

A Study on the Zooplanktonic Fauna of the Dam Lakes Kunduzlar and Çatören (Kırka-Eskişehir)

Ahmet ALTINDAĞ

Department of Biology, Faculty of Science, University of Ankara, Ankara-TURKEY

Şakir ÖZKURT

Department of Biology, Education Faculty of Kırşehir, University of Gazi, Kırşehir-TURKEY

Received: 12.06.1997

Abstract: In the present study, the zooplanktonic fauna of the Kunduzlar and Çatören dam lakes (Kırka basin–Eskişehir) was investigated during August 1994–June 1995. Eight species of Rotifera, five species of Cladocera and two species of Copepoda were identified in both dam lakes. In addition, the mean zooplankton abundance (ind. m⁻³) and physical and chemical parameters of dam lakes were given.

Key Words: Zooplankton, Cladocera, Copepoda, Rotifera, Abundance, Kunduzlar Dam Lake, Çatören Dam Lake.

Kunduzlar ve Çatören Baraj Göllerinin (Kırka–Eskişehir) Zooplankton Faunası Üzerinde Bir Çalışma

Özet: Ağustos 1994–Temmuz 1995 tarihleri arasında, Kunduzlar ve Çatören baraj göllerinin (Kırka Yöresi–Eskişehir) zooplankton faunası tesbit edilmiştir. Kunduzlar ve Çatören baraj göllerinden, Rotifera'dan 8 tür, Cladocera'dan 5 ve Copepoda'dan 2 tür olmak üzere toplam 15 tür teşhis edilmiştir. Ayrıca, baraj göllerinin ortalama zooplankton yoğunluğu (Birey sayısı/m³) ve bazı fiziksel ve kimyasal parametreleri verilmiştir.

Anahtar Sözcükler: Zooplankton, Cladocera, Copepoda, Rotifera, Yoğunluk, Kunduzlar baraj Gölü, Çatören baraj Gölü.

Introduction

In the lake ecosystems, zooplanktonic organisms, which from the second step of the food chain, are important food sources of some invertebrate animals and fishes. Zooplanktonic organisms play an important role in the water quality, eutrophic status and productivity of a lake (1, 2, 3). Studies on zooplankton have been conducted by Geldiay (4); Demirhindi (5); Ongan et al., (6) Tokat, (7); Margaritora et al., (8); Dumont, (9); Ustaoglu, (10); Ustaoglu & Balık, (11, 12, 13); Emir, (14, 15); Güher & Kırız, (16, 17); Gündüz, (18, 19, 20, 21); Altındağ & Sözen, (22).

In the Kırka basin of Eskişehir, during basin activities, the occurrence of boron pollution was determined in the Kunduzlar and Çatören dam lakes (23). In aquatic habitats, acceptable boron values are between 0.75–1.0 mg/l (24). Özkurt (1993) found that monthly mean boron values were 1.50 ppm and 4.0 ppm in the Kunduzlar and Çatören lakes, respectively (23). The mean values of boron were found to be 2.00 ppm and 5 ppm (23).

A comparison of the boron levels monitored by DSI between the years 1980 and 1995 to those in this study

showed that boron pollution has continuously increased in the Çatören dam lake (25).

There have been no scientific investigations in Kunduzlar and Çatören lakes except one conducted by DSI in 1986 and Özkurt (23). The aim of this study was to determine the zooplankton fauna, population abundance and the effects of boron pollution on the zooplanktonic organisms living in both lakes.

Study Area

The Kunduzlar and Çatören lakes are located in the Kırka basin of Eskişehir (Figure 1) and have been used for irrigation, erosion control and energy supply since 1984 and 1986, respectively. Both lakes were first stocked with mirror carp between 1988 and 1995 (26). The stocking rate was 112.000 and 150.000 fishes in Kunduzlar and Çatören dam lakes, respectively. The length of the stocked fish varied from 5 to 8 cm. While the rivers Harami and Kümbet feed the Çatören lake, the rivers Akin and Keçeliözü feed Kunduzlar dam lake (26). The surface areas and maximum depths of the dam lakes are 2.64 km² and 4.04 km², and 28 m and 38 m, respectively.

