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Status of abundant bird species in Lake Qaroun, Egypt.

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Abstract:

Egypt is home to diverse lakes that serve as appropriate habitats for a vast waterbird population, providing temporary shelter during winter migration and permanent dwellings. Among these lakes, Lake Qaroun in Egypt is significant as an important bird area, a Ramsar site, and a protected area. The study aims to state the status of the most abundant species in the lake. Ten points were chosen to represent the lake and were coded from S1 to S10. Furthermore, our investigation revealed that among the avian population, particularly waterfowl, the slender-billed gull (*Larus genei*) was the most important waterbird species in the study area except S2 and S3 in which Northern shoveler (*Spatula clypeata)* was the most important bird species and S9 and S10 in which Greater flamingo (*Phoenicopterus roseus)* was the most important bird species. For resident birds, slender-billed gull (*Larus genei)* was the most important bird species in the study area, except S3, where *Egretta garzetta* (Little egret) was the most important bird species. While for migratory birds, the Northern shoveler (*Spatulawereypeata)* was the most important bird species in S2 and S3, Black kite (*Milvus migrans*) in S1, *Charadrius hiaticula* (ringed plover) in S4, S5, Eurasian coot (*Fulica atra*) in S6, S7, S8, and Greater flamingo (*Phoenicopterus roseus)* was the most important in S9 and S10. These findings illustrate the abundant avian diversity and ecological significance of Egypt's Lake Qaroun. The presence of uncommon and endangered species highlights the significance of protecting this valuable habitat through conservation efforts. Understanding the distribution and abundance of various bird species contributes to developing effective conservation strategies for this Ramsar site and its waterbird populations.

Keywords: Birds, resident, migratory, Egypt, Fayoum, Lake Qaroun.

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Introduction:

Egypt serves as a connecting link between the landmasses of Europe, Asia, and Africa. Each fall, millions of migratory birds travel through Egypt on their route to warmer climates in East and South Africa from Scandinavia, Eastern Europe, the Balkans, Siberia, and Central Asia through the Black Sea-Mediterranean and East Africa-West Asia flyways. **(Soliman *et al.*, 2012).** Egypt is home to approximately 515 species of birds, of which 186 are classified as resident while the remaining species are migratory **(Tharwat, 1997).** Lake Qarun is considered one of Egypt's most ancient lakes. The lake was referred to as Lake Moeris by the ancient Egyptians. Lake Qarun serves as a secure refuge and hospitable environment for numerous migratory avian species seeking an escape from the harsh winter conditions of Europe. During the reproductive period, the lake islets serve as an incubator and nurturing environment for infant birds. The southern shoreline of Lake Qarun, which falls within the boundaries of the Protected Area, is subject to extensive utilization for customary farming practices and, more recently, fish culture. The lake is frequently utilized by fishermen who employ rowing boats and nets to engage in their fishing activities **(Fouda & Fishar, 2012).** In fact, limited research has been conducted regarding the avian diversity of the lake, which gives great value to our work in filling this gap since the work of **Baha el Din, (1999)** and the report of **Fouda & Fishar, (2012)** on Lake Qaroun as a Ramsar site. The aim of the study is to highlight the most important (abundant) bird species in the study area and create a comparison between today's numbers and the past studies' estimates in order to estimate the health of the lake as a habitat for birds.

Materials and Methods

Study area:

Lake Qaroun is an endorheic saline lake in Egypt's Fayoum depression, approximately 90 kilometers southwest of Cairo **(Mageed, 2000; El-Sayed *et al.*, 2021).** The lake was developed during the Middle Kingdom of ancient Egypt as a water storage unit for drought periods **(Meshal, 1977).** Lake Qaroun has a surface area of about 202 km2 and a total shoreline length of 110 km at its maximum water level. The lake has a total water volume of 0.97 km, making it the third-largest lake in Egypt **(El-shabrawy *et al.*, 2014; Hassan, 2018).** Lake Qarun is surrounded by desert to the north **(Meshal & Morcos, 1984),** while

from the south, agricultural terrain with several settlements and holiday resorts covers Lake Qaroun. The lake basin has roughly 3 million people and more than 1600 km2 of agricultural area **(Seif *et al.*, 2023).** The El-Batts and El-Wadi drain are two agricultural drainage channels that provide most of Lake Qarun's input **(Al-Afify *et al.*, 2019).** Each year, both drains discharge into the lake around 3 billion cubic meters of water (**Medani *et al.*, 2015).**

