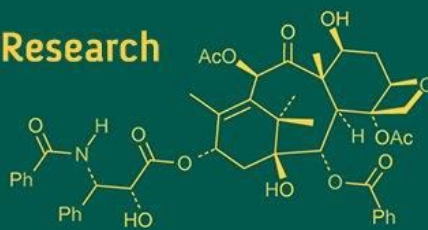


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Impact of differential habitat use and dominance of omnivore and insectivore trophic guilds in bird assemblages

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Abstract

The impact of differential habitat use and trophic guild dominance on bird assemblages was studied across six urban transects in Jalandhar, India, representing residential (R I, R II), commercial (C I, C II), and industrial (In I, In II) habitats. Overall, a total of 50 bird species, belonging to 13 orders were recorded with Passeriformes being the most dominant order and Blue Rock Pigeon was observed to be the most abundant species followed by Common Myna and House Crow. The bird diversity observed to be highest and lowest in transects In II and C I respectively. About 17, 24 and 9 bird species out of total 50 bird species were not recorded in residential, commercial and industrial transects. Trophic guild analysis revealed that omnivores and insectivores dominated most of the transects, granivores were consistently present particularly in residential areas, whereas nectarivores were least represented. Average bird counts per visit were highest in C II and peaked during July and August, likely linked to resource availability.

Keywords: Omnivore, insectivore, urbanization, commercial, residential, industrial

Introduction

Urbanization is among the most pervasive drivers of contemporary land-use change, fundamentally altering habitat structure, resource distribution, and ecological interactions across landscapes by imposing strong environmental filters on biological communities, leading to shifts in species composition, functional traits, and ecosystem processes (Grimm *et al.*, 2008, Marzluff, 2017) ^[1, 2]. In rapidly developing countries such as India, urban expansion has been particularly intense, resulting in extensive modification of natural and semi-natural habitats into residential, commercial, and industrial land-use types.

Birds are especially well suited for examining the ecological consequences of urbanization due to their high mobility, diverse trophic roles, and sensitivity to habitat structure and human disturbance. Numerous studies have documented that urban environments tend to support lower overall avian diversity but higher abundances of a few adaptable species, resulting in biotic homogenization (Aronson *et al.*, 2016) ^[3]. A prominent ecological outcome of urbanization is the restructuring of avian trophic guilds, reflecting changes in food availability, vegetation composition, and anthropogenic resource subsidies. Studies across global and Indian urban systems consistently show an increase in omnivorous and granivorous guilds and a concurrent decline of insectivores and other dietary specialists with increasing urban intensity (Mukherjee *et al.*, 2025) ^[4]. This trophic shift has important ecological implications, as insectivorous birds contribute significantly to pest regulation, while frugivores and nectarivores play key roles in seed dispersal and pollination (Wenny *et al.*, 2011) ^[5]. Loss or reduction of these functional groups may therefore compromise ecosystem services within urban landscapes. The omnivore birds feed on both plant and animal matter and omnivores were found to be more dominant bird trophic guild followed by insectivores, carnivores, granivores, frugivores and nectarivores in some of the agroecosystems (Ulman and Singh, 2021) ^[6].

Differential habitat use across urban land-use types strongly influences avian community organization. Residential areas with gardens, parks, and heterogeneous vegetation structure often support higher species richness and functional diversity compared to commercial and industrial zones, which are typically characterized by high disturbance, low vegetation cover,

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and limited nesting opportunities (Sun *et al.*, 2022) [7]. Indian studies have demonstrated that urban green spaces, roadside plantations, and residential gardens can act as important refugia for native bird species, particularly insectivores and frugivores, within otherwise hostile urban matrices (Kaushik *et al.*, 2022) [8].

Despite growing interest in urban ornithology in India empirical evidence linking differential habitat use to trophic guild patterns in urban cities remains limited, particularly in medium-sized rapidly urbanizing cities of northwestern India. Addressing this knowledge gap is essential for understanding urban ecosystem functioning and for developing biodiversity-sensitive urban planning strategies. In this context, the present study examines the impact of differential habitat use on trophic guild patterns of birds across residential, commercial, industrial, and anthropogenically subsidized habitats in Jalandhar city and provide insights into how urbanization reshapes avian functional structure in a rapidly developing Indian city.

