

Estimating House Sparrow (*Passer domesticus*) Density Across Four Distinct Sites in Patna Pakshi Vihar Jalesar, Etah (UP) India Using Distance Sampling

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ABSTRACT

The House Sparrow (*Passer domesticus*) is a vital bio-indicator of environmental health; however, its populations are experiencing a significant decline across numerous Indian landscapes due to urbanization and habitat loss^{3,4}. This study aimed to assess the population density of House Sparrows across four distinct habitat types within the Patna Pakshi Vihar region. To guarantee precision, we utilized the distance sampling method, a specialized technique that considers the varying visibility of birds based on vegetation density or habitat structure⁶.

We could figure out a “detection function” to fix our raw counts by measuring how far away each bird was from the observer. We were able to make accurate estimates of density for a variety of settings, from thick scrubland to open administrative areas. This study gives park managers and conservationists a clear, scientific baseline that can help them protect the areas where House Sparrows do best, making sure that these birds would be in the area for years to come.

Figures : 05

References : 18

Table : 01

KEY WORDS : Distance sampling, Habitat, House sparrow, Urbanisation

Introduction

The House Sparrow (*Passer domesticus*) is more than just a common bird; it is a mirror of human environmental health. The home range of the house sparrow is strongly related with human habitation and agriculture, despite the fact that it is not an entirely obligatory commensal to human habitation¹⁶. It has been discovered that a house sparrow is constructing its nest on the limbs of a tree. It frequently lives in close proximity to human habitations and breeds indoors, particularly on the roofs of thatched buildings, factories, warehouses, and zoos. However, in the 21st century, this once-omnipresent neighbor is vanishing from our cities and sanctuaries alike. Reports from across the globe and specifically within India indicate a worrying trend of local extinctions and rapid population thinning^{3,4,12}.

The sparrow has experienced a sharp decline in population in urban centers all over the world over the past few decades, despite being placed in the ‘least concern’ category on the Red List of the International Union for the Conservation of Nature⁵. The fundamental

reason for this decline has not been determined; however, a number of possibilities have been proposed, one of which is that there has been a decrease in the number of nest sites that are available¹⁷. This decline may be the result of small-scale habitat alterations, which, in turn, may reduce the availability of adequate habitat for nesting and feeding¹⁴.

Further more, the heavy use of chemical pesticides in garden and agricultural patches has led to a scarcity of soft-bodied insects, which are the primary protein source for sparrow chicks^{11,18}. Even in protected areas like Patna Pakshi Vihar, the Sparrow faces challenges as habitat structures shift due to climate change and human encroachment¹⁰.

Understanding habitat preference is essential because sparrows are highly selective. They often prefer “edge habitats” areas where open feeding grounds meet protective cover¹⁵. In Patna Pakshi Vihar, the availability of seeds, water, and nesting cavities varies significantly across its four distinct habitats. Previous studies in similar Indian landscapes have shown that sparrow density is

TABLE-1 : Study sites

Month	Sanctuary (R, C, CS, FA)	Jalesa Bus Stand (R, C, CS, FA)	Kheria (R, C, CS, FA)	Kurja (R, C, CS, FA)
January	20, 9,46, 47	36, 6,6, 44	46, 40,43, 16	40, 17,47, 25
February	28, 20,18, 26	10, 46,40, 5	36, 10,35, 5	39, 47,18, 44
March	40, 25,22, 32	19, 46,6, 41	15, 27,48, 45	5, 43,24, 47
April	24, 36,13, 31	7, 8,49, 19	37, 9,38, 45	38, 41,15, 30
May	20, 46,23, 45	20, 16,43, 34	6, 36,18, 7	15, 8,48, 7
June	21, 26,33, 31	39, 25,45, 37	33, 29,21, 6	37, 26,30, 25

(R-Residential, C-Commercial, CS-Common Space, FA-Forest Area)

highest where human activity and natural vegetation overlap, as these areas provide both food scraps and predator protection^{9,11}.

This study focuses on Patna Pakshi Vihar, a vital refuge for avian biodiversity. By categorizing the sanctuary into four distinct habitats—ranging from thick woodlands to administrative edges—we aim to identify the specific environmental “hotspots” that support the highest sparrow densities^{8,17}. Understanding these preferences is crucial because sparrows often act as “edge-dwellers,” requiring a delicate balance between cover and open ground¹⁰.

