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Birds of Lake Beyşehir (Isparta-Konya)

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Abstract: The Lakes Region contains wetlands important for Turkey's biodiversity. In this study conducted from October 2000 to September 2002 at Lake Beyşehir, 181 bird species were observed. Sixty-one residents, 43 winter migrants, 51 summer migrants, and 26 transit migrants were observed. According to the IUCN, *Pelecanus crispus*, *Phalacrocorax pygmeus*, *Aythya nyroca*, *Haliaeetus albicilla* and *Falco naumanni* are threatened and the other 176 species observed are not.

According to the statistical data, Cuculiformes, Strigiformes and Caprimulgiformes were less common, while Passeriformes was the most common order in the study in terms of bird species. Among the other lakes in the Lakes Region, Lake Beyşehir and Lake Burdur were found to be the most similar with regard to bird species.

Key Words: The Lakes Region, Birds, Bioecology, Lake Beyşehir

Beyşehir Gölü'nün (Isparta-Konya) Kuşları

Özet: Biyolojik çeşitlilik açısından Göller Bölgesi, Türkiye'nin önemli sulak alanlarındanadır. Eylül 2000- Ekim 2002'de Beyşehir Gölü'nde gerçekleştirilen bu çalışmada 181 kuş türü belirlenmiştir. Araştırma sahasında 61 yerli, 43 kış göçmeni, 51 yaz göçmeni ve 26 transit göçmen gözlenmiştir. IUCN verilerine göre *Pelecanus crispus*, *Phalacrocorax pygmeus*, *Aythya nyroca*, *Haliaeetus albicilla*, *Falco naumanni* tehdit altında ve 176 tür tehdit altında bulunmamaktadır.

Cuculiformes, Strigiformes ve Caprimulgiformes ordolarının baskınlığı az, Passeriformes takımı ise baskın bulunmuştur. Bu çalışmada, tür bakımından Göller Bölgesi'nde Beyşehir ve Burdur göllerinin benzer olduğu tespit edilmiştir.

Anahtar Sözcükler: Göller Bölgesi, Kuşlar, Biyokoloji, Beyşehir Gölü

Introduction

Turkey has a great variety of natural habitats, ranging from the Mediterranean, Aegean, and Black Sea beaches to towering coastal and interior mountains, from deeply incised valleys to expansive steppes, and from fertile alluvial plains to arid, rocky hill slopes (Kaya and Raynal, 2001). Therefore its varied geography and climatic conditions provide a suitable habitat for numerous bird species.

Turkey is located on major migration routes in the Palearctic region. Approximately 500 of the 9600 bird species worldwide are from Europe and nearly the same number (453) are found in Turkey (Bilgin and Akçakaya, 1987; Kirwan et al., 1998; Aslan and Kiziroğlu, 2003).

The Lakes Region, located in the Mediterranean Region of Turkey, has several important wetlands. Lake Beyşehir is located in the Lakes Region, which has 26 wetlands. Important among these wetlands are Eğirdir,

Burdur, Kovada and Yarışlı (Figure). However, the birds of Lake Beyşehir have not been studied in detail so far.

The goal of this study was to determine the number of bird species, the distribution and abundance of these species and the effects of hunting, overfishing, the use of chemicals (e.g, pesticides and fertilizers), pollution, and other factors on birds. The behavior of the observed species was also studied.

Study Area

Lake Beyşehir (37 ° 45' N - 31 ° 36' E) spans the border between Konya and Isparta provinces. It is the largest freshwater lake in Turkey, with a surface area of 65,600 ha. Its altitude is 1150 m and the maximum depth is 10 m. It is a tectonic lake, lying elongated from northwest to southeast between the Sultan and Anamas (Dedegöl) mountains. The lake is fed by streams (Çarıksaray Deresi, Eflatun Pınarı, Ozan and Termiye Çayı) mainly coming from the Anamas Mountains to the

west and the Sultan Mountains to the east. There are 24 islands in the lake of different sizes. Among them, only Mada is inhabited and farmed. The bigger islands are rocky hills, generally covered by *Juniperus* forest and maquis. Because it is an important wetland, Lake Beyşehir was declared a National Park by The Directorate of Nature Conservation and National Parks, The Ministry of Environment and Forestry Turkey, on 11.01.1993 (Yarar and Magnin, 1997).