Material and Methods

The present investigation assessed the impact of differential

habitat use on avian community composition, with particular emphasis on the structuring of trophic guilds and the nativity status of species, in Jalandhar city, Punjab, India, during the period from June 2018 to July 2019. The study employed a transect-based sampling design across three major land-use categories: residential, commercial, and industrial areas. Within each category, two linear transects of 1 km length were established, representing habitats with contrasting topographic and structural attributes, including variation in built-up cover, building typology, presence of green belts, and vegetation structure. Residential transects (R I and R II) were located in BastiGuzan (31°19'19.0"N, 75°33'10.5"E) and Guru TegBahadur Nagar (31°18'12.4"N, 75°34'10.5"E), respectively. Commercial transects comprised Rainak Bazaar (C I; 31°19'44.4"N, 75°34'31.5"E) and Model Town Market (C II; 31°18'24.3"N, 75°34'45.4"E). Industrial transects included Focal Point (In I; 31°21'51.6"N, 75°34'43.1"E) and the Sports and Surgical Complex (In II; 31°20'10.9"N, 75°31'52.7"E), representing the primary industrial zones of the city (Fig.1).

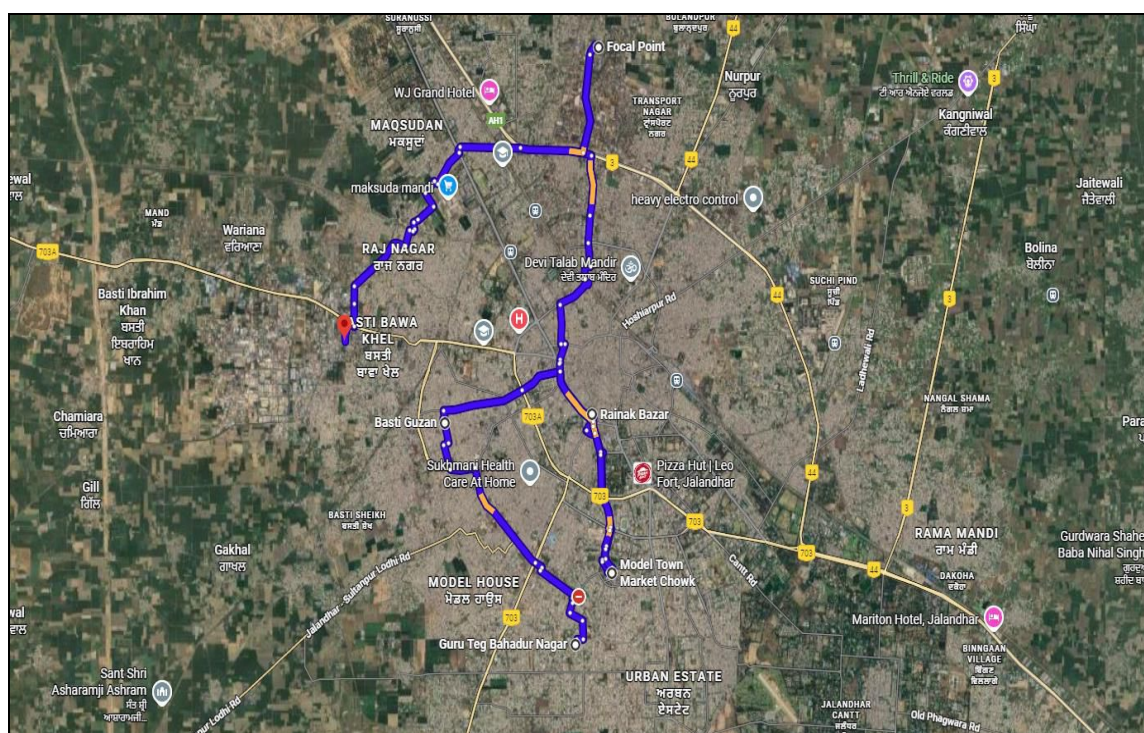


Fig 1: Six transects selected in Jalandhar city

Study Areas

Transect R I was established in Basti Guzan and extended for approximately 1 km, encompassing six interconnected lanes. The area represented an unplanned residential settlement characterized by narrow streets and predominantly old one-to two-storey houses. Commercial activity was limited and primarily consisted of small home-based shops. The transect also included a school and two temples. Vegetation cover was sparse, with a single mature *Ficus benghalensis* (banyan) tree located near the mid-section of the transect, along with a few scattered small trees and shrubs restricted to one of the lanes.

Transect R II was located in Guru Teg Bahadur Nagar, a well-planned residential locality characterized by wide roads and predominantly modern two-storey houses. This transect

exhibited relatively high vegetation complexity, including two public parks with diverse assemblages of trees and shrubs. Additionally, most households maintained private gardens comprising lawns, ornamental shrubs, seasonal vegetables, small trees, and occasional large palms or fruit-bearing species, collectively contributing to increased habitat heterogeneity and structural complexity.

Transect C I extended from Jyoti Chowk to slightly beyond Imam Nasir Chowk, covering an approximately 1 km stretch of one of the oldest and most intensively utilized marketplaces in the city centre. The area was characterized by very high commercial density, with shops that were predominantly single-storey or combined with residential units on the upper floors. The transect included a gurudwara and a mosque and experienced consistently high pedestrian

