

Population and behavioural ecology of Alexandrine Parakeet *Psittacula eupatria* in Dhaka city, Bangladesh

MD. SHARIF HOSSAIN SOURAV, PAUL M. THOMPSON & K. F. BISWAS

The population status and ecology of the Alexandrine Parakeet *Psittacula eupatria* are poorly known in Bangladesh. We studied a small population discovered in the centre of Dhaka city. Observations took place during 2013–2017, and secondary sources and unpublished reports were also consulted. All nesting activities observed in Dhaka city took place in cavities in one building. Few cavities suitable for nesting appear to exist and additional pairs were present but not nesting; 15 nest-boxes were therefore installed on the building's wall, but were not occupied. However, the number of Alexandrine Parakeets in Dhaka city more than doubled during the study. In 2016, 69 wild parakeets were counted (42 in Dhaka city, 15 in Lalmonirhat district and 12 in Bogura district). The number of offspring increased in Dhaka along with the number of active nests. A total of 16 tree species in Dhaka are used for regular foraging and diurnal roosting. Despite increasing in urban Dhaka, major constraints in Bangladesh include capture of nestlings and adults, felling of nesting trees and lack of suitable nesting cavities. Based on this study it is recommended that Alexandrine Parakeet be considered as Endangered within Bangladesh.

INTRODUCTION

The Alexandrine Parakeet *Psittacula eupatria* occupies a large range in Asia, from Pakistan and the Himalaya through parts of lowland South Asia and Myanmar to Indochina, but a moderately rapid decline in much of this range, owing to ongoing habitat destruction and unsustainable levels of poaching for the pet trade, has resulted in the species being uplisted to IUCN status Near Threatened (BirdLife International 2017). Owing to its popularity as a cage-bird, it is listed in Appendix II of the Convention on International Trade in Endangered Species (CITES).

In Bangladesh the Alexandrine Parakeet is legally protected under the Wildlife Preservation and Security Act, 2012. Nevertheless, it is on the verge of extinction in the country owing to the illegal capture and trade of nestlings and adults for sale as cage-birds and the destruction of nest-sites (IUCN Bangladesh 2000, Siddiqui *et al.* 2008). Despite this, it was recently classified as Least Concern (IUCN Bangladesh 2015), although it was previously considered as Critically Endangered (IUCN Bangladesh 2000). This re-classification made use of information on increasing numbers found in Dhaka city as presented in this paper, but we argue here that this was a far more optimistic interpretation of the evidence than can be justified.

Nineteenth century records of Alexandrine Parakeet in Bangladesh came from Khulna division (Rainey 1875) and Sylhet division (Hume 1888). Today the species has been described as an uncommon resident of sal *Shorea robusta* forest in Dhaka and Rajshahi divisions (Haque & Onu 2015). Recent records (Thompson *et al.* 2014) were from Dhaka (now Mymensingh) division, in Sherpur and Tangail districts; and the far north of Rajshahi (now Rangpur) division, from Lalmonirhat district. The few subsequent records include a disturbing report of 10 chicks captured by a trader from a large rain tree *Albizia saman* and a coconut palm *Cocos nucifera* in Meherpur district, Khulna division, in March 2015, then recovered by S. I. Sohel, a local bird conservationist at Kadamtola, near Kushtia town (south-west), and released back into the wild (Sohel 2015). Additional records include three birds at Aria Bazar, Bogura district (Rafid Yasir and Mahmudul Hasan Tapon pers. comm.), and one bird flying north over Barishal city (south-west) on 28 July 2015 (Abdul Mazid Shah pers. comm.). An unsupported claim of at least four in Inani Reserved Forest, Cox's Bazar district, south-east Bangladesh, in 2015 (Feeroz 2016) could have been vagrants from Myanmar, as there is no previous record of this species from that area.

Alexandrine Parakeet is known to nest in cavities in trees and palms but very rarely in buildings (Ali & Ripley 1983), and generally breeds from November to April, depending on geographic

location (Juniper & Parr 1998). However, the nesting and foraging behaviour of the species remain poorly understood, particularly in urban settings within its natural range. Although recent studies of urban parakeets have focused on introduced populations where they are considered potentially invasive (Angelici & Fiorillo 2016), with negative impacts on local ecology, the same capacity to make use of urban opportunities within their natural range could help to compensate for declines in original natural habitats.

This paper reports on a small population discovered in recent years in the centre of Dhaka city (hereafter Dhaka). The population's size and ecology were studied from 2013 to 2017, and nest-boxes were tested as a way of assisting the species to breed.

