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COMMUNICATION

CREPUSCULAR HUNTING OF SWIFTLETS (FAMILY: APODIDAE) BY BESRA (FAMILY: ACCIPITRIDAE) IN THE URBAN AREAS OF THE ANDAMAN ISLANDS, INDIA

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Crepuscular hunting of swiftlets (Family: Apodidae) by Besra (Family: Accipitridae) in the urban areas of the Andaman Islands, India

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Abstract: We report the crepuscular hunting behavior by the Besra *Accipiter virgatus*, on the Glossy Swiftlets *Collocalia esculenta affinis* and the Edible-nest Swiftlets *Aerodramus fuciphagus inexpectatus* in urban areas the Andaman & Nicobar Islands. Unlike other raptors in the islands, the Besra hunts at twilight often in the absence of moonlight or/and artificial light. Glossy and Edible-nest Swiftlets have been ranched in human habitations and their nests harvested for livelihood support of local communities under an ex situ conservation program. Using the focal animal sampling method, we recorded the hunting behavior of the Besra (the predator) on the swiftlets (the prey) for 40h (120 min/day for 20 days) at the ex situ swiftlet colony established in a house in the Middle Andamans. The Besra made 84 hunting attempts, with the highest success rate (15.4%) between 17.00–18.00 h. The catch rate was a mean of 4±11 (SD) per day. The maximum time that was used for attempt to kill the prey was two hours. Depredation of the Edible-nest Swiftlet by the Besra could affect ex situ conservation efforts, which can also lead to economic losses and retaliation against the raptor. Restricting perch sites for the raptor around ranching houses might reduce predation risks for the swiftlets.

Keywords: Andaman & Nicobar Islands, Besra, crepuscular hunting, Edible-nest Swiftlet, ex situ conservation, predatory behavior.

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Author contribution: AD—conceptualization, data curation, methodology, writing – original draft; DK—conceptualization, data curation, formal analysis, methodology, writing – original draft; PG—conceptualization, methodology, data curation, writing – original draft; SM—funding acquisition, investigation, project administration, resources, conceptualization, supervision, validation, writing – review & editing.

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INTRODUCTION

Availability of food and potential nesting sites play an essential role in adapting birds to survive urban environments (Marzluff 2016). Glossy Swiftlet *Collocalia esculenta affinis* and the Edible-nest Swiftlet *Aerodramus fuciphagus inexpectatus* (Cranbrook et al. 2013) are examples of birds that are adapted to urban habitats in the Andaman & Nicobar Islands (Manchi & Mane 2012). This successful adaptation is due to the availability of nesting locations and food. Some cave-dwelling swiftlets such as the Edible-nest Swiftlet are of human interest and famous worldwide for 'bird's nest soup,' a delicacy in Chinese cuisine, and traditional Chinese medicine (Koon & Cranbrook 2002; Chantler & Boesman 2019). The nests exclusively built using bird's saliva have a high market value due to their medicinal properties. These birds are farmed for mass production of the edible nests to sustain international demand (Hobbs 2004; Thorburn 2015).

In the past several decades, the nests have been illegally harvested from caves in the Andaman Islands, impacting the population. For sustainable use of the birds' nest and to reduce the pressure on wild populations, an ex situ conservation program was started in urban houses, which habituated the Edible-nest Swiftlet to nest in human-made structures. The Glossy Swiftlet also nests in abandoned houses, bridges, and jetties. As part of the conservation program, the swiftlets are attracted to human habitation and reared in an artificial structure, known as ex situ swiftlet house (Manchi & Mane 2012). Scientists and managers with years of efforts, have successfully attracted the Edible-nest Swiftlet population to breed in one such ex situ structure (henceforth 'swiftlet house') in the Middle Andamans by using the sympatric Glossy Swiftlet as foster parents to hatch the eggs and rear the chicks (Sankaran & Manchi 2008). This swiftlet house supports a colony of Glossy Swiftlet (~1,000 individuals) and Edible-nest Swiftlet (8–10 individuals). The Edible-nest Swiftlet (ENS) shares the nesting site with the Glossy Swiftlet. Some young ENS birds are also known to build nests on existing Glossy Swiftlet nests.

