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Protective Nest Design for Indian House Sparrow (*Passer domesticus* L.) - with Reference to Predation and Reuse

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ABSTRACT

Background: The House Sparrow (*Passer domesticus* L.), is a human-commensal bird species, belonging to the order Passeriformes. The rapid changes in our lifestyle resulted in the decrease of this bird population during the past four decades. Among the various causes *viz*., lack of food resources, pollution pressure, indiscriminate usage of pesticides *etc*. Habitat loss is found to be one of the main threats for their rapid decline. Installation of artificial nest boxes was found to be the best alternatives for raising the bird population.

Methods: Jangareddigudem of West Godavari district, Andhra Pradesh, India, was chosen as the study area. The nest boxes were designed by incorporating certain modifications to the basic model specified by British Trust of Ornithology. Installation of the nest boxes was initiated from an area with moderate food resources, located towards south-west edge of the town and was expanded in to other areas in a latitudinal wise towards north and south directions. Data was collected on a regular basis to study the occupancy of the nest boxes by the house sparrows.

Result: The model designed was proved to be protective from predators and also well accepted by the public. Out of 570 nests that were installed in the study area, 550 nests were occupied and being used for breeding, that comes to around 97.6% occupancy indicating the suitability and protectiveness of this model. The sparrow population in the study area has been increased with a count of sparrows from few to 300+ sparrows at each roosting site (two roosting sites) by the end of 2020 by utilizing the nest boxes.

Key words: Conservation, Habitat loss, House Sparrow, *Passer domesticus*, Protective nest design.

INTRODUCTION

House Sparrow is a human-commensal bird species. It is distributed all over the world, followed the man and extended to the remote areas. They make nests in the clefts of tiled and palm leaf roofs, ventilators and bushes. In the course of human settlements, House Sparrow moved from grass lands to agricultural land and then to humans in search of food. As our houses provide secured shelter, they became obligatory human commensals (Summer-Smith 1963, Anderson 2006). The House Sparrow population has been declined globally (Crick *et al.,* 2002, Summer Smith 2003). The 'State of India's birds 2020' report clearly pointed that though the population of House Sparrow is stabilized nationwide, a marked decrease is still observed in large cities. As per the report, lack of suitable nesting sites and lack of insect population that form a key part of bird's diet could be the main reasons for House Sparrow decline (https://www.stateofindiasbirds.in/). Recent population studies in United States and Canada reveals their decline trend (Berigan *et al.* 2021). The authors through their study from 1995 to 2016 stated that during winters the flock size declines by 22%.

The ornithological survey conducted by the Indian Council of Agricultural Research in the year 2010 found that around 80% of the sparrow population in Andhra Pradesh has disappeared and the condition is the same in other states too (Anjan *et al.,* 2010). Surveys conducted at different regions of Indian states indicated their decline (Rhoshant *et al*., 2008, Khera *et al*., 2010, Battacharya *et al.,* 2010, Ghosh *et al*., 2010). The predominant cause for the rapid decline of House Sparrow could be the habitat loss. Developmental practices also resulted in lack of food to these tiny birds. Evidences suggest that there is more demand for breeding spaces. According to Coleman (1974), the nest boxes kept for Starling (*Sturnus vulgaris* L.) were occupied and utilized by the House Sparrow for breeding indicating the demand for shelter. The habitat loss can be overcome by introducing artificial nest boxes which can be used as breeding grounds (Bhattacharya *et al.*, 2011, Ghosh *et al*., 2010). Balaji (2014) through his studies clearly stated that usage of nest boxes can solve the decline problem of House Sparrows in urban and semi urban areas. The studies of Akhilesh and Sonika (2019) at Lucknow showed that the

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sparrows prefer wooden nest boxes than carton boxes. Even, public got awareness and their participation in House Sparrow conservation by providing artificial nest boxes is also reported in several areas. Although several authors have designed and used different models of artificial nest boxes, still there is a need to further improve the nest box design in terms of protection, reuse and acceptability by pubic *etc*. (Chetan, 2012). The present paper describes a protective nest model designed by the author to raise sparrow population in the chosen study area with almost 97.6% occupancy indicating the comfortability of the model.