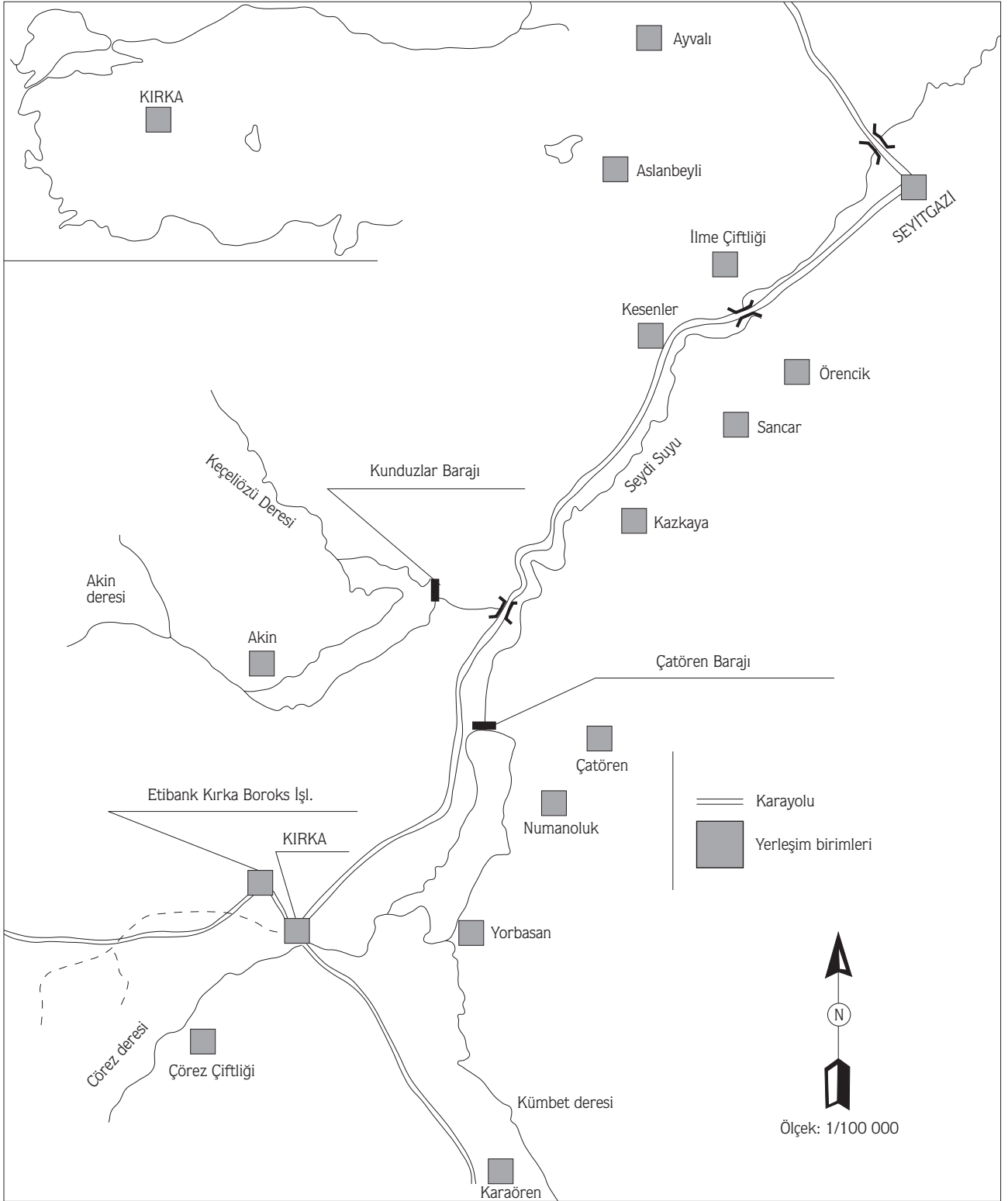


Figure 1. The location of dam lakes and sampling sites.

In the limnological investigations made by DSI in 1986, *Capoeta* sp. (79%), *Leuciscus* sp (18%), *Alburnus* sp (2%), *Barbus* (1%) were found in Kunduzlar dam lake, and *Capoeta* sp (79%), *Leuciscus* sp (18%), *Alburnus* sp (2%), *Barbus* sp (1%) were found in the Çatören lake.

Material and Method

This study was carried out between August 1994 and June 1995. The samples were taken monthly at two different stations (Figure 1), the average depths of which varied 13 m to 25 m in the Kunduzlar lake, and from 16 m to 28 m in the Çatören lake.

Zooplankton samples were collected with 55-µ-pore-sized Hydro-Bios Kiel plankton net. During the winter months, samples could not be taken due to unfavorable weather conditions. The zooplankton samples were collected by horizontal and vertical plankton net hauls. Horizontal hauls were performed with plankton nets 25 cm in diameter. The samples were collected, while moving to the haul point from a distance of 100 m or for 5 minutes. Vertically taken samples were evaluated quantitatively, and horizontally taken samples were used for the identification of the zooplanktonic species. The collected samples was poured into 250 ml bottles and were preserved in a 4% formalin solution. The zooplanktonic species were identified according to Kolisko (27), Koste (28, 29), Edmondson (30), Ward and Whipple (31), Harding and Smith (32), Needham (33) and Scourfield and Harding (34).

Quantitative analysis and evaluation of the zooplankton samples were conducted according to Edmondson (30) and Telesh (35).

The physicochemical parameters were determined by the Ankara Research Institute of Rural Services, and the average values are presented in Table 1.

4. Result and Discussion

The zooplankton species living in these dam lakes follow:

Kunduzlar Dam Lake

Cladocera

Daphnia longispina O.F. Müller, 1785

Daphnia cucullata Sars, 1862

Ceriodaphnia quadrangula (O.F. Müller 1785)

Bosmina longirostris (O.F. Müller 1785)

Diaphanosoma birgei Korinek, 1981.

Copepoda

Acanthodiptomus denticornis (Wierzejski, 1887)

Cyclops vicinus Uljanin, 1875

Rotifera

Keratella quadrata (O.F. Müller 1785)

Asplanchna priodonta Gosse, 1850

Filinia longiseta (Ehrenberg, 1834)

Brachionus urceolaris (O.F. Müller 1773)

Lecane lamellata (Daday, 1893)

Epiphanes sp.