During our study, the swiftlet population in the house was hunted by the raptor, Besra *Accipiter virgatus abdulalii*, at dawn and dusk. Besra is a small, diurnal bird of prey of the Order Falconiformes. Out of 11 subspecies of *A. virgatus*, *A.v. abdulalii* is an endemic subspecies restricted to the Andaman Islands (Naoroji 2006; Clark & Marks 2020). Due to the easy availability of the prey, and its nesting locations, Besra has adapted to the urban

habitats in the Andaman Islands. As the other members of the genus *Accipiter*, the Besra is a swift and silent hunter. The species is quick on the wing in quest of prey, often twisting and turning to chase the bird and escape hindrances. Besra breeds from March to May and nests on roadside trees, near human habitation, mangrove forests, and Padauk plantations (Ali & Ripley 1978). Being an opportunistic hunter, the diet of Besra includes small birds, insects, and some mammals and reptiles, depending on the season and availability of prey. It primarily preys on birds during the breeding season (Huang et al. 2004). In the Andaman Islands, the Besra predated on poultry near human habitation. It is also a potential predator of swiftlets breeding in the limestone caves of the Andaman Islands, according to Manchi & Sankaran (2009).

Foraging in twilight is generally regarded as an end or beginning of diurnal or nocturnal activity. While crepuscular foraging is uncommon, many nocturnal predators such as owls, nightjars, and waders begin hunting at dusk. The circumstances under which crepuscular hunting occurs are not well understood or documented (Martin 1990). Among diurnal raptors other than owls, the smaller species of the genus *Falco* (Lesser Kestrel *F. naumanni*, Kestrel *F. tinnunculus*, Hobby *F. Subbuteo* and Sooty Falcon *F. concolor*) and large-bodied falcons such as the peregrine falcon hunt at night under artificial lights such as street lamps, and moonlight (Ratcliffe 1980; Pierson & Donahue 1983).

As the swiftlet ranching in the ex situ houses aims to provide livelihood support for the economic development of the local populations in the Andaman Islands, the threat from Besra can have significant implications. Therefore, we studied the crepuscular hunting behavior of Besra. Further, we hypothesized that the successful hunting of swiftlets by Besra is associated with i) time of day (diurnal vs. crepuscular), ii) availability of perch sites, and iii) flock size of swiftlets.

MATERIALS AND METHODS

Study Area

The Andaman group of islands is in the northeastern Indian Ocean, along the southern extension of the Arakan Yoma mountain range, are peaks of a submerged continuous mountain ridge extending up to Sumatra in the south, between latitude 6.75–13.68 °N and 92.20–93.95 °E. The Andaman group of islands are divided into (a) South Andaman, (b) Middle Andaman, (c) North Andaman, (d) Baratang, and (e) Rutland. The forest