While the east and north of the lake are eutrophic, the other areas are mesotrophic (Saraçoğlu, 1990; Erdem, 1995). In the lake, 67 plant (especially, *Phragmites australis* and *Typha angustifolia*), 7 fish, 2 amphibia and 2 reptilia species were found (T.Ç.V., 1993).

Methods

This study was carried out from October 2000 to September 2002. During the observations, birds were counted at 4 stations. Observations were carried out using binoculars and telescope. Bruun and Singer (1978), Kiziroğlu (1989), Del Hoyo et al. (1992), Cerny (1993), Schneck (1999), Harrison and Greensmith (2000), Campbell (1999), Heinzl et al. (1995) and Cramp et al. (1980) were used for identification. Kocataş (1997) was used for statistical analysis.

Frequency Analysis

$F \% = Na / Nn \times 100$ (Na = The observation number of a species; Nn = The number of all observations)

F % of observed species is classified in 5 categories: 1–20%: rare; 21–40%: seldom; 41–60%: usual; 61–80%: frequent and 81–100%: common (Kocataş, 1997).

Dominance Analysis

$D \% = Na / Nn \times 100$ (D = Dominancy; Na = The number of individuals of one species, Nn = total number of individuals of all observed species.

D % of observed species is classified in 5 categories: 0 = not present; + = rare; 1 = population size of species is smaller than 5%; 2 = population size of species is 5–25%; 3 = population size of species is 25–50%; 4 = population size of species is 50–75% and 5 = population size of species is larger than 75% (Kocataş, 1997).

Similarity Analysis

$Q = 2c / a + b$ (Q = Sorensen similarity index; c = the number of bird species in both lakes; a = the number of

species in only the first lake; b = the number of species in only the second lake) (Kocataş, 1997).

Diversity Index

$D = S - 1 / \log_e N$ D = Diversity Index; S = the number in total species; N = the number of total individuals (Kocataş, 1997).

Observations were conducted at intervals of 20-25 days. Counts were performed between 9 AM and 6 PM starting from the 4th and sometimes from the 1st station, characterizing the properties of Lake Beyşehir. When choosing the stations, the main consideration was how well they reflected all the properties of the lake (Figure).

At Station I, located to the southwest of the lake fruit-gardens, fields and mountainous areas were present. This station was suitable for the breeding and feeding of birds. At Station II, located to the west of the lake, there were a lot of marshes. We observed that the flat area in front of Station III was used as a sheltering place by birds when the weather was bad. Food resources at Station III, situated in the southeast of the lake, were plentiful. Station III, which was far from settlements, was a suitable area for bird populations. At this station, dabbling ducks were observed in groups when the weather was bad. Station IV, situated in the northeast of the lake, had marshes, fields and agricultural areas.

Results

During October 2000-September 2002, 181 bird species, of which 61 were resident, 43 winter migrants, 51 summer migrants, and 26 transit migrants, were observed at Lake Beyşehir (Table 1).

Because food and shelter at the lake's edge were not sufficient for the bird populations, in relation to the number of bird individuals, Station II was poorer than the other stations. However, the lake's edge in the area was especially preferred by rails when the weather was rather bad at the lake.

Storks (*Ciconia ciconia*) were generally observed to breed in trees near the lake and its vicinity. While glossy ibis (*Plegadis falcinellus*) individuals were observed to feed near marshes at the station III, golden eagles (*Aquila chrysaetos*) were observed far from the settlement area in the vicinity. The common buzzard (*Buteo buteo*) and the long-legged buzzard (*B. rufinus*) were observed in the fields, forest and plain areas in its vicinity.

