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Original Research Article

Population Distribution of Two Sympatric Sparrow Species: House Sparrow (*Passer domesticus*) and Tree Sparrow (*Passer montanus*) in Urban Areas of Bodoland Territorial Region (BTR), Assam, India

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Abstract: We studied distribution and population densities of House Sparrow (*Passer domesticus*) and Tree Sparrow (*Passer montanus*) along urban–suburban gradients in five district Headquarter towns of the Bodoland Territorial Region (BTR), Assam—Kokrajhar, Kajalgaon, Udalguri, Tamulpur, and Mushalpur. We used 500 × 500 sq. m grids, selecting one point randomly in each grid. Stratified point count surveys (30 m radius, 5-minute counts) were conducted from April 2022 to June 2024 in different seasons across Commercial Areas (CA), Residential Areas (RA), and Suburban Areas (SUA). We did not find significant difference in population density of both the species among different seasons and two successive years as well as between the sexes in House Sparrows. We combined the data for further analyses. Kokrajhar had the highest density of House Sparrow in all the three habitats, and among the three habitats, the lowest density was found in suburban area in all the district Headquarter towns. The lowest density of Tree Sparrow was found in Kajalgaon in all the three habitats, and the highest density of Tree Sparrow was found in sub-urban area. House Sparrows were significantly more than the Tree Sparrows in all the district Headquarter towns and in all the habitats. We found highly significant difference of the population of both House Sparrow and Tree Sparrow across the district Headquarter towns and also among three different habitats. Interspecific comparisons confirmed clear habitat segregation between the two species. The study provides baseline data on sparrow populations in the urban areas of BTR, based on which population monitoring could be carried out.

Keywords: Urban ecology, House Sparrow, Tree Sparrow, Habitat preference, Urban–suburban gradient

Introduction

Among urbanized bird species, the House Sparrow (*Passer domesticus*) has long been among the most successful urban bird species. Highly commensal with human settlements, it is found in villages, towns, and cities of the Indian subcontinent and worldwide, but is seldom reported in intact natural habitats (Ali, 2002; Mahalingam *et al.*, 2016). Despite its ecological value and adaptability, the species has experienced dramatic population declines in most parts of the world. Reasons given for these declines are loss of nesting habitats because of contemporary architecture, lack of food resources, decrease

in tree cover, exposure to pollutants, and even potential impacts of electromagnetic radiation from mobile phone towers (Chopra *et al.*, 2012; Anandan *et al.*, 2014). Apart from its ecological importance, the House Sparrow also contributes ecosystem services like controlling mosquitoes, by consuming larvae in stagnant water near human habitations (Rajashekar, 2008). The recent decline of this previously ubiquitous bird has thus drawn the attention of the global conservation community, and the species was listed in the IUCN Red Data Book (Chopra *et al.*, 2012).

The Tree Sparrow (*Passer montanus*), on the other hand, is mostly found in temperate areas but is also present as a small resident population in Peninsular India (Grimmett *et al.*, 1999). Relative to the House Sparrow (HS), it has a higher preference for semi-urban or sub-urban environments with more vegetation and a higher percentage of green areas, keeping away from extremely urbanized environments (Zhang & Zheng, 2010; Šálek *et al.*, 2015a; Nath *et al.*, 2019). Although the House Sparrow is still quite widespread in certain European cities like Berlin (Witt, 2005) and Paris (Malher, 2006) long-term survey work in the United Kingdom has documented steep declines of 47% in rural and 60% in sub-urban and urban populations since the mid-1970s (Robinson *et al.*, 2005), leading to its classification as a Red List Bird of Conservation Concern (Gregory *et al.*, 2003).

