

On the breeding biology of the Indian Spotted Eagle *Aquila hastata*

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Introduction

The Indian Spotted Eagle *Aquila hastata* was recently re-elevated to full species status (Parry *et al.* 2002; Rasmussen & Anderton 2005). It is a widespread species and has been recorded in very low densities in the lowlands of the Indian Subcontinent; occurring in Pakistan, Nepal, India, and Myanmar (Robson 2000; Parry *et al.* 2002; Rasmussen & Anderton 2005). It is classified as Vulnerable by the IUCN (BirdLife International 2013) and is distributed mainly across the Gangetic Plains up to Manipur, central India, Orissa, West Bengal, Uttaranchal, and Karnataka (Rasmussen & Anderton 2005). A woodland species, it breeds in isolated trees or groves within cultivation or public and botanical gardens, occasionally in thick forest or along forest margins (Naoroji 2006). Less dependent on marshes and river systems, it nevertheless exploits aquatic systems for food (Naoroji 2006). Very few published records of its breeding biology are available; from Bharatpur, Rajasthan (Prakash 1996), Mysore, Karnataka (Shivaprakash *et al.* 2006), and Sonapat, Haryana (Sharma & Chanda 2010). In this paper we give additional information on the breeding biology and food habits of this species.

Study area

This study was conducted in Belgaum, a city and municipal corporation located in north-western Karnataka (India) at an altitude of 752 m above MSL. It is the fourth largest city in the state after Bengaluru, Hubli-Dharwad, and Mysore. It receives an annual rainfall of around 125–135 cms. Temperature varies from 8°C to 40°C.

The nesting area was located on the eastern side of Belgaum, quite close to human habitation. To the south of the city is a lone hill with an old fort atop, and a few settlements at its base. The nesting area is three kilometers from here and one and one-half

kilometers from human habitation. The area is mostly under cultivation with paddy being the main crop, while in winter cereals and mustard are also grown. A large rain-fed stream, named Ballari and its smaller tributaries, drain the area. Large trees of *Mangifera indica*, *Terminalia arjuna*, *Syzygium cumini*, *Ficus racemosa*, and *Eucalyptus* spp., stand on the banks of the stream and its tributaries. Such trees are also scattered in the fields.

Methodology

The study period lasted from 27 January 2011 to 27 July 2011, coinciding with the eagle's breeding season. A single nest of a pair was located by coincidence while birding in the area in March 2009 and other breeding pairs were seen in the area frequently. In 2011 we searched for more nest sites to conduct a study on the breeding biology of the species by following flying adult eagles, and located three. The three authors kept watch on one nest each. Observations from a distance of 75 m were carried out from 0630 to 1000 hrs and from 1530 to 1830–1900 hrs. On a few occasions observations were carried out at a stretch from 0630 to 1830–1900 hrs. Breeding was observed through courtship to fledging, and 450 hours of observation were completed. We used 10x42 Nikon and Leica binoculars, and digital cameras with super telephoto lenses (500mm and 800mm) for observation. All activities were recorded on digital camera.

Results

Three nesting attempts were observed during the study period. The nests are referred to as 'A', 'B', and 'C' hereafter.

Nest characteristics

All nests were on live *T. arjuna* trees on the banks or near the stream and its tributaries. An alternate nest of pair 'A' was on a *S. cumini* tree. Nest 'A' was in a stand of few *T. arjuna* trees in the middle of fields [25]. Nest 'B' and 'C' were on the banks of the main stream. Indian Spotted Eagle nests were located at an average height of 12.20 m above the ground in trees typically 13.99 m in height. The average DBH of nest trees was 1.07 m. All nests were below tree crowns, averaging 1.79 m from the treetops. Nests were placed on main branches or on lateral branches with supporting branches ranging from three to five. The distance between two neighboring nest sites averaged 1025 m (range 1000–2000 m).



25. Nesting tree *T. arjuna* of Indian Spotted Eagle. Photo: V. Shelke.



26. Breeding pair of Indian Spotted Eagle *Aquila hastata*.



27. Indian Spotted Eagle *A. hastata* male carrying a stick to the nest.

Breeding biology

Courtship began by end-January. The period was marked by aerial displays consisting of a floating flight with much vocalisation. During inactivity the pairs were seen perched on trees near respective nest sites [26].

Vocalisations

Throughout the nesting period the eagles vocalised. A melodious "keeeek" was uttered as a contact call; the female, upon sighting the male, uttered a "cluck cluck" call. She uttered a louder and urgent "chhaaakkk" when an intruder was seen around the nest site. Vocalisation of a fully-fledged juvenile was similar to the adults but softer.