Çatören Dam Lake

Cladocera

Daphnia longispina O.F. Müller, 1785

Daphnia cucullata Sars, 1862

| PARAMETERS | KUNDUZLAR | | | ÇATÖREN | | |
|--|-----------|---------|-------|---------|---------|-------|
| | Minimum | Maximum | Mean | Minimum | Maximum | Mean |
| Temperature (°C) | 10.0 | 14.0 | 12.0 | 9.0 | 19.0 | 14.0 |
| Dissolved Oxygen (mg/l) | 7.7 | 8.6 | 8.2 | 8.0 | 8.1 | 8.1 |
| Electrical Conductivity (µmhos/cm-25°C) | 325 | 327 | 326 | 263 | 316 | 290 |
| Amonium (mg/l) | 0.10 | 0.40 | 0.25 | 0.10 | 0.15 | 0.13 |
| Nitrate (mg/l) | 0.00 | 0.45 | 0.23 | 0.00 | 0.15 | 0.08 |
| Nitrite | 0.005 | 0.006 | 0.006 | 0.002 | 0.006 | 0.004 |
| Ortho-Phosphate (mg/l) | 0.03 | 0.17 | 0.10 | 0.03 | 0.07 | 0.05 |
| Calcium (mg/l) | 38.6 | 38.8 | 38.7 | 35.2 | 42.0 | 38.6 |
| Magnesium (mg/l) | 10.2 | 10.6 | 10.5 | 8.9 | 9.1 | 9.1 |
| Total hardness (mg/l CaCO ₃) | 138 | 141 | 140 | 125 | 142 | 134 |

Table 1. Some physical and chemical parameters of Kunduzlar and Çatören dam lakes.

Ceriodaphnia quadrangula (O.F. Müller 1785)

Bosmina longirostris (O.F. Müller 1785)

Diaphanosoma birgei Korinek, 1981

Copepoda

Acanthodiaptomus denticornis (Wierzejski, 1887)

Cyclops vicinus Uljanin, 1875

Rotifera

Keratella quadrata (O.F. Müller 1785)

Asplanchna priodonta Gosse, 1850

Filinia longiseta (Ehrenberg, 1834)

Lecane lamellata (Daday, 1893)

Epiphanes sp.

Hexarthra fennica (Levander, 1892)

Polyarthra vulgaris Carlin, 1943

The organisms of dam lakes can be classified into three main groups: Cladocera, Copepoda and Rotifera. Cladocera are represented by 5 species, the Copepoda by 2 species and the Rotifera by 6 species in the Kunduzlar and Çatören lakes. The amounts of these groups per cubic meter and their percent values are given in Table 2 and 3.

The zooplankton fauna of Kunduzlar dam lake were found to be 40.52% Copepoda, 39.06% Cladocera and 20.42% Rotifera species (Table 2). Quantitative estimations showed that zooplankton biomass was slightly dominated by Copepoda. Monthly seasonal variation in the main zooplankton groups—Copepoda, Cladocera and Rotifera—are given in Table 2 and Figure 2.

The dominant species of the dam lake are *Ceriodaphnia quadrangula* (17.08%), *Daphnia longispina* (14.61%), *Cyclops vicinus* (11.94%) and *Keratella quadrata* (12.05%) (Table 2). The monthly seasonal variation of these species are given in Figure 3. *Cyclops vicinus*, *Keratella quadrata* and *Asplanchna priodonta* were found every month, while the other species were not found in all months (Table 2). *Daphnia cucullata*, *Brachionus urceolaris*, *Lecane lamellata* and *Epiphanes* spp. were rarely seen in that period.

The zooplankton fauna composition of Çatören dam lake was found to be Copepoda 39.08%, Cladocera 30.88% and Rotifera 30.04%. Copepoda is the dominant group in this lake. The monthly seasonal variations of the zooplankton groups are given in Figure 4. The common species of this dam lake are *Cyclops vicinus* (89172 ind.m⁻³, 16.99%), *Keratella quadrata*

Table 2. The monthly abundance values (ind.m⁻³, %) of zooplanktonic organisms in the Kunduzlar dam lake.

| Species | Months | March | | May | | June | | August | | September | | October | | November | | Total | |
|--|--------|---------------------|-------|---------------------|-------|---------------------|-------|---------------------|-------|---------------------|-------|---------------------|-------|---------------------|-------|---------------------|-------|
| | | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % |
| CLADOCERA | | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % |
| <i>Daphnia longispina</i> | | 1630 | 1.45 | 17376 | 32.32 | 23439 | 23.76 | 12446 | 33.56 | 1223 | 6.67 | 4280 | 6.28 | 3261 | 6.96 | 63655 | 14.61 |
| <i>Daphnia cucullata</i> | | - | - | - | - | - | - | - | - | - | - | - | - | * | - | - | - |
| <i>Bosmina longirostris</i> | | 204 | 0.18 | 204 | 0.8 | 1834 | 1.86 | - | - | - | - | 1631 | 2.39 | 9682 | 20.65 | 13555 | 3.11 |
| <i>Ceriodaphnia quadrangula</i> | | 204 | 0.18 | - | - | 9172 | 9.30 | 1197 | 3.23 | 3261 | 17.77 | 47084 | 69.06 | 13453 | 28.69 | 74371 | 17.08 |
| <i>Diaphanosoma birgei</i> | | 408 | 0.36 | 2803 | 5.21 | 37095 | 37.60 | 3669 | 9.90 | 5299 | 28.89 | 3261 | 0.04 | 409 | 0.87 | 18499 | 4.24 |
| TOTAL | | 2446 | 3.61 | 20383 | 37.91 | 37095 | 37.60 | 17312 | 46.68 | 9783 | 53.33 | 56256 | 82.51 | 26805 | 57.17 | 170080 | 39.06 |
| CLADOCERA | | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % |
| <i>Acanthodiaptomus denticornis</i> | | 4892 | 4.35 | 204 | 0.38 | - | - | 408 | 1.10 | 1223 | 6.67 | 1790 | 2.63 | 7643 | 16.30 | 16160 | 3.71 |
| <i>Cyclops vicinus</i> | | 5299 | 4.71 | 7185 | 13.36 | 27516 | 27.89 | 1019 | 2.75 | 3261 | 17.77 | 5038 | 7.39 | 2650 | 5.65 | 51968 | 11.94 |
| Calonoid ve Cyclopoid (Nauplius+Copepodit) | | 44841 | 39.86 | 12484 | 23.22 | 21197 | 21.49 | 15083 | 40.67 | 3261 | 17.77 | 2650 | 3.89 | 8764 | 18.69 | 108280 | 24.87 |
| TOTAL | | 55032 | 48.91 | 19873 | 36.97 | 48713 | 49.38 | 16510 | 44.52 | 7745 | 42.22 | 9478 | 13.90 | 19057 | 40.65 | 176408 | 40.52 |
| ROTIFERA | | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % |
| <i>Keratella quadrata</i> | | 33834 | 30.07 | 3822 | 7.11 | 12025 | 12.19 | 408 | 1.10 | 408 | 2.22 | 1019 | 1.49 | 1019 | 2.17 | 52535 | 12.05 |
| <i>Asplanchna priodonta</i> | | 9376 | 8.33 | 9478 | 17.63 | 204 | 0.21 | 408 | 1.10 | 408 | 2.22 | 612 | 0.90 | 102 | 0.22 | 20588 | 4.72 |
| <i>Filinia longiseta</i> | | 111822 | 10.51 | 204 | 0.38 | 611 | 0.62 | 2446 | 6.60 | - | - | 815 | 1.20 | - | - | 15898 | 3.65 |
| <i>Brachionus urceolaris</i> | | - | - | - | - | - | - | - | - | * | - | * | - | - | - | - | - |
| <i>Lecane lamellata</i> | | - | - | * | - | - | - | * | - | - | - | - | - | - | - | - | - |
| <i>Epiphanes</i> sp. | | * | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| TOTAL | | 55032 | 48.91 | 13504 | 25.12 | 12840 | 13.02 | 3262 | 8.80 | 816 | 4.45 | 2446 | 3.59 | 1121 | 2.18 | 89021 | 20.42 |
| GENERAL TOTAL | | 112510 | 100 | 53760 | 100 | 98648 | 100 | 37084 | 100 | 18344 | 100 | 68180 | 100 | 46883 | 100 | 435409 | 100 |

