

Research Article

Diversity of Avian Fauna in and Around Kalyani, a Sub-Urban City near Kolkata, West Bengal, India

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Abstract— Avifaunal diversity has proven a crucial factor for maintaining the ecological equilibrium of any given ecosystem. The present investigation determines the avifaunal distribution, diversity and status in and around Kalyani from December 2021 to January 2023. During the appropriate study period, a total of 73 bird species belongs to 39 different families under 17 orders were reported. In agreement with the status of the bird species, 63 (86.30%) species were regional, 3 (4.11%) winter migrant, 4 (5.48%) regional migrant, 2 (2.74%) migratory and 1 (1.37%) monsoon visitor. Winter visiting species were Western yellow wagtail, Citrine wagtail and Common moorhen. Two migratory species were Common hill mayna, Sand Martin and one monsoon visitor was Jacobin cuckoo. Determining the relative abundance of the birds, 25 (34%) species were commonly seen, 31 (42%) very common, 12 (16%) uncommon but not rare and 5 (6.8%) rare. The Sturnidae (5 species) was the most diversified family in the investigation area, followed by Ardeidae, Alcedinidae, Columbidae and cuculidae (each having 4 species). The study also found seven unique feeding habits viz. 27% carnivorous, 26% insectivorous, 21% omnivorous, 11% granivorous, 9.6% frugivorous, 4.1% Nectarivorous and 1.4% Nectarivorous/Insectivorous species of bird. The current report is an attempt to chronicle the diversity of avian population in and around Kalyani and it is necessary to conduct a more through systematic research in order to investigate and safeguard the avifaunal variety within this area.

Keywords—Birds, Kalyani, Avian diversity, Status, Relative Abundance, Survey, Checklist

1. Introduction

Avifaunal diversity has proven a crucial factor for maintaining the ecological equilibrium of any given ecosystem [1]. Birds are considered as an outstanding bioindicator and supreme models for speculating environmental changes attributed to the effects of urbanization on the ecosystem because they are the highly diversified and prominent biota of the ecosystem [2]. Undoubtedly, birds are the promising indicator of overall habitat quality of an ecosystem. Population patterns of the bird can provide information concerning how effectively the ecosystem performs when the birds depend on the environment functioning in specified ways. Bird species react quickly to changes in the composition, function and transformation of the landscape as well as the availability of habitat structures [3], [4]. In some instances, the composition of bird species in a region rather than merely the quantity of birds present might reflect the quality of the habitat [5].

It is essential to perform scientific research on the avifaunal diversity in various ecosystems to gain insight into how

ecologically sound a region is. The local bird composition may be impacted by the input of human interferences. Presently, climatic change is also a global concern. Therefore, monitoring common birds is necessary to determine the extent of population fluctuations [6], [7], [8], [9].

Birds play an important role for the conservation of biodiversity regionally as well as globally. They are well known 'ecological indicator' in ecosystem health assessment (EHA) as they measured the health of the ecosystem [10]. Diversity of the avifauna is a pivotal ecological machinery which serves as a crucial indicator to assess different habitats quantitatively as well as qualitatively [11]. Unfortunately, the global avifaunal diversity is decreasing constantly primarily because of the anthropogenic disturbances and climate change [12], [13]. Some anthropogenic disturbances in the form of livelihood, urbanization, sound pollution, use of pesticides in agricultural field, increasing temperature, electromagnetic radiation, habitat destruction etc. are affecting the population of birds [14], [15], [16], [17], [18], [19], [20]. Birds perform a significant economic role in addition to the ecology, aiding with pest control, pollination, and other activities [6], [21], [22].

Kalyani and its surroundings are well recognised for its greeneries. Though some works on diversity of birds have been done in Purbasthali bird sanctuary [23], in the vicinity of Krishnanagar [6], in Kolkata Metropolitan region [24], Kalyani and its surroundings has never been evaluated for its avian fauna. Birds play significant role in ecosystem and sustain the trophic structure. To preserve the avifauna and their diversity, it is necessary to do in-depth research on them and to understand their ecology [22]. The study emphasizes toward the diversity, abundance and status of the bird population present in and around Kalyani for the very first time.

2. Materials and Methods

2.1. Study Area

Present investigation was carried out in and around Kalyani, a sub-urban city in the Nadia district of the state of West Bengal, India, located approximately 50 kilometres away from Kolkata. The overall study area is situated 22.983984° Latitude and 88.409636° Longitude to 23.038195° Latitude and 88.510813° Longitude (**Figure 1**). Annual high temperature in summer reaches up to 33.51°C and annual low temperature in winter goes down to 24.15°C. Average annual rainfall in the study area is around 96.3 mm and most of the rainfall is occurred in the month of August (266.95 mm). The area of investigation is located 2 kilometres beside river Bhagirathi, one of the major tributaries of river Ganga. The main crops are rice, jute, mustard, banana, legumes etc.

The survey was performed during December 2021 to January 2023, to explore the avian fauna of the area. The avian species were observed two times a day, one in the morning between 7:00 to 11:00 A.M. and second in the evening between 3:00 to 6:00 P.M. Identification and classification of the bird species were done from the books entitled “Birds of the Indian subcontinent, Oxford Publication” [25], “Handbook of the Birds of India and Pakistan, 2nd edition, Oxford University Press” [26] and from internet resources. Photographs were taken with the help of Nikon D5600 [NIKON D5600 a 24.2 MP APS-C (23.5 x 15.6 mm) sensor DSLR camera, used along with AF-P DX NIKKOR 70-300 mm F/4.5-6.3G ED VR tele-zoom lens]. Furthermore, observations and notes of the birds were produced by surveying at different locations *viz.* wetlands, pond and river banks (**Figure 2**), agricultural fields (**Figure 3**), tree (**Figure 4**) etc., present in the subject area. In the field area of research, several ponds, wetlands such as Kalyani Municipality pond, Jheelpar, Iswaripur pond, Majherchar etc. and River Bhagirathi are present. Several agricultural fields are also present surrounding the Kalyani town that serve as habitat, food etc. for the bird populations. The checklist of the avian fauna is developed by the guideline of Ali and Replay, 1983 [26]. Habitats and the feeding habit of the bird species were also carried out at the time of field investigation and the same also verified with available internet resources [24], [27], [28]. On the basis of their feeding habit, birds were differentiated into many categories including Omnivorous (OV), Carnivorous (CV), Granivorous

