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Avian Diversity and species richness in Khanyan and adjoining areas of Hooghly District, West Bengal

Dr. Ghosh K**Abstract**

A study of was conducted during April 2013 to February 2014 in Khanyan and adjoining regions of Hooghly District of West Bengal. This study was conducted in three different environments, Agricultural/grasslands, City Woodlands and Wetland ecosystems. 91 species were recorded belonging to 16 different orders and 45 different families. Among all the species recorded, species richness and the total abundance of birds were significantly higher in agricultural habitat followed by wetland and woodland habitat respectively. Though the agricultural land was surrounded by villages yet the bird species count in this region was very high negating intense anthropogenic activities. The abundance of birds was significantly high in winter in all three habitats. The data suggests that the agricultural system was most diverse, where as birds in the woodland ecosystems was more evenly distributed. An annotated checklist of these species is provided with special reference to their distribution in different habitats.

Keywords: Habitat, Species Diversity, Species Richness, Abundance

1. Introduction

Out of 8650 species of birds in the world, India has only 1200, out of which 142 are endemic species^[1]. In today's context, when bird populations are declining because of their habitats are being destroyed, polluted, and reduced on a large scale, a proper understanding about habitats and current diversity status would be quintessential.

Community ecology is the study of the manner in which groupings of species are formed and distributed in nature and the ways in which these can be influenced by interactions between and among the species and the physical and biological factors of their environment^[2]. Birds occupy a wide range of ecological positions and in many respects biodiversity. Both present and past, is better understood for birds than for any other major group of organisms^[3]. The avian populations have a direct relationship with the structure and nature of habitat. Measuring diversity through time and in changing habitats could be a good approach in generating an indicator where species gain or loss could be used to gauge the trends in biodiversity^[4, 5, 6]. Being ecologically diverse and very much sensitive to various kinds of perturbation, bird community always acts as a better predictor of the quality and health of the habitat than a single species^[7]. Traditionally, the population studies have been used to monitor large scale, long term changes in avian population and to assess both habitat quality and the responses of bird to both natural and human caused environmental changes^[8]. Recently the climatic and anthropogenic changes of nature showed adverse effects in bird life and ecological balance. So it is necessary at this hour, to save the bird species from the threats in order to maintain the biodiversity. Biodiversity conservation in urban areas has become significant not only because of increasing anthropogenic activities in urban centres but also because it is one of the innovative ways to conserve biodiversity as suggested by various global environmental conventions^[9]. Progressive urbanization often leads to biotic homogenization whereby a few widespread and successful species replace a diverse avifauna^[10, 11].

For the purpose of this study, three very different habitats were selected, namely, woodland/forest habitat, Agricultural/Grassland habitat and wetland one. We considered woodland habitat as one having a dense grouping of hardwood trees^[12]. Wetland can be defined as areas which have sufficient water long enough to support the growth of hydrophytic vegetation^[12]. It has been proved that the birdlife can be quite diversified in the manmade agricultural field as these areas receive the benefits of the edge effect.

Till date, no diversity of bird species was estimated for this part of geographic land, therefore, the present study was initiated to determine the structure of bird communities to bring out the diversity pattern in different habitats (mixed dry deciduous forest, wet land, and agricultural

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ecosystems) in this part of Hooghly District and surrounding region.

2. Materials and Methods

Study Area

Geo graphically the study region is located spanning 22°53'51.18" and 88°22'22.02" Latitude and Longitude respectively. In north of study area there is river Ganges. For this project three different habitats were selected namely, Agricultural/Grassland, Woodland/Forest and Wetland ecosystems. The study area is shown in figure 1. The Rice Research Centre located near Chinsurah Railway Station, the place in between Talandu Railway station and Khanyan railway station and Beta Village 10 km away from Chinsurah Railway Station were the three sites that were selected as Agricultural/grassland ecosystems. The Chupi wet land in Purbasthali, Burdwan District, Baidyabati khal near Baidyabati Railway Station, Hooghly, and Santragachi Jhill, near Santragachi Railway Station, Howrah District were excavated and considered as wet land ecosystem. Rajhat and Debanandapur village, some 4 km East of Bandel Railway Station, Hooghly, considered as the Woodland/forest ecosystem.

