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## **FACTORS AFFECTING HOUSE SPARROW *PASSER DOMESTICUS* DISTRIBUTION IN THE KANNUR DISTRICT OF KERALA, INDIA**

### ABSTRACT

House Sparrows are urban birds which are thought to be declining in different countries. The House Sparrow population in the Kannur district of Kerala in India was studied from March to May 2021 to understand the change in population and to identify the habitat variables that predict their distribution. A total of 914 House Sparrows were recorded from 61 sites. Compared with a previous study, the overall House Sparrow population declined by 27%. The sites having ration, grocery and chicken shops were found to have good House Sparrow populations. The presence or absence of roosting trees, old buildings, agricultural areas, and mobile towers didn't affect House Sparrow populations.

**Key words:** House Sparrow, Population, Habitat, Decline, Urban-semi urban-rural region

### INTRODUCTION

House Sparrows *Passer domesticus* have developed a close association with humans. They inhabit urban areas and usually stay in colonies of 10-20 individuals (Shaw *et al.* 2008, Bhattacharya *et al.* 2011). They show a historical and symbiotic relationship with humans and human settlements and play an important role in the ecological balance (Anandan *et al.* 2014, Jhajhria 2020). The existence of House Sparrows in any area indicates the region's environmental stability and sustainable development (Modak 2015). They are omnivorous birds that feed mainly on grains, cereals, seeds, fruits, fruit buds, flower nectar, food waste, insects and insect larvae (Rajashekar and Venkatesha 2008; Aheer *et al.* 2018). House Sparrows are sedentary birds and do not move more than 1 or 2 km from their nesting colony (Robinson *et al.* 2005).

In India, House Sparrows number has been fairly stable overall during the past 25+ years except for cities where a gradual decline was noted (SoIB 2020). But few studies in Andhra Pradesh, Tamil Nadu, Karnataka and Uttarakhand reported a decline in population (Gosh *et al.* 2010, Balaji *et al.* 2013, Hussain *et al.* 2014 Paul 2015, Naik 2018, Deepalakshmi and Salomi 2019, Sharma and Binner 2020, Renukadevi

*et al.* 2021). Studies in Kerala also indicated a decline (Dandapat *et al.* 2010). A study suggested the local extinction of House Sparrows in Trivandrum City of Kerala (Raju 2015). We have been monitoring the House Sparrow population in the Kannur district of Kerala and were working closely with the public, installing nest boxes each year to support the species (Roshnath *et al.* 2018).

Several factors are suggested to be responsible for the decline of House Sparrows, such as lack of food source (Jhajhria 2020), foraging area and habitat loss (Teotia *et al.* 2017, Anandan *et al.* 2014), and nesting space (Singh *et al.* 2013). Infrastructure development such as widening highways have caused the removal of roosting trees affecting the House Sparrow population highways (Singh *et al.* 2013; Balwan and Saba 2020). Also, intensive rates of pollution (Ghosh *et al.* 2010, Balmori and Hallberg 2007) and electromagnetic radiation from towers (Pradha 2015; Mahesh and Lanka 2021) were suggested to affect House Sparrows.

House Sparrows prefer urban and suburban areas to rural regions (Herrera-Dueñas *et al.* 2017, Moudrá *et al.* 2018). The extent of green cover which provides food, nesting and roosting places is an important factor in determining the House Sparrow distribution in urbanized regions (Chamberlain *et al.* 2007, Bernat-Ponce *et al.* 2018). Thus, the present study aims to understand and compare the House Sparrow population in the Kannur district of Kerala and the habitat variables that predict their distribution.

## STUDY AREA

The study was carried out in the Kannur district (11.9709° N, 75.6208° E) of Kerala which is the second northernmost district of Kerala, with an area of 2,966 km<sup>2</sup> (Fig. 1). The land use or land cover in the Kannur district is residential with agriculture (44.56%), forest (14.69%), water bodies (2.69%) and built-up areas (8.20%) (District Urbanisation Report, 2011). The study was conducted from March to May 2021.

