

Bird diversity at the Adıyaman-Gölbaşı Lakes Important Bird Area (IBA), in southeast Turkey

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Abstract

The diversity of avian species at three lakes (İnekli, Azaplı and Gölbaşı) in the Adıyaman-Gölbaşı Lakes Important Bird and Biodiversity Area (IBA), a unique karst landscape in southeast Turkey, was studied for the first time during 2018–2019. A total of 73 different bird species were detected, from 34 families in 18 orders, of which c. 30% were waterbirds. Fifty species potentially breed at the IBA, whilst 23 occur only in winter or during migration. One – the European Turtle Dove *Streptopelia turtur* – is of global conservation concern, classed as Vulnerable by the International Union for Conservation of Nature (IUCN) in its Red List of threatened species, and 14 are threatened at the national level. The results suggest that these natural lakes are of great importance for birds. Although the Adıyaman-Gölbaşı Lakes IBA was declared a Nature Park in 2008, illegal hunting, harvesting and reed burning are still major problems in the area. An innovative management approach is required to protect the habitat, water quality, avian diversity and water flow dynamics in the catchment, in order to protect these natural wetlands and ensure that human activity does not impinge on the integrity of the site.

Key words: avifauna, Adıyaman, natural lakes, southeast Anatolia, Turkey, wetlands.

Turkey is one of the most biologically diverse countries in the Palearctic region, reflecting its geographical position and the variety of its habitats and landforms (Ambarlı *et al.* 2016), with birds being among the main features of its biodiversity (Kirwan *et al.* 2008). Key habitats include regionally important wetlands (Meriç & Çağırankaya 2013), which provide crucial feeding and resting areas for birds during

migration, thus increasing the diversity of avian species in the country (Kılıç & Eken 2004; Welch 2004). Wetlands are among the most productive and beneficial ecosystems on Earth because of their biological diversity and the ecosystem services that they supply (Chmura *et al.* 2003; Mitsch & Gosselink 2007; Sebastián-González & Green 2016), and Turkey's geological history and climatic diversity makes it a

particularly important country for wetlands in the western Palearctic. At least 135 of its wetlands have been designated as internationally important areas, including 14 listed under the Convention on Wetlands of International Importance (the “Ramsar Convention”; Meriç & Çağırankaya 2013). None of Turkey’s Ramsar Sites are located in the southeast Anatolia region, however, probably because few of the artificial or natural aquatic ecosystems in the region have been studied in detail.

The Gölbashi Lakes refers collectively to Lake İnekli, Lake Azaplı and Lake Gölbashi, located in the Gölbashi district of Adiyaman Province, southeast Anatolia. These small, natural, karst lakes are in close proximity to each other (Fig. 1), and the area has been recognised as a Key Biodiversity Area (KBA; Key Biodiversity Areas Partnership 2022) and as an Important Bird and Biodiversity Area (the Adiyaman-Gölbashi Lakes IBA;

BirdLife International 2022). Factors contributing to the KBA and IBA designations included reports of species such as Ferruginous Duck *Aythya nyroca*, Pied Kingfisher *Ceryle rudis*, Common Crane *Grus grus*, Black-winged Stilt *Himantopus himantopus* and Pygmy Cormorant *Microcarbo pygmaeus* at the site in recent years (Kılıç & Eken 2004; Welch 2004; Eken *et al.* 2006), with 10–20 breeding pairs of Ferruginous Duck (classified as Near Threatened in the IUCN Red List of Threatened Species) recorded in 1998 (BirdLife International 2022). Yet although waterbirds and other species have been monitored at the Gölbashi Lakes since the early 21st century, for instance during the mid-winter waterfowl counts (Çağlayan *et al.* 2005; Suseven *et al.* 2006; Onmuş 2007; Akarsu & Balkız 2010; Erciyas Yavuz & Kartal 2011; Erciyas Yavuz & İsfendiyaroğlu 2012; Erciyas Yavuz & Boyla 2013), avian diversity at the site has

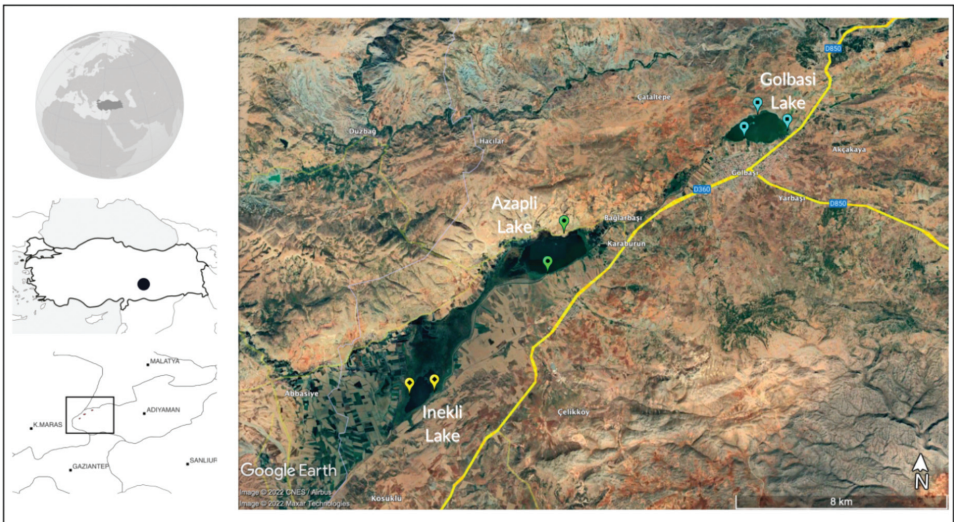


Figure 1. Map of the study area, with markers ($n = 7$) indicating the observation points at each lake.

not previously been studied systematically throughout the year.

