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Full Length Research Paper

Zooplankton composition of Van Lake Coastline in Turkey

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This study was completed with periodical surveys in coastal band of Van Lake between May and September in 2005 to 2006 period. It was carried out on a total of 20 sites selected as sampling points and having three distinct characteristics. During the study, a total of 20 species (14 belonged to genus of Rotifera, 4 to Copepoda and 2 Branchiopoda**) were found at the Van Lake coastal zone. Genera *Notholca squamula, Keratella quadrata, Colurella colurus, Lecane ohiensis, Lecane grandis* and *Lecane lamellata* have been detected for the first time at the Van Lake coastal zone.**

Key words: Zooplankton, Rotifera, Branchiopoda, Copepoda, Van Lake, Turkey.

INTRODUCTION

In the hydrophylic ecosystems, the first ring of the food chain is comprised of phytoplankton which is involved in the producers step and the second ring of zooplankton is involved in the consumers step. In a hydrophylic ecosystem, zooplanktonic organisms constitute the foods of invertebrates, fish and sometimes birds. They are the second most important energy transformation ring and the source of food after phytoplankton. Copepods turn the phytoplankton they ingest into animal protein rapidly (Berzins and Pejler, 1987; Mikschi, 1989; Saksena, 1987). Due to the reactions that cladocers show to environmental changes, some of their species have been the subject of research. Since some species and genuses of rotifers play a role as indicators in determining the water quality, eutrophication and water contamination levels, and zooplankton is very important in terms of pisciculture and fishery in hydrophylic ecosystems (Berzins and Pejler, 1987; Mikschi, 1989; Hecky and Kilham, 1973; Sharma, 1983; Saksena, 1987; Saler and Şen, 2002; Akbulut, 2004; Yiğit and Altindağ, 2005). The water content of Van Lake is highly salty-carbonated and the forth largest carbonated lake in the world (Öğün et al., 2005). Although there are a number of reseach conducted on the species of Rotifera, Copepoda and Cladocera that live in our contry's lake and stream systems, there are limited studies conducted in the Van lake area which is the study area.

The first of these studies was performed as a limnologic work by Abich in 1859. The first comprehensive description of species has been made by Kosswig and Batalgil (1942) and Kiefer (1952, 1978). In 1978, while Wong conducted his initial studies on the maximum depth and volum of Van Lake, he noted that Van lake was the fourth largest lake in the world.

Degens et al. (1984) carried out a comprehensive study on the chemistry and morphology of Van Lake and noted that it was the largest alkali-lake of the world. Many studies have been performed on zooplanktonic organisms of lentic ecosystems in Turkey, such as those by Muckle (1951), Noodt (1954), Ongan et al. (1972), Tokat (1972), Akdağ (1975), Gündüz (1986, 1997), Güher (2000, 2003), Bekleyen (1996) Altindağ and Yiğit (2002), Ustaoğlu et al. (2001), Erkan et al. (2000), Akbulut (2000), Temel and Ongan (1990), Emir and Demirsoy

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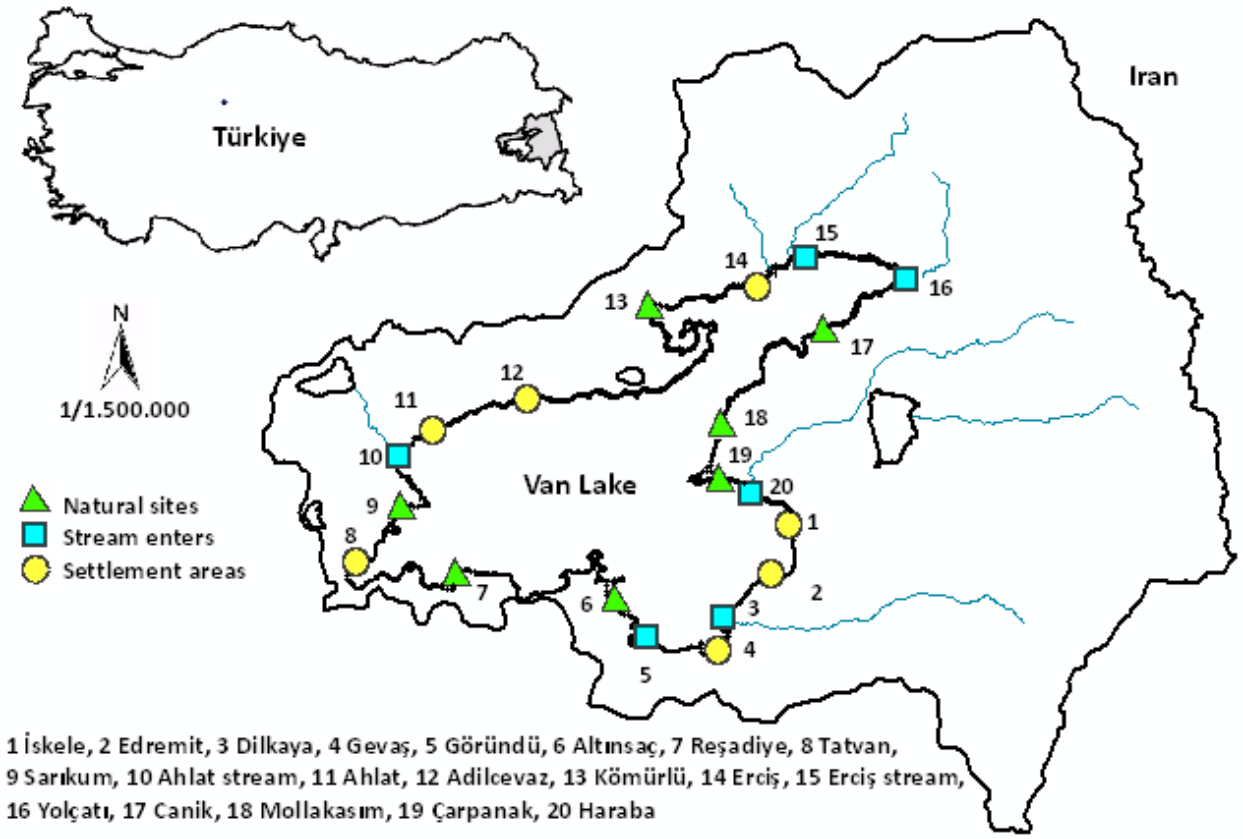

