

FIRST SUCCESSFUL NESTING OF THE LITTLE EGRET *EGRETTA GARZETTA* IN GHARDAÏA (ALGERIAN SAHARA)

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Chedad A., Bouzid A., Samraoui B. 2022. First successful nesting of the Little Egret *Egretta garzetta* in Ghardaïa (Algerian Sahara). *Zoology and Ecology* 32(1), 68–73. <https://doi.org/10.35513/21658005.2022.1.8>

Article history

Received: 08 March 2022;
accepted: 02 June 2022

Keywords:

Algerian Sahara; Ardeidae;
breeding; Little Egret;
waterbird; wetland

Abstract. We report on the first successful breeding of the Little Egret, *Egretta garzetta*, in the Sahara, Algeria. We conducted a study on the nesting of this species at Kef Doukhane, an artificial wetland in Northern Sahara that has become an increasingly important nesting site for waterbirds. The number of individuals was monitored between April and October 2021 and the greatest abundance with 470 individuals was recorded in October. However, during breeding, the colony decreased to about 50 birds that built seven nests. Egg-laying started at the beginning of July and at least 34 eggs were laid. Clutches varied between 5 and 6 eggs, and 28 nestlings fledged, yielding a breeding success of 82.4%.

INTRODUCTION

The climate of Algeria is varied, ranging from the mild Mediterranean and subtropical to semi-arid and the hyper-arid of the Sahara (Samraoui and de Bélair 1998; Stevenson et al. 1988). It is due to this climate and landscape heterogeneity that the country has an abundant biodiversity. The varied landscape shelters a wide spectrum of aquatic habitats such as lakes, freshwater ponds, brackish marshes, lagoons, etc. (Samraoui and Samraoui 2008; Chedad et al. 2020a). Saharan wetlands are vital ecosystems, hosting several species of sedentary, wintering, and staging waterbirds (Bouzid 2017). The M'Zab region (Ghardaïa) and the northern Tadmait Plateau (El Ménéa) contain several wetlands, both artificial and natural (Chedad et al. 2020b, 2021a).

The ten species of Ardeidae recorded in Algeria (Isenmann and Moali 2000; Samraoui and Samraoui 2008) include: the Cattle Egret *Ardea ibis*, Grey Heron *Ardea cinerea*, Purple Heron *Ardea purpurea*, Black-crowned Night-heron *Nycticorax nycticorax*, Little Egret *Egretta garzetta*, Squacco Heron *Ardeola ralloides*, Eurasian bittern *Botaurus stellaris*, Little Bittern *Ixobrychus minutus*, and the Great Egret *Egretta alba*. Recently, the Western Reef-heron *Egretta gularis* has been added to the list (Telailia et al. 2018; Chedad et al. 2021a).

Globally, the Little Egret is classified as a species of least concern (LC) according to the IUCN red list of threatened species, characterized by a wide range (BirdLife International 2021). In Algeria, it has three different phenological statuses (sedentary nesters, passage visitors, and winter stopover) (Isenmann and Moali 2000; Samraoui and Samraoui 2008). Couples breed in north-eastern Algeria (Chatt, Dakhla, Mekhada, Tonga, and Lake Fetzara) and to the northwest, on the islet of Rachgoun (Orania) (Samraoui-Chenafi 2009; Samraoui et al. 2011; Ghermaoui et al. 2013; Chettibi et al. 2014). It is also observed during the two migratory passages (August to November and March to May) and winters all over the country including the Sahara: Ouargla (Ain El Beïda, Safioune, and Oum Raneb), Touggourt (Temacine Lake), El Oued, and El Meghaier (Oued Khrouf, Sidi Amrane, Tindla, Lalla Fatma, and Merja Hamraïa), Biskra (Outaya), Ghardaïa, and El Ménéa (Sebkhet El Maleh, Kef Doukhane, Oued Bir, Fayjet El Gara, Hassi Ghanem) (Isenmann and Moali 2000; Samraoui and Samraoui 2008; Samraoui et al. 2011; Farhi and Belhamra 2012; Bouzid 2017; Chedad et al. 2020b; Chedad 2021). The objective of this study is to present data related to the reproductive biology of the Little Egret at Kef Doukhane (Ghardaïa, Algerian Sahara).