(GV), Insectivorous (IV), Frugivorous (FV), Nectarivorous (NV) etc. The global and local status were compared using the IUCN classification system [27]. The residential status of the avian population was performed with the help of habitat type and categorized as Regional (R) – if the species found throughout the study period, Regional Migratory (RM) – if the species observed in the research area unevenly, but they are regarded as the resident species of India, Winter Visitor (WV) – If the birds were observed only from December to February, Monsoon Visitor (MV) - If the species perceived during August-September and Migratory (M) – if the species was found once or twice throughout the time of survey. Relative abundance of the avian populations were designated as: ‘VC’ stands for Very Common species, observed plenty in numbers in research field, ‘C’ stands for Common species, familiarly found in the area, ‘UC’ stands for Uncommon species but they are not rare and ‘RA’ stands for Rare species which is observed once or twice during the research period [21], [23]. Relative diversity of the families (RDi) were measured with the help of subsequent formula:

$$RDi = \frac{\text{Number of individual species of bird in a family/}}{\text{combined number of all bird species}} \times 100$$

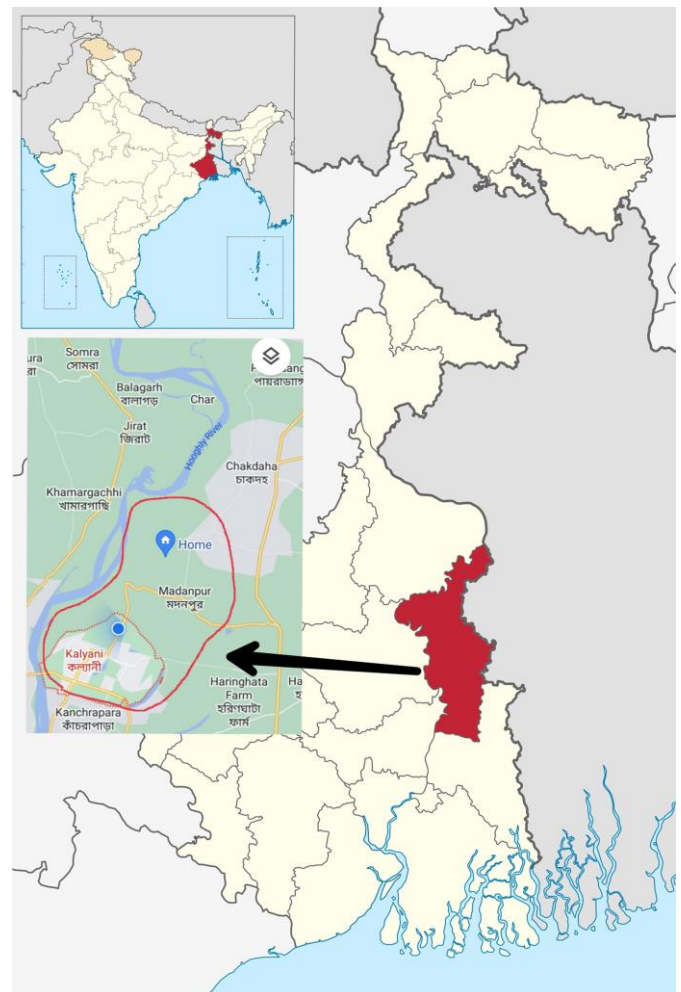


Figure 1. Map exhibiting study area in and around Kalyani, India.



Figure 2. Different wetlands and river present in the study area, **A.** Little Cormorant residing on a pole at Jheelpar; **B.** River Bhagirathi, Charsarati Ghat; **C.** Numerous Indian domestic duck present in the Pond located at Iswaripur; **D.** Wetland, University of Kalyani campus; **E.** Kalyani Municipality Pond; **F.** Wetland, Majherchar, Kalyani.



Figure 3. Different Agricultural fields present in the research area, **A.** Charsarati; **B.** Agricultural field, electric pole and wire located at Iswaripur; **C.** Agricultural field with flowering *Brassica juncea* located at Alaipur.