Our study at Gölbaşı Lakes in 2018–2019 therefore aimed to provide a year-round assessment of the lakes for avian species. In particular we sought to: (1) prepare an updated checklist of birds for each of the IBA lakes (*i.e.* for İnekli, Azaplı and Gölbaşı), (2) describe seasonal species occurrence patterns, (3) determine their breeding status, and (4) present the national and global threat categories of the birds identified in the area. Additionally, we noted and describe threats to the birds observed during our study and suggest conservation measures for protecting the area more effectively.

Methods

Study Area

The Adıyaman-Gölbaşı Lakes complex, is located within the Gölbaşı district of Adıyaman Province (Fig. 1). It was declared an IBA (No. TR079) in 2004 (Kılıç & Eken 2004) and as a Nature Park (the Gölbaşı Lakes Park) in 2008 in recognition of its diverse flora and fauna (Ministry of Agriculture and Forestry 2019). The Nature Park covers all three lakes (İnekli, Azaplı and Gölbaşı), the channels linking these waterbodies, and its total area extends to over *c.* 2,080 ha, whilst the IBA covers a larger area of 6,714 ha. The surface area of water for each lake has been put at 109 ha for Lake İnekli, 272 ha for Lake Azaplı and 219 ha for Lake Gölbaşı, although this may vary with seasonal precipitation levels (Biricik 1994; Korkmaz *et al.* 2008). The lakes and their environs, which form a

drainage basin that flows into the Aksu Creek (Korkmaz *et al.* 2008), hosts many species, attracted both by its strategic geographic position at the end of the Great Rift Valley (a main migration route in Palearctic; Welch 2004), and the variety of different habitats present in the region (Eroğlu 2013; Eğilmez 2014). Habitats around the Gölbaşı Lakes include woodland, shrub, reeds, swamp and steppe, and the lakes themselves are natural waterbodies with peripheral wetland characteristics (Eken *et al.* 2006).

The region has a typical steppe climate, with long and dry hot summers, whereas the winters are cold and rainy. The annual average temperature was 17.7°C for 2001–2021 inclusive, with a mean daily maximum of 23.7°C and a minimum of 12.3°C. Annual precipitation, which occurs mainly in winter and spring, averaged at 729.5 mm over this 20-year period (Turkish State Meteorological Service data; www.mgm.gov.tr).

Bird counts

A total of 35 days of observations were conducted at Gölbaşı Lakes between February 2018 and March 2019 (Table 1). Ornithological observations were restricted to areas immediately around the lakes (20–30 m from the shoreline) and were made from seven predetermined stations (at 863–870 m a.s.l.) which were all visited within each survey day. The order in which the observation stations were visited was rotated over the course of the study, to ensure that observations commenced at different stations on different days and to obtain data about the presence of birds for

Table 1. Number of days on which the Adıyaman-Gölbaşı Lakes IBA (*i.e.* Lake İnekli, Lake Azaplı and Lake Gölbaşı) were surveyed each month during the 2018–2019 study period.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2018		2	3	3	3	2	4	2	3	2	2	3	29
2019	3	2	1										6
Totals	3	4	4	3	3	2	4	2	3	2	2	3	35

each lake at different times of day (Bibby *et al.* 2000). A period of 0.5–1.0 h was devoted to recording birds at each station on each day during the fieldwork, using line transect and point count methodologies (Bibby *et al.* 1998). A single line transect was carried out by walking *c.* 800–1,100 m between two observation points at a normal slow walking speed, and recording birds seen on either side of the path. Observations were made using standard ornithological equipment: a pair of binoculars (8.5 × 56), telescope (20–60 × 80), digital photo camera (70–300 mm), a handheld GPS device, and an ornithological handbook (Mullarney *et al.* 1999) to confirm species identification.

The birds' behaviour, or the presence of a nest, eggs or chicks, were used to determine whether a species was breeding in the study area, in accordance with the breeding categories (1–2 = possible, 3–9 = probable and 10–16 = confirmed breeding) defined by the European Bird Census Council (EBCC; Hagemeyer & Blair 1997; Keller *et al.* 2020). The seasonal status of bird species (following del Hoyo & Collar

2014, 2016 taxonomy) detected at Gölbaşı Lakes was evaluated from the dates on which they were observed and the duration of the presence of each species at the site. The national status of each species in Turkey (*e.g.* whether resident, summer migrant, winter visitor, passage migrant, vagrant) is based on Kirwan *et al.* (1999).

Results

A total of 3,943 individuals from 73 bird species (belonging to 34 families in 18 orders), calculated by summing the maximum number of each species detected in each month, were counted in the Adıyaman-Gölbaşı Lakes IBA during the study period. Most species ($n = 27$) were Passeriformes, whilst the remaining 46 were non-passerines, most notably in the Accipitriformes (8 species), Anseriformes (7) and Charadriiformes (6) orders (Table 2, Supporting Materials Table S1).

The seasonal occurrence, threat categories, and breeding status of all bird species detected at the Gölbaşı Lakes, along with the functional groups recognised for the waterbirds based on their foraging activity

Table 2. Bird species detected in the Adıyaman-Gölbaşı Lakes IBA between February 2018 and March 2019, grouped by taxonomic order (Del Hoyo & Collar 2014, 2016). The maximum number of individuals counted in a month is given along with the month of the peak count (I–XII = January–December). Waterbirds are given in bold; risk status: NE = Not Evaluated, LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered.