In India, declines in the population of the House Sparrow have been recorded in many regions, such as Delhi (Khera *et al.*, 2010; Chaudhary *et al.*, 2020), Bengaluru (Modak, 2017), Tamil Nadu (Balaji *et al.*, 2017) and Haridwar (Saini, 2015). Yet, in northeastern India, both the House Sparrow and Tree Sparrow occur together and have significant ecological overlaps (Ali *et al.*, 1987). Both species have been known to hybridize in areas where they are sympatric (Summers-Smith, 1988) and as such, this region is of great interest for comparative ecological research. Though they are found extensively, there is limited research on the population status of sparrows in North-eastern India and the study on House Sparrow and Tree Sparrow in BTR is scarce has been made within the Bodoland Territorial Region (BTR) of Assam. The BTR is experiencing rapid urbanization and infrastructural growth, with resultant major alterations in land-use patterns and habitat structures. These changes are bound to have immediate consequences on bird populations, especially on species that are heavily dependent on human settlements, such as the sparrows. While both House Sparrow and Tree Sparrow are locally common in human habitats in the region, the absence of baseline knowledge on their population dynamics is a major research deficit.

Given this background, the current study intends to estimate the population status of the House Sparrow and Tree Sparrow along an urban–suburban gradients in the BTR. By providing the first baseline data for these birds in the region, this study hopes to advance knowledge of their population ecology in fast-evolving cityscapes and provide vital insights for their conservation in Northeast India.

Methodology

Study Area

We studied in the district headquarter towns of the Bodoland Territorial Region (BTR) (26°72 –26°472 N latitude and 89°472 –92°182 E longitude), Assam. The region borders Bhutan in the north and consists of five districts: Kokrajhar, Chirang, Baksa, Tamulpur, and Udalguri (Fig. 1). Among them, Kokrajhar is the westernmost town and serves as the capital of BTR, while Udalguri lies towards the east. The other three towns— Kajalgaon, Mushalpur, and Tamulpur are relatively new administrative centres that are still expanding their built-up areas. Compared to Kokrajhar and Udalguri, these towns support smaller populations (for instance, Kokrajhar had 34,136 residents as per the 2011 census).

For this study, each town was divided into three ecological zones, namely Commercial Area (CA), Residential Area (RA) and Sub-urban Area (SUA), based on their vegetation cover, building density, and human population (Nath *et al.*, 2019; 2022). Commercial areas (CAs) are characterized by dense infrastructure such as buildings, offices, markets, shops, shopping complexes, restaurants, hotels, and heavy traffic zones including railway stations and bus terminals, with relatively limited green

spaces. These areas are usually highly populated and located in the central parts of towns. Residential areas (RAs) consist of households comprising both RCC buildings and traditional Assam-type houses, often accompanied by gardens and a moderate amount of green cover. Sub-urban areas (SUAs) represent the outermost land-use zones situated on the periphery of towns. These areas typically include open spaces, water bodies, abundant vegetation, and sparsely distributed houses (Basumatary *et al.*, 2025).

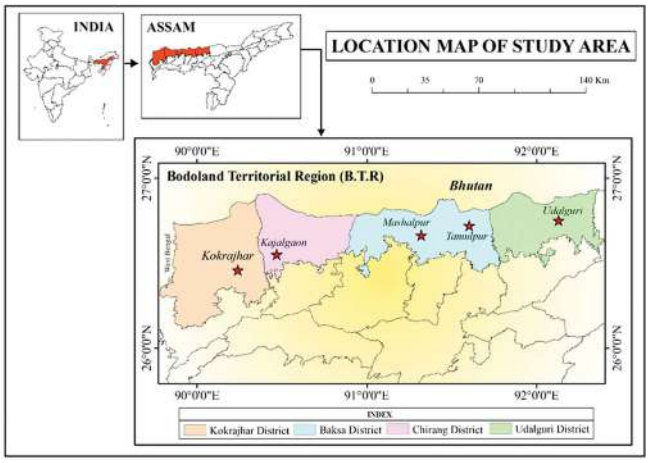


Fig. 1. Map of the study area Bodolnd Territorial Region, Assam.

Data Collection

A preliminary study was performed to compare various radii and observation time with respect to determining the optimal parameters for point count surveys. The primary aim was to determine the time and radius that would provide the optimal and most reliable data for urban sparrow population size estimates. Two-, three-, and five minutes' observation times and 15-, 20- and 30 meters' radii were tried; and 30-meter radius and 5 minutes' duration were found to be the most reliable for the point count.

