# Breeding biology of Blue-eared Kingfisher *Alcedo meninting*

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## Abstract

The breeding biology of the Blue-eared Kingfisher *Alcedo meninting* was studied in Ratnagiri District, Maharashtra, India, between 2012 and 2015. Thirteen clutches of four pairs were studied. Its breeding season extended from June till September. Pairs excavated tunnels ranging in lengths from 18 to 30 cm, with nest entrance diameters varying from 5.3 to 6.0 cm. The same pair probably reuse a nest across years. A typical clutch comprised six eggs. The incubation period was 21 days (20–23 days), while fledgling period was 23 days (20–27 days). Almost 40% of the nests were double-brooded, which ratio probably depends on the strength of the monsoon. Of 75 eggs laid, 66 hatched (88%), of which 60 fledged (90.9%; a remarkable breeding success of 80%.

## Introduction

The Blue-eared Kingfisher *Alcedo meninting* **[113, 114]** is morphologically similar to the Common Kingfisher *A. atthis* but is neither as common, nor as widely distributed, in India, as the former. It has a disjunct distribution in the Indian Subcontinent: a race (*A. m. coltarti*) is found along the base of Himalayas, from central Nepal to Assam, and the hills south of the Brahmaputra, extending till the north-eastern Eastern Ghats of Odisha; Another race (*A. m. phillipsi*) occurs along the Western Ghats, southwards from central Maharashtra, up to Sri Lanka (Ali & Ripley 2001; Shivaprakash 2005; Rasmussen & Anderton 2012). Some uncertainty exists over the race that occurs in the Western Ghats: Ali & Ripley (2001), and Woodall (2016) suggest that it is *coltarti*, and not *phillipsi*. It is also found in the Andaman Islands (*A. m. rufiagastra*), where it is, apparently, more abundant than the Common Kingfisher, contrary to its status elsewhere in its range (Rasmussen & Anderton 2012). Extralimitally, with two (or three) more races, it also occurs in south-western China, South-east Asia, and the Sundas (Dickinson & Remsen 2013; Woodall 2016). Phylogenetically, it is closely related to Blyth's Kingfisher *A. hercules*, while its nearest sympatric relative in the Western Ghats is the Common Kingfisher (Moyle *et al.* 2007). It has a strong preference for streams, creeks, and channels in evergreen, and wet deciduous forests, apart from bamboo forests, secondary jungle, forest edges, and plantations (Woodall 2016).

While a basic description of its breeding habits is known (Baker 1934; Ali & Ripley 2001; Woodall 2016), there is a paucity of detailed information on its breeding biology. This paper attempts to address this lacuna through a study of its breeding habits during 2013–2015 in southern Maharashtra, India. This study follows the pattern of our earlier attempts to record the breeding biology of other species of kingfishers: Oriental Dwarf Kingfisher *Ceyx erithaca* (Palkar *et al.* 2009a), White-throated Kingfisher *Halcyon smyrnensis* (Palkar *et al.* 2009b), Pied Kingfisher *Ceryle rudis* (Palkar & Joshi 2009), and Stork-billed Kingfisher *Pelargopsis capensis* (Palkar 2014).

Photo: Sachin B. Palkar

**113**. Male Blue-eared Kingfisher (with black lower mandible) at Dhamandevi.

## Study site

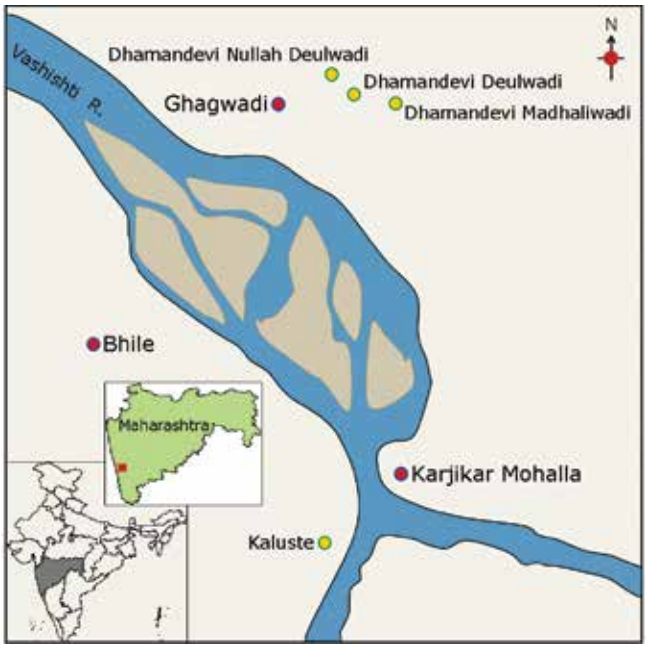
The study was conducted in Kaluste Village (17.53°N, 73.47°E), Khed Taluka, and the villages Dhamandevi, Madhaliwadi, and Deulwadi in Chiplun Taluka (17.57°N, 73.48°E): Ratnagiri District, Maharashtra, India (Fig. 1).

