

Recent breeding record and parental care behaviour of Glossy Ibis *Plegadis falcinellus* in the Assam state, India

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Abstract Glossy Ibis *Plegadis falcinellus* is one of the most cosmopolitan bird species, with its range of distribution undergoing frequent changes. However, many aspects of its ecology are still unknown. We used the focal sampling method on three nests to study male and female parental care roles during the pre- and post-hatching period and the nestlings' activities. Also, we conducted count surveys of the species in the Kamrup district of Assam, India. Our findings suggest that female parents devote more time than male parents to incubation (during the pre-hatching period) and brooding (after hatching). However, male parents and first-born chicks would spend more time perching in the nest. Count surveys, with up to 200 individuals in the Nagaon district, suggest that the Glossy Ibis tends to forage in the study area with single individuals during the breeding season and in flocks during the non-breeding season. Capture-mark-recapture and satellite tagging studies would be essential to improve our understanding of the species' behaviour and dynamics to implement appropriate conservation measures.

Keywords Glossy Ibis, breeding biology, Darabeel waterbody, Kamrup district, Assam.

Introduction

Globally, it has been proposed that four populations of Glossy Ibis *Plegadis falcinellus* exist; one of them would connect East Africa with the Indian subcontinent (Kirby *et al.* 2008). The species is one of the most widely distributed (Santoro *et al.* 2019) and is expanding its range in various areas like, for example, North America (Patten 2019). The Glossy Ibis breeds in India's northern plains, and it is a winter visitor in the Indian subcontinent (Ali and Ripley 1983; Rasmussen and Anderton 2017). The species is currently in the 'Least Concern' category of IUCN, because of its extensive range (BirdLife

International 2019). Based on Asian Waterbird Census (AWC) data and the Asian Waterfowl Census (South Asia) suggests a decline of the species (Perennou and Mundkur 1991; Perennou *et al.* 1994; Wetlands International South Asia 2019). Whereas winter Glossy Ibis visitors can be seen in hundreds at the Indian wetlands, recent 'breeding records' are rare (Tiwari and Rahmani 1998; Venkatraman 2009).

In Assam, the species was earlier found to be rare and sighted at only a few localities in eastern Assam, such as Jorhat and Sivasagar districts, during the winter season (Saikia and Bhattacharjee 1991). During the surveys carried out in protected and unprotected wetlands of Assam from 1986 to 1990 in November 1987, 35 Glossy Ibises were observed in Missamari beel near Jhanjimukh (Jorhat district) and on 17 November 1990, only

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seven individuals were sighted. On 14 February 1989 and 18 January 1990, respectively, 35 and 205 individuals were observed in the Panidihing Wetlands, Sivasagar Districts of Assam (Saikia and Bhattacharjee 1991, 1993). Choudhury (1991) recorded 300 Glossy Ibises in the same area in October 1987; the same study also reported its nesting in July 1988. From 2010 onwards, Glossy Ibis's available data in Brahmaputra valley suggest a broad distribution over the flood plains (Figure 1).

Study area

We monitored Glossy Ibis nests in Bortari village in the Kamrup district. In the same area, we also recorded specimens foraging in the wilderness and paddy fields. Opportunistically, large flocks of Glossy Ibis were observed in the Sivasagar and Nagaon districts of Assam..

Methods

We compiled data on the presence of the species in Assam State by reviewing the literature, the State-wide survey results for the Asian Waterfowl Census (AWC), and Glossy Ibis records in the Brahmaputra valley.

We monitored Glossy Ibis nests in a private orchard in

June-July 2020, during the daytime, when the house owner or locals were present. For that aim, we used binoculars (Nikon Aculon10 X 50), spotting scope (Cabela's spotting scope 20 to 50X), and took pictures by using a camera (Nikon Coolpix b700 and Nikon 850) with a zoom lens (200-500 Nikor).