MATERIALS AND METHODS

Several designs of nest boxes were prepared by the author, with reference to the basic model suggested by British Trust for Ornithology (BTO). According to BTO, the basic nest box design measurements include- height 200mm (front), 300mm (back), width 175 mm, depth 150cm and the diameter of entrance hole 32 mm. They also suggested that the thickness should be around 15 mm. At the beginning of our work, we have designed nest boxes using wooden slices. Processing of the wood and finishing the surface became laborious and time-consuming process. To overcome this, we have started designing the nest boxes using plywood. Mark *et al*. (2014) suggested that nest box design must be in accordance with the local environmental conditions. Considering the aesthetic sense and acceptance by the public as well as protective nature of the nest from invasive species, the basic model suggested by BTO is altered to meet the requirements.

Nest Box – Description

All nest boxes were made up of wood and plywood only. Wood is mainly chosen based on its longevity, durability and with regard to ease of handling. Moreover, our nest box design is like a house/hut and public can easily accept such a model because they feel it like 'a home in their home for sparrows'.

Dimensions

The nest box is prepared as per the parameters specified by BTO with certain modifications to increase the protective nature of the nest box and as well acceptability by the public. The specific parameters of the nest box are as follows: Height - 266.7 mm, width - 200 mm and breadth- 100 mm. Two wooden planks (with 6 mm thickness) with 150 × 150 mm in size are used for the roof. These roof planks extended up to 64 mm towards front side to provide a means of security to the sparrow nestlings from predator birds like crow. An entrance hole is placed in the middle of the box with 34 mm diameter and it is two inches (50 mm) away from the top. This much of depth prevents nestlings from accidental falls or escapes from the nest box.

A narrow cleft with 100 × 3 mm is made at the front, towards the lower side (50 mm away from the bottom) for aeration. A triangular platform is attached just 50 mm below the entrance hole, used to feed their nestlings.

At rear side, a hole is placed with 4 mm diameter towards upper-middle, two inches from the top, to be used for hanging the nest box. At lower end, a 100x 179 mm window is left which is useful for removing grass nests from abandoned nest boxes. Fig 1(a), 1(b) and 1(c) show the measurements of the wooden slices used to construct the nest, front view of the designed nest and rear view of the nest respectively.

Specifications of the nest box

i. Easily detectable by sparrows.
ii. Sparrows feel more secured.
iii. Easy to install (with one nail).
iv. Re-usable nest: The abandoned nests can be reused simply by removing the old grass through the rear window, without disturbing the nest boxes. Fig 2(a) shows the abandoned nest box and Fig 2(b) shows the occupied nest box after removal of grass from abandoned nest box and re-installation of it.
v. It is easy to detect the nest occupancy by the appearance of grass tips through the rear-window without disturbing the nest boxes.
vi. The extended roof planks protect nestlings from predator birds. Fig 3 (a) and 3(b) shows the changes incorporated in our present model to that of our previous model with respect to extended roof planks.
vii. Aeration cleft arranged on front lower side can be used as a window. This keeps the nest dry by drying the droppings of the nestlings.
viii. The entrance hole is comfortable, for both male and female parents. Sometimes the parents use to enter the nest in flight mode.
ix. Triangular platform is placed at the front side just 50 mm below the entrance hole is useful in several ways.
a. Male birds can sit on it during incubation time.
b. Parents use it for feeding the nestlings as shown in Fig 4(a) and 4(b). Whereas in our previous model, the triangular platform is placed at 100 mm below the entrance hole which is not convenient for feeding the nestlings (Fig 3(a).
c. Position of the platform also does not allow the crows to pick up the nestlings.

Study area

Jangareddigudem (17.1223°N, 81.2923°E) is an upland area of West Godavari District of Andhra Pradesh state of India. Its altitude is 74 meters above median sea level, with 15.8 Km^2 area. Jangareddigudem is a semi-urban town with tropical climate consists more of open areas. The town is also devoid of bulk food resources like paddy and cereals for sparrows. In 2014, as per our observation, the sparrow population is very less in this area and now the population has risen to several times with the establishment of our nest boxes. Fig 5 shows the study area with installed nests year wise.

Nest box installation method

Nest Boxes installation started from the Lane-3 of Ayyanna

Colony of town Jangareddigudem (17°07'16.9"N, 81°17'05.9"E). This area is located towards south-west edge of the town that consists of moderate food resources. Later installation of nest boxes was expanded in to other areas in a latitudinal wise towards north and south directions. We installed on an average one nest for two to three houses.

