



FAUNAL DIVERSITY OF LAKE BURDUR, AND ITS VULNERABILITY

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SYNOPSIS

Lake Burdur is one of the largest and deepest lakes of Turkey with an average depth of 40 m (70 m at maximum), while maximum surface area is 140 km² at 854 m elevation. It is salty (sodium sulphate and chloride type) and highly alkaline (pH 9-9,60), thus it never freezes. As a Ramsar Site since 1993 and Wildlife Reserve and A1 Class wetland, main faunistic importance of the lake comes from avifauna due to high numbers of winter and passage migrants. It is the in the world for the Although severe decrease in waterfowl counts has been recorded, a diverse and rich avifauna can be observed in the lake area. Among these, it is the most important wintering site of the globally threatened white-headed duck (*Oxyura leucocephala*). Population of the endemic fish *Aphanius anatoliae sureyanus* is severely endangered. Another endemic of the lake is still abundant copepods *Arctodiaptomus burduricus*. At the current stage, lake passes through a critical phase with visible ecological signs, e.g. in abrupt decline of bird populations. Most serious threats for the biota in the system are continuous decrease in the water level and pollution.

INTRODUCTION

Brackish and salty lakes usually are not studied well due to lesser economic importance. However, these lakes show high biological importance, although they are not taxonomically rich. Being the third largest salty lake in Turkey, Lake Burdur (37° 43' N, 30° 10' E) is also among the deepest with an average depth of 40 m (70 m at maximum), while maximum surface area is 140 km² at 854 m elevation. Being of tectonical origin, it is situated in a closed basin with a catchment area is 6150 km². It is salty (sodium sulphate and chlorine) and highly alkaline (pH 9-9,60), thus it never freezes (ANONYMOUS, 1993). Due to high salinity no aquatic plants can be found

except the freshwater inlets. To the northwest, lake is flanked by forested mountains, while the rest is surrounded by extensive alluvial flats and quaternary deposits.

The formation of the lake began in 5 mya as a tectonic depression. It is known that for long period the lake maintained freshwater character. The altitude in Pliopleistocene was 100 meters higher and the lake extended from Yarışlı lake to Senirce village (Isparta). Presence of ostracod *Candona neglecta* Sars 1887 in Pleistocene sediments of the lake (FREELS, 1980), as well as Hydrobiidae species (YILDIRIM, 1999) indicates freshwater character (although slightly brackish). In late Pleistocene salinization and shrinking of the lake began, which is a process in progress today. Since 1975, an altitude change of -10 m and 27% loss of velocity has been recorded. The main reasons for this figure are dams and ponds constructed on main sources of the lake, like Bozçay stream, the severe drought between 1988 and 1995, and especially extensive use of aquifers by locals (ŞENER ET AL,2005)

Physicochemical features of the lake

There is a termocline zone usually between 7.5 and 12.5 meters in the lake. The change of temperature and PH with depth is given in Figure 1 (Figure 1)

