

# The Mollusk Fauna of Lake Sapanca (Turkey: Marmara) and Some Physico-Chemical Parameters of Their Abundance

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**Abstract:** To identify the mollusk fauna of Lake Sapanca (Turkey), samples were collected monthly from 5 stations between September 2000 and August 2001. The mollusk fauna of the lake consists of a total of 16 species, 12 of which belong to Gastropoda: *Theodoxus fluviatilis*, *Viviparus acerosus costae*, *Esperiana accicularis situssineri*, *Esperiana esperi*, *Bithynia tentaculata*, *Lithoglyphus naticoides*, *Borysthenia naticina*, *Galba truncatula*, *Radix labiata*, *Lymnaea stagnalis*, *Planorbis planorbis*, and *Oxyloma elegans*, and 4 to Bivalvia: *Unio pictorum*, *Dreissena polymorpha*, *Anadonta cygnea*, and *Sphaerium lacustre*. Furthermore, temperature, dissolved oxygen, pH, turbidity, and depth of each sample were measured at the sampling sites.

**Key Words:** Mollusk, fauna, lake, Sapanca

## Sapanca Gölü (Türkiye: Marmara) Mollusk Faunası ve Onları Etkileyen Bazı Fizikokimyasallar

**Özet:** Sapanca Gölü Mollusk faunasını belirlemek amacıyla gölü temsilen seçilen 5 istasyonda Eylül 2000-Ağustos 2001 tarihleri arasında aylık örnekleme yapılmıştır. Değerlendirmelerin sonucunda, Gastropoda sınıfına ait *Theodoxus fluviatilis*, *Viviparus acerosus costae*, *Esperiana accicularis situssineri*, *Esperiana esperi*, *Bithynia tentaculata*, *Lithoglyphus naticoides*, *Borysthenia naticina*, *Galba truncatula*, *Radix labiata*, *Lymnaea stagnalis*, *Planorbis planorbis* ve *Oxyloma elegans* olmak üzere 12 tür; Bivalvia sınıfına ait 4 tür *Unio pictorum*, *Anadonta cygnea*, *Dreissena polymorpha* ve *Sphaerium lacustre* olmak üzere toplam 16 türün yayılış gösterdiği saptanmıştır. Ayrıca her örnek alınımında dip suyunun sıcaklığı, çözülmüş oksijeni ve pH'sı, bulanıklığı, derinliği ölçülmüştür.

**Anahtar Sözcükler:** Mollusca, fauna, göl, Sapanca

## Introduction

Mollusks are an important and common group of the macrobenthic fauna in aquatic ecosystems. Mollusks react strongly to environmental changes, which makes them suitable for studying the relationship between the organism and the environment. These animals also have economic importance. They are the source of pearl and provide the raw material for mother-of-pearl buttons, inlay work, and ornaments. The flesh and ground-up shells of some mollusks are used as feed for cattle. Mollusks are well suited for the identification of geologic-historical developments. They allow easy distinction of the biotopes: marine, brackish, terrestrial, and mountainous (Öktener, 2004). Some mollusks are intermediate hosts to parasitic worms that infect humans. Trematodiasis (disease caused by trematodes) afflicts both

farm animals and wild animals. According to Subba (1993) they may cause serious illness in humans. Among the most important diseases of humans and animals are fascioliasis (caused by *Fasciola hepatica* and *F. gigantea*) and opisthorchiasis (caused by *Opisthorchis felineus*).

In Turkey, studies about freshwater mollusks have increased recently. The first studies in Turkey about freshwater mollusks were performed by Bilgin (1967, 1980). Other studies were conducted by Geldiay and Bilgin (1969), Schütt (1988, 1993), Şeşen and Bilgin (1988), Soylu (1990, 1996), Şeşen and Yıldırım (1993), Yıldırım and Şeşen (1994), Kubilay and Timur (1995), Yıldırım et al. (1995), Ertan et al. (1996), Yıldırım and Morkoyunlu (1997), Yıldırım (1999), and Yıldırım and Kardeş (2000).

## Study Area

Lake Sapanca is located in the Marmara region (lat 40°41'N, long 30°09E-30°20'E) at an elevation of 30 m above sea level and is the second largest lake in the region. The surface area is 46.8 km<sup>2</sup> and maximum depth is 55 m. The lake is used as a source of drinking water and for recreation. Numan (1958), who carried out the first limnological study in Lake Sapanca, pointed out that the lake had an oligotrophic character. There are some submerged macrophytes, such as *Chara* sp., *Myriophyllum* sp., *Ceratophyllum* sp., *Potamogeton* spp., *Najas* sp., and *Nuphar* sp., in the lake.