## METHODS

A press release was published in all leading newspapers in the district (with the details of the project and contact numbers) to identify the



Fig. 1. Study area

potential House Sparrow areas in Kannur District (Roshnath *et al.* 2018). Locations of House Sparrows were also collected from the platform eBird where birdwatchers upload their findings. House Sparrows were counted in the morning from 6 to 8 a.m. by the same observer. The number of House Sparrows was then compared with the number found in a previous study in 2005 (Roshnath *et al.* 2018).

Binoculars (Celestron 8×45) were used when searching for House Sparrows and the total number of individuals (males and females separately, if possible) were noted. Further information collected concerned the type of study site, i.e., urban or semi urban according to the District Urbanisation Report, Kannur (2011). The absence or presence of old buildings, roosting trees, and food sources such as hotels, ration shops, grocery shops, chicken shops, residential areas, agriculture fields, and mobile towers was also noted (Fig. 3).

Old buildings are those constructed before 1990, with a tiled roof, shutters and other space for nests. Buildings with concrete roofs, walls made of glass and false ceiling were considered to be new buildings. Small and medium-sized trees (less than 5 m) are selected by House Sparrows for roosting (Dhanya and Azeez 2010). Thus, we have only noted the presence of such trees in each site. The presence of House Sparrows in each site was considered as a response variable in the models to predict the variables affecting the distribution. We used Generalized Linear Models (GLM) to compare the effects of variables on the House Sparrow count, with the lme4 package in R 3.2.1 (R Core Team 2014). The Shapiro-wilks test was employed for testing the normality of data. The difference in House Sparrow population from 2015 to 2021 was assessed by using Wilcoxon sign rank test. All the statistical procedures were carried out in R (version 4.0.3), considering a level of significance of  $p < 0.05$ .

## RESULTS

A total of 914 House Sparrows were recorded during the entire survey (220 individuals in urban and 694 in semi-urban areas) and the number of individuals varied across sites (Fig. 3). The House Sparrow population was found to be decline by 27% while comparing the previous study Roshnath *et al.*, (2018). Decline in House Sparrow population from 2015 ( $15.8 \pm 12.6SD$ ) to 2021 ( $11.5 \pm 13.9SD$ ) was significant ( $p = 0.01$ ). A considerable increase in population was found only in three sites (Irrikur, Thaliparamba and Old Bus Stand-Kannur) while seven sites showed a marginal increase ( $< 10$  individuals). A steady population decline was found in 9 sites ( $> 10$  individuals) and a marginal decline ( $< 10$  individuals) in 15 sites (Table 1).

The distribution of House Sparrows were predicted by the variables presence of ration shop ( $R^2 = 0.005$ ,  $p = 0.005$ ), grocery shops ( $R^2 = 0.06$ ,  $p = 0.04$ ), and chicken shop ( $R^2 = 0.08$ ,  $p = 0.02$ ) and the interaction between these factors ( $F(3,55) = 5.30$ ,  $P = 0.002$ ,  $R^2 = 0.22$ ). Mobile towers were present in 41 sites (68.3%) but didn't have any influence on the presence of House Sparrows ( $R^2 = 0.01$ ,  $p = 0.38$ ).