* Trace amount

Table 3. The monthly abundance values (ind.m⁻³, %) of zooplanktonic organisms in the Çatören dam lake.

| Species | Months | March | | May | | June | | August | | September | | October | | November | | Total | |
|---|--------|---------------------|-------|---------------------|-------|---------------------|-------|---------------------|-------|---------------------|-------|---------------------|-------|---------------------|-------|---------------------|---------|
| | | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % |
| <i>Daphnia longispina</i> | | 408 | 0.96 | 20.38 | 2.10 | 29554 | 24.45 | 1427 | 1.80 | 1020 | 1.90 | - | - | 612 | 0.80 | 35059 | 6.68 |
| <i>Daphnia cucullata</i> | | - | - | - | - | - | - | - | - | - | - | - | - | * | - | - | - |
| <i>Bosmina longirostris</i> | | 816 | 1.93 | 14268 | 14.72 | 3057 | 2.53 | - | - | - | - | 12637 | 22.55 | 1631 | 2.15 | 32409 | 6.18 |
| <i>Ceriodaphnia quadrangula</i> | | - | - | - | - | 23032 | 19.06 | 8969 | 11.34 | 15491 | 28.90 | 11188 | 19.97 | 18344 | 24.13 | 77024 | 14.67 |
| <i>Diaphanosoma birgei</i> | | - | - | - | - | 611 | - | 2854 | 3.61 | 8765 | - | 4281 | 7.64 | 1121 | 1.47 | 17632 | 3.37 |
| TOTAL | | 1224 | 2.89 | 16306 | 16.82 | 56254 | 46.54 | 13250 | 16.75 | 25276 | 47.15 | 28106 | 50.16 | 21708 | 28.55 | 162124 | 30.88 |
| CLADOCERA | | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % |
| <i>Acanthodiptomus denticornis</i> | | 816 | 1.93 | - | - | - | - | 408 | 0.52 | 2854 | 5.32 | 2854 | 5.09 | 1937 | 2.55 | 8869 | 1.69 |
| <i>Cyclops vicinus</i> | | 7745 | 18.27 | 37503 | 38.69 | 5503 | 4.55 | 15491 | 19.59 | 6930 | 12.93 | 6115 | 10.91 | 9885 | 13.00 | 89172 | 16.99 |
| Calonoid ve Cyclopoid (Nauplius+Copepodit) | | 9975 | 23.53 | 3179 | 3.28 | 19159 | 15.85 | 14675 | 18.56 | 7542 | 14.07 | 18140 | 32.37 | 34446 | 45.30 | 107116 | 20.40 |
| TOTAL | | 18536 | 43.73 | 40682 | 41.97 | 24662 | 20.40 | 30574 | 38.66 | 17326 | 32.32 | 27109 | 48.38 | 46268 | 60.85 | 205157 | 39.08 |
| ROTIFERA | | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % | ind.m ⁻³ | % |
| <i>Keratella quadrata</i> | | 18344 | 43.28 | 12637 | 13.04 | 12025 | 9.95 | 22828 | 28.86 | 10599 | 19.77 | 612 | 1.09 | 6726 | 8.85 | 83771 | 15.96 |
| <i>Asplanchna priodonta</i> | | 611 | 1.44 | - | - | 14471 | 11.7 | 1020 | 1.29 | - | - | - | - | 816 | 1.07 | 16918 | 3.22 |
| <i>Filinia longiseta</i> | | 3669 | 8.66 | 27312 | 28.17 | 13248 | 10.96 | 11414 | 14.43 | 408 | 0.76 | - | - | 306 | 0.40 | 56357 | 10.74 |
| <i>Lecane lamellata</i> | | - | - | - | - | - | - | - | - | - | - | - | - | 204 | 0.27 | 204 | 0.00038 |
| <i>Polyarthra vulgaris</i> | | - | - | - | - | 204 | 0.17 | - | - | - | - | - | - | - | - | 204 | 0.00038 |
| <i>Hexarthra fennica</i> | | - | - | - | - | - | - | - | - | - | - | 204 | 0.37 | - | - | 204 | 0.00038 |
| TOTAL | | 22624 | 53.38 | 39949 | 41.21 | 39948 | 33.06 | 35262 | 44.59 | 11007 | 20.53 | 816 | 1.46 | 8052 | 10.69 | 157658 | 30.04 |
| GENERAL TOTAL | | 42384 | 100 | 96937 | 100 | 120864 | 100 | 79086 | 100 | 53609 | 100 | 56031 | 100 | 76028 | 100 | 524939 | 100 |