Nest-building

Collection of twigs for nest construction was observed at all three sites and usually commenced at 0630–0830 hrs. Nest material collection activity was observed only in the mornings and eagles spent an average of 105 min per day for the same [27]. Males brought a majority of the sticks (c. 79%) compared to females (c. 21%). At the start of nest building when the nest structure was small, an average of eight sticks were brought in two hours' time.

As the structure grew, average number of sticks brought to the nest reduced to an average of three. Females were seen either sitting in the nest arranging twigs or sitting on a nearby tree, while the males brought in nest material.

During nest building, only the male brought in prey, sometimes half eaten, held in its beak or talons. Interestingly, even if brought in its talons, the prey would be transferred to its beak mid-flight and delivered to the nest. This was perhaps done to avoid pirating of food by an ever-present pair of Tawny Eagles *A. rapax* or Black Kites *Milvus migrans*. If the prey was small, the female swallowed it whole. Bigger prey was taken to a nearby tree and consumed.

Copulation

The female eagle mostly initiated copulation with characteristic posturing by lowering the head and vocalising [28]. Many times the male landed directly on the female to copulate. Copulation usually occurred after the male had placed a stick in the nest and mostly took place on a nearby tree and sometimes on the nest tree. The male called continuously during copulation. The highest frequency of copulation recorded on a single day was between 0700–0930 hrs, (N=4 copulations).

Pair changes and mate loss

The male from nest site 'C' went missing from 10 April. We kept a watch on the site for the next ten days, but the male was not to be seen. The female was seen on and around the nest during this time. House Crows *Corvus splendens* harassed the female in the nest and she frantically called and drove them away. On 15 April eight crows were sighted on the nest. The female was perched some distance away and did not try to chase the crows, nor did she vocalise. After this incident she was never seen on the nest, but perched on a nearby tree for the next few days. Soon after she left the site completely.

At site 'A', a new individual replaced the female of the breeding pair during nest building. The old female had a broken leg. She was driven off from the nest and not seen thereafter. Pair 'A' started building a new nest on a *S. cumini* tree 500 m from the earlier nest site.

Incubation

Incubation started on 10 and 18 April in nest sites 'A' and 'B' respectively [29]. We could not determine whether eggs were laid or not in nest site 'C'. The clutch size for the other two sites



28. Indian Spotted Eagle *A. hastata* pair copulating.

was unknown (we did not check the nest contents, so as not to disturb the birds). The incubation period varied from 38–42 days ($N=2$ nest sites). Mostly females incubated. The male's responsibility throughout this period was to provide food to the incubating female. Males brought prey to the nest and females took possession and consumed the prey on a nearby tree. The males relieved females for short periods ranging from 10–75 mins ($N=2$ pairs), while their mates fed. As soon as a female returned to the nest, the male got up and flew away. Most of the prey deliveries were done between 0700 and 0930 hrs, but very rarely in the late evenings as well.

It is perhaps worth noting that Parry *et al.* (2002) hypothesized a probable reason for the large gape of the *A. hastata* was in facilitating hyperventilation when confined to the nest. We did not notice any marked hyperventilation by either incubating adults, or the juvenile.

Nestling and fledging period

Site 'A'

On 20 May we observed a single, small, grayish-white wobbly head near the female's wings [30]. On most days the male brought prey between 0700 and 0830 hrs to the nest. On one occasion we saw the male bring a small frog and commence feeding the chick even though the female was sitting in the nest [31]. By the second week the chick grew bigger and turned very inquisitive. By this time the monsoon was in full swing and we observed the female shelter the chick from the downpour. Once the rain ceased, the female would fly off the nest onto a nearby tree to dry her plumage. As soon as the rain resumed, she would fly back to attend to her offspring. Because of heavy rains and flooding in the fields we could not carry out observations between 8 and 12 June. We resumed observations on the morning of 12 June, and found the nest empty. The male was seen flying and vocalising a couple of 100 m away. It would perch on a nearby tree for a while and then again fly, vocalizing, circling the tree, similar to the courtship display flights. There was no sign of the chick. The pair did not come to the nest that morning. We checked the site for the next four days and searched for the remains of chick, but failed to find anything. Since the chick was too young (three weeks old) to have fledged, we presumed it had perished.

Site 'B'

This site had one chick too. By the time it hatched, the monsoon



29. Nest 'A' with female Indian Spotted Eagle *A. hastata* incubating



30. Female Indian Spotted Eagle *A. hastata* and chick



31. Male Indian Spotted Eagle *A. hastata* feeding a frog to its chick.

had begun. The female alone brooded for the first 20 days, sheltering the chick from rain. The male was confined to bringing prey to the nest every morning. The female fed the chick with tiny morsels, and consumed bigger bones and head of the prey herself. By week two, the chick was seen moving in the nest and the following week small black-brown feathers started to emerge on its back and wings. With the growing chick, the frequency of prey delivery increased to three to four rodents a day. By week four, the female began leaving the nest unattended for differing periods of time, the maximum period being two hours. The female was observed reinforcing the nest with new material throughout the nesting period; mostly with live leafy twigs of *Eucalyptus* sp. By now the female resumed hunting, mostly from the nesting tree. By the sixth week the chick was almost covered with dark brown to black feathers, and was left unattended for hours at a time. Once in a while a parent would be observed circling around the nest.

