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Breeding Biology and Success of the Western Reef Heron *Egretta gularis* on Nakhiloo Island, Persian Gulf

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Abstract: A study of the breeding performance of the Western Reef Heron *Egretta gularis* was carried out on Nakhiloo Island in the Persian Gulf from March to September 2008. A total of 92 pairs nested on the island in four colonies. The breeding success during the incubation, nestling and post-nestling stages was 62.1%, 46.4% and 39.2%, respectively. Overall breeding success (the proportion of eggs laid that were successfully reared to fledging) was 39.2%, for 60 fledglings (*N*=153 eggs). Predation on eggs by Black Rats *Rattus rattus*, high temperatures and desertion due to unknown reasons were the most important causes of breeding failure. The average weight of the chicks was 22.19±0.61 g at hatching and 590±10 g at fledging.

Keywords: Breeding, *Egretta gularis,* Nakhiloo Island, Persian Gulf, survival, Western Reef Heron.

INTRODUCTION

The Western Reef Heron *Egretta gularis* occurs mainly on the coasts in tropical West Africa, the Red Sea, the Persian Gulf and east to India but vagrant individuals have been recorded as far away in Brazil, the Caribbean and North America (Birdlife International 2009). This medium-sized heron inhabits coastal areas, mainly on rocky or sandy shores and reefs, but is also found around estuaries, mudflats, salt marshes, mangroves, tidal creeks and lagoons (del Hoyo *et al.* 1996). It forages solitarily, although it is occasionally found in small groups (Grewal *et al.* 2002). It usually feeds by day, but also occasionally at night, depending on the tides, and roosts at night in large numbers of between 500 and 1,000 individuals in mangroves or on rocky cliffs and islets.

The taxonomy of this species is being seriously questioned. There are three subspecies: *E. g. gularis*, *E. g. schistacea* and *E. g. dimorpha*; all of them seem to be less closely related than formerly believed. This thin, medium-sized heron occurs in two distinct forms, one of which has mostly dark slaty-grey plumage and a white throat while the other has predominately white plumage (del Hoyo *et al.* 1996, Grewal *et al.* 2002).

The species nests in colonies. Nests are built by both sexes, and are located in a tree, on a rock ledge, under shrubs or on the ground (Cramp & Simmons 1977). The clutch is two to four greenish blue eggs. Incubation takes about 25 days and it is carried out by both parents. The young leaves the nest when they are about 30 days old. In Iran, the Western Reef Heron breeds in coastal wetlands and on offshore islands from Govater Bay in the extreme southeast to Khoor-e Musa in the southwest (Behrouzi-Rad 2009). It is one of the breeding birds of Nakhiloo Island.

STUDY AREA

Mond Protected Area, which includes Nakhiloo, Om-Al-Goram, Tahmadon and Khan Islands, is located in the south of Iran at a distance of about 180 km from Bushehr (27°15'N, 51°35'E; Fig. 1) Nakhiloo Island, 140 km to the southeast of Bushehr and 40 km west of Dayer, lies between 27º49'19"N to 27º49'47"N and 51º27'54"E to 51º28'16"E, and covers about 35 ha. The highest point of the island is 3 m a.s.l. The land is covered mainly by *Atriplex* and *Salsola* ssp. Nakhiloo Island is one of the most important areas for breeding

Western Reef Herons in Iran and also one of the 105 Iranian Important Bird Areas (IBAs) (Evans 1994, Behrouzi-Rad 2009).