MATERIALS AND METHODS

Study area

Kef Doukhane is a permanent artificial wetland, located north of Ghardaïa in the M'Zab valley. It was formed in 2012, after the creation of the wastewater treatment plant (STP) at El Atteuf (32°26'26.63"N; 3°48'38.44"E) on an area of 550 ha (Figure 1). The water depth in the wetland reaches up to 2.5 m. The dominant plant species include *Nicotiana glauca*, *Phragmites australis*, *Ricinus communis*, *Tamarix gallica*, with a significant range of spontaneous plants such as *Oudneya africana*, *Cynodon dactylon*, *Peganum harmala*, *Solanum nigrum*, *Retama raetam* (Chedad et al. 2020b).

The climate is Saharan with mild winters (the average minimum temperature is 11.5 °C and the average maximum equals to 35.5 °C), characterized also by low irregular annual precipitation varying between 50 and 70 mm (Chedad et al. 2021b).

Data collection

This study was conducted over a seven-month period, from April to October 2021. We carried out a selective count of the Little Egret individuals by direct observations with a telescope (20 × 60) and sometimes with a Nikon camera P900 (× 83). Once a nest was located, the geographical coordinates, date, status (old or recent), external and internal diameter, depth and nest height above water were recorded. Other measurements, such as water depth, vegetation height, the distance from a nest to open water, and nest building materials were also recorded. The laying date was calculated by backdating the known hatching date, assuming that the incubation period is 22 days (Hafner 1980). The R software (R Development Core Team 2022) was used to carry out descriptive statistics analysis such as means, standard deviations (SD), and ranges (min–max), which were computed to summarize reproduction data. Finally, using the version

10.8.1 of the ArcGIS software for Desktop: Esri®, we created a map representing the nesting sites of the Little Egret in Algeria.

RESULTS

The undertaken 13 counts revealed that the number of Little Egrets was fluctuating. The highest abundance was recorded in October with 470 individuals and the lowest in April with four individuals (Figure 2). This species was also accompanied by other Ardeidae, Recurvirostridae, and Scolopacidae.

At Kef Doukhane, on 17 August 2021, we noted seven Little Egret nests located in the middle of the water body (3°53'37.58"E, 32°24'30.09"N, 406 m). The nests were made of tree twigs and existing plants, such as *Phragmites australis*, *Typha* spp., *Nicotiana glauca*, and some annual plants. All nest supports were reed tufts (Figure 3). They were distributed over an area of 2.5 ha, the distance between the nests varying between 0.8 and 83 m. The external diameter of the nests varied between 40 and 52 cm (44.6 ± 3.8 cm), while the internal diameter varied between 30 and 36 cm (33.7 ± 2.2 cm). Nest height was between 8 and 10 cm (8.4 ± 0.7 cm). The nests were established at a height ranging from 12 to 57 cm (26.71 ± 18.16 cm) above the water and the vegetation height varied between 41 and 150 cm (111.71 ± 39.63 cm). Nests were located between 2.10 and 19 m (11.41 ± 7.33 m) from the open water and the water depth varied between 54 and 210 cm (122.86 ± 69.66 cm) (Table 1, Figure 3). One of the seven nests was found empty, but the other six nests contained two eggs and 28 nestlings that were alive and four other nestlings that were dead. Thus, at least 34 eggs must have been laid suggesting a minimum clutch size of 5.66 ± 0.52 ($N = 6$). According to our calculations, the eggs were laid in early July, with a clutch size varying between 5 and 6 eggs. The hatching period of the same