Nest boxes were preferably installed below the roof or slab. We did not prefer installing the nests on trees, in public places and in open areas considering the factors such as climatic conditions (exposure to direct sunlight and rainfall), pollution (noise and air pollution). In our study we have observed that the nests installed above the sunshade were not occupied and this could be due to movement of cats. The nest boxes were installed at 10 feet height from the ground with direction of the nest facing towards north or east. While the Installation of nests, care is taken that the proximity of the vegetation is not more than 100 mts.

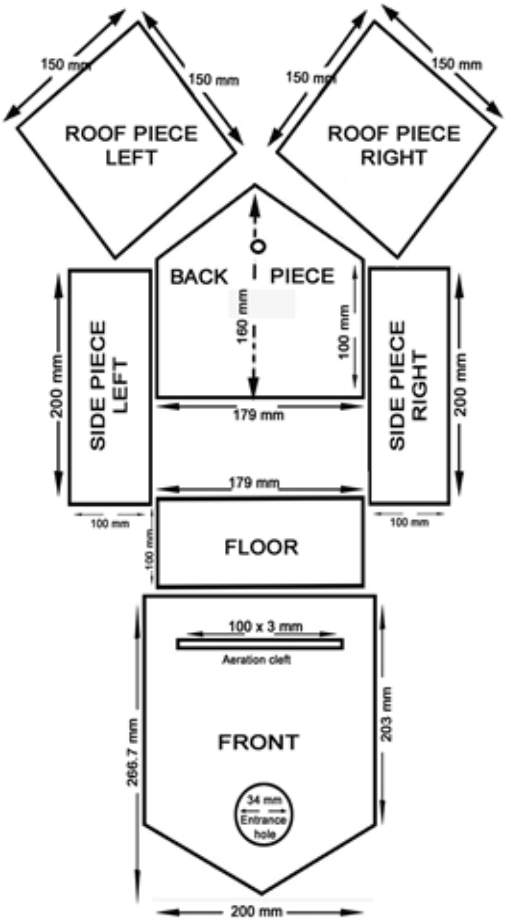

Fig 1(a): Measurements of the wood slices.

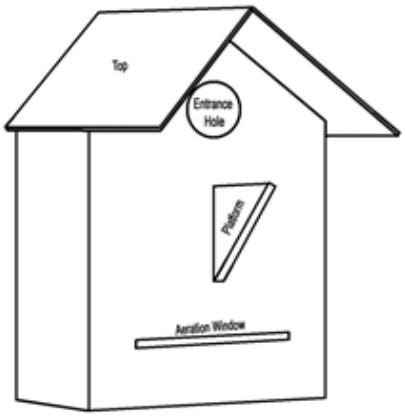

Fig 1(b): Nest box : Front view

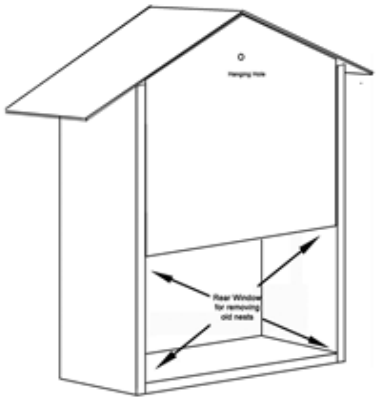

Fig 1(c): Nest box : Rear view

(a) **(b)**

Fig 2(a): Author removing grass nests from abandoned nest box. **(b):** Occupancy of re-installed nest box by same sparrow couple.

(a) **(b)**

Fig 3(a): Our earlier nest box design without extended roof. **(b):** Our present model with extended roof.

All the installed nests were observed on a regular basis to look for occupancy and for breeding activity. The systematic observation of the installed nests is to meet three objectives *viz.*, occupancy of the nest, built-up of nests inside the artificial box and to monitor the breeding activity.

RESULTS AND DISCUSSION

We have started conservation of House Sparrow in the year 2014 by installing around 10 nests and all of them were found occupied. It almost took around four to six months' time for occupancy of all the nests from the date of installation. In the next year, we installed about 20 nests in the adjacent areas. These nest boxes were found to be utilized by the new generations. Among these nest boxes, one nest box left unoccupied even after six months, because of the entry of House Gecko (*Hemidactylus frenatus* R.) Clearance and replacement of that nest box resulted in the occupancy of the next by the House Sparrow within a month.100% occupancy was observed in the year 2015 also and it also increased the demand for nest boxes. To fulfill that around 37 nests were installed in the adjacent new areas. By the end of the year 2016, 36 of them were occupied and utilized and among them, one nest box was utilized by Indian Robin (*Saxicoloides fulicata* L.) for breeding. Only one nest out of 37 was not occupied because of the usage of that nest by squirrel for breeding.

