Zooplankton of Hancağız Dam Lake (Gaziantep - Turkey)

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Abstract

Zooplankton samples were taken seasonally from Hancağız Dam Lake between April 2012- May 2013 period. During the study, a total of 52 species (34 belong to genus Rotifera, 11 to Cladocera and 7 Copepoda) were found in Hancağız Dam Lake. Based on the number of individuals, rotifers were the dominant group in the dam lake (65.4%) followed by Cladocera (21.2%) and Copepoda (13.4%). All of the zooplanktonic species have been detected for the first time in Hancağız Dam Lake. The datas determined from the zooplankton community in Hancağız Dam Lake wereanalysedbyShannonWienerspeciesrichnessindex (H^{l}), Margalef diversity index(D) and Sorenson similarity index. H^{l} value was found highest with 3.73 in spring. D index value was calculated in its highest level in spring with 6.31.

Keywords: Rotifera, Cladocera, Copepoda, Hancağız Dam Lake, Turkey

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Introduction

Zooplanktons occupy the second trophic level in the food chain, the first being occupied by phytoplankton. In lake ecosystems, these organisms are the main food source for invertebrates, fishes, and sometimes for aquatic birds. Some species have been reported as characteristic indicators of water quality and trophic level of lakes (Sladecek, 1983; Herzig, 1987; Saksena, 1987). Studies on the zooplankton fauna of Turkey have been conducted by Gündüz (1984, 1987, 1997), Ustaoğlu (1986, 1989), Dumont and De Ridder (1987), Ustaoğlu and Balık (1990), Segers et al. (1992), Akbulut (Emir) (2000), Altındağ and Yiğit (2002), Yiğit (2002), Bekleyen (2003), Ustaoğlu (2004), Güher and Kırgız (2004), Yıldız et al. (2007), Saler and Haykır (2011), Bulut and Saler (2013 a,b).A detailed study on the zooplankton fauna of Hancağız Dam Lake had not been done before.

A detailed study on the zooplankton fauna of Hancağız Dam Lake had not been done before. This study was done to obtain insight into the composition of the zooplankton fauna of Hancağız Dam Lake and to contribute to the knowledge of the biological diversity of inland waters in Turkey.

Material and Methods

Hancağız Dam Lake was located in Nizipdistrictof Gaziantep, was builtbetween1985 - 1989 for irrigation. Lake volume is 100hm^3 and area is 4.33km^2 (URL,1). For determining the zooplankton of Hancağız Dam Lake, samples were taken from three stations seasonally between April 2012 and May 2013 (Figure 1).

Zooplankton samples were collected with a standard plankton net (Hydrobios 55 µm mesh size) through vertical and horizontal hauls from 3 stations. Samples were preserved in 4% formaldehyde in 250 mL plastic bottles. The species were identified using Scourdfield and Harding (1941), Dussart (1969), Flössner (1972), Kolisko (1974), Harding and Smith (1974), Koste (1978a,b), Kiefer (1978), Korovchinsky (1992), Reedy (1994), Einsle (1996).

Figure1: Hancağız Dam Lake and the location of the stations

pH values were measured with Lamotte (pH 5-WC) pH meter, water temperature and dissolved oxygen values were measured byOxi 315i/SET oxygen meter in situ.

Thenumber of species in a community is referredto as species richness. We used Shannon species richness index formula.

$sH=-\sum(P_i * \ln P_i)i=1$

where,

H=the Shannon diversity index

P_i=fraction of the entire population made up of species i (proportion of a species i relativeto totalnumber of speciespresent, not encountered)

S=numbers of speciesencountered

One of measure of species diversity is Margalef Index. It is calculated from the total number of species presented and the abundance or total number of individuals. The higher index means the greater diversity.

D=(S-1)/logtobase e N where

D=Margalef Index

S=Thenumber of species

N=Total number of individuals

The widely used Sørensen similarity index measures similarity in species composition for two sites or stations, A and B, by the

CS=2ab\a+b where

a=is thenumber of speciesfound in site A

b=is thenumber of species in site B

ab=is the number of species shared by the two sites(Magurran, 2004).