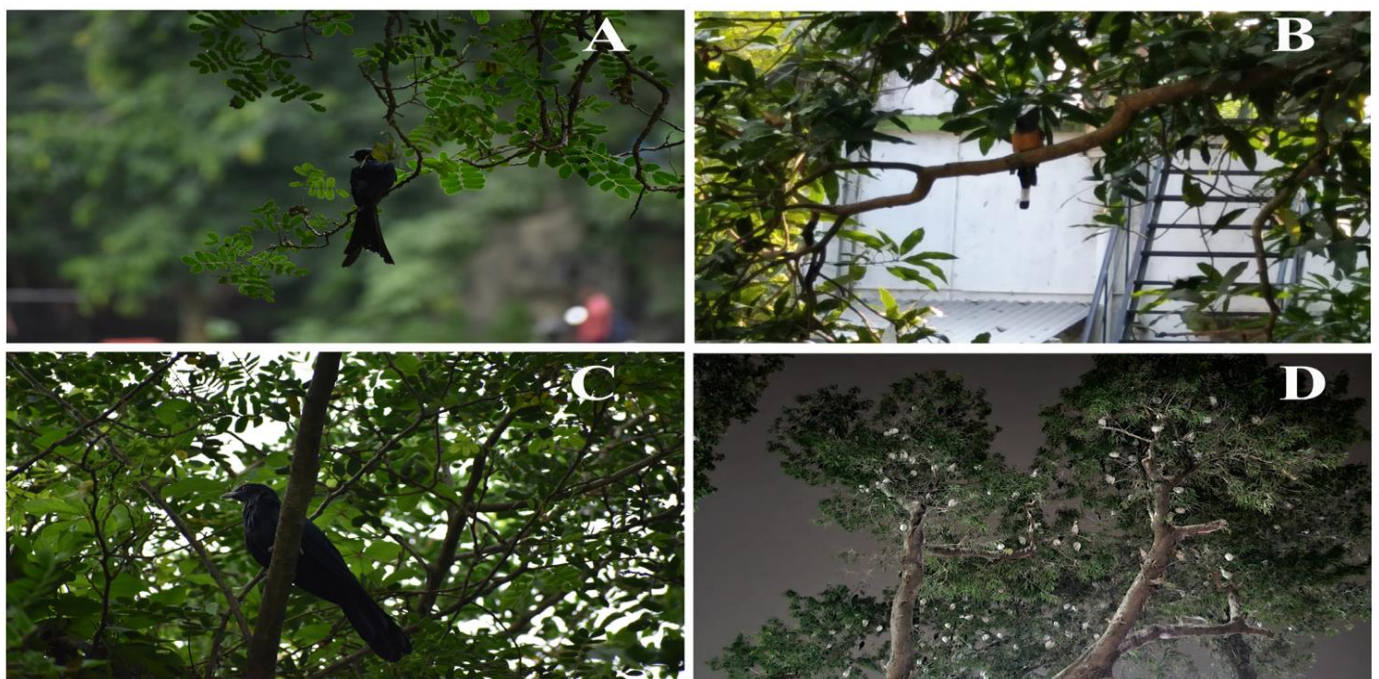


Figure 4. Bird species inhabiting in different trees in the study area, **A.** Black Drongo, University of Kalyani campus; **B.** Rufous treepie on mango tree, Central Park, Kalyani; **C.** Asian Koel, University of Kalyani campus; **D.** Intermediate egret resting at night on a tree near 1 no. market, Kalyani.

3. Results

The current survey investigated a checklist of 73 avian species tabulated in **Table 1**. Total number of 73 birds documented in the study area attributed to 39 different families under 17 Orders. The study area depicts 33 passerine and 40 non-passerine species of birds. The large number of avian species belonging to the Order Passeriformes having 19 families, followed by Coraciiformes having 3 families, and Charadriiformes and piciformes, both having 2 families each (**Table 2**). The current study shows that the site of investigation was predominated by the Sturnidae family (5 species).

The most diversified families (5 species, RDi = 6.85) were Sturnidae, followed by Alcedinidae, Ardeidae, Columbidae, Cuculidae (4 species each, RDi = 5.48), Corvidae, Estrildidae, Nectariniidae, Picidae (3 species each, RDi = 4.11), Accipitridae, Charadriidae, Cisticolidae, Laniidae, Megalaimidae, Motacillidae, Phalacrocoracidae, Psittaculidae, Pycnonotidae, Rallidae (2 species each, RDi = 2.74) and Aegithinidae, Anatidae, Apodidae, Caprimulgidae, Ciconiidae, Coraciidae, Dicruridae, Jacanidae, Hirundinidae, Leiothrichidae, Meropidae, Muscicapidae, Oriolidae, Paridae, Passeridae, Ploceidae, Strigidae, Turdidae, Upupidae, Zosteropidae (1 species each, RDi = 1.37) (**Table 3**).

On the basis of residential status data, out of 73 bird species, 63 (86.30%) species were held to be residential, the remaining 10 bird species were divided into four categories including 4 (5.48%) species were regional migratory (RM), 1 (1.37%) Monsoon visitor (MV), 3 (4.11%) Winter Visitor (WV), and 2 (2.74%) Migratory species (M). All the bird species in the research field attributed to the Least Concern (LC) category of IUCN. The residential avian population found in the research area were Black kite, Shikra, Common iora, White-throated kingfisher, Stork-billed kingfisher, Common kingfisher, Pied kingfisher, Lesser whistling duck, Asian palm swift, Cattle egret, Intermediate egret, Little egret, Indian pond heron, Large-tailed nightjar, Red-wattled lapwing, Grey-headed lapwing, Common tailor bird, Common pigeon, Spotted dove, Eurasian collared dove, Yellow-footed green pigeon, Indian roller, House crow, Indian jungle crow, Rufous treepie, Asian koel, Greater caucal, Black drongo, Scaly-breasted munia, White-rumped munia, Tricoloured munia, Bronze-winged jacana, Long-tailed shrike, Brown shrike, Jungle babbler, Blue-throated barbet, Coppersmith barbet, Asian green bee-eater, Oriental magpie-robin, Little spider hunter, Purple sunbird, Purple-rumped sunbird, Black-hooded oriole, Cinereous tit, House sparrow, Indian cormorant, Little cormorant, Black-rumped flameback, Fulvous-breasted woodpecker, Yellow-crowned woodpecker, Baya weaver, Rose-ringed parakeet, Plum-headed parakeet, Red-vented bulbul, Red-whiskered bulbul,

White-breasted waterhen, Spotted owlet, Jungle mayna, Common mayna, Asian pied starling, Orange-headed thrush, Hoopoe, Oriental white eye. Winter visiting avian species were Western yellow wagtail, Citrine wagtail and Common moorhen. Two migratory birds were Common hill mayna, Sand martin and one monsoon visitor Jacobin cuckoo reported in the research area. There were four residential migratory bird viz. Asian openbill, Plain prinia, Common hawk cuckoo and Chestnut-tailed starling (**Table 1**). Some of the avian fauna found in the research area are depicted in **Figure 5A & B**.

The variations in the relative abundance of the birds were revealed based on their residential status. Additional studies unveiled that 31 (42%) species were categorised as very common, 25 (34%) common, 12 (16%) uncommon and 5 (6.8%) rare (**Figure 6A**). The most frequent avian species observed in the research area were White-throated kingfisher, Cattle egret, Little egret, Indian pond heron, Red-wattled lapwing, Common tailor bird, Common pigeon, Spotted dove, House crow, Rufous treepie, Asian koel, Greater caucal, Black drongo, Bronze-winged jacana, Long-tailed shrike, Brown shrike, Jungle babbler, Blue-throated barbet, Coppersmith barbet, Oriental-magpie robin, Little spider hunter, Purple sunbird, Black-hooded oriole, Little cormorant, Rose-ringed parakeet, Red-vented bulbul, Red-whiskered bulbul, White-breasted waterhen, Jungle mayna, Common mayna and Asian pied starling. The avian species that are common in agricultural fields, wetlands, ponds, tree and urban regions were Black kite, Shikra, Common iora, Asian palm swift, Intermediate egret, Asian openbill, Plain prinia, Eurasian collared dove, Indian roller, Indian jungle crow, Common hawk cuckoo, Scaly-breasted munia, White-rumped munia, Tricoloured munia, Asian green bee-eater, Purple-rumped sunbird, Cinereous tit, House sparrow, Indian cormorant, Black-rumped flameback, Fulvous-breasted woodpecker, Yellow-crowned woodpecker, Baya weaver, Plum-headed parakeet and Spotted owlet. The uncommon but not rare population of birds were Stork-billed kingfisher, Common kingfisher, Pied kingfisher, Lesser whistling duck, Grey-headed lapwing, Western yellow wagtail, Citrine wagtail, Common moorhen, Chestnut-tailed starling, Orange-headed thrush, Hoopoe and Oriental white eye. Rare avian species in and around Kalyani were Large-tailed nightjar, Yellow-footed green pigeon, Jacobin cuckoo, Sand martin and Common hill mayna (**Table 1**).