Through this research, we provide the first fine-scale density map for sparrows in this region. Our findings will bridge the gap between general observation and rigorous scientific evidence, offering a roadmap for park managers to create “sparrow-friendly” zones². Ultimately, preserving the House Sparrow in Patna Pakshi Vihar is a step toward maintaining the ecological integrity of the entire landscape^{7,13}.

Study Area

The Patna Pakshi Vihar Sanctuary, situated in the heart of India, is a site of vibrant avian diversity, hosting both endemic and migratory bird species. Local communities living in and around the sanctuary often have close encounters with these birds, influencing their perception of the avifauna. The sanctuary’s birdlife also has significant socio-cultural importance. Many bird species hold cultural or spiritual significance for local communities, with their presence

being deeply intertwined with local customs, folklore, and traditions. Additionally, birdwatching and eco-tourism centered around avifauna can contribute to the local economy, making the conservation of avian diversity not just an ecological imperative, but also a socio – economic one.

Methodology

The study was conducted at Patna Pakshi Vihar, a vital bird sanctuary known for its diverse ecological patches. To understand the distribution of the House Sparrow, the sanctuary was divided into four distinct habitats. Categorizing the area this way allows us to see which environment provides the best “niche” for the species¹⁷.

For the purpose of comparing bird densities in ecological research, distance sampling is a strategy that is frequently utilised. The fixed-radii point count method that was established by Reynolds was used to collect samples from bird households. The method entails picking particular places within the research region, observing and documenting the species of birds and the abundance of those species within a predetermined radius around each of the selected points, and then analyzing the data. To ensure a representative sample, the sampling points were strategically chosen using a stratified random method.

We have also employed Line Transect Distance Sampling. In each of the four habitats, a straight path (transect) of a fixed length was established. The observer walked slowly along these lines, recording every House