Chiplun city (17.51°N, 73.51°E) is 50 km inland from the Arabian Sea, and about 13 km west of the main Western Ghats range. Its habitat mostly comprises semi-evergreen jungles. Vegetation around it is

Photo: Sachin B. Palkar

**114**. Female Blue-eared Kingfisher (with dusky-red lower mandible) at Kalsute.

plush, and its proximity to the Koyna electric power generation plant ensures the area has water throughout the year. The major tree species here are mango *Mangifera indica*, teak *Tectona grandis, Terminalia crenulata, T. bellirica*, silk cotton *Bombax ceiba*, and jamun *Syzygium cumini.* Rice is the main crop in the study area. The south-west monsoon is active from June till the end of September. The cold season is from October to January, with the hot season following, and lasting till the beginning of the monsoon. The average temperature ranges between 23°C–40°C, while the annual rainfall during the study was 4532 mm in 2013, 3247 mm in 2014, and 2126 mm in 2015, obtained from department of water resources, Chiplun (Ram Vasudeo Mone, *verbally*, September 2015).




Map: S. Subramanya

Fig. 1. Map of the nest sites.

The nests were located near the Vasisti River, which has excess water flowing in it from the Koyana electric power generation project. All nesting sites were in semi-evergreen forests near rural areas, in exposed, vertical earthen banks near the road, close to a small nullah (water channel).

## Methodology

During the breeding season, the study area was thoroughly searched for nests. As kingfishers are cavity nesters, and lay eggs in a chamber at the end of a burrow with a small entrance hole, it is difficult to observe what happens inside the nest. To observe these activities we devised a camera stick apparatus, which we had used earlier to study other kingfisher species (Palkar *et al.* 2009a; Palkar *et al.* 2009b; Palkar & Joshi 2009). This comprised a small closed circuit television camera attached to one end of a stick, which was inserted into the nest burrow until it reached the chamber **[115]**. The diameter of the camera was 2.5 cm. It was operated by a 12-volt battery, and was connected to a battery-operated MP4 camera. Two small LEDs were attached to the camera to light the inside of the chamber. A 3-volt battery operated the LEDs.

Nests were observed twice a day: early in the morning, and in the late evening. Observations of nesting activities were made for a minimum of two hours a day; the quantum of time spent in the morning, and evening, was not same every day, but totalled to two hours, up to the completion of the clutch, and then from the eighteenth day onwards, when the eggs were due to hatch, the inside of the nest was also checked.

We inserted the camera stick inside the nest, up to the chamber, when the adults flew out of the nest. Then we switched on all connections and then entire nest chamber was easily visible on the MP4 (JXD) display. We also recorded a video using the camera.

We measured the nests after completion of breeding activities. The length of the nest tunnel, width of the chamber, and diameter of the entrance opening were all measured with a

