Seasonal Variations of Zooplankton in Nazik Lake (Turkey)

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Abstract: In this study, zooplankton community of Nazik Lake studied seasonally. Zooplankton samples were collected from three different stations with standart hydro-bios plankton net, both horizontally and vertically. In the lake 25 zooplankton species were identified. Zooplankton samples were consisted of 14 Rotifera, 8 Cladocera, and 3 Copepoda, respectively. Rotifera was the dominant group of zooplankton with regard to species numbers and densities

Key words: Rotifera, Cladocera, Copepoda, Nazik Lake

Nazik Gölü Zooplanktonunun Mevsimsel Değişimi (Türkiye)

Öz: Bu çalışmada, Nazik Gölü'nün zooplankton yoğunluğu mevsimsel olarak çalışıldı. Zooplankton örnekleri standart Hydro-bios plankton net ile hem horizontal hem de vertikal olarak 3 farklı istasyondan toplandı. Gölde 14 Rotifera 8 Cladocera, 3 Copepoda olmak üzere toplam 25 zooplankton teşhis edildi. Rotifera tür sayısı ve yoğunluğu bakımından zooplanktonun en baskın grubudur**.**

Anahtar kelimeler: Rotifera, Cladocera, Copepoda, Nazik Gölü

1. Introduction

The lakes comprise the one of the most productive ecosystems. Lake ecosystems are made up of physical, chemical and biological properties contained within these water bodies [1]. Zooplankton community always acts as a key component which transfers the energy in different trophic level in an aquatic ecosystem and it helps to regulate the productivity of the water body.

The primary function of freshwater zooplankton is an important component in aquatic ecosystems, which act as primary and secondary links in the food chain. Zooplankton community structure is affected by physical and chemical environment. These communities are also affected by biological interactions, predation and their competition for food resources [2]. Most groups of zooplankton have been used as a bioindicator for monitoring aquatic ecosystems and the integrity of water. Copepoda, Cladocera and Rotifer are filter feeding organisms, they play a significant role in food chain by transforming the phytoplankton to animal protein. Zooplankton community may be considered as a bioindicators of eutrophication, because they are coupled to environmental conditions, responding more rapidly to changes than do fishes, and are easier to identify than phytoplankton. Therefore, they are potential value as water quality indicators [3-4]. The aim of this study was to determine the zooplankton distribution of Nazik Lake qualitatively and quantitatively and to evaluate the zooplankton community.

2. Materials and Methods

Nazik Lake was located 25 km far from Van Lake and 16 km from northwest Ahlat. It is one of the volcanic set origin lakes of Eastern Anatolia Region. Lake has got 40-50 m deep. This freshwater lake is fed with melted snow and rain water, and can even be used as a road in winter due to the ice layer formed in the lake. Lake is also used for irrigation. In the lake, pearl mullet (*Alburnus tarichi*), mirrored carp (*Cyprinus carpio*) and *Capoeta cosswigi* have been caught economically. The irrigation of agricultural lands reduces the water level of the lake, the number of birds and fish species decreases due to illegal hunting. The disappearance of reeds due to unconscious animal grazing puts the existence of many living creatures in the lake in danger [5].

Zooplankton samples were taken seasonally between January 2014 - February 2015 from three different stations with 55μ mesh sized Hydro-bios plankton net and preserved with 4% formaldehyde solution (Fig, 1).

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Counting slide and Leitz brand inverted microscope were used to indicate the number of zooplankton per unit volume. For counting, the jar was shaken gently and 1 ml was taken by pipette and this process was repeated 10 times.

The number of organisms in m^3 was calculated by first comparing the results with the volume of the jars and then with the amount of water filtered through the plankton bucket. For detailed identification of organisms, Nikon scanning microscope was used. Some physico-chemicals parameters such as temperature, pH and dissolved oxygen have been measured in situ. Temperature and dissolved oxygen values were measured by an Oxi 315i/SET oxygen-meter, pH by a Lamotte (pH 5-WC) model pHmeter. The species were identified by using relevant literature [6-12].

**Figure 1.** Sampling stations in Nazik Lake [13].

3. Results

In Nazik Lake totally 25 zooplankton species have been identified. From these species 14 species from Rotifera, 8 species from Cladocera and 3 species from Copepoda have been identified. In the lake the most number of species have been recorded from station I st (15 species) (Table 1). Rotifera was the most recorded group with 56%, followed by Cladocera with 32% and Copepod with 12% (Figure 2).