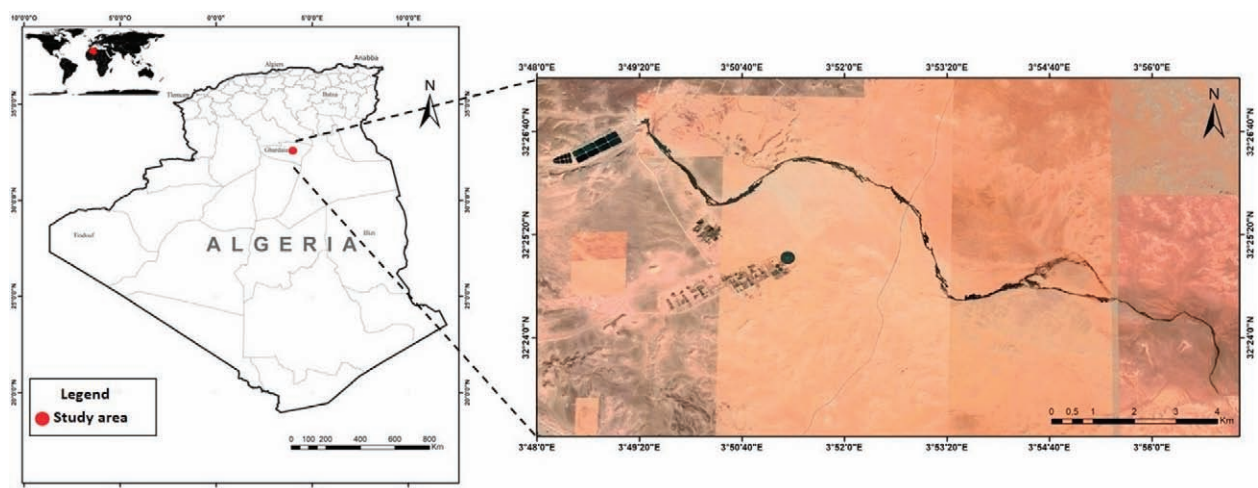


Figure 1. Location of Kef Doukhane wetland.

clutch was estimated to last 12 days (Figure 4). A total of 28 nestlings successfully fledged providing a nesting success of 82.4% (N = 6).

Throughout the monitoring period of the Little Egret at Kef Doukhane, we observed seven Ardeid species: Cattle Egret, Grey Heron, Purple Heron, Black-crowned Night-heron, Squacco Heron, Great Egret, and Little Bittern. The other bird species recorded at this site were the Glossy Ibis *Plegadis falcinellus*, Eurasian Spoonbill *Platalea leucorodia*, Greater Flamingo *Phoenicopterus roseus*, Black-winged Stilt *Himantopus himantopus*, Pied Avocet *Recurvirostra avosetta*, Mallard *Anas platyrhynchos*, Ferruginous Duck *Aythya nyroca*, and the Marbled Teal *Marmaronetta angustirostris*.

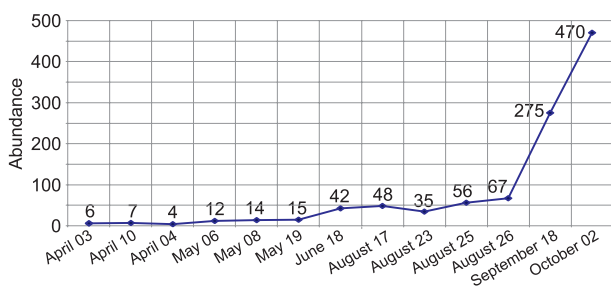


Figure 2. Changes in Little Egret abundance between April and October 2021.



Figure 3. Little Egret feeding its chicks.



Figure 4. Little Egret nest with four chicks and two eggs.

Table 1. Nest and vegetation measurements.

