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RESEARCH PAPER

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Seasonal Dynamics of the Zooplankton Community in the Temperate Eutrophic Çaygören Reservoir (Balıkesir), Turkey Related to Certain Physicochemical Parameters of Water

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Abstract

Seasonal dynamics in the zooplankton community and its relationships with certain physicochemical parameters (water temperature, Secchi disk transparency, conductivity, nitrate-nitrogen (NO_3-N), phosphate (PO_4), pH, oxidation-reduction potential (ORP) and chlorophyll-*a*) were studied in the eutrophic Çaygören Reservoir, Turkey from February 2007 to March 2008. *Cyclops vicinus* was dominant throughout the year; *Acanthocyclops robustus* was dominant in fall and summer; *Asplanchna priodonta* was dominant in fall, winter and spring at all stations. Canonical correspondence analysis (CCA) showed that *A. robustus* had high correlations to conductivity, *C. vicinus* to PO_4 and NO_3-N and *Metacyclops gracilis* to water temperature and chl-*a*. The number of individual were significantly different among the seasons and stations ($p<0.05$). The number of species were significantly different among the seasons ($p<0.05$), but not among the stations ($p>0.05$). Zooplankton community in the Çaygören Reservoir underwent changes in species composition from small-bodied

Introduction

The functioning of aquatic ecosystems depends on the biological diversity of the system (Veerendra, Thirumala, Manjunatha, & Aravinda, 2012). Zooplankton community is an important biotic component of aquatic ecosystems, as it occupies a critical link between primary producers and consumers and contributes to the recycling of nutrients (Hood & Sterner, 2010).

The major freshwater zooplankton groups include Cladocera, Copepoda and Rotifera. Cladocerans have the ability to survive in extreme conditions (Sarma, Nadini, & Gulati, 2005). Copepods are important prey items for

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the young fish and they feed on intermediate consumers, mainly ciliates (Sommer *et al*., 2001; Feuchtmayr, Zollner, Santer B, Sommer, & Grey, 2004). Many rotifer species are indicators of water quality in inland waters (Rajashekhar, Vijaykumar, & Parveen, 2009).

The distribution and diversity of zooplankton in aquatic ecosystems depend mainly on the physicochemical properties of the water column (Barnett & Beisner, 2007). The temporal variations in zooplankton community may depend on changes in the availability of edible phytoplankton which often vary depending on the physical processes and nutrient availability in the water bodies (Sarmento *et al*., 2008).

An understanding of the community patterns will better allow us to predict the dynamics of zooplankton community structure under future scenarios of anthropogenically induced changes in lakes and reservoirs. Lately the zooplanktonic organisms of reservoirs in Turkey have attracted the attention of many scientists (Baykal, Salman, & Açıkgöz, 2006; Kaya & Altındağ, 2007; Bozkurt & Göksu, 2010; Buyurgan, Altındağ, & Kaya, 2010; Gökçe & Özhan, 2011; Apaydın Yağcı & Ustaoğlu, 2012; Bozkurt & Akın, 2012; Gökçe & Turhan, 2014; Saler, Alpaslan, Karakaya, & Gündüz, 2017).

There are still reservoirs in Turkey that its zooplanktonic organisms have not been studied yet. In this study, we aimed to assess the seasonal dynamics of zooplankton community in relation to certain physicochemical and biological parameters in the eutrophic temperate Çaygören Reservoir, Balıkesir, Turkey.

Materials and Methods

Study Area

In Turkey, the most important problem for agriculture is the lack of irrigation water during summer due to its dry and hot Mediterranean climate. One of the effective solutions for this problem is building dams on the running waters. The Çaygören Reservoir was built in 1971 for the purpose of irrigating the Sındırgı and Bigadiç plains. It is also used for power generation. Sport fishing in the reservoir is also popular. Therefore, the reservoir is important to the local and regional economic and ecological sustainability (Arslan & Ergül, 2014).

The Çaygören Reservoir **is** located at 39° 17' 24'' N and 28**°** 19' 16'' E, 55 km southeast of Balıkesir, Turkey (Fig. 1). I**t** lies at 273 m above the sea level and has a maximum depth of 28 m, a length of 4.6 km and a surface area of 9 km^2. The reservoir is fed by the Simav Stream (State Water Works, 2017).