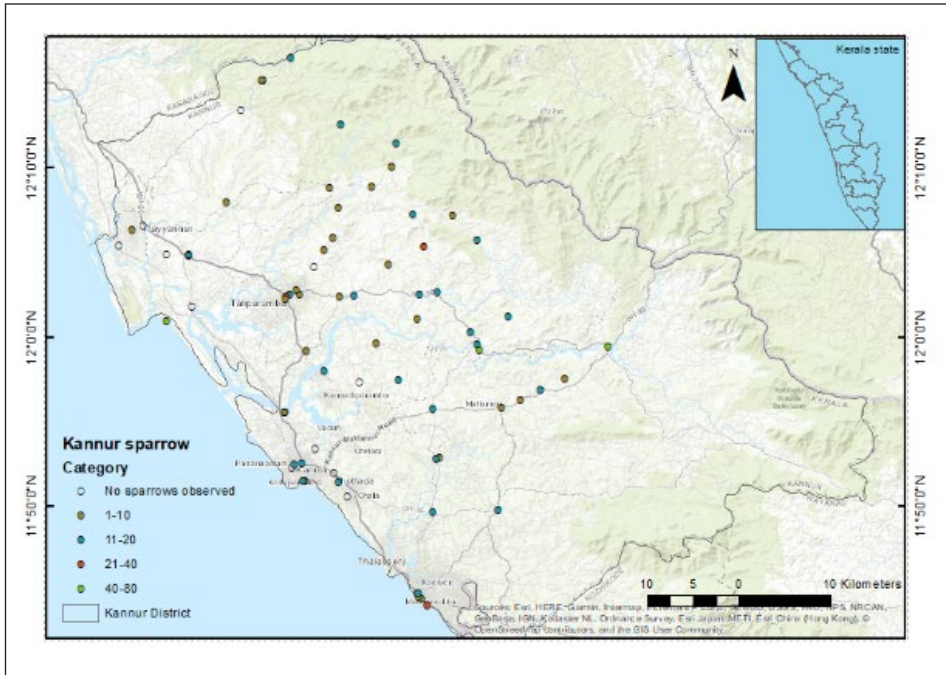


Fig. 2. House Sparrow distribution across the Kannur District of Kerala

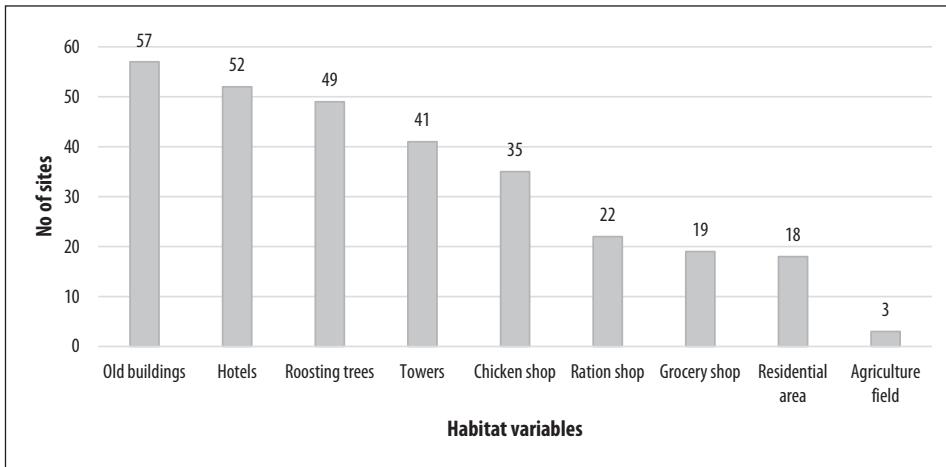


Fig. 3. Frequency of habitat types found on the House Sparrow study sites

Table 1. Number of House Sparrow individuals in all study sites investigated 2015 and 2021