METHODS

The fieldwork in this study focused on a cluster of adjacent sites where the species was seen on a daily basis: Ramna Park, Baily Road, Dhaka University Campus, Supreme Court, Dhanmondi, Segunbagicha and Suhrawardy Udyan (formerly known as Ramna Race Course). Surveys and searches for parakeets also covered the northern suburbs (Tejgaon airport area, Gulshan, Baridhara and the National Botanical Garden). In addition, six field visits were made to other parts of the country where the species had nested in the past or where there were recent reports of parakeets: four rural districts (Lalmonirhat, Meherpur, Sherpur and Jamalpur) and Bogura city. Direct observations were made in these five areas and 23 local people were interviewed to identify roosts and threats and to obtain their opinions on the numbers present.

In Dhaka, where parakeets roost communally in trees at night, simultaneous monthly counts were made at identified roosts from 2013 to 2016. Incoming birds were recorded from all directions from vantage points around the roost. The breeding study started after an apparent nesting site was discovered, with parakeets entering three cavities in a building on 15 March 2014. Breeding behaviour was observed at these cavities between March 2014 and May 2015, and between August 2016 and April 2017, involving usually 1–2 observation periods per day (06h00–08h00 and/or 18h00–19h30). Nest-site attendance at two cavities was studied for 1–11 hours per day (mainly 07h00–11h00 and 15h00–17h00) for a total of 54 days between December 2016 and March 2017, by recording the times that male and female parakeets entered and left the cavity. The percentage of observation periods with adult female or adult male birds inside the cavity was calculated. From 2016 onwards observations also covered the use of artificial wooden nest-boxes and plastic pipe nest-boxes installed on the same building. During the non-breeding season observations were typically made two days



M. S. H. SOURAV

M. S. H. SOURAV

Plate 1. Nesting building and examples of activities of Alexandrine Parakeet *Psittacula eupatria*: (left) Cavity 2 on 4 April 2014 (one hatchling and breeding pair); (right) west side of nest building in 2017, with parakeets inspecting wooden nest-boxes and Cavity 2 (bottom right).

a week (06h00–13h30 and/or 17h30–19h30). Feeding, roosting, breeding and other behaviour were observed mostly in the main Dhaka study area close to the building where the birds nested, using 10×42 binoculars. Observations were made from the ground and at a minimum distance of 100 m to avoid disturbance. Data on diet were based on direct observations and images. A Nikon Forestry Pro Laser Rangefinder (0–500 m) was used for height measurement. Feeding data were taken in the morning, noon and evening (about one hour before roosting).

RESULTS

Distribution and population

Sightings of Alexandrine Parakeets in Dhaka were from comparatively well-wooded areas with large trees. We found that the population there is increasing, more than doubling in four years to 42 birds in 2016, contrasting with two other sites in Lalmonirhat and Bogura (Figure 1). The monthly counts in Dhaka indicated that numbers were lowest in June–July and highest in October–December each year. From 2013 to 2016 the numbers of both male and female parakeets in Dhaka increased in similar strong linear trends (male $r^2 = 0.969$, female $r^2 = 0.979$). The number of juveniles recorded also increased, as did the number of active nests found. Juveniles were seen every year from 2012, rising to 10 in 2017, and active nests were found from 2014 onwards. Figure 2 indicates a

strong positive correlation between the number of juveniles seen and number of active nests ($r = 0.84$).

Outside Dhaka, the second highest population of the species found in this study was in Hatibandha subdistrict, Lalmonirhat district; this declined from 25 to 15 adults. A stable population of 9–12 parakeets was found at Shajhanpur, Bogura district, where local people informed us that they had seen Alexandrine Parakeets in their villages for five or six years. No birds were found in Sherpur, Jamalpur or Meherpur districts.

Breeding

The nesting season was found to start with the inspection of potential cavities in the ‘nest building’ in August–September and to end with fledging in April.

Onset of breeding

We found that non-breeding birds spent only the morning and early evening close to the nest building. Courtship began in September and continued until January. During the breeding season the male would try to attract the female while they perched on tree branches during the day, and when roosting at night pairs also sat close together. Pairs would make distinctive rapid joint flights of 3–5 minutes calling *tii...uu...tii... uu*. During courtship the male display consisted of exaggerated advances, bowing, stretching, twirling and eye-blazing, with shoulders thrust out. Before mating, the male fed the female. They would mate several times a day, mostly in the

Figure 1. Yearly maximum numbers of Alexandrine Parakeet found in study areas (2013–2016).