## Materials and Methods

Samples were taken from Lake Sapanca by Ekman grab (225 cm<sup>2</sup>) and hand dredge between September 2000 and August 2001 (Figure 1). The materials were preserved in 70% ethanol. Welch's (1948) method was followed to collect, sift, and preserve the samples, and also to calculate the number of individuals. At each sampling station, temperature, dissolved oxygen, pH, turbidity, and depth were measured (Table 1). Mollusks were identified according to Zhadin (1965), Edmondson (1966), Macan (1969, 1977), Schütt (1988, 1993), Glöer and Meier (1994), and Yıldırım (1999).

## Results

### Environmental parameters

Selected physicochemical parameters are shown in Table 1. Monthly variations of some physicochemical parameters are provided in Table 2. Deep water temperature averaged 14.8 ± 3.9 °C. The level of dissolved oxygen averaged 7.4 ± 1.2 mg/l and pH

averaged 7.8 ± 0.4. Secchi disc depth average was 3.2 ± 1.1 m. The water temperature average was 19.6 ± 7.8 °C and air temperature average was 19.8 ± 7.6 °C.

### Mollusk fauna

During our survey 16 species were found, of which 7 species belong to prosobranchiate Gastropoda: *Theodoxus fluviatilis* (T.f.), *Borysthenia naticina* (B.n.), *Viviparus costae* (V.c.), *Lithoglyphus naticoides* (L.n), *Esperiana accicularis situssineri* (F.a.s.), *Esperiana esperi* (F.e.), and *Bithynia tentaculata* (B.t.), 5 are pulmonate species: *Galba truncatula* (G.a.), *Planorbis planorbis* (P.p), *Radix labiata* (R.l), *Lymnaea stagnalis* (L.s.), and *Oxyloma elegans* (O.e.), and 4 are bivalves: *Unio pictorum* (U.p.), *Anodonta cygnea* (A.c.), *Dreissena polymorpha* (D.p.), and *Sphaerium lacustre* (S.l). The abundance of each species (individual/m<sup>2</sup>) is given in Table 2.

The most dominant species of Lake Sapanca was *Esperiana esperi* with a maximum density of 2266/m<sup>2</sup> at station 5. *Theodoxus fluviatilis*, *Esperiana esperi*, *Esperiana accicularis situssineri*, *Dreissena polymorpha* were detected in all stations throughout the study period. *Bithynia tentaculata*, *Radix labiata*, and *Oxyloma elegans* were found rarely.

Among the 5 stations in Lake Sapanca, *Esperiana esperi*, *Esperiana accicularis situssineri*, and *Borysthenia naticina* were the most widespread species (Figure 3a-e). The stations with the highest species numbers were 1, 3, and 5, followed by 4 and 2.

## Discussion

This study, which was carried out between September 2000 and August 2001, identified 16 species in Lake Sapanca.



Figure 1. Sampling stations at Lake Sapanca.

Table 1. Selected physicochemical measurements of Lake Sapanca.