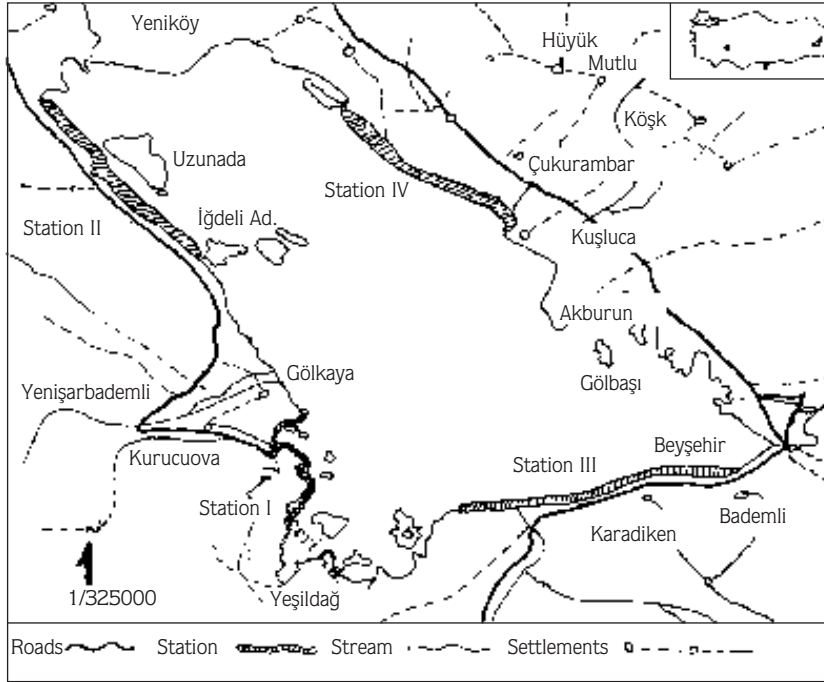


Figure. Lake Beyşehir and the stations.

Table 1. Species list and statistics of Lake Beyşehir.

Family	Species	R.S.	S	F %	D %	IUCN
Podicipedidae	<i>Podiceps cristatus</i>	R	I, II, III, IV	100	0.4	LC
	<i>P. griseus</i>	WM	I, II, III	19	0.007	LC
	<i>P. nigricollis</i>	WM	I, II, III	23	0.001	LC
	<i>Tachybaptus ruficollis</i>	R	I, II, III, IV	100	0.28	LC
Pelecanidae	<i>Pelecanus crispus</i>	SM	II	11	0.001	VU
Phalacrocoracidae	<i>Phalacrocorax pygmeus</i>	WM	II, III	7	0.003	NT
Ardeidae	<i>Ardea cinerea</i>	R	I, II	62	0.01	LC
	<i>A. purpurea</i>	SM	I, II	58	0.004	LC
	<i>Egretta alba</i>	R	I, II, III, IV	77	0.01	LC
	<i>E. garzetta</i>	PM	I, II, III, IV	15	0.002	LC
	<i>Ardeola ralloides</i>	SM	I, II, III, IV	38	0.01	LC
	<i>Ixobrychus minutus</i>	SM	I, II, II	19	0.01	LC
	<i>Botaurus stellaris</i>	WM	I, II	19	0.01	LC
	Ciconiidae	<i>Ciconia ciconia</i>	SM	I, II, III, IV	58	0.06
Threskiornithidae	<i>Plegadis falcinellus</i>	PM	II	7	0.002	LC
Anatidae	<i>Cygnus olor</i>	WM	II	11	0.001	LC
	<i>Anser anser</i>	WM	II, III	11	0.06	LC
	<i>A. albifrons</i>	WM	II, III	11	0.04	LC
	<i>Tadorna tadorna</i>	WM	II, III	11	0.06	LC
	<i>T. ferruginea</i>	WM	I, II, III, IV	23	0.02	LC
	<i>Anas platyrhynchos</i>	R	I, II, III, IV	88	0.1	LC
	<i>A. crecca</i>	WM	II, III, IV	19	0.01	LC
	<i>A. acuta</i>	WM	II, III, IV	50	0.2	LC
	<i>A. clypeata</i>	WM	III, IV	23	0.07	LC
	<i>A. querquedula</i>	WM	III, IV	19	0.02	LC
	<i>A. strepera</i>	WM	II, IV	27	0.02	LC
	<i>A. penelope</i>	WM	II, IV	19	0.02	LC

Table 1. (continued).