Bird survey and sampling technique:

A monthly avian survey was carried out at ten key locations representative of the study area. Sites were selected between 30.8184 and 30.4352 longitudes and 29.51335 to 29.45651 latitudes **(Table. 1).** The selection of study sites was based on varying land use activities and habitat heterogeneity in the vicinity of the lake. The lake exhibits a distinctive ecological character in terms of its habitat. Point count survey methods were used **(Sheta, 2019).**

Statistical analysis:

A species importance curve was generated based on the abundance values of each species which were ranked, and a curve was generated using Microsoft 356 Excel.

Table. 1: coordinates of the study sites.

No.	Code	Latitude	Longitude
1	S1	29.51335	30.8184
2	S2	29.48319	30.81649
3	S3	29.4812	30.81323
4	S4	29.47886	30.71414
5	S5	29.46734	30.69968
6	S6	29.44429	30.65529
7	S7	29.43442	30.64121
8	S8	29.40598	30.49093
9	S9	29.4536	30.40655
10	S10	29.45651	30.4352

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Results:

Bird community composition and total abundance:

Slender-billed gull (*Larus genei*) was the most important species in the entire study area (7928 individuals). **Table. 2** showed the most important species in each site and the different groups of bird species that belonged to. The data showed that the abundant birds in the community were the following waterbirds: Slender-billed gull (*Larus genei*) was the most important species in S1, S4, S5, S6, S7, and S8 (1511, 1081, 302, 946, 363, 659 respectively). While *Spatula clypeata* (Northen shoveler) was the most important species in S2 and S3 (2610, 160 respectively) and *Phoenicopterus roseus* (Greater flamingo) was the most important species in S9 and S10 **(Fig 1).** For resident and migratory species, Slender-billed gull (*Larus genei*) was the most important resident species in all sites except for S3 in which *Egretta garzetta* (Little egret) was the most important resident species (**Fig 2).** Meanwhile, *Milvus migrans* (Black kite) the most important migratory species in S1 (391 individuals), *Spatula clypeata* (Northen shoveler) in S2 and S3 (2610, 160 individuals respectively), *Charadrius hiaticula* (ringed plover) in S4 and S5 (22, 60 individuals respectively), *Fulica atra* (Eurasian coot) in S6, S7 and S8 (122, 148, 371 individuals respectively), and Greater flamingo (*Phoenicopterus roseus)* was the most important in S9 and S10 (2199, 1723 individuals respectively) **(Fig 3).**

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Sites	Important species	ALL	Water birds	Important species	Resident	Important species	Migratory
S1	*Larus genei (Slender billed gull)*	1511	1511	*Larus genei (Slender billed gull)*	1511	*Milvus migrans (Black kite)*	391
S2	*Spatula clypeata (Northen shoveler)*	2610	2610	*Larus genei (Slender billed gull)*	1270	*Spatula clypeata (Northen shoveler)*	2610
S3	*Spatula clypeata (Northen shoveler)*	160	160	*Egretta garzetta (Little egret)*	113	*Spatula clypeata (Northen shoveler)*	160
S4	*Larus genei (Slender billed gull)*	1081	1081	*Larus genei (Slender billed gull)*	1081	*Charadrius hiaticula (ringed plover)*	22
S5	*Larus genei (Slender billed gull)*	302	302	*Larus genei (Slender billed gull)*	302	*Charadrius hiaticula (ringed plover)*	60
S6	*Larus genei (Slender billed gull)*	946	946	*Larus genei (Slender billed gull)*	946	*Fulica atra (Eurasian coot)*	122
S7	*Larus genei (Slender billed gull)*	363	363	*Larus genei (Slender billed gull)*	363	*Fulica atra (Eurasian coot)*	148