To estimate the population density of both the sympatric sparrows i.e., HS and TS in urban areas of BTR, the point count method (Buckland *et al.*, 2001) was applied. To survey sparrows in these towns, we placed grids of 500 × 500 sq. m area over Google Earth maps of each town, thus each town was divided into 24 grids. Stratified random sampling was applied so that all three habitats (CA, RA, SUA) were proportionally represented (Table 1). One point was randomly chosen within each grid, giving us 24 sampling points per town. However, number of grids varied under each habitat in all the sites. Each point was repeated in each season for two consecutive years At each point, we spent five minutes recording all sparrows seen within a 30 m radius, between 0600 to 0800 hours. We covered six points in six grids per day. We collected data seasonally during Pre-Monsoon (April to July), Monsoon (August to November) and Post-Monsoon (December to March) (Roopha *et al.*, 2022; Basuamtary *et al.*, 2025) from April 2022 to June 2024. Each point was visited once per season, resulting into six visits in two years, thus altogether, 144 (24 × 6) observations per town and 720 (144 × 5) observations across all five towns over the two years were done.

Statistical analyses

All population data of House Sparrow and Tree Sparrow collected across the five towns of the BTR, Assam, were analyzed using PAST 4.03 statistical software. The population density (D) of each species was calculated for each habitat type (Commercial Area, Residential Area, and Sub-urban Area) using the standard formula: D = N/ A; where N is the total number of individuals observed in a point, and A is the area of the point i.e., 2828 square meters (Nath *et al.*, 2019; 2022). The average density was calculated by dividing the total density by the total number of points studied. Population densities were expressed as mean ± standard deviation (SD).

Before the statistical tests, we first had checked the data if those were normally distributed. When the data were not normally distributed, we applied log transformation. After transforming the data, if the data still were not normally distributed, we used non-parametric tests.

To see if there was significant difference of population between male and female HS in all the habitats and in all the seasons, the Mann-Whitney U test was applied; and since we found that there was no significant difference between the sexes, we combined the data and compared between HS and TS by Mann-Whitney U test. The Kruskal-Wallis test was

used to examine if there was significant difference in population of both the species separately among the three seasons in two consecutive years; however, when there was no significant difference, we combined the data of both the years. Now we used Kruskal-Wallis test to see if there was significant difference of population of each species of sparrow among three habitats i.e., CA, RA and SUA.

Results

Population Density Estimates for House Sparrow and Tree Sparrow

The average population density of House Sparrow and Tree Sparrow in Commercial Areas (CA), Residential Areas (RA), and Sub-urban Areas (SUA) of five district Headquarter towns— Kokrajhar, Kajalgaon, Mushalpur, Tamulpur and Udalguri of the Bodoland Territorial Region (BTR) in Assam are shown in Tables 1 & 2.

Among all the towns, Kokrajhar had the highest density of House Sparrow in all the three habitats. The lowest density in residential area was observed in Tamulpur, while the lowest density in suburban area was recorded in Kajalgaon. And among the three habitats, the lowest density was found in suburban area in all the district Headquarter towns.

The lowest density of Tree Sparrow was found in Kajalgaon in all the three habitats. The highest density in commercial area was found in Udalguri, while the highest density in residential area was observed in Mushalpur, and the highest density in sub-urban area was recorded in Kokrajhar town. Among all the three habitats and in all the five district Headquarter towns the highest density of Tree Sparrow was found in sub-urban area.

The grid-wise distribution of number of both the House Sparrow and Tree Sparrow has been displayed in the Figures 2A to 2J in each of the district headquarter towns of BTR. In all the study sties, the population of House Sparrow was more than that of Tree Sparrow. More House Sparrows were recorded in the CA and more Tree Sparrows were recorded in SUA.

Comparison of Populations of sparrows across Commercial, Residential, and Sub-urban Area

Table 3 shows the Mann-Whitney U test statistics comparing populations of House Sparrow and Tree Sparrow among various urban habitats within each study site in BTR, Assam. The significant differences between the TS and HS populations were found in all the district Headquarter towns and in all the habitats.