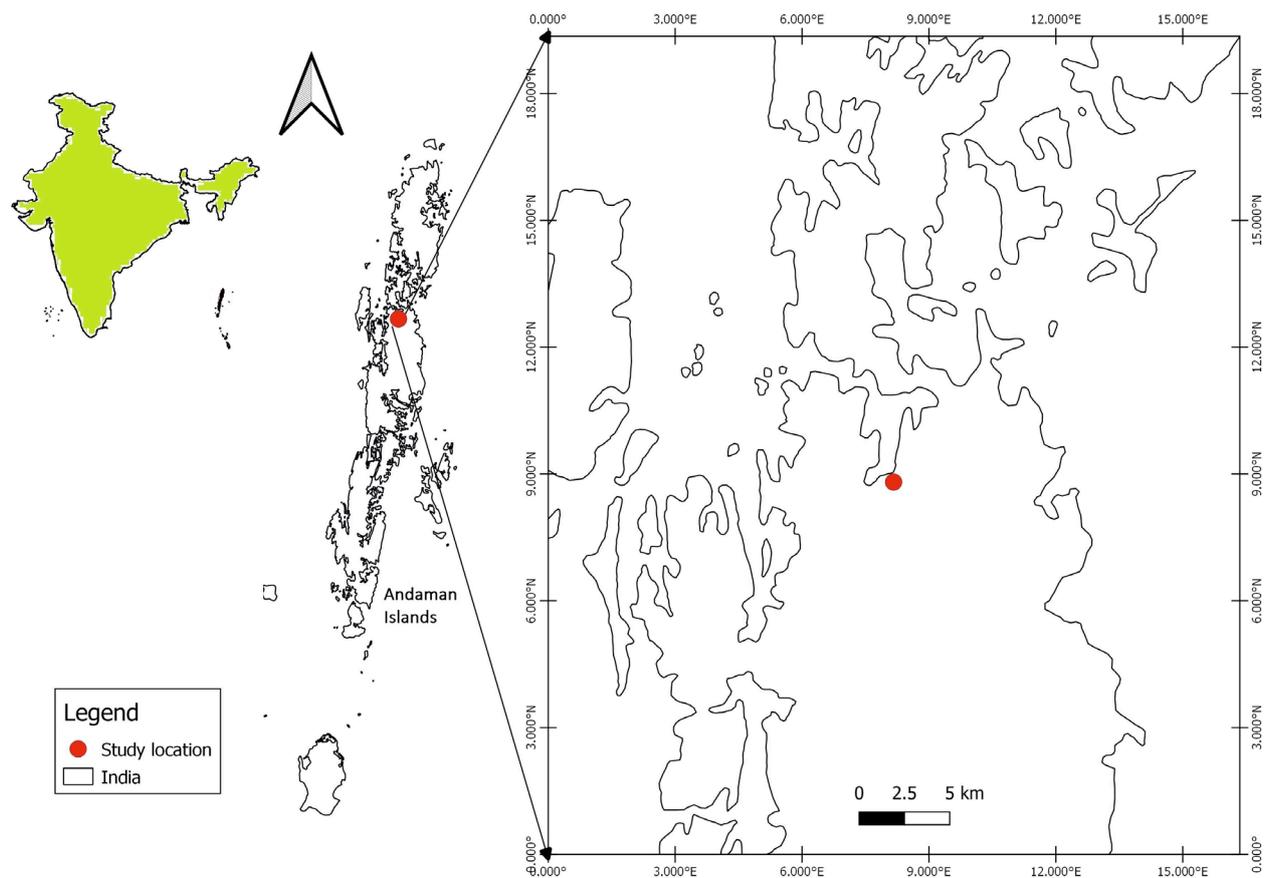


Figure 1. Geographical location of the study site.

types range from the tropical wet evergreen forest towards the south to tropical moist deciduous forest in the North Andaman group of islands (Davidar et al. 2001; Champion & Seth 2005). Parts of the islands also have human settlements and agricultural fields surrounded by deciduous forests. This island group, with a high proportion of endemic flora and fauna, is one of the global biodiversity hotspots in the world (Conservation International 2005). The archipelago has 19 identified Important Bird and Biodiversity Areas (Rahmani et al. 2016) and is also recognized as an endemic bird area (Birdlife International 2019). Including endemic species such as Andaman Serpent Eagle *Spilornis elgini*, Great Nicobar Serpent Eagle *Spilornis klossi*, Central Nicobar Serpent Eagle *Spilornis minimus*, and Nicobar Sparrowhawk *Accipiter butleri*; the Andaman & Nicobar Islands have 22 raptor species.

We conducted the present study in the northernmost part of Middle Andaman in Tugapur near Mayabunder town (Figure 1). The temperature in Tugapur during April was between 27°C and 35°C (Accuweather 2018). Sunrise and sunset were between 05.01h & 05.16h and

17.31h & 17.33h, respectively (Time and Date 2018). Human habitation and small patches of deciduous forest surround the swiftlet house. Plant species such as *Azadirachta indica* A. Juss., *Gliricidia sepium* (Jacq.) Walp., *Calamus* sp. L., *Tectona grandis* L.f., and *Ficus religiosa* L. are seen around the swiftlet house. We made daily visits to the swiftlet house during the late summer season from 02 April to 28 April 2018 between 16.00h and 18.00h. The study period coincided with the breeding season of the Besra (Ali & Ripley 1978) and swiftlets (Manchi & Sankaran 2014). The activities of the Besra near the swiftlet house were studied using focal animal sampling (Altmann 1974). We made observations from the moment the individual arrives around the swiftlet house until it leaves the site. Simultaneously, swiftlets around the house were observed to understand the interaction between the prey and predator. Three observers were stationed at different observation stations around the house to observe and note the behavior of the Besra along with the time (Figure 2). With 120 min of observation every day, we collected data for 2,400 min in 20 days. Occasionally, we prolonged the observations