Sampling Procedure and Analysis

Sampling was started in February 2007 and ended in March 2008. Zooplankton was sampled with vertical net hauls using a 0.30 m diameter net with 60 µm mesh size at three stations. Vertical tows were carried out from the bottom to the surface.

A total of 100 L water was filtered through the net for a composite sample. The volume of filtered water was calculated by multiplying the area of the mouth of the net by the length (depth) through which the net was towed. A calibrated meter in the net corrected for back flushing during vertical hauls. Samples were fixed and preserved with 4% formaldehyde in 500 ml plastic bottles immediately after collection (APHA, 1995).

Zooplankton specimens were identified and counted under an inverted microscope. Counting was done in Petri dishes from 4 ml sub-samples. A minimum of 200 individuals were quantified per replicate, and the final density was converted to individuals per cubic meter. The zooplankton taxa were identified using the common taxonomic keys (Dussart, 1968; Ruttner-Kolisko, 1974; Harding & Smith, 1974; Kiefer, 1978; Koste, 1978; Stemberger, 1979; Negrea, 1983; Amoros, 1984; Koste, 2000; Nogrady & Segers, 2002; Benzie, 2005).

Measurements of water temperature, conductivity, pH, oxidation-reduction potential (ORP) and chlorophyll-*a*

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(chl-*a*) were taken using a YSI water quality multi-probe. Water transparency was measured using a Secchi disk. Phosphate (PO_4) and nitrate-nitrogen (NO_3-N) concentrations were determined spectrophotometrically on filtered water (APHA, 1995).
An ANOVA test was carried out to test the spatial and temporal variations among stations and seasons using SPSS (ver. 11.0) software. Canonical Correspondence Analysis (CCA) was applied to the data to determine the relationships between the dominant zooplankton species and water temperature, conductivity, Secchi disk transparency, pH, oxidation-reduction potential, PO_4, NO_3-N and chl-*a* using the CANOCO program (ter Braak & Smilauer, 2002).

Results

Chl-*a* ranged from 2.2 μgl^{-1} to 30.0 μgl^{-1} at the first station, from 1.9 μgl^{-1} to 37 μgl^{-1} at the second station and from 1.4 μgl^{-1} to 37 μgl^{-1} at the third station (Table 1). Secchi disk depth ranged from 0.3 m to 1.5 m at the first station, from 0.6 m to 1.95 m at the second station and from 0.6 m to 1.98 m at the third station (Table 1).
Water temperature ranged from 5 °C to 26 °C at the first station, from 4 °C to 26 °C at the second station and from 5 °C to 25.87 °C at the third station (Table 1).
Conductivity ranged from 0.34 $mScm^{-1}$ to 0.63 $mScm^{-1}$ at the first station, from 0.33 $mScm^{-1}$ to 0.53 $mScm^{-1}$ at the second station and from 0.32 $mScm^{-1}$ to 0.88 $mScm^{-1}$ at the third station (Table 1).
pH ranged from 8 to 11.6 at the first station, from 8.2 to 11 at the second station and from 8.4 to 11.1 at the third station (Table 1). Phosphate (PO_4) concentrations ranged from 0.003 mgl^{-1} to 0.006 mgl^{-1} at the first station, from 0.001 mg l^{-1} to 0.003 mgl^{-1} at the second station and from 0.001 mgl^{-1} to 0.006 mgl^{-1} at the third station (Table 1). Nitrate-nitrogen (NO_3-N) concentrations ranged from 0.08 mgl^{-1} to 0.25 mgl^{-1} at the first station, from 0.007 mgl^{-1} to 1.6 mgl^{-1} at the second station and from 0.007 mgl^{-1} to 0.3 mgl^{-1} at the third station (Table 1).
During the study, a total number of 9 rotifers, 7 cladocerans and 4 copepods were collected. At the first station, the most dominant species, *Asplanchna priodonta* (Rotifera), reached its peak abundance in November 2007 and *Metacyclops gracilis* (Copepoda) in July 2007. At the second station, the most dominant species, *A priodonta* (Rotifera), reached its peak abundance in November 2007, *Trichocerca capucina* (Rotifera) in August 2007, *Daphnia galeata* (Cladocera) in November 2007 and *M. gracilis* (Copepoda) in February 2007. At the third station, the most dominant species, *Filinia longiseta* (Rotifera), reached its peak abundance in in September 2007 and *Cyclops vicinus* (Copepoda) in February 2008.
At the first station, 7 species of Rotifera, 2 Cladocera and 4 Copepoda were collected. The lowest number of species (1) was collected in February 2007 and 2008 and March 2008, the highest number (8) of species was collected in September 2007 (Table 2). At the second station, 8 species of Rotifera, 7 Cladocera and 3 Copepoda were collected (Table 3). The lowest number of species (4) was collected in December 2007 and March 2008 and the highest number (12) was collected in September 2007. At the third station, 7 species of Rotifera, 6 Cladocera and 4 Copepoda were collected (Table 4). The species number was at the lowest level (5) in February, March, May and December 2007 and in January and February 2008 and it reached at the highest level (11) in August and September 2007.
The average annual abundance of zooplankton for the Çaygören Reservoir was 17326.71 $ind.m^{-3}$, the nauplius larvae of Cladocera and Copepoda were not included in counting because of the identification difficulties. At the first station, the lowest number of individuals (674 $ind.m^{-3}$) was collected in February 2007 and the highest number (118569 $ind.m^{-3}$) was collected in September 2007 (Table 2). At the second station, the lowest number of individuals (3529 $ind.m^{-3}$) was collected in