Family	Species	R.S.	S	F %	D %	IUCN
	<i>Netta rufina</i>	WM	II, IV	19	0.01	LC
	<i>Aythya ferina</i>	R	I, II, III, IV	88	1	LC
	<i>A. nyroca</i>	WM	I, II, III, IV	42	0.02	NT
	<i>A. fuligula</i>	WM	II, III, IV	19	0.02	LC
Accipitridae	<i>Haliaeetus albicilla</i>	PM	II	7	0.005	NT
	<i>Accipiter nisus</i>	R	I, II, III, IV	96	0.01	LC
	<i>A. gentilis</i>	WM	III	35	0.03	LC
	<i>Circus aeruginosus</i>	R	III, IV	96	0.01	LC
	<i>C. cyaneus</i>	WM	III, IV	31	0.03	LC
	<i>Buteo rufinus</i>	R	I, II, III, IV	92	0.07	LC
	<i>B. buteo</i>	R	I, II, III, IV	85	0.01	LC
	<i>Aquila chrysaetos</i>	WM	II, III	15	0.006	LC
Pandionidae	<i>Pandion haliaetus</i>	PM	IV	7	0.004	LC
Falconidae	<i>Falco tinnunculus</i>	R	I, II, III, IV	100	0.06	LC
	<i>F. naumanni</i>	SM	I, II, III	54	0.04	VU
	<i>F. peregrinus</i>	WM	IV	19	0.03	LC
	<i>F. vespertinus</i>	PM	IV	15	0.06	LC
Phasianidae	<i>Alectoris chukar</i>	R	I, II, III	100	0.1	LC
	<i>Coturnix coturnix</i>	SM	III, IV	38	0.06	LC
Rallidae	<i>Rallus aquaticus</i>	WM	I, II, III	19	0.01	LC
	<i>Gallinula chloropus</i>	R	I, II, III, IV	100	0.1	LC
	<i>Fulica atra</i>	R	I, II, III, IV	100	43	LC
Recurvirostridae	<i>Himantopus himantopus</i>	SM	I, II, III, IV	35	0.06	LC
Charadriidae	<i>Charadrius dubius</i>	SM	II, III, IV	42	0.1	LC
	<i>Vanellus vanellus</i>	PM	III, IV	15	0.01	LC
	<i>Vanellus spinosus</i>	PM	IV	15	0.05	LC
Scolopacidae	<i>Calidris minuta</i>	PM	III, IV	15	0.04	LC
	<i>C. alba</i>	PM	II, III	15	0.04	LC
	<i>Tringa totanus</i>	WM	III, IV	30	0.1	LC
	<i>T. stagnatilis</i>	PM	III	15	0.05	LC
	<i>T. hypoleucos</i>	WM	III, IV	46	0.2	LC
	<i>T. ochropus</i>	WM	III, IV	38	0.1	LC
Laridae	<i>Larus melanocephalus</i>	SM	II, IV	35	0.02	LC
	<i>L. ridibundus</i>	WM	IV	27	0.02	LC
	<i>L. canus</i>	WM	II, III, IV	27	0.02	LC
	<i>L. fuscus</i>	WM	IV	27	0.01	LC
	<i>L. argentatus</i>	R	I, II, III, IV	100	1	LC
Sternidae	<i>Sterna nilotica</i>	PM	III, IV	15	0.1	LC
Columbidae	<i>Columba livia</i>	R	I, II, III, IV	100	0.5	LC
	<i>C. palumbus</i>	SM	II, III	23	0.08	LC
	<i>Streptopelia decaocto</i>	R	I, II, III, IV	100	0.5	LC
	<i>S. turtur</i>	SM	II, III, IV	42	0.03	LC
Cuculidae	<i>Cuculus canorus</i>	SM	I, II, III	42	0.09	LC
Strigidae	<i>Bubo bubo</i>	R	II, III	92	0.09	LC
	<i>Otus scops</i>	R	II, III	88	0.06	LC
	<i>Athene noctua</i>	R	I, II, III, IV	100	0.04	LC
Caprimulgidae	<i>Caprimulgus europaeus</i>	SM	I, II, III, IV	38	0.06	LC
Apodidae	<i>Apus apus</i>	SM	I, II, III, IV	23	1	LC
	<i>A. melba</i>	SM	I, II, III, IV	23	1	LC
Alcedinidae	<i>Alcedo atthis</i>	SM	I, II, III, IV	58	0.02	LC
Meropidae	<i>Merops apiaster</i>	PM	I, II, III, IV	15	0.01	LC
Coraciidae	<i>Coracias garrulus</i>	PM	I, II, III, IV	15	0.06	LC