Figure 1. Sampling places in Van Lake and Van basin.

(1996) and Yıldız et al. (2007).

MATERIALS AND METHODS

Study area

Van Lake is located at 43 east longitude and 38.5 north latitude and on high plataeus of the East Anatolia, it is a volcanic lake which occurred with lava sed. It was thought to have occured due to exploit of the Nemrut volcanic mount. It was stated that the Lake has 3.574 km² surface areas, 70 km length and 1.648 m altitudes (Wong and Degens, 1978). The study area consists of coastline of the Lake (Figure 1).

Sampling

The study was completed with periodical surveys in coastal band of Van Lake between May and September in 2005 to 2006 period. Twenty sampling points having three different characters were determined as stream enterance points (4, 5, 10, 15, 16 and 20), settlement coastlines (1, 2, 4, 8, 11, 12 and 14) and natural coastlines (6, 7, 9, 13, 17, 18 and 19), and samples were taken from these sampling points according to Hansen et al. (2000) (Figure 1). The zooplankton samples were collected with plankton nets (153 No. Mesh). Three different methods were used in plankton sampling (Southwood, 1978; Rosenberg, 1997; Hansen et al., 2000). In the first one, plankton net was layed down on the floor about 1 m. depth, then it was taken up vertically to be five replicates in the same sampling sites. In the second one, surface sampling was made with plankton net in about 10 min. In this procedure, about half of the chamber of plankton net was doused into water and swept. In the third method, plankton net tied with long rope was swept away by slightly down-below movements in about 1.5 m. depth along 200 steps. Planktons that were collected in the sampling cases by three methods were combined in 250 ml collecting case and they were all transported to the laboratory with cold chain.

Collected plankton samples were preserved in 4% formal and macroinvertebrates in 90% ethanol. In sampling, preservation, preparation and dissection procedures, Edmonson's (1959), Welch's (1948), Koste (1978), Kolisko (1974), Scourfield and Harding (1966), Harding and Smith (1962) and Dussart (1967) were used. Species identifications were made by specialists.

RESULTS AND DISCUSSION

In this study, zooplanktons were listed (Table 1). As a result of the study, 14 rotifer species, 4 copepod species and branchiopod species were determined in Van Lake coastline. It has been shown that indicator species adapting to alkali waters with high pH were distributed.

It appears that Rotifera species are more predominant than Branchiopoda and Copepoda species in the Van Lake coast line. Among the total zooplankters determined, Rotifera has been found at a rate of 70%, Copepoda 20% and Branchiopoda 10%. The cosmopolitan species and

Table 1. Zooplankton species and their distribution in coastal band of Van Lake depending on Rotifera, Copepoda and Branchiopoda in 2005 and 2006.

Class	Order	Family Sub famamily	Species	Location	
				2005	2006
Rotifera	Monogononta	Brachionidae	*Brachionus pilicatilis* (O. F. Müler)	All	All
			Brachionus anqularis (Gosse)	All	All
			Keratella quadrata (O. F. Müler)	Except 2, 8, 9, 14 and 15	All
			Notholca squamula (O. F. Müller)	Except 20	All
		Lecanidae	*Lecane ohiensis* (Herrick)	Except 2, 3, 4, 5, 7 and 8	All
			Lecane grandis (Murray)	All	Except 19
			Lecane lamellata (Daday)	Except 7	All
		Colurellidae	*Colurella colurus* (Ehrenberg)	Except 2, 5, 7, 9, 13, 17 and 19	All
		Trichocercidae	*Trichocerca taurocephala* (Hauer)	All	All
			Trichocerca cylindrica (Imhof)	Except 15 and 18	All
		Filinidae	*Filinia maior* (Coldita)	Except 7, 8, 13, 14 and 17	All
		Mytilinidae	*Mytilina spinigera* (Sache)	Except 4, 13, 14 and 20	Except 16 and 17
		Hexarthridae	*Hexarthra mira* (O. F. Müler)	All	All
			Hexarthra fennica (Levander)	All	All
Copepoda	Calanoida	Diaptomidae	*Arctodiaptomus spinosus* (Kiefer)	All	All
			Acanhtodiaptomus denticornis (Wierzejski)	All	All
	Cyclopoida	Cyclopidae	*Cyclops strenuus* (Fisher)	All	All
			Megacyclops viridis (Jurine)	All	All
Branchiopoda	Cladocera	Bosminidae	*Bosmina longirostris* (O.F.M)	Except 7	All
	Diplostraca	Moinidae	*Moina macrocarpa* (Straus)	All	All