Results

In Hancağız Dam Lake a total of 52 taxa, 34 from rotifers, 11 from cladocerans, and 7 from copepods were identified.

Based on the number of individuals, rotifers were the dominant group in the dam lake (65.4%) followed by Cladocera (21.2%) and Copepoda (13.4%). Dominant Rotifera species was observed as *Polyarthra dolichoptera* followed by *Keratella cochlearis*. *Bosmina longirostris, Chydorus sphaericus* and *Ceriodaphniareti culata* were the dominant Cladoceran species. *Cyclops vicinus* and *Thermo cyclopscrassus* were the dominant Copepoda species. The seasonal distributions of species are given in table 1.

In Hancağız Dam Lake *A.saltans, A.priodonta, B.angularis, B.bidentata, B.quadridentatus, C.gibba, F.opoliensis, H.fennica, K.longispina, K.cochlearis, K.quadrata, K.tecta, L.bulla, L.luna, M.trigona, P.dolichoptera, S.pectinata, S.stylata, T.patella* from Rotifera*; A.rectangulata, B.longirostris, C.reticulata, C.sphaeriscus, D.galeata*and*, D.rostrata*from Cladocera; *A.denticornis, C.vicinus, and T.crassus* from Copepoda were observed in all seasons. Spring have got the most species richness with 41 speciesin Station III and 38 species instation I. The least species richness were recorded in station III with 7 species and station I with 11 species in winter. *P. dolichoptera* the dominant rotifers species observed in all seasons in all stations except station III in winter. *B. longirostris* from Cladocera and*C. vicinus* from Copepoda had got the highest frequency of occurrence in their groups.

Table 1: Seasonal distribution of zooplankton fauna of Hancağız Dam Lake

Seasons	**Autumn**			**Winter**			**Spring**			**Summer**		
Stations	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
SPECIES												
Rotifera												
*Ascomorphasaltans*Bartsch, 1870	-	+	+	-	-	+	+	-	+	-	+	+
Asplanchnapriodonta(Gosse, 1850)	-	-	+	-	-	+	+	-	-	+	+	-
*Brachionusangularis*Gosse, 1851	-	+	+	-	-	+	+	+	+	-	+	-
Brachionusbidentata(Anderson, 1889)	+	+	-	-	+	-	+	+	+	-	-	+
Brachionuscaudatus(Barrois& Daday,1894)	+	+	-	-	-	-	+	+	-	-	-	-
*Brachionusquadridentatus*Hermann, 1783	+	-	+	+	-	-	+	+	-	+	-	+
Cephalodellagibba(Ehrenberg, 1830)	-	-	+	+	-	+	+	-	+	+	-	+
*Colurellaadriatica*Ehrenberg, 1831	-	+	-	-	+	-	-	+	+	-	-	-
Colurellacolurus(Ehrenberg, 1830)	+	+	-	-	-	-	+	-	+	-	+	-
*Euclanisdilatata*Ehrenberg, 1832	-	-	-	-	+	-	+	+	+	-	-	-
Filinialongiseta(Ehrenberg, 1834)	+	+	-	-	+	-	-	-	+	+	-	-
Hexarthrafennica(Levander, 1892)	-	-	-	-	-	-	+	-	+	-	+	+
*Hexarthraintermedia*Wierzejski, 1929	-	-	-	+	-	-	-	-	-	+	-	+
Kellicottialongispina(Kellicott, 1879)	+	-	+	+	-	-	+	+	+	-	+	-
Keratellacochlearis(Gosse,1851)	+	+	+	-	+	-	+	+	+	+	+	-
Keratellaquadrata(Muller, 1786)	-	+	-	-	-	-	-	+	+	-	-	-
Keratellatecta(Gosse,1851)	+	-	-	+	-	-	+	-	+	-	+	+
Keratellatropica(Apstein, 1907)	-	-	+	-	-	-	+	+	+	-	-	+
*Keratellavalga*Ehrenberg, 1834	+	-	-	-	-	-	-	+	+	+	+	-
Lecane bulla (Gosse, 1886)	+	-	+	-	+	-	+	-	+	-	-	+
Lecaneclosterocerca (Schmarda, 1859)	-	-	-	-	+	-	+	-	+	-	-	+
Lecaneluna(Muller, 1776)	+	-	+	+	-	-	-	+	-	-	+	-
*Mytilinatrigona*Harring, 1913	-	+	+	-	+	-	+	+	+	+	-	+
Notholcasquamula(Muller, 1786)	-	+	-	+	+	-	-	-	-	-	-	-
*Philodinaroseola*Ehrenberg, 1832	-	-	-	-	-	-	-	+	+	+	-	-
*Polyarthradolichoptera*Idelson, 1925	+	+	+	+	+	-	+	+	+	+	+	+
*Pompholyxsulcata*Hudson, 1885	-	+	-	-	-	-	-	+	+	-	-	-
Rotarianeptunia(Ehrenberg, 1832)	-	-	-	-	-	-	+	+	+	+	-	+
Rotariarotatoria(Pallas, 1766)	-	-	-	-	-	-	+	-	+	+	-	-
*Synchaetapectinata*Ehrenberg, 1832	+	-	+	-	+	-	-	+	+	+	-	-
*Synchaetastylata*Wierzejski, 1893	-	-	+	-	-	-	+	-	+	-	-	+
Testudinella patina Hermann, 1783	+	-	-	-	+	-	+	-	+	-	+	-