As the new generations were brought up from those 66 installed nests, a competition aroused between old male sparrows and new generations for existing nests for breeding. Again 90 more nests were installed in the study area in the year 2017 and among them, 88 nests were occupied and used for breeding. Another 147 more nests were installed in the year 2018 and among these, 138 nests were occupied by the new generations. This indicates that by the end of the year 2017, the sparrow population has been increased to 138 couples. In the year 2019, 138 more nests were installed extending to the adjacent areas. We found that except five all of them were occupied by house sparrows. By the next year *i.e.*, 2020, we have successfully installed 128 nests and among them, 124 nests were found

to be occupied (Table 1). The occupancy rate of the nest box (within 30 days after installation) was increased from 15% to 39% in the past three years. Occupancy rate has been doubled in the next thirty days after installation (Fig 6,7).

The current work on the design of a protective nest for House Sparrow is highly significant to sustain its population and we are almost involved in sparrow conservation from the past 7 years and are successful in raising the sparrow

(a) **(b)**

Fig 4 (a, b): Parent sparrows feeding nestlings by using triangular platform.

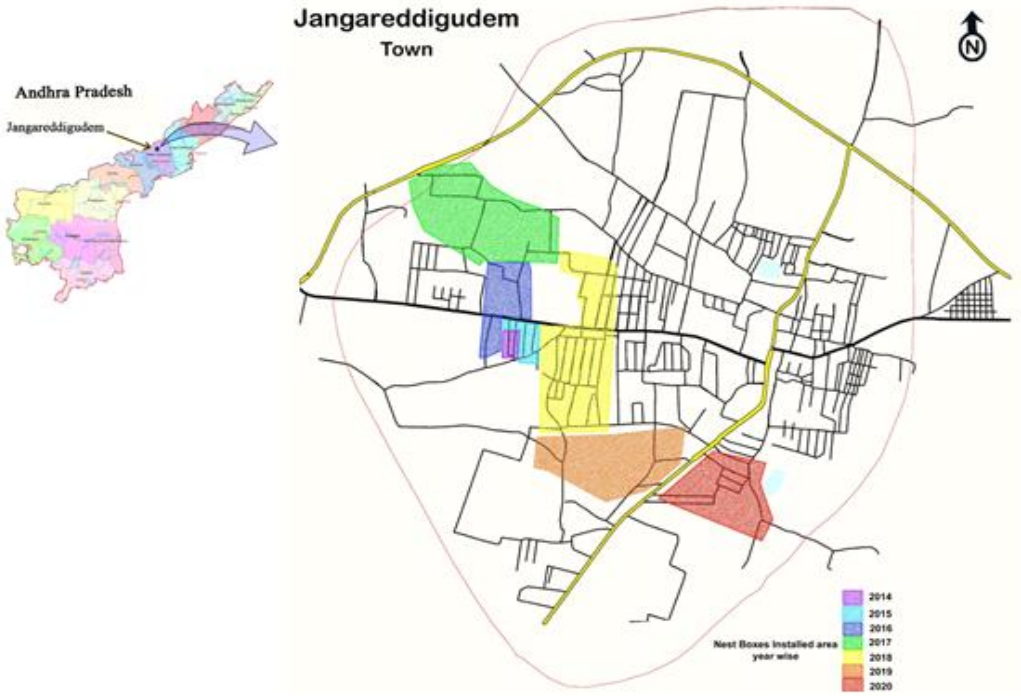

Fig 5: Showing Study area and Nest Installation zones (Year wise).

Table 1: Monthly analysis of occupancy of Nest Boxes by Sparrows.