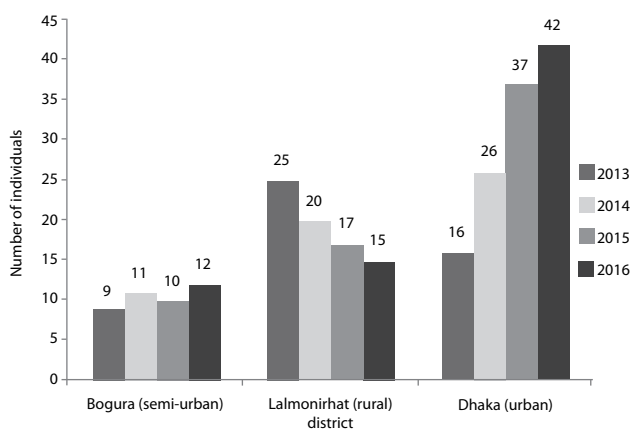
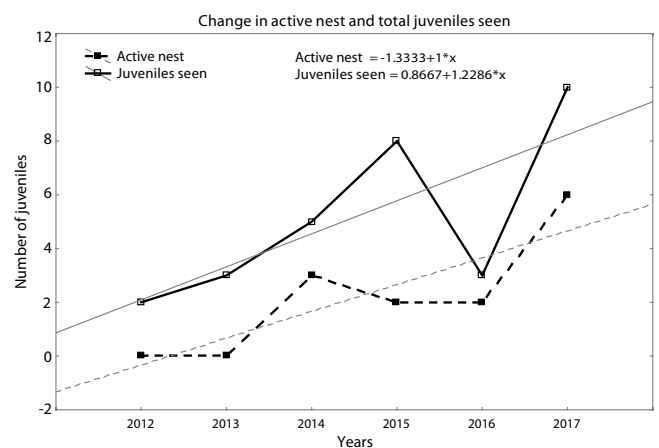


Figure 2. Numbers of juvenile Alexandrine Parakeets and active nests observed in Dhaka city, 2012–2017.



afternoon. Displays and mating typically lasted 10–12 minutes (on one occasion a subadult male was seen disturbing a pair during mating).

It is possible that the same pair nests in the same building cavity in consecutive years, but this could not be proved as individual birds could not be identified with certainty. Initially, breeding pairs visited the nest-site every morning and afternoon, making several visits each of 5–10 minutes' duration inside the nest-hole during the last hour of light, although neither adult roosted in it. This changed when incubation started (presumed to be with the first egg laid since hatching was asynchronous), the birds, especially the females, spending long periods inside the cavities. At the nest building, pairs were very sociable and did not show aggression towards members of other pairs, except when there were squabbles over a new nest cavity on 17 January 2017.

Nests

Data on nesting were collected initially from three cavities in three walls of a single 10-storey building, and in 2017 from an additional cavity in the same building. Details of cavity use and nesting are

summarised in Table 1. The building is located in the Bangladesh Supreme Court area near an urban park known as Suhrawardy Udyan, with a good number of tall native and exotic trees nearby. The parakeets used cavities made for the cable connections of air-conditioning units and other holes. During the breeding season parakeets visited the nesting site as a flock every morning and afternoon and birds not occupying holes perched near the building in tall trees, on a cell-phone tower and also on the building itself.

In addition, three other active nests were discovered on 24 February 2017 in two buildings in the nearby Segunbahicha area. These cavities were 28, 32 and 66 m above ground, and at two of these cavities adult female parakeets were seen feeding chicks.

Nest attendance

During 2016–2017, observations over 54 days of the nesting attempt in Cavity 2 (Table 1) indicated that the female spent more time in the cavity than the male, and that the longest period during which the adults spent time together in the cavity was 47 minutes, on 13 January 2017 (Figure 3). Observations of Cavities 1 and 2 on the same day showed that the attendance patterns of the two