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March 2007 and the highest number (68751 ind.m^{-3}) was collected in August 2007 **(Table 3)**. At the third station, the lowest number of individuals (5952 ind.m^{-3}) was collected in March 2007 and the highest number (74034 ind.m^{-3}) was collected in February 2008 **(Table 4)**.

At the first station, *A. priodonta* was dominant in the fall, winter and spring; *Daphnia longispina* was dominant in the winter and spring; *M. gracilis* was dominant in the spring, summer and fall; *Leptodora kindtii* was dominant in the summer; *Acanthocyclops robustus* was dominant in the summer and spring.

At the second station, *A. priodonta* was dominant in the fall, winter and spring; *B. longirostris*, *C. vicinus* and *D. galeata* were dominant throughout the year; *D. longispina* was subdominant in the fall, winter and spring; *M. gracilis* was dominant in the spring, summer and fall.

At the third station, *A. priodonta* was dominant in the spring, summer and fall; *C. vicinus* was dominant in the spring, fall and winter; *B. longirostris* was dominant the in spring; *D. galeata* was dominant throughout the year; *D. longispina* was dominant in the winter; *M. gracilis* was dominant in fall and summer; *A. robustus* was dominant in the summer.

The ANOVA results showed that the number of species were significantly different among the seasons ($F=1.7$, $p<0.05$), but the stations ($F=0.76$, $p>0.05$). The number of individual were significantly different among the seasons ($F=1.9$, $p<0.05$) and stations ($F=2$, $p<0.05$).

CCA showed that *Keratella cochlearis* was correlated to chl-a; *C. vicinus* was to water temperature; *D. galeata* and *D. longispina* to NO_3-N; *M. gracilis* and *A. robustus* to PO_4 and the other dominant species were not correlated to any measured physicochemical parameters (Fig. 2).

Discussion

Based on Secchi disk depth (average1 m) and chl-*a* concentrations (average 17 µg l^{-1}), the Çaygören Reservoir can be classified as eutrophic (OECD, 1982). Secchi disk depth was negatively correlated with nutrient concentrations at all stations. This was probably due to as nutrient levels rise, the abundance of phytoplankton increase, which absorb light causing reduced water transparency (LaBounty, 2008).

There was a positive correlation between conductivity and nutrient concentrations. Conductivity is often considered as parameter showing the degree of nutrient loading (Parinet, Lhote, & Legube, 2004). Intensive agriculture has been practiced in surroundings of the Çaygören Reservoir, resulting in high nutrient loading and conductivity in the reservoir as agricultural nonpoint sources are a major contributing factor to surface water eutrophication worldwide.