The highest numbers of individuals (ind/m^3) was at spring at 2nd station (312224 ind/m^3), the least numbers of individual in winter at 2nd stations (1020 ind/m^3) (Figure 3).

Table 1. Distribution of zooplankton species in the stations of Nazik Lake

Species name	Stations		
	I	II	III
Rotifera			
Ascomorpha saltans Bartsch, 1870	-	-	+
Asplachna priodonta Gosse 1850	+	+	+
Asplanchna sieboldi (Leydig, 1854)	-	-	+
Cephalodella forficula (Ehrenberg 1830	-	+	+
Encentrum saundersia (Hudson, 1885)	-	+	-
Euclanis dilatata Ehrenberg 1832	-	-	+
Filinia longiseta (Ehrenberg, 1834)	-	+	-
Flinia terminalis (Plate, 1886)	-	+	-
Keratella quadrata (Müller, 1786)	+	+	+
Lecane ohioensis (Herrick, 1885)	+	-	-
Philodina roseola Ehrenberg, 1832	+	-	+
Polyarthra dolichoptera Idelson 1925	+	+	+
Polyarthra remata Skorikov 1896	+	-	-
Trichotria tetractis (Ehrenberg, 1830)	+	-	-
Cladocera			
Alona rectangula Sars, 1862	+	-	+
Bosmina coregoni (Baird, 1857)	+	-	-
Bosmina longirostris (Müller 1785)	+	-	+
Daphnia cucullata Sars, 1862	+	-	-
Daphnia galaeta Sars, 1864	-	+	-
Daphnia longispina Müller, 1785	+	-	-
Daphnia magna (Straus, 1820)	-	+	-
Diaphaosoma birgei Korinek, 1981	+	-	+
Copepoda			
Acanthodiaptumus denticornis (Wierzejski, 1887)	+	-	-
Cyclops vicinus Uljanin 1875	+	+	+
Nitokra hibernica (Brady, 1880)	-	+	-
Total taxa number	**15**	**11**	**12**
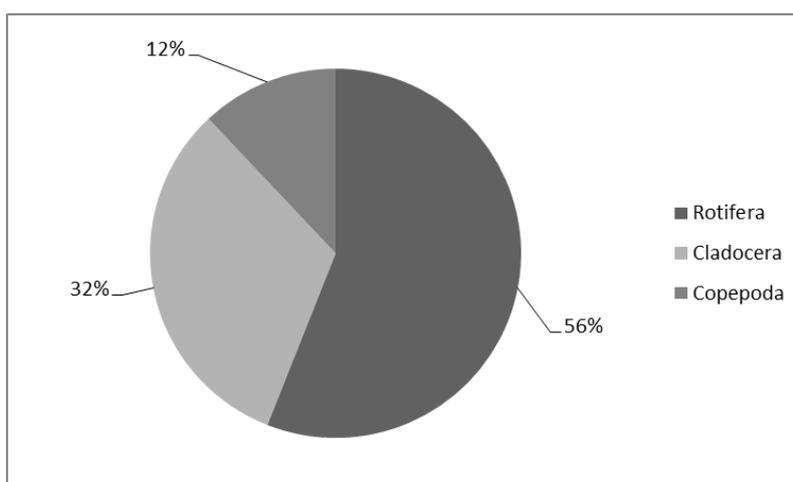
Figure 2. Relative densities of zooplankton species according to groups
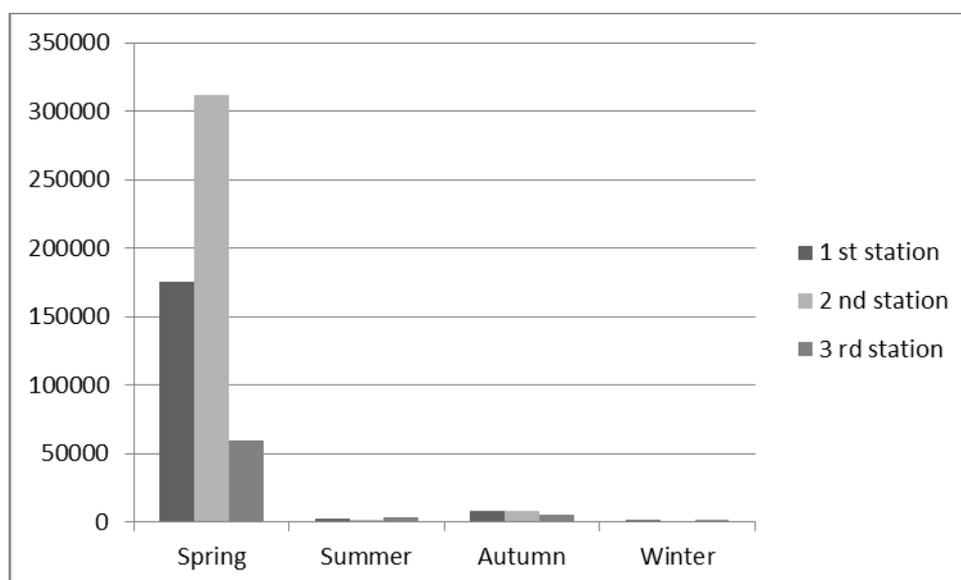
Figure 3. Number of individuals in the stations (ind/m^3) in Nazik Lake.