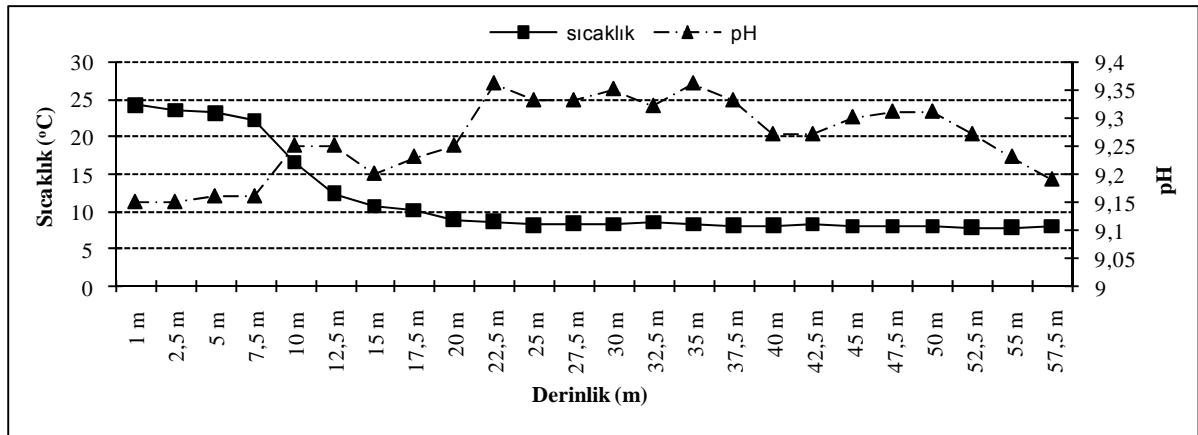


Figure 1. Graph showing pH versus temperature in Burdur Lake (on 2/7/2008)

First water quality study was conducted by NUMANN (1958) which was followed by other studies. In the view of present findings, a gradual increase in organic pollution is increased since 1958.

Table 1. Chemical and physical parameters of Burdur Lake (average values obtained from regular observations between December 2003 to January 2004)

	RANGE	MEAN
PO ₄ -P (mg/l)	0.016-0.48	0.11
NO ₃ -N (mg/l)	0.03-2.4	0.49
NH ₄ -N (mg/l)	0.004-3.170	0.29
Total Filtrable Residue (g/l)	26.54-35.74	28.9
Suspended Matter (mg/l)	8.25-20	15.2
Salinity (‰)	18.3-19.6	19
Water temperature (°C)	6-25.3	17.3
Dissolved oxygen (mg/l)	6.10-24.40	9.20
Oxygen saturation (%)	70-130	103
PH	9.00-9.45	9.23
Conductivity (µS/cm at 25 °C)	29.5-31.42	30.5

PRESENT STATUS OF BIODIVERSITY IN AND AROUND LAKE BURDUR

Phytoplanktons

From a total of 58 taxa mentioned in the literature (NUMANN, 1958; ONGAN et al 1972; TİMUR et al 1988; KAZANCI, 1998; ARCAK and ALTINDAĞ, 2000 ; ALTINDAĞ and YİĞİT, 2002) , 17 species were determined from the lake: 9 species from Bacillariophyta; 4 from Chlorophyta; 2 from Cyanophyta and Dinophyta. *Amphiprora alata* (Ehrenberg), *Nitzschia sigmoidea* (Nitzsch) W. Smith, *Campylodiscus bicostatus* W. Smith, *Chaetoceros* sp. (Bacillariophyta) and *Peridinium cinctum* (Müller) Ehrenberg (Dinophyta) were found to be the most dominant taxa.

Macroalgae

Chara sp. forms dense cover in NE part of the lake where depth is the lowest (<5 m) and continuous inflow of freshwater until recently.

Plants

The coverage of reeds and aquatic plants is very small around the lake, where 13 monocot and 6 dicot taxa are found (SEÇMEN & LEBLEBİCİ, 1997; KAZANCI, 1998). Of these, *Schoenoplectus litoralis* (Schrader) Palla (Cyperaceae) is the dominant taxon (KAZANCI,1998). *Potamogeton pectinatus* L. has recently found to invade inlets (mainly canalization) up to 15 m depth.

Zooplanktons

The endemic copepod *Arctodiaptomus burduricus* Kiefer is the most important zooplankton in the lake with 81% of total biomass and 40% of total density. Its highest density in July is between 10 and 25 m. Nauplius larvae show a regular distribution concentrated around 10 m, while for Rotifera it is ca 5 m. Both groups

can't survive beneath 20 m, but *A. burduricus* can reach 40 m. Among rotifers *Hexarthra fennica* (Levander), and *Brachionus plicatilis* Müller are the most dominant taxa.

Molluscs

In the lake no mollusk lives today as they became extinct during Pleistocene. According to fossil shells (Schütt, 1990), 6 bivalve and 10 gastropods were found in the lake. Two of these, *Dreissena bouldurensis* Fischer and *Micromelania ottomana* Bukowski were oligohaline organisms (YILDIRIM, 1999). From springs flowing into the lake 3 prosobranch, 7 basommatophoran and 1 bivalve have been determined (YILDIRIM, 1999)..