Regarding the foraging behaviour of birds, the research area revealed the presence of seven major feeding guilds (**Figure 6B**). These seven feeding guilds were carnivorous 20 (27%), insectivorous 19 (26%), omnivorous 15 (21%), Granivorous 8 (11%), Frugivorous 7 (9.6%), Nectarivorous 3 (4.1%) and Nectarivorous/Insectivorous 1 (1.4%) species, respectively.

Table 1. The checklist of the avian species in and around Kalyani from December 2021 to January 2023 with residential status, relative abundance and feeding habit.

Sl. No.	Family	Scientific Name	Common Name	IUCN category	Residential status	Relative abundance	Feeding habits
1.	Accipitridae	<i>Milvus migrans</i>	Black Kite	LC	R	C	CV
2.		<i>Accipiter badius</i>	Shikra	LC	R	C	CV

3.	Aegithinidae	<i>Aegithina tiphia</i>	Common Iora	LC	R	C	IV
4.	Alcedinidae	<i>Halcyon smyrnensis</i>	White-throated Kingfisher	LC	R	VC	CV
5.		<i>Pelargopsis capensis</i>	Stork-billed Kingfisher	LC	R	UC	CV
6.		<i>Alcedo atthis</i>	Common Kingfisher	LC	R	UC	CV
7.		<i>Ceryle rudis</i>	Pied Kingfisher	LC	R	UC	CV
8.	Anatidae	<i>Dendrocygna javanica</i>	Lesser whistling duck	LC	R	UC	OV
9.	Apodidae	<i>Cypsiurus balasiensis</i>	Asian Palm Swift	LC	R	C	IV
10.	Ardeidae	<i>Bubulcus ibis</i>	Cattle Egret	LC	R	VC	CV
11.		<i>Ardea intermedia</i>	Intermediate Egret	LC	R	C	CV
12.		<i>Egretta garzetta</i>	Little Egret	LC	R	VC	CV
13.		<i>Ardeola grayii</i>	Indian Pond Heron	LC	R	VC	CV
14.	Caprimulgidae	<i>Caprimulgus macrurus</i>	Large-tailed Nightjar	LC	R	RA	IV
15.	Charadriidae	<i>Vanellus indicus</i>	Red-wattled Lapwing	LC	R	VC	OV
16.		<i>Vanellus cinereus</i>	Grey-headed Lapwing	LC	R	UC	CV
17.	Ciconiidae	<i>Anastomus oscitans</i>	Asian Openbill	LC	RM	C	CV
18.	Cisticolidae	<i>Prinia inornata</i>	Plain Prinia	LC	RM	C	OV
19.		<i>Orthotomus sutorius</i>	Common Tailor Bird	LC	R	VC	IV
20.	Columbidae	<i>Columba livia</i>	Common Pigeon	LC	R	VC	GV
21.		<i>Spilopelia chinensis</i>	Spotted Dove	LC	R	VC	GV
22.		<i>Streptopelia decaocto</i>	Eurasian Collared Dove	LC	R	C	GV
23.		<i>Treron phoenicoptera</i>	Yellow-footed Green Pigeon	LC	R	RA	FV
24.	Coraciidae	<i>Coracias benghalensis</i>	Indian Roller	LC	R	C	CV
25.	Corvidae	<i>Corvus splendens</i>	House Crow	LC	R	VC	CV
26.		<i>Corvus culminates</i>	Indian Jungle Crow	LC	R	C	CV
27.		<i>Dendrocitta vagabunda</i>	Rufous Treepie	LC	R	VC	FV
28.	Cuculidae	<i>Clamator jacobinus</i>	Jacobin Cuckoo	LC	MV	RA	IV
29.		<i>Eudynamis scolopaceus</i>	Asian Koel	LC	R	VC	OV
30.		<i>Hierococcyx varius</i>	Common Hawk Cuckoo	LC	RM	C	IV
31.		<i>Centropus sinensis</i>	Greater Caucal	LC	R	VC	IV
32.	Dicruridae	<i>Dicrurus macrocercus</i>	Black Drongo	LC	R	VC	IV
33.	Estrildidae	<i>Lonchura punctulata</i>	Scaly-breasted Munia	LC	R	C	GV
34.		<i>Lonchura striata</i>	White-rumped Munia	LC	R	C	GV
35.		<i>Lonchura malacca</i>	Tricoloured Munia	LC	R	C	GV
36.	Jacaniidae	<i>Metopidius indicus</i>	Bronze-winged Jacana	LC	R	VC	CV
37.	Hirundinidae	<i>Riparia riparia</i>	Sand Martin	LC	M	RA	IV
38.	Laniidae	<i>Lanius schach</i>	Long-tailed Shrike	LC	R	VC	CV
39.		<i>Lanius cristatus</i>	Brown Shrike	LC	R	VC	IV
40.	Leiothrichidae	<i>Turdoides striata</i>	Jungle Babbler	LC	R	VC	IV
41.	Megalaimidae	<i>Psilopogon asiaticus</i>	Blue-throated Barbet	LC	R	VC	OV
42.		<i>Psilopogon haemacephalus</i>	Coppersmith Barbet	LC	R	VC	FV
43.	Meropidae	<i>Merops orientalis</i>	Asian green bee-eater	LC	R	C	IV
44.	Motacillidae	<i>Motacilla flava</i>	Western Yellow Wagtail	LC	WV	UC	IV
45.		<i>Motacilla citreola</i>	Citrine Wagtail	LC	WV	UC	IV
46.	Muscicapidae	<i>Copsychus saularis</i>	Oriental magpie-robin	LC	R	VC	IV
47.	Nectariniidae	<i>Arachnothera longirostra</i>	Little Spider Hunter	LC	R	VC	NV
48.		<i>Cinnyris asiaticus</i>	Purple Sunbird	LC	R	VC	NV
49.		<i>Leptocoma zeylonica</i>	Purple-rumped Sunbird	LC	R	C	NV
50.	Oriolidae	<i>Oriolus xanthornus</i>	Black-hooded Oriole	LC	R	VC	OV
51.	Paridae	<i>Parus cinereus</i>	Cinereous Tit	LC	R	C	IV
52.	Passeridae	<i>Passer domesticus</i>	House Sparrow	LC	R	C	GV
53.	Phalacrocoracidae	<i>Phalacrocorax fuscicollis</i>	Indian Cormorant	LC	R	C	CV
54.		<i>Microcarbo niger</i>	Little Cormorant	LC	R	VC	CV
55.	Picidae	<i>Dinopium benghalense</i>	Black-rumped Flameback	LC	R	C	IV
56.		<i>Dendrocopos macei</i>	Fulvous-breasted Woodpecker	LC	R	C	IV