In the Lake, temperature ranged from 7.50°C to 28.6°C. The highest water temperature values was measured at station 3 (28.6 °C), whereas the lowest value was observed at station 1 (7.5 °C). The pH values varied from 9.1 to 9.6. The highest DO value was measured at 2 nd station with 10.5 mg/L the lowest at 1 st station with 7.5 mg/L (Table 2).

Table 2. Temperature, pH and dissolved oxygen values of Nazik Lake

Parameters	1st station			2nd station			3th station		
	Min	Max	Average	Min	Max	Average	Min	Max	Average
Water temperature (°C)	7.5	27.6	16.4	8.7	28.2	16.9	9.1	28.6	17.2
pH	9.1	9.3	9.2	9.0	9.4	9.2	9.1	9.6	9.4
Dissolved Oxygen (mg/L)	7.5	10.5	9.05	8.0	10.4	9.58	7.6	10.2	9.30

4. Discussion

In this study, totally 25 species were recorded. 14 species from Rotifera, 8 species from Cladocera and 3 species from Copepoda were recorded. According to the results of this study, Rotifera is recorded as the dominant zooplankton group. The family Brachionidae was found to the most dominant group (with 3 species, *Asplanchna priodonta Keratella quadrata, P. dolichoptera* and *C. vicinus* was observed in all stations in every seasons. The number of zooplankton species showed an increase in spring and autumn, decrease in winter.

Dumont and De Ridder [14]. stated some species as *Lecane luna, Keratella cochlearis, Keratella quadrata* have got high tolerance to some factor as pH, salinity, oxygen and temperature. From these species K. quadrata observed in all stations. The species that are observed in almost all seasons such as *K. quadrata* and *A. priodonta* have a wide temperature tolerance [6]. It is reported that the pH is significantly effective in the distribution of zooplankton and that the alkali limit in density is pH 8.5 [15]. In Nazik Lake pH levels are over alkali limit. But zooplankton species has showed adaptation to these pH values. The oxygen tolerances of most Rotifera species are quite wide [7-8]. In the study area dissolved oxygen level changed between 7.5-10.5 mg/L. These values had not got negative effect on zooplankton distribution.

Studies in Ladik Lake [16] and Ulaş Lake [17] demonstrated that Rotifera group was dominant over other zooplankton groups with respect to both species diversity and individual numbers as in Nazik Lake.
The zooplankton structure of, Hancağız, Kalecik, Beyhan, Uzunçayır, İkizcetepeler and Keban Dam Lakes were showed similarities with this study's findings [18-23]. In all of these dam lakes, rotifers were found to be the dominant species as species richness and frequency of occurrence. In Nazik Lake also species from Rotifer took first place as frequency of occurrence and individual numbers among the other zooplankton groups.

In Van Lake [24] a total of 20 species (14 belonged to genus of Rotifera, 4 to Copepoda and 2 Cladocera) in Ulaş Lake (Sivas) [17] 30 species (18 belonged to genus of Rotifera, 8 to Cladocera and 4 to Copepoda) in Mogan Lake (Ankara) [25] 33 species (25 belonged to genus of Rotifera, 7 to Cladocera and 1 to Copepoda) have been identified. In all of these lakes Rotifers were dominant as species richness and diversity like Nazik Lake. All of the identified zooplankton species are the first record for Nazik Lake.

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