activity between 10:00 and 20:00 h. Vegetation cover was extremely limited and restricted to a single mature *Ficus religiosa* (peepal) tree, with a diameter at breast height (DBH) of approximately 155 cm.

Transect C II was located within a well-planned commercial zone characterized by wide roads and sustained heavy vehicular traffic throughout most of the day. Built-up structures primarily comprised double-storey shops and a few multi-storey shopping complexes, along with institutional and public-use buildings, including a gurudwara, a government school, a post office, and a public park. In contrast to Transect C I, this transect supported relatively higher vegetation complexity, with several large trees such as *Eucalyptus* spp., *Ficus benghalensis* (banyan), and *Kigelia africana* (sausage tree), as well as smaller trees and shrubs including *Morus alba* (shahtoot), *Nerium oleander* (kaner), and *Plumeria* spp. (frangipani).

Transect In I was established within the primary industrial zone of the city and extended for approximately 1 km from the electrical substation at Focal Point to MBD Publishers. The area was dominated by industrial establishments characterized by large factory buildings with high metal roofs and tall boundary walls, interspersed with two vacant plots and a mosque. Vegetation cover was sparse and largely confined to short trees and shrubs along factory perimeters, along with a limited number of roadside trees. Roads were wide and experienced relatively low traffic intensity, except during peak hours corresponding to factory opening and closing times.

Transect In II extended for 1 km from the entrance of the Sports and Surgical Complex along the Jalandhar-Kapurthala Road, passing major industrial units including J.B. Laboratories Pvt. Ltd., Cheema Surgical Industries, and Leeds Corporation, and terminating near an electrical substation. In addition to industrial buildings, the transect included workers' residential quarters and several large vacant plots supporting tall grasses, weeds, and shrub growth. Traffic density remained low for most of the day due to wide roadways. Vegetation structure was comparatively heterogeneous, comprising large roadside trees as well as smaller trees, shrubs, and maintained lawns along factory boundary walls.

Line Transect Method

Avian populations inhabiting or actively foraging within the selected transects were surveyed using the line transect method following Verner (1985)^[9]. Counts were conducted on a weekly basis during morning hours, between 06:00-08:00 h in summer and 07:00-09:00 h in winter, corresponding to peak bird activity. Only individuals visually detected within the predefined transect boundaries were recorded. Birds detected solely by calls or noise were excluded from analysis, and individuals exhibiting repeated to-and-fro movements or occurring beyond the fixed transect limits were not considered. Bird movements were carefully tracked during observations to minimize double counting and avoid pseudoreplication.