Order	Species	Max. count	Month of peak count	No. months detected	No. lakes detected	Risk status	
						National	Global
Galliformes	Common Quail <i>Coturnix coturnix</i>	14	IV	6	3	NE	–
	Chukar Partridge <i>Alectoris chukar</i>	1	X	1	1	VU	–
Anseriformes	Whooper Swan <i>Cygnus cygnus</i>	6	III	3	3	NT	–
	Bewick's Swan <i>Cygnus columbianus bewickii</i>	2	II	1	1	EN	–
	Ruddy Shelduck <i>Tadorna ferruginea</i>	5	VIII, XII	5	3	LC	–
	Red-crested Pochard <i>Netta rufina</i>	21	I	6	3	NT	–
	Northern Shoveler <i>Spatula clypeata</i>	80	I	6	3	LC	–
	Mallard Anas <i>platyrhynchos</i>	20	I	2	2	LC	–
Podicipediformes	Eurasian Teal <i>Anas crecca</i>	18	I	1	1	LC	–
	Little Grebe <i>Tachybaptus ruficollis</i>	50	I	6	2	LC	–
	Great-crested Grebe <i>Podiceps cristatus</i>	43	III	6	3	LC	–
	Rock Dove <i>Columba livia</i>	11	II	10	3	LC	–
Columbiformes	Common Wood Pigeon <i>Columba palumbus</i>	6	VIII	1	1	NT	–
	European Turtle Dove <i>Streptopelia turtur</i>	5	VIII	3	2	LC	VU
	Eurasian Collared Dove <i>Streptopelia decaocto</i>	21	V	8	3	LC	–
	Laughing Dove <i>Spilopelia senegalensis</i>	8	VIII	6	3	LC	–

Table 2 (continued).

Order	Species	Max. count	Month of peak count	No. months detected	No. lakes detected	Risk status	
						National	Global
Apodiformes	Common Swift <i>Apus apus</i>	20	VII	4	1	LC	-
Cuculiformes	Common Cuckoo <i>Cuculus canorus</i>	5	VII, VIII	3	2	DD	-
Gruiformes	Common Moorhen <i>Gallinula chloropus</i>	10	I	6	3	LC	-
	Eurasian Coot <i>Fulica atra</i>	134	I	7	3	LC	-
Ciconiiformes	White Stork <i>Ciconia ciconia</i>	7	V	4	3	LC	-
Pelecaniformes	Cattle Egret <i>Bubulcus ibis</i>	4	V	2	2	NE	-
	Grey Heron <i>Ardea cinerea</i>	13	IV	6	3	LC	-
	Great Egret <i>Ardea alba</i>	9	I	4	3	LC	-
Suliformes	Great Cormorant <i>Phalacrocorax carbo</i>	2	I	1	1	LC	-
Charadriiformes	Common Ringed Plover <i>Charadrius hiaticula</i>	6	III, IV	3	2	NE	-
	Little Ringed Plover <i>Charadrius dubius</i>	4	VI, VII	2	1	NT	-
	Northern Lapwing <i>Vanellus vanellus</i>	12	II	1	1	LC	NT
	Black-headed Gull <i>Chroicocephalus ridibundus</i>	34	II	5	3	LC	-
	Armenian Gull <i>Larus armenicus</i>	81	III	7	3	LC	NT
	White-winged Gull <i>Chlidonias leucopterus</i>	2	VII	1	1	NT	-
Strigiformes	Little Owl <i>Athene noctua</i>	10	VII	6	3	LC	-
Accipitriformes	Black-winged Kite <i>Elanus caeruleus</i>	1	III	1	1	DD	-
	Cinereous Vulture <i>Aegypius monachus</i>	1	XII	1	1	EN	NT
	Marsh Harrier <i>Circus aeruginosus</i>	6	IV, V	5	3	NT	-

Table 2 (continued).

Order	Species	Max. count	Month of peak count	No. months detected	No. lakes detected	Risk status	
						National	Global
	Hen Harrier <i>Circus cyaneus</i>	4	IV	3	3	NE	-
	Eurasian Sparrowhawk <i>Accipiter nisus</i>	4	IX	3	2	NT	-
	Black Kite <i>Milvus migrans</i>	10	IX	2	1	NE	-
	Common Buzzard <i>Buteo buteo</i>	5	IX	2	2	LC	-
	Long-legged Buzzard <i>Buteo rufinus</i>	3	V, VI	5	2	NT	-
Bucerotiformes	Eurasian Hoopoe <i>Upupa epops</i>	2	II	1	1	LC	-
Coraciiformes	European Bee-eater <i>Merops apiaster</i>	10	IV	5	3	LC	-
	European Roller <i>Coracias garrulus</i>	9	V	3	3	LC	-
	Pied Kingfisher <i>Ceryle rudis</i>	7	VI	4	2	CR	-
Piciformes	Syrian Woodpecker <i>Dendrocopos syriacus</i>	10	III	7	3	LC	-
Falconiformes	Common Kestrel <i>Falco tinnunculus</i>	7	VI	6	3	LC	-
Passeriformes	Eurasian Jay <i>Garrulus glandarius</i>	2	III	2	1	LC	-
	Eurasian Magpie <i>Pica pica</i>	9	IX	9	2	LC	-
	Jackdaw <i>Corvus monedula</i>	111	IV	9	3	LC	-
	Rook <i>Corvus frugilegus</i>	20	VI	8	3	LC	-
	Hooded Crow <i>Corvus cornix</i>	28	III	7	3	LC	-
	Sombre Tit <i>Poecile lugubris</i>	9	VIII	2	2	LC	-
	Great Tit <i>Parus major</i>	53	IV	8	3	LC	-
	Greater Short-toed Lark <i>Calandrella brachydactyla</i>	2	V	1	1	LC	-

Table 2 (continued).