Occupancy	30 Days	60 days	90 days	120 days	After120 days	After 180 days	Not occupied	Total
2014	2	3	3	2		-	-	10
2015	3	3	8	4	1	1		20
2016	5	6	13	7	4	1	1	37
2017	12	18	42	9	5	9	2	90
2018	18	31	67	11	8	4	8	147
2019	56	44	17	10	4	2	5	138
2020	49	40	15	13	5	2	4	128
Total number of nests installed								570

population. But our studies are limited to Jangareddigudem, an upland area in the West Godavari district of Andhra Pradesh with minimum crop food resources. The study area is famous for tobacco, chillies, oil palm and cashew nut cultivation. Initially we used different nest designs made of carton boxes and wooden boxes to provide artificial habitats that can be used as breeding grounds by House sparrows. The wooden boxes were found to be the best choice owing to their durability, longevity and ease of handling. Our first nest model made of wood contained less extended roof planks. That nest was disturbed randomly by the Indian Myna *Acridotheres tristis* that too only during its breeding season. Another model made without the extension of roof planks, was also tried by a pair of Rose-ringed Parakeet *Psittacula krameri*, but could not succeed to enter into the nest box as the entrance hole can only fit and permit the entry of House sparrows. By these observations, a specific protective nest design was made. Sparrows can be attracted easily to this model and as well feel secured. In our study, we have observed that one of the nest boxes (Nest Box No. 275) was occupied within 30 minutes after installation.

Studies of Bhattacharya *et al*. (2011) using artificial nest boxes made up of wood with flat top, showed that 60-70% nests were occupied by House Sparrows and were used for breeding. Their study was conducted for 3 months, with 25 nests. In their design, the depth of nest box is 190 mm and such a depth creates more space than what is required, which increases the labour to construct the first nest at bottom. Our nest model has a depth of only 100 mm and this reduces half of the effort to build the first nest. Balaji (2014) used shoe boxes as nesting habitats and among the 50 installed nests; only 30 nests were occupied by sparrows giving 60% occupancy. Studies of Akhilesh kumar *et al*. (2014) showed that sparrows give first priority to wooden nests for breeding and this could be the reason for decreased occupancy observed by Balaji (2014) with Carton boxes (shoe boxes). In our case, the nests installed were made up of wood (owing to their durability, longevity and ease of

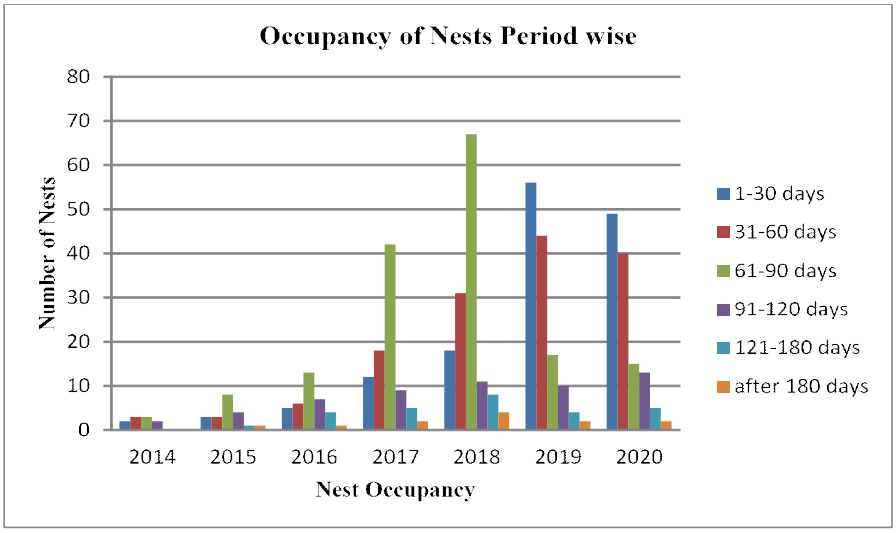

Fig 6: Graph showing the comparison of installed Vs occupied nest boxes (year wise).