On 27 May 2020, while observing a heronry at Bortari village, Kamrup district, a Glossy Ibis pair was sighted for the first time. Subsequently, the presence of the nest was confirmed (N26° 06' 33", E091° 25' 13") on a bamboo thicket - *Bambusa tulda* (locally known as Jati bah) in the backyard orchard of a rural house. The nest was about 10 m above ground. About 15 m high (Figure 2), the bamboo thickets were at the edge of an orchard and in the village road's proximity. The thicket was surrounded by marsh and ditches covered with water hyacinth *Eichhornia crassipes*, *Colocasia* species and a few Banana plants *Musa* species. Also, there were two tall trees *Bombax ceiba* (21 m and 30 m high), in the surrounding area, 10 Arica nut trees *Areca catechu* (10 m), five coconut trees *Cocos nucifera* (12 m), and a Jack fruit tree *Artocarpus heterophyllus* (12 m) in the orchard. After we started the monitoring of this nest (nest 1), another nest (nest 2) was spotted on 9 June in the same bamboo thicket, at a distance of only 8 m (at the same height). A third one (nest 3) was discovered at about 30 m from the first nest in a bamboo thicket across the road on 21 July 2020.

We monitored nest 1 in the period between 2 June and 29 July (23 days). The data on nest 2 proceed from observations made between 9 and 28 June (13 days).

