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Breeding Biology and Success of the Little Egret *Egretta garzetta* in Karfestan Ab-bandan, Roudsar, Gilan Province, Northern Iran

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Abstract: The breeding ecology of the Little Egret *Egretta garzetta* was studied during the 2006 breeding season in Karfestan Ab-bandan, Gilan Province, northern Iran. The breeding parameters, namely egg-laying date, clutch and brood size, egg measurements, nest-site characteristics and breeding success were examined. The birds laid eggs from 28 March to 11 April. The average clutch size (98 eggs in total) was 4.26±0.81. Of these, 82.6% hatched and 80.6% fledged. On average, 3.43 chicks per nest reached fledging stage at this colony. In a dietary survey of the chicks following prey species were identified: Mole Cricket *Gryllotalpa gryllotalpa*, Walker *Chilo suppressalis*, Steppe Cricket *Gryllus desertus*, Asiatic Locust *Locusta migratoria*, Prussian Carp *Carassius gibelio*, Caspian Spined Loach *Sabanejewia caspia*, Riffle Minnow *Albumoides bipunctatus elchwaldi*, Carp *Cyprus* spp., European Catfish *Silurus glanis*, Common Grass Snake *Natrix natrix natrix* and Marsh Frog *Rana ridibunda.*

Keywords: breeding biology, breeding success, diet, *Egretta garzetta*, Gilan, Iran, Little Egret.

INTRODUCTION

The reproductive success of long-legged wading birds is of considerable interest to wildlife and land managers because these species are useful indicators of wetland productivity, trophic structure, human disturbance and contamination of wetland ecosystems (Custer & Osborn 1977). The breeding success in waterbirds changes remarkably depending on the inter- and intra-species relationships in the colony, food resources and predator pressure (Frederick & Collopy 1989). Their reproductive parameters may be the most sensitive bio-indicators of their population, community and ecosystem because they reveal primary responses to the environmental changes (Temple & Wiens 1989). Therefore, studying and monitoring breeding success can act as a good indicator of the quality of aquatic ecosystems for species dependent on them (Van Eerden *et al*. 1995).

The Little Egret *Egretta garzetta* is generally often been observed feeding on freshwater wetlands, rivers, shores, islands, farmlands and grasslands; and they nest on trees and shrubs (Cramp & Simmons 1977). So far, there has been a number of studies conducted on breeding activities of this species including Uzun *et al.* (2008) in Turkey, Hilaluddin *et al.* (2003) in Utter Pradesh, India and by Kazantzidis *et al.* (1996) and in the Axios Delta in Greece.

The Little Egret is distributed throughout Iran but breeds only in the southern part of the Caspian Sea basin, northwest Iran and in southern Iran in Khuzestan, Fars, and Sistan & Baluchestan Provinces (Mansoori 2008). In Gilan Province, this species is a fairly common breeding bird at wetlands, nesting in mixed colonies with other herons and egrets (Scott 2007). In the 1970s four colonies were reported in Gilan Province: Abbas-Abad Dam (40 pairs), Asalem (40 pairs), Anzali Wetlands (150 pairs) and Bandar-e Kia-Shahr (30 pairs) (Scott 2007). In recent years, this species has been observed in Gilan Province in all seasons; and bred in mixed colonies with other species of herons and cormorants in some areas of this province: Anzali wetland (150 pairs), Kiakolayeh wetland near Langarood (42 pairs), Alalan wetland near Asalem (28 pairs), Abbas-Abad wetland, Astara (54 pair) and Karfastan Ab-bandan near Roudsar (80–100 pair) (A. Ashoori, pers. obs.).

The aim of the present research was to study the breeding biology (in particular breeding success) of the Little Egret in Karfestan Ab-bandan in northern Iran.

Figure 1. Karfestan Ab-bandan (left) and Karfestan village (right), © Google Earth.

STUDY AREA

Karfestan Ab-bandan is situated in the 8 km south to Roudsar in Gilan Province on the south coast of the Caspian Sea (37°06'07.5″N, 50°15' 9.9″E, –6 m a.s.l.) and covers an area of about 7 ha. Streams and precipitation feed the Karfestan Ab-bandan, but in most years it dries up in August, September and October. About one third of this wetland is covered by Alder *Alnus glutinosa* trees, one third by Cattail *Typha angustifolia*, and the rest is open water. The Alder trees are between 4 and 7 m in height. The water depth of this wetland in breeding season is about 1–2 m in the margins and 10 to 70 cm amongst the trees (Fig. 1). Its waterbird breeding community includes Grey Heron *Ardea cinerea*, Black-crowned Night Heron *Nycticorax nycticorax*, Cattle Egret *Bubulcus ibis*, Squacco Heron *Ardeola ralloides* and Little Bittern *Ixobrychus minutes*. This area has never been covered by formal protection.

