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# Zooplankton Fauna and Seasonal Changes of Gelingüllü Dam Lake (Yozgat, Turkey)

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**Abstract:** Seasonal variation and density of the zooplankton fauna were studied in Gelingüllü Dam Lake from July 2004 to June 2005. Samples were collected from 4 different stations on a monthly basis with a plankton net, both horizontally and vertically.

The zooplankton sample consisted of 92% Rotifera, 7% Cladocera, and 1% Copepoda, including 54, 9, and 2 taxa, respectively. Rotifera were the dominant group of zooplankton with respect to species numbers, count, and density ( $l/m^3$ ).

**Key Words:** Zooplankton, Gelingüllü Dam Lake, seasonal distribution

## Gelingüllü Baraj Gölü'nün Zooplankton Faunası ve Mevsimsel Değişimi (Yozgat, Türkiye)

**Özet:** Gelingüllü Baraj Gölü'nün zooplankton faunasının mevsimsel değişimi ve yoğunluğu Temmuz 2004-Haziran 2005 tarihleri arasında araştırılmıştır. Zooplankton örnekleri aylık periyotlar halinde gölde seçilen farklı özellikteki dört istasyondan, plankton kepçesi ile vertikal ve horizontal olarak toplanmıştır.

Göldeki zooplanktonik organizmaların sayısal ( $B/m^3$ ) olarak % 92'sini Rotifera, % 7'sini Cladocera ve % 1'ini Copepoda türlerinin oluşturduğu belirlenmiştir. Rotifera grubundan 54 takson, Cladocera grubundan 9 takson, Copepoda grubundan da 2 takson bulunmuştur. Rotifera grubu hem tür hem de türlere ait birey sayıları bakımından zooplankton içinde baskın grubu teşkil etmiştir.

**Anahtar Sözcükler:** Zooplankton, Gelingüllü Baraj Gölü, mevsimsel değişim

## Introduction

In freshwater ecosystems, 3 groups of zooplankton, namely Rotifera, Cladocera, and Copepoda, have been reported (Berzins and Pejler, 1987). Zooplankton 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 (Hecky and Kilham, 1973; Sladeczek, 1983; Herzig, 1987).

A number of studies of the zooplankton fauna have previously been conducted in Turkey and other countries, such as those by Tokat (1972), Dumont (1981), Ustaoglu and Balik (1987), Emir (1989, 1990), Emir (1991),

Gündüz (1991), Segers et al. (1992), Altındağ (1999), Altındağ and Yiğit (1999), Altındağ and Yiğit (2002), Bekleyen (2003), and Ustaoglu (2004).

## Study Area

Gelingüllü Dam Lake is located in central Anatolia near the city of Yozgat (lat 39°36'30"N, long 35°03'20"E). The lake is fed by the Kızılırmak River, Delice River, Kanak River, and Eğriöz Brook (Figure). Its altitude is 1050 m a.s.l. and surface area is 23.2 km<sup>2</sup>. Mean depth of the sampled stations was 20 m. In winter, its temperature falls below 0 °C and the lake remains frozen throughout. In summer it increases to a moderate level. The average annual rainfall is 380 mm, which defines the lake as being in an arid area (Kırankaya and Ekmekçi, 2002).