57.		<i>Leiopicus maharattensis</i>	Yellow-crowned Woodpecker	LC	R	C	OV
58.	Ploceidae	<i>Ploceus philippinus</i>	Baya Weaver	LC	R	C	OV
59.	Psittaculidae	<i>Psittacula krameri</i>	Rose-ringed Parakeet	LC	R	VC	FV
60.		<i>Psittacula cyanocephala</i>	Plum-headed Parakeet	LC	R	C	FV
61.	Pycnonotidae	<i>Pycnonotus cafer</i>	Red-vented Bulbul	LC	R	VC	FV
62.		<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	LC	R	VC	OV
63.	Rallidae	<i>Amaurornis phoenicurus</i>	White-breasted Waterhen	LC	R	VC	OV
64.		<i>Gallinula chloropus</i>	Common Moorhen	LC	WV	UC	OV
65.	Strigidae	<i>Athene brama</i>	Spotted Owlet	LC	R	C	CV
66.	Sturnidae	<i>Acridotheres fuscus</i>	Jungle Mayna	LC	R	VC	OV
67.		<i>Acridotheres tristis</i>	Common Mayna	LC	R	VC	GV
68.		<i>Gracula religiosa</i>	Common Hill Mayna	LC	M	RA	FV
69.		<i>Gracupica contra</i>	Asian Pied Starling	LC	R	VC	OV
70.		<i>Sturnia malabarica</i>	Chestnut-tailed Starling	LC	RM	UC	OV
71.	Turdidae	<i>Geokichla citrina</i>	Orange-headed Thrush	LC	R	UC	OV
72.	Upupidae	<i>Upupa epops</i>	Hoopoe	LC	R	UC	IV
73.	Zosteropidae	<i>Zosterops palpebrosus</i>	Oriental White Eye	LC	R	UC	NV/IV

Table 2. Table showing number of families and their corresponding avian species recorded in the area of interest during the study period.

Sl. No.	Order	Number of Families	Number of Avian Species
1.	Accipitriformes	1	2
2.	Apodiformes	1	1
3.	Anseriformes	1	1
4.	Bucerotiformes	1	1
5.	Caprimulgiformes	1	1
6.	Charadriiformes	2	3
7.	Ciconiiformes	1	1
8.	Columbiformes	1	4
9.	Coraciiformes	3	6
10.	Cuculiformes	1	4
11.	Gruiformes	1	2
12.	Passeriformes	19	33
13.	Pelecaniformes	1	4
14.	Piciformes	2	5
15.	Psittaciformes	1	2
16.	Suliformes	1	2
17.	Strigiformes	1	1
	Total	39	73

Table 3. The RD (Relative diversity) of different families of bird in the research area.

Sl. No.	Family Name	Number of Species	RDi	Sl. No.	Family Name	Number of Species	RDi
1.	Accipitridae	2	2.74	21.	Megalaimidae	2	2.74
2.	Aegithinidae	1	1.37	22.	Meropidae	1	1.37
3.	Alcedinidae	4	5.48	23.	Motacillidae	2	2.74
4.	Anatidae	1	1.37	24.	Muscicapidae	1	1.37
5.	Apodidae	1	1.37	25.	Nectariniidae	3	4.11
6.	Ardeidae	4	5.48	26.	Oriolidae	1	1.37
7.	Caprimulgidae	1	1.37	27.	Paridae	1	1.37
8.	Charadriidae	2	2.74	28.	Passeridae	1	1.37
9.	Ciconiidae	1	1.37	29.	Phalacrocoracidae	2	2.74
10.	Cisticolidae	2	2.74	30.	Picidae	3	4.11
11.	Columbidae	4	5.48	31.	Ploceidae	1	1.37
12.	Coraciidae	1	1.37	32.	Psittaculidae	2	2.74
13.	Corvidae	3	4.11	33.	Pycnonotidae	2	2.74
14.	Cuculidae	4	5.48	34.	Rallidae	2	2.74
15.	Dicruridae	1	1.37	35.	Strigidae	1	1.37
16.	Estrildidae	3	4.11	36.	Sturnidae	5	6.85
17.	Jacanidae	1	1.37	37.	Turdidae	1	1.37
18.	Hirundinidae	1	1.37	38.	Upupidae	1	1.37
19.	Laniidae	2	2.74	39.	Zosteropidae	1	1.37
20.	Leiothrichidae	1	1.37				