	Parameters	2000				2001								average	SD
		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug		
1 <sup>st</sup> station	Secchi Disk (m)	2	3.5	4.8	3.2	3.1	2	3.5	2.7	4.1	2.7	3	3	3.1	0.7
	Air °C	26	23	13	9	10	7	16	18	23	23	30	32	19.1	8.2
	Water °C	19	19	15	12	11	9	14	13	19	25	20	20	16.3	4.6
	Dissolved O2	8	8	9	7	8	6	6	8	10	9	7	7	7.7	1.2
	pH	8	8	7.4	8	8	8.2	8.2	8.1	8.1	8.4	8.6	7.9	8.0	0.2
2 <sup>nd</sup> station	Secchi Disk (m)	3.2	2.5	5.2	4.1	5	3	3.5	1.7	3.2	3	2.5	4	3.4	1.0
	Air °C	25	22	16	9	11	9	14	18	22	25	29	33	19.4	7.8
	Water °C	12	14	16	14	14	20	17	20	17	15	15	12	15.5	2.6
	Dissolved O2	8	7.8	8.2	7.9	10	5.3	8.1	7.1	7.8	8.2	6.8	7.1	7.6	1.1
	pH	8	8	7.2	7.6	8	8	8.1	8.1	7.9	8.2	8.3	7.6	7.9	0.3
3 <sup>rd</sup> station	Secchi Disk (m)	3.5	3	5.6	5	2	2.3	4	2	4.4	3.2	4	2	3.4	1.2
	Air °C	28	25	16	10	9	10	18	21	21	31	33	32	21.1	8.7
	Water °C	18	17	16	10	9	11	17	13	19	20	20	20	15.8	4.0
	Dissolved O2	7.2	7.1	7.5	7.5	8.2	7.1	7.6	8	9.7	8	7.6	8.8	7.8	0.7
	pH	7.2	7.9	7.2	7.6	8	8.6	8.6	8.2	8.4	8.3	8.6	8.1	8.0	0.5
4 <sup>th</sup> station	Secchi Disk (m)	4	4	0	2	-	4	4	5	2.5	3	3	3	3.1	1.3
	Air °C	25	23	9	11	-	9	15	18	21	20	29	34	19.4	8.1
	Water °C	19.6	12.3	11	9.5	-	9	16	10.4	12	11	15	20	13.2	3.8
	Dissolved O2	7	7	7.8	7.9	-	5.8	8	4.5	6.8	4.2	3.8	8.6	6.4	1.6
	pH	7	7.6	7.9	8.1	-	8	7.6	7.6	7.3	7.4	7.6	6.7	7.5	0.4
5 <sup>th</sup> station	Secchi Disk (m)	2	2	5.8	5	3.5	3	3	2.7	3	2	3	2	3.0	1.2
	Air °C	26	24	15	9	11	10	16	18	20	19	27	31	18.8	7.0
	Water °C	20	18	16	11	9	10	14	16	18	20	14	19	15.4	3.8
	Dissolved O2	7.3	7.9	7.8	7.3	7.1	8.1	6.7	4.6	10.1	7.9	6.8	8.3	7.4	1.2
	pH	7.3	8	7.8	8	8	8.1	7	7.6	8.2	8	7.5	7.7	7.7	0.3

The genus *Theodoxus* can survive moderately brackish conditions of up to 0.13% salinity, although it will then tend to grow to a smaller maximum size. They are found predominantly on plants and rocks in moving water or the rocky shores of lakes (Roth, 1987).

*Theodoxus fluviatilis* is distributed in lakes, small streams, and springs. It was detected at all stations throughout the study period. *Theodoxus* guts contained 65% diatoms, 30% detritus and bacteria, and 5% algal filaments. Distribution in Turkey includes the Marmara, southeast Anatolia, the Aegean, the Mediterranean, central Anatolia, and the Black Sea regions (Öktener, 2004).

According to Soylu (1996), *Theodoxus fluviatilis* was

the most dominant species (2154/m<sup>2</sup>). In our research, *Esperiana esperi* was the dominant species (2266/m<sup>2</sup>). *Viviparus acerosus costae* was detected at 3 stations (1, 3, and 5) and nomenclature species of *Viviparus acerosus costae* distribution in Turkey includes the Marmara, the Black Sea, and east Anatolian regions.

According to Hart and Samuel (1974), *Bithynia tentaculata* is a eurytopic species. The species exists on a diet of detritus (95% detritus and 5% algae). *B. tentaculata* was collected only from the 3rd and 5th stations throughout the study period (44/m<sup>2</sup>). Distribution in Turkey includes the Mediterranean, central Anatolia, and the Aegean (Yıldırım, 1999). Among the