| Site                       | No of Individuals (percentage) |            | Difference  |
|----------------------------|--------------------------------|------------|-------------|
|                            | 2015                           | 2021       |             |
| Irikkur                    | 6 (1.0)                        | 60 (14.8)  | 54          |
| Thaliparamba               | 13 (2.3)                       | 43 (10.6)  | 30          |
| Old bus stand (Kannur)     | 5 (0.9)                        | 16 (4.0)   | 11          |
| Thalassery old bus stand   | 17 (3.1)                       | 25 (6.2)   | 8           |
| Cherupuzha                 | 8 (1.4)                        | 13 (3.2)   | 5           |
| Chuzhali                   | 3 (0.5)                        | 7 (1.7)    | 4           |
| Mambaram                   | 8 (1.4)                        | 11 (2.7)   | 3           |
| Mattannur                  | 5 (0.9)                        | 8 (2.0)    | 3           |
| Kambil                     | 10 (1.8)                       | 12 (3.0)   | 2           |
| Therthally                 | 19 (3.4)                       | 20 (4.9)   | 1           |
| Madarisa (Thaliparamba)    | 3 (0.5)                        | 3 (0.7)    | 0           |
| Anjarakkandy               | 15 (2.7)                       | 14 (3.5)   | -1          |
| Aykkara                    | 36 (6.5)                       | 35 (8.7)   | -1          |
| Thazhechovva               | 2 (0.4)                        | 0          | -2          |
| Palliparamba               | 3 (0.5)                        | 0          | -3          |
| Shoprix - thaliparamba     | 7 (1.3)                        | 4 (1)      | -3          |
| Kakkad                     | 5 (0.9)                        | 0          | -5          |
| Muzhappilangad             | 5 (0.9)                        | 0          | -5          |
| Kannur market              | 6 (1.1)                        | 0          | -6          |
| Koottupuzha                | 6 (1.1)                        | 0          | -6          |
| Parassinikadavu            | 6 (1.1)                        | 0          | -6          |
| Kurumathur                 | 20 (3.6)                       | 13 (3.2)   | -7          |
| Kanjirangad (Thaliparamba) | 8 (1.4)                        | 0          | -8          |
| Peringome                  | 8 (1.4)                        | 0          | -8          |
| Manna                      | 22 (4.0)                       | 12 (3.0)   | -10         |
| Blathoor                   | 25 (4.5)                       | 15 (3.8)   | -10         |
| Sreekandapuram             | 30 (5.4)                       | 19 (4.7)   | -11         |
| Mattambram mosque          | 16 (2.9)                       | 2 (0.5)    | -14         |
| Chalil (Thalassery)        | 49 (8.86)                      | 35 (8.7)   | -14         |
| Payyanur                   | 22 (4.0)                       | 5 (1.2)    | -17         |
| Chemberi Town              | 30 (5.4)                       | 11 (2.7)   | -19         |
| Chalode                    | 33 (6.0)                       | 13 (3.2)   | -20         |
| Malapattam                 | 30 (5.4)                       | 8 (2.0)    | -22         |
| Nedumpoyil                 | 30 (5.4)                       | 0          | -30         |
| Thottada                   | 42 (7.6)                       | 0          | -42         |
| <b>Total</b>               | <b>553</b>                     | <b>404</b> | <b>-149</b> |