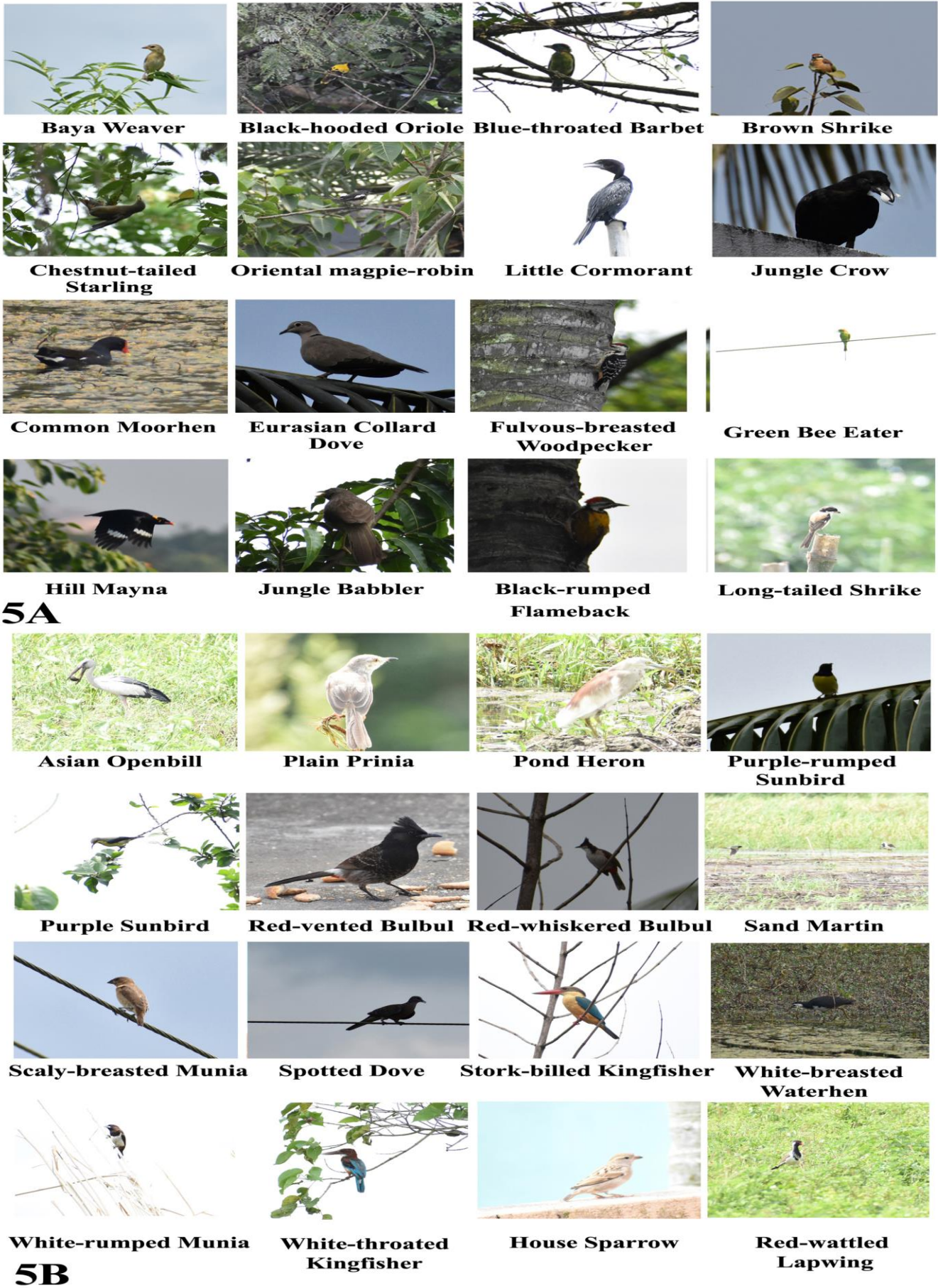


Figure 5A & B: Some of the bird species found in and around Kalyani from December 2021 to January 2023.

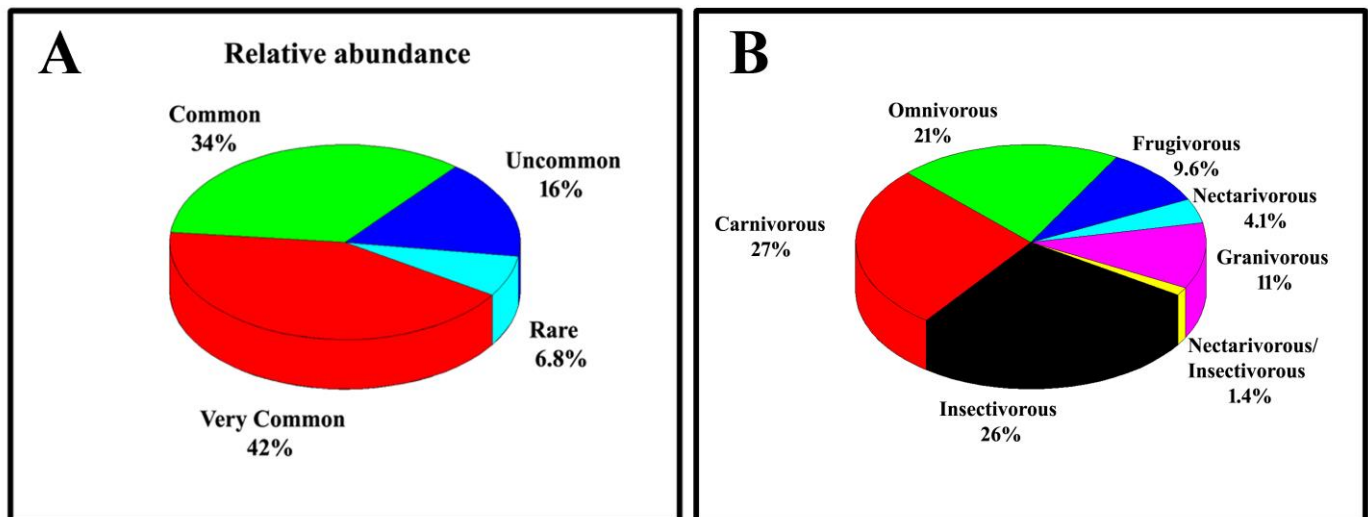


Fig. 6A: The relative abundance of avian species observed in the research area; 6B: Feeding Guild Pattern of bird located in the area of interests.