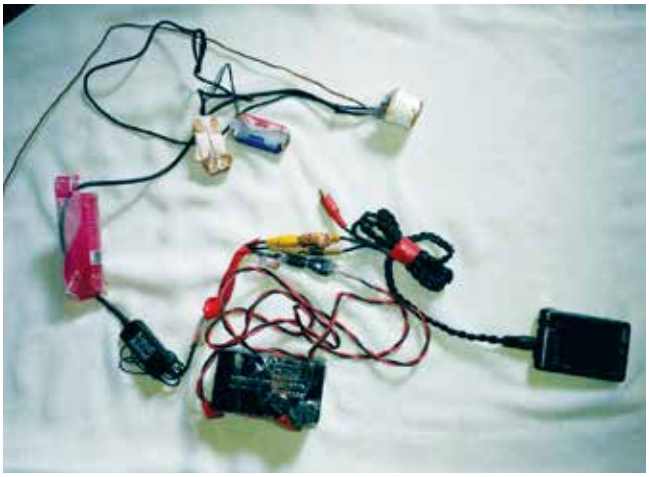


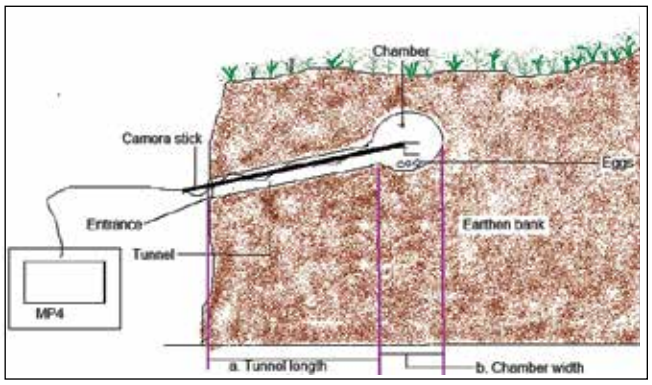
Photo: Sachin B. Palkar

**115**. Equipment used for monitoring the nest.

standard measuring tape. To do this, the tape was attached to the camera stick. With the camera switched on, the stick was inserted into the nest, up to the entrance of the chamber, and the length measured. A second measurement was taken after inserting the stick further, up to the rear wall of chamber (Fig. 2).

Studies of avian breeding biology are always intrusive, particularly where hole-nesters are concerned. Our earlier experience of using this method (see above) helped us design a study that was least disturbing to the breeding pair. Local people were sensitised about the rarity of the species, and the fact that it was nesting in their neighbourhood. They were always responsive to the extra care they needed to take so that the nesting site was not lost due to routine disturbances. General photography was not considered important, as we wanted to keep the nest site secret, especially since we wanted to determine for how long one nest would be reused. We did not disturb the hole diameter, regular perches that the birds used, nor any vegetation around the nest. Everything was kept intact. For the study we selected the smallest available camera that could enter the hole. We had a fairly accurate idea of the tunnel's length in each case, and hence it was easy to stop the camera right at the entrance of the chamber. As soon as we completed making the required images, which took but a few minutes, we withdrew the equipment and left the nesting site.

The length of the incubation period (the period from the laying of the last egg of a clutch to the hatching of the last nesting), and fledging period (the period from the hatching of the last chick to the date when the last hatchling leave the nest) follow Skutch (1945).




Artwork: Sachin B. Palkar

Fig. 2. Diagrammatic presentation of the study method.

## Results

### Breeding season

Breeding activities started in June, with the onset of the south-west monsoon, and extended till the end of September (Tables 1, 3). Pairs often raised two broods. During this period, birds were more vocal, and chased one other up to the time of completion of the clutch; They also indulged in courtship feeding, and copulated. Thereafter the birds remained silent.

### Nests

During the course of the study we identified four nesting holes, and studied 13 clutches in them (Table 1). All the nests that we studied, had been constructed by the birds in man-made earthen banks along roads **[116]**. Both sexes excavated a nest burrow. The nest was a long horizontal tunnel with a widened egg chamber at its end. The chamber was placed slightly higher than the entrance, to prevent the flow of water into the nest. Probably, this also allows waste material to easily trickle out.