A. priodonta was dominant during fall, winter and spring at all stations. This is an omnivorous species and common in temperate eutrophic lakes. *It* is an opportunistic filter feeder capable of influencing the phytoplankton community structure in lakes and reservoirs by taking advantage of the abundance of different groups during different seasons (Oganjan, Virro, & Lauringso, 2013)

L. kindtii was dominant in the summer at the first station. This is a common invertebrate predator in temperate lakes (Herzing & Auer, 1990). *L. kindtii* selects its prey based on size, usually feeding on smaller cladocerans. This was probably why zooplankton community in the Çaygören Reservoir underwent changes in species composition from small-bodied species in spring to large-bodied species in the summer (Apaydın Yağcı & Ustaoğlu, 2012; ApaydınYağcı *et al.*, 2015).

B. longirostris, *C. vicinus* and *D. galeata* were dominant throughout the year at second and third stations. These species are common members of zooplankton community characteristic to temperate eutrophic lakes

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(Petrusek, Cerny, & Audenaert, 2004; Bledzki & Rybak, 2016). The Çaygören Reservoir is a eutrophic temperate reservoir providing suitable habitat for these cosmopolitan crustaceans.

B. longirostris is a small-bodied, filter-feeding cladoceran widely distributed throughout the world in all kinds of freshwater ecosystems regardless of their trophic state (Toth & Kato, 1997). This study showed that *B. longirostris* was more tolerant than large bodied-cladocerans to environmental stress. Because 2007 and 2008 were the driest years in the last there decades in Turkey and the water level was extremely low in the Çaygören Reservoir.

CCA showed that *D. longispina* and *D. galeata* had high correlations to nitrate concentrations. This could be attributed to high abundance of Cyanobacteria in the summer. Elser & Urabe (1999) noted that increased biomass of *D. galeata* when nitrogen concentrations increased in Lake Biwa, Japan. The phytoplankton of the Çaygören Reservoir is dominated by the nitrogen fixing Cyanobacteria during warm seasons (Çelik & Sevindik, 2015).

Studies suggest that *D. longispina*, favor development of Cyanobacteria blooms by removing small edible phytoplankton (Leibold, 1989). High abundance of Cyanobacteria during the summer contributes to high nitrate concentrations by fixing nitrogen in the eutrophic water bodies (Presing, Herodek, Preston, & Vörös, 2001). High abundance of nitrogen fixing Cyanobacteria during summer probably resulted in high correlation between *D. longispina* and NO_3 in the Çaygören Reservoir.

CCA showed that *M. gracilis* had high correlations to phosphate concentrations. This was probably the result of a counteracting stimulus represented by low DO concentrations which cause the release of phosphorus in the sediment of the eutrophic reservoirs. *M. gracilis* was dominant during the summer months especially at the deep third station. Phosphorus is released from the sediments into the lake water in deep lakes in the anoxic hypolimnion during the stratification period (Sondergaard, Jensen, & Jeppens, 2003).

CCA showed that *C. vicinus* was correlated to water temperature. *C. vicinus* is a cosmopolitan copepod that is common in Turkey's inland waters. In recent years, many studies reported high abundance of the *C. vicinus* in Turkish reservoirs (Bekleyen, 2003; Saler & Alış, 2014; ApaydınYağcı, Yılmaz, Yazıcıoğlu, & Polat, 2015; Alış & Saler, 2016; Saler, 2017). Although *C. vicinus* was common throughout the year at all stations, it had the highest abundance during the summer time. This explains the correlation between this species and high water temperature.

C. vicinus is known to feed on a variety of prey types such as algae, rotifers and small crustaceans, but it prefers rotifers when they are abundant (Devetter & Seda, 2006). The year-long dominance of *C. vicinus* shows that it not only preys on rotifers, it can also use different source of food. Phytoplankton offers an alternative food source for this species when rotifers are scarce (Devetter & Seda, 2003).

In summary, this is the first limnological study conducted on the Çaygören Reservoir and the study revealed that the trophic status of this reservoir was eutrophic (OECD, 1982). The annual average chlorophyll-*a* concentration of the reservoir is 18.25 $\mu g l^{-1}$ and the annual average Secchi disk depth is 1.15 m. Karadzic, Subakov-Simic, Krizmanic, & Natic (2010) discussed the range of physical and chemical parameters for the trophic classification of reservoirs in Serbia, based on their results, the Çaygören Reservoir can be considered as eutrophic. The dominant zooplankton species in the Çaygören Reservoir are cosmopolitan and characteristic to the eutrophic temperate lake zooplankton communities. Finally, the size selective predation by *L. kindtii* probably contributed to the dominance of the large-bodied zooplankton in this reservoir. When *L. kindtii* was

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abundant during the summer 2007, the zooplankton community underwent changes in species composition from small-bodied species in spring to large-bodied species in the summer.