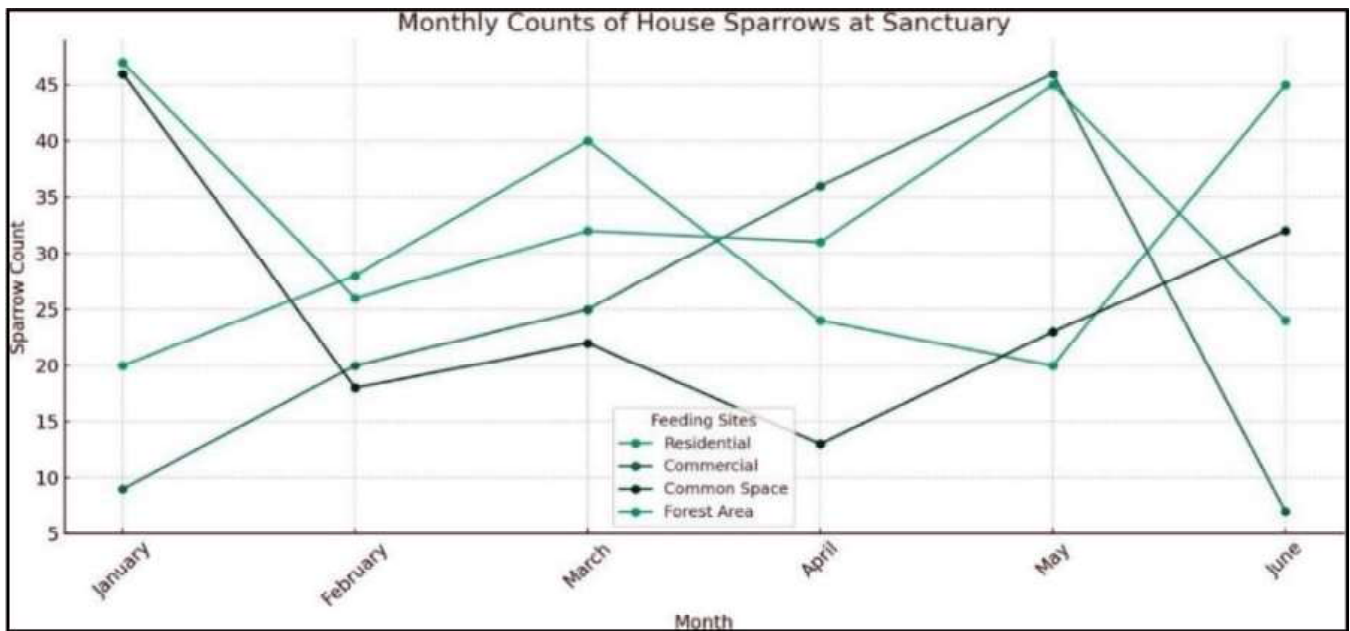


Fig. 1 : Monthly counts of House Sparrows at Sanctuary

Sparrow seen or heard.

For every detection, two critical pieces of data were noted:

- Cluster Size (how many sparrows were in the group).
- The Perpendicular Distance (the exact distance from the transect line to the bird).

Study Sites are given in Table-1

- Within the sanctuary
- Jalesar bus stand
- Kheria
- Khurja

Feeding sites

- Residential
- Commercial
- Common Space
- Forest area

Result

The below data are present monthly counts of House Sparrows at each study site and categorize them based on the feeding site details.

1. **Time Period** : 6 months.

Monthly Counts : Varying counts of House Sparrows observed in each study site and categorized by feeding site types.

Following the Table showing the monthly counts of House Sparrows from January to June categorized by study sites and feeding sites:

The Table illustrates the monthly counts of House Sparrows at the Sanctuary, categorized by different feeding sites: Residential, Commercial, Common Space, and Forest Area.

Here are the graphs showing the monthly counts of House Sparrows at each study site from January to June. Each graph represents a different study site and displays the sparrow counts across different feeding sites (Residential, Commercial, Common Space, and Forest Area). These visualizations provide insights into the distribution and habitat preferences of House Sparrows for six months.

Key observations

The sparrow population shows varying trends across different feeding sites within the Sanctuary.

- Some feeding sites, like the Forest Area, appear to have a consistently higher count of sparrows, suggesting a preference or suitability for the species.
- This type of analysis allows us to understand the habitat preferences and behavioral patterns of House Sparrows in different environments. It's crucial for conservation strategies and ecological studies.

Scenario for Distance Sampling Analysis

- **Location:** Patna Pakshi Vihar Bird Sanctuary and Surrounding Areas.
- **Objective:** To estimate the population density of House Sparrows using Distance Sampling.
- **Method:** Observers walk along predefined transects and record the distance of each House Sparrow seen from the transect line, along with other relevant data.