Table 1. (continued).

Family	Species	R.S.	S	F %	D %	IUCN
Upupidae	<i>Upupo epops</i>	SM	I, II, III, IV	58	0.02	LC
Picidae	<i>Dendrocopos major</i>	R	I, II, III, IV	100	0.3	LC
Alaudidae	<i>Melanocorypha calandra</i>	R	I, II, IV	100	0.5	LC
	<i>Calandrella rufescens</i>	SM	I, II, IV	42	0.1	LC
	<i>Galerida cristata</i>	R	I, II, III, IV	100	2	LC
	<i>Lullula arborea</i>	R	I, II, IV	100	0.6	LC
	<i>Alauda arvensis</i>	R	I, II, IV	100	1	LC
Hirundinidae	<i>Hirundo rustica</i>	SM	I, II, III, IV	62	2	LC
	<i>H. daurica</i>	SM	I, II, III, IV	62	1	LC
	<i>H. rupestris</i>	SM	I, II, III, IV	62	0.4	LC
	<i>Riparia riparia</i>	SM	I, II, III, IV	62	1	LC
	<i>Delichon urbica</i>	SM	I, II, III, IV	62	1	LC
Motacillidae	<i>Anthus trivialis</i>	PM	II, III	15	0.01	LC
	<i>A. pratensis</i>	PM	I, II, III	15	0.01	LC
	<i>A. cervinus</i>	PM	I, II, III	15	0.01	LC
	<i>A. spinoletta</i>	PM	I, II, III	15	0.01	LC
	<i>Motacilla flava</i>	SM	II, IV	50	0.1	LC
	<i>M. cinerea</i>	R	II, IV	100	0.1	LC
	<i>M. alba</i>	R	I, II, III, IV	100	0.8	LC
Cinclidae	<i>Cinclus cinclus</i>	R	I, II, III	85	0.07	LC
Troglodytidae	<i>Troglodytes troglodytes</i>	R	I, II, III	100	0.05	LC
Turdidae	<i>Erythropygia galactotes</i>	SM	I, II, III	31	0.03	LC
	<i>Erithacus rubecula</i>	WM	II, III	31	0.01	LC
	<i>Luscinia megarhynchos</i>	SM	I, II, III, IV	42	0.02	LC
	<i>Phoenicurus ochruros</i>	SM	I, II, III	46	0.04	LC
	<i>P. phoenicurus</i>	SM	I, II, III	46	0.1	LC
	<i>Saxicola rubetra</i>	SM	I, II, III, IV	42	0.06	LC
	<i>S. torquata</i>	R	I, II, III, IV	100	0.09	LC
	<i>Oenanthe oenanthe</i>	SM	I, II, III, IV	50	0.2	LC
	<i>O. pleschanka</i>	SM	I, II, III, IV	50	0.06	LC
	<i>O. hispanica</i>	PM	I, II, III, IV	15	0.05	LC
	<i>O. isabellina</i>	R	I, II, III, IV	100	0.5	LC
	<i>Monticola solitarius</i>	SM	II, IV	46	0.01	LC
	<i>Turdus torquatus</i>	WM	I, II, III	23	0.03	LC
	<i>T. merula</i>	R	I, II, III	100	0.5	LC
	<i>T. pilaris</i>	WM	I, II, III	30	0.02	LC
	<i>T. iliacus</i>	WM	I, II, III	30	0.04	LC
	<i>T. philomelos</i>	WM	I, II, III	30	0.02	LC
	<i>T. viscivorus</i>	R	I, II, III, IV	100	0.7	LC
	Sylviidae	<i>Cettia cetti</i>	R	I, II, III	92	0.09
<i>Locustella luscinioides</i>		PM	I, II, III, IV	15	0.01	LC
<i>Acrocephalus scirpaceus</i>		SM	I, II, III, IV	58	0.1	LC
<i>A. arundinaceus</i>		SM	I, II, III, IV	58	0.3	LC
<i>Sylvia hortensis</i>		SM	I, II, III	46	0.03	LC
<i>S. borin</i>		PM	I, II, III, IV	15	0.01	LC
<i>S. communis</i>		SM	I, II, III, IV	50	0.1	LC
<i>S. melanocephala</i>		R	I, II, III	96	0.1	LC
<i>S. atricapilla</i>		SM	I, II, III, IV	50	0.2	LC
<i>Hippolais pallida</i>		SM	I, II, III, IV	54	0.1	LC
<i>Phylloscopus bonelli</i>		PM	I, II, III, IV	15	0.02	LC
<i>P. sibilatrix</i>		PM	I, II, III	15	0.05	LC
<i>P. collybita</i>		WM	I, II, III	31	0.07	LC