Study Summary

The Study was conducted between April 2013 to February 2014. A total of 11 strips were used to carry out the field study in 11 months time. A total of 21 days and 244 hours were spent on the field for data collection. Field works were carried out on foot at an average speed of 1.5 to 2 km/hour. The visiting hours were from 6 a.m. to 7.30 a.m, and from 5 p.m to 6 p.m. For this purpose two pairs of binoculars (PORO Prism) (8X40 and 10X50 magnification) made by Olympus, and one digital camera Model L110, Nikon, (comprising 16.0 mpx, and 16X Optical Zoom were used), and other relevant materials were used. The birds flying from behind were also noted. In Forest the more emphasis were given to birds call rather than their sight. The recorded bird species were identified, followed nomenclature using the books of 'The Birds of Indian Subcontinent, By Girit *et al*; [13] and 'The book of Indian birds' by Salim Ali and Ripley (1983) [14].

Climate

This study was conducted spanning three different seasons, summer, rainy and winter.

Summer: March to end of May was considered as summer. The average day temperature was 38.7 °C, minimum temperature was 23.8 °C. Relative humidity varies from 88% to 94% and average rainfall was 153 mm.

Rainy: June to end of September was considered as rainy season. The day temperature varied from 32° to 36 °C, minimum temperature was 23 °C. This season receives monsoon rainfall of more than 900 mm. Relative humidity was very high.

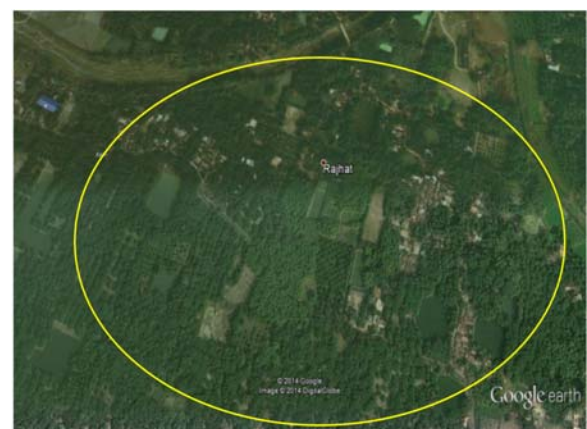
Winter: October to February was designated as winter season with minimum temperature recorder was 8.8 °C. This season encounters only 1 day rain of 6.8 mm.



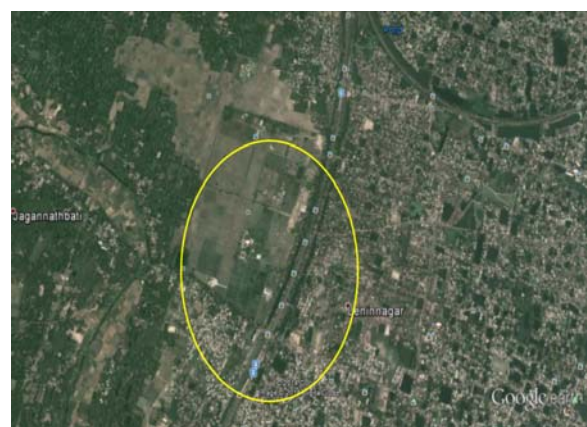
A Chupi, Purbasthali (Wetland)



B Baidyabati Khal (Shared Habitat)



C Rajhat/Debanandapur (Woodland)



D Rice Research centre (Agricultural)

Fig 1: Pictures of Different habitats, study areas are encircled in yellow colour.

Line Transect Method

Line transect survey method were used following Johnsing 1983 and Gregory, R.D. (2000). [15, 16] for the density estimation of avian species. This method is increasingly preferred for the formal population estimation method based on visual detection of birds (Burnham 1980) [17]. For the density estimation in a difficult terrain like wetlands the traditional method was slightly modified in this present study. All the data were accumulated and analysed following standard methods through various computer models.

Data Analysis

Species Richness and Abundance

Species Richness was calculated by simply counting the number of species in any given habitat. To calculate species richness the abundance of birds were not taken into account [18].

Species Diversity

Species diversity was calculated using the Shannon - Weaver index [19].

