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Zooplankton fauna of Lake İznik (Bursa, Turkey)

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Abstract: In the present study the zooplankton fauna of Lake İznik (Bursa) was investigated during January-December 2006. A total of 54 taxa—35 taxa from rotifers, 14 taxa from cladocerans, and 5 taxa from copepods—were identified in Lake İznik. *Brachionus calyciflorus*, *B. angularis*, *Notholca squamula*, *N. acuminata*, *Euchlanis dilatata*, *E. deflexa*, *Platylas quadricornis*, *Trichocerca similis*, *T. cylindrica*, *T. chattoni*, *T. lophoessa*, *T. bicristata*, *Asplanchna girodi*, *Conochilus dossuarius*, *Synchaeta pectinata*, *Lecane luna*, *L. bulla*, *L. stenroosi*, *L. clostrocera*, *L. lunaris*, *Lepadella patella*, *Dicranophorus forcipatus*, *Mytilina mucronata*, *Lophocharis salpina*, *Trichotria tetractis*, *T. pocillum*, *Testudinella patina*, *Hexarthra fennica*, and *Collotheca* sp. from the rotifera species; *Diaphanosoma lacustris*, *D. orghidani*, *Daphnia cucullata*, *Ceriodaphnia quadrangula*, *Macrothrix laticornis*, *Alona rectangula*, *Leydigia leydigi*, *Graptoleberis testudinaria*, *Cyhdorus sphaericus*, *Pleuroxus aduncus*, *P. trigonellus*, *Alonella excisa*, and *Phrixura rostrata* from the cladocera species; and *Eucyclops macruroides*, *Paracyclops fimbriatus*, *Cyclops vicinus*, and *Thermocyclops crassus* from the copepoda species are new records for Lake İznik. According to the $Q_{\text{Brachionus/Trichocerca}}$ index ($Q = 0.8$) used for the determination of trophic level, the lake is oligotrophic.

Key words: Rotifera, cladocera, copepoda, zooplankton, Lake İznik

İznik Gölü'nün zooplankton faunası (Bursa-Türkiye)

Özet: Ocak 2006-Aralık 2006 tarihleri arasında, İznik Gölü'nün (Bursa) zooplankton faunası araştırılmıştır. İznik Gölü'nden Rotifera'dan 35, Cladocera'dan 14 ve Copepoda'dan 5 olmak üzere toplam 54 takson teşhis edilmiştir. Rotifera'dan *Brachionus calyciflorus*, *B. angularis*, *Notholca squamula*, *N. acuminata*, *Euchlanis dilatata*, *E. deflexa*, *Platylas quadricornis*, *Trichocerca similis*, *T. cylindrica*, *T. chattoni*, *T. lophoessa*, *T. bicristata*, *Asplanchna girodi*, *Conochilus dossuarius*, *Synchaeta pectinata*, *Lecane luna*, *L. bulla*, *L. stenroosi*, *L. clostrocera*, *L. lunaris*, *Lepadella patella*, *Dicranophorus forcipatus*, *Mytilina mucronata*, *Lophocharis salpina*, *Trichotria tetractis*, *T. pocillum*, *Testudinella patina*, *Hexarthra fennica*, *Collotheca* sp.; Cladocera'dan *Diaphanosoma lacustris*, *D. orghidani*, *Daphnia cucullata*, *Ceriodaphnia quadrangula*, *Macrothrix laticornis*, *Alona rectangula*, *Leydigia leydigi*, *Graptoleberis testudinaria*, *Cyhdorus sphaericus*, *Pleuroxus aduncus*, *P. trigonellus*, *Alonella excisa*, *Phrixura rostrata*; Copepoda'dan *Eucyclops macruroides*, *Paracyclops fimbriatus*, *Cyclops vicinus*, *Thermocyclops crassus* türleri İznik Gölü için yeni kayıttır. Trofik seviyenin belirlenmesinde kullanılan $Q_{\text{Brachionus/Trichocerca}}$ indeksine göre ($Q = 0.8$) gölün oligotrof olduğu tespit edilmiştir.