* Trace amount

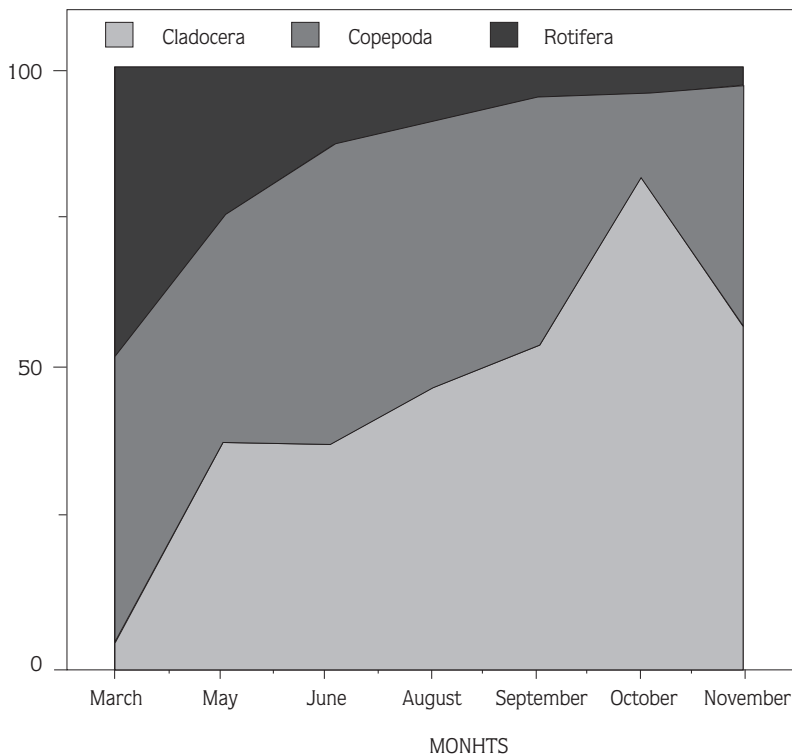


Figure 2. The monthly percent distribution of zooplankton groups in Kunduzlar dam lake.

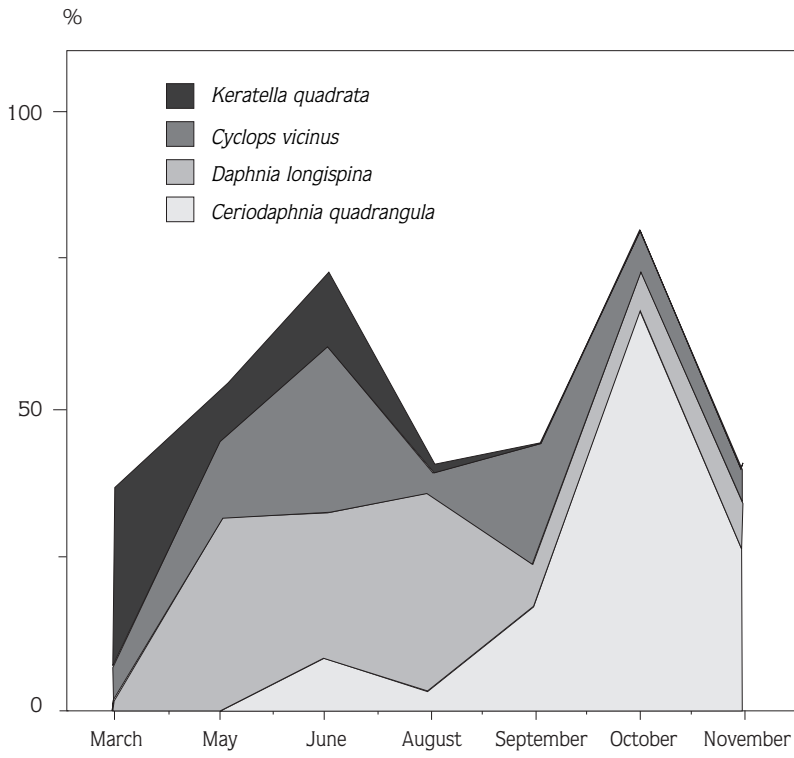


Figure 3. The monthly distribution of the main dominant species, *Ceriodaphnia quadrangula*, *Daphnia longispina*, *Cyclops vicinus* and *Keratella quadrata* in Kunduzlar dam lake.