Comparison of sparrow Populations among different Study Sites

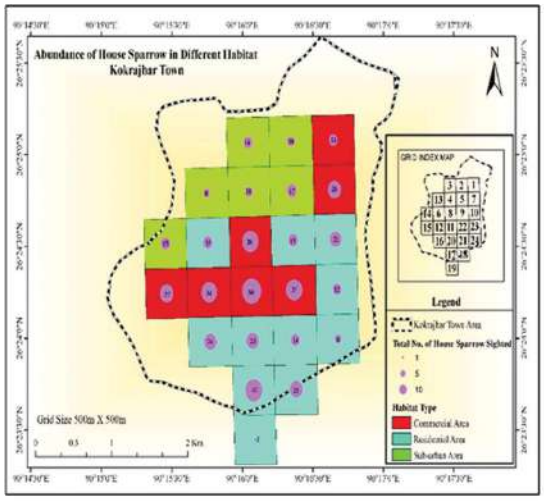
We found highly significant difference of the population of both House Sparrow and Tree Sparrow across the district Headquarter towns in the BTR (Table 4).

Table 1. Population density per square meter of House Sparrow among three habitats across different study sites.

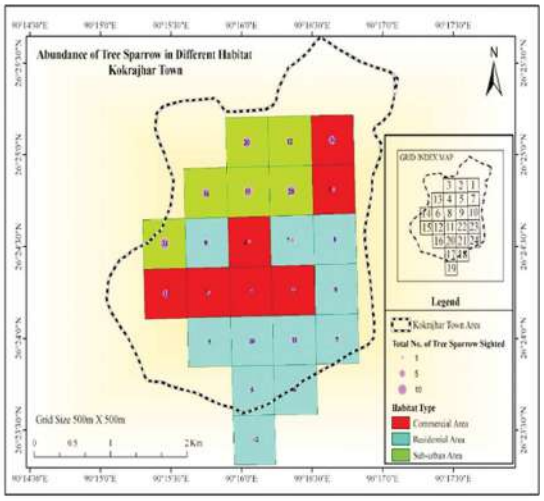
Habitat	Kokrajhar (Mean±SD)	Kajalgaon (Mean±SD)	Mushalpur (Mean±SD)	Tamulpur (Mean±SD)	Udalguri (Mean±SD)
Commercial area (CA)	8.15±3.12 (n =8)	6.22±1.03 (n=7)	6.89±1.26 (n=4)	7.68±0.95 (n=9)	7.45±1.18 (n=11)
Residential area (RA)	2.37±0.56 (n=10)	1.02±0.29 (n=12)	1.25±0.34 (n=8)	0.98±0.21 (n=5)	1.47±0.38 (n=5)
Suburban area (SUA)	0.91±0.31 (n=6)	0.55±0.19 (n=5)	0.72±0.27 (n=12)	0.81±0.24 (n=10)	0.65±0.23 (n=8)

Table 2. Population density per square meter of Tree Sparrow among three habitats across different study sites.

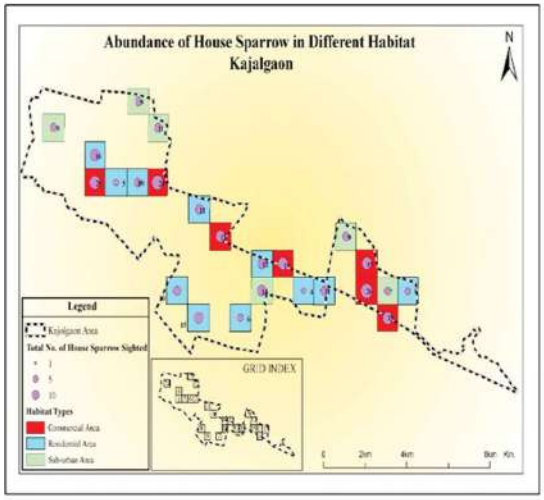
Habitat	Kokrajhar (Mean±SD)	Kajalgaon (Mean±SD)	Mushalpur (Mean±SD)	Tamulpur (Mean±SD)	Udalguri (Mean±SD)
Commercial area (CA)	8.0±2.0 (n=8)	7.0±1.5 (n=7)	7.8±1.9 (n=4)	7.5±1.7 (n=9)	8.2±1.8 (n=11)
Residential area (RA)	10.5±2.3 (n=10)	9.0±2.0 (n=12)	11.0±2.3 (n=8)	10.0±2.0 (n=5)	10.2±2.5 (n=5)
Suburban area (SUA)	14.0±3.0 (n=6)	12.0±2.5 (n=5)	13.2±2.6 (n=12)	13.0±2.2 (n=10)	13.5±2.8 (n=8)