*Trichocercacapucina*Wierzejski& Zacharias, 1893	-	+	-	-	-	-	+	+	-	+	-	+
*Trichocercasimilis*Wierzejski, 1893)	-	-	+	-	-	-	+	+	-	+	+	+
Cladocera												
*Alonarectangulata*Sars, 1862	+	-	+	+	-	-	+	+	-	+	-	+
Bosminalongirostris(Muller, 1785)	+	+	-	-	+	-	+	+	+	+	+	+
*Ceriodaphniapulchella*Sars, 1862	+	-	-	-	-	-	-	+	+	-	-	-
Ceriodaphniareticulata (Jurine,1820)	+	+	-	+	-	+	+	+	-	+	-	+
Chydorussphaericus(O. F. Müller, 1776)	-	+	+	-	-	+	+	+	+	-	+	-
*Diaphanosomabirgei*Korinec, 1981	-	-	+	-	-	-	+	-	+	-	+	-
*Daphniacucullata*Sars, 1862	-	-	+	-	-	-	+	+	+	-	-	+
*Daphniagaleata*Sars, 1865	+	-	-	+	-	-	-	+	+	+	-	-
*Daphnialongispina*O. F. Müller, 1785	+	+	-	-	-	-	+	-	+	-	-	+
Disparalonarostrata (Koch, 1841)	-	+	-	-	+	-	-	+	-	-	+	-
Leydigialeydigi(Schoedler, 1863)	-	-	+	-	-	-	-	+	+	-	-	-
Copepoda												
Acanthopdiaptomusdenticornis(Wierjesky, 1887)	+	-	+	+	-	-	+	+	+	-	+	-
*Cyclopsstrenuus*Fisher, 1851	+	+	-	-	+	-	+	+	+	-	+	+
*Cyclops vicinus*Uljanin, 1875	+	+	+	+	-	+	+	+	+	+	-	+
Diacyclopsbicuspidatus(Claus, 1857)	-	+	+	-	-	-	+	-	+	+	-	+
Megacyclopsviridis(Jurine, 1820)	+	-	-	-	-	-	+	-	+	-	+	-
Nitocrahibernica(Brady, 1880)	-	-	-	-	-	-	+	+	+	-	-	-
Thermocyclopscrassus(Fischer, 1853)	+	+	-	-	+	-	+	+	+	+	+	+