S8	*Larus genei (Slender billed gull)*	659	659	*Larus genei (Slender billed gull)*	659	*Fulica atra (Eurasian coot)*	371
S9	*Phoenicopterus roseus (Greater flamingo)*	2199	2199	*Larus genei (Slender billed gull)*	485	*Phoenicopterus roseus (Greater flamingo)*	2199
S10	*Phoenicopterus roseus (Greater flamingo)*	1723	1723	*Larus genei (Slender billed gull)*	1210	*Phoenicopterus roseus (Greater flamingo)*	1723

Table. 2: the most important (abundant) species in the study sites.

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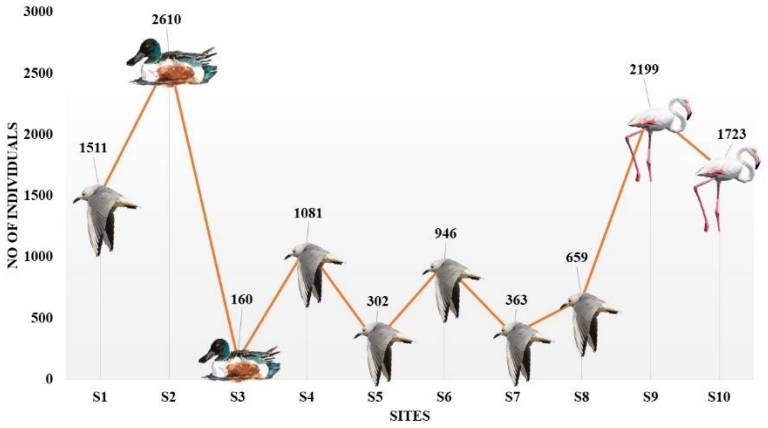

Fig. 1. The most abundant bird species of the general bird community and Waterbirds in each site.

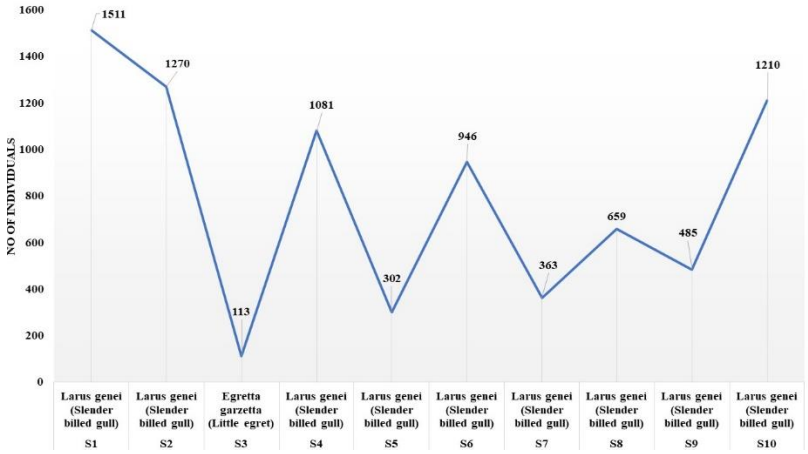

Fig. 2. The most abundant resident bird species in each site.

