *Hexarthra fennica* were constant species. However, their population density was very low, whilst copepods made up more than 90% of the total zooplankton. Moreover, an increase in nauplius lengths correlated with maximum salinity in both lagoons. Results of this research indicated that climate-dependent salinisation of shallow lagoons is an important factor in ecological explanations of zooplankton biodiversity, density, and biomass.

Keywords: Zooplankton, Biomass, Diversity, Chemicals, Uzungöl and Paradeniz Lagoon

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Introduction

Rotifers are among the most important groups of zooplankton and play an important role in nutrient cycling and energy flow in aquatic systems (Herzig, 1987; Wallace, 2002; Emir, 1994). Seasonal zooplankton dynamics and population structure are highly susceptible to changes in environmental variables, especially in shallow lakes. Several previous studies have indicated that nutrients, primary production, temperature, abundance of predators, competitors, and potential food resources are important factors influencing the structure of the zooplankton abundance as well as the population dynamics and the productivity patterns (Galkovska, 1987; Herzig, 1987; Devetter, 1998; Caglierani et al., 2009; Donisete et al., 2022). Among the zooplankton, the studies on the population dynamics of rotifers, dissolved oxygen concentration, water conductivity and salinity were the most important factors driving differences in species diversity and abundance (Egborge, 1994; Khaleqsefat & Malekzadeh-Viayeh, 2013; Yuan et al., 2020); dissolved oxygen and temperature concentration (Armengol et al., 1993; Mikschi, 1989); pH (Grajner, 2001) and turbidity (Duggan et al., 2002); trophic level (Duggan et al., 2001; Yoshida et al., 2003). In addition, predation pressure decreased the maximum population density and maximum population growth rate of rotifers (Sarma et al., 2011)

The differences observed in the saline and freshwater environments, abundance and biomass of zooplankton in the lagoons were caused not only by salinity and temperature conditions, but also by dissolved oxygen concentrations, the trophic state of the studied water body and the existing biocenotic relationships (Paturej & Kruk, 2011; Paturej et al., 2017)

As transition zones between marine and terrestrial environments, lagoons are important areas where biodiversity is high and biogeochemical cycling occurs. (Kjerfve, 1994). The high productivity of coastal lagoons makes them habitats for many fish and invertebrates, and most lagoons support important fisheries or aquaculture (Ruzafa et al., 2024).

Although various parameters affect zooplankton species diversity and density in lagoons, high salinity is among the most important limiting factors, as in temperate lakes. The significant suppressive effect of salinity on zooplankton distribution, especially in small-bodied zooplankton groups, has been studied by various researchers. Danni et al. (2020) observed that zooplankton species number, richness, evenness, Shannon index, and Simpson's index values decreased with increasing salinity. The abundances of total zooplankton, rotifers, and cladocerans were negatively correlated with salinity, while there was little correlation between copepod abundance and salinity (Akbulut & Tavşanoğlu, 2015). Saline wetlands were colonised by more salt-tolerant species such as *Brachionus plicatilis*, *Trichocerca* sp., and calanoid copepods. The results indicate that increasing salinity may reduce freshwater zooplankton richness, shifting the community toward more salt-tolerant species (Toruan, 2012). Even relatively small increases in salinity levels can drive such systems to a state of depleted biodiversity and abundance, altering ecosystem functioning (Schallenberg et al., 2003). Grajner and Cudak (2014) observed that increased salinity decreased rotifer species richness and diversity. Min-Chul et al. (2022), based on their laboratory work, found that among the abiotic factors, salinity and temperature induced adverse effects on reproduction in the tropical rotifer species.

There are some studies on zooplanktonic organisms in lakes, streams and rivers in the Kızılırmak Basin, like on the Cladocera and Copepoda taxonomy in Bafra Balık Lake (Gündüz, 1991a, 1991b); on the Rotifera taxonomy and ecology (Emir, 1989,1990; Akbulut et al., 2008), Zooplankton fauna in Çernek Lake (Bekleyen, 2008), Rotifers from Kızılırmak River and its branches were observed (Günsel &Akbulut, 2012). Also, recent studies are available on the zooplankton community and physicochemical properties of Uzungöl Lagoon (Özdemir et al., 2021), on zooplankton population dynamics and biomass distribution in Gıcı Lake (Gül, 2021), and on zooplankton population dynamics in Tatlı Lake in the Kızılırmak Delta (Tugaytimur, 2023). Although rotifers predominate in most aquatic environments, such as lagoons, few studies have examined zooplankton, including rotifers, in saline waters to compare them with those in temperate lakes (Akbulut & Tavşanoğlu, 2015, 2018)**.** The purpose of our study was to determine the effects of saline intrusions and temperature on zooplankton biomass and community structure in two lakes located in different climate zones.

Materials and Methods

Study Sites

Uzungöl Lagoon is an eutrophic lake with typical brackish water characteristics, located in the Kızılırmak Delta, Black Sea Region of Turkey (41°34'N 36°05'E, Figure 1). Although the closest point to the sea is 1 km away, a channel opens to the sea in line with anthropogenic interventions. This lake, located in the eastern part of the basin, lies parallel to the sea and covers 219 ha. Its depth varies between 1 meter and 1.5 meters. Although it is common in the southern part of

the lake, emergent macrophytes, especially *Phragmites australis*, were observed (Akbulut & Bayramıalemdarı, 2015).

Figure 1. Satellite images of study sites with geographical location and coordinates

Paradeniz Lagoon is a saline lake located on the southern coast of Turkey and is one of the four lakes in the Göksu Delta that pour into the Mediterranean Sea (36° 24'N, 33° 45'E, Fig. 1). Paradeniz is the second-largest lake in the basin, with a surface area of 492 ha. There is a sand bar between the sea, and it has a saltier water chemistry than other lakes in the basin due to its direct connection to the sea. It has a depth of 1 meter to 0,5 meters. It is possible to say that anthropogenic interference is high, though it is linked to neighbouring Akgöl due to fishing activities.

Sampling

Samples were collected at Uzungöl Lagoon, located in the Kızılırmak Delta (Samsun, Turkey), and Paradeniz Lagoon, located in the Göksu Delta (Mersin, Turkey), at four stations in each lake between August 2014 and May 2016. Zooplankton samples were collected horizontally using a standard plankton net (44 µm mesh size), and Secchi depth was measured with a 20 cm disc. Samples were preserved in 4% Lugol solution and examined using a Leica DM5000B trinocular microscope. Physicochemical parameters, including salinity, pH, dissolved oxygen, and temperature, were measured using a Consort C933 Multi-Parameter Analyser. Physical and chemical data were obtained from project report no. 014 D04 818 001-598, which supported the study.

Species were identified using the keys of Koste (1978a, 1978b), Kutikova (1970), Nogrady (1980), Segers (1995, 2007, 2008), De Semet (1996, 1998), Dumont (2006), De Smet and Pourriot (1997), and species were checked according to Ustaoğlu et al. (2012) and Ustaoğlu (2015).

Data Analysis

The organisms observed in the samples taken from Uzungöl and Paradeniz Lagoons were counted in 5 replicates on a 1 mL capacity Seewick-Rafter counting slide, after homogenization by shaking the sample tube. It was prepared following the methods described by Downing and Rigler (1984), Edmondson (1971), and Telesh (1986). Considering the density of the samples, plankton counts were recorded by examining a minimum of 0.25 ml and a maximum of 1 ml of water samples, and the dilution rate was determined for each diluted sample.