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Table 1. Minimum, maximum, Mean and Standard deviation physical and chemical water characteristics for water quality parameters in the Çaygören Reservoir

	Station 1				Station 2				Station 3			
Var.	Min.	Max.	Mean	Std. D.	Min.	Max.	Mean	Std. D.	Min.	Max.	Mean	Std. D.
Chl-a (μgl^{-1})	2.2	30.0	14.3	9.8	1.90	37.0	12.0	10.9	1.40	37.0	10.08	9.33
Secch (m)	0.4	1.5	0.85	0.33	0.6	1.95	1.10	0.47	0.6	1.98	1.21	0.48
Temp. (^0C)	5.0	26.6	14.20	7.07	4.0	26.0	13.5	6.63	5.00	25.87	12.82	5.90
Cond. ($mScm^{-1}$)	0.34	0.63	.44	.08	.33	.53	.44	.08	.32	.88	.45	.09
pH	8.9	11.0	9.84	.61	8.2	11.0	9.69	.66	8.40	11.1	9.72	.57
PO_4 (mgl^{-1})	0.003	0.06	.03	.005	.001	.03	.022	.007	.001	.06	.023	.011
NO_3 (mgl^{-1})	.08	.25	.18	.052	.07	1.6	.65	.27	.07	.30	.19	.052

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Table 2. The number and density of the identified species (species and individuals per M³) at the first station of the Çaygören Reservoir

	Fb.07	Mr.07	Ap.07	My.07	Jn.07	Jl.07	Ag.07	Sp.07	Oc.07	Nv.07	Dc.07	Jn.08	Fb.08	Mr.08
Number of Species	1	1	6	5	4	3	4	8	7	2	3	2	1	4
Rotifera														
Asplanchna priodonta Gosse, 1850	0	0	4704	0	0	0	0	860	715	13780	1139	588	0	12576
Pompholyx sulcata Hudson, 1885	0	0	0	147	0	0	0	0	0	0	0	0	0	0
Keratella cochlearis (Gosse, 1851)	0	0	784	0	0	0	122	214	0	0	0	0	0	0
Polyarthra vulgaris Carlin, 1843	0	0	0	0	0	0	0	0	0	0	0	0	0	114
Brachionus calyciflorus Pallas, 1766	0	0	784	0	0	0	0	120	0	0	37	0	0	0
Filinia longiseta (Ehrenberg, 1834)	0	0	0	0	0	0	0	16440	286	0	0	0	0	0
Trichocerca capucina (Wierzejski & Zacharias, 1893)	0	0	0	0	25948	0	3214	251	143	0	0	0	0	0
Cladocera														
Daphnia longispina O.F.Müller, 1875	0	0	0	735	490	1043	0	216	500	0	0	0	0	0
Leptodora kindtii (Focke, 1844)	0	0	0	12	1234	101	13	12	0	0	0	0	0	0
Copepoda														
Cyclops vicinus Uljanin, 1875	674	10403	1568	294	0	0	0	234	2858	10963	1286	2352	172375	2401
Acanthocyclops robustus (G.O.Sars, 1863	0	0	4312	1423	1533	3583	0	0	0	0	0	0	0	0
Metacyclops gracilis (Lilljeborg, 1853)	0	0	3920	11523	11616	24497	653	216	357	0	0	0	0	0
Eucyclops speratus (Lilljeborg, 1901)	0	0	0	0	0	0	41	0	143	0	0	0	0	57

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Table 3. The number and density of the identified species (species and individuals per M³) at the second station of the Çaygören Reservoir