Photo: Sachin B. Palkar

**116**. Nest DND from outside.

**Table 1.** Overview of the nests

| Nest tag | Locality | Year | Clutch ID number | Start date of egg laying | Number of eggs | Incubation period (Days) | Fledgling period (Days) |
|---|---|---|---|---|---|---|---|
| DDW | Dhamandevi-Deulwadi | 2013 | 1 | 19.06 | 6 | 21 | 23 |
| | | 2013 | 2 | 11.08 | 6 | 21 | 21 |
| | | 2014 | 3 | 21.06 | 6 | 21 | 23 |
| | | 2014 | 4 | 14.08 | 6 | 20 | 24 |
| DMW | Dhamandevi-Madhaliwadi | 2014 | 5 | 27.07 | 3 | 23 | 27 |
| DND | Dhamandevi Nullah-Deulwadi | 2014 | 6 | 18.06 | 6 | 22 | 25 |
| | | 2014 | 7 | 14.08 | 6 | 21 | 20 |
| KAL | Kaluste | 2014 | 8 | 13.06 | 6 | 21 | 23 |
| | | 2014 | 9 | 05.08 | 6 | 21 | 21 |
| DMW | Dhamandevi-Madhaliwadi | 2015 | 10 | 26.06 | 6 | 22 | Predated |
| DND | Dhamandevi Nullah-Deulwadi | 2015 | 11 | 19.06 | 6 | 21 | 20 |
| | | 2015 | 12 | 12.08 | 6 | Infertile | - |
| KAL | Kaluste | 2015 | 13 | 03.07 | 6 | 21 | 22 |

**Table 2.** Dimensions of the nests

| Nest tag | Diameter of nest entrance (cm) | Length of tunnel (cm) | Width of the chamber (cm) |
|---|---|---|---|
| DDW | 5.5 | 30 | 15 |
| DMW | 6.0 | 18 | 13 |
| KAL | 5.3 | 25 | 13 |
| DND | 5.8 | 30 | 15 |
| Average size | 5.6 | 25.75 | 14 |

In one instance (Nest DMW), the pair usurped the nest cavity that had been excavated by an Oriental Dwarf Kingfisher, whose chicks had been predated. Three days after the tragic incident, the nest was taken over by the Blue-eared Kingfishers, who widened the nest before use.

## Nest measurements

The four nests were measured after the breeding season (Table 2).

## Courtship, egg laying, and incubation

Egg laying started after completion of the nest excavation. Eggs were rounded ovals, milky white, and without any markings **[117]**. A typical clutch comprised six eggs, with one exception where only three were laid (Tables 1, 3).

The eggs were laid each morning, at a roughly 24-hour interval. Courtship feeding, and mating were observed near the nest, on each day up to the laying of the last egg. The male would offer a fish to the female **[118]**, after which the birds copulated **[119]**. After mating both birds flew away.

Limited incubation was carried out while the eggs were being laid, but they were unattended at night. Full time incubation started only after the last egg was laid. Both sexes incubated the eggs. However, my observations indicate that female does most of the incubation in all the clutches we studied. Infact, at night, the hen alone incubated the eggs. During the interchange of duties, the reliever would come near the nest, sit on a regular patch, and call. In response, the relieved bird would emerge from the nest and fly off, upon which, the reliever entered the nest and began incubation. During the incubation period, undigested food, in the form of pellets, apart from bird droppings, mosquitoes, houseflies, millipedes, and snails were all observed inside the nest.

## Hatching and fledging

All the eggs hatched between 20–23 days with a median of 21 days. The attending parent removed the eggshells from the nest. The hatchlings were nidicolous **[120]**. Eyelids appeared large and black. The egg tooth was visible on the tip of the upper mandible. In all nests, the female stayed in the nest, with the chicks, for four–six days after they hatched. The fledging period was between 20–27 days with a median of 23 days (Table 2).