Evenness Index

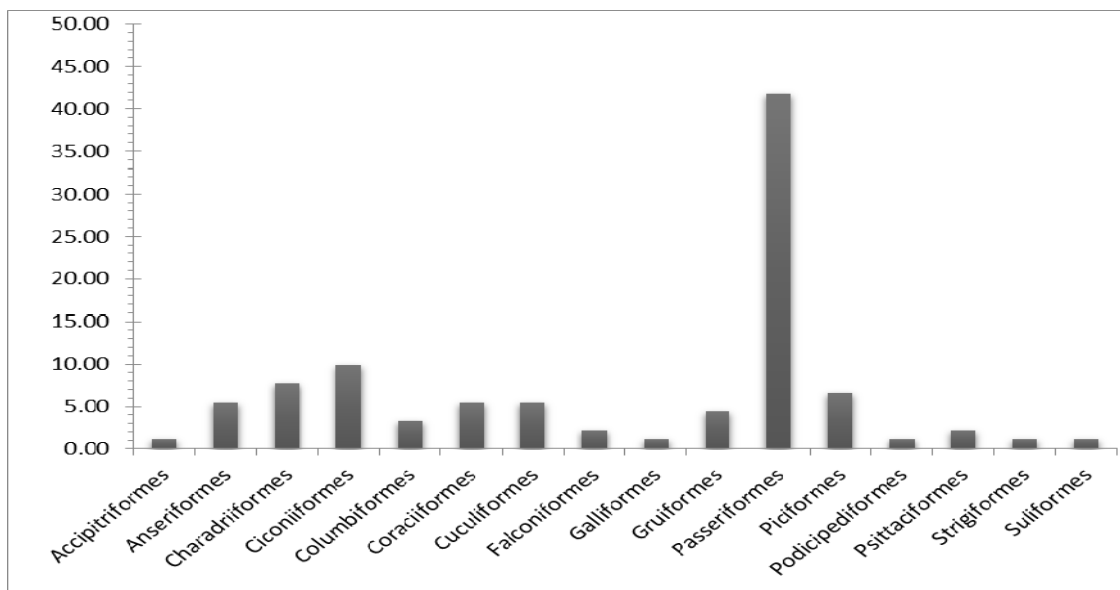
Evenness 1 is used here, this expresses the ratio of Hill's number; $E1 = H' / \ln(S) = \ln(N) / \ln(N_1)$ [20].

Similarity coefficient: The similarity coefficient was calculated between two different communities using Sorensen coefficient using the following formula- $C_s = 2a / (2a + b + c)$ [21].

Dominance Index: Two separate dominance index were used to calculate the diversity of birds, one is Berger-Parker index and the other is Simpson index. Berger-Parker index was calculated using the following formula, $D_{BP} = N_{Max} / N$, where, N_{max} is the total number of individuals in the most common species and N is the total number of individual in the community [18]. To express greater diversity with numerically increasing value $D_{BP} = 1/D$ was used. Simpson's index was calculated using the protocol given by Simpson 1964 [22]. Simpson's index is expressed here as $1/D_s$ in order to obtain increasing values of the index with increasing diversity.

3 Results

During the present study, 91 bird species were identified belonging to 16 different orders and 45 different families (Appendix). Among the 16 orders Passeriformes was predominant one having 38 different species comprising 41.76% of the total population, and order Ciconiiformes being the second comprising only 9.89% of total bird population (Graph 1). The 38 bird species of order Passeriformes fall under 22 different families with where family Sturnidae being the dominant one with 5 different species (Appendix).



Graph 1: Percentage of bird species composition based on Orders in study areas.

Appendix: Feeding, Taxonomic rank and Distribution in different habitats of the avian species.