MATERIALS AND METHODS

This survey was carried out from 24 March to 1 June 2006. In 2006, the breeding population of Little Egret at this colony was about 80–100 pairs but only 23 nests were investigated because the other nests were inaccessible. Nests were detected from a boat, the observer using a pair of 8×32 Swarovski binoculars. When a nest was found, it was tagged by a numbered wooden plaque. Nests and their contents were monitored at intervals of 3, 5, 6 and 7 days. During each visit, nest contents were recorded and nest parameters, including outer greater diameter, outer lesser diameter, as well as the height of nest and nest cup were measured by measuring tape. The length and width of eggs were measured using vernier callipers. The mass and egg shape index were calculated by the formula: $V(cc) = K \times L\ (cm) \times B^2(cm)$ where L indicates maximum length, B is maximum breadth and K is constant (0.51) as the Egg shape index = $B/L \times 100$ defined by Hoyt 1979. Nestlings were divided in two categories and defined as newly-hatched and downy nestlings (lacking the ability to move around – usually up to 10 days old), post-nestlings (having lost their down and being able to move around the nests and on to adjacent branches – usually aged between 10 and 20 days still not unable to fly). To calculate the rate of breeding success, the number of nests, eggs and nestlings were compared between clutch sizes and the numbers of chicks based on post-nestlings or average rate for different breeding stages (Smith & Renken 1993). The statistical analyses were performed using SPSS software (Norusis 1990). The diet of the pulli, based on food remains inside the nests and beneath the trees, was examined. Additionally, the crop contents regurgitated after the observer approached were also examined. Food items were classified as fish, reptile, amphibian, and insects. The fish body lengths were measured by measuring tape (cm).

RESULTS

After the initial visit to the heron breeding colony in Karfestan Ab-bandan in 2005, 342 nests were counted (98 Little Egret, 87 Black-crowned Night Heron, 157 Cattle Egret and one Grey Heron). In 2006, the nest composition was

92 Little Egret, 89 Black-crowned Night Heron, 159 Cattle Egret and one Grey Heron.

Breeding biology

The nests were constructed between24 March to 6 April. All 23 studied nests were built on Alder trees. There was also a colony on trees beside Karfestan Ab-bandan. Nests were constructed mainly of Alder twigs. The mean height of nests above water level was 3.07±1.04 (Min=1.8, Max=5.3, *N*= 23) (Table 1).

The first eggs were laid on 28 March and the last on 11 April. The clutch size averaged 4.26±0.81. Nests containing four eggs all were built more than three meters above the water level while nests with 3 and 6 eggs happened to be all less than three meters above the water level. The mean length of eggs was measured as 45.82±1.82 mm (*N*=89, Max. 50.1, Min. 40.4), and the mean width of eggs was 33.88±1.23 mm (*N*=89, Max. 39.9, Min. 30.7). The mean egg volume was 26.89±2.48 and average egg shape index was calculated as 74.05±3.47 (Table 2).

The first egg hatched on 18 April and hatching continued until 10 May. The chicks reached the post-nestling stage on 5–18 May, when they left the nests, but were yet unable to fly. On 22 May, the first fledglings flew, and by late May (25–30) all fledglings had departed the nests (Fig. 2). The period between hatching and fledgling is estimated about 5–7 weeks.

Breeding Success

Of 98 eggs, 81 eggs hatched and 79 chicks reached their post-nestling stage, resulting in a breeding success of 80.6%. The lowest breeding success was observed in the clutch sizes of 4 and 5 (77.5%). The mean brood per nest reaching the post-nestling stage was 3.52 (SD = 0.95) for eggs and 3.43 (SD = 0.94) for nestlings respectively (Table 3). The mortality rate before the hatching period was 0.77% and during the nestling period was 0.09% (Table 3).

Chick diet

The nestling diet comprised four insect species (52%), five fish species (30), one reptile (10%) and one amphibian (8%). Little Egrets consumed both larvae and adults of three insect species (*Gryllotalpa gryllotalpa, Chilo suppressalis* and *Gryllus desertus)*. Among the different insect species, Mole Cricket *Gryllotalpa gryllotalpa* was the most frequent item in their diet (28%). Among the fish species, three species of Cyprinidae (18%) and one species of Cobitidae (9%) were the most common prey (Table 4).