Order	Species	Max. count	Month of peak count	No. months detected	No. lakes detected	Risk status	
						National	Global
	Crested Lark <i>Galerida cristata</i>	13	IV, V, VII	11	3	LC	-
	Eurasian Reed Warbler <i>Acrocephalus scirpaceus</i>	10	VI	6	3	LC	-
	House Martin <i>Delichon urbicum</i>	10	IV, V	2	1	VU	-
	Red-rumped Swallow <i>Cecropis daurica</i>	10	VI	3	1	LC	-
	Barn Swallow <i>Hirundo rustica</i>	28	IV	6	3	LC	-
	Sand Martin <i>Riparia riparia</i>	10	V, VI	3	1	VU	-
	Chiffchaff <i>Phylloscopus collybita</i>	4	V	3	2	LC	-
	Cetti's Warbler <i>Cettia cetti</i>	1	V	1	1	LC	-
	Eurasian Nuthatch <i>Sitta europaea</i>	34	VII	2	2	LC	-
	European Starling <i>Sturnus vulgaris</i>	19	V	4	3	LC	-
	European Robin <i>Erithacus rubecula</i>	9	II, III	4	3	NE	-
	Common Nighthawk <i>Luscinia megarhynchos</i>	4	VI	1	1	NE	-
	Common Stonechat <i>Saxicola torquatus</i>	2	V	1	1	LC	-
	House Sparrow <i>Passer domesticus</i>	95	V	12	3	LC	-
	White Wagtail <i>Motacilla alba</i>	6	VI	4	2	LC	-
	Chaffinch <i>Fringilla coelebs</i>	14	II	6	3	LC	-
	Hawfinch <i>Coccothraustes coccothraustes</i>	2	II	1	1	DD	-
	Goldfinch <i>Carduelis carduelis</i>	25	IV	9	3	LC	-
	Corn Bunting <i>Emberiza calandra</i>	15	VI	7	2	LC	-

when on water (from Ramirez *et al.* 2018; Almeida *et al.* 2020), are presented in detail in the Supporting Materials (Table S1). Although the three lakes are close to each other, 23 species (32%; Table 2) were recorded only in one area, whereas 35 commoner species (48% of all species detected) were seen across the study site. On considering the importance of the Gölbaşı Lakes for waterbirds (using the Wetlands International definition of waterbirds), 22 (c. 30%) of the 73 bird species identified in the study area are directly dependent on water (Wetlands International 2022). Of these, 14 were detected at Lake İnekli (among 45 species identified at the site), 15 (of 51) at Lake Azaplı and 21 (of 63) at Lake Gölbaşı (from data in Supporting Materials Table S1). Species may occasionally have been missed because of the observation period (e.g. Northern Lapwing *Vanellus vanellus* were seen only at Lake İnekli; all other waterbirds were seen at Lake Gölbaşı), but nonetheless there was no significant difference between the three lakes in the proportion of waterbird species detected in comparison with other species ($\chi^2_2 = 0.20$, $P = 0.90$, n.s.).

Among the species recorded, 35 were classed as resident, 16 as summer migrants, 15 as winter visitors, six as passage migrants, and one species – the Black-winged Kite *Elanus caeruleus* – is considered a vagrant in the region (Supporting Materials Table S1). Additionally, assessments suggest that 50 (c. 68%) of the species detected may potentially breed in the IBA: 30 were classed as possible breeding species (EBCC categories 1–2), nine as probably breeding (categories 3–9), and 11 were found to be

breeding (categories 10–16) in the region. A further 23 species use the area in winter or only during migration, with no evidence of any breeding activity by these birds in the area. The national and global threat status of birds identified in the Adıyaman-Gölbaşı Lakes IBA was also examined. Fourteen were found to be in various threat categories for Turkey: eight in the Near Threatened (NT) category, three classed as Vulnerable (VU), two as Endangered (EN) and one – the European Turtle Dove *Streptopelia turtur* – is Critically Endangered (CR) in the country (Supporting Materials Table S1). The remaining 59 species were in the Least Concern (LC) or Not Evaluated (NE) categories (Kılıç & Eken 2004). The European Turtle Dove is also of conservation concern at the global level (classed as Vulnerable by the IUCN), and three more species (the Northern Lapwing, Armenian Gull *Larus armenicus* and Cinereous Vulture *Aegypius monachus*) are classed as Near Threatened globally because of their decreasing population sizes (IUCN 2019). It should be emphasised that, with 3–5 individuals recorded in June–August inclusive (Table S1), the European Turtle Dove is considered to be a possible breeding species in the study area.

There was temporal variation in both the number of species and the number of individuals recorded during the study. Species richness peaked in May, when 41 species were detected, and the highest abundance was of 642 individuals observed in March (Fig. 2). Within the IBA, bird species richness was highest at Azaplı Lake in April and May (Fig. 3a), while the highest numbers were recorded at Gölbaşı Lake in

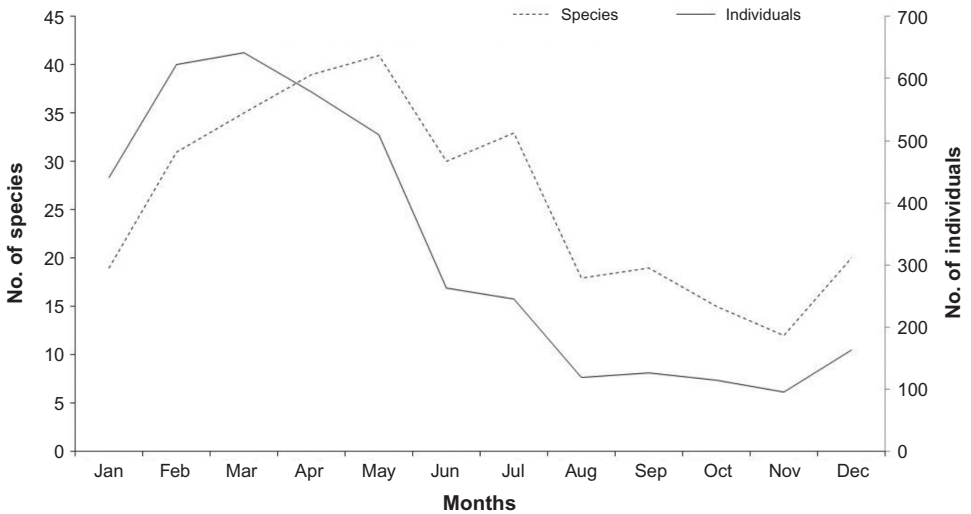


Figure 2. Maximum number of species (dashed line, left ordinate) and birds (solid line, right ordinate) recorded for each month across the Gölbaşı Lakes study area in 2018–2019.