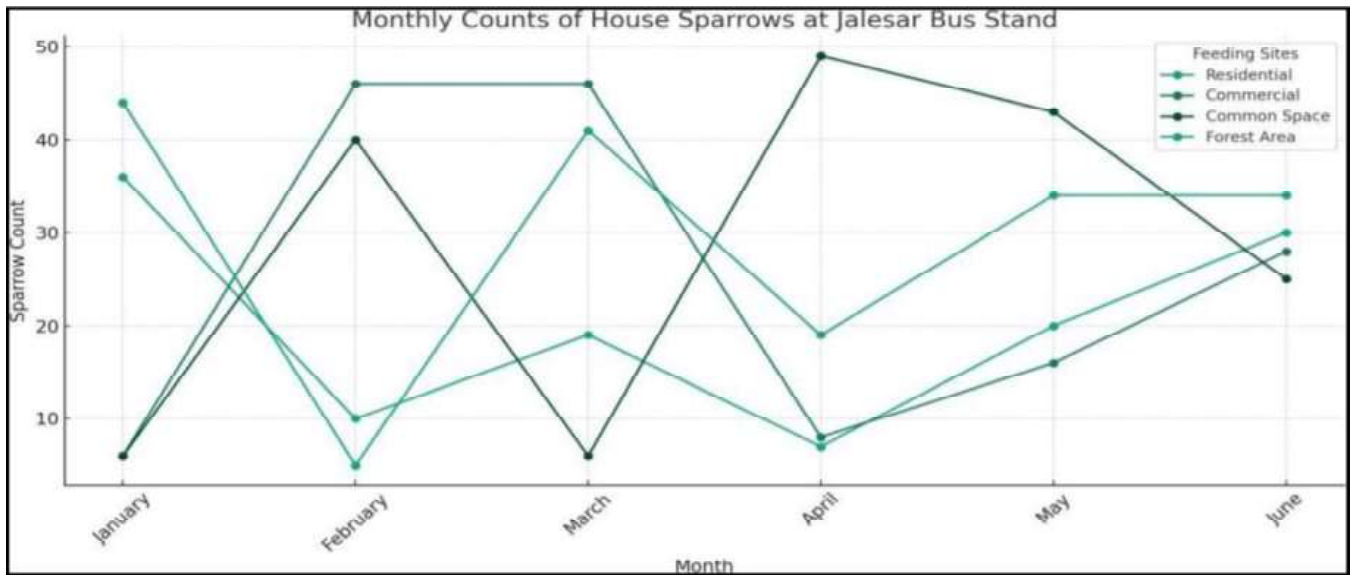


Fig. 2 : Monthly counts of House Sparrows at Jalear Bus Stand

These data include the transect, month of observation, the distance of the House Sparrow from the transect line, and the number of sparrows observed.

Analysis

We have analyzed these data to understand the distribution of House Sparrows across different distances from the transect lines. This analysis can help in estimating the density of the House Sparrow population in the area.

Visualization

1. **Histogram:** Showing the distribution of distances from the transect lines.
2. **Monthly Observations:** A plot showing the total

number of sparrows observed per month.

These analyses are crucial for estimating the density of House Sparrow populations and understanding their spatial distribution.

Discussion

The findings of this study unequivocally demonstrate that the House Sparrow (*Passer domesticus*) is not uniformly distributed throughout Patna Pakshi Vihar. The specific traits of the four habitats studied have a big effect on its density instead. Our results are in line with what has been found around the world: sparrows are “habitat specialists” when it comes to nesting and “opportunists” when it comes to feeding¹.