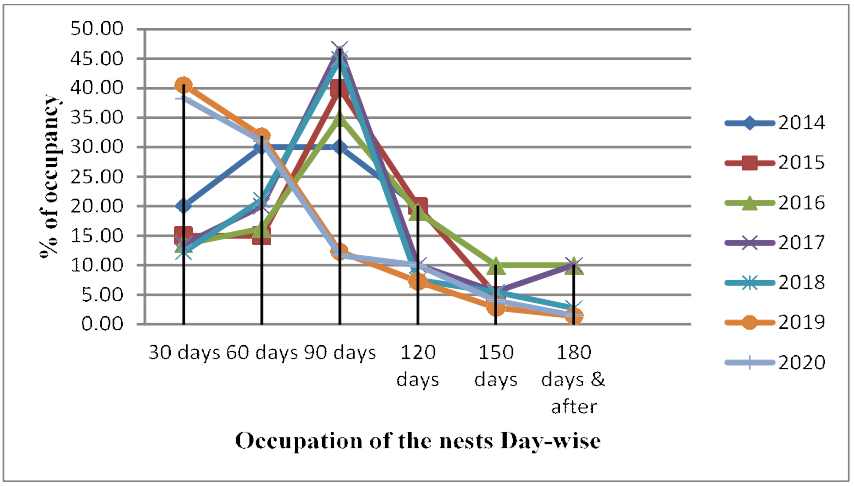

Fig 7: Rate of occupancy of the nests day wise.

handling) and sparrows also preferred our nests as is indicated by an occupancy rate of 97% indicating the suitability of our nest design.

The suggested diameter of entrance hole for House Sparrow by BTO is 32 mm. Conservation studies conducted by Gitanjali *et al.* (2017) used artificial nest boxes that had a nest mouth with a diameter of 64 mm, which is wider and allow the entry of other birds that are larger than sparrows. In their model, the entrance hole is also placed at the middle of the nest box and it is just 75 mm from the base. It doesn't give much security for nestlings and in addition, leaves little depth inside the box which is comparatively too less to construct more nests. Where as in our model, we made entrance hole 180 mm above from the base. It not only provides mere security to the nestlings (extended roof planks will only allow sparrows to pass through the entrance hole) but also facilitates construction of more nests inside the nest box. In our study, we have observed a maximum of 15 constructed nests inside the nest box (Nest box No.23), during the last summer (April, 2020) when we removed the abandoned nests form nest boxes.

The model developed by Chetan (2012) has a wider bottom than our design which increases the labour of the sparrows to build their first nest in the nest box. Our present model reduces this burden on sparrows. Coming to the installation of nest boxes, Bhattacharya *et al*. (2011) installed nest boxes in open areas, public places and near to water tanks. They observed some disturbance to the nest boxes by other bird species (name of other bird species not mentioned) and to avoid that they have arranged mesh-like guard on the top of the nest boxes. No specific disturbances have been reported by Balaji (2014) because they arranged their nest boxes in secured areas. In our study, we have arranged nest boxes in the houses requesting the house owners, under the slab, at open space, where the sparrows can approach easily. During the past seven years of our study, only a very less disturbance has been observed by other species. Extended roof planks placed in our model obstruct the entry of other species that are larger than sparrows. Thus our model specifications provide protection from other competing species and predators like crows. An occupancy rate of 97.59% clearly indicates the specificity of our model. Only 2.41% of the nests were not occupied and it could be due various reasons like- entry of lizards into those nests, cat predominant areas, invasion of other bird species (Indian Myna) and entry of animals like Squirrel and Rat.

The success of occupancy is in consistent with increasing population. From 2014 to 2020, 570 nest boxes were installed in Jangareddigudem town, at periodic intervals. Each nest has been utilized on an average thrice for breeding in a year. Sparrow population in our study area has been significantly increased after installation of nest boxes indicating the demand for artificial nest boxes.

CONCLUSION

Habitat loss is found to be the predominant cause for the reduction in the population of House Sparrow. The present trend of house design *i.e.* RCC buildings, were unable to provide breeding spaces for secondary cavity nesters like House Sparrows. Besides this, changes in the methods of transportation and storage of crop yield also resulted in the decreased availability of food resources to this tiny bird population. A pollution pressure, such as increased use of pesticides to improve the crop yield is also one of the contributing factors for their decline. Providing artificial nest boxes as breeding spaces is the only option to stabilize the sparrow population. The specific nest model designed by us is attractive, secured and as well convenient for the parent birds to feed their nestlings. Sparrows are continuously utilizing these nest boxes as their breeding grounds. In our observation, one nest box (Nest box no. 335), has been utilized more than six times in the year 2020. Most of the nest boxes provided were occupied and utilized by the sparrows indicating the raise in population in the study area. Competition among various couples was also observed for the available nest boxes indicating the demand for breeding spaces. Conservation of wild life must become a fundamental duty of each citizen. Then only the future generations can have this tiny bird.

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