	Fb.07	Mr.07	Ap.07	My.07	Jn.07	Jl.07	Ag.07	Sp.07	Ot.07	No.07	Dc.07	Jn.08	Fb.08	Mr.08
Number of species	2	5	3	5	9	6	9	12	5	6	4	5	6	4
Rotifera														
Asplanchna priodonta Gosse, 1850	0	0	0	0	0	0	0	860	0	13833	196	286	719	3528
Pompholyx sulcata Hudson, 1885	0	0	0	0	0	0	0		0	0	0	0	359	0
Keratella cochlearis (Gosse, 1851)	0	0	0	0	0	0	0	214		0	0	0	0	0
Polyarthra vulgaris Carlin, 1843	0	0	0	0	539	0	0	0	0	0	0	0	0	0
Notholca squamula (Müller, 1786)	0	0	0	0	0	0	0	0	0	0	0	0	180	0
Brachionus calyciflorus Pallas, 1766	0	0	0	0	0	0	98	120		0	0	163	0	0
Filinia longiseta (Ehrenberg, 1834)	0	0	0	0	0	0	19402	1644	0	0	0	0	0	0
Trichocerca capucina (Wierzejski & Zacharias, 1893)	0	0	0	0	10150	0	24987	251	0	0	0	0	0	0
Cladocera														
Daphnia longispina O.F.Müller, 1875	0	221	0	564	0	0	0	0	898	126	1254	998	198	653
Daphnia galeata Sars, 1864	0	490	0	4557	7096	5732	4018	422		16168	2090	13555	1617	2090
Ceriodaphnia pulchella Sars, 1862	0	0	0	0	0	0	0	2450	0	0	0	0	0	0
Bosmina longirostris (O.F.Müller, 1785)	0	817		2646		147	257	120	3185	2156	131	939	180	2678
Moina micrura Kurz, 1874	0	0	0	0	269		3723	3150	2205		0	0	0	0
Diaphanosoma brachyurum (Lievin, 1848)	0	0	0	0	2605	4850	4997	1874	327	359	0	0	0	0
Leptodora kindtii (Focke, 1844)	0	0	0	1176	449	588	588	216	0	0	0	0	0	0
Copepoda														
Cyclops vicinus	0	0	98	0	3266	4491	1372	898	6341	9015	0	0	0	0

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Uljanin, 1875														
Acanthocyclops robustus (G.O.Sars, 1863)	898	4263	98	0	163	0	0	0	0	0	0	0	0	0
Metacyclops gracilis (Lilljeborg, 1853)	10779	9995	10485	294	1552	539	0	0	0	0	0	0	0	0

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Table 4. The number and density of the identified species (species and individuals per M^3) at the third station of the Çaygören Reservoir

	Fb.07	Mr.07	Ap.07	My.07	Jn.07	Jl.07	Ag.07	Sp.	Oc.07	Nv.07	Dc.07	Jn.08	Fb.08	Mr.08
Number of species	5	5	-	5	8	8	11	11	10	7	5	5	5	6
Rotifera														
Asplanchna priodonta Gosse, 1850	0	0	-	0	0	0	0	73	257	5063	102	225	784	245
Pompholyx sulcata Hudson, 1885	0	0	-	0	0	0	0	0	0	0	0	0	392	0
Keratella cochlearis (Gosse, 1851)	0	0	-	0	0	0	97	110	0	0	0	0	0	0
Keratella quadrata (Müller, 1786)	0	0	-	0	41	0	0	0	0	0	0	0	0	0
Brachionus calyciflorus Pallas, 1766	0	0	-	0	0	0	0	37	0	0	0	0	0	0
Filinia longiseta (Ehrenberg, 1834)	0	0	-	0	0	49	124	14294	0	0	0	0	0	0
Trichocerca capucina (Wierzejski & Zacharias, 1893)	0	0	-	0	245	98	152	331	294	0	0	0	0	0
Cladocera														
Daphnia longispina O.F.Müller, 1875	387	367	-	367	0	0	0	0	0	453	1450	812	149	490
Daphnia galeata (Sars, 1890)	645	1764	-	1764	1715	3675	2154	220	478	5226	296	9252	5683	1715
Bosmina longirostris (Müller, 1776)	122	588	-	588	82	73	169	73	331	1796	102	584		2205
Moina micrura (Kurz, 1874)	0	0	-	0	0	0	917	3087	588	0	0	0	0	0
Diaphanosoma brachyurum (Lievin, 1848)	0	0	-	0	286	3919	678	478	1139	327	0	0	0	0
Leptodora kindtii (Focke, 1844)	0	0	-	0	122	539	194	0	331	0	0	0	0	0
Copepoda														
Cyclops vicinus Uljanin, 1875	16903	3013	-	3013	0	0	216	73	1874	10779	1062	494	67026	10534
Acanthocyclops robustus (G.O.Sars, 1863)	0	0	-	0	531	931	349		257	490	0	0	0	0