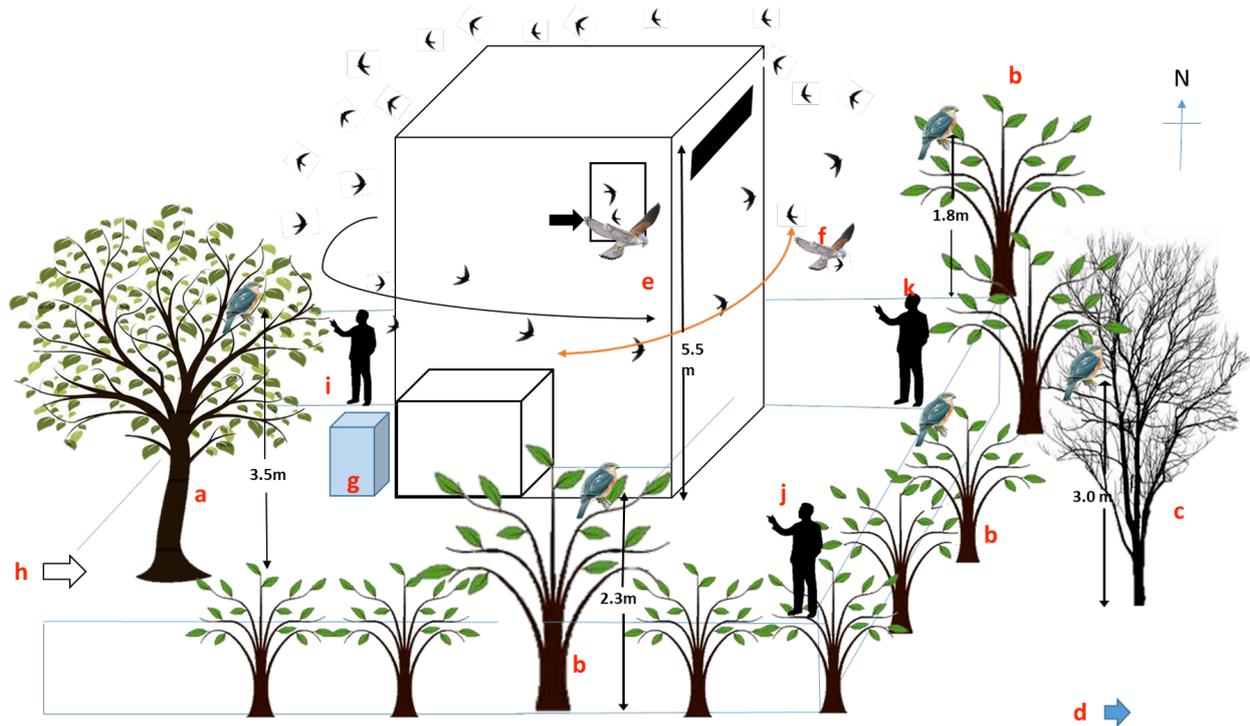


Figure 2. Study site: a—*Azadirachta indica* | b—*Gliricidia sepium* | c—*Tectona grandis* | d—towards *Ficus religiosa* | e—entrance of the swiftlet house for swiftlets | f—frequently used path by Besra | g—water tank | h—entry of the study site | i–j–k—observation stations.

until 18.30h to check the presence and activity of Besra. Because of unfavorable circumstances, we could make only one observation during the morning hours (04.45–07.00 h). To process the collected data, we used XL-STAT software (Ver. 2020, Addinsoft 2020). We excluded the set of data from the single morning visit during analysis. Ethograms of Besra was made based on behavioral observations. No ethical approval was obligatory for this study.

RESULTS

The present study confirms the Besra as a predator of the swiftlets. Swiftlets being diurnal foragers, the breeding individuals keep returning to the breeding location to feed their nestlings, and the arrival of the Besra was at 16.00h. During the 20 days of observations, the Besra made 84 hunting attempts per day to catch swiftlets with 4 ± 11 (Mean \pm SD). It preyed upon 1 ± 0.5 swiftlets per day, with 14.92% (n=84) successful attempts. The most hunting attempts were between 17.31–17.50 h (67.80 %), and most successful (11.48%) and unsuccessful (56.32%) attempts were also made during the same period (Figure 3). Comparing the sunset timings (17.31h to 17.33h on observation days)

and the period of most hunting attempts were during the crepuscular (twilight) hours (Time and Date 2018). It confirmed the crepuscular hunting behavior of Besra, the predator. Out of the total time the besra spent near the ex situ house, 48% was spent attempting a kill while 35% time was spent on the perch (Figure 4).