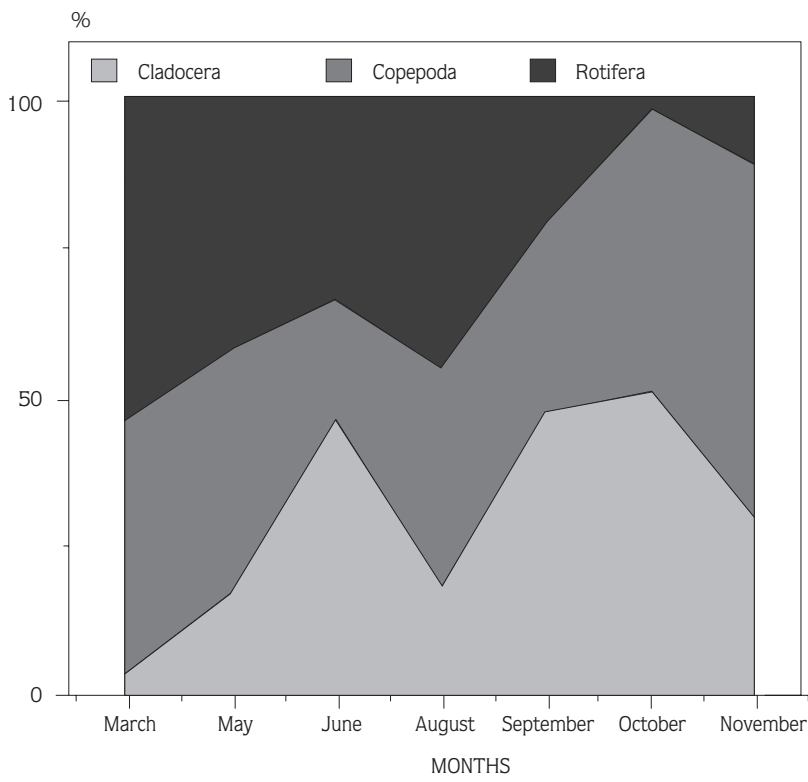


Figure 4. The monthly percent distribution of zooplankton groups in Çatören dam lake.

(83771 ind.m⁻³, 15.96%) and *Ceriodaphnia quadrangula* (77024 ind.m⁻³, 14.67%) (Table 3). The monthly seasonal variations of these species are given in Figure 5. While the species *Cyclops vicinus* and *Keratella quadrata* were recorded in the plankton samples throughout the sampling period, the others were rarely found.

Cyclops sp., *Daphnia* sp., *Ceriodaphnia* sp., *Bosmina* sp., *Asplanchna* sp., *Polyarthra* sp., *Synchaeta* sp., *Brachionus* sp., *Filinia* sp., *Epiphanes* sp. and *Keratella* sp. were determined in the limnological investigations in the Kunduzlar lake, and Rotifera were recorded as the dominant group of this lake by Anonymous (26). In this study, Copepoda (40.52%), Cladocera (39.06%) and Rotifera (20.42%) were determined in this lake. The dominant group was Copepoda. It might be assumed from the data obtained that Rotifera (69.5%) have been noticeably reduced to 20.42% since 1988. In contrast to this, the abundance of Copepoda markedly increased up to 40.52%. These findings showed that Copepoda and Cladocera have tolerance to boron pollution.

Copepoda (45.3%), Rotifera (26.7%) and Cladocera (30.04%) were determined in the Çatören lake (26). Our finding is consistent with Anonymous (26) Common species in this lake were *Asplanchna* sp., *Daphnia* sp., and *Cyclops* sp. (26). In contrast, *Keratella quadrata*, *Ceriodaphnia quadrangula* and *Cyclops vicinus* were found

in this study. Additionally, 15 species were reported in the Kunduzlar and Çatören lakes for the first time.

While the species of Rotifera are abundant in the eutrophic lakes, Copepoda and Cladocera species are found in higher density in oligotrophic lakes (36). The zooplankton fauna of the Kunduzlar and Çatören lakes, the composition of zooplankton fauna are highly similar to each other. Only a few species of Rotifera were different. *Brachionus urceolaris*, *Epiphanes* sp. were absent in the Çatören lake, and *Polyarthra vulgaris* and *Hexarthra fennica* were absent in the Kunduzlar lake.

The mean number of zooplankton per cubic meter was determined as 435.409 ind.m⁻³ in Kunduzlar and 524.939 ind.m⁻³ in Çatören. The mean numbers of zooplankton in some other lakes from 1976 to 1977 are as follows: in Seyfe lake (381.107 ind.m⁻³) (39), in Bafra lake (480.600 ind.m⁻³) (37), in Akşehir lake (1.122.741 ind.m⁻³) (38), in Eğirdir lake (65.462 ind.m⁻³) (39) and in Keban dam lake (57.324 ind.m⁻³) between (40).

Physical and chemical parameters (Table 1), (eg, temperature dissolved oxygen, electrical conductivity) play an important role in the occurrence of zooplankton communities. Obviously, temperature is a key factor in restricting the occurrence of rotifers (36). According to Herzig (36), five factors seem to influence species abundance and cause species succession: (a) physical and