Abundance of House Sparrow in Different Habitat
Kokrajhar Town
N
GRID INDEX MAP
Legend
Kokrajhar Town Area
Total No. of House Sparrow Sighted
Habitat Type
Commercial Area
Residential Area
Sub-urban Area
Grid Size 500m X 500m

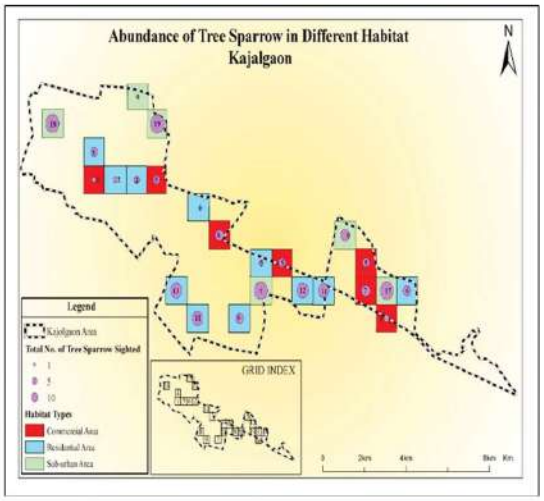
(A)


Abundance of Tree Sparrow in Different Habitat
Kokrajhar Town
N
GRID INDEX MAP
Legend
Kokrajhar Town Area
Total No. of Tree Sparrow Sighted
Habitat Type
Commercial Area
Residential Area
Sub-urban Area
Grid Size 500m X 500m

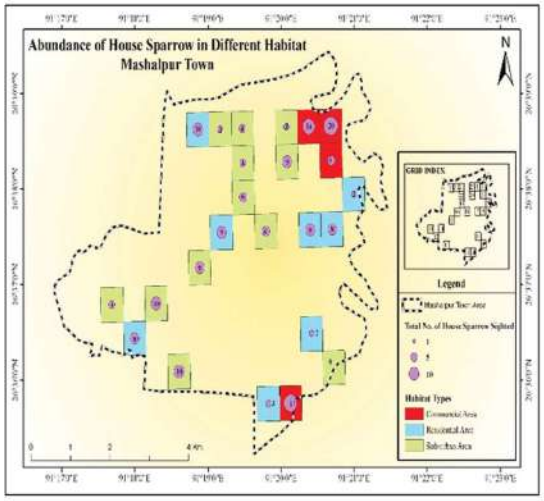
(B)


Abundance of House Sparrow in Different Habitat
Kajalgaon
N
Legend
Kajalgaon Area
Total No. of House Sparrow Sighted
Habitat Types
Commercial Area
Residential Area
Sub-urban Area
GRID INDEX

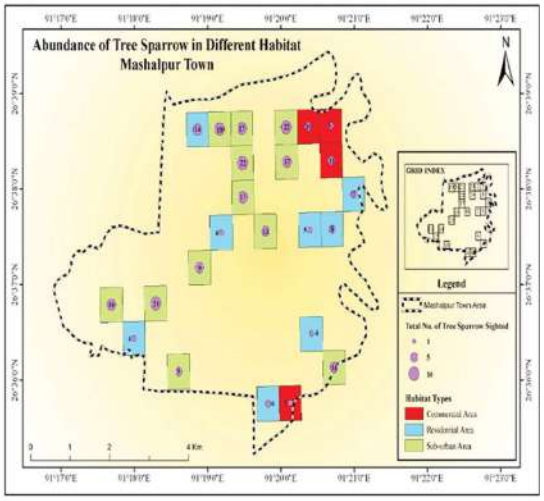
(C)