Anahtar sözcükler: Rotifera, cladocera, copepoda, zooplankton, İznik Gölü

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Introduction

The zooplankton of freshwater systems has been recognized as an important energy resource for fish of small body size that, in turn, provide energy to piscivorous fish consumers higher up in the food web (Medeiros and Arthington, 2008). Zooplankton is known to respond quickly to environmental conditions, and only a few attempts have been made to use the zooplankton community to evaluate the quality of aquatic ecosystems (Lougheed and Chow-Fraser, 2002). Studies on the zooplankton fauna of Turkey have been conducted by Mann (1940), Lindberg (1953), Noodt (1954), Margaritora et al. (1977), Gündüz (1984, 1987, 1997, 1999), Dumont and De Ridder (1987), Ustaoglu and Balık (1989, 1990), Segers et al. (1992), Akbulut (Emir) (2000), Altındağ and Yiğit (2002), Yiğit (2002), Bekleyen (2003), Ustaoglu (2004), Güher and Kırgız (2004), and Yıldız et al. (2007). A detailed study on the zooplankton fauna of Lake İznik had not been done before. This study was done to obtain insight into the composition of the zooplankton fauna of Lake İznik and to contribute to the knowledge of the biological diversity of inland waters in Turkey.

Materials and methods

Lake İznik, the largest lake in the Marmara region and the fifth largest in Turkey, is located between the districts of İznik and Orhangazi in the Province of Bursa. A freshwater lake, it located between 40°23'

and 40°30'N latitudes and 29°20' and 29°42'E longitudes. The lake, which located 85 m above sea level, has a length of 32 km and a maximum width of 12 km. It is about 15-16 km from the Bay of Gemlik. It has a surface area of 310 km² and a water volume of 12.2 billion cubic meters. Lake İznik is a tectonic lake extending from the Bay of Gemlik to the Geyve Basin. The maximum depth of the lake (80 m) has been measured near Karacakaya. It is fed by small streams, the most outstanding of which are Karasu, which flows into the lake on its northeastern side, and Sölöz, which flows into the lake on its southwestern side (Saçlıoğlu-Taylor, 1993; Yayar and Magnin, 1997; Öztürk et al., 2005).

With the aim of determining the zooplankton fauna of Lake İznik, samples were taken from 4 different stations from January 2006 to December 2006; station I was in the Boyalıca area (40°28'N, 29°33'E), station II in the Orhangazi area (40°27'N, 29°21'E), station III in the Göllüce area (40°25'N, 29°35'E), and station IV in the Çakırca area (40°27'N, 29°35'E). The zooplankton samples were collected with a standard plankton net (Hydrobios, Kiel; 55 µm mesh size) through vertical and horizontal hauls from the 4 stations (Figure 1). Samples were preserved in 4% formaldehyde in 250 mL plastic bottles. The species were identified using Mann (1940), Scourfield and Harding (1941), Rylov (1963), Dussart (1967, 1969), Flössner (1972), Ruttner-Kolisko (1974), Harding and Smith (1974), Smirnov (1974, 1992, 1996), Pontin (1978), Koste (1978), Kiefer (1978), Negrea (1983), Korovchinsky

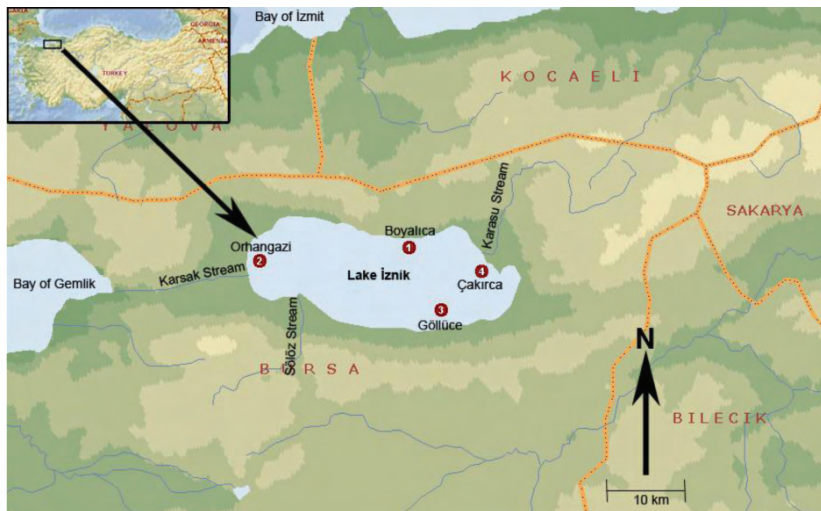


Figure 1. Map of Lake İznik and sampling stations.

