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Provisioning behaviour of Malabar Starling *Sturnia blythii*

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Abstract

The Malabar Starling *Sturnia blythii* is a widespread endemic bird of the Western Ghats of India. In this study, we tried to understand the provisioning behaviour of this species and the preferred resource choice for its offspring. We found a conspicuous omission of caterpillars, and the addition of amphibians in their provisioning diet. We also noticed a significant flight bias towards a particular direction from the nest for provisioning trips, although the reasons for this were unclear. The small sample size of the study has its limitations, but we have found evidence for previously unrecorded resource use by this species.

Introduction

The Malabar Starling *Sturnia blythii* is a passerine bird endemic to south-western India. It is a common resident in the wooded habitats of the Western Ghats till about northern Maharashtra (SolB 2020). It was previously considered a subspecies of the Chestnut-tailed Starling *S. malabarica* (Praveen et al. 2020). Jaman & Sahreen (2004) studied the breeding biology and ecology of the Chestnut-tailed Starling. However, there are no targeted studies of the ecology of Malabar Starling. Hence, this study was conducted to provide baseline information about parental care and nesting of a Malabar Starling pair.

Provisioning of nestlings is a key behaviour where low food supply often results in a reduced growth rate in nestlings (Wilkin et al. 2009). Diet plays a significant role in bird ecology (Duraes & Marini 2003) and studies on feeding ecology help to understand the community structure, co-existence, and resource use pattern in its habitat (Asokan & Ali 2010; Kaur & Kler 2018).

The present study investigated the provisioning behaviour

of Malabar Starlings, specifically: (1) food items they feed their offspring, (2) provisioning activity patterns, and (3) habitats the parent birds forage in.

Methods

We studied a single nest of the Malabar Starling in a private farmland at Gudalur (11.51°N, 76.50°E), located in The Nilgiris District, Tamil Nadu. The study area borders Mudumalai Tiger Reserve and Nilgiri Reserve Forest. The landscape is characterised by a mosaic of commercial plantations, agricultural fields, and settlements. The predominant tree species are *Mangifera indica*, *Artocarpus heterophylla*, *Eucalyptus* sp., and *Lagerstroemia microcarpa*. Agricultural fields were mostly fallow during the study.

At the farmland, we located a single Malabar Starling nest in a cavity at the height of five meters from the ground on a Ben Teak *L. microcarpa*, a medium-sized deciduous tree endemic to the Western Ghats. The tree was quite conspicuous compared to other trees around it; hence, we did not need to mark it for

identification. We used a focal pair sampling method (Lehner 1992) while observing the provisioning parents till the hatchlings left the cavity. Our observations were carried out between 28 March 2020 and 18 April 2020 during the nationwide Covid-19 lockdown.

We followed the guidelines to study nesting biology as outlined in Barve et al. (2020). We took the utmost care to ensure that the birds weren't disturbed during the provisioning activities and avoided alerting potential predators. We observed them from a temporary platform in a tree, located 12 m northwards of the nest to reduce disturbance during multiple visits. No attempts were made to approach the nest tree since the study did not require measuring the nests or nestlings. The parental visits to the nest were observed for ten minutes every two hours between 0600 h and 1900 h, and hence we sampled only 10% of the daylight hours. The sampling method assured a uniform spread of our observations while limiting the impact of human presence on the provisioning behaviour. The nest already had nestlings when the observations began; hence we weren't at risk of disturbing the egg-laying process while visiting the nest early in the morning (Barve et al. 2020). At each feeding visit, we noted the time and direction of the birds' arrival and departure. DJ photographed the food type brought to the nest using a DSLR camera (Nikon D850) equipped with 200–500 telephoto lenses, and the photos were later transcribed into data. The sex of the feeding parent was noted for each visit.

We used photographs to identify the foraged species and classified them till the order level. We categorized the provisioning counts between the time of the day and used chi-square tests to check if the provisioning varies significantly for a particular time of the day through the days of observation, or whether foraging patterns had a sex-based difference. We also used the chi-square test to check if a particular direction of the nest is preferred for foraging trips. To establish the land cover used predominantly for foraging, we calculated the percentage land cover within each quadrant (N, S, E, and W) of varying radial distances from the nest—100 m, 150 m, 200 m, 250 m, 500 m, and 1000 m. We used chi-square tests to examine the predominance of a particular land cover in the most preferred direction of foraging. We cropped the land cover map of our site from a map for the Western Ghats (hereinafter WG) from an ongoing project (Jobin et al. 2021). The map, with an accuracy of ~70%, was created using the Google Earth Engine, classifying the WG into eight land cover types based on Arasumani et al. (2018). The accuracy was assessed for the classification using ground truth data and creating an error matrix (Congalton 1991). We assume that the birds do not feed more than 1,000 m away from the nest, as the frequency of foraging reduces significantly in similar species beyond 500 m (Heldbjerg et al. 2017).

Results

We recorded 252 trips of the parent birds in 21 days of provisioning, out of which we could observe 111 food items that were carried to the chicks. Invertebrates formed 85.5% of the total food items provisioned to the chicks, vertebrates 10%, and plant materials (fruits and leaves) [70]. Orthoptera, Blattodea, and Hemiptera formed 25.5%, 21.8%, and 13.6% respectively. Amphibians were the most common vertebrates fed to the chicks, with their frequency being over 8% of the total provisioned food. Fig. 1 shows the frequency of other orders provisioned.