February and March (Fig. 3b). It should also be noted, however, that these differences may be affected by the displacement of birds among these lakes between one visit and the next, which are close to each other, during the observation period.

Discussion

Although the importance of the Gölbaşı Lakes system for wildlife has been recognised through its designation as both an IBA and a KBA (Kılıç & Eken 2004; Eken *et al.* 2006), bird communities in the area have not previously been studied systematically throughout the year. Earlier information on the range of birds using these special wetlands comes primarily from the midwinter waterbird censuses (conducted in Turkey over the last two decades), and from a study of biological diversity in southeast Turkey which included some parts of the Gölbaşı Lakes for a

limited period (Welch 2004). These lakes, together with the surrounding wet meadows and reed beds (which sometimes flood and turn into swamps), constitute important habitats for many avian species, and their position at the northern end of the Great Rift Valley could provide feeding and resting areas for a range of migratory birds (Kılıç & Eken 2004; Welch 2004; Eken *et al.* 2006). Given the diversity of habitats and location of the study area, we therefore expected to see many more species during a 15-month study than the 73 recorded. The observation period, weather conditions and other factors, however, may have resulted in some species being missed by observers, and if the frequency of studies in the area is increased then the number of birds detected may prove to be much higher than those described here.

Meanwhile, a comparison of the birds recorded in 2018–2019 with earlier data

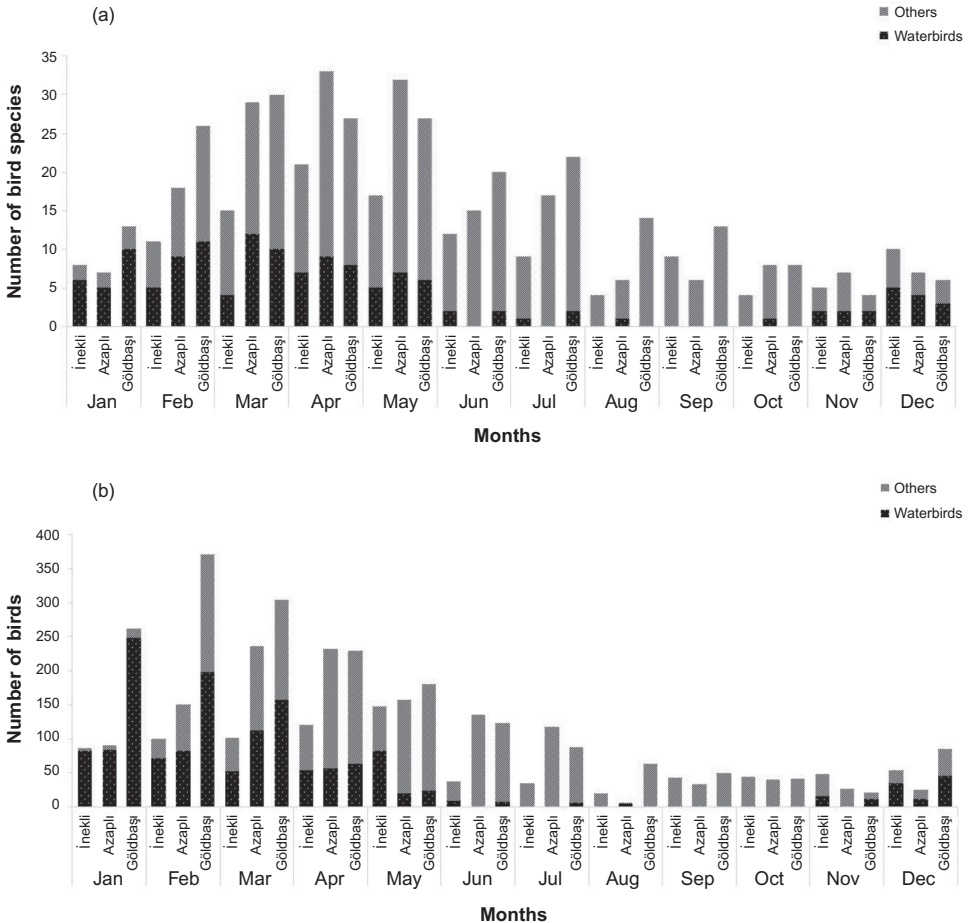


Figure 3. Comparison of (a) the maximum number of bird species, and (b) the maximum number of individuals recorded during surveys at Lake Inekli, Lake Azaplı and Lake Gölbaşı each month between February 2018 and March 2019.

from related studies indicates a change in the range of species occurring in the region. In the biological diversity study made in southeast Turkey, Welch (2004) identified 46 bird species in the Gölbaşı Lakes area (18 of which were dependent on water) and emphasised the importance of this region for its wildlife. However, several species reported by Welch – e.g. the Pygmy

Cormorant, Ferruginous Duck, Montagu’s Harrier *Circus pygargus*, Black-eared Wheatear *Oenanthe hispanica*, Upcher’s Warbler *Hippolais languida*, Orphean Warbler *Sylvia hortensis*, Woodchat Shrike *Lanius senator* and Black-headed Bunting *Emberiza melanocephala* – were not detected during our more recent study. Observations made between 1998–2015 also found that Lake

İnekli was an important breeding and wintering site for Ferruginous Duck (a globally threatened species), and 5–10 pairs breeding pairs were present at the Gölbaşı Lakes in 2001 and 2002 (Karakaş & Biricik 2018), but none were recorded during 2018–2019. Furthermore, some other species reported from the area during earlier midwinter waterfowl censuses (Çağlayan *et al.* 2005; Suseven *et al.* 2006; Onmuş 2007; Akarsu & Balkız 2010; Erciyas Yavuz & Kartal 2011; Erciyas Yavuz & İsfendiyaroğlu 2012; Erciyas Yavuz & Boyla 2013) were not recorded.