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Metacyclops gracilis (Lilljeborg, 1853)	94	220	-	220	392 0	333 2	993	37	992	0	0	0	0	0
Eucyclops speratus (Lilljeborg, 1901)	0	0	-	0	0	0	0	0	0	0	0	0	0	245

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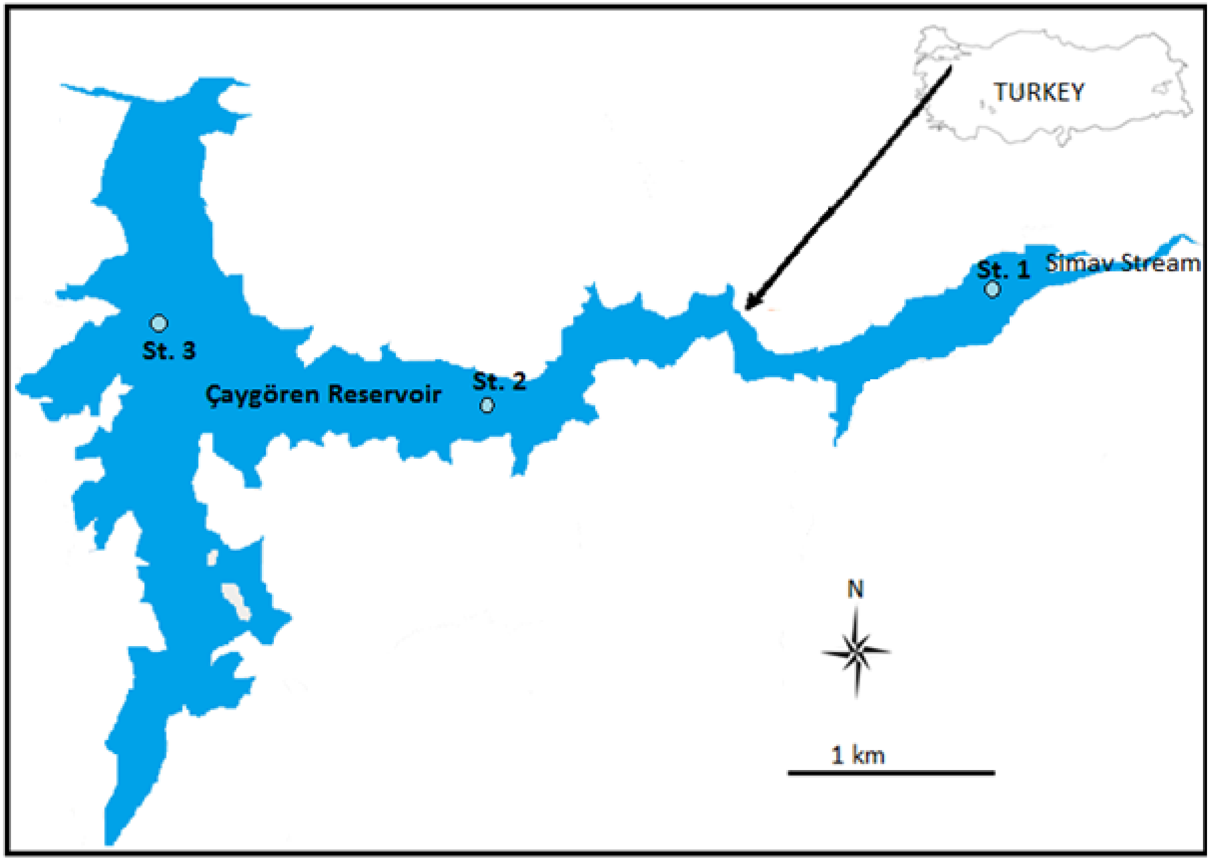

Figure 1. The map of the Çaygören Reservoir and the location of sampling stations.