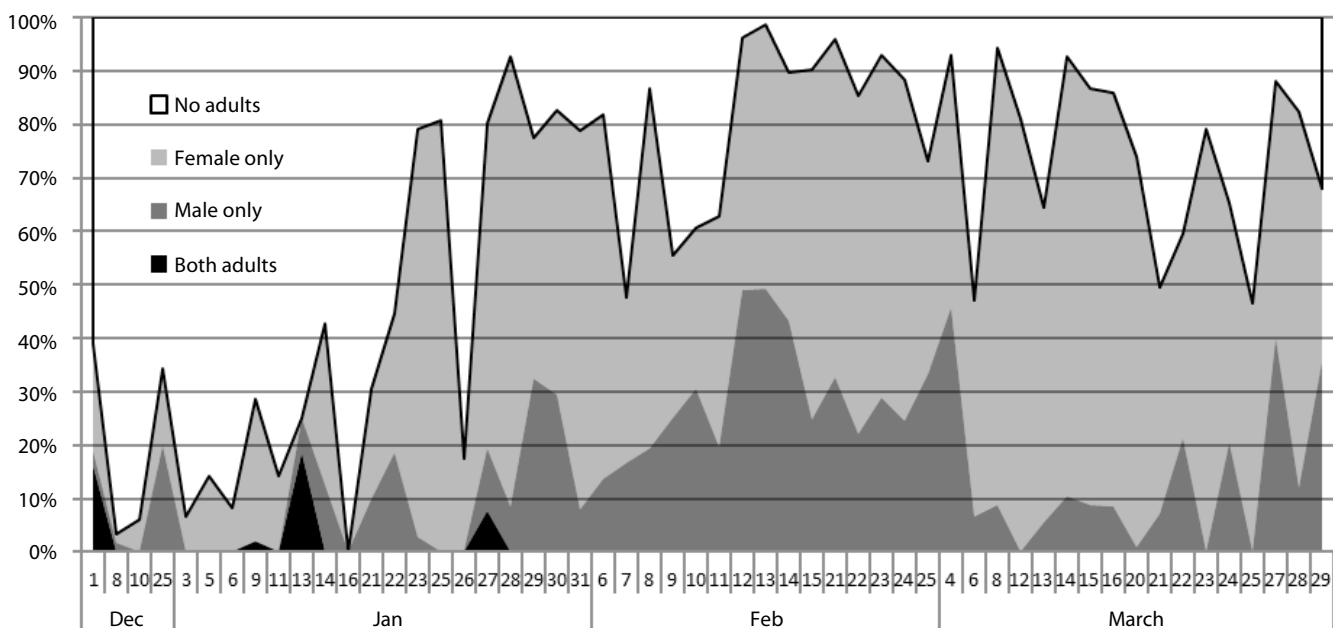
Table 1. Summary of nesting activities in main study building.

	Cavity 1*	Cavity 2	Cavity 3	Cavity 4**
Orientation	North facing	West facing	East facing	North facing
Height above ground	25 m	16 m	19 m	8 m
15 March 2014	Pair	Pair with 2 chicks	Pair	
April–May 2014	Pair last seen 16 April; then occupied by Common Myna	3 chicks 11 April; one fledged 16 April, one fledged 19 April, one reported stolen by locals; later occupied by Common Myna	Pair present throughout both months	
Autumn 2014	Pair in October	Pair from September	Pair from September	
February–May 2015	Pair regularly present 27 February–17 April with presumed nest; 25 April occupied by Jungle Myna	Pair regularly present from 27 February; 3 chicks seen 17 April, fledging on 30 April, 10 May and 15 May; occupied soon after by Jungle Myna	Noisy construction started in September 2014 and cavity not used thereafter	
Autumn 2016	Pair present in September	Pair present in August		
January–April 2017	Pair continually present January to March but no chicks seen	Pair present, 2 chicks seen early April but cavity abandoned 12 April		Aggression between two pairs 29 January; in February one pair apparently hatched eggs; in March occupied by feral Rock Dove

* Small—only one adult ever seen inside

** Parakeets not seen using this cavity before January 2017

Figure 3. Percentage of observation time with adult parakeets present in Cavity 2 during the 2016–2017 nesting attempt.



pairs differed. At Cavity 1 male attendance was negligible, whilst attendance by the female peaked in February but averaged less than 40% of our observation time. At Cavity 2 the male contributed significant time, particularly in February (30% of observation time), and female attendance was higher than in Cavity 1 (Figure 3), rising to a peak of 60% of observation time in March. Data combined from both nests show a strong positive linear correlation ($r = 0.68$) between female and male time (minutes per day) spent in the cavities (although this was also influenced by the duration of observations).

Both males and females vocalised—making a single call—when entering and leaving cavities. Females usually took a break from what was presumed to be incubation from noon into the afternoon, but went inside the cavity for short, 1–3 minute visits during this time. While the female was incubating, the male stayed in the nearest tree to the nest-site and returned to the nest when other cavity-nesting birds approached; usually he also offered food to the incubating female. Male incubation periods were shorter (when the female was feeding), and when the female returned to the nest both birds stayed inside. Extrapolating from the dates on which chicks were first seen, and assuming a 19–21 day incubation period (Ali & Ripley 1983), eggs were thought to have been laid between late January and early February and to have hatched in late February.

Behaviour with offspring present

Both parents took part in feeding the chicks at Cavity 2 in both 2015 and 2017. In 2015 the nestlings stayed in the nest for at least 30–40 days and fledged up to 10 days apart. The chicks called only when the adults came to the nest; otherwise they were silent. While the unfledged young parakeets were in the nest other non-breeding pairs came very close but did not feed them or show aggression. In 2015, when detailed timings of observations were made, chicks were fed regularly at 10–35 minute intervals from early morning up to 10h30 and then in the afternoon from 17h20 to sunset, with fewer feeds during the middle of the day, especially in the late morning. When an adult fed the chicks in the nest, it stayed there for 5–15 minutes. Only the female brooded the chicks overnight, while the male joined other Alexandrine Parakeets at their night-time roost. However, females were not seen to stay in the nest cavities after the chicks were about 15 days old, when presumably space was limited and the chicks were able to maintain their body temperature without brooding.