Based on these comparisons, it is considered that species (mainly waterbirds) not seen in 2018–2019 but present during previous studies may have been adversely affected by one or a combination of pressures in the Gölbaşı Lakes area such as illegal hunting, habitat destruction, human disturbance (Eken *et al.* 2006) and water pollution (Uçkun 2018). Regional, flyway-level or even global declines in bird populations may also affect the numbers and distribution of species present, emphasising the importance of protecting key sites and ensuring that they are managed sustainably. Among these disadvantages, cutting and burning of the reeds and stubble can have a major impact, because they provide crucial shelter and other services to many bird species (Eken *et al.* 2006). For instance, the burning of reeds reduces feeding and nesting opportunities for the birds which in turn has a negative influence on species richness (Eken *et al.* 2006). There was also a decrease in the number of waterbirds seen during the summer months of our study, and future studies may

determine whether this is attributable to human activity. Water extraction from the lakes for irrigation or other purposes, resulting in lower water levels, may be a reason for the decrease in waterbirds recorded in summer and potentially the loss of breeding waterbirds that previously occurred at the site.

Wetlands are among the most productive ecosystems in the world (Chmura *et al.* 2003; Sebastián-González & Green 2016), being transitional between aquatic ecosystems and terrestrial habitats (Keddy 2010; Tokatlı 2017), and serve to protect biological diversity by hosting a range of specialist wildlife (Tokatlı 2017). Yet despite having a critical role for sustaining not only wildlife but human ecosystem services, wetlands and their vital functions continue to be under threat (Giosa *et al.* 2018). The problems faced by wetlands are limited not only to the southeast Anatolia region of Turkey; the same or similar problems occur in many parts of the world (Zedler & Kercher 2005; Ma *et al.* 2010; Giosa *et al.* 2018), including elsewhere in Turkey (Green *et al.* 1996). As a result of habitat degradation and loss, the feeding, breeding and resting areas required by many species are shrinking or disappearing, giving rise to population declines particularly for wetland-dependent species. Although illegal hunting is prohibited in many countries, it is still a serious problem (especially in wetlands) in most of the countries in the Mediterranean basin, including Turkey (Brochet *et al.* 2016), and it remains as a serious threat at and around the Gölbaşı Lakes IBA. The protection of wetlands therefore continues to be an important conservation issue, for

maintaining and improving biological diversity and bird diversity (Cherkaoui *et al.* 2018). Conservation plans for wetlands should consider the ecosystem as a whole, with a broad perspective incorporating all biotic and abiotic components. Protection of Gölbaşı Lakes within a sustainable perspective consequently requires a comprehensive approach that includes the habitat structure, water quality, species composition and basin dynamics of the area.

In conclusion, this is the first study of avian diversity at the Gölbaşı Lakes to be conducted systematically throughout the year. The lack of comparable long-term, year-round monitoring studies makes it difficult to make a robust assessment of changes in the numbers of waterbirds and total avifauna, but there does seem to have been a general decrease in the range and abundance of waterbirds at the site. Main reasons for these declines may include illegal hunting, reed burning and the application of agricultural chemicals, which together with industrial waste may have changed the chemical properties of water (Korkmaz *et al.* 2008; Uçkun 2018). Despite some environmental problems and threats, the results suggest that Gölbaşı Lakes still serve as important breeding and feeding areas, which support many bird species at different times of the year. Yet although the lakes' wetland areas have been a Nature Park for more than a decade, there is still little nature protection effort in practice. A biodiversity inventory study is required, so that appropriate conservation and habitat management programmes can be implemented in the area as soon as possible.

The management plan should highlight the importance of nesting areas such as reed beds for preserving existing bird communities. Effective conservation of the Gölbaşı Lakes' wetlands and its birds requires cooperation among different governmental bodies, universities and local agencies in Adıyaman Province, as well as in Şanlıurfa, Diyarbakır and Malatya.

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References

- Akarsu, F. & Balkız, Ö. 2010. *Türkiye Kış Ortası Sukuşu Sayımları 2008–2010*. [Turkey Midwinter Waterfowl Counts 2008–2010.] Doğa Derneği, Ankara, Turkey.
- Almeida, B.A., Sebastián-González, E., dos Anjos, L. & Green, A.J. 2020. Comparing the diversity and composition of waterbird functional traits between natural, restored and artificial wetlands. *Freshwater Biology* 65: 2196–2210.
- Ambarlı, D., Zeydanlı, U.S., Balkız, Ö., Aslan, S., Karaçetin, E., Sözen, M., Ilgaz, Ç., Ergen, A.G., Lise, Y., Çağlayan, S.D., Welch, J.H., Welch, G., Turak, A.S., Bilgin, C.C., Özkil, A. & Vural, M. 2016. An overview of biodiversity and conservation status of steppes of the Anatolian Biogeographical Region. *Biodiversity and Conservation* 25: 2491–2519.
- Bibby, C., Jones, M. & Marsden, S. 1998. *Expedition Field Techniques: Bird Surveys*. Royal Geographical Society, London, UK.