Abundance of Tree Sparrow in Different Habitat
Kajalgaon
N
Legend
Kajalgaon Area
Total No. of Tree Sparrow Sighted
Habitat Types
Commercial Area
Residential Area
Sub-urban Area
GRID INDEX

(D)


Abundance of House Sparrow in Different Habitat
Mashalpur Town
N
GRID INDEX
Legend
Total No. of House Sparrow Sighted
Habitat Types

(E)


Abundance of Tree Sparrow in Different Habitat
Mashalpur Town
N
GRID INDEX
Legend
Total No. of Tree Sparrow Sighted
Habitat Types
Commercial Area
Residential Area
Sub-urban Area

(F)

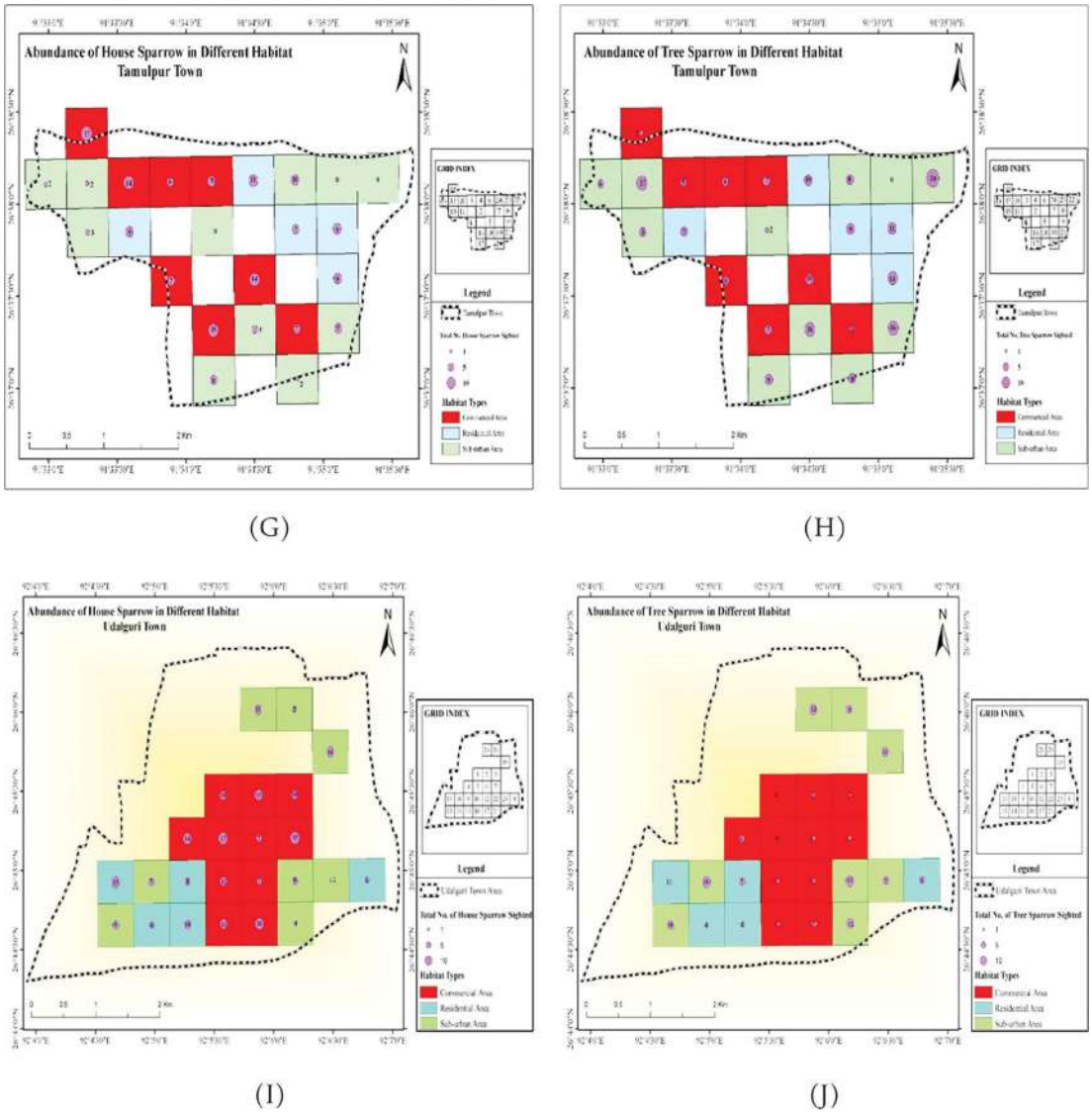


Fig. 2. The comparative number of sparrows recorded in district Headquarter towns in BTR during 2022-2024 (Kokrajhar: A = House Sparrow, B = Tree Sparrow), (Kajalgaon: C = House Sparrow, D = Tree Sparrow), (Mushalpur: E = House Sparrow, F = Tree Sparrow), (Tamulpur: G = House Sparrow, H = Tree Sparrow) and (Udalguri: I = House Sparrow, J = Tree Sparrow). The radii of pink coloured circles represent respective number of sparrows.

Comparison of Sparrow Populations among three different habitats

We found highly significant difference in the population of both House Sparrow and Tree Sparrow among three different habitats across all five district headquarter towns of the Bodoland Territorial Region (BTR), indicating that habitat type strongly influences the distribution of both species within towns (Table 5).

Discussion

Population Density and Habitat Preference of House Sparrow and Tree Sparrow

This study examined the population density of House Sparrow and Tree Sparrow across three urban habitat types—Commercial Areas (CA), Residential Areas (RA) and Sub-urban Areas (SUA)— in district headquarters of the Bodoland Territorial Region (BTR), Assam. The results revealed clear