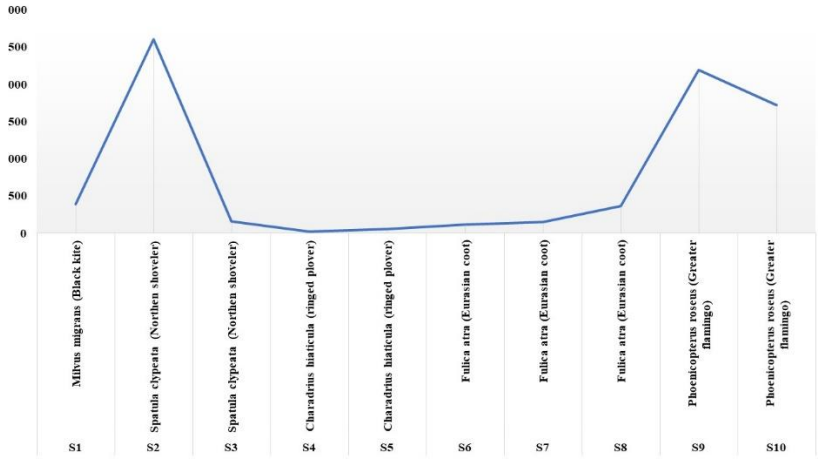

Fig. 3. The most abundant migratory bird species in each site.

Rare ornithological records:

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Table. 3 showed that two scarce migrant species were recorded in S8. White-headed duck (*Oxyura leucocephal*, Anseriformes: Anatidae) (one female) was recorded in March 2021 as the first record of this species in Egypt since 1996. The Graylag goose (*Anser anser*, Anseriformes: Anatidae) (three individuals) was recorded in November 2021 for the first time to record this species in El Fayoum governorate. Unfortunately, most of these recordings were hard to document with photos due to the very far distance of the species at the time and the disability of the used digital camera to capture them.

Table (3): The two scarce migrant species recorded during the study period in the different study sites.

Common name	Latin name	Site	Habitat type	Status	Date
White-headed duck	*Oxyura leucocephala*	S8	UrV	Vagrant (rare passer)	March 2021
Graylag goose	*Anser anser*	S8	UrV	Winter visitor	Nov 2021

Discussion and conclusion:

Over the last several decades, a lot of work has been put into sustaining biodiversity. However, the loss of biodiversity is still occurring at a remarkable pace, as shown by the continued decreases in population size and the global shrinkage of many species' ranges **(Pievani, 2014; Tittensor *et al*., 2014).** Hence, it was important to address the abundance of the most important bird species recorded in the lake to comprehend future conservation plans. Slender-billed gull (*Larus genei*) was the most important resident waterbird species in the lake. **Meininger and Atta, (1994)** were the first to mention the presence of a breeding population of slender-billed gulls in the lake, explaining its large numbers**.** The breeding population has undoubtedly increased with time. Little Egret's presence was strongly associated with the site S3. This site consisted of an open-water body and a rocky lake shore. Since the little egret is a shorebird that prefers wetlands **(Pang *et al.*, 2020),** it can explain it is the most important resident bird in this habitat.

Northern shoveler preferred open water habitats as a migratory waterbird species, thus being the most important in both S2 and S3. The fact that the Northern shoveler is a migratory dabbling duck explains its preference for open-water surfaces. **Herbert *et al.*, (2021)** explained that dabbling ducks' presence was positively associated with open-water habitats. They argued that many factors affected their distribution as surface water provides proper feeding and a safe place from predators. Yet, hunting activity remains a significant threat to these species**.** According to **Meinnger et al., (1981)** who agreed with the previous explanation, lake Qaroun is an important wintering ground for Northern shoveler. Yet, hunters were forming a major threat to the shoveler's population resulting in a decrease from 11686 individuals in the years 1979/80 to 2855 individuals in the entire study area during our study in 2021/2022. Black kite *(Milvus migrans)* was found to be the most important migrant species in site S1. The black kite is a species belonging to the Accipitridae family. It exhibits a wide geographical distribution across the Old World **(Gupta & Kanaujia, 2011).** As scavenger raptors, black kites frequently feed on human waste materials **(Pomeroy, 1975; Blanco, 1994 and 1997).**

The association of the presence of black kites in large numbers on this site is related to the presence of trees, agricultural and highly vegetated areas, and dumping grounds. **Haque et al., 2020** agreed with our justification as they found black kites roosting in trees and dumping grounds with trees being possible breeding sites. Thus, its elevated numbers might be an undiscovered breeding location in the trees of the mentioned site.