Biomass measurements of zooplankton samples were made using a trinocular light microscope with a Leica-branded differential interference contrast (DIC) attachment, and a computer program called LAS 4.1 to measure Rotifera species. Moreover, nauplii, the larvae of Copepoda, were also measured. The weights of organisms whose biometric measurements were made were calculated using equations from the literature; biovolume was calculated from biometric data of Rotifera members, and biomass was determined using geometric equations (Kolisko, 1977).

Statistical evaluations of zooplankton communities; for population evaluation, relative abundance, and frequency (Tischler, 1949), species richness (S), Shannon-Weiner diversity (H') and Pielou evenness (J) indices were used. Moreover, to test seasonal differences in zooplankton community parameters, One-Way Analysis of Variance (ANOVA) was used; statistical analyses were performed using Past 4.03 Statistical Software.

Results and Discussion

Physicochemical Data

The physicochemical data for the sample collection dates from Lake Uzungöl and Lake Paradeniz are given in Table 1. The highest water temperature was measured in August 2014, with 27.6 C° recorded in Uzungöl and 32.4 C° in Paradeniz. However, the lowest water temperatures were measured in November 2015: 10 °C in Uzungöl and 13,5 °C in Paradeniz. In the physicochemical examinations conducted in Uzungöl,

the pH ranged from 8.89 to 9.57, indicating an alkaline water state. Salinity ranged from 0.55‰ to 1.21‰; the lowest was recorded in March 2015, and the highest in May 2016. Dissolved Oxygen (DO) was measured in the range of 6.3 mg/L to 10.9 mg/L and recorded above the eutrophication limit according to the Water Pollution Control Regulation, except for August 2014 (T.C Orman ve Su işleri Bakanlığı 2012, 2014). Electrical Conductivity (EC) was observed in November 2015, with a maximum of 2240.5 µS cm-1, while a minimum of 1078.5 µS cm^{-1} was recorded in March 2015. Chemical data show that anions and cations reached maximum levels in November 2015 at 27.12 mg/L and 28.58 mg/L; moreover, they are at minimum levels in March 2015 at 12.68 mg/L and 13.37 mg/L.

In the physicochemical examinations conducted in Paradeniz, pH levels ranged from 6.03 to 9.515, indicating an alkaline water state, except in August 2014. Salinity varied between 11.67‰ and 31.4‰; the lowest was recorded in March 2015, and the highest in August 2014. Dissolved Oxygen (DO) was measured at 1.15-9.15 mg/L; these values are much lower than those in Uzungöl. Electrical Conductivity (EC) ranged from 20834.5 to 48484 µS cm-1, with the highest value recorded in August 2014 and the lowest in March 2015. Secchi disk measurements showed that turbidity did not differ significantly between the dates, with a standard deviation of 13.36 and a mean of 81.56 cm. Chemical data show that the anion and cation values ranged from 27.12 to 28.58 in November 2015, with the minimum values recorded in March 2015 at 12.68 and 13.37 in Uzungöl.

In terms of the highest Chl-a values, the two lakes differ, while the lowest values coincide with the same date. While Chl-a values were at their maximum (26.91 µg/L) in Uzungöl in August 2014, they were at their maximum (5.01 µg/L) in Paradeniz in March 2015. On the other hand, the lowest values were measured as 3.963 µg/L for Uzungöl and 0.125 µg/L for Paradeniz in May 2016.

Biotic Data

In this study, 43 species and 1 genus of Rotifera were identified. While 41 of the identified species were recorded in Uzungöl and 8 in Paradeniz, 5 species were found in both lakes: *Brachionus calyciflorus*, *Keratella cochlearis*, *Keratella tropica*, *Lecane bulla*, and *Synchaeta pectinata*. However, unlike Uzungöl, *Hexarthra fennica*, *Synchaeta grandis* and *Synchaeta* sp. species were identified in Paradeniz (Table 2).

A comparative abundance and frequency table of Rotifera species in lakes is shown in Table 3. Based on the frequency classification presented by Tischler, 15 incidental species, nine accessory species, and 17 fixed species were recorded in Uzungöl (Tischler, 1949). Three recorded species *Brachionus angularis*, *Brachionus calyciflorus*, and *Trichocerca marina* were evaluated in the definitely fixed species category. Among the species detected in Paradeniz, B*rachionus bidentata*, *Hexarthra fennica*, *Keratella tropica*, L*ecane bulla*, *Synchaeta grandis* and *Synchaeta pectinata* are considered as incidental species. At the same time, *Keratella cochlearis* is an accessory species, and *Synchaeta* sp. has been identified as a definite fixed species. However, it was determined that 2 species, *Brachionus bidentata* and *Lecane bulla*, were incidental species for both lakes.

Density values of zooplankton in samples taken from Uzungöl and Paradeniz lagoons are given in Table 4. The population density difference between the two lakes is remarkable. While the highest individual count in Uzungöl was 43353.84 ind.m^{-3} for *Hexarthra mira* in August 2014, the lowest was 23.87 ind.m^{-3} for *Mytilina ventralis*, *Trichocerca rattus*, and *Trichothria pocillum* in March 2016. In terms of the total number of individuals, the highest value recorded in Uzungöl was 120416.73 ind.m^{-3} in August 2014, while the lowest value was 62189.846 ind. m^{-3} in March 2015. The highest number of individuals measured in Paradeniz was recorded in May 2016 as *Synchaeta* sp. with 6923.24 ind.m^{-3}, while the lowest number of individuals recorded was in November 2015 as *Brachionus calyciflorus* and *Lecane bulla* and in May 2016 as *Hexarthra fennica* with 15.915 ind.m^{-3}

Also, the highest total number of individuals was recorded at 8307.90 ind.m^{-3} in May 2016, while the lowest was 15.91 ind.m^{-3} in March 2015.

The Shannon-Wiener diversity index and Pielou Evenness index were calculated from the density values for the two lakes per cubic meter, as given in Table 5. Calculated values are shown in Table 5. In line with Uzungöl data, species diversity decreased significantly in March 2015 and then increased; the highest value was recorded in May 2016. Statistical analysis shows that the Shannon-Wiener Diversity Index differs significantly among lakes (One-Way ANOVA; $F=19.69$, $p < 0.05$) and sampling dates (One-Way ANOVA; $F=3.857$, $p < 0.05$). Based on Pielou's Evenness Index calculations, the date with the lowest species homogeneity was March 2015. Statistical analysis shows that there is no significant difference in Pielou Evenness index across sampling dates (One-Way ANOVA; $F=0.2779$, $p>0.05$); however, statistically significant differences were observed between Pielou Evenness index and lakes (One-Way ANOVA; $F=59.58$, $p<0.01$) (Table 5, Figure 2).

Table 6 presents the species identified in the study areas and their corresponding biomass values. Among the species common in Uzungöl and Paradeniz, only *Keratella cochlearis*

seems to provide comparable data (Figure 3). It was determined that *Keratella cochlearis* individuals whose biomass was measured showed no statistical difference across measurement dates and lakes (F=0.8655, p>0.05).