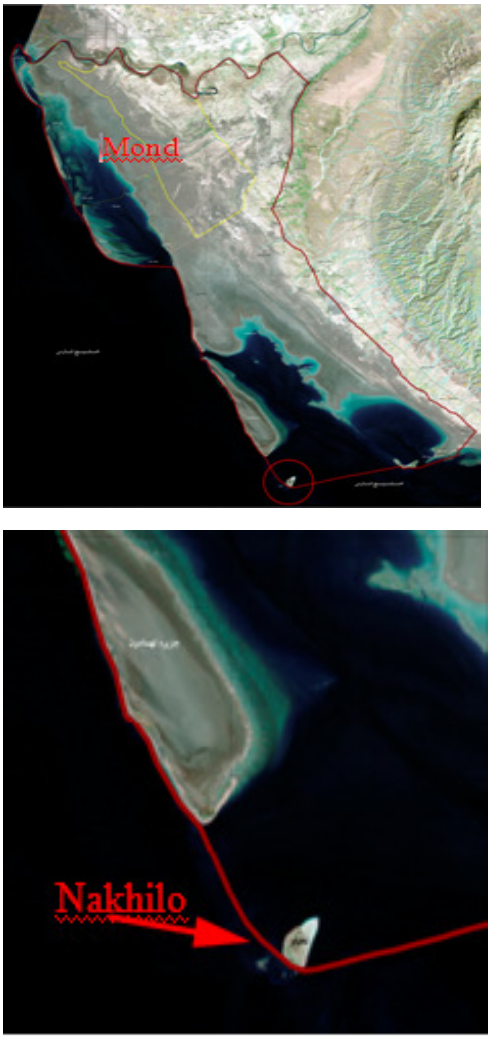

Figure 1. Geographical situation of Mond Protected Area and Nakhiloo Island.

METHODS AND MATERIALS

Field work was conducted once a week from the beginning of nest-building (March) to fledging (September) in 2008. According to field observations, Western Reef Herons arrive on Nakhiloo Island in mid-March and depart in early September. A total of 92 nests were counted in 2008, in four colonies: 16 nests at 27°49́'17.5"N, 51°28́'13.3"E, 19 nests at 27°49'15.5"N, 51°28'11.5"E, 47 nests at 27°49'19.5"N, 51°28'13.8"E, and 10 nests only 8.5 m from the latter. The largest of these colonies, with 47 nests, was selected for detailed study. Those nests selected for study (*N*=47) were identified by numerical tags, and some parameters such as the diameter of the nest and the distance between nests were measured with a measuring tape. The Total Count Method (Symens 1996) was used to determine the number of breeding pairs. After the beginning of egg-laying, in each of the marked nests the length and diameter (breadth) of the eggs were measured using calipers (±0.1 mm) and the eggs were weighed to the nearest 0.1 g using digital scales. The volume of the eggs was determined using the equation V=k L (cm). B² (cm), where, L is the length of the egg, B is the diameter or breadth of the egg and k is the coefficient 0.4866 (Hoyt 1979). The index of egg shape (B÷L.100) was also determined (the greater the index of egg shape, the more spherical the egg).

Chicks (*N*=60) in the marked nests were weighed at hatching and every week thereafter (a red colour was used to distinguish them). By regular checking of the marked nests, it was possible to record the number of eggs that hatched, the number of nestlings that survived to leave the nest, and the number of young birds that eventually fledged successfully (Scarton 1994, Symens 1996). We defined Nestling, Post-nestling and Fledging as follows: Nestling = less than 10 days old, or unable to leave the nest; Post-nestling = 10–25 days old, or able to leave the nest but unable to fly; Fledging = more than 25 days old, or able to fly.

RESULTS

Nest characteristics

On Nakhiloo Island, Western Reef Herons build their nests on the top of the tallest *Atriplex* bushes averaging 62.75±1.81 cm in height. In 2008, the birds nested in the southeast part of the island, but during the period 2005–2007, the birds bred on tall bushes in the southwest of the island. The nests are constructed with pieces of *Suaeda fruticosa*, *Atriplex leucoclada* and *Arthrocnemum macrostachyum*. The mean diameter of the nests was 38.42±0.53 cm, and the mean width of the nests was 27.59±0.38 cm. The mean circumference of the nests was 107.03±2.7 cm and the mean perimeter of the nest cups was 45.63±0.86 cm. The mean

thickness of the nests was 13.14±0.31 cm (*N*=47). The maximum distance between nests was 8.50 m while the minimum distance was only 80 cm.

Eggs

Egg-laying took place between mid-May and mid-June and the chicks left their nests between late June and late August and then remained on the island until September. The nesting season of nominate *gularis* falls between April and August in all part of its range (Hancock *et al.* 1978). The mean clutch size was 3.2. Clutch size ranged between 1 and 5 (Table 1). Clutches of three eggs were the most frequent (51.06%) (*N*=24). The average weight of the eggs was 27.38±0.09 g (*N*=153). The average length and breadth of the eggs were 47.02±0.16 mm and 34.12±0.08 mm, respectively. The average volume of the eggs was 26.63±0.17 cc and the index of egg shape was 72.35±0.32 (*N*=153). Other authors have reported egg measurements of 44×32 mm in nominate *gularis*, 44.9×34.3 mm in *schistacea* (*asha*) and 46.5×33.6 in *dimorpha* (Hancock *et al.* 1978).