Table 3. Mann-Whitney test between House Sparrow and Tree Sparrow among three habitats across different study sites (* = significant, ** = highly significant, *** = very highly significant).

Urban areas	Habitats	U value	n_1, n_2	P value
Kokrajhar	CA	237	48,48	0.0001***
	RA	1106.5	60,60	0.0001***
	SUA	430	36,36	0.001**
Kajalgaon	CA	442	42,42	0.0001***
	RA	2130	72,72	0.048*
	SUA	320.5	30,30	0.05*
Mushalpur	CA	192	24,24	0.04*
	RA	867.5	48,48	0.021*
	SUA	1636	72,72	0.0001***
Tamulpur	CA	1147.5	54,54	0.03*
	RA	333	30,30	0.006**
	SUA	1068.5	60,60	0.0001***
Udalguri	CA	931.5	66,66	0.0001***
	RA	321	30,30	0.04*
	SUA	880	48,48	0.03*

Table 4. Kruskal-Wallis test results to see the significant difference in the population of House Sparrow and Tree Sparrow among all the district Headquarter towns.

Habitats/	House Sparrow			Tree Sparrow		
Species	H	df	P value	H	df	P value
CA	41.53	4	0.0001	12.31	4	0.001
RA	9.952	4	0.02	10.97	4	0.01
SUA	40.07	4	0.0001	9.287	4	0.04

Table 5. Kruskal-Wallis test results to see the significant difference in the population of House Sparrow and Tree Sparrow among the three different habitats across all the district headquarter towns.

Habitats/	House Sparrow			Tree Sparrow		
Species	H	df	P value	H	df	P value
Kokrajhar	17.87	2	0.001	5.5	2	0.02
Kajalgaon	16.98	2	0.001	9.482	2	0.01
Mushalpur	11.02	2	0.001	10.89	2	0.001
Tamulpur	11.1	2	0.001	10.76	2	0.001
Udalguri	7.12	2	0.02	17.23	2	0.001

differences in habitat preference between the two species, although no significant seasonal variation in abundance was observed.