Table 1. (continued).

Family	Species	R.S.	S	F %	D %	IUCN
Muscicapidae	<i>Regulus regulus</i>	WM	I, II, III	23	0.02	LC
	<i>R. ignicapillus</i>	WM	I, II, III, IV	23	0.03	LC
	<i>Muscicapa striata</i>	SM	I, II, III, IV	54	0.1	LC
	<i>Ficedula parva</i>	PM	II, III, IV	15	0.01	LC
	<i>F. hypoleuca</i>	PM	II, III, IV	15	0.01	LC
	<i>F. albicollis</i>	PM	II, III, IV	15	0.03	LC
	<i>F. semitorquata</i>	PM	II, III, IV	15	0.02	LC
Paridae	<i>Parus ater</i>	R	II, III	100	0.06	LC
	<i>P. caeruleus</i>	R	II, III	100	0.04	LC
	<i>P. major</i>	R	I, II, III, IV	100	0.5	LC
	<i>P. lugubris</i>	R	II, III, IV	100	0.04	LC
Sittidae	<i>Sitta europaea</i>	R	I, II, III	100	0.1	LC
	<i>S. neumayer</i>	R	I, II, III	100	0.08	LC
	<i>S. krueperi</i>	R	II	92	0.07	LC
Certhiidae	<i>Certhia brachydactyla</i>	R	IV	100	0.03	LC
Remizidae	<i>Remiz pendulinus</i>	SM	II, IV	50	0.04	LC
Oriolidae	<i>Oriolus oriolus</i>	SM	IV	27	0.005	LC
Laniidae	<i>Lanius collurio</i>	SM	I, II, III, IV	42	0.05	LC
	<i>L. minor</i>	SM	I, II, III, IV	42	0.03	LC
	<i>L. senator</i>	SM	I, II, III	42	0.04	LC
	<i>L. excubitor</i>	SM	I, II, III	15	0.006	LC
	<i>L. nubicus</i>	SM	I, II, III	38	0.01	LC
Corvidae	<i>Garrulus glandarius</i>	R	I, II, III, IV	100	0.1	LC
	<i>Pica pica</i>	R	I, II, III, IV	100	0.1	LC
	<i>Corvus corone cornix</i>	R	I, II, III, IV	100	0.1	LC
	<i>C. monedula</i>	R	I, II, III, IV	100	0.08	LC
	<i>C. frugilegus</i>	WM	II	27	0.02	LC
	<i>C. corax</i>	R	II, III	96	0.09	LC
Sturnidae	<i>Sturnus vulgaris</i>	R	I, II, III, IV	100	3	LC
	<i>S. roseus</i>	SM	II, III	46	1	LC
Passeridae	<i>Passer domesticus</i>	R	I, II, III, IV	100	8	LC
	<i>P. montanus</i>	R	I, II, III, IV	100	0.1	LC
	<i>P. hispaniolensis</i>	R	II, III	100	0.09	LC
	<i>Montifringilla nivalis</i>	WM	III	23	0.01	LC
	<i>Petronia petronia</i>	R	II, III	100	0.1	LC
Fringillidae	<i>Fringilla coelebs</i>	R	I, II, III, IV	100	5	LC
	<i>F. montifringilla</i>	WM	II	19	0.01	LC
	<i>Serinus serinus</i>	R	I, II, III, IV	96	0.1	LC
	<i>S. pusillus</i>	R	I, II, III, IV	96	0.1	LC