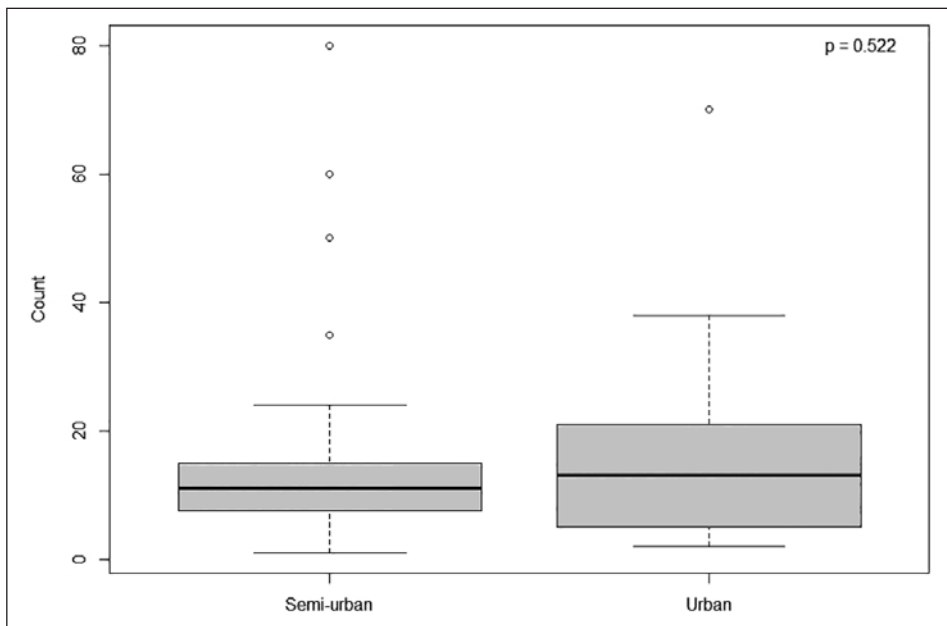


Fig. 4. Box plot showing the House Sparrow count across different sites

## DISCUSSION

Urban areas of low socioeconomic status were extensively used by House Sparrows due to the availability of food, foraging ground and nesting space (Choudhary *et al.* 2019). Urbanization and industrialization, leading to the loss of suitable foraging and nesting spaces have contributed much to the declining House Sparrow populations (Pineda *et al.* 2013, Choudhary *et al.* 2019). The presence of grocery shops, ration shops and chicken stalls positively influenced habitat selection by House Sparrows, while agricultural areas, old buildings, hotels, roosting trees and residential areas showed a negative correlation with habitat selection.

Grocery shops and ration shops are very important sources of food, where cereals, millets and food waste are easily available for the House Sparrows. Apart from eating grains openly available for sale, fallen or discarded, House Sparrows pick insects from the grain and vegetables. Chicken shops mostly have fallen feeds under the cages which is another food source. We found a comparatively high population of House Sparrows associated with these shops.

*Terminalia catappa*, *Trema orientalis*, *Mimusops elengi*, *Samanea saman*, *Cassia fistula*, *Ficus* spp., *Mangifera indica*, *Macaranga peltata*, *Tamarindus indica*, *Psidium guajava*, *Bougainvillea* spp., etc. were the common roosting trees found in study sites. House Sparrows are known to roost in trees with a height of less than 5 m (Dhanya and Azeez 2010). The availability of roosting trees was suggested to be a factor limiting the

House Sparrow population (Patel and Dodia 2021), but we didn't find any significant relationship between the presence of roosting trees and House Sparrow numbers.

Towns in Kannur are rapidly being renovated and modernised. Old buildings with crevices and holes in walls, gaps under the roofs or on shutter's roller boxes offer the most suitable nest sites for House Sparrows (Paul 2015). Even though most of the sites surveyed had old-fashioned buildings, we couldn't find any hike in population when compared with sites having new buildings.

Even though House Sparrows are granivorous, they are not observed near agricultural fields, which may be simply due to the lack of agricultural fields in urban areas or the presence of predators (Choudhary *et al.* 2019). House Sparrows are found mostly in urban areas, and the reason for the decline House Sparrow numbers in human settlement in India has not yet been identified (Sudhira and Gururaja 2013). Residential areas with preferred trees, shrubs and the presence of a home garden will attract the House Sparrows (Kanaujia *et al.* 2014). In this study, the residential areas didn't have any influence on the House Sparrow population, maybe due to the lack of the above mentioned components.

Radiation from the mobile tower was suggested to be one of the reasons for the decline of House Sparrows, but there is no serious evidence for this assumption (Samson and Ramakrishnan 2020). The continuous exposure of higher degree of electro magnetic radiations from mobile towers was suggested to affect House Sparrow behaviour, as well as the abundance of House Sparrows and can result in a decline (Everaert and Bauwens 2007) and embryo mortality (Singh *et al.* 2017). But some studies also suggested House Sparrows are known to withstand electromagnetic radiations (Mahesh and Lanka 2021). 41 out of our 60 study sites had mobile towers and we couldn't find any significance relationship between the number of House Sparrows and presence of towers.

House Sparrows have been studied in urban study for quite some time, and most studies suggest a population decline all over India and elsewhere. The results of the present study fit into this general picture. Sites with provision for food such as ration, grocery and chicken shops had high House Sparrow numbers. The presence of roosting trees and old buildings are generally thought to positively influence House Sparrow populations was found to be of less significance in our investigation. More intensive studies on tree abundance and nest site selection can help in better understanding basic ecological requirements of the House Sparrow. Urbanisation will adversely affect overall biodiversity, including the House Sparrow. An increase in green areas and provision of nest sites and food would help to sustain the House Sparrow populations.

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