For about three days before fledging the chicks came to the cavity entrance and flapped their wings; however, they did not leave their cavity together on the same day. Intervals between the young birds fledging were from 3–10 days (Table 1). When a chick left the nest an adult also flew with it, and both adults would feed it at 10–25 minute intervals. In the first week after fledging the young birds did not fly frequently or join the night roost with adults, but instead rested on tree branches near the nest-site. About 15–30 days after leaving the nest, the young parakeets joined the adults at their night roost. During the first four weeks after leaving the nest, the fledglings learnt to fly well and to feed independently, but stayed in the treetops with adults. They were the target of vigorous predation attempts by House Crows *Corvus splendens* but were saved by the efforts of their parents, especially the females, which chased and pecked any approaching crows. The crows made few attacks on young parakeets when an adult was perched at their side, but made frequent predation attempts when the fledglings were perched alone.

Use of nest-boxes

In 2015, five PVC pipe nest-boxes were attached to the nest building, but were rarely visited by parakeets. Instead, Common Myna *Acridothères tristis*, Jungle Myna *A. fuscus* and Chestnut-tailed Starling *Sturnia malabarica* nested in them in 2015 and 2016. In August 2016, 10 wooden nest-boxes were fixed on the building,

two on the north side and eight on the west side. In September adult parakeets showed some interest in the wooden nest-boxes. During the 2016–2017 breeding season all the wooden nest-boxes were inspected by different pairs, and pairs showed aggression over the boxes on the west side during September and October 2016. In March 2017 one pair spent a considerable amount of time in one box on the north side, and another pair spent time in different boxes on the west side, mostly during the morning and afternoon, but no female stayed overnight in the boxes. A pair of Common Myna occupied a wooden nest-box during the last week of March 2017, and after 10 April they prevented Alexandrine Parakeets approaching any of the nest-boxes.

Other observations

Feeding

In Dhaka, observations were mainly made in the areas surrounding the nest building, where the Alexandrine Parakeets fed in light to well-wooded habitat, open areas with trees, parks and gardens, normally foraging in the canopy of tall trees. They appeared to behave cautiously and circled a tree repeatedly in order to satisfy themselves that it was safe to feed before landing. Early in the morning they flew in groups to favoured trees, where they fed typically for 10–90 minutes—depending in part on disturbance by humans and House Crows—before resting or feeding chicks or, in the case of males, feeding incubating females. Juveniles fed with their parents. Young shoots and leaves were the preferred food for offspring in their first two weeks, but the adults also fed them seeds. Adults (nesting pairs and others) usually went back to the nest-site after feeding. Birds were often observed to feed on seeds and to be wasteful feeders, frequently dropping or discarding partially consumed food. Alexandrine Parakeets did not dominate Rose-ringed Parakeet *P. krameri* or other birds when feeding, but were very sociable, usually foraging in flocks.

During the midday period on sunny days birds stayed in the shade of a rain tree *Albizia saman* and did not fly much, except for pairs with chicks in the nest. Every day they came to the nest building at about 17h00. During this pre-roost gathering the birds checked nest-boxes, rested and preened, or fed for a short time and then took a drink of water. At the nest building they drank from a water tank connection pipe and drips from an air-conditioning unit.

Elsewhere, Alexandrine Parakeets have been found to feed on a range of wild and cultivated seeds, flowers, buds, nectar, grain, fruit and vegetables (Ali & Ripley 1983, Khan & Hussain 1990, Juniper & Parr 1998). In Dhaka we identified 16 tree species where they foraged and we estimated the extent to which each of them was used (Table 2). Most of the trees are common and found throughout the city but some, such as Bengal almond *Terminalia catappa* and ber *Ziziphus mauritiana*, were clearly favoured for feeding. Table 2 shows the number of trees of each species in the most intensively studied area, as well as a subjective assessment of their abundance in Dhaka in general. Seven species were used daily for foraging (*Ziziphus mauritiana*, *Polyalthia longifolia*, *Spathodea campanulata*, *Acacia moniliformis*, *Albizia saman*, *Terminalia catappa*, *Gmelina arborea*), six were used often (2–4 times in a week) (*Neolamarckia cadamba*, *Putranjiva roxburghii*, *Melia azedarach*, *Tectona grandis*, *Albizia richardiana*, *Senna siamea*) and three were used rarely (no more than twice a month) (*Lagerstroemia indica*, *Leucaena leucocephala*, *Psidium guajava*). The birds were seen to feed on five types of vegetative material taken from the trees, but mostly on seeds extracted from fruits (14 species), followed by flowerbuds (six species) (Figure 1).