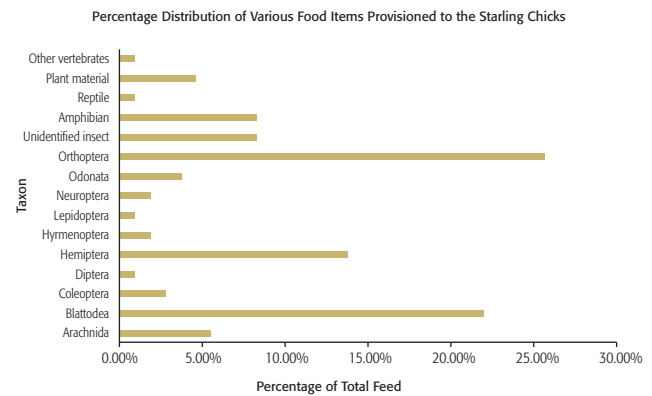


Fig. 1. Percentage distribution of various food items provisioned to the starling chicks



70. Chicks provisioned with both vertebrates and invertebrates by the parent birds

The provisioning frequencies did not change with the time of the day (chi-sq p-value, 0.1598), nor across the days of provisioning (chi-sq p-value, 0.9870). The provisioning frequencies did not vary between the parents either (Male—58, female—53, chi-sq p-value, 0.6351), but it was significantly biased towards the northern direction (chi-sq p-value<0.001) (Table 1, Fig. 3).

NUMBER OF TO-AND-FRO FORAGING TRIPS
(AVERAGED) IN EACH DIRECTION

—0800 —1000 —1200 —1400 —1600 —1800

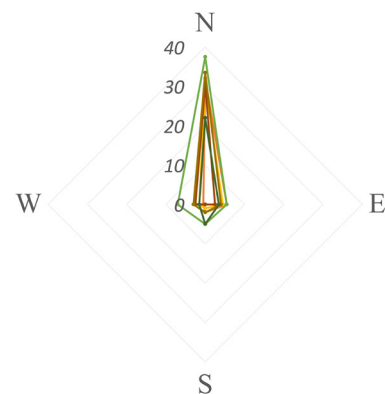


Fig. 3. Average frequency of trips taken by parent birds in each cardinal direction across the day. The North direction is the most preferred direction of movement.

Table 1. Average frequency of trips taken in each cardinal direction by the parent birds across the day

Directions	Time in hours					
	0800	1000	1200	1400	1600	1800
North	32	30.5	37.5	30.5	33.5	22
East	5.5	4.5	5.5	2.5	4	3.5
West	0.5	1.5	7	2.5	3	1.5
South	2	1	5	0	2	5

When we compared the percentage land cover in the northern quadrant for radii, 100 m, 150 m, 200 m, 250 m, 500 m and 1000 m, none of the quadrants could explain a significant change in a particular land cover that could explain this preference of northern direction for foraging (chi-sq p-values ~ 0.99), although one can see a decrease in agricultural fields and increase in plantation stands between the distances of 250 m and 500 m from the nest tree (Fig. 4).

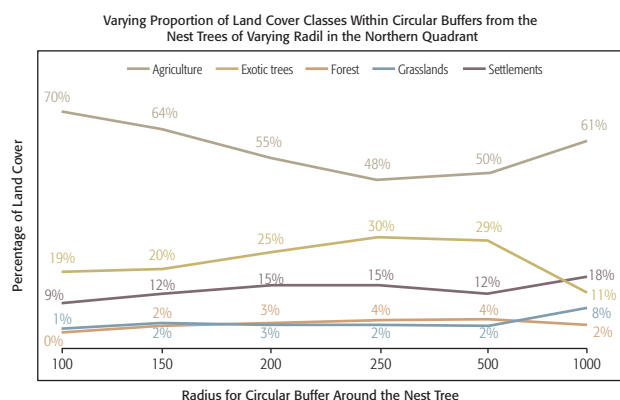


Fig. 4. Varying proportion of land cover classes within circular buffers from the nest trees of varying radii in the Northern quadrant

Discussion

The study was carried out during the COVID-19 lockdown, and has definite limitations as the observations were conducted on a single nest; but it clearly describes some unique behavioural aspects of the species that have not been recorded before. Chestnut-tailed Starlings are known to nest in tree holes, often secondary ones, at heights of 3–15 m from the ground (Craig & Feare 2020). Malabar Starlings show a similar nesting behaviour, at least in this case.

In the Chestnut-tailed Starling, the nestlings are mainly provisioned with insects, lepidopteran larvae, and coleopterans (Craig & Feare 2020), but for the Malabar Starling, at this particular site, we see the addition of Blattodea and vertebrates in their diet, and the surprising omission of caterpillars. Since the diet composition can vary based on parental efforts, season, or food availability (Serrano-Davies & Sanz 2017; Catto 2018), we did not opt to test for the apparent preference towards particular orders of food items. Jaman & Sahreen (2004) mention that both sexes of Chestnut-tailed Starling feed the chicks, and our study finds the same results for Malabar Starling.

We could not differentiate between the incubation and nestling periods for this particular nest, but the period might definitely be higher than, or approximately 21 days. The provisioning rate remains constant across the day, contrasting with the pattern

seen in several other birds (Mennechez & Clergeau 2006). Still, the lack of sample size disallows further discussion. The directional bias of the pair, while travelling in a particular direction for their provisioning trips, cannot be explained with correlation to the presence of any land cover, but it does warrant further study in the future.

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