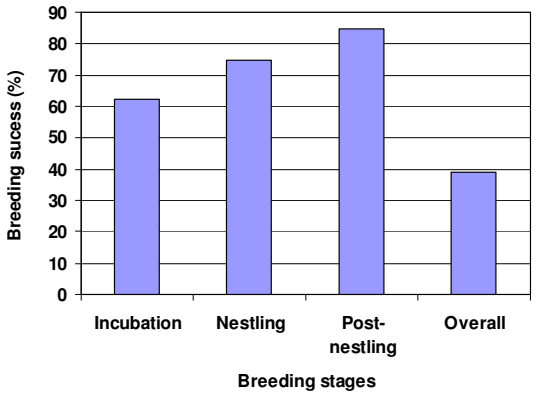

Figure 2. Breeding success of *Egretta gularis* on Nakhiloo Island in 2008 (*N*= 153 eggs).

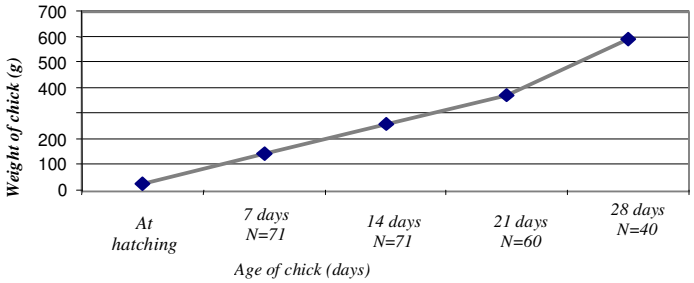

Figure 3. Relationship between age and weight of chicks of *Egretta gularis* on Nakhiloo Island in 2008.

Breeding success

Hatching success, *i.e.* the proportion of eggs laid that hatched, in 47 nests was 62.1% (95 chicks from 153 eggs), success in nestling 74.7% (*N*=71 nestlings from 95 chicks), success in post-nestling 84.5% (*N*=60 post-nestling from 71 nestlings) and overall success from egg-laying to fledging 39.2% (Fig. 2). The average weight of the chicks at hatching was 22.19±0.61 g (*N*= 95), at seven days old, 140.91±12.3 g (*N*=71), and at 14 days old, 251.63±14.9 g (*N*=71) (Fig. 3). Egg loss in 47 nests (*N*= 153 eggs) was thus 37.9%; nestling mortality was 25.3%; and post-nestling mortality was 15.5%.

Table 1. Clutch sizes of *Egretta gularis* on Nakhiloo Island in 2008.

Clutch size	One egg	Two eggs	Three eggs	Four eggs	Five eggs	Total
Number of nests	2	4	24	14	3	47
Frequency (%)	4.2	8.5	51.1	29.8	6.4	100

DISCUSSION

Population

The Western Reef Heron is widespread along the Persian Gulf and Oman sea coasts. Its wintering population in Bushehr Province has been estimated at about 500 individuals and its breeding population at about 20 pairs on Sheedvar Island, 20 pairs on Gabre-Nakhoda Island, 18 pairs on Ommal-Gorm, 10 pairs on Hormoz Island, 70 pairs on Khan Island and 92 pairs on Nakhiloo Island (Behrouzi-Rad 2009). On Nakhiloo Island, the population of Western Reef Herons increased from 10 to 44 breeding pairs during the period 2005–2007 (Behrouzi-Rad & Tayfeh 2008). On the southern coast of the Persian Gulf, over 350 pairs nest around Hawar close to areas where large numbers of herons congregate to catch fish in the shallows (Gallagher & Rogers 1978, Gallagher *et al.*1984).

Breeding season

The breeding season of the Western Reef Heron is between April and August in all parts of its range, except for one January record in eastern Nigeria (Cramp & Simmons 1977). On Nakhiloo Island, it is the only breeding heron. Here it is associated with Lesser Crested Tern *Sterna bengalensis*, Swift Tern *Sterna bergii* and Bridled Tern *Sterna anaethetus* (Behrouzi-Rad & Tayfeh 2008). Breeding activity begins in mid-April and the birds leave the island in early September. Birds begin to arrive at the breeding grounds in mid-April; courtship and nest-building begin in early March, and egg-laying begins in late March, In Hara Protected Area in the southern Persian Gulf, egg-laying was from 21 March to 17 April in 2008 and from 28 March to 28 April in 2009 (Etezadifar *et al.* 2010).