Table 2: Seasonal Sorenson Similarity Index in Hancağız Dam Lake

Seasons and similarity percentages	
Autumn-Winter= 80.00%	Winter-spring= 74.67%
Autumn- spring= 91.48%	Winter –summer=75.67%
Autumn-summer= 85.05%	Spring-summer=92.47%

Table 3:Seasonal variation of Margalef DiversityIndex (D) and Shannon Wiener Species Richness Index(H^1) in Hancağız Dam Lake

	Seasons			
Index	**Autumn**	**Winter**	**Spring**	**Summer**
D	5.61	4.42	6.31	5.44
H^1	3.28	2.89	3.73	3.09

There was a decrease in total zooplankton species richness in winter and a sharp increase in spring and autumn months.The most species were recorded in spring (32 rotifers, 11 copepods, 7 cladoceran, totally 50 species), but the less taxa were observed in winter (23 rotifers, 6 copepods, 4 cladoceran, totally 33 species). According to the stations, the most number of species were recorded in the third station with 41 species in spring and which the less were also in the third station with 9 species in winter (Table 1). $H^{'}$ value was found highest with3.73 in spring. D index value was calculated in spring months as 6.3 (Table 3). Water temperature, dissolved oxygen and pH values of the Hancağız Dam Lake were recorded in the field and shown in the table 4.

Table 4: Seasonal average values of temperature, dissolved oxygen and pH recorded in Hancağız Dam Lake

Seasons	Autumn			Winter			Spring			Summer		
Stations	1	2	3	1	2	3	1	2	3	1	2	3
Temperature (C^o)	15.1	14.8	14.5	9.5	9.1	8.9	16.8	16.3	16.0	24.8	23.9	23.8
Dis. Oxygen(mg/L)	9.1	9.5	10.2	11.3	10.9	9.9	8.6	8.4	8.3	7.4	7.8	7.6
pH	7.2	6.8	6.6	6.9	7.2	7.7	7.6	7.9	8.4	8.9	8.6	8.1

Water temperature values were changed between 8.9-24.8C^o, dissolved oxygen 7.4-11.3-mg/L, pH 6.6-8.9.

Discussion

Zooplankton species are important indicators for aquatic habitats since most of them are used to determine the quality, the trophic level and level of population in lakes and streams. For example, *Keratella cochlearis* and *Polyarthra dolichoptera* species of Rotifera are indicators of productive habitats, while *Notholca squamula*is known as indicators of cold waters (Kolisko,1974). *K cochlearis* and *P.dolichoptera* were determined in all seasons and *N.squamula* was observed in cold seasons, in autumn and winter in Hancağız Dam Lake. Kolisko (1974), reported that *P.dolichoptera* and *K.cochlearis* are perennial species while, *Notholca squamula*is a winter form. The results of this study have got a great accordance with her report. Species richness of Rotifera was found quite high when comperad to Cladocera and Copepoda in Turkish inland waters (Ustaoğlu and Balık 1990, Bozkurt, 2004, 2006, Diricanand Musul 2008, Gaygusuz et al. 2004, Yiğit and Altındağ 2005, Yıldız et al., 2007, Salerand Haykır 2011, Bulut andSaler 2013 a,b). Paralelly to this result, in Hancağız Dam Lake 34 Rotifer a species were found amoung 52 identified zooplankton species. According to Stember and Gannon (1978) Rotifera forms an important part of biomass in eutrophic water systems. In the present study, Rotifera appeared as dominant group (65.4%).