All the hunting attempts, successful or unsuccessful, were on the flock of swiftlets swarming in the lower canopy (2–5 m above ground) and never above the canopy. The number of attempts increased as the swiftlet flock size increased (Table 1). The Besra captured and carried its kill with its claws. Immediately after capture, the predator brought each kill to the same perch of attack (mostly *Azadirachta indica*) or the nearest landing site (mostly *Tectona grandis* within 10m). As the swiftlets gathered around the house in small groups (15–20 birds), the Besra would chase the selected prey with athletic ease, twisting, turning, and swooping close to the ground (6 in Figure 2) as the aerodynamic swiftlet tried to break away from its grasp. The predator and the prey are swift flyers, and thus sometimes swiftlets managed to evade the predator successfully. The height at which the chase was made, particular areas around the swiftlet house, and the time of the hunt influenced a successful kill.

Table 1. Table 1. The hunting attempts by the Besra (the predator) at a given time in relation to the flock size of swiftlets (the prey) (Note: flock size: <50—small | 50–200—medium | 200–500—large)

Time (h)	Flock size of swiftlets	Total hunting attempts (% success)
16.20–16.30	small	1 (0)
16.30–16.40	small	1 (0)
16.40–16.50	small	6 (50)
16.50–17.00	large	3 (0)
17.00–17.10	large	0
17.10–17.20	large	6 (0)
17.20–17.30	large	11 (0)
17.30–17.40	large	35 (14.28)
17.40–17.50	small	21 (23.80)
17.50–18.00	small	0
	Total	84

The Besra usually ripped off the feathers of its prey before consuming the kill. Occasionally, it would swallow the feathers too. The Besra spent 16% of its time in consuming the kill (Figure 4). By examining the kill remnants, we confirmed that the prey species was Glossy Swiftlet, however, once the population of the Edible-nest Swiftlet grows, we cannot deny the possibility of it being hunted by the Besra.

The most hunting attempts by Besra were from a particular perch in the canopy of a large *Azadirachta indica* (46.17%), beside the swiftlet house, however, the Besra was observed using other perching sites around the swiftlet house as well (Table 2). After each attempt, it often perched (30.76%) on *Gliricidia sepium* (2 in Figure 2). The predator returned to the same perch on *Azadirachta indica* for the next attempt to catch a swiftlet.

DISCUSSION

Swiftlets are known to flock near their breeding and roosting sites during dawn and dusk while leaving or returning to their roosts (Tarburton 2009; Mane & Manchi 2017). The cave-dwelling swiftlets are usually known to be vulnerable while entering and exiting the caves (Mane & Manchi 2017). The present study, however, is the first to document aerial predation of swiftlets by the Besra around human-habitation. Flying in flocks equips the swiftlets to successfully evade predators. The time of arrival at the roost (Mane & Manchi 2017, 2019) and the speed used for entering the

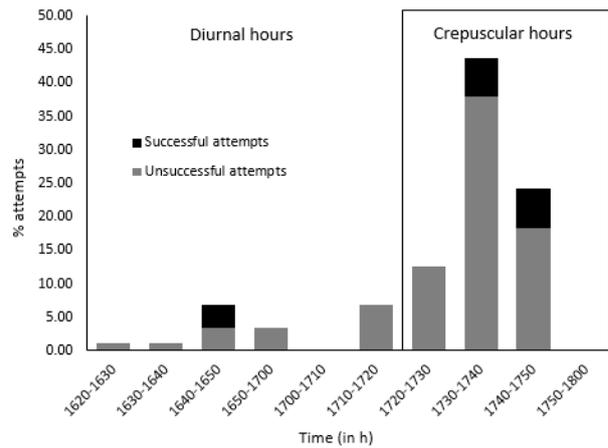


Figure 3. Hunting attempts (in %) by the Besra in relation to the time of the day.

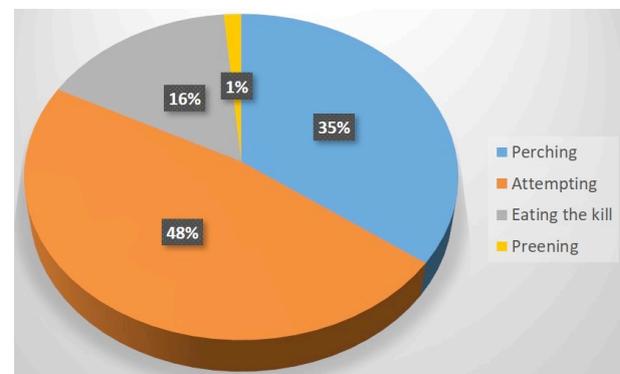


Figure 4. Activity time budget of Besra near the ex situ swiftlet house, Middle Andaman Island.

breeding/roosting sites (Tarburton 2009) are counted as the anti-predatory behaviors of the swiftlets.