House Sparrow populations were consistently higher than Tree Sparrow across all study towns, which agrees with the findings of Nath *et al.* (2019, 2022). The higher abundance of House Sparrow might be attributed to its strong association with urban environments and its ability to exploit built-up habitats that are rapidly increasing in urban landscapes (Ramos-Elvira *et al.*, 2023). House Sparrow are known to adapt well to human-dominated environments and have effectively coexisted with humans for centuries, whereas Tree Sparrow tend to prefer comparatively less disturbed habitats.

House Sparrow Distribution Across Habitat Types

House Sparrow showed significantly higher densities in commercial areas compared to residential and sub-urban habitats. This pattern suggests that House Sparrow benefit from areas with intense human activity where anthropogenic food resources such as food waste, grain stores, markets, and restaurants are readily available (Anderson, 2006). Similar associations between House Sparrow abundance and human population density have been reported in by Vincent (2005).

The dominance of House Sparrow in commercial hubs such as Kokrajhar and Tamulpur further indicates that urban infrastructures provide suitable nesting sites and consistent food resources. Previous studies have also shown that House Sparrow thrive in human-dominated environments due to access to food waste and nesting cavities in buildings (Šálek *et al.*, 2015b; Nath *et al.*, 2019, 2022).

In contrast, suburban habitats supported the lowest densities of House Sparrow. These areas generally contain more vegetation and fewer built structures, resulting in reduced availability of anthropogenic food sources and nesting opportunities. Similar trends have been reported in other regions where House Sparrow populations decline in areas with lower human density (Anderson, 2006).

Tree Sparrow Habitat Preference

Tree Sparrow exhibited significantly higher densities in residential and sub-urban habitats compared to commercial areas. This pattern reflects the species' preference for habitats with vegetation cover and lower levels of disturbance (Murgui, 2017; Thomas *et al.*, 2010). Tree Sparrows typically depend

on natural food sources such as seeds and insects and frequently utilize shrubs and trees for nesting (Summers-Smith, 1988).

The relatively higher Tree Sparrow densities in the suburban zones of Mushalpur and Kokrajhar suggest that vegetation-rich environments provide suitable foraging and nesting opportunities. Similar habitat preferences have been reported in studies from Europe and Asia, where Tree Sparrow populations are associated with greener urban landscapes (Jokimäki, 2021 and Chace 2006).

Residential areas also supported considerable sparrow populations because they provide moderate human activity, gardens, trees, and shrubs, which offer both food and nesting opportunities (Seress & Liker, 2015). Such environments create favourable conditions for both species, although TS appear better adapted to areas with higher vegetation cover.

Seasonal Stability of Sparrow Populations

The absence of significant seasonal variation in the populations of House Sparrow and Tree Sparrow across habitats suggests that sparrow populations in BTR remain relatively stable throughout the pre-monsoon, monsoon, and post-monsoon seasons. This contrasts with temperate regions where sparrow populations often fluctuate seasonally due to variations in food availability and breeding cycles (Shaw *et al.*, 2008).

Urban environments generally provide more consistent food resources and nesting sites throughout the year, which may buffer populations against seasonal changes (Ramos-Elvira *et al.*, 2023). Studies have shown that urban sparrows often maintain stable population levels because anthropogenic food sources and nesting structures remain available year-round (Vincent *et al.*, 2005; Weir, 2015).

Species Interactions and Ecological Strategies

The contrasting distribution patterns of House Sparrow and Tree Sparrow across habitats reflect differences in their ecological strategies. House Sparrows depend strongly on anthropogenic food sources and nesting sites associated with buildings, whereas Tree Sparrows are better adapted to moderately disturbed habitats with vegetation cover. Similar patterns of habitat partitioning between these two species have been documented in several studies across Europe and Asia (Shaw *et al.*, 2008; Ciach & Fröhlich, 2017; Sharma & Singh, 2018).

This niche differentiation likely reduces direct competition and allows both species to coexist within urban landscapes (Catterall, 1991; Liker *et al.*, 2008). The persistence of both species in BTR indicates that heterogeneous urban habitats—comprising commercial, residential, and suburban zones can support sparrow populations when adequate food and nesting resources are available.

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