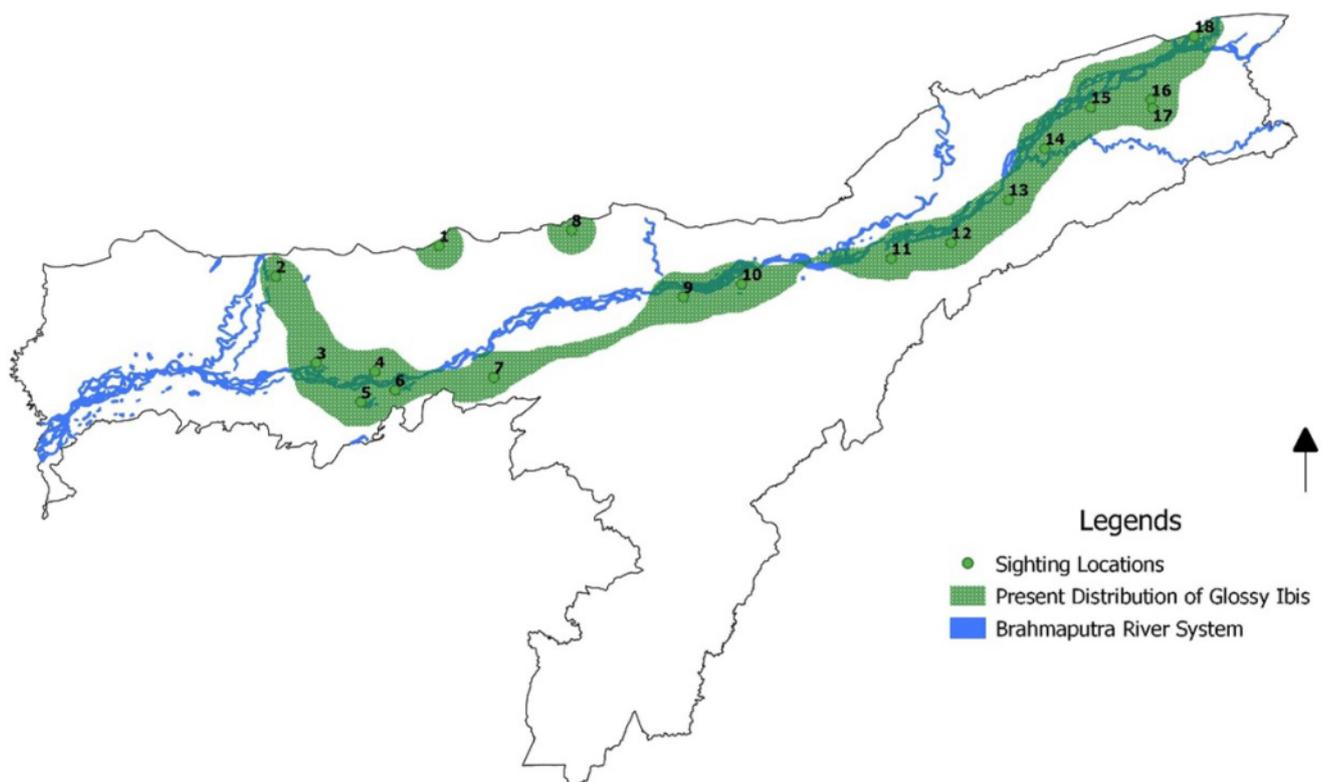


Figure 1. Current Distribution of Glossy Ibis in Brahmaputra valley (map was prepared based on available recent Citizen Science data). List of sites : 1. Bogamati, 2. Manas National Park, 3. Barpeta, 4. Sungarbari, Kamrup, 5. Kamargaon, Kamrup, 6. Kamrup Metro, 7. Morigaon, 8. Bogamati, Udalguri, 9. Kaziranga NP, 10. Kaziranga NP, 11. Kokilamukh, Jorhat, 12. Jhanjimukh, Jorhat, 13. Panidihing WLS, Sivasagar, 14. Bogibeel, Dibrugarh, 15. Dibrugarh, 16. Dibru Saikhowa NP, 17. Maguri motapung Wetland, 18. Sadiya, Tinsukia.



nest 2 was abandoned on 30 June 2020. The third nest was discovered late in the season (on 21 July 2020) when the young birds were almost fledged out, and their detailed observations could not be recorded. All the three nests were in heronries, along with the following nesting species: Cattle Egret *Bubulcus ibis*, Little Egret *Egretta garzetta*, Intermediate Egret *Mesophoyx intermedia*, Little Cormorant *Phalacrocorax niger* and Indian Cormorant *P. fuscicollis*.



Figure 2. Adult Glossy Ibis with the nest on a bamboo thicket.

Following the focal animal sampling method, we recorded parents and nestlings' activities at five-minute intervals (Altmann 1974; Palmer *et al.* 2001). We monitored the pre- and post-hatching activities of the female and male parents and the nestlings. In size and colour, both adults looked similar, although the female's colour was somehow dull relative to that of the male. We observed nest 1 parents (male observed before egg hatch 5 times, after egg hatch 134 times, female before egg hatch 133 times and after egg hatch 101 times) and the nest 2 parent male (6 times) and female (225 times) only before egg hatching. For the parents, we calculated the time-activity budgets, i.e. the proportion of time spent in one activity, of the following behaviours: (i) incubation, (ii) brooding, (iii) perching on the nest and (iv) perching on nest tree (bamboo thicket - *Bambusa tulda*). For the nestlings, we recorded: (i) sit/crouching in the nest, (ii) sitting on the hock, (iii) perching on the nest, (iv) perching on the nest tree, (v) begging for food, and (vi) feeding. We collected 249 observations of the first hatching, 251 of the second one, and 251 of the third one. We used a Chi-square test to compare the percentages of male and female activities and nestlings at nest 1. Bar graphs were used to visualize the data.

Results

Time activity budget of the male, female and the nestlings at the nest

A Glossy Ibis pair was first noted perching and mating in the Bamboo thicket in the last week of May 2020. However, we limited our presence to avoid possible disturbance to the pair. We started

observing nest 1 on 2 July, once the pair had settled on the nest. We observed the incubation over 18 days, possibly missing the first 3-4 days. It appeared that the female spent most of the time incubating. The hatching's appearance was first noted on 21 June as the sitting posture of the parents changed. Before the hatching, females showed a more prolonged presence in the nest than males in both the nests under observation. In nest 1, the female incubated for a longer duration (79%) than the male (3%). The female in nest 1 also perched on the nest more often (12%) than the male (1%). The female perched on the nesting tree (5%) while the male did not perch on a tree at all (Figure 3).

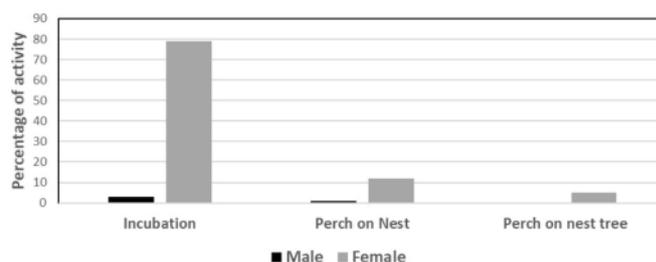


Figure 3. Activity of male and female Glossy Ibis before the hatching of eggs in nest 1.