Variables Number	External diameter (cm)	Internal diameter (cm)	Nest height (cm)	Nest height above water (cm)	Vegetation height (cm)	Water depth (cm)	Distance nest–open water (cm)
1	45	35	8	15	41	85	1500
2	52	36	10	57	76	60	1600
3	46	30	8.5	48	130	54	210
4	40	32	8.1	12	110	73	360
5	43	33	7.8	13	150	180	570
6	42	36	8.2	22	135	198	1850
7	44	34	8.1	20	140	210	1900
Mean ± SD	44.57 ± 3.82	33.71 ± 2.21	8.39 ± 0.74	26.71 ± 18.16	111.71 ± 39.63	122.86 ± 69.66	1141.43 ± 732.70
Range	(40–52)	(30–36)	(8–10)	(12–57)	(41–150)	(54–210)	(210–1900)

and Lake Fetzara), the islet of Rachgun, in the northwest (Samraoui et al. 2011; Ghermaoui et al. 2013; Chettibi et al. 2014), and in northern Sahara at Kef Doukhane (Ghardaïa). The latter event is the first successful reproduction of the Little Egret recorded in the Algerian Sahara (Table 2; Figure 5).

The reproduction of the Little Egret in Mediterranean wetlands, including Spain, starts from the first fortnight of May (Galarza 2020), a different timeline than the one observed in the present study, where reproduction is rather late, starting around the beginning of July. The onset of egg-laying is often explained by synchroniza-

Table 2. Nesting sites of *Egretta garzetta* in Algeria.

Wetland	Geographic coordinates	Altitude (m)	Bioclimatic stage	Type	References
Dakhla (El Kala)	7°59'15.02"E 36°50'40.03"N	4	Humid	Natural	Samraoui et al. 2011
Mekhada (El Kala)	8°0'50.29"E 36°46'44.81"N	0	Humid	Natural	Samraoui et al. 2011
Tonga lake (El Kala)	8°30'7.03"E 36°51'20.92"N	0	Humid	Natural	Samraoui et al. 2011
Chatt (El Kala)	7°54'41.00"E 36°49'49.00"N	3	Humid	Natural	Samraoui et al. 2011
Lake Fetzara (Annaba)	7°30'57.02"E 36°47'31.77"N	12	Humid	Natural	Samraoui et al. 2011
Islet of Rachgoun (Aïn Temouchent)	1°28'48.00"O 35°19'17.00"N	50	Humid	Natural	Samraoui et al. 2011 Ghermaoui et al. 2013
Kef Doukhane (Ghardaïa)	3°53'40.05"E 32°24'30.85"N	407	Saharan	Artificial	Current study