The lone chick grew fast and by week seven its plumage was mostly dark-black with heavy spots all over except the lower belly down from the chest. The chick was now fully-fledged. It was observed flapping its wings a lot [32]. It sat on branches right over the nest and whenever Black Kites dived at it, uttered a loud call and jumped onto the nest. Frantic loud vocalisation by the fledgling indicated an adult approaching the nest with prey. As

soon as an adult came close to the nest with food, the fledgling jumped onto the nest and the prey was delivered to it inside. If the prey was small, it was swallowed whole, while larger items were torn up into pieces. The juvenile eagle made its maiden flight on 17 July. It flew a distance of 50 m and sat atop a tree, but was mobbed by House Crows and consequently flew back to the nest. With each passing day the juvenile flew regularly and seemed to gain in confidence. Even when the juvenile was on a nearby tree, the adults delivered prey to the nest. By 20 July the juvenile started to spend a lot of time away from the nest tree, perched in thick foliage of nearby trees. On 27 July, we observed the juvenile for the last time near the nest site. The monsoon made it impossible to access the nest site for further observations. The fledgling period was 57 days.

Reproductive success

In the three fully documented nest sites, two pairs bred chicks, out of which only one fledged successfully. The clutch sizes remained unknown, but we have observed two chicks successfully fledging in previous seasons. In the three breeding attempts during the current season, one nest failure occurred during incubation or just prior to it (site 'C'), while the other during nesting period (site 'A'). Causes for failure could not be determined. With the presented data, detailed conclusions cannot be reached on the reproductive success of Indian Spotted Eagles. This is an ongoing study and we intend to collect more data in coming years from more nest sites.

Intraspecific and interspecific interactions

Once the chicks hatched the eagles became more aggressive towards threats. At the slightest alarm, the male eagles chased away intruders. Even females were very wary of intruders, and vocalised loudly whenever Black Kites and House Crows came near the vicinity of a nest site. At site 'A' we observed a juvenile Changeable Hawk-eagle *Nisaetus cirrhatus*, which landed 100 m from the nest site. The response from the male eagle was very different from how it tended to react to a kite, crow or even an Oriental Honey Buzzard *Pernis ptilorhynchus*; it took off from its favorite perch, landed on the nest, and simply sat on it. Both male and female looked very 'uncomfortable' till the hawk-eagle flew away; there was no vocalisation.

At site 'B' some interactions were observed; as the chick grew bigger, the adults left it unattended for hours together, and the chick was harassed by crows and kites. It would vocalise loudly at the intruders. Adult eagles would respond to the calls and drive them away. We observed a Bonelli's Eagle *A. fasciata* land on an electricity pole 200 m from the nest site. The response was muted and similar to that of the site 'A' pair when they came



33. Male Indian Spotted Eagle *A. hastata* carrying a rodent to the nest

across the hawk-eagle; the female was on a nearby tree and she quickly flew onto the nest and sat there. The behavior of the eagles towards the more predatory Changeable Hawk-Eagle and Bonelli's Eagle was totally different from that towards Black Kites, Oriental Honey Buzzards, and Tawny Eagles.

Food Habits

During the entire nesting period, we observed the eagles preying mostly on rodents. Only on one occasion did we see a small frog being brought to the nest. Once the chick grew bigger, we observed the female from nest 'B' hunting, mostly from the nest tree. It would glide down smoothly into surrounding scrub or paddy fields to catch rodents. We observed it trying to flush prey from bushes, by jumping on the bush and flapping its wings, and as soon as the prey was flushed, it was caught. Almost every time the prey was brought to the nest held in the beak [33]. During the study period we recorded 90 Indian Spotted Eagle prey items (N=3 nest sites), mostly prey deliveries to nest. Rodents (lesser bandicoot-rat *Bandicota bengalensis*, roof rat *Rattus rattus*, little Indian field mouse *Mus booduga* and Asian musk shrew *Suncus murinus*) comprised 98% (N=89) and amphibians (unidentified frog sp.) comprised 1% (N=1). Males delivered 73% (N=66) and females 26% (N=24) of the 90 prey deliveries. It was observed that the number of shrews brought to the nest increased after the rainy season. It is safe to conclude that the Indian Spotted Eagles in the study area play a significant role in controlling rodent populations.

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32. Juvenile. Photos: N. Sant.