Table 1. Average values of physicochemical parameters in Lake Uzungöl and Paradeniz between August 2014 and May 2016

	Uzungöl				Paradeniz			
	19.08.2014	3.03.2015	19.11.2015	13.05.2016	31.08.2014	15.03.2015	24.11.2015	7.05.2016
DO (mg L^{-1})	6.3 (±0)	10.99 (±0.447)	9.8825(±2.299)	8.13 (±0.955)	1.15 (±0.08)	9.1475 (±0.38)	7.89 (±0.11)	5.2575 (±0.26)
DO %	80.7 (±0)	97.775 (±4.147)	94.475 (±12.092)	92.625 (±10.946)	18.8 (±1.1)	95.375 (5.19)	84.575 (±0.82)	69.6 (±3.79)
EC (µS cm^{-1})	2055 (±0)	1078.5 (±283.98)	2240.5 (±1132.21)	2187.5 (±534.461)	48484 (±887.6)	20834.5 (±5999.03)	27200.75 (±2931.9)	39760.75 (±2005.92)
Salinity ‰)	1 (±0)	0.55 (±0.15)	1.175 (±0.63)	1.2125 (±0.314)	31.4 (±0.54)	11.675 (±2.9)	17.9 (±1.16)	27.6 (±1.15)
Temperature (C°)	27.6 (±0)	10.1 (±0.255)	10.075 (±0.415)	21.45 (±0.173)	32.4 (±0.47)	14.225 (±0.606)	13.55 (±0.29)	21.235 (±0.83)
pH	9.25 (±0)	8.89 (±0.308)	9.57 (±0.17)	9.0075 (±0.342)	6.03 (±0.25)	8.7425 (±0.024)	9.515 (±0.69)	8.3375 (±0.016)
Secchi Disk (cm)	48 (±0)	45 (±5)	76.25(±23.81)	85 (±26.926)	97.5 (±18.9)	68.75 (±29.66)	72.5 (±17.85)	87.5 (±25.86)
Depth (cm)	48 (±0)	95 (±22.941)	92.5 (±34.187)	130 (±25.495)	120 (±25.5)	107.5 (±17.85)	91.25 (±32.09)	97.5 (±34.91)
Chl-a (µg/L)	26.91 (±0)	22.07 (±6.5)	3.978 (±1.469)	3.963 (±3.011)	2.17 (±0.518)	5.01 (±3.14)	1.155 (±0.411)	0.125 (±0.069)
Cl (mg/L)	473.91 (±0)	242.57 (±100.38)	690.451 (±427.594)	610.07 (±198.754)	19053.17 (±515.58)	7657.2 (±1916.495)	14724.47 (±1395.193)	18294.575 (±954.034)
NO2 (mg/L)	0	0.0314 (±0.033)	0.1008 (±0.175)	0.366 (±0.157)	0	0	0	1.58 (±0.996)
NO3 (mg/L)	1.988 (±0)	1.279 (±0.692)	0.2955 (±0.261)	0.832 (±0.827)	0	1.5 (±1.552)	0	0
PO4 (mg/L)	0	0	0	0	0	0	0	0
SO4 (mg/L)	280.543 (±0)	88.899 (±26.03)	167.196 (±52.416)	135.68 (±28.531)	2228.1 (±61.62)	892.62 (±219.276)	1722.601 (±165.147)	2115.9675 (±112.302)
CO3 (mg/L)	0	16.5 (±2.598)	24.519 (±11.079)	19.853 (±14.91)	33.66 (±2.53)	30 (±0	28.85 (±0	29.4117 (±4.16)
HCO3 (mg/L)	148.78 (±0)	207.4 (±11.206)	200.89 (±25.014)	239.215 (±39.894)	139.85 (±5.15)	198.25 (±16.425)	156.9 (±7.62)	167.451 (±14.65)
Na (mg/L)	306.68 (±0)	157.665 (±53.994)	422.428 (±241.635)	371.231 (±111.60)	9196.1 (±267.15)	4040.55 (±1020.87)	8102.63 (±717.466)	10119.996 (±489.611)
NH4 (mg/L)	1.28 (±0)	0.197 (±0.197)	1.239(±1.488)	0	37.15 (±14.47)	0	18.834 (±20.404)	0
K (mg/L)	12.864 (±0)	8.438 (±1.934)	16.736 (±8.131)	13.24 (±3.321)	391.49 (±16.33)	157.77 (±38.812)	280.02 (±28.98)	337.25275 (±15.482)
Mg (mg/L)	71.881 (±0)	36.998 (±9.533)	79.879 (±34.594)	76.42 (±16.398)	1816.43 (±95.94)	725.21 (±180.746)	1133.636 (±75.296)	1595.25225 (±71.561)
Ca (mg/L)	53.224 (±0)	64.963 (±2.196)	62.703 (±19.788)	70.55 (±11.382)	1261.11 (±328.43)	439.3 (±106.001)	663.979 (±33.49)	675.62395 (±15.752)
Anion (mg/L)	21.70 (±0)	12.684 (±3.558)	27.12 (±13.45)	24.667 (±6.75)	587.94 (±15.83)	239.18 (±58.463)	455.353 (±42.75)	564.52485 (±29.158)
Cation (mg/L)	22.31 (±0)	13.372 (±3.210)	28.58 (±14.497)	26.298 (±6.803)	624.58 (±5.49)	261.43 (±65.21)	487.171 (±40.38)	613.9234 (±28.13)

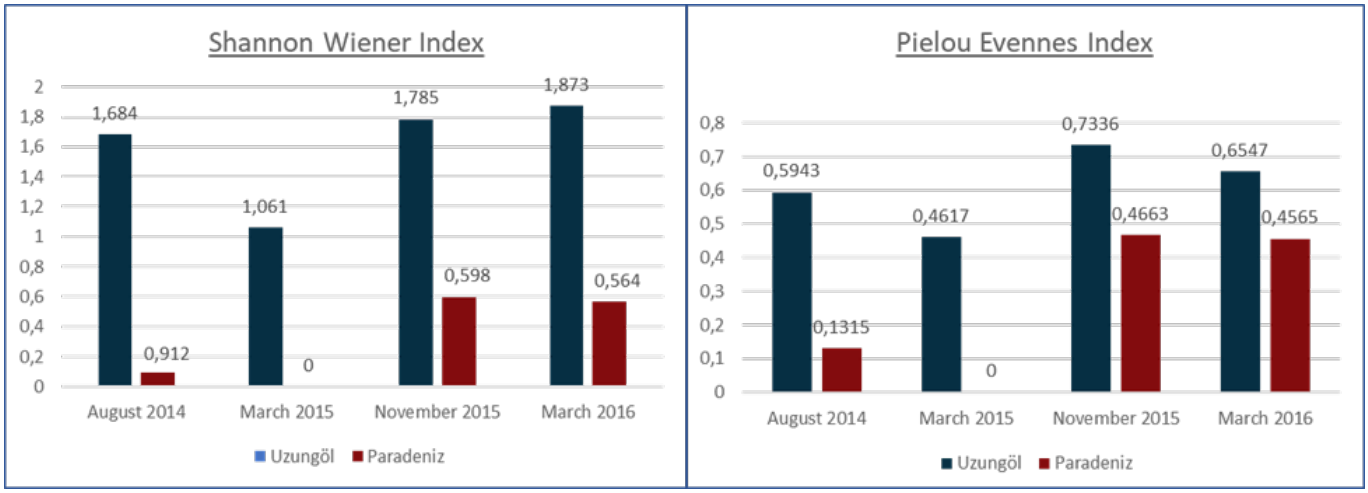

Figure 2. Bar graph of Shannon Wiener Index and Pielou Evenness Index data of Uzungöl and Paradeniz from August 2014 to May 2016.