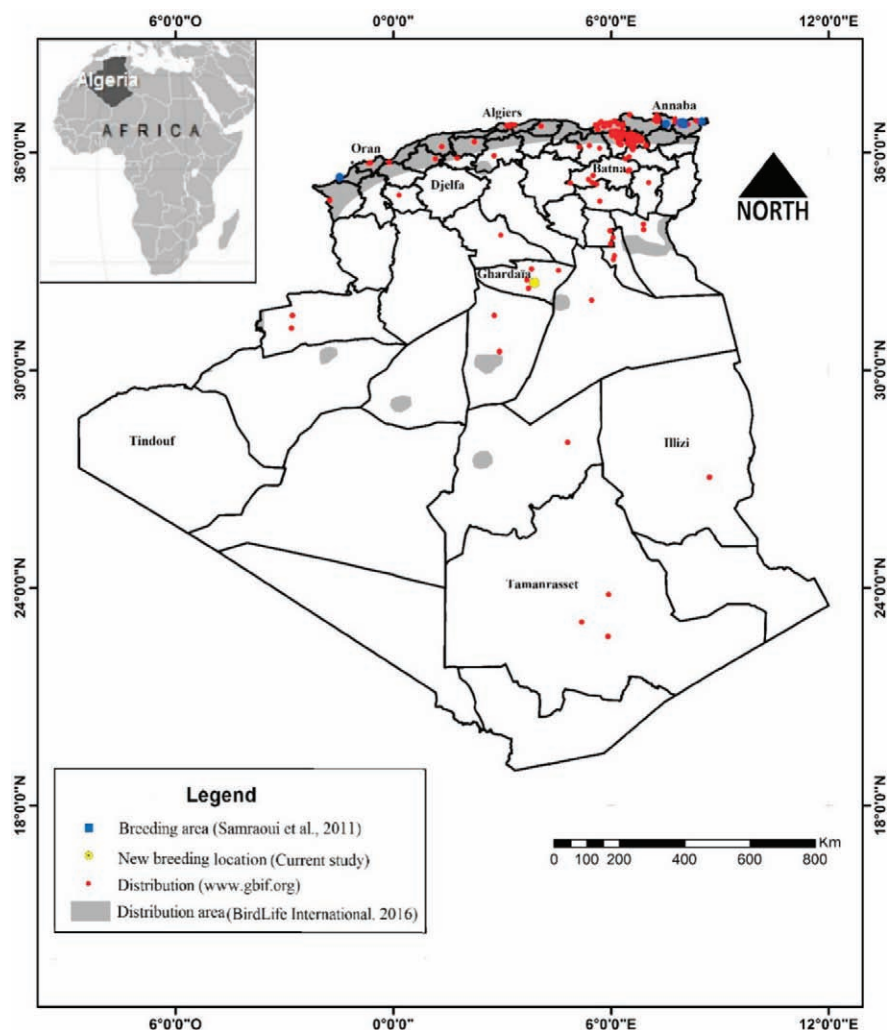


Figure 5. Distribution map of breeding and non-breeding sites of Little Egret in Algeria.

tion with food availability (Lack 1968; Murphy 1986; Meijer et al. 1999; Dunn 2004). Further investigations into the diet and breeding phenology of the resident waterbirds in the Sahara are warranted.

The recorded nest measurements are relatively close to those reported by Chettibi et al. (2014) (large diameter: 44.5 ± 9.09 cm, small diameter: 26.5 ± 6.6 cm, and depth: 5.5 ± 4.94 cm). Clutch size varies from 5 to 6 eggs (5.66 ± 0.52 ; $N = 6$); this parameter depends on the quality of food available and the body condition of the female (Hafner 1997).

Predation on the Little Egret nestlings, especially after their hatching, was recorded, with the Western Marsh-harrier *Circus aeruginosus* being the main predator responsible for the death of at least 6 nestlings. According to Galarza (2020), other predatory species preying on the Little Egret, such as the Peregrine Falcon *Falco peregrinus*, are absent from the northern Sahara. Contrary to expectations, the clutch size of the Little Egret recorded in the harsh Saharan climate was similar to that known from further north (Samraoui-Chenafi 2009). Herons nesting in coastal and marine habitats may have smaller broods than those in freshwater environments (Henny 1972; Maxwell and Kale 1977). However, the decreased competition for food resources due to the absence of other breeding herons (Samraoui et al. 2012) and the limited number of breeding pairs at Kef Doukhane can be considered as an important favourable factor.

CONCLUSION

This study reports the first recorded breeding of the Little Egret in the Algerian Sahara, in an artificial wetland (wastewater treatment plant) at Kef Doukhane. A total of 28 nestlings successfully fledged, resulting in a nesting success of 82.4%. The successful nesting of the Little Egret at the study site can be explained by the difficult site accessibility and the resultant relative absence of anthropogenic disturbance. The focus in the future will be on the monitoring of the breeding ecology of the Little Egret population at Kef Doukhane and in adjacent areas, as well as on the monitoring and studying of the breeding biology of some threatened species such as *M. angustirostris*, *A. nyroca*, and *T. ferruginea*.

ACKNOWLEDGMENTS

We thank two reviewers for their comments and suggestions. We also would like to thank the General Directorate of Forests and the members of the National Network of Algerian Ornithologist Watchers “R.N.O.O.A.”. The

support of the Algerian Ministry of Higher Education is acknowledged.

Conflicts of interest

The co-authors report no conflicts of interest.

Funding

This research did not receive any financial support.

Data Availability

The data used to support the findings of this study are included within the article.

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