Identification of Birds

Birds were recorded across the study areas were identified through direct visual observations based on diagnostic morphological features, including body size, plumage coloration, body shape, and characteristics of the beak and wings, using binoculars and photographic documentation.

Species identification was confirmed by comparison with standard field guides, namely *The Book of Indian Birds* (Ali, 2002)^[10] and *Birds of the Indian Subcontinent* (Grimmett et al., 2016)^[11]. Nomenclature and common names followed Manakadan and Pittie (2004)^[12]. Feeding guilds of observed birds were characterized as per *The Book of Indian Birds* (Ali, 2002)^[10].

Community Characteristics

Bird assemblages recorded along the transects were analyzed to assess relative abundance across different habitats. Relative abundance of each species was calculated as the proportion of individuals of the *i*th species (n_i) relative to the total number of individuals recorded (N), expressed as a percentage ($n_i/N \times 100$). Monthly bird count data were pooled to quantify community structure across the study sites using standard ecological indices.

Results and Discussion

A total of 50 bird species were recorded across six selected transects (R I, R II, C I, C II, In I and In II), representing a diverse avifaunal assemblage with Blue Rock Pigeon emerging as the most dominant species followed by Common Myna, House Crow, Eurasian Collared-Dove, Red-vented Bulbul, Rose-ringed Parakeet, Common Tailorbird, Purple Sunbird and Black Kite and these bird species were found to present in all the six transects (Table 1).

In R I, maximum abundance was recorded for Blue Rock Pigeon followed by Common Myna, Eurasian Collared-Dove, House Sparrow, Bank Myna and House Crow whereas minimum abundance was recorded for Ashy Prinia. In R II, the maximum abundance was recorded for the Blue Rock Pigeon followed by House Sparrow, House Crow, Common Myna, Eurasian Collared-Dove, Red-vented Bulbul and Jungle Babbler whereas the minimum abundance was recorded for Common Chiffchaff, Oriental Magpie Robin, Red-wattled Lapwing and White-throated Fantail. The 17 bird species were found to be absent in both R I and R II transects. In transect C I, the maximum abundance was recorded for Blue Rock Pigeon and the minimum abundance values were recorded for species such as Common Tailorbird. In transect C II, the maximum abundance was recorded for House Crow followed by Common Myna and Blue Rock Pigeon whereas the minimum abundance was observed for species such as the Black Redstart and Shikra. There were 24 bird species which were absent in both transects of commercial habitats. In transect In I, the highest abundance was recorded for Blue Rock Pigeon followed by Red-vented Bulbul, Eurasian Collared-Dove, House Crow and Common Myna whereas the lowest abundance values were observed for Black Drongo. In transect In II, the maximum abundance was recorded for Blue Rock Pigeon, followed by Common Myna, Eurasian Collared-Dove, Red-vented Bulbul and Jungle Babbler whereas the minimum abundance values were recorded for Common Hoopoe and Black Redstart. There were 9 bird species which were found to be absent in both transects of industrial habitats.

The composition of bird assemblage showed the continuous and restricted distribution of bird species in all and some of the transects respectively based on the availability of resources. Among raptors, two species namely the Black Kite and Shikra though limited in species number were