Roosting

Alexandrine Parakeets roost communally in trees at night, gathering together at dusk and leaving at dawn (Pithon & Dytham 1999), as our study confirmed. Before departure for the night roost, all

Table 2. Trees used by Alexandrine Parakeet for foraging in Dhaka city.

Status in Dhaka: C – common throughout Dhaka (and Bangladesh), mostly planted, numbering in thousands within the city; UC – uncommon, scattered in parks and roadsides in Dhaka, about 100–500 (pers. obs.); R – rare, not more than 100 (pers. obs.).

Visit trend: C – used daily; UC – observed use 2–4 times a week; R – observed use up to twice a month.

Number of trees at foraging site: census of trees in named foraging locations within 2 km radius of nesting building.

Foraging location: BR – Baily Road; DUC – Dhaka University Campus; RP – Ramna Park; SC – Supreme Court; SU – Suhrawardy Udyan.

Scientific name	English name	Local name	Parts eaten	Flowering/ fruiting season	Months with fruit or flower	Status in Dhaka	Visit trend	No. of trees at foraging site	Foraging location	Number of days observed
<i>Acacia moniliformis</i>	Ear-leaf Acacia	Akashmoni	seed	winter to summer	6	C	C	15	RP, DUC, SU	40
<i>Albizia richardiana</i>	–	Gagan Sirish	seed, young leaf	rain	2	C	UC	6	RP, DUC, SU	6
<i>Albizia saman</i>	Rain Tree	Rain Tree	flower bud, young leaf	year round	12	C	C	9	RP, DUC, SU	25
<i>Gmelina arborea</i>	Beech-wood	Gamari	flower bud, leaf, seed, nectar	spring	1	R	C	6	RP, DUC, SU	15
<i>Lagerstroemia indica</i>	Crepe Myrtle	Jarul	seed	rain to winter	4	C	R	5	RP, DUC, SU	3
<i>Leucaena leucocephala</i>	White Lead Tree	Ipil Ipil	seed	year round	12	C	R	1	SU	1
<i>Melia azedarach</i>	White Cedar	Ghoraneem	seed	winter	2	UC	UC	2	RP, SU	7
<i>Neolamarckia cadamba</i>	Burflower- tree	Kadam	seed	rain to autumn	4	C	UC	6	RP, DUC, SU	12
<i>Polyalthia longifolia</i>	Indian Mast Tree	Debdaru	seed	rain	2	C	C	6	RP, DUC, SU	10
<i>Psidium guajava</i>	Guava	Peara	fruit, seed	year round	12	C	R	1	BR	1
<i>Putranjiva roxburghii</i>	Putranjiva	Putranjib	seed	winter to summer	3	UC	UC	2	RP, SU	4
<i>Senna siamea</i>	Kassod Tree	Minjira	seed, flower bud		3	C	UC	2	RP, SU	2
<i>Spathodea campanulata</i>	African Tulip Tree	Rudro Palash	nectar, flower bud	summer	2	UC	C	1	RP	10
<i>Tectona grandis</i>	Teak	Segun	seed	rain	2	UC	UC	4	RP, SC	5
<i>Terminalia catappa</i>	Bengal Almond	Khat Badam	seed, flower bud	year round	12	C	C	8	BR, RP, SU	60
<i>Ziziphus mauritiana</i>	Ber	Baroi	seed	winter to spring	2	UC	C	1	BR	30

adults made screaming *kreeer* calls, and when they started flying to the roost they called with a loud screaming *kree-arr* note. Before roosting they visited surrounding trees. After reaching a roost tree they made little noise. During 2013 to 2015 they regularly roosted on the branches of an *Albizia richardiana*, about 35 m tall, departing from it in small groups before sunrise and returning in groups every evening just after sunset. During the night they did not move around much between branches and did not squabble with the Rose-ringed Parakeets which also occupied the roost.

In 2015, the two large roosting trees were cut down and the parakeets shifted their roost to two nearby large rain trees *Albizia saman*, about 22 m tall. Here, thousands of Rose-ringed Parakeets have roosted, according to local reports, for fifty years, and the two species roosted together.

Anthropogenic and natural threats

Alexandrine Parakeets are large, noisy and brightly coloured. This makes them very easy for local people to detect when nesting. Moreover, because they are faithful to the same nest-site from year to year, people have scope to make advance plans to capture nestlings, with or without tree-felling.