Table 2. Seasonal Distribution of the Rotifers in Uzungöl and Paradeniz Lagoons

	Uzungöl				Paradeniz			
	Aug. 2014	Mar. 2015	Nov. 2015	May 2016	Aug. 2014	Mar. 2015	Nov. 2015	May 2016
Anuraeopsis fissa				*				
Asplanchna priodonta	*		*	*				
Brachionus angularis	*	*	*	*				
Brachionus bidentata	*							
Brachionus calyciflorus	*	*	*	*			*	
Brachionus diversicornis	*		*					
Brachionus plicatilis		*						
Brachionus quadridentatus	*		*	*				
Brachionus urceolaris		*		*				
Cephalodella catellina			*	*				
Cephalodella delicata			*	*				
Cephalodella gibba		*	*	*				
Colurella colurus		*	*	*				
Filinia longiseta	*		*	*				
Filinia terminalis		*						
Hexarthra fennica								*
Hexarthra intermediata	*			*				
Keratella cochlearis	*			*			*	*
Keratella quadrata		*	*	*				
Keratella tropica	*		*	*			*	*
Lecane bulla	*						*	*
Lecane closterocerca	*		*	*				
Lecane hamata	*							
Lecane luna	*		*	*				
Lecane imbricata		*						
Lecane lunaris	*							
Lecane ohioensis	*		*					
Lepadella ovalis	*		*					
Mytilina mucronata				*				
Mytilina ventralis				*				
Notholca acuminata		*						
Monommata sp.			*					
Polyarthra dolichoptera				*				
Polyarthra vulgaris		*	*	*				
Synchaeta grandis					*			
Synchaeta oblonga		*	*	*				
Synchaeta pectinata		*	*	*				*
Synchaeta sp.					*	*	*	*
Testudinella patina		*						
Trichocerca gibba	*	*	*	*				
Trichocerca marina				*				
Trichocerca rattus		*	*					
Trichothria pocillum		*	*					
Trichothria tetractis			*	*				

Table 3. Abundance and frequency of rotifers by sampling areas and sampling dates (%)

	Frequency (%)									
	August 2014		March 2015		November 2015		May 2016			
	Uzungöl	Paradeniz	Uzungöl	Paradeniz	Uzungöl	Paradeniz	Uzungöl	Paradeniz	Uzungöl	Paradeniz
Anuraeopsis fissa	0	0	0	0	0	0	1.543	0	**25**	**0**
Asplanchna priodonta	2.85	0	0	0	1.271	0	0.364	0	**75**	**0**
Brachionus angularis	2.69	0	0.2687	0	1.617	0	23.520	0	**100**	**0**
Brachionus bidentata	0.24	0	0	0	0	0	0	0	**25**	**25**
Brachionus calyciflorus	4.92	0	0.729	0	0.404	1.785	0.728	0	**100**	**0**
Brachionus diversicornis	0.079	0	0	0	0.1443	0	0	0	**50**	**0**
Brachionus plicatilis	0	0	0.0383	0	0	0	0	0	**25**	**0**
Brachionus quadridentatus	0.238	0	0	0	0.1444	0	0.2572	0	**75**	**0**
Brachionus urceolaris	0	0	0.0767	0	0	0	0.0428	0	**50**	**0**
Cephalodella catellina	0	0	0	0	10.568	0	3.473	0	**50**	**0**
Cephalodella delicata	0	0	0	0	0.3753	0	0.557	0	**50**	**0**
Cephalodella gibba	0	0	1.343	0	1.443	0	2.294	0	**75**	**0**
Colurella colurus	0	0	0.3454	0	1.530	0	1.843	0	**75**	**0**
Filinia longiseta	35.29	0	0	0	5.948	0	13.765	0	**75**	**0**
Filinia terminalis	0	0	23.0710	0	0	0	0	0	**25**	**0**
Hexarthra fennica	0	0	0	0	0	0	0	0.1915	**0**	**25**
Hexarthra mira	36.00	0	0	0	0	0	1.672	0	**50**	**0**
Keratella cochlearis	0.079	0	0	0	3.176	50	8.490	2.681	**75**	**50**
Keratella quadrata	0	0	22.226	0	8.431	0	1.372	0	**75**	0
Keratella tropica	0.952	0	0	0	20.589	7.142	0.321	0	**75**	**25**
Lecane bulla	7.61	0	0	0	0	1.785	0	0	**25**	**25**
Lecane closterocerca	2.854	0	0	0	3.522	0	0.750	0	**75**	**0**
Lecane hamata	0.158	0	0	0	0	0	0	0	**25**	**0**
Lecane imbricata	0	0	0	0	0	0	0.042	0	**25**	**0**
Lecane luna	0.555	0	0	0	2.3678	0	0.107	0	**75**	**0**
Lecane lunaris	0	0	0	0	0.144	0	0	0	**25**	**0**
Lecane ohioensis	0.396	0	0	0	0.721	0	0	0	**50**	**0**
Lepadella ovalis	0.158	0	0	0	1.270	0	0	0	**50**	**0**
Monommata sp.	0	0	0	0	0	0	0.064	0	**25**	**0**
Mytilina mucronata	0	0	0	0	0	0	0.364	0	**25**	**0**
Mytilina ventralis	0	0	0	0	0	0	0.0214	0	**25**	**0**
Notholca acuminata	0	0	8.867	0	0	0	0	0	**25**	**0**
Polyarthra dolichoptera	0	0	0	0	0	0	0.064	0	**25**	**0**
Polyarthra vulgaris	0	0	38.925	0	6.901	0	17.645	0	**75**	**0**
Synchaeta grandis	0	96.417	0	0	0	0	0	13.409	**0**	**25**
Synchaeta oblonga	0	0	0.422	0	3.696	0	8.983	0	**75**	**0**
Synchaeta pectinata	0	0	0.2687	0	23.390	0	10.463	0.383	**75**	**25**
Synchaeta sp.	0	3.582	0	100	0	39.285	0	83.333	**0**	**100**
Testudinella patina	0	0	0.076	0	0	0	0.0857	0	**50**	**0**
Trichocerca marina	4.916	0	1.190	0	1.126	0	0.364	0	**100**	**0**
Trichocerca rattus	0	0	0.383	0	0.490	0	0.0214	0	**75**	**0**
Trichocerca stylata	0	0	0	0	0	0	0.686	0	**25**	**0**
Trichothria pocillum	0	0	1.765	0	0.173	0	0.021	0	**75**	**0**
Trichothria tetractis	0	0	0	0	0.548	0	0.064	0	**50**	**0**
SUM	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**		

Table 4. Amount of individuals in cubic meters (ind.m^{-3}) by sampling areas and sampling dates