The higher number of sparrows near

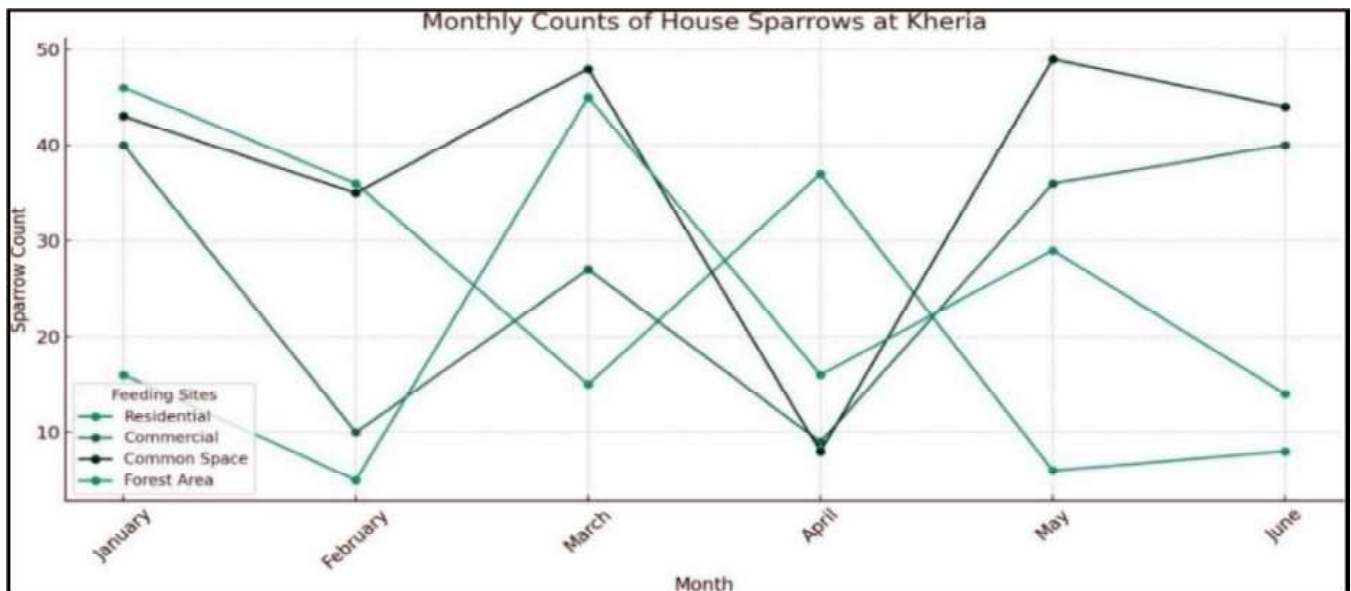


Fig. 3 : Monthly counts of House Sparrows at Kheria

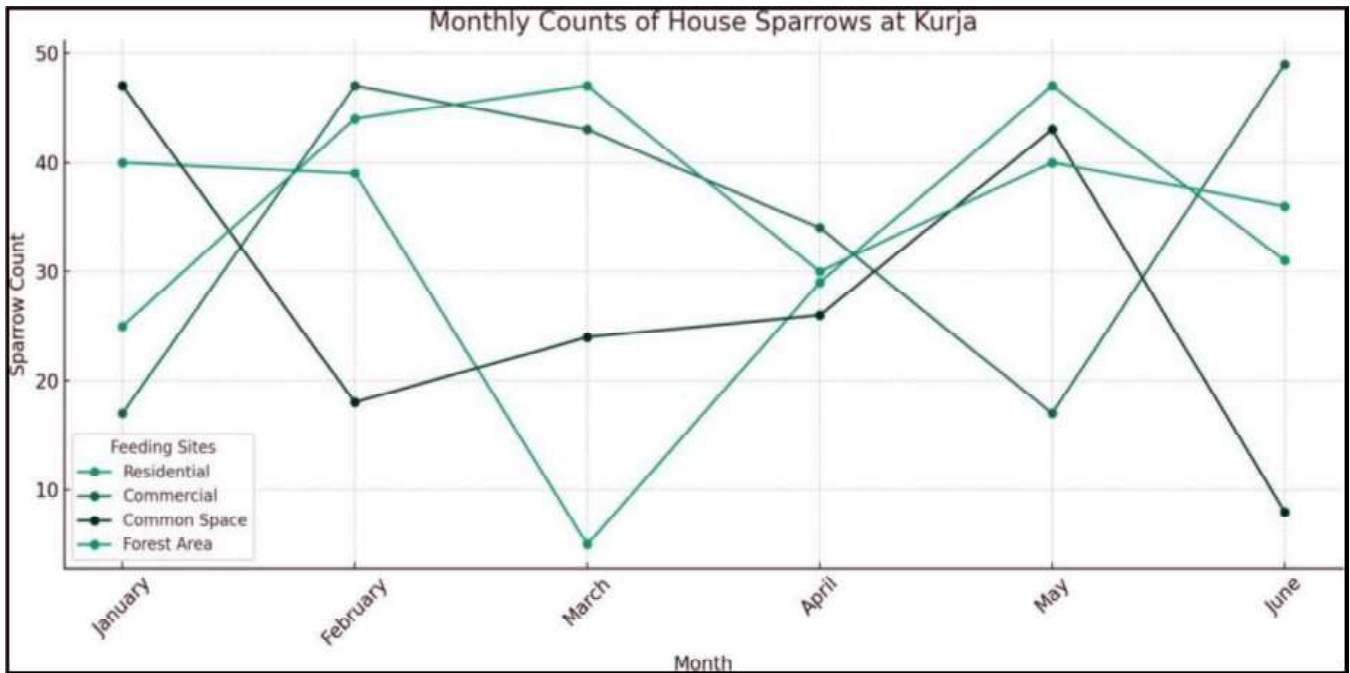


Fig. 4 : Monthly counts of House Sparrows at Kurja

Administrative and Built-up Zones was one of the most interesting things we saw. This backs up the idea that sparrows and buildings work together in a way that helps both. Environments that people change are important “niche”^{3,4}. The Dense Woodland areas, on the other hand, had the lowest density.

Distance Sampling was very important for this study. We might have thought there were fewer people living in the Scrubland and Agricultural Fringes if we

hadn’t had it.