Arthropods

In benthic fauna chironomid larvae from 11 taxa (ŞAHİN, 1987; KAZANCI, 1998) are common. However, the faunal composition (species richness) may negatively affected by pollution (TAŞDEMİR & USTAOĞLU, 2005).

Around the lake 3 species of Lepidoptera and 11 species of Odonata were recorded in small numbers (Kazancı, 1998).

Fishes

Aphanius anatoliae sureyanus Neu is endemic to lake and some springs near the shore, which lack submerged vegetation except some algae (WILDECAMP, 1993; WILDECAMP et al 1999; KURU, 2004). Recent study shows that it is highly adapted to conditions of the lake, being euryphagous (although only copepod *A. burduricus*, another lake endemic, and rotifer *Brachionus plicatilis* are main food items) and able to feed also on benthic organisms as well.

Especially in 1950s, tilapia and eel were inoculated into the lake unsuccessfully. After study of nutrients for fish development, *Chalcalburnus tarichi* (Pallas, 1881) was brought to lake. This species has also vanished due to organic pollution caused by direct discharge of industrial wastes (AKŞIRAY, 1982).

Amphibians

4 species, *Bufo bufo* (Linnaeus), *Bufo viridis* Laurenti, *Hyla arborea* (Linnaeus), *Rana ridibunda* Pallas have been recorded from the terrestrial habitats around the lake (KAZANCI, 1998).

Reptiles

14 reptile species have been recorded from the proximity of the lake. Of these, ottoman viper *Vipera xanthina* (Gray, 1849) is a medically important species.

Birds

Being not frozen in winter, the lake has a special ornithological importance as wintering grounds. 126 bird species were recorded from the lake, mainly winter or passage migrants. The lake is known to be the winter site for 70% of the world

population of white-headed duck, *Oxyura leucocephala* (Scopoli). Although in 1991 there is a wintering record of 10927 birds, there is a sharp decline in Burdur population of the bird for the last two decades (GREEN, 1996). As it is seen in Figure 2, till 1991, undulating numbers between ca 6000 and 9000 birds wintered each year in Lake Burdur (lower counts must be due to insufficient number observations or observers). After 1991, when the highest count for the bird was recorded, serious decline trend has been observed while the last count (2008) being 655. General number of birds have been declining since 70s, but to a lesser rate: from 2020000 (1973) to 122588 (2007). However, this year's (2008) counts show a drastic decline with a total of 27932 birds.