Sl No.	Common name	Scientific Name	Feeding	Order	Family	Habitat
1	Shikrah	<i>Accipiter badius</i>	C	Accipitriformes	Accipitridae	A,F
2	Black Kite	<i>Milvus migrans</i>	O	Accipitriformes	Accipitridae	A
3	Cotton Pigmy Goose	<i>Nettapus coromandelianus</i>	C	Anseriformes	Anatidae	W
4	Lesser Whistling Duck	<i>Dendrocygna javanica</i>	C	Anseriformes	Anatidae	W
5	Gadwall	<i>Anas strepera</i>	C	Anseriformes	Anatidae	W
6	Ferruginous Pochard	<i>Aythya nyroca</i>	C	Anseriformes	Anatidae	W
7	Red Crested Poachard	<i>Netta rufina</i>	C	Anseriformes	Anatidae	W
8	Bronze Winged Jacana	<i>Metropidius indicus</i>	C	Charadriiformes	Jacanidae	W
9	Red Wattled Lapwing	<i>Vanellus indicus</i>	I	Charadriiformes	Charadriidae	A,W
10	Common Sandpiper	<i>Actitis hypoleucos</i>	I,C	Charadriiformes	Scolopacidae	W
11	Citrine Wagtail	<i>Motacilla citreola</i>	I	Charadriiformes	Motacilidae	A
12	Wood Sandpiper	<i>Tringa glareola</i>	I,C	Charadriiformes	Scolopacidae	W
13	Pheasant tailed Jacana	<i>Hydrophasianus chiurgus</i>	I,C	Charadriiformes	Jacanidae	W
14	Green Sandpiper	<i>Tringa ochropus</i>	I,C	Charadriiformes	Scolopacidae	W
15	Pond heron	<i>Ardeola grayii</i>	C	Ciconiiformes	Ardeidae	A,W