(1992), Nogrady et al. (1995), Segers (1995), Einsle (1996), and Nogrady and Segers (2002).

In addition, some physical and chemical parameters of Lake İznik were determined during the sampling period. Dissolved oxygen and dissolved oxygen saturation were measured with a WTW CellOx-325 type oxygen meter, pH and temperature were measured with a WTW Electrode SenTix 41 pH meter, and electrical conductivity was recorded using a WTW Tetracon 325 type conductivity meter.

Water samples obtained from the 4 stations were analyzed in the laboratory of the Eğirdir Fisheries Research Institute. The maximum temperature of the surface water was 28.4 °C and the minimum was 7.2 °C. The transparency of Lake İznik varied from a maximum of 496 cm and a minimum of 130 cm. Dissolved oxygen ranged from 4.1 mg/L to 13.5 mg/L, conductivity ranged from 927 µS/cm to 999 µS/cm, and the lake was alkaline with a pH value ranging between 7.7 and 9.1. Additionally, yearly variations in nutrient levels were measured as follows: nitrate, 0-1.3 mg/L; orto-phosphate, 0-0.1 mg/L; sulfate, 12-239.6 mg/L; magnesium, 80.8-100.9 mg/L; calcium, 18-53.1 mg/L; and silica, 0.1-0.4 mg/L.

In order to find the trophic state of the lake the trophic state index (TSI) method developed by Carlson (1977)—based on the total phosphorus level in water column—and Secchi depth (SD) were used. While calculating TSI values the following formulas were used: $TSI (SD) = 60 - 14.41 \ln (SD)$ and $TSI (TP) = 14.42 \ln (TP) + 4.15 [SD (Secchi \text{ disk, m}), TP (Total \text{ phosphorus, } \mu\text{g/L})]$.

Sládeček (1983) has suggested an index Q for the determination of the trophic level of a given lake. This index is shown by the formula: $Q_{B/T} = \text{number of species of } Brachionus / \text{number of species of } Trichocerca$. He reported that if the ratio is $Q = 1.0$ the lake is oligotrophic, if it is $Q = 1.0-2.0$ it is mesotrophic, and if $Q > 2$ the lake is eutrophic. This index was used for Lake İznik in the present study.

Results and discussion

As a result of qualitative determinations, a total of 54 taxa—35 from rotifers, 14 from cladocerans, and 5 from copepods—were identified. Classifications of these taxa are as follows (Ustaoğlu, 2004):

Phylum: ROTIFERA

Subclass: Monogononta

Order: Ploima

Family: Brachionidae

Brachionus calyciflorus Pallas, 1766

Brachionus quadridentatus Hermann, 1783

Brachionus urceolaris (O.F. Müller, 1773)

Brachionus angularis Gosse, 1851

Keratella quadrata (O.F. Müller, 1786)

Keratella cochlearis Gosse, 1851

Notholca squamula (O.F. Müller, 1786)

Notholca acuminata (Ehrenberg, 1832)

Platylabus quadricornis (Ehrenberg, 1832)

Family: Euchlanidae

Euchlanis dilatata Ehrenberg, 1832

Euclanis deflexa (Gosse, 1851)

Family: Trichocercidae

Trichocerca similis (Wierzeski, 1893)

Trichocerca cylindrica (Imhof, 1891)

Trichocerca chattoni (De Beauchamp, 1907)

Trichocerca lophoessa (Gosse, 1886)

Trichocerca bicristata (Gosse, 1887)

Family: Asplanchnidae

Asplanchna girodi (De Guerne, 1888)

Family: Conochilidae

Conochilus dossuarius (Hudson, 1885)

Family: Synchaetidae

Polyarthra dolichoptera Idelson, 1925

Synchaeta pectinata Ehrenberg, 1832

Family: Lecanidae

Lecane luna (O.F. Müller, 1776)

Lecane bulla (Gosse, 1851)

Lecane clostrocerca (Schmarda, 1859)

Lecane stenroosi (Meissner, 1908)

Lecane lunaris (Ehrenberg, 1832)