4. Discussion

Kalyani and its surroundings are well characterized for its greeneries, several wetlands, agricultural fields that offered a variety of food and worthy habitat for the bird population. This paper demonstrates that the area is moderately rich in biodiversity of birds having 73 distinct species attributed to 39 different families categorised under 17 orders for the first time. The most diversified family in the research area were sturnidae (RDi = 6.85) having 5 distinct species of bird, followed by Alcedinidae, Ardeidae, Columbidae, Cuculidae and Corvidae, Estrildidae, Nectariniidae, Picidae having 4 (RDi = 5.48) and 3 (RDi = 4.11) different species of bird, respectively. The least diversified family in the research field were Aegithinidae, Anatidae, Apodidae, Caprimulgidae, Ciconiidae, Coraciidae, Dicruidae, Jacanidae, Hirundinidae, Leiothrichidae, Meropidae, Muscicapidae, Oriolidae, Paridae, Passeridae, Ploceidae, Strigidae, Turdidae, Upupidae, Zosteropidae (each having single species of bird) (RDi = 1.37). Concerning this, similar kind of study have been conducted by [23] to demonstrate the status and biodiversity of avifauna in Purbasthali of West Bengal and observed 86 different birds attributed to 31 family. The most predominant family present in the research field were Ardeidae, Anatidae having 7 species each, thereafter, Scolopacidae; Picidae, Motacillidae and Cuculidae, Charadriidae, Alcedinidae, Rallidae having 6, 5 and 4 different species, respectively. The RDi value of the family Ardeidae and Anatidae have the maximum (8.14), while, Cisticolidae, Meropidae, Aegithinidae, Psittaculidae, Pandionidae, Zosteropidae, Rhipiduridae, Recurvirostridae and Podicipedidae have the minimum (1.16) [23]. The study investigated by [28] at Bibhutibhushan Sanctuary of West Bengal suggested presence of 102 birds attributed to 46 family under 13 orders. Order Passeriformes containing the maximum number of birds (49). The three most diversified family in the sanctuary were Accipitridae, Cuculidae, Muscicapidae having 6 species each, followed by Columbidae, Sturnidae, Picidae and Alcedinidae, Campephagidae, Corvidae, Dicruidae, Turdidae, Rhamphastidae, Psittaculidae, Strigidae having 4 and 3 species, respectively. The least diversified family were

Apodidae, Anatidae, Artamidae, Aegithiniidae, Ciconiidae, Charadriidae, Coraciidae, Hirundinidae, Irenidae, Passeridae, Scolopacidae, Leiothrichidae, paridae, Pycnonotidae, Pittidae, Phylloscopidae, Pellorneidae, Zosteropidae, Tytonidae and Vangidae (one species each) [28]. Similar study conducted by [29] in Burdwan district of West Bengal have found 144 birds attributed to 51 family under 19 order. The highest avian population belongs to the order Passeriformes. The most diversified family in the investigation area were Ardeidae, Anatidae having 9 species each, followed by Accipitridae, Muscicapidae and Motacillidae, Scolopacidae having 8 and 6 species each, respectively; while, least diversity observed in Artamidae, Aegithinidae, Coraciidae, Cerylidae, Alcedinidae, Rostratulidae, Recurvirostridae, Anhingidae, Upupidae, Paridae, Passeridae, Phasianidae, Falconidae, Ploceidae, Phylloscopidae, Sylviidae, Tytonidae, Phalacrocoracidae and Podicipedidae (each having one species) [29]. Study of the Purulia Town of West Bengal reported by [30] revealed 115 birds attributed to 43 family under 19 orders. The most dominated order was Passeriformes having 46 species. The most diversified family in the investigation area were Anatidae having 9 species, followed by Ardeidae, Motacillidae, Muscicapidae and Columbidae, Cuculidae, Laniidae, Sturnidae with 7 and 5 species each, respectively. The least diversified family were Alaudidae, Podicipedidae, Bucerotidae, Picidae, Chloropseidae, Megalaimidae, Phylloscopidae, Campephagidae, Ploceidae, Coraciidae, Pycnonotidae, Phasianidae, Falconidae, Meropidae, Laridae and Upupidae (one species each) [30]. Study conducted in the campus of Government College of Durgapur, West Bengal by [31] depicted 106 birds confined to 47 different family. The most diversified family was Sylviidae having 9 species, followed by Motacillidae and Ardeidae having 6 species each. The least diversified family were Aegithinidae, Anatidae, Artamidae, Burhinidae, Caprimulgidae, Charadriidae, Chloropseidae, Ciconiidae, Dicaeidae, Falconidae, Lanidae, Phalacrocoracidae, Phasianidae, Passeridae, Rallidae, Scolopacidae, Threskiornithidae, Turnicidae, Upupidae and Tytonidae (one species each) [31]. Study revealed in and around Digha, West Bengal outlined 86 birds attributed to 35 family under 10 order by [32] and Order Passeriformes was

the most predominant one. The most diversified family were Columbidae, Passeridae (each having 6 species), followed by Ardeidae, Charadriidae and Corvidae, Alcedinidae, Glareolidae, Sturnidae, Picidae having 5 and 4 species, respectively. The least diversified family were Aludidae, Anhingidae, Coraciidae, Cisticolidae, Phalacrocoracidae, Rallidae, Pycnonotidae, Phasianidae, Rhipiduridae, Sylviidae, Recurvirostridae and Zosteropidae (each with single species) [32].