- Bibby, C.J., Burgess, N.D., Hill, D.A. & Mustoe, S. 2000. *Bird Census Techniques*. Academic Press, London, UK.
- BirdLife International 2022. *Important Bird Areas factsheet: Adıyaman – Gölbaşı Lakes*. BirdLife International, Cambridge, UK. Available at <http://datazone.birdlife.org/site/factsheet/9621> (last accessed 6 April 2022).
- Biricik, S.A. 1994. Gölbaşı Depresyonu. [*Gölbaşı Depression*.] *Turkish Geographical Review* 29: 53–81.
- Brochet, A.L., Van Den Bossche, W., Jbour, S., Ndang'Ang'A, P.K., Jones, V.R., Abdou, W.A.L.I., Al-Hmoud, A.R., Asswad, N.G., Atienza, J.C., Atrash, I., Barbara, N., Bensusan, K., Bino, T., Celada, C., Cherkaoui, S.I., Costa, J., Deceuninck, B., Etayeb, K.S., Feltrup-Azafaz, C., Figel, J., Gustin, M., Kmecl, P., Kocevski, V., Korbeti, M., Kotrošan, D., Mula Laguna, J., Lattuada, M., Leitaõ, D., Lopes, P., López-Jiménez, N., Lucic, V., Micol, T., Moali, A., Perlman, Y., Piludu, N., Portolou, D., Putilin, K., Quaintenne, G., Ramadan-Jaradi, G., Ružic, M., Sandor, A., Sarajli, N., Saveljic, D., Sheldon, R.D., Shialis, T., Tsiopelas, N., Vargas, F., Thompson, C., Brunner, A., Grimmett, R. & Butchart, S.H.M. 2016. Preliminary assessment of the scope and scale of illegal killing and taking of birds in the Mediterranean. *Bird Conservation International* 26(1): 1–28.
- Cherkaoui, S.I., Selmi, S., Amhaouch, Z. & Hanane, S. 2018. Assessment of the effectiveness of wetland protection in improving waterbird diversity in a Moroccan wetland system. *Environmental Monitoring and Assessment* 190: 699. <https://doi.org/10.1007/s10661-018-7092-6>.
- Chmura, G.L., Anisfeld, S.C., Cahoon, D.R. & Lynch, J.C. 2003. Global carbon sequestration in tidal, saline wetland soils. *Global Biogeochemical Cycles* 17(4): 1111. doi: 10.1029/2002GB001917.
- Çağlayan, E., Kılıç, D.T., Per, E. & Gem, E. 2005. *Türkiye Kış Ortası Sukuşu Sayımları*. [*Turkey Midwinter Waterfowl Counts*.] Doğa Derneği, Ankara, Turkey.
- Del Hoyo, J. & Collar, N.J. 2014. *HBW and BirdLife International Illustrated Checklist of the Birds of the World. Volume 1: Non-Passerines*. Lynx Edicions and BirdLife International, Barcelona, Spain and Cambridge, UK.
- Del Hoyo, J. & Collar, N.J. 2016. *HBW and BirdLife International Illustrated Checklist of the Birds of the World. Volume 2: Passerines*. Lynx Edicions and BirdLife International, Barcelona, Spain and Cambridge, UK.
- Eğilmez, Ç. 2014. *Gölbaşı Gölleri (Adıyaman) Havzası'nın Vejetasyonu*. M.Sc. thesis, Adıyaman University Graduate School of Natural and Applied Science, Adıyaman, Turkey.
- Eken, G., Bozdoğan, M., İsfendiyaroğlu, S., Kılıç, D.T. & Lise, Y. (eds.) 2006. *Türkiye'nin Önemli Doğa Alanları*. [*Turkey's Key Biodiversity Areas*.] Doğa Derneği, Ankara, Turkey.
- Erciyas Yavuz, K. & Kartal, E. 2011. *Türkiye Kış Ortası Su Kuşu Sayımı 2011*. [*Turkey Midwinter Waterfowl Counts 2011*.] Ondokuz Mayıs Üniversitesi Yayınları, Samsun, Turkey.
- Erciyas Yavuz, K. & İsfendiyaroğlu, S. 2012. *Türkiye Kış Ortası Su Kuşu Sayımları 2012*. [*Turkey Midwinter Waterfowl Counts 2012*.] Doğa Derneği, İzmir, Turkey.
- Erciyas Yavuz, K. & Boyla, K.A. 2013. *Türkiye Kış Ortası Sukuşu Sayımları 2013*. [*Turkey Midwinter Waterfowl Counts 2013*.] Ondokuz Mayıs Üniversitesi Yayınları, Samsun, Turkey.
- Eroğlu, S. 2013. *Adıyaman Gölbaşı Gölü'nün Bentik Diyatomeleri ve Bazı Limnolojik Parametrelerinin Mevsimsel Değişiminin İncelenmesi*. M.Sc. thesis, Adıyaman University Graduate School of Natural and Applied Science, Adıyaman, Turkey.