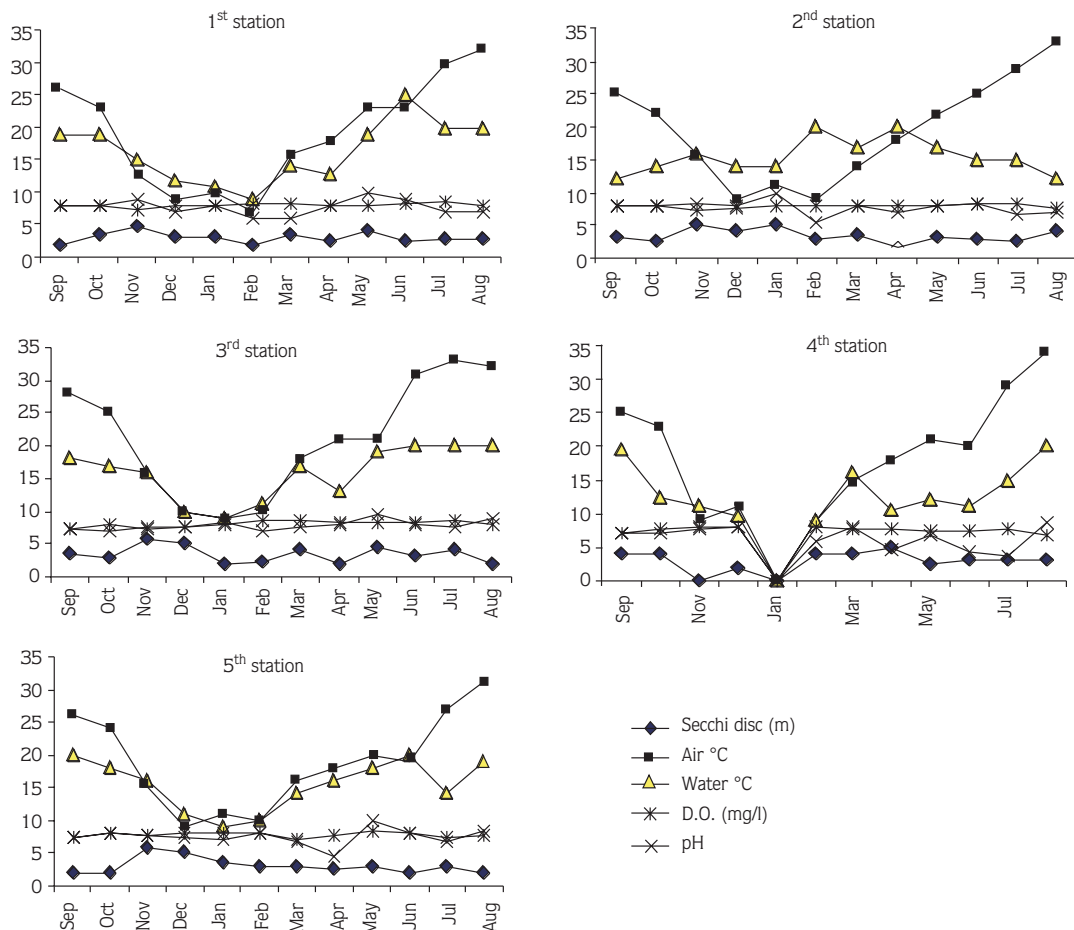


Figure 2. Monthly variations of some physicochemical measurements (September 2000-August 2001).

stations studied in Lake Sapanca, *Esperia esperi* was the most abundant species. The species is distributed in the upper and central parts of the Danube, and locally in other rivers that drain towards the west of the Black Sea (Schütt, 1988).

Another species belonging to the same genus, *Esperia accicularis situssineri*, which is almost the same as the species found in the central part of the Danube and in the Sava, occurring as far as Voslau near Vienna, was the second most abundant species (Schütt, 1988; Glöer, 2002).

A Danubian species, *Lithoglyphus naticoides*, to which the population in Lake Sapanca can be attributed, was identified by Schütt (1988) in the Balkans. This also emphasizes the Danubian relationship of the Lake Sapanca mollusk fauna (Schütt, 1988).

*Borysthenia naticina* has Pontic-Baltic distribution in lakes (Glöer, 2002) and its distribution in Turkey includes

the Mediterranean (Yıldırım, 1999). *B. naticina* was found abundantly at stations 1, 3, 4, and 5.

Pulmonates are generally widespread eurytopic species and *Galba truncatula*, *Radix labiata*, *Lymnaea stagnalis*, *Planorbis planorbids*, and *Oxyloma elegans* were found at all stations throughout the study period. Though they do not have zoogeographic importance, there is a linear balance between high trophic levels of a lake and abundance of the species (Zhadin, 1965; Hart and Samuel, 1974).

*Galba truncatula* was the most widespread species in Lake Sapanca, although *Anadonta cygnea*, *Dreissena polymorpha*, *Sphaerium lacustre*, and *Unio pictorum* were very common in the lake. The common presence of the species in the lake is proof of the trophic levels of the lake, as a whole. In particular, species of sphaeridae are indicators of eutrophication (Yıldırım et al., 1995).

Table 2. Species abundance (individual/m<sup>2</sup>).