16	Cattle Egret	<i>Bubulcus ibis</i>	C	Ciconiiformes	Ardeidae	A,W
17	Night Heron	<i>Nycticorax nycticorax</i>	C	Ciconiiformes	Ardeidae	F,W
18	Little Egret	<i>Egretta garzetta</i>	C	Ciconiiformes	Ardeidae	A,W
19	Asian Open Billed Stork	<i>Anastomus oscitatus</i>	C	Ciconiiformes	Ciconiidae	A,W
20	Intermediate Egret	<i>Mesophoyx intermedia</i>	C	Ciconiiformes	Ardeidae	W
21	Purple Heron	<i>Ardea purpurea</i>	C	Ciconiiformes	Ardeidae	A,W
22	Yellow Bittern	<i>Lixobrychus sinensis</i>	C	Ciconiiformes	Ardeidae	W
23	Great Egret	<i>Ardea alba</i>	C	Ciconiiformes	Ardeidae	A,W
24	Spotted Dove	<i>Spilopelia chinensis</i>	G	Columbiformes	Columbidae	A,F
25	Common Pigeon	<i>Columba livia</i>	G	Columbiformes	Columbidae	A,F
26	Collared Dove	<i>Streptopelia decaocto</i>	G	Columbiformes	Columbidae	A,F
27	Stork Bill Kingfisher	<i>Pelargopsis capensis</i>	I,C	Coraciiformes	Halcionidae	A,W
28	Common Kingfisher	<i>Alcedo atthis</i>	I,C	Coraciiformes	Alcedinidae	A,W
29	White Breasted Kingfisher	<i>Halcyon smyrnensis</i>	I,C	Coraciiformes	Halcionidae	A,W
30	Green Bee Eater	<i>Merops orientalis</i>	I	Coraciiformes	Meropidae	A,W
31	Common Hoopoe	<i>Upupa epops</i>	I	Coraciiformes	Upupidae	A,W
32	Common Cuckoo	<i>Cuculus canorus</i>	I	Cuculiformes	Cuculidae	F
33	Jacobian Pied Cuckoo	<i>Clamator jacobinus</i>	I	Cuculiformes	Cuculidae	F
34	Asian Koel	<i>Eudynamis scolopaceus</i>	I,FR	Cuculiformes	Cuculidae	A,F
35	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	I	Cuculiformes	Cuculidae	F
36	Great Coucal	<i>Centropus sinensis</i>	I,C	Cuculiformes	Cuculidae	A,F
37	Osprey	<i>Pandion haliaetus</i>	C	Falconiformes	Pandionidae	W
38	Indian Pea Fowl	<i>Pavo cristatus</i>	O	Galliformes	Phasianidae	F
39	White Breasted Waterhen	<i>Amaurornis phoenicurus</i>	I,C,G	Gruiformes	Rallidae	W
40	Common Moorhen	<i>Gallinula chloropus</i>	I,C,G	Gruiformes	Rallidae	W
41	Purple Swamphen	<i>Porphyrio porphyrio</i>	I,C,V	Gruiformes	Rallidae	W
42	Common Koot	<i>Fulica atra</i>	I,C,V	Gruiformes	Rallidae	W
43	Rosy Minivet	<i>Pericrocotus roseus</i>	I	Passeriformes	Campephagidae	F
44	Common Moina	<i>Acridotheres tristis</i>	O	Passeriformes	Sturnidae	A,F
45	Red veinted Bulbul	<i>Pycnonotus cafer</i>	I,V,N	Passeriformes	Pycnonotidae	A,F
46	Jungle Babbler	<i>Turdoides striata</i>	I,C,N	Passeriformes	Leiotherichidae	F
47	Black Drongo	<i>Dicrurus macrocercus</i>	I,C,N	Passeriformes	Dicruridae	A,F,W
48	Pied Starling	<i>Gracupica contra</i>	I,G	Passeriformes	Sturnidae	A
49	Scaly Breasted Munia	<i>Lonchura punctulata</i>	G	Passeriformes	Estrildidae	A
50	Indian Robin	<i>Saxicoloides erythrorus</i>	I	Passeriformes	Muscicapidae	A,F
51	Baya Weaver	<i>Ploceous philippinus</i>	I,G	Passeriformes	Ploceidae	A,F
52	Common Prinia	<i>Prinia inornata</i>	I,C	Passeriformes	Cisticolidae	A
53	Black Hooded Oriole	<i>Oriolus xanthornus</i>	I,FR,N	Passeriformes	Oriolidae	F
54	Chestnut Tailed Starling	<i>Sturnia malabarica</i>	I,FR,N	Passeriformes	Sturnidae	A,F
55	Rufous/Indian Treepie	<i>Dendrocitta vagabunda</i>	O	Passeriformes	Corvidae	F
56	Purple Sunbird	<i>Cinnyris asiaticus</i>	I,N	Passeriformes	Nectariniidae	F
57	Brown Shrike	<i>Lanius cristatus</i>	I,C	Passeriformes	Laniidae	A,F,W
58	Red Rumped Swallow	<i>Cecropis daurica</i>	I	Passeriformes	Hirundinidae	W
59	White Wagtail	<i>Motacila alba</i>	I	Passeriformes	Motacilidae	A,F
60	Indian Silverbill	<i>Lonchura malabarica</i>	G	Passeriformes	Estrildidae	A
61	Long Tail Shrike	<i>Lanius schach</i>	I,C	Passeriformes	Laniidae	A
62	Tailor Bird	<i>Orthotomus sutorius</i>	I,N	Passeriformes	Eisticolidae	F
63	Ashy Minivet	<i>Pericrocotus divaricatus</i>	I	Passeriformes	Campephagidae	F
64	House Sparrow	<i>Passer domesticus</i>	O	Passeriformes	Passeridae	A
65	House Crow	<i>Corvus splendens</i>	O	Passeriformes	Corvidae	A,F,W
66	Black Headed Munia	<i>Lonchura malacca</i>	G	Passeriformes	Estrildidae	A
67	Paddy Field Pipit	<i>Anthus campestris</i>	I	Passeriformes	Motacilidae	A
68	Purple rumped Sunbird	<i>Leptocoma zeylonica</i>	I,N	Passeriformes	Nectariniidae	F
69	Black Nepped Oriole	<i>Oriolus chinensis</i>	I,FR,N	Passeriformes	Oriolidae	F
70	Grey Wagtail	<i>Motacilla caspica</i>	I	Passeriformes	Motacilidae	A
71	Blue Throated Flycatchure	<i>Cyornis rubeculoides</i>	I	Passeriformes	Muscicapidae	F
72	Great Tit	<i>Parus major</i>	I,FR,N	Passeriformes	Paridae	F
73	Brahmin Starling	<i>Sturnia pagodarum</i>	O	Passeriformes	Sturnidae	A,F
74	Barn Swallow	<i>Hirundo rustica</i>	I	Passeriformes	Hirundinidae	F,W
75	Pale billed Flowerpecker	<i>Dicaeum erythrorhynchos</i>	FR	Passeriformes	Dicacidae	F
76	Bank Myna	<i>Acridotheres ginginianus</i>	O	Passeriformes	Sturnidae	W
77	Red Whiskered Bulbul	<i>Pycnonotus jocosus</i>	I,FR,N	Passeriformes	Pycnonotidae	A,F
78	Bengal Bushlark	<i>Mirafra assamica</i>	I,G	Passeriformes	Alaudidae	A
79	Plain Martin	<i>Riparia paludicola</i>	I	Passeriformes	Artamidae	A,F,W
80	Common Iora	<i>Aegithina tiphia</i>	I,C	Passeriformes	Irenidae	A
81	Rufous Woodpecker	<i>Micopternus brachyurus</i>	I,V,N	Piciformes	Picidae	F
82	Lesser Goldenback Woodpecker	<i>Dinopium benghalense</i>	I,V,N	Piciformes	Picidae	F
83	Copper Smith Barbet	<i>Megalaima haemacephala</i>	I,FR	Piciformes	Megalaimidae	F
84	Blue Throated Barbet	<i>Megalaima asiatica</i>	I,FR	Piciformes	Megalaimidae	F
85	Lineated barbet	<i>Megalaima lineata</i>	I,FR,C	Piciformes	Megalaimidae	F
86	Giant Barbet	<i>Megalaima virens</i>	I,FR	Piciformes	Capitoniidae	F
87	Little Greebe	<i>Tachybaptus ruficollis</i>	I,C	Podicipediformes	Podicipitidae	W
88	Rose ringed Parakeet	<i>Psittacula krameri</i>	FR,N	Psittaciformes	Psittaculidae	A,F
89	Plum Headed Parakeet	<i>Psittacula cyanocephala</i>	FR,N	Psittaciformes	Psittaculidae	A,F
90	Spotted Owlet	<i>Athene brama</i>	C	Strigiformes	Strigidae	F
91	Little Cormorant	<i>Microcarbo niger</i>	C	Suliformes	Phalacrocoracidae	W