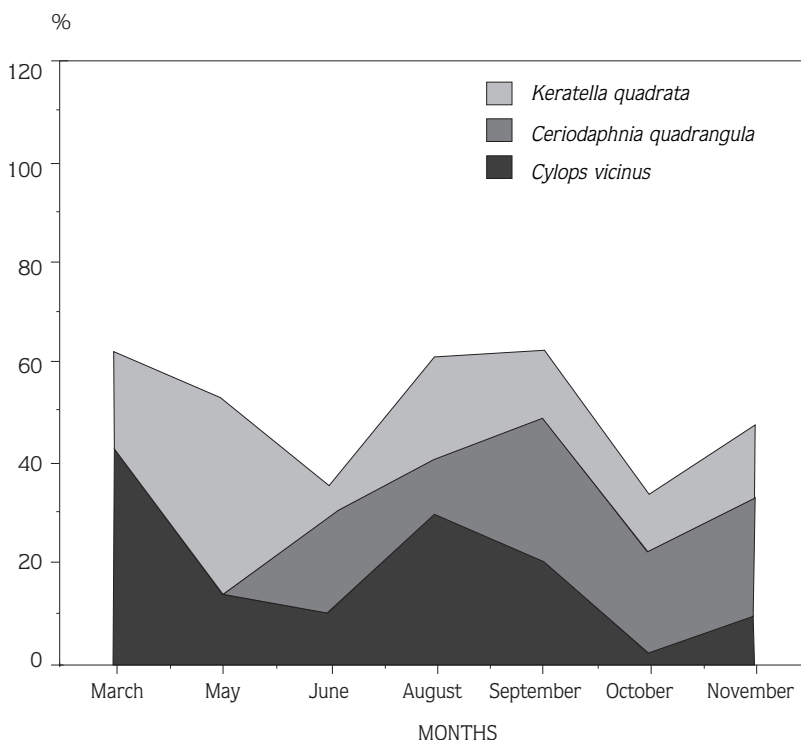


Figure 5. The monthly distribution of the dominant species, *Keratella quadrata*, *Ceriodaphnia quadrangula* and *Cyclops vicinus* in Çatören dam lake.

chemical limitations, (b) food and exploitative competition, (c) mechanical interference competition, (d) predation and (e) parasitism. Salinity and dissolved oxygen concentration are examples of the chemical limitation of rotifer communities (36).

A large number of zooplanktonic species living in dam lakes can be considered an indicator of eutrophic status (41, 42, 43). Of these species, *Asplanchna priodonta* and *Polyarthra vulgaris* were found in the plankton of eutrophic lakes (41, 42). Berzins and Pejler (43) suggested that *Filinia longiseta* was a indicator of eutrophic conditions. The same researcher determined that *Daphnia culcullata* was a well-known indicator for eutrophic lakes with a maximal density above the 50 mg/l phosphate values. Pejler and Bertilsson (44) stated that *Bosmina longirostris* was dominant when the total phosphor content in lake increased to high level. *Ceriodaphnia quadrangula*, recorded from both lakes, had

maximal density at a very low level of electrical conductivity in this study. Additionally, the values of average electrical conductivity were determined to be 326 µmhos/cm and 290 µmhos/cm in the Kunduzlar and Çatören lakes, respectively.

The Kunduzlar and Çatören dam lakes were found to be very poor in respect to zooplanktonic species but rich in density of zooplankton biomass. This findings shows that boron pollution has a negative effect on the number of zooplanktonic species.

Acknowledgement

We would like to thank Assoc. Prof. Dr. Ertuğ GÜNDÜZ (Department of Biology, University of Hacettepe) for the identification of Cladoceran and Copepod species.

References

1. Berzins, B., Pejler Rotifer Occurrence in Relation to pH. Hydrobiol. 147: 107–116, 1987.
2. Mikschi, E., Rotifer Distributions In Relation to Temperature and Oxygen Content. Hydrobiol. 186/187: 209–214, 1989.
3. Hecky, R.E., Kilham, P., Diatoms in Alkaline, Saline Lakes: Ecology and Geochemical. Limnol. Oceanogr. 18: 53–71, 1973.
4. Geldiay, R., Çubuk Barajı ve Eymir Gölü'nün Makro ve Mikro Faunasının Mukayeseli Olarak İncelenmesi. Ank. Üniv. Fen. Fak. Mec. 2: 146–252, 1949.
5. Demirhindi, Ü., A Preliminary study on the plankton of the barrage lake Demirköprü. İstanbul Üniv. Fen. Fak., Biyoloji Der., 54, 51–78, 1989–1990.
6. Ongan, T., Akdağ, O., Kırgız, T., Kaftancıoğlu, M., Burdur, Yanışlı, Karataş ve Beyşehir Gölleri Cladocera (Crustacea) Türleri. İstanbul Üniv. Fen. Fak. Hidrobiyoloji Araştırma Enstitüsü Yayınları, 12, 1–19, 1972.
7. Tokat, H., Hazar (Gölcük) Gölünün Copepoda ve Cladocera Türleri. İstanbul Üniv. Fen. Fak. Hidrobiyoloji Araştırma Enstitüsü Yayınları, 10, 1–19, 1972.
8. Margaritora, F.G., Stella, E., Mastrantuano, L., Contributo allo studio della fauna ad endostraci delle acque temporanee della Turchia Asiatia, Riv. Idrobiol. 16, 151–172, 1977.
9. Dumont, H.J. & M. De RIDDER, 1987. Rotifers from Turkey. Hydrobiologia, 147: 65–73, 1987.
10. Ustaoglu, M.R., Zooplankton (Metazoa) of the Karagöl (Yamanlar, Izmir-Turkey), Biologia Gallo Helvetica, 12, 273–281, 1986.
11. Ustaoglu, M.R., Balık, S., Kuş Gölü (Bandırma) Zooplanktonu X. Ulusal Biyoloji Kongresi 18–20 Temmuz, Erzurum, 11–19, 1990 a.
12. Ustaoglu, M.R., Balık, S., Zooplankton of lake Gebekirse (Izmir-Turkey). Rapp. Comm. int. Mer. Médit, 32: 74, 1990 b.
13. Ustaoglu, M.R., Balık, S., Akgöl'ün (Selçuk-Izmir) Rotifer Faunası. VII. Ulusal Biyoloji Kongresi, Cilt II: 614–626, 1987.
14. Emir, N., A note on four rotifer species new to Turkey, Biol. Jb. Dodonaea, 57: 78–80, 1989.
15. Emir, N., Some rotifers species from Turkey, Turk. J. of Zool. 15: 39–45, 1991.
16. Güher, H., Kırgız, T., Süleoğlu Baraj Gölü ve Korucuköy, Budak doğanca, Eskikadın Göletlerinin Cladocera ve Copepoda (Crustacea) Türleri. Anadolu Üniv. Fen Edebiyat Dergisi, 25–43, 1989.
17. Güher, H., Kırgız, T., Edirne Bölgesi Cladocera (Crustacea) Türleri. XI. Ulusal Biyoloji Kongresi–Elazığ, (Baskıda), 1992.
18. Gündüz, E., Karamık ve Hoyran Göllerinin Cladocera (Crustacea) Türleri Üzerine Taksonomik Bir Çalışma. Doğa TU Zooloji Dergisi. 11, 26–36, 1987.
19. Gündüz, E., A new species of Ilyocryptus (Crustacea: Anomopoda) from Bafra Balıkgölü, Turkey. Hydrobiologia, 199, 237–241, 1990.
20. Gündüz, E., Bafra Balıkgölünün (Bafra Balıkgölü–Uzungölü) Cladocera Türleri Üzerine Taksonomik Bir Çalışma. Doğa TU J. Zooloji D., 15, 115–134, 1991.