	Uzungöl				Paradeniz			
Dates / **Species** *(ind.m^{-3})*	August 2014	March 2015	Novem-ber 2015	May 2016	August 2014	March 2015	November 2015	May 2016
Anuraeopsis fissa	0	0	0	1718.87	0	0	0	0
Asplanchna priodonta	3437.74	0	1050.42	405.85	0	0	0	0
Brachionus angularis	3246.76	167.11	1336.90	26188.96	0	0	0	0
Brachionus bidentata	286.47	0	0	0	0	0	0	0
Brachionus calyciflorus	5920.56	453.59	334.225	811.69	0	0	15.92	0
Brachionus diversicornis	95.49	0	119.36	0	0	0	0	0
Brachionus plicatilis	0	23.87	0	0	0	0	0	0
Brachionus quadridentatus	286.47	0	119.36	286.47	0	0	0	0
Brachionus urceolaris	0	47.75	0	47.746	0	0	0	0
Cephalodella catellina	0	0	8737.61	3867.47	0	0	0	0
Cephalodella delicata	0	0	310.35	620.70	0	0	0	0
Cephalodella gibba	0	835.56	1193.66	2554.44	0	0	0	0
Colurella colurus	0	214.86	1265.28	2053.11	0	0	0	0
Filinia longiseta	42494.40	0	4917.89	15326.63	0	0	0	0
Filinia terminalis	0	14347.83	0	0	0	0	0	0
Hexarthra fennica	0	0	0	0	0	0	0	15.92
Hexarthra mira	43353.84	0	0	1862.11	0	0	0	0
Keratella cochlearis	95.49	0	2626.05	9453.81	0	0	445.64	222.82
Keratella quadrata	0	13822.62	6970.99	1527.88	0	0	0	0
Keratella tropica	1145.92	0	17021.64	358.09	0	0	63.66	0
Lecane bulla	9167.33	0	0	0	0	0	15.915	0
Lecane closterocerca	3437.75	0	2912.54	835.56	0	0	0	0
Lecane hamata	190.98	0	0	0	0	0	0	0
Lecane imbricata	0	0	0	47.746	0	0	0	0
Lecane luna	668.45	0	1957.61	119.36	0	0	0	0
Lecane lunaris	0	0	119.36	0	0	0	0	0
Lecane ohioensis	477.46	0	596.83	0	0	0	0	0
Lepadella ovalis	190.99	0	1050.42	0	0	0	0	0
Monommata sp.	0	0	0	71.61	0	0	0	0
Mytilina mucronata	0	0	0	405.85	0	0	0	0
Mytilina ventralis	0	0	0	23.87	0	0	0	0
Notholca acuminata	0	5514.73	0	0	0	0	0	0
Polyarthra dolichoptera	0	0	0	71.62	0	0	0	0
Polyarthra vulgaris	0	24207.48	5705.71	19647.69	0	0	0	0
Synchaeta grandis	0	0	0	0	4631.41	0	0	1114.08
Synchaeta oblonga	0	262.61	3055.77	10002.89	0	0	0	0
Synchaeta pectinata	0	167.11	19337.34	11650.15	0	0	0	31.83
Synchaeta sp.	0	0	0	0	190.98	15.91	350.14	6923.25
Testudinella patina	0	47.74	0	95.49	0	0	0	0
Trichocerca marina	5920.57	740.07	931.057	405.84	0	0	0	0
Trichocerca rattus	0	238.73	405.85	23.87	0	0	0	0
Trichocerca stylata	0	0	0	763.94	0	0	0	0
Trichothria pocillum	0	1098.17	143.24	23.87	0	0	0	0
Trichothria tetractis	0	0	453.59	71.62	0	0	0	0

Table 6. Biomass values of rotifers in Uzungöl and Paradeniz between August 2014 and May 2016

	Uzungöl				Paradeniz			
	August 14	March 15	November 15	May 16	August 14	March 15	November 15	May 16
	x̄ µg ± SD	**x̄ µg ± SD**	**x̄ µg ± SD**	**x̄ µg ± SD**	**x̄ µg ± SD**	**x̄ µg ± SD**	**x̄ µg ± SD**	**x̄ µg ± SD**
Asplanchna priodonta	0	0	0.1775 ± 0.101	0	0	0	0	0
Brachionus angularis	0.133 ± 0.031	0	0.359 ± 0.037	0.1615 ± 0.036	0	0	0	0
Brachionus calyciflorus	1.115 ± 0.357	1.351 ± 0.225	1.505 ± 0.099	0.950 ± 0.101	0	0	0	0
Brachionus diversicornis	0	0	0	0.3062 ± 0.082	0	0	0	0
Brachionus plicatilis	0	0	0	0.0412 ± 0.004	0	0	0	0
Brachionus quadridentatus	0	0	0	0.3446 ± 0.13	0	0	0	0
Filinia longiseta	0.2501451 ± 0.116	0	0. 2635 ± 0.056	0.2042 ± 0.048	0	0	0	0
Filinia terminalis	0	0.3888 ± 0.173	0	0	0	0	0	0
Hexarthra mira	0.2023399 ± 0.091	0	0	0.1768 ± 0.06	0	0	0	0
Keratella cochlearis	0	0	0. 0.0184 ± 0	0.0271 ± 0.005	0	0	0.04716 ± 0.006	0.06529 ± 0.008
Keratella quadrata	0	0.6436 ± 0.112	0.3142 ± 0.778	0.3818 ± 0.076	0	0	0	0
Keratella tropica	0.22143255 ± 0.038	0	0.226 ± 0.017	0.225 ± 0.008	0	0	0	0
Notholca acuminata	0	0.3908 ± 0.086	0	0	0	0	0	0
Polyarthra vulgaris	0.277014 ± 0.091	0.351 ± 0.113	0.2905 ± 0.0916	0.2971 ± 0.078	0	0	0	0
Synchaeta grandis	0	0	0	0	0.3697 ± 0.118	0	0	0.3625 ± 0.143
Synchaeta oblonga	0	0	0.1772 ± 0.055	0.1788 ± 0.02	0	0	0	0
Synchaeta pectinata	0	0	0.5455 ± 0.135	0	0	0	0	0
Synchaeta sp.	0	0	0	0	0	0	0	0.1001 ± 0.296
Trichocerca gibba	0.4800944 ± 0.164	0	0.00198 ± 0.035	0.0007 ± 0.055	0	0	0	0
	x̄ µm ± SD	**x̄ µm ± SD**	**x̄ µm ± SD**	**x̄ µm ± SD**	**x̄ µm ± SD**	**x̄ µm ± SD**	**x̄ µm ± SD**	**x̄ µm ± SD**
Nauplii	177.319 ±41.198	153.616 ± 25.706	175.086 ± 31.340	173.303 ± 27.936	120.481 ± 21.503	98.876 ± 6.384	97.054 ± 5.894	107.971 ± 11.065

Table 5. Shannon Wiener and Pielou Evenness Index of Uzungöl and Paradeniz between August 2014 and May 2016

	Uzungöl		Paradeniz	
	Shannon Wiener Diversity Index	Pielou Evenness Index	Shannon Wiener Diversity Index	Pielou Evenness Index
August	1.6837	0.5942	0.0911	0.1315
March	1.0611	0.4617	0	0
November	1.7854	0.7336	0.5975	0.4663
May	1.8726	0.6547	0.5642	0.4564
(Min-Max)	(0.2509-2.4019)	(0.1289-0.831)	(0- -1.0735)	(0- -0.7253)
Mean	1.5816	1.5777	-0.3132	-0.2635
(± SD)	0.5181	0.1613	0.3466	0.2605