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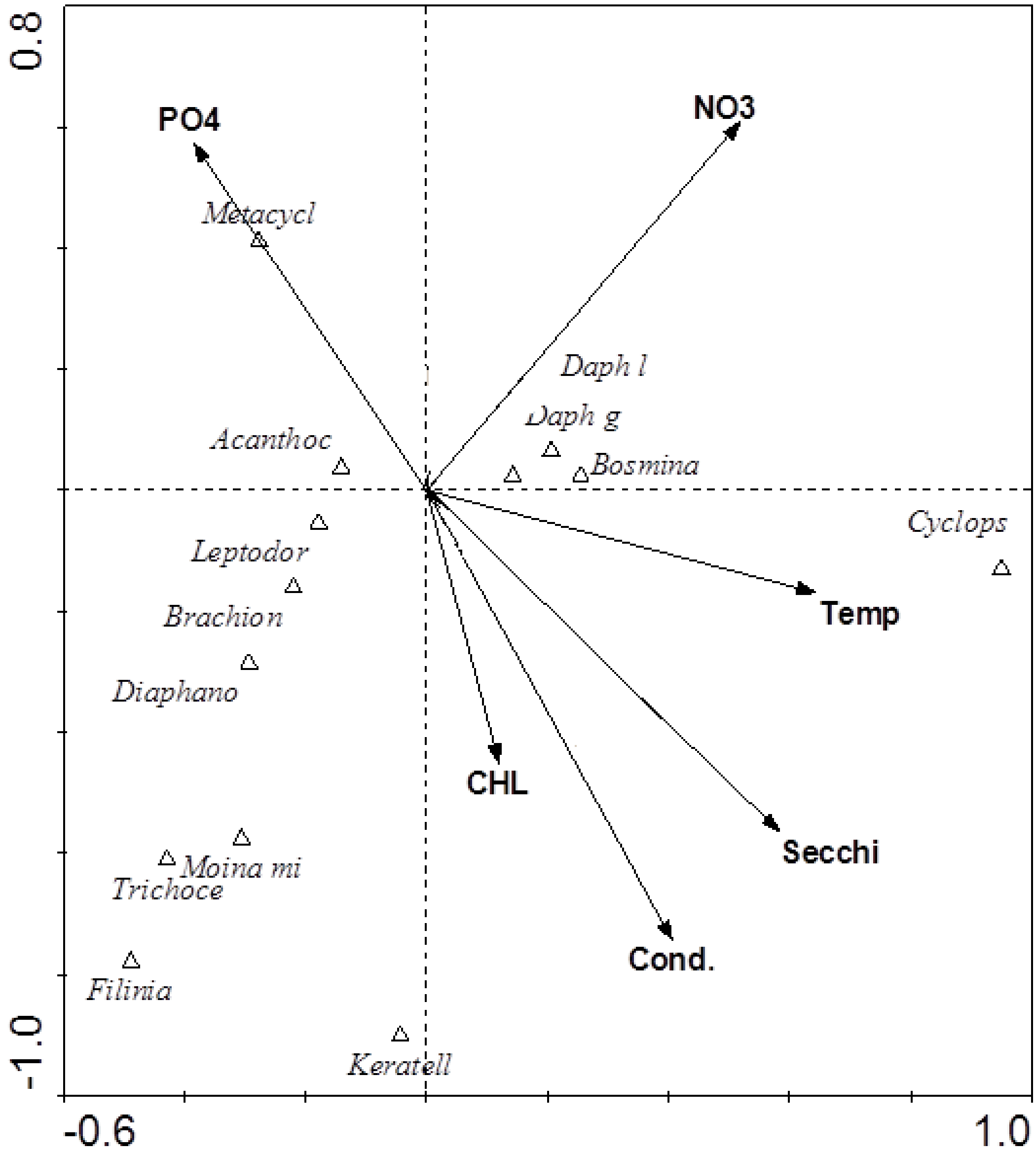

Figure 2. The diagram of Canonical Correspondence Analysis (CCA) showing the relationships between the physicochemical parameters and the dominant zooplankton species**.** Abbreviations: Trichoce, *Trichocerca capucina***;** Leptodor, *Leptodora kindtii*; Metacycl, *Metacyclops gracilis*; Diaphano, *Diaphanosoma brachyurum*; Daph l, *Daphnia longispina*; Daph g, *Daphnia galeata*; Acanthoc, *Acanthocyclops robustus*; Keratell, *Keratella cochlearis*; Bosmina, *Bosmina longirostris*; Brachion, *Brachionus calyciflorus*; Moina mi, *Moina micrura*; Filinia, *Filinia longiseta*; Cyclops, *Cyclops vicinus*.