Photo: Sachin B. Palkar

**117**. Eggs of Blue-eared Kingfisher (Clutch ID 2).

Photos: Vishal Jadhav

**118**. Female holding the fish after courtship feeding at Nest DND.

**119**. The pair copulating.

**Table 3.** Milestone dates (DD.MM) for egg laying, hatching, and fledgling for the 13 clutches

| Clutch ID | Egg laying dates (per egg) | | | | | | Egg hatching dates (per egg) | | | | | | Fledgling date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 | |
| 1 | 19.06 | 20.06 | 21.06 | 22.06 | 23.06 | 24.06 | 13.07 | 13.07 | 14.07 | 14.07 | 14.07 | 14.07 | 05.08 |
| 2 | 11.08 | 12.08 | 13.08 | 14.08 | 15.08 | 16.08 | 04.09 | 05.09 | 05.09 | 05.09 | 05.09 | 05.09 | 25.09 |
| 3 | 21.06 | 22.06 | 23.06 | 24.06 | 25.06 | 26.06 | 15.07 | 16.07 | 16.07 | Infertile | Infertile | Infertile | 07.08 |
| 4 | 14.08 | 15.08 | 16.08 | 17.08 | 18.08 | 19.08 | 06.09 | 06.09 | 06.09 | 06.09 | 07.09 | 07.09 | 30.09 |
| 5 | 27.07 | 28.07 | 29.07 | - | - | - | 20.08 | 20.08 | 20.08 | NA | NA | NA | 15.09 |
| 6 | 18.06 | 19.06 | 20.06 | 21.06 | 22.06 | 23.06 | 14.07 | 14.07 | 14.07 | 14.07 | 14.07 | 14.07 | 07.08 |
| 7 | 14.08 | 15.08 | 16.08 | 17.08 | 18.08 | 19.08 | 08.09 | 08.09 | 08.09 | 08.09 | 08.09 | 08.09 | 27.09 |
| 8 | 13.06 | 14.06 | 15.06 | 16.06 | 17.06 | 18.06 | 07.07 | 07.07 | 08.07 | 08.07 | 08.07 | 08.07 | 30.07 |
| 9 | 05.08 | 06.08 | 07.08 | 08.08 | 09.08 | 10.08 | 29.08 | 29.08 | 29.08 | 30.08 | 30.08 | 30.08 | 19.09 |
| 10 | 26.06 | 27.06 | 28.06 | 29.06 | 30.06 | 01.07 | 21.07 | 21.07 | 21.07 | 22.07 | 22.07 | 22.07 | Predated |
| 11 | 19.06 | 20.06 | 21.06 | 22.06 | 23.06 | 24.06 | 14.07 | 14.07 | 14.07 | 14.07 | 14.07 | 14.07 | 02.08 |
| 12 | 12.08 | 13.08 | 14.08 | 15.08 | 16.08 | 17.08 | Infertile | Infertile | Infertile | Infertile | Infertile | Infertile | NA |
| 13 | 03.07 | 04.07 | 05.07 | 06.07 | 07.07 | 08.07 | 28.07 | 28.07 | 28.07 | 28.07 | 28.07 | 28.07 | 18.08 |

Photos: Sachin B. Palkar

**120**. Hatchlings of Blue-eared Kingfisher on the first day (Clutch ID 11)
**121**. Inside the chamber of showing white coloured maggots (Clutch ID 5).

## Food

Both adults fed the chicks only with small fishes. From several photographs of the birds with the fishes in their bill, some could be identified to genus level: *Garra* (stone sucker), *Schistura* (loach), *Aplocheilus* (panchax), and *Rasbora* (rasbora) (Rajeev Raghavan, in litt., e-mail dated 22 April 2016). Feeding was more frequent in the morning than in the evenings. The parents were never seen removing undigested food, in the form of pellets, nor their droppings from the nest. Due to extreme humidity, and waste material, large numbers of white-coloured maggots were observed in the nest chamber **[121]**. The entire floor of the chamber looked wet, and dirty, even though the chamber was higher than the nest hole and the excess fluid waste was easily flowed out of the nest.

## Second brood

Three of the four nests monitored had a second brood. Five clutches, out of the thirteen studied, were second broods. Egg laying of the second brood started on the seventh day (range = 6–8 days) after the fledglings of the previous brood left the nest (Table 3). Before initiating a second clutch, the pair cleaned out the nest over three days. The overall time taken for the second brood, from egg laying, incubation, brooding, and feeding was similar to that of the first brood.

In 2015, only one pair (of the three present) raised a second brood. Rainfall in 2015 was significantly lower, less than half of fell in 2013, with most of the nesting areas being dry. This could be the reason for the lack of a second brood.

## Breeding success

Of 75 eggs (from four nests), 66 hatched (88%), of which 60 resulted in successful fledgings (~91%); nine were infertile, six chicks were presumed lost to predation (although this was not observed), and the overall breeding success was 80%. For second brooded nests, hatching success was 83%, and all young fledged successfully, giving a slightly better breeding success (83%) than the average.

## Nest reuse

The same pair, presumably, reused the nest also in the next season. After arrival, the pair cleaned their nest for about a week. They removed dry bony material from the nest. One active nest (DDW) was found in October 2012 in which there were chicks. The same nest was reused in 2013, and 2014. In 2015 the nest's chamber had caved in and the nest was abandoned.

## Post-breeding

All the birds left the immediate vicinity of the nesting area after breeding. However, they were resident in the general locality as birds were occasionally observed along the river during non-breeding period.