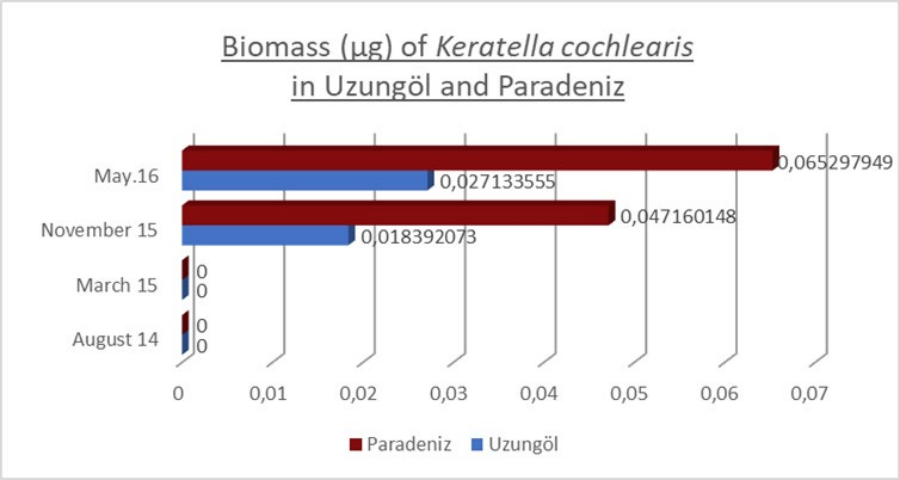

Figure 3. Biomass values of *Keratella cochlearis* in Uzungöl and Paradeniz between August 2014 to May 2016

The possible effects of physical and chemical parameters on zooplankton species diversity, density, and distribution have been studied by many researchers (Berzins & Pejler, 1987; Shaw & Kelson, 1992; Williams et al., 1990). It is known that many environmental factors, such as salinity (Williams, 1998), temperature, and EC, are effective. Zooplanktonic organisms have a wide distribution and are found in almost all aquatic systems (Galkovskaja, 1987). The most diverse rotifer assemblages occur in soft, slightly acidic, oligo- to mesotrophic waters. These are particularly vulnerable to eutrophication and salinisation (Segers, 2008).

In areas where eutrophication and salinity increase, species diversity and population density also decrease. During our study, salinity was changed to 0.55 in March and 1.21 in May in Uzungöl, and to 11.67 in March and 31.04 in August in the Paradeniz Lagoon. Species diversity and distribution also varied significantly with salinity. In the Paradeniz lagoon, where salinity and EC were high, species diversity and population density were low, and these species are highly salt-tolerant, such as the genera *Synchaeta* and *Hexarthra*.

Egborge (1994) observed that species richness would decrease with increasing conductivity from 2800 to 50000 µS cm. When the EC values determined in both areas were analysed, it was observed that they varied between 1078.5-2240.5 µS cm^{-1} in Uzungöl and 20834.5-48484 µS cm^{-1} in Paradeniz Lagoon, and that the number and density of species showed significant differences in both areas.

During the study, 41 species were recorded in Uzungöl and 8 in Paradeniz. Among the sampling dates, species diversity and density were higher in November and May in Uzungöl than on other dates. Although there was no significant difference in physicochemical parameters between the sampling dates, except salinity and EC, significant differences were observed in chlorophyll a. Generally, rotifer population growth increases with increasing temperature and food concentration

(Kauler & Enesco, 2011). In November and May, when zooplankton density was high, chlorophyll a was 3.97 - 3.96 µg/L due to feeding pressure; accordingly, in March and August, when zooplankton density was lower, chlorophyll a was much higher at 26.9 - 22 µg/L.

In conclusion, the major environmental factor affecting rotifer communities is salinity. An increase in salinity resulted in a decrease in species richness and diversity (Bielańska & Cudak, 2014). The highest densities were recorded in freshwater and hyposaline Uzungöl, whereas the lowest were in high saline Paradeniz lagoon, and species richness also differed significantly between the two sampling areas. Statistical analysis also showed that the Shannon-Wiener Diversity Index and Pielou Evenness index differ significantly among the lakes (One-Way ANOVA; F F= 59.58; $p < 0.01$).

Conclusion

In both areas, biomass calculations were made by utilising the length-weight relationship. For each species for which biomass was measured, the lengths of about 20 individuals were measured, average values were taken, and the weights of each species in micrograms were calculated. Analysis of biomass from the lagoons reveals that nauplii have a significant mass in both areas. No significant difference in rotifer species biomass was found in Uzungöl compared with previous studies conducted in eutrophic lakes (Kolisko, 1977; Downing & Rigler, 1984; Akbulut, E., 1998). Depending on the plankton density, zooplankton biomass is also high in November and May. However, nauplii biomass was high in all seasons sampled.

Compliance with Ethical Standards

Conflict of interest: The author declares no actual, potential, or perceived conflict of interest for this article.

Ethics committee approval: Ethics committee approval is not required for this article.

Data availability: The data will be made available upon request from the author.

Funding disclosure: This research was funded by Hacettepe University (BAP-014 D04 818 001-598; FHD 2015-8292).

Acknowledgements: The authors thank İbrahim Arslan and Vahid Bayramıalemdarı for their assistance with the field experiments.

Disclosure: Abstract/summary of this MS has been published in the XVI Rotifer Conference Proceedings in Zagreb, 2022

References

Akbulut, E.N. (1998). Biomass analysis of dominant zooplanktonic organisms living in Lake Mogan (Turkey). *Turkish Journal of Zoology*, 22, 333-339.

Akbulut Emir, N, Akbulut, A., Park, Y.S. (2008). Relationship between zooplankton (rotifera) distribution and physicochemical variables in Uluabat Lake (Turkey). *Fresenius Environmental Bulletin* 17(8A), 947-955.

Akbulut, Emir N. (1998). Biomass analysis of dominant zooplanktonic organisms living in Lake Mogan (Turkey), *Turkish Journal of Zoology*, 22(4), 333-340.

Akbulut, N., & Bayramıalemdarı, V., (2015). Türkiye Lagünlerinin Biyolojik Çeşitliliğinin Tespiti, Hacettepe Üniversitesi Bilimsel Araştırmalar Birimi, 014 D04 818 001-598 Nolu Proje Sonuç Raporu.

Akbulut, N., & Tavşanoğlu, U. N., (2015). Susurluk Havzası Lagünlerinde Sucul Biyoçeşitliliğin Araştırılması, Hacettepe Üniversitesi Bilimsel Araştırmalar Birimi, 013 D11 818 002-427 Nolu Proje Sonuç Raporu.