Nest

On Nakhiloo Island, the nest was a rough platform constructed from the twigs of *Suaeda fruticosa*, *Atriplex leucoclada* and *Arthrocnemum macrostachyum*. The length of twigs was about 50 cm. It was difficult to obtain exact dimensions of the nests due to their untidy construction. The nests are usually round or oval in shape, with a shallow depression in the centre. In Hara Biosphere Reserve, the mean internal diameter of nests was 40.8±0.8 cm (N=78) and the mean nest height from the ground was 153.3±2.86 cm as measured for 141 nests, while about 50% of the nests were located at a distance of 10–20 m from the mangrove forest border (Etezadifar *et al*. 2010).

Clutch

The clutch of pale blue eggs varies from 2 to 3 in *dimorpha*, and 3 to 5 in the other subspecies (Cramp & Simmons 1977; Table 1). On Nakhiloo Island, 93.4% of the eggs were light blue and 6.5% were white or light green. The mean clutch size in the present study was 3.26; the maximum clutch size was 5 (6.4%) and the minimum was one (4.2%, Table 1). The mean clutch size in Hara Biosphere Reserve in 2008 and 2009 combined was 3.37±0.05 and the mean brood size was 2.0±0.1 for all clutches (Etezadifar *et al.* 2010).

Table 2. Comparison of egg parameters of *Egretta gularis* on Nakhiloo Island, Iran, and in Africa (Cramp & Simmons 1977).

Studied parameters of eggs	Nakhiloo Island	Africa
Length	47.02 mm	47
Breadth	34.22 mm	34
Weight	27.38 g	29
Incubation period	22-25 days	23–26

Egg

The average length and breadth of Western Reef Heron eggs on Nakhiloo Island (length 47.02±16 mm and breadth 34.22±.08 mm) did not differ significantly from measurements taken in Africa (47×34 mm; Cramp & Simmons 1977). The weight of eggs on Nakhiloo did not show a significant difference from the samples in Africa (P>0.05) (Cramp & Simmons 1977; Table 2).

Incubation

Western Reef Herons lay their eggs at intervals of one or more days and incubation begins only when the clutch is complete. The eggs are incubated by both sexes for 20–25 days (Grewal *et al.* 2002). On Nakhiloo Island, the eggs were incubated by both sexes for 22 to 25 days.

Chick

The semi-altricial young stay in the nest for about 30 days (Grewal *et al.* 2002). Milon (1946) found that *dimorpha* chicks began clambering out of the nest after about 15 days but were incapable of flight for another month. On Nakhiloo Island, the chicks begin clambering out of the nest after 10 to 15 days, returning only when a parent bird approaches with food. The young birds can fly after 45–55 days. The beak becomes paler and the down on the head stands upright like a crest. The ring around the iris appears white, the belly is pale, the bottom half of the legs is green and the top half of the legs is grey with greenish rings (Behrouzi-Rad & Tayfeh 2008). The chicks are cared for and fed by both sexes (Hancock *et al.* 1978). Mortality of chicks was higher during the post-nestling stage than at any other time.

Survival

Nakhiloo Island is a safe place for Western Reef Herons to breed as it is an uninhabited island about 30 km from the coast with no natural predators. When the eggs first hatch, one parent normally stays close to the nest and can often be seen shading the chicks with its body. Overexposure to the hot sun poses a threat to young chicks, but both parents will often leave their chicks for extended periods when they go off to fish (Kushlan & Hancock 2005). The possibility of limited disturbance by humans cannot be ruled out, but it is thought that this would be, at most, of a minor nature.

CONSERVATION

This species has an extremely large range and relatively large population size, and the population trend appears to be stable. For these reasons the species is evaluated as Least Concern (BirdLife International 2009).

The Western Reef Heron does not suffer from hunting in Iran. It remains common in the Persian Gulf and on Oman Sea coasts, and does not appear to be under threat, although it does not receive any special protection in Iran. However it is suggested that long-term studies be carried out on the breeding colonies on Nakhiloo Island to monitor populations trends and breeding success, and that a ringing programme be initiated. Training and public awareness programmes should be developed, in particular to raise the awareness of local people and fishermen about the island's ecological values and the need for effective protection of the island's habitats by publishing brochures, making films and producing other promotional material about in these areas.

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