Family: Lepadellidae

Lepadella patella (O.F. Müller, 1786)
Family: Dicranophoridae
Dicranophorus forcipatus (O.F. Müller, 1786)
Family: Mytilinidae
Mytilina mucronata (O.F. Müller, 1773)
Lophocharis salpina (Ehrenberg, 1834)
Family: Trichotriidae
Trichotria tetractis (Ehrenberg, 1830)
Trichotria pocillum (O.F. Müller, 1776)
Order: Flosculariacea
Family: Testudinellidae
Testudinella patina (Hermann, 1783)
Family: Filiniidae
Filinia longiseta (Ehrenberg, 1834)
Family: Hexarthridae
Hexarthra fennica (Levander, 1892)
Order: Collothecaceae
Family: Collothecidae
Collotheca sp.
Phylum: Arthropoda
Subphylum: Crustacea
Subclass: Phyllozoa
Order: Diplostraca
Suborder: CLADOCERA
Infraorder: Ctenopoda
Family: Sididae
Diaphanosoma lacustris Korinek, 1981
Diaphanosoma orghidani Negrea, 1982
Infraorder: Anomopoda
Family: Daphniidae Sars, 1865
Daphnia cucullata Sars, 1862
Ceriodaphnia quadrangula (O.F. Müller, 1785)
Family: Macrothricidae
Macrothrix laticornis (Fischer, 1851)
Family: Bosminidae
Bosmina longirostris (O.F. Müller, 1776)

Family: Chydoridae
Subfamily: Aloninae
Alona rectangula Sars, 1862
Leydigia leydigi (Schoedler, 1862)
Graptoleberis testudinaria (Fischer, 1848)
Subfamily: Chydorinae
Chydorus sphaericus (O.F. Müller, 1776)
Pleuroxus aduncus (Jurine, 1820)
Pleuroxus trigonellus (O.F. Müller, 1776)
Alonella excisa (Fischer, 1854)
Phrixura rostrata (Koch, 1841)
Phylum: Arthropoda
Class: Maxillozoa
Subclass: COPEPODA
Superorder: Podoplea
Order: Cyclopoida
Family: Cyclopidae
Subfamily: Eucyclopinae
Eucyclops macruioides Lilljeborg, 1901
Paracyclops fimbriatus (Fischer, 1853)
Subfamily: Cyclopinae
Cyclops vicinus Uljanin, 1875
Thermocyclops crassus (Fischer, 1853)
Order: Harpacticoida
Family: Ameiridae
Nitokra hibernica (Brady, 1880)

During the study, the rotifera: *K. quadrata*, *K. cochlearis*, *T. similis*, *P. dolichoptera*, and *S. pectinata*; the cladocera: *B. longirostris*, and *A. rectangula*; and the copepoda: *C. vicinus*, and *N. hibernica* were observed year round. Station IV (54 species) and station II (48 species) were the most biologically diverse. Station I had 46 species whereas station III had 43. The vertical and horizontal monthly distribution of zooplankton in all stations was: January, 23; February, 28; March, 27; April and May, 25; June, 33; July, 40; August, 30; September, 34; October, 29; November, 37; and December, 29 taxa. Dominant rotifers species observed in July, when the highest

number of species were observed, were: *K. quadrata*, *K. cochlearis*, *T. similis*, *T. chattoni*, *P. dolichoptera*, *S. pectinata*, *L. luna*, *L. bulla*, *L. patella*, *D. forcipatus*, and *H. fennica*; dominant cladocera species were: *D. lacustris*, *D. orghidani*, *D. cucullata*, *B. longirostris*, *A. rectangula*, and *C. sphaericus*; and dominant copepoda species were *C. vicinus* and *N. hibernica*. Dominant rotifer species observed in January, when the lowest number of species was observed, were: *K. quadrata*, *K. cochlearis*, *B. angularis*, *T. similis*, *N. squamula*, *S. pectinata*, and *A. girodi*; dominant cladoceran species were: *D. lacustris*, *B. longirostris*, and *L. leydigi*; and dominant copepod species were *C. vicinus* and *N. hibernica* (Table 1). July, with 40 species, was the month when the highest number of species was observed; January, with 23 species, was the month with the lowest number of species. In January rotifer (14), in April cladoceran (5), and in January copepod (2) species were at their lowest numbers (Figure 2).