*Sampling locations were marked in Figure 1.

indicator species of certain oligotrophic lakes have demonstrated distribution. Distribution of Rotifers is cosmopolite, therefore, they constitute a significant part of the food chain. Nevertheless, in fresh water ecosystems, Rotifers show more distribution than other zooplankton groups because they are rarely subjected to geographical barriers. Birds spread about the extended fields through pursuing food chain (grazing), wind, etc (Kolisko, 1974). They are more susceptive to environmental changes than Copepod and Cladocer groups(Ganon and Stremberger, 1978). The most important factor that controls the incidence of Rotifers is heat. *Brachionus pilicatilis* and *Hexartra mira* are present together at elevated oligotrophic mountain lakes and at higher sodium carbonate concentrations (Kolisko, 1974). This is supported by the results of this study. Both species have been seen in all the sites of Van Lake and at distinct heat intervals. It was seen that Rotifer groups have increased during spring and summer months and reduced during winter months. Remarkably, similar results have been reported in some research. Demir and Kirkağaç (2003) in a study carried out related to photo-zooplankton composition at the Ankara Western Pond, reported that Rotifera species was predominant in this group of Zooplankters.

Similarly, Güher (2003) and Saksena (1987) showed that Rotifera species was the predominant group among the Zooplanktonic organisms and the least group was Branchiopoda (Cladocera) in terms of number of species. In respect to individual count, mostly *Arctodiaptomus spinosus* (37% in 2005 and 21% in 2006), *Acanhtodiaptomus denticornis* (20% in 2005 and 2006) (Copepoda) and *B. pilicatilis* (7% in 2005 and 10% in 2006) (Rotifera) species were detected in both years.

In oligotrophic lakes, compared to Cyclopoid copepods and Cladocers, Calanoid copepods seemed more abundant and highly adapted to this type of lake (Ganon and Stremberger, 1978.). The fact that species of *A. spinosus* and *A. denticornis* are more predominant, supports these results.

Similarly study have been carried out on population dynamics of zooplanktons (Akbulut, 2000). In a similar study, it is suggested that *A. spinosus* in all biotopes constitutes a more dominant population than other taxa. The species of *B. pilicalitis* which was found to be more predominant than Rotifer species, is being proliferated in culture media because it is a rich food source in cultivation of shelled sea animals (Özden and Türkmen, 2002; Savaş and Gökpinar, 2002; Serdar and Lök, 2002). In this study, distinct from a previous study (Selçuk, 1993), for the first time, *Notholca squamula* (1.80 and 1.09%), *Keratella quadrata* (1.42 and 2.38%), *Colurella colurus* (0.83 and 2.14%), *Lecane ohiensis* (1.44 and 1.27%) *Lecane grandis* (1.08 and 1.57%) and *Lecane lamellata* (2.16 and 1.72%) species were found along the caust line of Van Lake.

The majority of Rotifera species detected at Van Lake has been found in lakes possessing the characteristic of salty and brackish water. *B. pilicatilis* and *H. mira* have been established by Bayly (1976) in Erie Lake with 7-28 salinity. *Hexartra mira* has been detected in Van Lake as 5.50% in 2005 and 5.0% in 2006. Also, it was found in Acigöl with hyperhalin features by Dumont and De Ridder (1987). Copepode species which constitute the typical characteristic of oligotrophic lakes do not show diversity as much as Rotifera species but their excessive number constitutes the important part of the biomass. Inability to collect sample during winter months causes adult Copopoda individuals to be seen less frequently. While *A. spinosus* space is encountered in brackish waters in waters with high pH, *A. denticornis* is wide spread in fresh and salty waters especially in Beyşehir Lake, Hazar Lake and Hirfanli dam Lake (Atindağ and Yiğit, 2004). The species of *Cyclops strenuus* (3.78 and 8.78%), *Megacyclops viridis* (2.36 and 7.37%) have been seen in Işikli Lake and Hirfanli dam Lake (Yigit and Altindağ, 2005). It was seen as wide spread as Diaptomidae in Van Lake. In Van Lake, the increase seen in copepod species during some months can be explained by fish food chain. It is thought to be consumed by *Chalhaburnus tarichi* which is an endemic species in lake and other macrovertebrates.

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