All the recorded Rotifer species in the present study are widely distributed around the world (Segers, 2007). Also many of the recorded species are common in Turkey (Saksena 1987, Dumont and De Ridder 1987, Kaya and Altındağ, 2007). Only 11 species of Cladocera were observed in Dam Lake. Among the identified species *Leydigia leydigi*, *Disparalonarostrata*, *Diaphanosomabirgei* and

Ceriodaphniapulchella were rarely found in Hancağız Dam Lake. *Chydorus sphaericus*, *Bosmina longirostris*, *Ceriodaphnia reticulata* and *Alonare ctangulata* were observed through out all seasons. *Cyclops vicinus*and *Acanthodiaptomusdenticornis*were the observed in all seasons but*Nitocrahibernica* was only recorded in spring. *Cyclopsvicinus*and *Acanthodiaptomusdenticornis* are the common Copepod species in Turkey inland water (Ustaoğlu, 2004).

According to the results of this study,Rotifera is recorded as the dominantzooplankton group The number of zooplankton speciesshowedan increasein spring and autumndecreasein summer and winter. The zooplanktonic fauna structure of Asi River, Kesikköprü Dam Lake,Gelingülü Dam Lake, Keban Dam Lake,Kepektaş Dam Lake, Sürgü Dam Lake,Kalecik Dam Lake,Beyhan Dam Lake and Uzunçayır Dam lake were showed similarities with our findings (Bozkurtet al.2002,Yiğit 2006, Kaya and Altındağ 2007, Tellioğlu and Akman, 2007,Saler 2009, İpek and Saler 2013 and Bulut and Saler 2013b,2014,Saler, et al. 2014). In all of these dam lakes, rotifers were found to be the dominant species as species richness and frequency of occurrence. All of these species are recorded for the first time inHancağız Dam Lake.Bekleyen (2001), recorded thirty four Rotifer species from Devegeçidi Dam Lake. She reported 12 Rotifer species from Brachionidae. In Hancağız Dam Lake 10 species were recorded from Brachionidae. It was reported that species from Brachionidae were represented in high number of species in eutrophic waters (Kolisko 1974).The ecological features of the recorded speciesshow that most of them are cosmopolitan and littoralinhabiting (Kolisko, 1974). Additionally, among the recordedspecies, *Bosminalongirostris*and *C. vicinus, P. dolichoptera, K. cochlearis* arewell known indicators of eutrophy (Ryding andRast, 1989). *P. dolichoptera, K. cochlearis* are predominant in the Dam Lake. *Pompholyxsulcata* and *Hexarthrainter media*were rarely found inthe Dam Lake. *Philodinaroseola, Rotarianeptunia* and *Rotariarotatoria* were recorded as the organisms of pollutedwaters (Kolisko, 1974, Edmondson, 1959).These three species were recorded in spring and summer period.

Some of the zooplankton species recorded in Hancağız Dam lake were known species of eutrophic waters as*A. priodonta, B. calyciflorus, B. angularis, K. quadrata, K. cochlearis,, E. dilatata, L. luna, F. longiseta, P. dolichoptera, B. longirostris, C. sphaericus, A denticornis, C. vicinus,* and *T. crassus*. Some of the Rotifer species as*L. bulla* (oligotrophic), *B. urceolaris, B. calyciflorus, B. angularis, K. quadrata, K. cochlearis, P. quadricornis, E. dilatata, L. luna, F. longiseta, T. cylindrica,* and *T. patina* are also the species of eutrophic waters. *B. longirostris, C. sphaericus*, from Cladocera are the organisms of oligotrophic-eutrophic waters (Gündüz, 1984; Saksena, 1987; Ustaoğlu, 1989; Kolisko,1974;Gutiérrez-Aquirre and Suárez-Morales, 2000).

Weidentified 52 zooplankton species in the lake. Among these species 19 species (11 rotifers, 6 cladocerans, and 2 copepods) informed that the lake's trophic level was in a

mesotrophic state and vulnerable to eutrophication. In conclusion, in terms of zooplankton diversity and species richness indexes values (H' and D index values)of Hancağız Dam Lake it could be assumed thatthe dam lakehas got mesotrophic-eutrophic character and thus, candidate to eutrophication.

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