The minimum depth (2.5 m) was measured in January while the maximum depth (62 m) was measured in April and May at station III. When observed closely, TSI values (average) are 21 at the lowest (May) and 66 at the highest (February). Stations I, II, and IV were found to be gradually transforming from a mesotrophic-eutrophic state to a eutrophic one. However, station III was in a mesotrophic-eutrophic state (Table 2, Figure 3). In his study based on the methods of Carlson (1977), Akkoyunlu (2003) reported that TSI values were between 40 and 60 and the lake was in mesotrophic-eutrophic state, which supports our study (Table 2, Figure 3). When a general evaluation was done according to all the physicochemical parameters, and when an examination of the quality criteria was carried

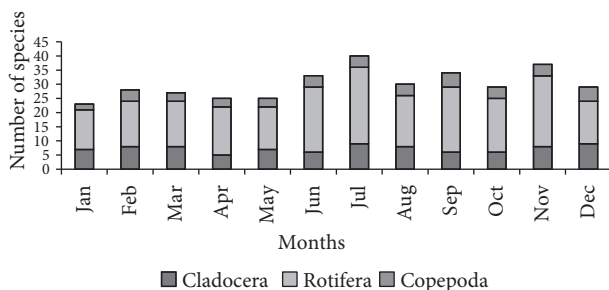


Figure 2. Monthly changes in the number of zooplankton species in Lake İznik.

out based on inland water resources classification criteria, it was found that the quality of water was in category I-II. In the present study a total of 8 species were the same as the ones reported by Noodt (1954), Tokat (1975), Ongan (1982), Dumont and de Ridder (1987), Gündüz (1997), Akbulut (1999), Gündüz (1999), and Gaygusuz et al. (2004); from the rotifers: *B. quadridentatus*, *B. urceolaris*, *K. cochlearis*, *K. quadrata*, *P. dolichoptera*, and *F. longiseta*; from the cladocerans *B. longirostris*; and from the copepods *N. hibernica* (Table 3). Of the species identified in previous studies, *Acanthocyclops niceae*, reported by Mann (1940); *Nitocrella kosswigi*, *Paraleptastacus spinicaudata*, *Parastenocaris phyllophora*, *Nannopus palustris*, *Limnocletodes behningi*, and *Onychocamptus mohammed*, reported by Noodt (1954); *Cyclops scutifer*, reported by Toparlak (1975) and Ongan (1982); *Hexarthra mira*, reported by Tokat (1975) and Ongan (1982); *Kellicottia longispina*, *Brachionus plicatilis*, and *Brachionus diversicornis*, reported by Tokat (1975); *Brachionus rubens*, reported by Dumont and de Ridder (1987); *Arctodiaptomus bacillifer*, reported by Mann (1940), Toparlak (1975), and Ongan (1982); *Diaphanosoma brachyurum*, reported by Gündüz (1999) and Gaygusuz et al. (2004); and *Asplanchna pridonta*, *Synchaeta grandis*, *Trichocerca harveyensis*, and *Leptodora kindtii*, reported by Gaygusuz et al. (2004) were not observed in our study (Table 3). This may be explained by the fact that the species reported by Noodt (1954) were benthic species and the trophic state of the lake had changed over time. In determining the trophic state of the lake, rotifer species are used as an indicator. In the study carried out on Lake İznik, Q was found to be 0.8. Thus, an evaluation based on the rotifer index says that the lake has oligotrophic characteristics in terms of zooplankton. Of the zooplanktonic organisms identified in the lake: *B. urceolaris*, *B. calyciflorus*, *B. angularis*, *K. quadrata*, *K. cochlearis*, *P. quadricornis*, *E. dilatata*, *L. luna*, *F. longiseta*, *T. cylindrica*, *B. longirostris*, *C. sphaericus*, *C. vicinus*, and *T. crassus* are among the species characteristic of eutrophic waters (Ustaoglu, 1989; Makarewicz, 1993; Gutiérrez-Aguirre and Suárez-Morales, 2000). Of the rotifers: *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* (eutrophic);

Table 1. Monthly distribution of zooplankton species in Lake İznik.