- Giosa, E., Mammides, C. & Zotos, S. 2018. The importance of artificial wetlands for birds: a case study from Cyprus. *PLoS ONE* 13(5): e0197286. Available at <https://doi.org/10.1371/journal.pone.0197286> (last accessed 6 April 2022).
- Green, A.J., Fox, A.D., Hilton, G.M., Hughes, B., Yarar, M. & Salathé, T. 1996. Threats to Burdur Lake ecosystem, Turkey and its waterbirds, particularly the White-headed Duck *Oxyura leucocephala*. *Biological Conservation* 76: 241–252.
- Hagemeijer, E.J.M. & Blair, M.J. (eds.) 1997. *The EBCC Atlas of European Breeding Birds: their Distribution and Abundance*. T. & A.D. Poyser, London, UK.
- International Union for Conservation of Nature (IUCN) 2019. *The IUCN Red List of Threatened Species. Version 2018-1*. Available at www.iucnredlist.org (last accessed 10 January 2019).
- Karakaş, R. 2012. Does the Black-Winged Kite *Elanus caeruleus* (Desfontaines, 1789) have an expansion in its range in Turkey? *Acta Zoologica Bulgarica* 64(2): 209–214.
- Karakaş, R. & Biricik, M. 2018. On the status and distribution of the Ferruginous Duck *Aythya nyroca* in South-eastern Anatolia, Turkey. *North-Western Journal of Zoology* 14: 255–258.
- Keddy, P.A. 2010. *Wetland Ecology Principles and Conservation*. Cambridge University Press, Cambridge, UK.
- Keller, V., Herrando, S., Voříšek, P., Franch, M., Kipson, M., Milaneli, P., Martí, D., Anton, M., Klvaňová, A., Kalyakin, M.V., Bauer, H.-G. & Foppen, R.P.B. (eds.) *European Breeding Bird Atlas 2: Distribution, Abundance and Change*. European Bird Census Council & Lynx Edicions, Barcelona, Spain.
- Key Biodiversity Areas Partnership 2022. *Key Biodiversity Areas factsheet: Adıyaman-Gölbaşı Lakes*. Extracted from the world database of Key Biodiversity Areas. Developed by the Key Biodiversity Areas Partnership: BirdLife International, IUCN, American Bird Conservancy, Amphibian Survival Alliance, Conservation International, Critical Ecosystem Partnership Fund, Global Environment Facility, Global Wildlife Conservation, NatureServe, Rainforest Trust, Royal Society for the Protection of Birds, World Wildlife Fund and Wildlife Conservation Society. Available at <https://www.keybiodiversityareas.org/site/factsheet/9621> (last accessed 6 April 2022).
- Kılıç, D.T. & Eken, G. 2004. *Türkiye'nin Önemli Kuş Alanları – 2004 Güncellemesi*. [Turkey's Important Bird Areas – 2004 Update.] Doğa Derneği-BirdLife International, Ankara, Turkey.
- Kirwan, G.M., Martins, R.P., Eken, G. & Davidson, P. 1999. A checklist of the birds of Turkey. *Sandgrouse* (Supplement 1): 1–32.
- Kirwan, G.M., Boyla, K., Castell, P., Demirci, B., Özen, M., Welch, H. & Marlow, T. 2008. *The Birds of Turkey*. Christopher Helm, London, UK.
- Kirwan, G.M., Özen, M., Erturhan, M. and Atahan, A. 2014. Turkey bird report 2007–2011. *Sandgrouse* 36(2): 146–175.
- Korkmaz, H., Karabulut, M. & Gürbüz, M. 2008. Water potential of the Gölbaşı Lakes and their sustainable management. *Journal of International Environmental Application & Science* 3(5): 390–398.
- Ma, Z., Cai, Y., Li, B. & Chen, J. 2010. Managing wetland habitats for waterbirds: an international perspective. *Wetlands* 30: 15–27.
- Meriç, T. & Çağrankaya, S. (eds.) 2013. *Sulak Alanlar*. [Wetland Areas.] Ministry of Forestry and Water Affairs, General Directorate of Nature Conservation and National Parks, Department of Sensitive Areas, Wetlands Branch, Kayıhan Agency, Ankara, Türkiye.

- Ministry of Agriculture and Forestry. 2019. *T.C. Tarım ve Orman Bakanlığı Doğa Koruma ve Milli Parklar Genel Müdürlüğü, Gölbaşı Gölleri Tabiat Parkı Revizyon Gelişme Planı*. [T.R. Ministry of Agriculture and Forestry, General Directorate of Nature Conservation and National Parks, Gölbaşı Lakes Park Revised Development Plan.] Ministry of Agriculture and Forestry, Istanbul, Turkey. [In Turkish.]
- Mitsch, W.J. & Gosselink, J.G. 2007. *Wetlands*. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.
- Mullarney, K., Svensson, L., Grant, P.J. & Zetterström, D. 1999. *Collins Bird Guide*. HarperCollins, London, UK.
- Onmuş, O. 2007. *Türkiye Kış Ortası Sukuşu Sayımları 2007*. [Turkey Midwinter Waterfowl Counts 2007.] Doğa Derneği, Ankara, Turkey.
- Ramirez, F., Rodriguez, C., Seoane, J., Figuerola, J., & Bustamante, J. 2018. How will climate change affect endangered Mediterranean waterbirds? *PLoS One* 13: e0192702.
- Sebastián-González, E. & Green, A.J. 2016. Reduction of avian diversity in created versus natural and restored wetlands. *Ecography* 39: 1176–1184.
- Suseven, B., Onmuş, O. & İsfendiyaroğlu, S. 2006. *Türkiye Kış Ortası Sukuşu Sayımları 2006*. [Turkey Midwinter Waterfowl Counts 2006.] Doğa Derneği, Ankara, Turkey.
- Tokatlı, C. 2017. Bioecological and statistical risk assessment of toxic metals in sediments of a worldwide important wetland: Gala Lake National Park (Turkey). *Archives of Environmental Protection* 43: 34–47.
- Uçkun, A.A. 2018. Investigation of toxic metal contamination in water and sediments of Gölbaşı Lake (Adıyaman). *Adıyaman University Journal of Science* 8(2): 129–140.
- Zedler, J.B. & Kercher, S. 2005. Wetlands resources: status, trends, ecosystem services, and restorability. *Annual Review of Environment and Resources* 30: 39–74.
- Welch, H.J. (ed.) 2004. *GAP Biodiversity Research Project 2001–2003. Final Report*. Doğan Hayatı Koruma Derneği (DHKD; Turkish Society for the Conservation of Nature), Istanbul, Turkey.



Photograph: Gölbaşı Lake by Gökhan Büyük.