observed in most of the transects thus highlighting the role of urban ecosystems in supporting higher trophic levels, particularly scavengers and opportunistic predators. Black Kite dominance in Indian cities has been widely documented and is strongly associated with open waste dumps, slaughterhouse refuse, and high availability of carrion and food waste (Kumar *et al.*, 2014; Gangoso *et al.*, 2015) ^[13,14]. The occurrence of the Spotted Owlet in residential and industrial transects further reflects the persistence of cavity-nesting species in urban mosaics where old buildings, trees, and semi-open habitats remain available, a trend reported from several north Indian cities. The relatively high representation of Blue Rock Pigeon and Eurasian Collared-Dove aligns with findings from urban avifaunal studies across India that identify these species as key urban exploiters (Kler and Kumar, 2015) ^[15]. Their strong association with built structures, food provisioning, and nesting ledges allows them to dominate highly modified habitats, particularly commercial and industrial zones. The restricted distribution of the House Sparrow, confined to residential and select industrial transects, corroborates national-level declines reported from several Indian cities, attributed to changes in building architecture, reduced nesting sites, electromagnetic radiation, and declining insect prey availability (Kler and Kumar, 2018) ^[16]. Its absence from commercial transects reinforces concerns regarding the unsuitability of heavily built and highly disturbed urban cores for this once ubiquitous species. Among the bird species recorded, four species of winter migrants (Black Redstart, Common Chiffchaff, White Wagtail and White-throated Fantail) and one summer migrant (Purple Sunbird) were observed. Two Alien invasive (Ai) bird species (Blue Rock Pigeon and Common Myna) and five Native invasive (Ni) bird species (Eurasian Collared-Dove, House Crow, House Sparrow, Red-vented Bulbul and Rose-ringed Parakeet) were recorded. The overwhelming numerical dominance of invasive and native invasive species, particularly Blue Rock Pigeon, Common Myna, House Crow, Eurasian Collared-Dove, and Red-vented Bulbul, reflects a well-documented pattern in Indian cities where a small subset of generalist species contributes disproportionately to total abundance (Urfi and Keshav, 2013, Sengupta *et al.*, 2014) ^[17,18]. These species are known to outcompete habitat specialists, leading to biotic homogenization, a phenomenon increasingly reported from rapidly urbanizing regions of India.

The highest total number of bird species was recorded in transect In II followed by In I and R II and lowest no. of bird species occurred in C I indicating comparatively lower habitat suitability or higher disturbance. During the current study, bird species were recorded in six selected transects which belonged to 13 orders. The avifaunal assemblage was dominated by the order Passeriformes, which accounted for more than half of the recorded species (27 species). The differences in the number of species belonging to different orders among transects indicate that urban land-use patterns selectively influence avian composition and species of order Passeriformes, being highly adaptable are typically well represented across urban habitats due to their behavioural flexibility, broad dietary niches and tolerance to anthropogenic disturbances (Sengupta *et al.*, 2014; Bhattacharya *et al.*, 2020) ^[18, 19]. Transect In II had maximum number of bird orders (11). Transect R II, C II and In I each had bird species from 8 orders. R I and C I had

least number of orders, 4 and 5 respectively. The number of bird species recorded was maximum in In II (34) followed by R II and In I (30), C II (24), R I (17) and CI (15). Transect In II supported the maximum number of bird orders suggesting that this industrial landscape provided a diverse range of ecological niches due to presence of vacant plots with tall grasses and weeds, roadside trees, shrubs, lawns, which support a wide range of foraging guilds, including ground-foraging, insectivorous, frugivorous, and canopy-dwelling birds (Biella *et al.*, 2025) ^[20]. The transects R I and C I recorded the lowest number of orders as these transects were characterized by dense built-up structures, high human activity, and extremely limited vegetation reflecting limited availability of suitable foraging material and nesting sites (Pena *et al.*, 2023) ^[21].