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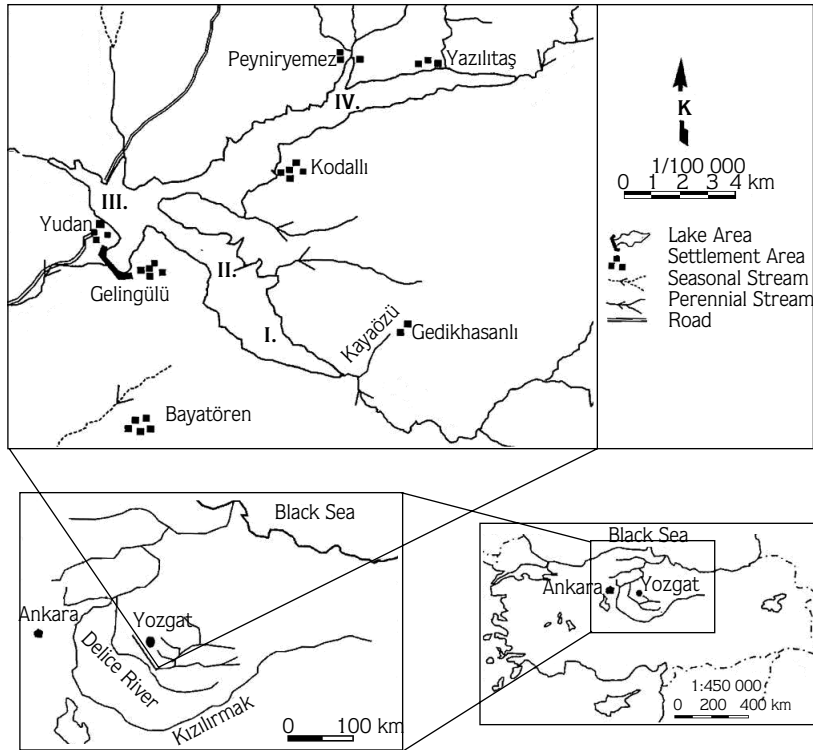


Figure. Sampling stations of Gelingüllü Dam Lake (Ekmekçi and Kirankaya, 2004)

## Materials and Methods

In Gelingüllü Dam Lake, between July 2004 and June 2005, zooplankton sampling was carried out at 4 stations with a plankton net (Hydro-Bios Kiel mark) by making vertical and horizontal hauls. Vertical hauls were taken at surface and horizontal hauls from the side of a boat. Samples were preserved in 4% formaldehyde in 100-ml plastic bottles.

In addition, some physical and chemical parameters of Gelingüllü Dam Lake were determined during the sampling period. Of these, dissolved oxygen was measured with a YSI 51 B-type oxygen-meter, pH with a WTW 340-A/SET-1 pH-meter, electrical conductivity with a WTW LF 92-type conductometer, and light permeability with a 20-cm diameter Secchi disk.

Specimens collected by vertical hauls were used for zooplankton density and those collected by horizontal hauls were used for species identification. Zooplankton counts were made according to Botrell et al. (1976) and species identification followed Koste (1978), Edmondson (1959), Harding and Smith (1974), Nogrady and Pourriot (1995), and Segers (1995).

## Result and Discussion

In all, 3 zooplankton groups were found in Gelingüllü Dam Lake: Rotifera, Cladocera, and Copepoda. From the samples, 65 taxa (54 Rotifera, 9 Cladocera, and 2 Copepoda) were identified. From a density point of view, Rotifera were found to cover 92%, whereas Cladocera covered 7% and Copepoda 1%. Rotifera was the dominant group in the lake. Rotifera count peaked in April, which continued later on as the dominant group. Rotifera were found to be more sensitive to environmental changes as compared to Cladocera and Copepoda, and are known to be characteristic indicators of water quality (Gannon and Stremberger, 1978). In Gelingüllü Dam Lake, average Secchi depth was 137 cm. According to the level system of OECD for trophic status of lakes, if Secchi depth is between 0.8 and 1.5 m, the lake is eutrophic, if it is between 1.4 and 2.4 m, it is mesotrophic, and if it is between 3.6 and 5.9 m, it is oligotrophic (Ryding and Rast, 1989). According to those limits, Gelingüllü Dam Lake could be categorized as eutrophic. Calanoids are generally suited to oligotrophic conditions, and cladocerans and cyclopoids are suited and

well adapted to eutrophic conditions (Gannon and Stremberg, 1978). According to Blancher (1984), in eutrophic lakes, cladocerans and cyclopoids, in comparison to calanoids, can be more abundant. This phenomenon was observed in Gelingüllü Dam Lake. The cyclopoid species *Cyclops vicinus*, as compared to calanoids, was more abundant, demonstrating the eutrophic status of the lake. Among the zooplankton groups, Cladocera and Rotifera were most abundant at station IV. This may have been due to the presence of a sugar mill near this station. In November and April this mill discharges its material into the lake. Rotifers are generally abundant in eutrophic lakes, whereas copepods are in oligotrophic lakes (Herzig, 1987). In freshwater ecosystems, rotifers are more abundant than other zooplankton groups; therefore, they account for a major portion of the food chain. An increase in Rotifera, Cladocera, and Copepoda populations may affect fish populations (Emir and Demirsoy, 1996). In Gelingüllü Dam Lake, one of the possible causes of the decreased number of Copepoda and Cladocera may have been that fish ate more of these 2 zooplankton groups than Rotifera.