When the bird community of three different habitats were compared it was found that 21 species were recorded exclusively in Agricultural/grassland (A); 7 species recorded only from Woodland/forest (F); and 21 species were found only in and around Wetland (W) habitat. Many bird species

shared multiple habitats, 15 species shared Agricultural/Grassland and Wetland (A, W); 6 species documented from woodland/Forest, Agricultural (F, A) and 21 species were found in all the three regions (F, A, W), (Table 1).

Table 1: Distribution of bird species among habitats

	Agricultural	Wetland	Woodland
Agricultural/Grassland	21	15	06
Wetland	15	21	21
Woodland	06	21	07

* 21 bird species were found sharing all three habitats.

Birds were also classified into 7 groups based on their food preferences. It was found that among all these bird species, 19 and 18 species were exclusively Carnivorous and

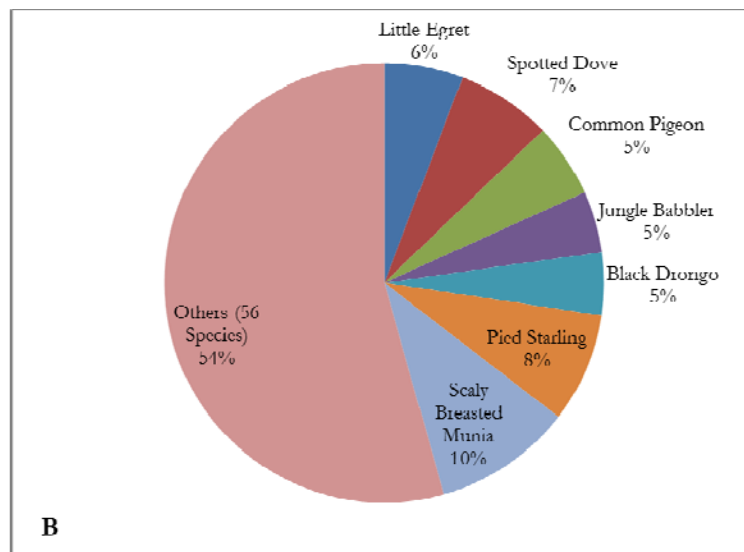
Insectivorous respectively. Six bird species were Granivorous and 08 were Omnivorous. Remaining 39 bird species had mixed food preferences (Table 2).

Table 2: Grouping of birds based on food preferences.