Approximately 20km from the swiftlet house, we located a Besra chasing the swiftlets during morning and evening twilight hours. This location hosts thousands of Glossy Swiftlets. Here, we observed the swiftlets forming to chase away the predator. Therefore, we can see two anti-predatory mechanisms in the swiftlets, one to escape the predator by forming groups, and secondly by mobbing the predator by forming larger groups. The anti-predatory behavior may limit the number of prey obtained by the Besra. Apart from the Besra, we noticed that the Shikra *Accipiter badius* attempting to hunt swiftlets near the swiftlet house between 16.00 and 16.30 h from the *Ficus benghalensis* L. trees which was the tallest in the study site. The Shikra chased the swiftlets swarming in the open air but was unsuccessful in catching a bird.

As the number of Glossy Swiftlets in the swiftlet

Table 2. Perch sites used by Besra while hunting the swiftlets near the ex situ swiftlet house, Middle Andaman.

	Scientific name of the perch tree	Common name of the perch tree	Height of perch (meters)	Total hunting attempts (% success)
1	<i>Azadirachta indica</i> A. Juss	Neem	3.5	13 (46)
2	<i>Gliricidia sepium</i> (Jacq.) Walp	Gliricidia	2.3	13 (15)
3	<i>Gliricidia sepium</i> (Jacq.) Walp	Gliricidia	1.8	13 (8)
4	<i>Gliricidia sepium</i> (Jacq.) Walp	Gliricidia	2.3	13 (8)
5	<i>Tectona grandis</i> L.f.	Teak	3	7 (14)
6	<i>Ficus religiosa</i> L.	Peepal	~7	26 ((8)

house is greater than the Edible-nest Swiftlet, we can say that the Besra may be preying on the more easily available target. It makes the Edible-nest Swiftlet as vulnerable to predation as the Glossy Swiftlets, putting the already low population at risk.

Sparrow-hawks use at least a 15cm circumference branch of a tree or a moderately flat surface for perching (Owen 1932). Although we could not confirm the same for the Besra, the repetitive use of the same perch shows some preference for perches. To avoid predation of swiftlets, it is essential to avoid such ideal ‘perches’ or trees near the swiftlet house. Removal of these ideal available perches might drastically reduce the rate of predation of the swiftlets by the Besra, at least till the individual finds and learn to use any other perching site and hunting strategy. The predation behavior depends mostly on the cognitive ability of an individual; it is challenging at present to ascertain the change in the predation rates by the Besra after removal of the perch trees around the house.

Many raptors have shown adaptations in hunting and foraging behavior according to the prey resources. The Bat Hawk *Macheiramphus alcinus* in sub-Saharan Africa, South Asia, and New Guinea, is known to hunt bats during the twilight hours. The bat hawk’s adaptation in morphology and behavior results from the prey’s biology (Black et al. 1979). The Bat Falcon *Falco ruficularis*, found in Mexico, and Central and South America, is another bird that hunts bats at dusk. The Bat Falcon has also adapted to hunting in urban environments (Seijas 1996). The Peregrine Falcon, a diurnal bird, is also reported to prey on bats (Pierson & Donahue 1983), and some even during dusk or at night (Rejt 2001). Mester & Oliver (2018) reported an unusual fishing behavior of the Eurasian Sparrowhawk during winter when the prey are scarce. Their report suggested, ‘Raptors may be able to adopt unusual hunting or foraging behavior and prey selection in response to changing environmental conditions and changing availability of potential prey

resources.’ Therefore, with a more focused study and observations throughout the islands, it can be concluded whether *A. v. abdulalii* of Andaman Islands has adapted to crepuscular hunting owing to the swiftlet’s ecology, and whether this behavior is limited to urban areas (in ex situ structures) or exists everywhere.

CONCLUSION

Since the swiftlet-farming efforts are in the direction of livelihood development and economic growth in the islands, any hindrance to such a program will ultimately affect the local human populations. The raptor-human conflict that may arise from this is a threat to the survival of both (prey and predator) species. Based on the observations discussed, we now recommend maintaining the premises of the swiftlet houses by restricting the vegetation growth for better management of the swiftlet populations in urban areas and also to avoid future raptor-human interaction.

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