	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	H	V	H	V	H	V	H	V	H	V	H	V	H	V	H	V	H	V	H	V	H	V	H	V
ROTIFERA																								
<i>K. quadrata</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+
<i>K. cochlearis</i>	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	-	+	+	+
<i>B. angularis</i>	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
<i>B. calyciflorus</i>	+	-	+	+	+	+	+	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	+
<i>B. urceolaris</i>	-	-	-	-	-	+	+	+	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-
<i>B. quadridentatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-
<i>N. acuminata</i>	+	-	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
<i>N. squamula</i>	+	+	+	-	+	+	-	-	+	+	-	-	+	-	-	-	-	-	-	-	+	+	+	+
<i>E. dilatata</i>	-	+	+	-	+	-	+	-	+	+	+	-	+	+	+	-	+	-	-	-	+	+	+	-
<i>E. deflexa</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-
<i>P. quadricornis</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	+	-	-	-	-	-
<i>T. similis</i>	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>T. cylindrica</i>	-	-	-	-	-	-	+	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-
<i>T. chattoni</i>	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	+	-	-	-	-	-	-	-	-
<i>T. lophoessa</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	+	+	+	+	+	+	+	-	-
<i>T. bicristata</i>	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	+	+	+	+	+	+	+	-	-
<i>A. girodi</i>	+	+	+	+	+	+	-	+	-	+	+	+	+	-	-	+	-	+	-	-	-	-	-	-
<i>C. dossuarius</i>	-	-	-	-	-	-	+	+	+	+	+	-	+	-	-	+	-	-	-	-	-	-	-	+
<i>P. dolichoptera</i>	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>S. pectinata</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
<i>L. luna</i>	-	+	+	+	-	+	+	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	-	-
<i>L. bulla</i>	-	-	-	-	-	+	-	-	-	-	+	-	+	+	+	+	+	+	+	+	+	-	-	-
<i>L. clostrocerca</i>	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-	-
<i>L. stenroosi</i>	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-
<i>L. lunaris</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-
<i>L. patella</i>	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	+	-	+	-	+	-	+	-	-
<i>D. forcipatus</i>	-	-	-	-	+	-	+	-	-	-	+	-	+	-	-	+	-	+	+	+	+	-	-	-
<i>L. salpina</i>	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	+	-	-	-	-
<i>T. tetractis</i>	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	-	+	-	+	+	+	+	-	-
<i>T. pocillum</i>	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-
<i>M. mucronata</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-
<i>T. patina</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	+	
<i>F. longiseta</i>	+	-	+	-	+	-	-	+	-	-	-	-	-	-	-	-	+	-	+	-	+	-	+	
<i>H. fennica</i>	-	-	-	+	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Collotheca</i> sp.	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+		+	+	-	
CLADOCERA																								
<i>D. lacustris</i>	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>D. orghidani</i>		+	+	+	-	+	+	-	+	-	-	+	+	-	-	-	+	-	-	+	+	-	+	
<i>D. cucullata</i>	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	-	+	-	-	-	-	-	+
<i>C. quadrangula</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
<i>M. laticornis</i>	-	+	+	+	+	-	-	-	+	+	+	+	-	+	-	-	-	-	-	+	-	-	-	-
<i>B. longirostris</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>A. rectangula</i>	+	-	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>L. leydigi</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+
<i>G. testudinaria</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	+
<i>C. sphaericus</i>	-	-	+	-	+	-	+	-	+	-	+	-	+	-	-	+	-	-	+	-	+	-	+	-
<i>P. aduncus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-
<i>P. trigonellus</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-
<i>A. excisa</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>P. rostrata</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
COPEPODA																								
<i>E. macruroides</i>	-	-	-	-	-	-	+	-	-	-	+	-	+	+	-	+	+	+	+	-	+	-	+	-
<i>P. fimbriatus</i>	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	+	-
<i>C. vicinus</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>T. crassus</i>	-	-	+	+	-	-	-	-	-	+	+	-	-	+	-	+	+	+	+	+	-	-	+	-
<i>N. hibernica</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

H: horizontal, V: vertical.

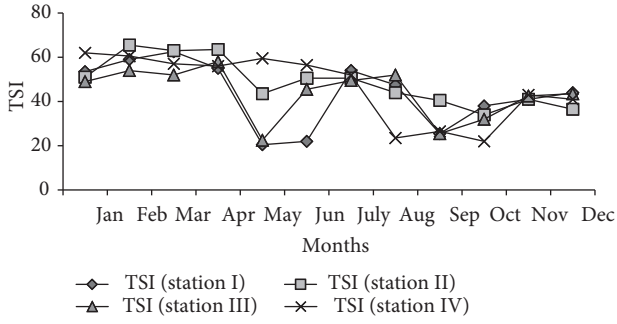


Figure 3. Monthly TSI values of stations.