Table 1. Mean±SD of nest parameters of Little Egret in the Karfestan Ab-bandan breeding colony in 2006.

Parameter	Mean±SD	Min.–Max.
External greater diameter of nests (cm)	36.75±4.43 (N=12)	30–43
External lesser diameter of nests (cm)	19.66±2.63 (N=12)	14–24
External height of nests (cm)	31.85±5.03 (N=12)	21–48
Height of nests above water surface (m)	3.07±1.04 (N=23)	1.8– 5.3
Height of canopy above nests (m)	3.26±1.17 (N=23)	2.5–4.10

Table 2. Egg parameters of Little Egret in 2006 at Karfestan Ab-bandan.

Clutch size	Frequency (%)	Length (mm)	Width (mm)	Egg V (cm^3)	Egg shape Index
3	13.5 (12)	46.25±2.25	34.72 ±2.38	27.72±4.54	73.99±5.42
4	43.8 (39)	45.89±1.77	33.25±0.71	25.89±1.49	72.55±3.06
5	36 (32)	45.28±1.65	34.37±0.74	27.32±1.93	75.96±2.35
6	6.7(6)	46.88±1.22	34.75±1.00	29.36±2.26	73.85±1.34
Average		**45.82±1.82**	**33.88±1.23**	**26.89±2.4**	**74.05±3.47**

Table 3. Breeding success in different stages of nests and clutch sizes of Little Egret in 2006 at Karfestan Ab-bandan.

Clutch size	Frequency (nest number)	Hatched eggs	Eggs reached Post-Nestling stage
3	17.4% (4)	91.6% (11)	91.6% (11)
4	43.5% (10)	80% (32)	77.5% (31)
5	34.8% (8)	80% (32)	77.5% (31)
6	4.3% (1)	100% (6)	100% (6)
Total Breeding Success	**100 (23)**	**82.6% (81)**	**80.6% (79)**

Table 4. Diet of Little Egret chicks at Karfestan Ab-bandan, Roudsar, Gilan, 2006.

Family	Species	Percentage of occurrence in the diet (%)	Length (cm) ±SD
Gryllotalpidae	*Gryllotalpa gryllotalpa*	28	-
Pyralidae	*Chilo suppressalis*	9	-
Gryllidae	*Gryllus desertus*	9	
Acrididae	*Locusta migratoria*	6	-
Cyprinidae	*Carassius gibelio*	9	9.6±0.88
Cyprinidae	*Albumoides bipunctatus elchwaldi*	6	5.6±0.64
Cyprinidae	*Cyprus* spp.	3	6.4±0.87
Cobitidae	*Sabanejewia caspia*	9	6.1±0.53
Siluridae	*Silurus glanis*	3	24.4±2.1
Coluberidae	*Natrix natrix natrix*	10	48+3.4
Ranidae	*Rana ridibunda*	8	-

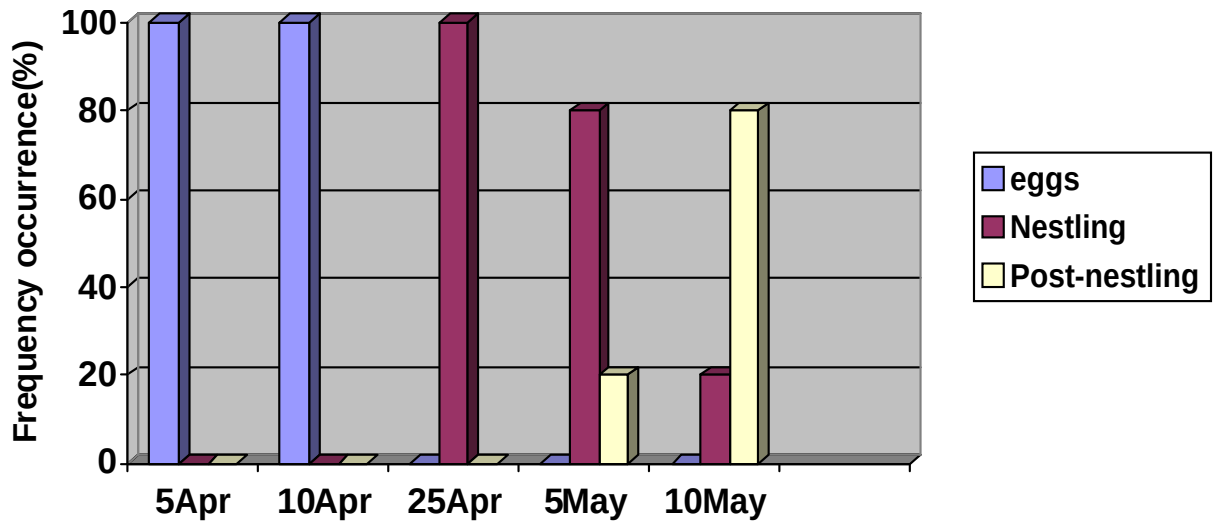

Figure 2. Breeding phenology of the Little Egret colony at Karfestan Ab-bandan, northern Iran.