The current investigation suggests the presence of 63 (86.30%) regional, 2 (2.74%) migratory, 3 (4.11%) winter migrant, 1 (1.37%) monsoon migrant and 4 (5.48%) regional migratory species of bird. The relative abundance of the avian population suggested that there were 31 (42%) very common, 25 (34%) common, 12 (16%) uncommon and 5 (6.8%) rare species of bird, respectively, in the investigation area. At Purbasthali by [23], among 86 species of bird, 51 species were categorised as regional, 21 migratory and 14 regionally migrant. Relative abundance study of the avian population categorised 26 species of bird as common, 13 very common and 28 rare. The very commonly found birds at Purbasthali were Asian open bill stork, Black drongo, Greater caucal, White-throated kingfisher, Lesser whistling-duck, Little egret, Cattle egret, Pheasant-tailed jacana, Little cormorant, Little grebe, Red-vented bulbul, Common and Jungle mayna [23]. Bibhutibhushan Sanctuary reported by [28] revealed that 83 (81.37%) species were recognized as regional, 3 (2.94%) summer visitor, 15 (14.71%) winter visitor and 1 (0.98%) passage migrant. Also, their relative abundance suggested 41 species were common, 24 very common, 22 uncommon and 15 rare. The very commonly observed birds in the Sanctuary were Lesser whistling-duck, Rock Pigeon, Spotted dove, Common kingfisher, White-throated kingfisher, Greater caucal, Asian koel, Common tailorbird, Rufous tree pie, House crow, Black drongo and Jungle babbler [28]. The residential status of the birds of Burdwan district surveyed by [29] were 18.70% species considered as very common, 20.14% common, 30.94% fairly common and 30.22% rare. The very common birds of the investigation area were Asian palm swift, Bronze-winged jacana, Asian open bill stork, Blue rock pigeon, Spotted dove, Cattle egret, Eurasian collared dove, Indian pond heron, Green bee-eater, Asian-pied starling, White-breasted kingfisher, Red-vented bulbul, White-breasted waterhen, Little egret, Rose-ringed parakeet, Lesser golden-backed woodpecker, Common mayna, House crow, Common tailor bird, Black drongo, Brown shrike, Jungle babbler, Oriental magpie-robin, House sparrow, Spotted owlet and Little cormorant. There were 61.15% of the birds categorised as regional, 7.20% migratory and 31.65% regional migrant [29]. Study revealed by [30] that, out of 115 species, 78 were regional, 36 winter migrant and single summer visitor was Jacobin cuckoo in the Purulia district. Campus of the Government College of Durgapur investigated by [31] revealed that 77 bird species were regional, 23 winter migrant, 4 summer migrant, 1 vagrant and 1 passage migrant. The residential position of the birds found in the surrounding of Digha revealed 73% regional, 11% migrant and 16% regional migrant, out of 86 birds [32]. Study revealed by [33] of Mondouri, present in the Nadia district of West Bengal

suggested 74 birds attributed to 18 orders, among them 67.57% species were regional, 12.16% winter migrant and 20.27% regional migratory. The maximum number of birds found in the investigation area were Common mayna, Spotted dove, Tri-coloured munia, Scaly-breasted munia and Coppersmith barbet [33]. The presence of good amounts of agricultural fields, wetlands, greeneries which serve as food, shelter etc. for the birds present in the research area. Though, we have observed some sort of disturbances in the form of urbanization, use of pesticides in crop fields, noise pollution, cutting of trees and their branches, anthropogenic interferences etc. influencing on aggregation and overall biodiversity of the avian population.

Understanding the complex structure of the ecosystem and supplying information on each type of habitat therein require a thorough recognition of bird feeding habits [34]. The quality and quantity of food available is the primary factor determining the spatiotemporal distribution and relative abundance of birds in a given habitat [27], [28]. There were total seven major feeding guilds observed during our investigation, of which, 20 (27%) and 19 (26%) species were carnivorous and insectivorous, respectively, followed by omnivorous 15 (21%), granivorous 8 (11%), frugivorous 7 (9.6%), nectarivorous 3 (4.1%) and Nectarivorous/insectivorous 1 (1.4%). Feeding guilds of the 102 birds of Bibhutibhushan Sanctuary suggested 46.08%, 22.55%, 15.69%, 6.86%, 5.88%, 1.96% and 0.98% attributed to insectivorous, carnivorous, omnivorous, granivorous, frugivorous, Nectarivorous and herbivorous, respectively [28]. Feeding habits of 115 birds of Purulia revealed 29%, 26%, 25%, 8%, 7%, 3% and 2% contributed by omnivorous, invertivorous, Carnivorous, granivorous, herbivorous, frugivorous and Nectarivorous, respectively [30]. Feeding status of the birds of Mondouri recorded 31.08%, 21.62%, 17.57%, 14.86%, 9.45%, 2.70% and 2.70% regarded as insectivorous, omnivorous, granivorous, carnivorous, frugivorous, Nectarivorous and piscivorous, respectively [33]. Numerous insectivorous birds present in the investigation area are significant biological control representatives for different pests in forestry, horticulture and agriculture [8], [27].

This is the first scientific record of the avifaunal population present in the area of interests which showed a somewhat healthy biodiversity. Basic data on diversity and abundance trends of bird from this study can be applied to future ecological assessments and comparative studies. Monitoring the avifauna on a regular basis is a great way to keep an eye on the ecosystem's health and could potentially reveal an early warning of any negative changes [28]. This location holds great potential for doing extensive ecological studies on avifauna. Comprehensive research on habitat utilization, population size, nesting, breeding and foraging habits, as well as evaluation of risks and conservation concerns, may help close the information gap regarding avifauna in the subject area.

5. Conclusion

The study claims that both the geographical location as well as the habitat composition of the research area are

accountable for the large variety of bird species. This region seems to provide an extensive variety of habitats for both the residential and migratory birds. Protecting the habitat structure and variety present on bird-inhabited areas is vital to maintain the ecological balance and diversity of the bird population. The moderate healthy diversity and richness of the bird population was likely caused by the complex vegetative structure, which offers a variety of niches, adequate foraging grounds and shelters to diversified bird species. Though there are some sort of anthropogenic disturbances present in the investigation area in the form of sound pollution, unplanned urbanization, livelihood and use of pesticides in the agricultural field, cutting of plants and their branches etc. that negatively affects the biodiversity and aggregation of the birds. The research work underlines the need of maintaining greener or open space in the research area to protect the avian diversity in order to ensure ecological equilibrium. Hence, integrated management programme and sustainable development should be implemented by the local or state level authorities to ensure a healthy habitat for the bird populations over the years. This is the first record of its kind to create a comprehensive data of the bird population present in the investigation area.

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AUTHOR'S CONTRIBUTION

Both SS and TG were engaged in data collection and identification of the specimens. TG were involved in the data compilation, analysis and complete write up of the paper.

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