Table 2. Monthly average TSI values of Lake İznik by station.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
I	54	59	63	55	21	22	54	48	26	38	41	44
II	51	66	63	64	44	51	51	44	41	34	41	37
III	49	54	52	58	23	46	50	52	26	32	43	44
IV	62	61	57	56	60	57	52	24	27	22	43	41

Table 3. Zooplankton species of Lake İznik, and species reported in previous studies of the lake.

Species	1	2	3	4	5	6	7	8	9	10	11
Rotifera											
<i>B. calyciflorus</i>	-	-	-	-	-	-	-	-	-	-	*
<i>B. quadridentatus</i>	-	-	+	-	-	-	-	-	-	-	+
<i>B. urceolaris</i>	-	-	-	-	-	+	-	+	-	-	+
<i>B. angularis</i>	-	-	-	-	-	-	-	-	-	-	*
<i>B. rubens</i>	-	-	-	-	-	+	-	-	-	-	-
<i>B. plicatilis</i>	-	-	+	-	-	-	-	-	-	-	-
<i>B. diversicornis</i>	-	-	+	-	-	-	-	-	-	-	-
<i>K. quadrata</i>	-	-	+	-	-	-	-	-	-	+	+
<i>K. cochlearis</i>	-	-	+	-	+	-	-	-	-	-	+
<i>K. longispina</i>	-	-	+	-	-	-	-	-	-	-	-
<i>N. squamula</i>	-	-	-	-	-	-	-	-	-	-	*
<i>N. acuminata</i>	-	-	-	-	-	-	-	-	-	-	*
<i>E. dilatata</i>	-	-	-	-	-	-	-	-	-	-	*
<i>E. deflexa</i>	-	-	-	-	-	-	-	-	-	-	*
<i>P. quadricornis</i>	-	-	-	-	-	-	-	-	-	-	*
<i>T. similis</i>	-	-	-	-	-	-	-	-	-	-	*
<i>T. cylindrica</i>	-	-	-	-	-	-	-	-	-	-	*
<i>T. chattoni</i>	-	-	-	-	-	-	-	-	-	-	*
<i>T. lophoessa</i>	-	-	-	-	-	-	-	-	-	-	*
<i>T. bicristata</i>	-	-	-	-	-	-	-	-	-	-	*
<i>T. harveyensis</i>	-	-	-	-	-	-	-	-	-	+	-
<i>A. girodi</i>	-	-	-	-	-	-	-	-	-	-	*
<i>A. priodonta</i>	-	-	-	-	-	-	-	-	-	+	-
<i>C. dossuarius</i>	-	-	-	-	-	-	-	-	-	-	*
<i>P. dolichoptera</i>	-	-	+	-	+	-	-	-	-	-	+
<i>S. pectinata</i>	-	-	-	-	-	-	-	-	-	-	*
<i>S. grandis</i>	-	-	-	-	-	-	-	-	-	+	-
<i>L. luna</i>	-	-	-	-	-	-	-	-	-	-	*
<i>L. bulla</i>	-	-	-	-	-	-	-	-	-	-	*
<i>L. clostrocerca</i>	-	-	-	-	-	-	-	-	-	-	*
<i>L. stenroosi</i>	-	-	-	-	-	-	-	-	-	-	*
<i>L. lunaris</i>	-	-	-	-	-	-	-	-	-	-	*
<i>L. patella</i>	-	-	-	-	-	-	-	-	-	-	*
<i>D. forcipatus</i>	-	-	-	-	-	-	-	-	-	-	*
<i>L. salpina</i>	-	-	-	-	-	-	-	-	-	-	*
<i>T. tetractis</i>	-	-	-	-	-	-	-	-	-	-	*
<i>T. pocillum</i>	-	-	-	-	-	-	-	-	-	-	*
<i>M. mucronata</i>	-	-	-	-	-	-	-	-	-	-	*

Table 3 (continued).