Nestlings in Lalmonirhat were stolen by local people; in 2017 five nestlings were stolen by a local boy at Hatibandha Upazila (sub-district). However, in Dhaka the major problem we found was disturbance by other birds at nesting cavities, especially House Crow and Common Myna, but even feral Rock Doves *Columba*

livia, which were witnessed defending their nest containing eggs by flapping their wings at prospecting parakeets. There appear to be limited numbers of suitable nesting cavities in modern buildings and high competition for these between species affects nesting attempts. Intense storms (locally called *kalbaishakhi*) in April are also a natural threat to the offspring, which mainly fledge during that month.

DISCUSSION

At best, Alexandrine Parakeet barely survives in the north-west, north and south-west of Bangladesh, where felling of large trees and capture of nestlings remain serious threats. In contrast, despite limited tree cover, we have found an increasing population in Dhaka. Despite the few previous sightings from Ramna Green, Dhaka, noted in Thompson *et al.* (2014), Dhaka now holds the largest population in Bangladesh.

The species appears to be gradually adapting to urban and semi-urban ecosystems where there are fewer human threats. The recent population increase in Dhaka may be due to a variety of factors, including availability of food, safe nesting cavities in buildings, and lack of predators. It is assumed that the parakeets initially escaped from captivity and bred successfully for a few years before being discovered by birdwatchers. It is also notable that not a single nest has been found in a tree so far in Dhaka.

Ancillotto *et al.* (2016) predicted a high invasion risk across many parts of the globe by this species, and in Europe feral Alexandrine Parakeets have adapted to a colder climate, probably by taking advantage of the abundant food resources and range of microclimates present in urban areas, as it has done in Iran (Khaleghizadeh 2004) and as Rose-ringed Parakeets have done in Rome, Italy (Fratelli 2014), and many other European cities. Behavioural plasticity has been identified as a factor in the capacity

of other parrot species to adapt to anthropogenic habitat change (Salinas-Melgoza *et al.* 2013), and this appears to lie behind the expansion of Alexandrine Parakeet into urban areas of Bangladesh. However, despite a perceived shortage of suitable nesting cavities in buildings, the species has not so far successfully nested in artificial nest-boxes. Even so, birds regularly entered and spent increasing time in wooden nest-boxes, suggesting that they may be used in future.

Plate 2. Feeding activities of Alexandrine Parakeet in different trees. M. S. H. SOURAV



Ziziphus mauritiana (seed)



Polyalthia longifolia (seed, young leaf)



Spathodea campanulata (nectar, flower bud)



Acacia moniliformis (seed)



Terminalia catappa (seed)



Gmelina arborea (seed, nectar, flower bud, young leaf)



Neolamarckia cadamba (fruit, seed)



Putranjiva roxburghii (seed)



Melia azedarach (seed)



Tectona grandis (seed)



Cassia simea (seed, flower bud)



Lagerstroemia indica (seed)

Contrary to IUCN Bangladesh (2015), we recommend that this species be re-categorised as nationally Endangered. IUCN Criteria B2ab (ii), (vi) and (v) are met as the area of occupancy has drastically reduced to three subpopulations. In the north-west there are high threats (nestling capture and loss of old trees with cavities) to the small population in Lalmonirhat, where recent observations are from just two locations (including surrounding connecting areas, the area of occupancy is about 550 km²), and the number of mature individuals is declining, while in Bogura a small population has been found in a few square kilometres of the city. The growing Dhaka city population remains small and appears to depend for nesting on one small area covering about 12 km² (although the greater city has an area of about 300 km²). Criterion C2a (i) is met by the small subpopulations and a continued decline (at least in the north-west). The total number of mature individuals is estimated to be in the range of 50–250, meeting Criterion D. The two urban subpopulations are 150–200 km distant from the two locations in Lalmonirhat and, although the Lalmonirhat subpopulation is only some 50 km from the nearest sites where parakeets have been recently recorded in India (eBird – for example the Indian Teesta Barrage), the fact that birds are rapidly declining here suggests that there is no effective replenishment from birds outside Bangladesh.

The future of Alexandrine Parakeet in Bangladesh appears now to depend on its ongoing adaptation to urban life. The population in Dhaka should continue to be studied with the aim of documenting its size, trends, nesting success, use of nest-boxes and further adjustment to city conditions, and thereby understanding whether or not it needs any additional human support in the enterprise. Although parakeets clearly can use buildings for nesting, it will be important to protect existing mature trees that parakeets depend on for feeding and roosting, since many mature trees have recently been felled for urban development. Radio-telemetry could be used to understand local movements in different seasons and to determine whether parakeets are totally reliant on city trees for foraging or if they forage further afield for parts of the year. In rural areas where parakeets still occur, awareness-raising campaigns are needed to discourage capture and trade and to encourage protection of suitable nesting trees.