Species	1 <sup>st</sup> station	2 <sup>nd</sup> station	3 <sup>rd</sup> station	4 <sup>th</sup> station	5 <sup>th</sup> station	Total
<i>Theodoxus fluviatilis</i>	488	44	80	133	356	1101
<i>Bithynia tentaculata</i>	-	-	44	-	44	132
<i>Lithoglyphus naticoides</i>	44	-	89	-	133	266
<i>Borysthenia naticina</i>	356	-	356	489	578	1779
<i>Viviparus acerosus costae</i>	933	-	711	-	489	2133
<i>Esperiana esperi</i>	756	756	1422	756	2266	5956
<i>Esperiana accicularis situssineri</i>	756	711	578	311	1244	3600
<i>Radix labiata</i>	-	-	89	-	-	89
<i>Lymnaea stagnalis</i>	133	-	89	89	89	400
<i>Galba truncatula</i>	89	-	1422	44	89	1644
<i>Planorbis planorbis</i>	89	-	133	44	-	266
<i>Oxyloma elegans</i>	178	-	-	-	-	178
<i>Anadonta cygnea</i>	89	-	89	-	-	178
<i>Dreissena polymorpha</i>	711	44	44	311	933	2043
<i>Sphaerium lacustre</i>	-	44	133	-	-	177
<i>Unio pictorum</i>	311	-	-	-	400	711

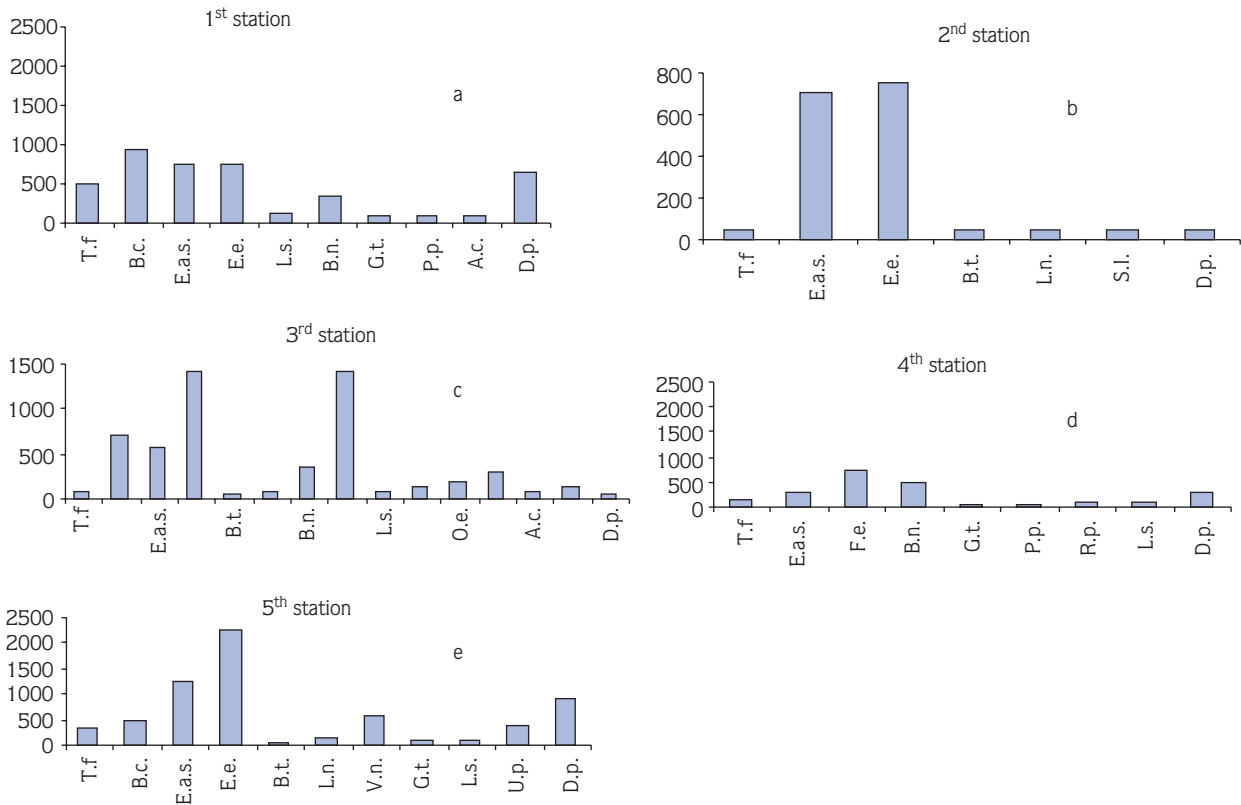


Figure 3. a-e: Species abundance at each station.

The distribution of the genus *Dreissena* is mostly limited to shallow, warm, and relatively eutrophic coastal and estuarine localities, which are characterized by the presence of abundant hard substrata. *Dreissena polymorpha* are intermediate hosts to parasitic worms that infect human beings, potentially leading to serious illness (Kinzelbach, 1986).

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