Species	1	2	3	4	5	6	7	8	9	10	11
Rotifera											
<i>T. patina</i>	-	-	-	-	-	-	-	-	-	-	*
<i>F. longiseta</i>	-	-	-	-	+	-	-	-	-	-	+
<i>H. fennica</i>	-	-	-	-	-	-	-	-	-	-	*
<i>H. mira</i>	-	-	+	-	+	-	-	-	-	-	-
<i>Collotheca</i> sp.	-	-	-	-	-	-	-	-	-	-	*
Cladocera											
<i>D. lacustris</i>	-	-	-	-	-	-	-	-	-	-	*
<i>D. orghidani</i>	-	-	-	-	-	-	-	-	-	-	*
<i>D. brachyurum</i>	-	-	-	-	-	-	-	-	+	+	-
<i>D. cucullata</i>	-	-	-	-	-	-	-	-	-	-	*
<i>C. quadrangula</i>	-	-	-	-	-	-	-	-	-	-	*
<i>M. laticornis</i>	-	-	-	-	-	-	-	-	-	-	*
<i>B. longirostris</i>	-	-	-	-	-	-	+	-	+	-	+
<i>A. rectangula</i>	-	-	-	-	-	-	-	-	-	-	*
<i>L. leydigi</i>	-	-	-	-	-	-	-	-	-	-	*
<i>G. testudinaria</i>	-	-	-	-	-	-	-	-	-	-	*
<i>C. sphaericus</i>	-	-	-	-	-	-	-	-	-	-	*
<i>P. aduncus</i>	-	-	-	-	-	-	-	-	-	-	*
<i>P. trigonellus</i>	-	-	-	-	-	-	-	-	-	-	*
Cladocera											
<i>A. excisa</i>	-	-	-	-	-	-	-	-	-	-	*
<i>P. rostrata</i>	-	-	-	-	-	-	-	-	-	-	*
Copepoda											
<i>E. macruroides</i>	-	-	-	-	-	-	-	-	-	-	*
<i>P. fimbriatus</i>	-	-	-	-	-	-	-	-	-	-	*
<i>C. vicinus</i>	-	-	-	-	-	-	-	-	-	-	*
<i>C. scutifer</i>	-	-	-	+	+	-	-	-	-	-	-
<i>T. crassus</i>	-	-	-	-	-	-	-	-	-	-	*
<i>N. hibernica</i>	-	+	-	-	-	-	-	-	-	-	+
<i>N. kosswigi</i>	-	+	-	-	-	-	-	-	-	-	-
<i>A. niceae</i>	+	-	-	-	-	-	-	-	-	-	-
<i>A. bacillifer</i>	+	-	-	+	+	-	-	-	-	-	-
<i>P. spinicaudata</i>	-	+	-	-	-	-	-	-	-	-	-
<i>P. phyllophora</i>	-	+	-	-	-	-	-	-	-	-	-
<i>N. palustris</i>	-	+	-	-	-	-	-	-	-	-	-
<i>L. behningi</i>	-	+	-	-	-	-	-	-	-	-	-
<i>O. mohammed</i>	-	+	-	-	-	-	-	-	-	-	-
<i>L. kindtii</i>	-	-	-	-	-	-	-	-	-	+	-

Annotation: species marked by an asterisk are new records for Lake İznik.

(1) Mann (1940); (2) Noodt (1954); (3) Tokat (1975); (4) Toparlak (1975); (5) Ongan (1982); (6) Dumont & De Ridder (1987); (7) Gündüz (1997); (8) Akbulut (1999); (9) Gündüz (1999); (10) Gaygusuz et al. (2004); (11) current study.

of the cladocerans: *G. testudinaria* (dystrophic), *B. longirostris*, *C. sphaericus*, *D. cucullata*, *C. quadrangula*, and *P. aduncus* (oligotrophic-eutrophic); and of the copepods: *C. vicinus*, and *T. crassus* are among the species characteristic of eutrophic waters (Gündüz, 1984; Saksena, 1986; Ustaoğlu, 1989; Makarewicz, 1993; Özdemir Mis, 1999; Gutiérrez-Aquirre and Suárez-Morales, 2000; Smakulska and Górniak, 2004; Sendacz et al., 2006; Paturej, 2006). When analyzed in terms of zooplankton, of the 54 species identified in the lake 19 species (11 rotifers, 6 cladocerans, and 2 copepods) suggested that the lake's trophic level was in a mesotrophic state and vulnerable to eutrophication. In conclusion, in terms of zooplankton Lake İznik had a mesotrophic-eutrophic character and was, thus, vulnerable to eutrophication. To date there has

been no detailed study on the zooplankton fauna of Lake İznik. The species identified in the present study are expected to contribute to the knowledge of zooplankton fauna of the lake and of Turkey and provide a resource for future studies.

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