We found that ringed plover *(Charadrius hiaticula),* which is a late summer migrant, was associated with the sites S4 and S5. This is due to the habitat heterogeneity in these sites including marshy wetlands. These wetlands are perfect habitats for this wader species as they offer proper refuge and a secure place from predators **(Johnsgard, 1981; IUCN, 2016, 2019).**

The Greater Flamingo *(Phoenicopterus roseus)* is a species that exhibits partial migration, dispersal, and occasional nomadism. It is known to have a wide distribution across shallow brackish or saline lakes in the Mediterranean region **(Kahl, 1975; Johnson, 1997).** Although the Greater flamingo is a migrant species, it was recorded during all months of the study period. Moreover, its presence was strongly associated with the sites S9 and

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S10 which were located at the desert margin of the lake. A breeding population of greater flamingo was recorded by **Meinnger et al., (1981) in** another area in Egypt called Malaha which is a part of Lake Manzala, yet it was not officially recorded in previous literature at Lake Qaroun. Only some sights by the local residents and bird watchers were the only recordings of the greater flamingos in the lake. Thus, there is a massive gap in prior research documenting the presence of Greater flamingos in Lake Qaroun.

Eurasian coot *(Fulica atra)* was found to be the most important migratory species in S6, S7 and S8. These sites had different microhabitats including the open water body of a pond formed by agricultural wastewater, the lake's open water body, and densely vegetated areas. Thus, the importance of coots in this habitat can be attributed to their preferences of open water areas. Coots are aquatic birds that inhabit a variety of still and slow-moving bodies of water **(Taylor and Kirwan, 2020).** Aside from the reproductive season, they are extremely gregarious, forming wintering flocks of several thousand individuals **(Cramp and Simmons 1980; Šćiban et al. 2012).** They primarily consume aquatic vegetation, which they acquire through a variety of foraging techniques, such as dabbling, pecking, and diving **(Fortunati and Battisti 2011; Taylor and Kirwan 2020).** The White-headed Duck *Oxyura leucocephala* is endangered according to the IUCN Red List of Threatened Species. According to the latest update of the IUCN red list in October 2017 and BirdLife International, *Oxyura leucocephala* was marked as endangered species with only 5300-8700 adult individuals in the whole world, and it was recognized as a vagrant none breeding species that mainly favors inland wetlands **(BirdLife International, 2017).**

Due to habitat loss and hunting pressure, its range and population have significantly shrunk since the 1900s **(Green & Anstey 1992).** The White-headed Duck's global population was probably above 100,000 in the early 20th century, declining to an estimated 19,000 birds in 1991. Since then, its numbers have likely decreased to less than 10,000 individuals **(Green & Hughes, 1996).**

Meinertzhagen, 1930; **Urban, 1993** mentioned that over 40 individuals of *Anser Anser* were recorded in the Nile Delta lakes between 1925 and 1930. We recorded a female in March 2021 at Tunis village, where all the rare sightings occurred. It is one of the most important touristic villages in the lake. Graylag goose is considered 'least concern' by the latest update

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of the IUCN red list on 9 August 2018. It is a vagrant passer to Egypt, according to the IUCN red list **(BirdLife International, 2018). (Goodman & Meininger, 1989; Urban, 1993)** stated that the only record of graylag goose in Egypt was six individuals at Lake Maryut in January 1942. We recorded three individuals in March 2021 also at Tunis village. The rare recordings of this study were associated with UrV habitat. This might be attributed to the presence of open water and vegetated areas as microhabitats within this habitat type, supporting the basic needs of these species of food and refuge. Overall, it can be concluded that Lake Qaroun is a very reproductive habitat that is understudied regarding the status of its bird community. Our study tended to shed light on the most important abundant species present in the lake, hoping that the study could be a stepping stone to further research regarding avian conservation.

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