In eutrophic lakes, permanent dominant rotifer species have been reported, such as *Brachionus* and *Keratella* (Tanyolaç, 1993). In Gelingüllü Dam Lake, the Rotifera group was more dominant (92%) than the other 2 groups. Additionally, 4 *Brachionus* species and 3 *Keratella* species were found in the lake, which may indicate that Gelingüllü Dam Lake is eutrophic. *Bosmina longirostris*, *Daphnia longispina*, and *Chydorus sphaericus*, of the Cladocera group, were dominant in the lake; however, these species are generally found in eutrophic lakes (Berzins and Bertilson, 1989). Lake pH

can range between 6 and 9. When photosynthetic activities increase, CO<sub>2</sub> decreases, which results in an increase in pH. In sediments, when organic material decomposes, CO<sub>2</sub> increases and pH decreases (Wetzel, 1983). In Gelingüllü Dam Lake, average pH was 8.92. The minimum pH of 8.33 was measured in November 2004 and the maximum pH of 9.51 was measured in September 2004. According to mean pH values, Gelingüllü Dam Lake was rated as alkaline. In Gelingüllü Dam Lake, *Brachionus angularis*, *B. calyciflorus*, and *B. quadridentatus*, which are characteristic species of alkaline lakes (Koste, 1978) were found. In Gelingüllü Dam Lake, the mean EC value was 409.7 µS/cm. From a fisheries point of view, 500 µS/cm may be the maximum value. In the lake, average pH values were normal (McKe and Wolf, 1963). In the lake, average dissolved oxygen was 8.50 mg/l. The maximum (11.12 mg/l) was measured in April 2005 and the minimum (6.13 mg/l) in November 2004. In freshwater ecosystems, in aerobic conditions, the minimum dissolved oxygen for aquatic life may not be less than 5.0 mg/l (Gülle, 1999). In Gelingüllü Dam Lake, this may be a limiting factor. In Gelingüllü Dam Lake average surface temperature was 15.7 °C; the minimum was 11.2 °C in October 2004 and the maximum was 23.5 °C in August 2004. Temperature is known as one of the limiting factors for zooplankton abundance and distribution (Mikschi, 1989). In this study, it was aimed to determine the zooplankton fauna and seasonal changes of Gelingüllü Dam Lake.

### Acknowledgments

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### Appendix

Phylum	Arthropoda	Species	<i>Daphnia longispina</i> O.F.Müller, 1785	(O.F.Müller, 1785)
Subphylum	Crustacea			<i>Alona rectangularis</i> Sars, 1862
Class	Branchiopoda		<i>Daphnia galeata</i> Sars, 1864	<i>Pleuroxus aduncus</i> (Jurine, 1820)
Order	Cladocera		<i>Ceriodaphnia quadrangula</i> (O.F.Müller, 1785)	<i>Leydigia leydigi</i> (Schoedler, 1863)
Family	Bosminidae	Family	Chydoridae	
Species	<i>Bosmina longirostris</i> (O.F.Müller, 1785)	Species	<i>Chydorus sphaericus</i> (O.F.Müller, 1776)	Class
Family	Daphniidae		<i>Alona quadrangularis</i>	Copepoda
				Order
				Cyclopoida
				Family
				Cyclopoidae