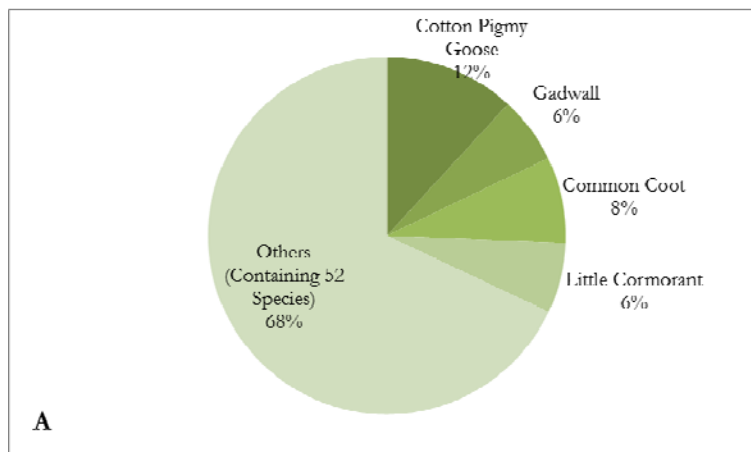
	Carnivore	Insectivore	Granivore	Omnivore	Mixed preferences
No. of Species	19	18	06	08	39

During this study period total 2370 birds were observed, with Agricultural/Grassland habitat were the richest with 1326 individuals, wetland habitat preferred by 862 individuals and the rest 178 birds were recorded from woodland/Forest habitat (data not shown).

The study data confirms that the avian population of Agricultural/Grassland ecosystem was dominated by Little Egret, Spotted Dove, Common Pigeon, Jungle Babbler, Black Drongo, Pied Starling, and Scaly Breasted Munia (Graph 2, plate B).



Graph 2: Dominant Birds species in different habitats, **B**-Agricultural



Graph 2: Dominant Birds species in different habitats, **A**-Wetland.

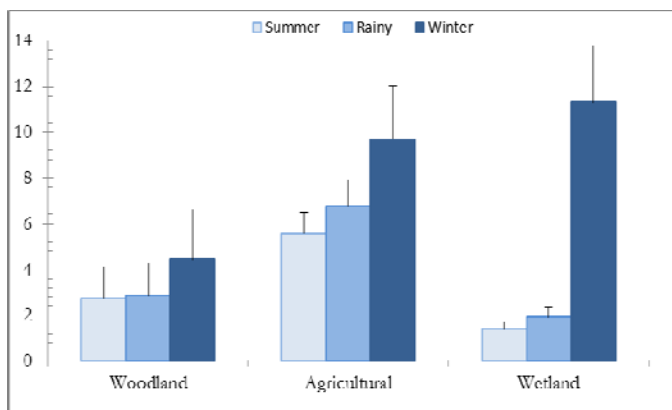
Dominant species in wetland habitat were Cotton Pigmy Goose, Gadwall, Common Coot, Little Cormorant (Graph 2, plate A). During this study period it was found that the dominant bird species in wetland habitat are mainly winter migratory in nature and clearly outnumbered the other species in winter, but in summer and in rainy season there were no such dominant species. Surprisingly, no such dominant species were found in Woodland/forest habitat in any season (data not given).

Maximum Species diversity was found in agricultural community, followed by wetland habitat. Woodland habitat showed least diversity during the three seasons (Table 3). Contrasting with this data it was found that the forest community showed highest evenness (.91), than agricultural (.83) and wetland (.85) ecosystems.

Table 3: Species Diversity, Richness and Evenness in three habitats

Parameters	Habitats		
	Woodland	Agricultural	Wetland
Berger-Parker index	7.44	9.90	8.33
Simpson's index	21.98	22.99	22.52
Shannon index	3.30	3.50	3.50
Evenness	0.91	0.83	0.85
Species Richness	35	63	57

Species richness was high throughout the year in agricultural habitat (63) as compared to wetland (57) and woodland (35) (Table 3). In all three habitats highest abundance of birds were observed in winter season (Graph 3) and the summer experienced the minimum abundance of bird population.



Graph 3: Relative abundance of bird population in different habitats spanning three different seasons.

The similarity coefficient comparing different habitats were calculated using Sorensen coefficient.

Table 4: Similarity coefficient comparing bird species in different habitats.