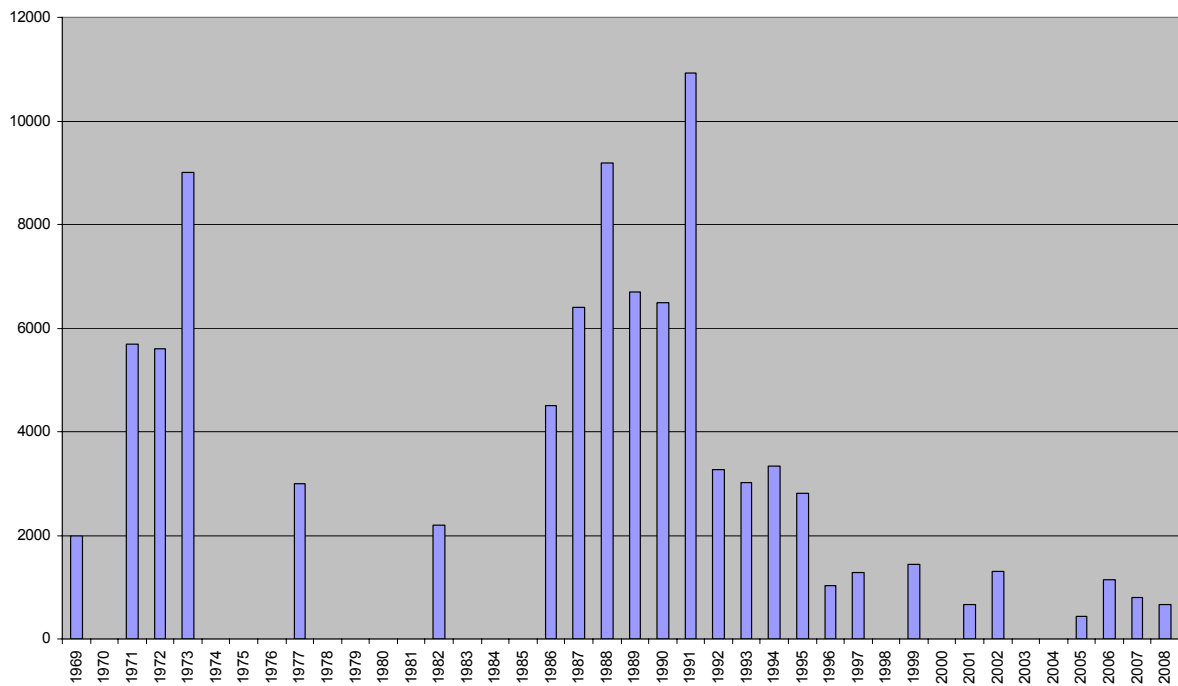


Figure 2. Total annual numbers of white-headed duck wintering in Lake Burdur (Source: Nature Society)

For protection of avifauna, 38125 ha area covering the lake area was declared by Ministry of Forestry as Permanent Wildlife Reserve in 1993. Accordingly, a hunting ban was introduced. Lake Burdur has been listed as a Ramsar site (site no. 658) since 1994. The site covers almost half of the lake (12600 ha). Also it has IBA (important bird area) status according to following information (Table 2).

Mammals

Of 10 species recorded from lake Burdur and around the lake, swamp cat *Felis chaus* Schreber is a nationally endangered animal species and it can be seldomly seen by the reedbeds of the lake.

Species	Season	Year	Min	Max	Criteria
Ruddy Shelduck (<i>Tadorna ferruginea</i> Pallas)	passage	1995		405	A4i, B1i
Ruddy Shelduck (<i>Tadorna ferruginea</i>)	wintering	1996	235	550	A4i, B1i
Red-crested Pochard (<i>Netta rufina</i> Pallas)	wintering	1995	750	2814	A4i, B1i
Common Pochard (<i>Aythya ferina</i> L.)	wintering	1995	11160	57555	A4i, B1i
Tufted Duck (<i>Aythya fuligula</i> L.)	wintering	1987	6000	6000	B1i
White-headed Duck (<i>Oxyura leucocephala</i>)	wintering	1996	342	10927	A1, A4i, B1i
Black-necked Grebe (<i>Podiceps nigricollis</i> Brehm)	passage	1995	5163	25280	A4i, B1i
Greater Flamingo (<i>Phoenicopterus roseus</i> Pallas)	passage			6500	A4i, B1i
Common Coot (<i>Fulica atra</i> L.)	passage			300000	A4i, B1i
Common Coot (<i>Fulica atra</i>)	wintering	1995	34067	138925	A4i, B1i
Spur-winged Lapwing (<i>Vanellus spinosus</i> L.)	breeding		1	0	B2
Black Tern (<i>Chlidonias niger</i> L.)	passage			2105	A4i, B1i

Table 2. Bird records from Lake Burdur and IBA criteria they meet
Source: BIRDLIFE INTERNATIONAL, 2008

DISCUSSION

Considering PO₄-P, NO₃-N, Klorofil-a and Seccki disk results today Lake Burdur is a mesotrophic lake. Furthermore, abundance of benthic chironomid fauna and *Hexarthra* prove that the lake has lost oligotrophic character. Oxygen saturation levels also show a great reduction since NUMANN's (1958) findings as depths below 20 m are generally anoxic.

Two occurrences of algal blooms in 2000 and 2007 caused by *Nodularia spumigena* were recorded, leading to severe fish deaths. Continuation of pollution trend is a sign of further occurrences as well as the eutrophication.

Apart from the pollution most important problem of the lake is drying. Without serious steps to prevent further losses, the tragic end for the life in the lake would be sooner, as indicated by dramatic declines of the visiting birds.

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