Akbulut, E.N., & Tavşanoğlu, U. N., (2018). Impacts of environmental factors on zooplankton taxonomic diversity in coastal lagoons in Turkey. *Turkish Journal of Zoology*, 42, 68–78.
https://doi.org/10.3906/zoo-1704-37

Armengol -J.D., A. Esparcia A., Vicente E., & Miracle M.R. (1993). Vertical distribution of planktonic rotifers in a karstic meromictic lake. *Hydrobiologia,* 255/256, 381-388.
https://doi.org/10.1007/BF00025863

Bekleyen A. (2008). Çernek gölü'nün (Samsun) zooplankton faunası. *Ekoloji,* 17(67), 24-30.
https://doi.org/10.5053/ekoloji.2008.674

Berzins B., & Pejler B. (1987). Rotifer occurrence in relation to pH. *Hydrobiologia*, 147, 107-116.
https://doi.org/10.1007/BF00025733

Bielańska, G.I, Cudak A. (2014). Effects of salinity on species diversity of rotifers in anthropogenic water bodies. *Polish Journal of Environmental Studies,* 23(1), 27-34.

Danni, Y., Chen, L., Luan, L., Wang, Q., & Yang Y. (2020). Effect of salinity on the zooplankton community in the Pearl River Estuary. *Journal of Ocean University of China*, 19(6), 1389-1398.

https://doi.org/10.1007/s11802-020-4449-6

De Smet, W.H. & Pourriot, R. (1997). Rotifera, Vol. 5: The Dicranophoridae (Monogonanta). In: Dumont HJF, editor. Guides to the Identification of the Microinvertebrates of the Continental Waters of the World 12. The Hague, the Netherlands: SPB Academic Publishing, 1-344 pp.

De Smet, W.H. (1996). Rotifera, Vol. 4: Proalidae (Monogonanta). In: Dumont HJF, editor. Guides to the Identification of the Microinvertebrates of the Continental Waters of the World 9. Amsterdam, the Netherlands: SPB Academic Publishing, 849-913 pp.

De Smet, W.H. (1998). *Cephalodella segersi* n.sp. (Notommatidae, Monogononta), a new rotifer from Belgium, with notes on *C. catellina* (O.F. Müller, 1786*), C. fluviatilis* (Zavadovsky, 1926) and C. maior Zavadovsky, 1926 stat. Nov. *Hydrobiologia,* 367, 1-13.
https://doi.org/10.1023/A:1003199004604

Devette, M. (1998). Influence of environmental factors on the rotifer assemblage in an artificial lake. *Hydrobiologia* 387/388, 171–178.
https://doi.org/10.1023/A:1017050011995

Candeias, D.A., Moi, D.A., Simoes, N.R., Azevedo, F., Meerhoff, M., Bonecker, C.C. (2022). High temperature, predation, nutrient, and food quality drive dominance of small-sized zooplankton in Neotropical lakes, *Aquatic Science,* 84, 49.
https://doi.org/10.1007/s00027-022-00881-4

Downing, J.A. & Rigler, F.H. (1984). A Manual Methods for Assessment of Secondary Productivity in Fresh Waters. IBP Handbook No. 17, 2nd ed. Blackwell Sci. Publ.

Duggan, I.J., Green, J.D., Thomasson, J.D. (2001). Do rotifers have potential as bioindicators of lake trophic state?. *Verhandlungen des Internationalen Verein Limnologie,* 27, 3497–3502.
https://doi.org/10.1080/03680770.1998.11902479

Duggan, I.C., Green, J.D., Shiel, R.J. (2002). Distribution of rotifer assemblages in North Island, New Zealand, lakes: relationships to environmental and historical factors. *Freshwater Biology*, 47(2), 195–206.
https://doi.org/10.1046/j.1365-2427.2002.00742.x

Dumont, H.J.F. (2006). Guides to the Identification of the Microinvertebrates of the Continental Waters of the World: Rotifera Biology, Ecology and Systematics, (2nd edition), (Eds. Wallace, R.L., Snell, T.W., Ricci, C., Nogrady, T)

Edmondson, W.T. (ed.) (1971). A Manual on Methods for the Assessment of Secondary Productivity in Fresh Waters, Blackwell, London.

Egborge, A.B.M. (1994). Salinity and the distribution of rotifers in the Lagos Harbour- Badagry Creek system, Nigeria. *Hydrobiologia*, 272, 95-104.
https://doi.org/10.1007/BF00006515

Emir N. (1989). Samsun Bafra gölü Rotatoria türlerinin mevsimsel değişimi üzerine ekolojik bir çalışma. *Doğa TU Zooloji,* 13(3), 220-227.

Emir N. (1990). Samsun Bafra gölü Rotatoria faunasının taksonomik yönden incelenmesi. *Doğa Türk Zooloji,* 14(1), 89-106.

Emir N. (1994). İç Anadolu Bölgesi Çavuşcu, Akşehir, Eber ve Karamuk gölleri rotatoria faunasının taksonomik ve ekolojik açıdan değerlendirilmesi, Hacettepe Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi, 171s.

Galkovskaja G.A. (1987). Planktonic rotifers and temperature**.** *Hydrobiologia,* 147, 307-317.
https://doi.org/10.1007/BF00025759

Grajner I.B. (2001). The psammic rotifer structure in three Lobelian Polish lakes differing in pH. *Hydrobiologia* 446/447(1), 149–153.
https://doi.org/10.1023/A:1017551323170

Gül, E. (2021). Farklı İki Lagün Sisteminde (Samsun, Gıcı ve Karacabey, Dalyan) Fizikokimyasal Parametrelere Bağlı Olarak Zooplankton Biyokütle Değişiminin İncelenmesi. Hacettepe Üniversitesi Fen Bilimleri Enstitüsü Yüksek Lisans tezi 140s.

Gündüz, E. (1991a). Bafra Balık Gölü'nün (Balıkgölü-Uzungöl) Cladocera türleri üzerine taksonomik bir çalışma. *Turkish Journal of Zoology* 15, 115-133.

Gündüz, E. (1991b). Bafra Balık Gölü'nün (Balıkgölü-Uzungöl) Calanoida ve Cyclopoida (Copepoda) türleri üzerine taksonomik bir çalışma. *Turkish Journal of Zoology,* 15, 296-305.

Günsel, S. & Akbulut, N.E. (2012). The investigation of the zooplanktonic organisms of Delice River and its arms in Kızılırmak River Basin Turkey. *Hacettepe Journal of Biology and Chemistry,* 40(5), 309-316.

Herzig, A. (1987). The analysis of planktonic rotifer populations: A plea for long-term investigations. *Hydrobiologia*, 147, 163–180. https://doi.org/10.1007/BF00025739

Kauler, P., Enesco, H. E. (2011). The effect of temperature on life history parameters and cost of reproduction in the rotifer *Brachionus calyciflorus*. *Journal of Freshwater Ecology* 26, 399-408. https://doi.org/10.1080/02705060.2011.563998

Khaleqsefat, E., Malekzadeh-Viayeh, R. (2013). Effect of season and environmental variables on rotifer community structure: evidence from two selected freshwaters in Northwest Iran. *Research Journal of Animal Sciences*, 7, 34–41.

Kjerfve, B., (1994). Coastal Lagoon Processes, Elsevier, Oceanography Series 60. 576p

Kolisko, A.R. (1977). Suggestion for biomass calculation of plankton rotifers. *Archiv für Hydrobiologie, Beihefte der Ergebnisse der Limnologie,* 8, 71–76.

Kolisko, R. (1974). *Planktonic Rotifers Biology and Taxonomy, Die Binnengewässer*. Stuttgart: Schweizerbart, 146 p.