The bird species recorded in various transects belonged to different trophic guilds (Table 2). The omnivore bird species dominated in two residential transects i.e R I and R II and in one commercial transect i.e. C II. Insectivores were most prominent in three transects i.e. C I, In I and In II. Among all the six transects the granivore species were consistently present across all transect and their highest proportion was recorded in transect R I and R II, likely due to food availability from human activities. The carnivores highest percentage was observed in transect In II followed by In I and C II indicating more complex food webs in industrial and commercial landscapes due to availability of open spaces and waste-associated prey populations. Frugivores were more abundant in commercial and Industrial transects, with the highest proportion in transect C II followed by In II whereas Nectarivores were the least represented guild across all transects. Thus residential areas are the preferred habitat for omnivorous and granivorous birds due to stable and predictable food resources from human activities, whereas commercial and industrial areas are more suitable for insectivorous, carnivorous, and frugivorous birds owing to open spaces, waste-associated prey, and the presence of planted or unmanaged vegetation, while nectarivorous birds show low habitat preference across all transects because of limited floral resources (Rodewald *et al.*, 2013) ^[22]. Overall, among all the trophic guilds in various types of habitats i.e. residential, commercial and industrial, the prevalence of omnivores and insectivores trophic guilds were found to be maximum as compared to other trophic guilds. The urban vegetation favours various types of feeding trophic guilds of birds with maximum favour provided to insectivorous and omnivorous birds as compared to other feeding guilds (Muehlbauer *et al.*, 2025) ^[23]. The omnivory is a key trait enabling species to cope with the fluctuating resource availability and novel conditions associated with urban ecosystems due to their ability to exploit a wide range of food resources, including natural prey, plant material, and human-derived food waste (McKinney, 2006) ^[24]. The insectivorous birds play an important role in suppressing potentially harmful insect pests on a global scale as insects are main part of their diet (Nyffeler *et al.*, 2018) ^[25]. In Indian agroecosystem, insectivorous birds play an important role in controlling insect pests in crop fields (Rajashekara and Venkatesha, 2014) ^[26]. Sharma *et al.* (2024) ^[27] recorded 63 insectivorous bird species in arid agro-ecosystems of Haryana, India showing that crop fields and associated vegetation structure strongly influence avian feeding guild composition.

The data on average bird count per visit showed highest bird count for C II, followed by R II, C I, In I, In II and R I and bird count was highest in the months of July and August on an average (Table 3). Bird abundance peaked during July and August, reflecting seasonal effects associated with the breeding and post-breeding periods, when fledglings contribute to higher counts and food availability is enhanced by increased primary productivity. Besides this, seasonal variation in bird abundance, with peak counts during July and August, corresponds with the monsoon-linked increase in food availability, particularly insects and plant resources, as reported in urban bird studies from northern India (Verma

et al., 2020) [28]. Despite these seasonal peaks, the overall declining trend in bird abundance across most transects was observed which reflect cumulative effects of habitat loss, reduced vegetation cover, pollution and increasing anthropogenic pressures, which have been widely documented in urban ecosystems. The difference in bird count recorded on an average and different transects as well as over different months indicating spatial and temporal variation in average bird abundance across residential, commercial and industrial transects, reflecting the combined influence of habitat structure, vegetation complexity, human disturbance and seasonal dynamics.