## Discussion

The Blue-eared Kingfisher's breeding season in southern India was believed to be in January (Ali & Ripley 2001; Woodall 2016), probably based on a collection of eggs obtained by John Stewart from Travancore and presented to E. C. Stuart Baker (Baker 1934). The present study contradicts this, but is more aligned to the breeding season of other subspecies, including the north Indian *coltarti*, which falls between April and August (Baker 1934). It is recommended that the provenance, and identity, of Stewart's eggs be established before treating January, a dry-season month, as one in which it also breeds (see Ali 1969: 12 for doubts about Stewart's egg collections).

Nest reuse in different years is not known yet for this species. Though we could not establish this with ringed individuals, the amount of nest fidelity, shown in multiple cases, points to the

fact that the same pair might be visiting these nests across years. Here, we also established that the species may occupy nests used by conspecifics– particularly those that are similar in size, like the Oriental Dwarf Kingfisher.

On the nest structure, the mean length of the tunnel, 25.75 cm (18–30), is significantly shorter than that of the Oriental Dwarf Kingfisher, which is 56–64 cm (Palkar 2009a). Woodall (2016) also indicates a longer nest tunnel (30-100cm) for this species. The known diameter of the entrance, and chamber size of these two speices overlap in the study area (Palkar 2009a).

That the incubation period is 21 days (20–23), and fledging period 23 days (20–27) are first time records for this species across its entire range. Clutch size of 3–7 eggs recorded by Woodall (2016) seems to match my observations, though my study additionally suggest that it is more likely to be six. Though nest management duties are shared by both sexes (Woodall 2016), here, females demonstrated a greater role in incubation.

Blue-eared Kingfisher is known to feed on fish, crustaceans, insects, and larvae, including dragonflies (Woodall 2016). However, as this is the breeding season, it was exclusively feeding on fish, in contrast to Oriental Dwarf Kingfisher, which took a variety of prey including lizards, gecko, etc., to feed its chicks (Palkar 2009a).

Double brood has been known for this species from India and this study reconfirms it. The lack of a double brood appears to be more of an exception than the rule—unlike 'in some pairs', as suggested by Woodall (2016). Rainfall is probably a critical factor in triggering a second brood. One pair forsook a brood, in trying conditions, rather than attempting a smaller brood, or risking lower breeding success.

Breeding success (=80%) is remarkably high for a tunnel-nesting species vis-à-vis that of other kingfisher species, including the similar-sized, and forest-dwelling Oriental Dwarf Kingfisher (Palkar *et al.* 2009a; Palkar *et al.* 2009b; Palkar & Joshi 20). If the Blue-eared Kingfisher were to raise two broods (~40% nests were from second brood here), with 80% breeding success, and a six-eggs clutch size, it would produce six to seven healthy off-spring in one season, thereby increasing its population by more than 200%. Perhaps there are other predation risks, post breeding, or higher mortality, or such favoured nesting sites are very patchy. Otherwise its present rarity status is inexplicable.

## Conclusion

Through this study, I establish the breeding season, clutch size, nest dimensions, and second brood behaviour of Blue-eared Kingfishers in the Western Ghats. Documentation of incubation period, fledging period, and plumage of the nestlings are presented for the first time. Breeding success is remarkably high in this study. Other such studies should be repeated elsewhere to substantiate these results.

## Acknowledgements

I thank Shailesh Sansare from Malad, Mumbai, for providing much more information about close circuit camera. My thanks to Rajeev Raghavan, Kerala University and Fisheries and Ocean Studies, for identifying the fish from the images. I also thank the editorial team at *Indian BIRDS* for improving an earlier draft of this manuscript.

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# Errata

In ***Indian BIRDS*** 7 (5), Aiyadurai (2011) reported a dead specimen of Oriental Stork ***Ciconia boyciana*** from Arunachal Pradesh. Rajah Jayapal verified the photographs showing the remains of its wings and legs, and emended the identification to that of a crane (***Grus*** species); the exact species is unclear.

In ***Indian BIRDS*** 11 (3), Chudasama (2016) reported a first winter Rufous-tailed Rock Thrush ***Monticola saxatilis*** from Gujarat. Krys K. verified the photograph and emended the identification to that of a female of the species.