Koste, W. (1978a). *Rotatoria, Die Radertiere Mitteleuropas. Ein Bestimmungswerk*, begründet von max Voigt. 2 Aufl. 1 vols. Berlin: Gebrüder Borntraeger.

Koste W (1978b). *Rotatoria, Die Radertiere Mitteleuropas. Ein Bestimmungswerk*, begründet von Max Voigt. 2 Aufl., 2 Bände. Berlin: Gebrüder Borntraeger.

Kutikova, L.A. (1970). Kolovratki Fauna SSSR. (The rotifer fauna of USSR), Leningrad.

Mikschi, E. (1989). Rotifer distribution in relation to temperature and oxygen content. *Hydrobiologia,* 186, 209-214. https://doi.org/10.1007/BF00048914

Lee, M.C., Yoon, D.S., Park, J.C., Choi, H., Shin, K.-H., Hagiwara, A., Lee, J.-S., & Park, H.G. (2022). Effects of salinity and temperature on reproductivity and fatty acid synthesis in the marine rotifer *Brachionus rotundiformis. Aquaculture*, 546, 737282. https://doi.org/10.1016/j.aquaculture.2021.737282

Nogrady, T. (1980). Canadian rotifers II Parcmont Trembland Quebec. *Hydrobiologia*, 71, 35-46. https://doi.org/10.1007/BF00005826

Özdemir, C.D., Saygi, Y., Gündüz, E., Demirkalp, F.Y., & Karacaoğlu, Ç., (2021). Assessment of the zooplankton community structure of the coastal Uzungöl Lagoon (Kızılırmak Delta, Turkey) based on community indices and physicochemical parameters. *Turkish Journal of Zoology*, 45(1) 33–45. https://doi.org/10.3906/zoo-2006-9

Paturej, E., Gutkowska, A., Koszałka, J., Bowszys, M., (2017). Effect of physicochemical parameters on zooplankton in the brackish, coastal Vistula Lagoon. *Oceanologia* 59, 49-56. https://doi.org/10.1016/j.oceano.2016.08.001

Paturej, E., Kruk, M. (2011). The impact of environmental factors on zooplankton communities in the Vistula Lagoon, *Oceanological and Hydrobiological Studies*, 40(2) 37-48. https://doi.org/10.2478/s13545-011-0015-6

Ruzafa, A.P., Molina-Cuberos, G.J., Oliva, M.G., Umgiesser, G., Concepción, M. (2024). Why coastal lagoons are so productive? Physical bases of fishing productivity in coastal lagoons. *Science of the Total Environment*, 922, 171264. https://doi.org/10.1016/j.scitotenv.2024.171264

Sarma, S.S.S., Resendiz, R.A.L., Nandini, S. (2011). Morphometric and demographic responses of brachionid prey (*Brachionus calyciflorus* Pallas and *Plationus macracanthus* (Daday)) in the presence of different densities of the predator *Asplanchna brightwellii* (Rotifera: Asplanchnidae). *Hydrobiologia*, 662(1), 179–187. https://doi.org/10.1007/s10750-010-0494-2

Schallenberg, M., Hall, C.J., & Burns, C.W. (2003). Consequences of climate-induced salinity increases on zooplankton abundance and diversity in coastal lakes. *Marine Ecology Progress Series,* 251, 181-189. https://doi.org/10.3354/meps251181

Segers, H. (1995). The Lecanidae. In: Dumant HS, editor. Rotifera Vol. 2. Guides to the Identification of the Macroinvertebrates of the Continental Waters of the World. Amsterdam, the Netherlands: SPB Academic Publishing, 226 pp.

Segers, H. (2007). Annotated checklist of the rotifers (phylum rotifera) with notes on nomenclature, taxonomy and distribution. *Zootaxa*, 1564, 1-104.
https://doi.org/10.11646/zootaxa.1564.1.1

Segers, H. (2008). Global diversity of rotifers (Rotifera) in freshwater. *Hydrobiologia*, 595 49–59.
https://doi.org/10.1007/s10750-007-9003-7

Shaw, M.A., & Kelso, J.R.M. (1992). Environmental factors influencing zooplankton species composition of lakes in north-central Ontario, Canada. *Hydrobiologia*, 241, 141-154.
https://doi.org/10.1007/BF00028637

T.C. Orman ve Su İşleri Bakanlığı (2012). Yerüstü Su Kalitesi Yönetmeliği, Resmî Gazete Sayısı: 28483, Resmî Gazete Tarihi: 30.11.2012.

T.C. Orman ve Su İşleri Bakanlığı (2014). Sulak Alanların Korunması Yönetmeliği, Resmî Gazete Sayısı: 28962, Resmî Gazete Tarihi: 04.04.2014.

Telesh, I.V. (1986). Comparative effectiveness of methods of counting planctonic rotifers. *Scripta Technica*, 101–104.

Tischler, W. (1949). *Grundzüge der terrestrischen Tierökologie.* Braunschweig, Germany: F Vieweg & Sohn.
https://doi.org/10.1007/978-3-663-02549-8

Toruan, R.L. (2012). Zooplankton community emerging from fresh and saline wetlands. *Ecohydrol. Hydrobiologia*, 2, 53.
https://doi.org/10.2478/v10104-012-0003-5

Tugaytimur, T. (2023). Tatlı göl, Hersek ve Paradeniz lagünleri'nin zooplankton (Cladocera, Copepoda, Rotifera) türlerinin tespit edilerek, mevsimsel dağılımlarının incelenmesi. Hacettepe Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi, 135 s.

Ustaoğlu, M.R. (2015). An updated zooplankton biodiversity of Turkish inland waters. *Journal of Limnology and Freshwater Fisheries Research*, 1(3), 151-159.
https://doi.org/10.17216/LimnoFish-5000151941

Ustaoğlu, M.R., Mis, D.Ö., Aygen, C. (2012). Observations on Zooplankton in Some Lagoons in Turkey. *Journal of Black Sea/Mediterranean Environment*, 18(2), 208-222.

Wallace, R.L. (2002). Rotifers: Exquisite metazoans. *Integrative and Comparative Biology*, 42(3), 660-667.
https://doi.org/10.1093/icb/42.3.660

Williams, W.D. (1998). Salinity as a determinant of structure of biological communities in salt lakes. *Hydrobiologia*, 381, 191-201.
https://doi.org/10.1023/A:1003287826503

Williams, W.D., Boulton, A.J., & Taaffe, R.G. (1990). Salinity as a determinant of Salt Lake fauna: A question of scale. *Hydrobiologia*, 197, 257-266.
https://doi.org/10.1007/BF00026955

Yoshida, T., Urabe, J., Elser, J.J. (2003). Assessment of 'top-down' and 'bottom-up' forces as determinants of rotifer distribution among lakes in Ontario, Canada. *Ecological Research,*18 (6), 639-650.
https://doi.org/10.1111/j.1440-1703.2003.00596.x

Yuan D., Chen L., Luan Leilei, Wang Q. and Yang Y. (2020). Effect of salinity on the zooplankton community in the Pearl River Estuary. *Oceanic and Coastal Sea Research*, 19(6), 1389-1398.
https://doi.org/10.1007/s11802-020-4449-6