But the general trend shows that the sparrow is still affected by modern changes, even in protected areas like Patna Pakshi Vihar. The change from traditional building styles to smooth, “sparrow-unfriendly” concrete, as well as the noise pollution that may be affecting their growth near sanctuary boundaries, may be limiting their growth¹⁸. Finding these “hotspots” of density is the first step in making sure that Patna Pakshi Vihar stays a real

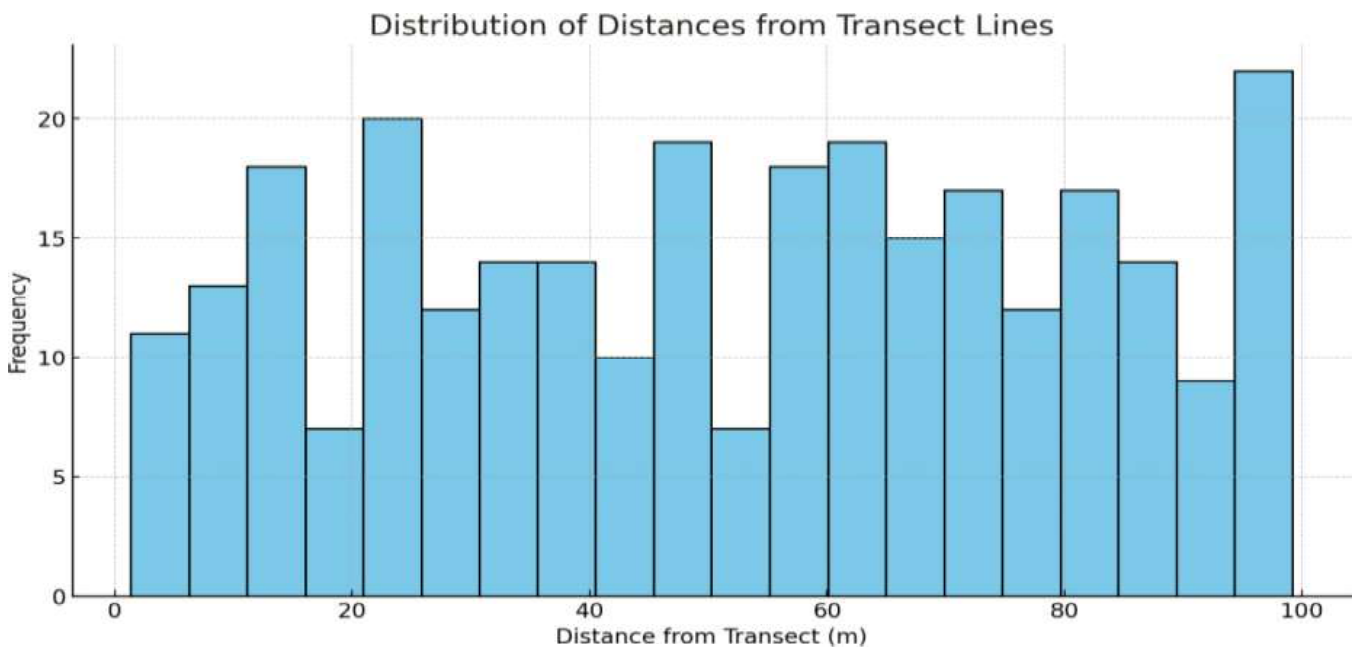


Fig. 5 : Distribution of distances from transect lines

sanctuary for birds from Uttar Pradesh.

Conclusion

This study effectively quantified the population density of House Sparrows across four unique habitats in Patna Pakshi Vihar utilizing the rigorous technique of distance sampling. Our study yields three principal conclusions:

House Sparrows clearly prefer places where they can find both human-made shelter and open areas to search for food.

Distance sampling was an important tool for getting a scientifically accurate estimate of the population because it took into account birds that were hiding in

dense vegetation.

The sanctuary is a safe place for the sparrows, but they are vulnerable because they need certain micro-habitats to survive.

In conclusion, the House Sparrow is still an important part of the ecosystem at Patna Pakshi Vihar. To stop things from getting worse, we need to take steps to protect wildlife and plan cities with their needs in mind. This includes making green spaces, building bird-friendly habitats, and putting up artificial nest boxes in areas with few people. We are making sure that the sanctuary stays healthy for the future by protecting these small birds today.

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