DISCUSSION

Breeding of the Little Egret in Karfestan Ab-bandan in 2006 started late March and lasted to the end of May and early June. In a comparable habitat in Amroha, India in 2001 breeding took place from late May to the end of August (Hilaluddin *et al.* 2003).

The mean clutch size (4.26) fell within the range of mean sizes from comparable studies. For breeding sites, in Spain it is reported 4.9 (Inoue 1985) and 4.8 (Valverde 1955–56 in Cramp & Simmons 1977), in Serros, Greece 4.7 (Tsahalidis 1990), in the Axios Delta, Greece 4.3 (Kazantzidis *et al*. 1997) and 4.1 (Kazantzidis *et al.* 1996), in Uttar Pradesh, India 3.22 (Uddin *et al.* 2003) and in Turkey 3.17 (Uzun *et al.* 2008). The clutch size of 4 was the most frequent in the present study (43.5% of 23 nests) followed by 34.8% for clutch size 5. In India, 39% of nests of Little Egrets contained more than 4 eggs, 39% with 3 eggs and 22% with 1 or 2 eggs (Hilaluddin *et al.* 2003). However, clutch size in birds is often dependent on the age of parents – younger parents lay fewer eggs (Coulson 1966, Klomp 1970, Coulson & Porter 1985). Little Egret clutch size also depends on the quality of diet and the female's body condition (Hafner 1997). Many studies remain to be undertaken on these matters.

The reproductive success of waterbirds varies depending on the species composition of the colony (Frederick & Collopy 1989). Interspecific and intraspecific aggression by means of results in many chicks and juveniles falling from the nests of Little Egret was probably the most important factor in the reduction of breeding success (Table 3) – siblings in the same nest and adults of adjacent nests were involved in interspecific aggression and both adults and juveniles of Black-crowned Night Heron were involved in intraspecific aggression. Of all eggs, 82.6% (81 eggs) hatched. 79 of the chicks reached post-nestling stage, 80.6% of all eggs laid. These values were 51.7% and 40.8% respectively in India (Hilaluddin *et al.* 2003). In Turkey the numbers varied annually from 84.1% to 97.4% in the 2002–2005 period, while fledgling success varied from 74.3% to 88.5%. In Turkey fledgling and reproductive success for smaller clutch sizes (2–3 eggs) was higher than for larger clutches (4–5 eggs) (Uzun *et al*. 2008). However, in herons and egrets, fledging success per egg has been shown not to be significantly related to clutch size (Pratt & Winkler 1985). Growth rates of the young are, in contrast, often correlated with nestling survival (Spahn 1997). Nestling survival is presumably dependent on the quality of prey items in the diet, mainly during the peak of their development period (Kazantzidis *et al*. 1996).

In Greece, the most important prey category was fish (39.6%) followed by insects (32.1%) and amphibians (24.9%) (Kazantzidis & Goutner 2005) while in the present study, insects were more frequent than fish, reptiles and amphibians in the chick's diet. *Chilo suppressalis* is considered as rice pests (Khanjani 2005). When study began, local people from Karfestan village were uncomfortable with herons breeding, especially the Little Egret, because in this region the breeding season and rice transplantation coincide, the egrets being thought to damage the rice paddies while foraging. However, after gathered food residues of chicks had been shown to local people, they no longer saw the bird as a threat.

CONCLUSION

With a small change in ploughing and transplantation times of rice paddies, the Little Egret could potentially be integrated into the fields as a biological control agent for rice pests. Planting trees such as Alder *Alnus glutinosa* to provide nesting opportunities around rice fields could possibly increase the breeding population of the Little Egret in rice fields within Integrated Pest Management (IPM) programmes. Such programmes should involve input by the Iranian Research Institute of Plant Protection, the Plant Protection Organization, the Rice Research Institute and the Department of the Environment. We therefore suggest supplementary studies on trophic levels in lowlands south of the Caspian Sea to be conducted. Such studies would not only help the development of conservation plans, but could also prove invaluable in the education of the local people about wildlife, including the Little Egret. The locals will

certainly benefit from this education and interaction, sometimes in unexpected ways.

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