21. Gündüz, E., Türkiye İç Sularında Yaşayan Cladocera (Crustacea) Türlerinin Listesi. Doğa TU J. Zooloji D., 21. 37–45, 1997.
22. Altındağ, A., Sözen, M., Seyfe (Kırşehir) Gölü Rotifera Faunasının Taksonomik Yönden İncelenmesi, Doğa Tr. J. of Zoology, 20, 221–230, 1996.
23. Özkurt, Ş., Kırka Boraks İşletmesi Atıkları ile Kirlenen Kırka Yöresi (Eskişehir) Sularında Bor Kirliliğinin Tesbiti. Y. Lisans Tezi, Gazi Üni. Gazi Eğt. Fak., 1993.
24. Jeffrey, A. Black, James B. Bronum and Wesley J. Birge., An Integrated Assessment of Biological Effects of Boron on the Rainbow Trout. *Chemosphere* Vol. 26, No.7, pp. 1383–1413, 1993.
25. Anonymous, DSI Su Kalite Gözlemleri., Ankara, 1995.
26. Anonymous, DSI Kunduzlar ve Çatören Baraj Gölleri Limnolojik Etüd Raporu, 1988.
27. Kolisko, R.M., Plankton Rotifers Biology and Taxonomy Biological Station. Lunnz of the Austrian Academy of Science, Stuttgart, 1974, 974 p.
28. Koste, W., Die Radertiere Mitteleuropas I. Textband, Berlin, Stuttgart, 1978, 673 p.
29. Koste, W., Die Radertiere Mitteleuropas II. Tafelband, Berlin, 1978, 235 p.
30. Edmondson, W.T., Freshwater Biology, Second Edition, John Wiley Sons, Inc. London, Chapman & Hall Limited, 1959, 1248 p.
31. Ward, H.B., Whipple, G.C., Freshwater Biology. John Wiley and Sons Inc. New York (Second edition), 1945.
32. Harding, J.P., Smith, W.A., A key to the British Freshwater Cyclopoid and Calonoid Copepods, *Freshwater Biol. Ass. Sci. Publ.* (2nd. ed.), 1974.
33. Needham, J.G., A guide to the study of Freshwater Biology, Holden Day Inc. San Francisco, 1962.
34. Scourfield, D.J., Harding, J.P., A key to the British Freshwater Cladocera, *Freshwater Biol., Ass. Sci. Publ.*, No. 5, 1966.
35. Telesh, I.V., 1986, Comparative effectiveness of methods of counting planktonic rotifers, *Scripta Technica*, 101–104.
36. Herzig, A., The analysis of planktonic rotifer population: A plea for long-term investigations. *Hydrobiologia*. 147: 163–180, 1987.
37. Anonymous., Bafra Balık Göllerinin (Balık gölü–Uzun göl) Limnolojik Özelliklerinin Tesbiti. Proje No. 1. Tarım Orman ve Köyişleri Bakanlığı, Su Ürünleri Daire Başkanlığı, Samsun Su Ürünleri Bölge Müd., 1983.
38. Anonymous., Akşehir Gölü'nün Bazı Limnolojik Özellikleri Üzerine Bir Araştırma. Isparta Su Ürünleri Bölge Müd. Yayınları: 4, s.1–43, Isparta, 1984.
39. Anonymous., Eğirdir ve Akşehir Göllerinin Bazı Limnolojik Özellikleri Üzerine Bir Araştırma. Isparta Su Ürünleri Bölge Müd., Yayın No: 3–4, 1984.
40. Anonymous., Keban Baraj Gölü Limnolojik Etüd Raporu. Enerji ve Tabii Kaynaklar Bakanlığı DSI İşl. ve Bakım Dairesi Başkanlığı Ankara, 90 s., 1982.
41. Berzins, B., Pejler, B., Rotifer occurrence in relation to temperature, *Hidrobiol.* 175: 223–231, 1989.
42. Saunders–Davies, A.P., Horizontal distributions of the plankton rotifers *Keratella cochlearis* (Bory de st Vicent) and *Polyarthra vulgaris* (Carlin) in a small eutrophic lake. *Hidrobiol.*, 186/187: 153–156, 1989.
43. Berzins, B., Pejler, B., Rotifer occurrence in relation to pH. *Hidrobiol.* 147: 107–116, 1987.
44. Berzins, B., Bertilson, J., On limnic micro–crustacean and trophi degree. *Hidrobiol.* 185: 95–100, 1989.