In nest 2, the female incubated for less duration (42%) than the nest 1 female. It perched more often on the nest (30%) or the nest tree (25%). The male activity in nest 2 was scarce and exclusively devoted to perching on the nest tree (3%) (Figure 4).

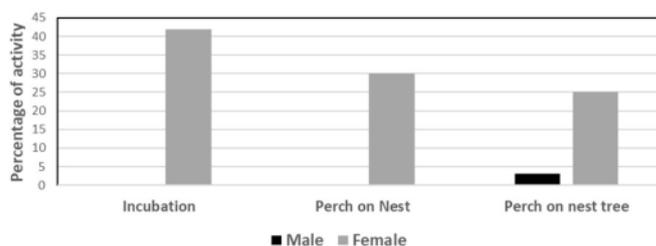


Figure 4. Activity of male and female Glossy Ibis before the hatching of eggs in nest 2.

After the hatching of the eggs in nest 1, both parents were often observed close to the nest. The female was engaged in brooding for more time (18%) than the male was (4%). The male, however, was more often perching on the nest (25%) and the Bamboo thicket (28%) than the female (respectively 17% and 8%; Figure 5).

The hatching was asynchronous, the offspring were named as per their order of hatching – Offspring1, Offspring2 and Offspring3. The offspring that hatched first (Offspring1) was found perching on the nest and subsequently perching on



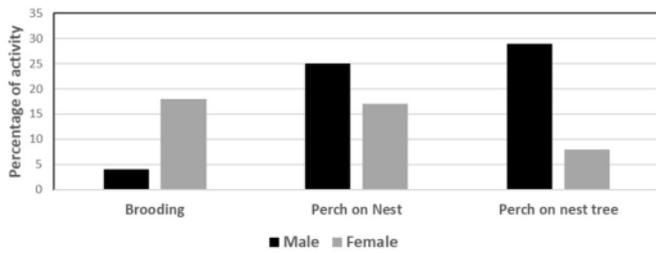


Figure 5. Activity of male and female Glossy Ibis after the hatching of eggs in nest 1.

the nest tree a greater number of times (55%) as compared to Offspring2 (42%) and Offspring3 (27.6%; Figure 6). The perching time difference was statistically significant only between Offspring1 and Offspring3 ($\chi^2 = 8.783$, d.f. = 1, $p = 0.003$). It was neither statistically significant between Offspring1 and Offspring2 ($\chi^2 = 1.742$, d.f. = 1, $p = 0.19$), nor between the Offspring2 and Offspring3 ($\chi^2 = 2.8$, d.f. = 1, $p = 0.09$). The Offspring3 was recorded to be sitting for longer time (62.8%) as compared to the Offspring1 (36%) and Offspring2 (46.4%). The sitting time difference was again statistically significant only between Offspring1 and Offspring3 ($\chi^2 = 7.364$, d.f. = 1, $p = 0.007$) but it was not statistically significant between Offspring1 and Offspring2 ($\chi^2 = 1.22$, d.f. = 1, $p = 0.3$), and Offspring2 and Offspring3 ($\chi^2 = 2.651$, d.f. = 1, $p = 0.1$). All the three offsprings begged for food and were fed by parents more or less equally ($\chi^2 = 0.154$, d.f. = 2, $p = 0.09$).

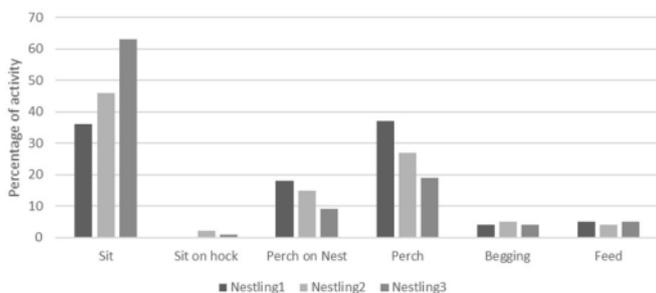


Figure 6. Activity of three nestlings of Glossy Ibis in nest 1.