Species	<i>Cyclops vicinus</i> Uljanin, 1875		<i>Gastropus styliifer</i> Imhof, 1891	(O.F.Müller, 1773)
Order	<b>Calanoida</b>	Family	Lecanidae	<i>Cephalodella catellina</i>
Family	Diaptomidae	Species	<i>Lecane luna</i> (O.F.Müller, 1776)	(O.F.Müller, 1786)
Species	<i>Arctodiaptomus</i> sp.		<i>Lecane lunaris</i> (Ehrenberg, 1832)	<i>Cephalodella gibba</i> (Ehrenberg, 1838)
Phylum	<b>Rotifera</b>		<i>Lecane closteroerca</i> (Schmarda, 1859)	<i>Monommata arndti</i> Remane, 1933
Order	<b>Monogononta</b>		<i>Lecane bulla</i> (Gosse, 1851)	Family Trichocercidae
Family	Brachionidae		<i>Lecane stenroosi</i> (Meissner, 1908)	Species <i>Trichocerca cylindrica</i> (Imhof, 1891)
Species	<i>Brachionus angularis</i> Gosse, 1851		<i>Lecane hamata</i> (Stokes, 1896)	<i>Trichocerca elongata</i> (Gosse, 1886)
	<i>Brachionus calyciflorus</i> Palas, 1766			<i>Trichocerca similis</i> (Wierzeski, 1893)
	<i>Brachionus quadridentatus</i> Hermann, 1783	Family	Asplanchnidae	<i>Trichocerca tenuior</i> (Gosse, 1886)
	<i>Brachionus urceolaris</i> (O.F.Müller, 1773)	Species	<i>Asplanchna girodi</i> (de Guerne, 1888)	
	<i>Anuraeopsis fissa</i> Gosse, 1851		<i>Asplanchna priodonta</i> Gosse, 1850	Family Testudinellidae
	<i>Kellicottia longispina</i> (Kellicott, 1879)		<i>Asplanchna sieboldi</i> (Leydig, 1854)	Species <i>Pompholyx sulcata</i> (Gosse, 1851)
	<i>Keratella cochlearis</i> (Gosse, 1851)	Family	Filinidae	Family Philodinidae
	<i>Keratella quadrata</i> (O.F.Müller, 1786)	Species	<i>Filinia cornuta</i> (Weisse, 1847)	Species <i>Philodina megalotrocha</i> Ehrenberg, 1832
	<i>Keratella tecta</i> (Gosse, 1851)		<i>Filinia limnetica</i> (Zacharias, 1893)	Species <i>Rotaria neptunia</i> (Ehrenberg, 1832)
	<i>Notholca squamula</i> (O.F.Müller, 1786)		<i>Filinia longiceta</i> (Ehrenberg, 1834)	Family Conochilidae
Family	Collothecidae	Family	<i>Filinia terminalis</i> (Plate, 1886)	Species <i>Conochilus unicornis</i> Rousset, 1892
Species	<i>Collotheca mutabilis</i> (Hudson, 1885)	Species	<i>Synchaetidae</i>	Family Hexarthriidae
	<i>Collotheca ornata</i> (Ehrenberg, 1832)		<i>Polyarthra dolichoptera</i> Idelson, 1925	Species <i>Hexarthra fennica</i> (Levander, 1892)
Family	Colurellidae		<i>Polyarthra remata</i> (Skorikov, 1896)	Family Lepadellidae
Species	<i>Colurella adriatica</i> Ehrenberg, 1831		<i>Polyarthra vulgaris</i> Carlin, 1943	Species <i>Lepadella patella</i> (O.F.Müller, 1786)
	<i>Colurella obtusa</i> (Gosse, 1886)		<i>Synchaeta littoralis</i> (Ehrenberg, 1831)	<i>Lepadella acuminata</i> (Ehrenberg, 1834)
Family	Dicranophoridae		<i>Synchaeta oblonga</i> Ehrenberg, 1831	Family Mytilinidae
Species	<i>Dicranophorus grandis</i> (Ehrenberg, 1832)		<i>Synchaeta pectinata</i> (Ehrenberg, 1832)	Species <i>Lophocharis salpina</i> (Ehrenberg, 1834)
Family	Gastropodidae		<i>Synchaeta stylata</i> Wierzejski, 1893	
Species	<i>Ascomorpha ecaudis</i> (Petry, 1850)			
	<i>Ascomorpha saltans</i> Bartsch, 1870	Family	Notommatidae	
		Species	<i>Cephalodella auriculata</i>	

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