ACKNOWLEDGEMENTS

We thank Farhad Ahasan Pavel for his help during fieldwork, Roland Nathan Mandal, Sayam U. Chowdhury, Mohammed Rouashon Ali, Dr Md Jakariya, Enam Ul Haque, Ronald Halder and M. H. Khan for their support of the research, and two anonymous reviewers and Nigel Collar for their suggestions and improvement to this paper.

REFERENCES

Ali, S. & Ripley, S. D. (1983) *Compact handbook of birds of India and Pakistan*. Bombay: Oxford University Press.

- Ancillotto, L., Strubbe, D., Menchetti, M. & Mori, E. (2016) An overlooked invader? Ecological niche, invasion success and range dynamics of the Alexandrine Parakeet in the invaded range. *Biol. Invasions* 18: 583–595.
- Angelici, F. M. & Fiorillo, A. (2016) Repeated sightings of Alexandrine Parakeet *Psittacula eupatria* in Rome (Central Italy) and its likely acclimatization. *Riv. Ital. Orn.* 85(2): 33–35.
- BirdLife International (2017) Species factsheet: *Psittacula eupatria*. Accessed at <http://www.birdlife.org> on 19/06/2017.
- Feeroz, M. M., ed. (2016) *Biodiversity of Inani Protected Forest*. Dhaka: Arannayk Foundation.
- Fratlicelli, F. (2014) The Rose-ringed parakeet (*Psittacula krameri*) in an urban park: demographic trend, interspecific relationships and feeding preferences (Rome, central Italy). *Avocetta* 38: 23–28.
- Haque, E. U. & Onu, T. (2010) *Bangladesher pakhir field guide* [Field guide to birds of Bangladesh]. Dhaka: Bangladesh Bird Club.
- Hume, A. O. (1888) The birds of Manipur, Assam, Sylhet and Cachar. *Stray Feathers* 11: 1–353.
- IUCN Bangladesh (2000) *Red list of threatened birds of Bangladesh*. Dhaka: IUCN.
- IUCN Bangladesh (2015) *Red list of Bangladesh*, 3. Dhaka: IUCN.
- Juniper, T. & Parr, M. (1998) *Parrots: a guide to the parrots of the world*. Robertsbridge, UK: Pica Press.
- Khaleghizadeh, A. (2004) On the diet and population of the Alexandrine Parakeet, *Psittacula eupatria*, in the urban environment of Tehran, Iran. *Zoology in the Middle East* 32: 27–32.
- Khan, A. A. & Hussain, I. (1990) Parakeet damage to standing crop in Pakistan. *Sarhad J. Agric.* 6: 185–191.
- Pithon, J. A. & Dytham, C. (1999) Census of the British Ring-necked Parakeet *Psittacula krameri* population by simultaneous counts of roosts. *Bird Study* 46: 112–115.
- Rainey, H. J. (1875) Nidification and breeding habits of the large Rose-ringed Paroquet in the eastern Sundurbun. *Stray Feathers* 3: 382–384.
- Salinas-Melgoza, A., Salinas-Melgoza, V. & Wright, T. F. (2013) Behavioral plasticity of a threatened parrot in human-modified landscapes. *Biol. Conserv.* 159: 303–312.
- Siddiqui, K. U., Islam, M. A., Kabir, S. M. H., Ahmad, M., Ahmed, A. T. A., Rahman, A. K. A., Haque, E. U., Ahmed, Z. U., Begum, Z. N. T., Hassan, M. A., Khondker, M. & Rahman, M. M., eds. (2008) *Encyclopedia of flora and fauna of Bangladesh*, 26. Birds. Dhaka: Asiatic Society of Bangladesh.
- Sohel, S. I. (2015) [Mithu-Pakhir Chao] (chicks of Mithu bird). [*Banglar Pakhi*] (Bangladesh Bird Club Newsletter) 2: 8.
- Thompson, P. M., Chowdhury, S. U., Haque, E. U., Khan, M. M. H. & Halder, R. (2014) Notable bird records from Bangladesh from July 2002 to July 2013. *Forktail* 30: 50–65.

Md. Sharif Hossain SOURAV, Ecology, Forestry and Biodiversity Division, Center for Environmental and Geographic Information Services (CEGIS), Dhaka, Bangladesh. Email: nature.sourav@gmail.com

Paul M. THOMPSON, Middlesex University, Hendon, London, United Kingdom.

K. F. BISWAS, Department of Environmental Science and Management, North South University, Dhaka, Bangladesh.