It took 39 days for all the three nestlings to fledge out that we observed to occur on 29 July 2020. The young birds looked all black, with two whitish-yellow bands on the beak, a white patch on the throat and a small white patch above the eyebrow (Figure 7). nest 2 did not succeed, probably due to relatively inattentive parents compared to those of nest 1. In nest 3, the parent birds' attentiveness could not be recorded, but two nestlings successfully fledged. In the subsequent 15 days, the juveniles were regularly seen feeding in the paddy fields, about 500 m from the nesting site in the Bortari village (N 26° 06' 36", E 91°



Figure 7. Fledglings on a bamboo thicket.

25' 37"). The Cattle Egret and Indian Pond Heron *Ardeola grayii* were the most common associate species within the flock while feeding. The Glossy Ibis families joined to form a larger flock of about 200 individual in September 2020. This flock grew up, and more than 500 individuals were counted in October 2020 at a water body - Darabeel, Kamrup district (26° 5' 37" N, 91° 27' 42" E; Figure 8). In the Kamrup district, opportunistic records (n = 150) of foraging individual throughout 2019 showed that the birds feed alone during the breeding season (n=40) and in flocks (n=110) in the non-breeding season. Flocks of about 40 individuals were the more frequently observed in the study area (n = 80). In January 2019, a flock of about 200 individuals was sighted in Nagaon district (N 26° 23' 47", E 92° 44' 36") and in April 2019, a flock of about 50 individuals at Disangmukh, Sivasagar district (N 27° 3' 28", E 94° 34' 51").



Figure 8. A large flock of Glossy Ibis at Darabeel, Kamrup district, October 2020.

Discussion

In India, Ali and Ripley (1983) have documented breeding of Glossy Ibis in Sind, Oudh (now Uttar



Pradesh), Orissa, Assam and Manipur from May to July on moderate-sized trees such as *Prosopis spicigera* and the incubation period is mentioned as 21 days. Rasmussen and Anderton (2012) have described the Glossy Ibis breeding in the northern plains where they nest on trees, reeds or above the ground. Tiwari and Rahmani (1998) reported 250 to 725 nests of Glossy Ibis at Kutch in the months of August-September from 1992 to 1994. In a relatively recent record, Venkatraman, (2009) recorded the breeding of this species at Vedanthangal Waterbird Sanctuary, Tamil Nadu; the author reported 52 nests built on *Acacia nilotica*, at the mean nest height of 3.82 m, during January 2008. Nevertheless, data deficiency and the seemingly declining trend of the Glossy Ibis numbers are worrisome (Sundar and Kittur 2019). Our observations agree with earlier studies as the nesting took place during June-July. The nesting tree (Bamboos in this case) was close to a water body. However, a relevant difference between our and previous studies is that the females incubated for a much higher duration than the male, whereas others (e.g. Ali & Ripley 1983) indicated that both sexes devoted the same time to incubate. In nest 1, the female incubated for a longer duration (79%) than the male (3%). We found a statistically significant difference between the female and the male ($\chi^2 = 97.566$, d.f. = 1, $p < 0.0001$). The difference could be due to the methodology, as we observed the birds only during the day time while earlier work possibly considered the entire daytime. Males might incubate more in the night-time when we could not obtain records. Among the nestlings, the oldest sibling perched for a longer time than the younger ones, and the youngest sibling was the one that perched the least. Similar results were found in Tengmalm's Owl *Aegolius funereus* suggesting its significance in obtaining food from parents and affirming social dominance (Kouba *et al.*, 2014). Out of the three nests recorded in the current study, two Glossy Ibis pairs successfully raised the young ones. Five offspring fledged out successfully from the three breeding attempts of the species. In the future, ringing, individual marking, and satellite tagging would provide detailed information about parents' role and the movement of these birds in the non-breeding season. It will also help determine the existing nesting colonies of this species to protect them in view of future colonization in South and South-East Asia.

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