	<i>Carduelis chloris</i>	R	I, II, III, IV	100	0.2	LC
	<i>C. carduelis</i>	R	I, II, III, IV	100	3	LC
	<i>C. spinus</i>	R	I, II, III, IV	85	0.06	LC
	<i>C. cannabina</i>	R	I, II, III, IV	100	0.07	LC
	<i>Coccothraustes coccothraustes</i>	WM	III	15	0.004	LC
	<i>Pyrrhula pyrrhula</i>	WM	II, III	15	0.01	LC
	<i>Emberiza citrinella</i>	WM	I, IV	23	0.02	LC
Emberizidae	<i>E. cia</i>	SM	I, II, III, IV	46	0.04	LC
	<i>E. caesia</i>	SM	I, II, III	46	0.2	LC
	<i>E. melanocephala</i>	SM	I, II, III, IV	46	0.1	LC
	<i>Miliaria calandra</i>	R	I, II, III, IV	100	2	LC

Abbreviations in Table 1: R.S.; Regional Status; S: Stations; R: Resident; WM: Winter Migrant; SM: Summer Migrant; PM: Passage Migrant; F. %: Observation Frequency %; D %: Dominance %; VU: Vulnerable; NT: Near Threatened; LC: Least Concern.

We found that dabbling ducks preferred the northeast of the lake during winter observed at the lake's edge. The coots (*Fulica atra*) were high in number in the west rather than in the east, plovers and gulls were at lake's edge and its vicinity. Falcons, pigeons and song-birds were present at the lake's edge and in the surrounding. Although hunting was generally observed around parts of the lake, any protection measures were insufficient, both in the lake and in its surroundings.

Forty-seven species were rare, 33 species seldom, 35 usual, 7 frequent and 59 common. Pockards, coots, shallows and house sparrows were the most common species (Table 2). According to species diversity in the lake, the diversity ratio was 30.50.

When the lake-related data on bird species is compared with those of other lakes (Tabur, 2002), the highest similarity ratio of Lake Beyşehir is with Lake Burdur, 96%, while the lowest is with Lake Kovada, 91% (Table 3).

Discussion

Species in the lake and its surroundings were reported by Acar (1972), Baran and Yılmaz (1984), Kiziroğlu (1989), Turan (1990), Demirsoy (1992), T.Ç.V. (1993), Erdem (1995), Green and Moorhouse (1995), Kuru (1996) and Kirwan et al. (1998).