Table 1: Bird abundance (%) and status of bird species in six transects

Species Name	Scientific name	R I	R II	C I	C II	In I	In II	Overall	Residence Status	Trophic group	Nativity status
Alexandrine Parakeet	<i>Psittacula eupatria</i>	-	-	-	-	0.15	0.46	0.10	R	F	N
Ashy Prinia	<i>Prinia socialis</i>	0.05	0.18	-	0.1	0.65	0.25	0.21	R	I	N
Asian Koel	<i>Eudynamis scolopacea</i>	-	-	-	-	-	0.56	0.09	R	O	N
Asian Pied Starling	<i>Sturnus contra</i>	-	-	-	-	-	0.28	0.05	R	O	N
Bank Myna	<i>Acridotheres ginginianus</i>	6.61	-	-	-	0.89	-	1.25	R	O	N
Black Drongo	<i>Dicrurus macrocercus</i>	0.27	-	-	-	0.03	1.39	0.28	R	I	N
Black Kite	<i>Milvus migrans</i>	0.41	0.21	0.26	1.40	1.26	1.01	0.76	R	C	N
Black Redstart	<i>Phoenicurus ochruros</i>	-	0.18	-	0.05	0.1	0.05	0.06	WM	O	N
Blue Rock Pigeon	<i>Columba livia</i>	50.71	23.88	87.25	29.35	42.04	24.99	43.04	R	G	Ai
Brahminy Starling	<i>Sturnus pagodarum</i>	-	0.05	-	-	-	-	0.01	R	O	N
Brown-headed Barbet	<i>Megalaima zeylanica</i>	-	-	-	0.12	-	0.15	0.05	R	F	N
Cattle Egret	<i>Bubulcus ibis</i>	-	-	-	-	-	0.17	0.03	R	C	N
Common Babbler	<i>Turdoides caudatus</i>	-	0.94	-	-	-	-	0.16	R	O	N
Common Chiffchaff	<i>Phylloscopus collybita</i>	-	0.02	-	-	-	-	0	WM	I	N
Common Hoopoe	<i>Upupa epops</i>	-	-	-	-	-	0.05	0.01	R	I	N
Common Myna	<i>Acridotheres tristis</i>	8.65	8.75	3.35	16.81	6.09	17.52	10.20	R	O	Ai
Common Tailorbird	<i>Orthotomus sutorius</i>	1.28	3.32	0.06	1.33	2.59	2.85	1.91	R	I	N
Coppersmith Barbet	<i>Megalaima haemacephala</i>	-	0.07	-	0.07	-	0.11	0.04	R	F	N
Eurasian Collared-Dove	<i>Streptopelia decaocto</i>	9.83	8.86	3.12	5.36	9.25	13.65	8.34	R	G	Ni
Greater Coucal	<i>Centropus sinensis</i>	-	0.04	-	-	-	-	0.01	R	O	N
House Crow	<i>Corvus splendens</i>	5.34	16.05	2.91	21.78	6.71	7.5	10.05	R	O	Ni
House Sparrow	<i>Passer domesticus</i>	6.07	16.69	-	-	0.37	-	3.85	R	G	Ni
House Swift	<i>Apus nipalensis</i>	-	-	0.07	-	-	-	0.01	R	I	N
Indian Chat	<i>Cercomela fusca</i>	1.45	-	0.07	-	3.38	0.43	0.89	R	I	N
Indian Grey Hornbill	<i>Ocyrceros birostris</i>	-	0.07	-	0.5	0.14	-	0.12	R	O	N
Indian Peafowl	<i>Pavo cristatus</i>	-	-	-	-	-	0.07	0.01	R	O	N
Indian Robin	<i>Saxicoloides fulicata</i>	-	-	-	-	1.05	-	0.18	R	I	N
Indian Treepie	<i>Dendrocitta vagabunda</i>	-	-	-	-	-	0.26	0.04	R	O	N
Jungle Babbler	<i>Turdoides striatus</i>	0.25	3.33	-	0.87	3.91	5.82	2.36	R	O	N
Jungle Myna	<i>Acridotheres fuscus</i>	0.25	-	-	2.67	-	-	0.49	R	O	N
Lesser Golden-backed Woodpecker	<i>Dinopium benghalense</i>	-	-	-	-	-	0.08	0.01	R	I	N
Little Brown Dove	<i>Streptopelia senegalensis</i>	2.56	3.11	-	0.2	1.01	2.04	1.49	R	G	N
Oriental Magpie Robin	<i>Copsychus saularis</i>	-	0.02	-	0.14	-	-	0.03	R	I	N
Purple Sunbird	<i>Nectarinia asiatica</i>	1.45	2.15	0.12	1.63	1.49	3.96	1.80	SM	N	N
Red-rumped Swallow	<i>Hirundo daurica</i>	-	0.24	0.52	0.91	0.53	0.45	0.44	R	I	N
Red-vented Bulbul	<i>Pycnonotus cafer</i>	4.5	8.14	1.01	3.99	11.20	6.1	5.82	R	O	Ni
Red-wattled Lapwing	<i>Vanellus indicus</i>	-	0.02	-	-	-	0.62	0.11	R	C	N
Rose-ringed Parakeet	<i>Psittacula krameri</i>	0.31	2.6	0.69	6.56	2.06	5.95	3.03	R	F	Ni
Rufous-backed shrike	<i>Lanius schach</i>	-	0.06	-	-	-	-	0.01	R	C	N
Shikra	<i>Accipiter badius</i>	-	0.13	0.12	0.05	0.59	0.45	0.22	R	C	N
Small Bee-eater	<i>Merops orientalis</i>	-	-	-	-	1.03	0.7	0.29	R	I	N
Spotted Dove	<i>Streptopelia chinensis</i>	-	0.13	-	-	-	0.13	0.04	R	G	N
Spotted Munia	<i>Lonchura punctulata</i>	-	0.28	-	-	1.62	0.7	0.43	R	G	N
Spotted Owlet	<i>Athene brama</i>	-	-	-	0.19	0.69	0.69	0.26	R	C	N
Streak-throated Swallow	<i>Petrochelidon fluvicola</i>	-	-	0.15	0.19	0.1	-	0.07	R	I	N
White Wagtail	<i>Motacilla alba</i>	-	-	-	-	-	0.08	0.01	WM	I	N
White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	-	-	-	0.08	0.56	0.56	0.2	R	C	N
White-throated Fantail	<i>Rhipidura albicollis</i>	-	0.02	-	-	-	-	0	WM	I	N
White-throated Munia	<i>Lonchura malabarica</i>	-	0.23	-	-	0.16	-	0.06	R	G	N
Yellow-legged Green-Pigeon	<i>Treron phoenicoptera</i>	-	0.27	0.31	5.66	0.30	0.61	1.19	R	F	N
	Total no. of bird species	17	30	15	24	30	34	50	4 (WM)+ 1(SM)+ 45(R)	1 (N)+ 5(F)+ 7(C)+ 7(G)+ 15(I)+ 15(O)	2(Ai)+ 5(Ni)+ 43(N)
	No. of Orders	4	8	5	8	8	11	13			