Similarity compared between	Values
Agricultural vs. Wetland	0.63
Agricultural vs. Woodland	0.65
Wetland vs. Woodland	0.6

The values were very high and the maximum value of similarity index was obtained when bird populations of agricultural land and woodland were compared (.65) (Table 4). Same comparison between agricultural land with wetland and woodland with wetland also gave higher numerical values, i.e., 0.63 and 0.6 respectively.

4. Discussion

In this study we performed sampling of birds in three different habitats and almost equal number of sampling was performed in each habitat. From the data it was clear that the species richness was highest in Agricultural system than the other two. Though species richness in wetland was not far behind. The probable explanation is that the method we followed for counting of birds that is line transects system suits the senses of birds in open land compared to forest system, where point count method is favoured [23]. Another explanation is that, it was very difficult to count the number of birds in forest due to the dense canopy.

In tune with the previously reported data obtained from other parts of the country, the order Passeriformes stands the most dominant Order [24, 25] with nearly 50% of total families found. The species diversity was highest in agricultural communities and this trend was followed by every diversity indices (Shannon, Simpson's, Berger-Parker index). As species diversity is based on species richness and abundance, it was found that this particular habitat was the most species rich (63) and the abundance was also very high relative to the other habitats. In all three parameters, species richness, abundance and species diversity the wet land community stands second. The least diverse community was the wood land ecosystem. The wood land habitat comprises a wide variety of different plant species which suits different kinds of bird species. This explains why the evenness value in this habitat is more (0.9) than any other habitats, with no single dominant species. Agricultural and/or wet land habitat is dominated by few bird species and the evenness value is relatively low (0.83,0.85 respectively) as compared to wood land habitat.

Water birds dominated the winter season in wet land were mostly migratory in nature. Previously it was reported that Ferruginous Poachard was disappearing from Santragachi jheel [26] but we fortunately found eight of them in winter. Another important observation was the finding of a group of Rosy Minivet during winter in wood land habitat. This is the first sighting of this bird in South Bengal, as we received no reported data of its occurrence. After our findings, this species was photographed in Hijuli Forest Ranaghat Nadia District on 8th of March this year by Anupam Mukherjee [Website of Oriental Birds Club]. The minimum temperature in winter in this area ranged from 7 °C to 10 °C which matched closely to the climate of north Bengal which might explain their winter migration in this region.

The similarity coefficient calculated comparing different habitats stands very close to each other and varied between 0.6 to 0.65. This data indicates that though we sampled the avian species in different habitats yet these three habitats lies close to each other and birds of different species shared them conspicuously. For example, Common Hoppoe, Jacobian Pied Cuckoo, Scaly Brested Munia etc known to exist in Agricultural/ Grassland habitat yet we encountered them in wet land habitat along with their natural habitat.

When the seasonal abundance of the bird species was calculated it was found that the species abundance was least in summer in all communities. The daylight is very severe and sometimes in the months of late April to early June the temperature usually exceeds 38°C which might result into low species distribution and low sightings in the study area. The winter season experienced the highest abundance of birds population in every community, mostly due to the infiltration of winter migrants and few resident species. Similar results have been shown by Gokula [27] but Sundaramoorthy [28]

revealed that species diversity was high in summer in mixed vegetation at Bharatpur Keoladeo National Park. Gaston's [29] study on the New Delhi ridge also showed similar result where diversity was high during winter and low in summer. One severe problem we experienced during this study is that, the natural habitats for these avian species are destroying at an alarming rate due to anthropogenic activities. The trees are being cut for household and commercial purposes.



Fig 2: Awaiting deforestation.

It is clear from the figure that these marked trees are waiting to be cut in near future. The water bodies are being filled regularly for construction purposes. The agricultural systems are being disturbed by large scale grazing, courtesy domestic animals of the villagers. This preliminary study showed that still some diversity is left as far as avian community is concerned. But we will have to take some immediate action to protect them. This study should continue for few years to get the precise picture of the avian diversity of this locality.

5. Conclusion

This study confirms that this region is rich in respect to avian populations as 91 different bird species were identified in just 1 year period. The experiment was conducted in 3 different habitats and come to know that the agricultural habitat was most diverse as far as avian populations are concerned. But the similarity co-efficient showed that the highest evenness was found in woodland ecosystem. The data also confirms that in this region most of the winter migrants were water birds. The unfortunate part is that most of the habitats are deteriorating due to anthropogenic activities.

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