Ertan et al. (1989) and Turan (1990) reported that the Dalmatian pelican (*Pelicanus crispus*) breed in the lake and on its islands (Hacıakif, Eşek Adası and Kızkalesi) in 1960. However, one observations did not support this finding. Furthermore, as can be seen from Table 1, the observation frequency of the Dalmatian pelican was 11%. While this region is suitable for breeding, feeding and other activities for waterfowl, the number of this species has been decreasing gradually. In relation to this

decrease, it is thought that some effects such as the use of chemicals in agricultural areas, overhunting, changing conditions etc. substantially affect all species, especially sensitive ones.

Kiziroğlu (1989) and T.Ç.B. (2002) recorded that the number of pygmy cormorants (*Phalacrocorax pygmeus*) was decreasing due to hunting, pollution, use of chemical materials and other factors. A drop in the individual number of this species was also observed in this study. In other words, pygmy cormorants were rarely observed compared to other species. However, Ayvaz (1990) reported that the pygmy cormorant defended itself by diving into the lake from anthropogenic factors. The described avoidance behavior of this species was observed in this study.

T.Ç.V. (1993) reported that the grey heron (*Ardea cinerea*), purple heron (*A. purpurea*) and little egret (*Egretta garzetta*) breed in Lake Burdur and Lake Beyşehir. Ertan et al. (1989) determined that *A. purpurea* was a winter migrant in Lake Beyşehir. In addition, Erdem (1995) found little heron (*E. garzetta*) and squacco heron (*Ardeola ralloides*) breed in Lake Beyşehir. However, no breeding activity of these species was recorded during our observation periods.

While Green and Moorhouse (1995) reported that the squacco heron (*Ardeola ralloides*) is a transit or winter migrant in Turkey, Ertan et al. (1989) found that the night heron (*Nycticorax nycticorax*) bred during 1962-1987 and the common tern (*Sterna hirundo*) was a winter visitor to the lake. However, the squacco heron was observed as a summer migrant to the lake. The night heron and common tern were not recorded in our study.

According to Steadman (1996), many bird species, including the golden eagle (*Aquila chrysaetos*), suffered from anthropogenic effects such as hunting, pollution,

Table 2. Species observation frequency.

Species Observation Frequency	Species Number
1 – 20%	47
21 – 40%	33
41 – 60%	35
61 – 80%	7
81 –100%	59

Table 3. Similarity ratio in Lake Beyşehir with other lakes.

Lakes	Lake Beyşehir
Lake Beyşehir	1
Lake Burdur	0.96
Lake Eğirdir	0.95
Lake Gölhisar	0.94
Lake Kovada	0.91

and chemical materials etc. An industrial complex, settlement areas, pollution, chemical materials used on farmland, and other factors affected all bird species. When we compare the individual number of present species in the lake with previous observations, it can be seen that the individual number of all species is diminishing today. Thus, the effects described must be affecting all bird species in the region studied.

Conclusion

Since this study was conducted only in the lake and its vicinity, many of the land birds listed by Kullberg (1998) around Lake Beyşehir were not observed. Lake Beyşehir is the second most important wetland (after Lake Burdur) in the Lakes Region. The lake has 181 bird species, a 30.50 biodiversity rate, 32 islands, marshes, and forest. Due to its features, this lake has a prominent role for local and migrant bird species. Negative effects in the lake include anthropogenic effects, use of chemicals on farmland, overfishing, organic pollution, overhunting,

etc. Kızıroğlu (2001) demonstrated that 200 bird species have become extinct over the last 3 centuries. Thus, it is important to protect this and similar wetlands for bird and other species.

All factories and the settlement areas surrounding threaten significantly the future of Lake Beyşehir and its fauna. The factories and the settlement areas must have modern sewage systems. Hydrologic studies in all wetlands must be carried out by the Turkish Government. Hunting must be controlled at the lake. The Turkish Government must prepare management plans. Measurements of water chemistry should be obtained on a regular basis to allow long-term monitoring of changes in nutrient levels and other parameters. Because 93 endangered species were observed in the lake and these species are important for protecting the birds of Turkey, endangered species should be protected at the lake.

This study is only a beginning for further investigations. It will be possible to determine the reduction in the number of species with further periodical counts.

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