R-Resident, Wm-Winter migratory, Sm-Summer migratory, F-Frugivore, C-Carnivore, G-Granivore, I-Insectivore, N = Nectarivore, O-Omnivore, Ai-Alien invasive, Ni-Native invasive, N-native

Table 2: Trophic Guild of Bird Assemblages in six transects

Transects	Trophic guild											
	Nectarivore		Frugivore		Carnivore		Granivore		Insectivore		Omnivore	
	No. of species	%	No. of species	%	No. of species	%	No. of species	%	No. of species	%	No. of species	%
R I	1	5.88	1	5.88	1	5.88	4	23.52	4	23.52	6	35.29
R II	1	3.33	3	10.00	4	13.33	7	23.33	6	20.00	9	30.00
C I	1	6.67	2	13.33	2	13.33	2	13.33	5	33.33	3	20.00
C II	1	4.17	4	16.67	4	16.67	3	12.50	5	20.83	7	29.17
In I	1	3.33	3	10.00	5	16.67	6	20.00	8	26.67	7	23.33
In II	1	2.94	5	14.70	6	17.65	5	14.71	9	26.47	8	23.53
Overall	-	4.39	-	11.76	-	13.91	-	17.90	-	25.14	-	26.89

Table 3: Average bird count per visit in six transects

Transects	2018						2019						Average
	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	
R I	38.00	41.00	27.00	28.33	27.30	28.40	36.00	29.00	32.50	56.00	33.40	40.00	34.74
R II	79.00	81.75	72.00	87.20	92.50	66.50	81.00	78.00	76.67	88.00	71.75	59.67	77.84
C I	87.67	83.50	69.50	58.00	56.00	56.25	53.25	69.00	53	41.25	70.00	69.50	63.91
C II	104	116.75	109.5	100.67	108.5	91.50	97.50	102	81.33	105	86.80	89.33	99.41
In I	79.83	67.00	56.00	58.00	81.00	61.00	60.50	56.00	54.00	63.75	60.50	68.50	63.84
In II	57.33	56.25	57.50	58.67	55.50	54.00	66.50	62.00	55.50	51.00	47.00	41.33	55.22
Average	74.31	74.38	65.25	65.15	70.13	59.61	65.79	66.00	58.83	67.50	61.58	61.39	65.83

Conclusion

The study showed that differential use of residential, commercial and industrial habitats strongly influences the composition and trophic organization of bird assemblages in the urban landscapes depending on availability of food and nesting resources. Thus, urban planning and management strategies incorporating green spaces and native vegetation can enhance avifaunal conservation in rapidly urbanizing landscapes.

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