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Diversity of Avifauna and Their Heterogeneous Habitat Preference in Barrackpore and its' Surrounding Areas, North 24 Parganas, West Bengal, India

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ABSTRACT

As members of ecosystems, birds play many roles, including as predators, pollinators, scavengers, seed dispersers, ecosystem engineers and act as bioindicators for measuring environmental health. Information is scanty on avian diversity with respect to the different habitats of Barrackpore and its' surrounding areas, town of North 24 Parganas, West Bengal, India. Therefore, the present study attempts to gain insight into avian diversity with respect to habitat heterogeneity during the survey period (August 2021 to July 2022). 50 bird species and 552 individuals distributed over 29 families are observed and identified in the study area at different locations like human habitats, riverbanks, wetlands, grasslands and woody areas. Due to loss of natural habitats specialist birds are gradually replaced by habitat generalists. Species dominance is found high in and around grassland. No. of individuals are more in and around riverbanks mainly for diverse vegetation. River banks and grassland have highest similarity index in terms of species composition. Human habitat has highest species richness and are enjoyed by most no. of species, probably due to presence of various resource materials in large amount exploited by the birds. Areas having human settlements show more opportunistic ones. An overall negative impact of human settlements on avian population and abundance is evidenced from the present study. More intensive studies may enrich us about avian diversity and distribution pattern of the study zone. The natural habitats for these avian species are being destroyed at an alarming rate due to anthropogenic activities. To save this urban avifaunal diversity awareness in the local people about the ecosystem and environment is needed.

Keywords: Avifauna, Barrackpore, Habitat heterogeneity Species richness, Habitat generalist, Habitat specialist, Species abundance, Biodiversity indices

1. INTRODUCTION

Birds occupy every continent, utilize all habitat types, and display incredible variety in behaviour and appearance. These feathered bipeds have adapted to some of Earth's most extreme environments. The tremendous diversity of birds contributes to their importance within ecosystems. Ecosystem services refer to the benefits that humans derive from the natural world, and birds are key players in providing many of these benefits [1-3] and act as bioindicators for measuring environmental health [4, 5]. Nearly 200 species of birds have gone extinct since the 1500s, due to habitat loss, predation, hunting, poaching which leads to the thought of bird conservation [6, 7]. The official data indicates that by 2100, 6–14% of all bird species will be extinct, and 7–25% (28–56% on oceanic islands) will be functionally extinct [8]. The extinction rate of birds is much higher in urbanized area in comparison to village area [9]. The present paper attempts to analyse the avifaunal diversity of Barrackpore and its' surrounding areas, North 24 Parganas, West Bengal, India.

Study site

The study was carried out in Barrackpore and its surrounding areas, town of North 24 Parganas, West Bengal, India (Table 1). The town is on the flood plain of right bank of the river Ganges (Bhagirathi-Hooghly). It is a town consisting of a large area of concrete forests made by anthropogenic invaders, surrounded by small villages, wetlands, grasslands, woodlands, farmlands and thin forest (Figs. 1, 2 & 3). Concretes as well as temporary colony like habitations cover most of the study area.

Table 1. Site specific Longitudes & Latitudes.

Sites	Name	Longitude (°E)	Latitude (°N)
Site 1	Muragacha bil (Kalyani express way)	88.411	22.71354
Site 2	Johar Kunj & gandhighat surrounding	88.3623	22.7528
Site 3	Anandapuri & surroundings	88.37669	22.76306
Site 4	Riverside road Lath bagan	88.34196	22.76822
Site 5	Mohanpur pauliya aambagan	88.39569	22.76611
Site 6	West bengal state university	88.4343	22.73827
Site 7	Bortir bil	88.4367	22.7838

Study area

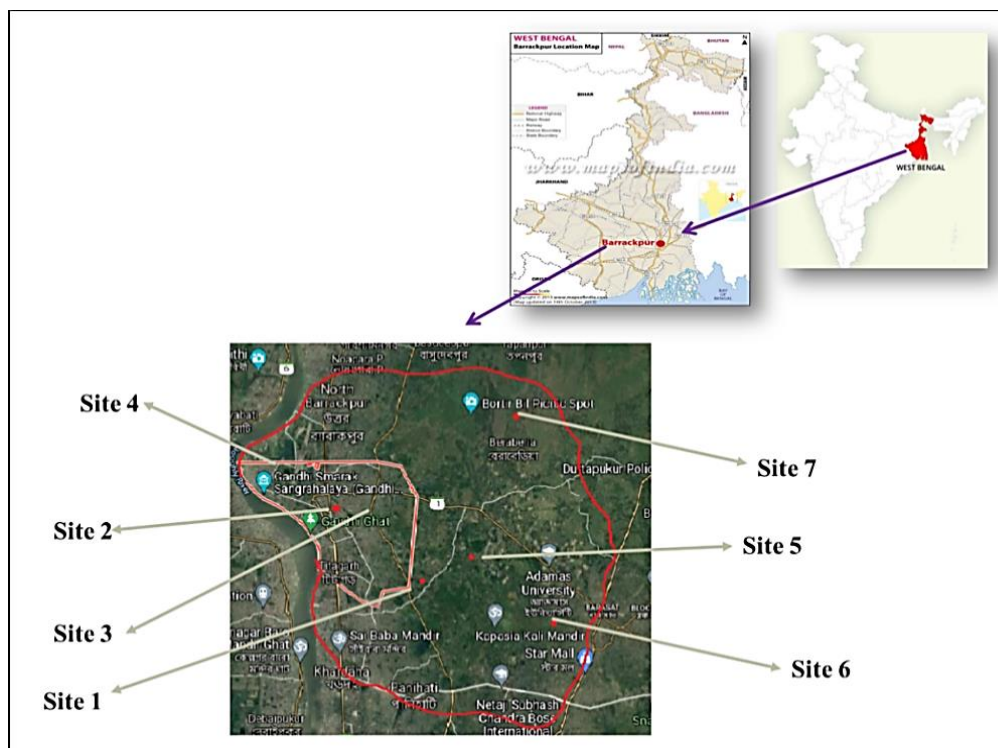
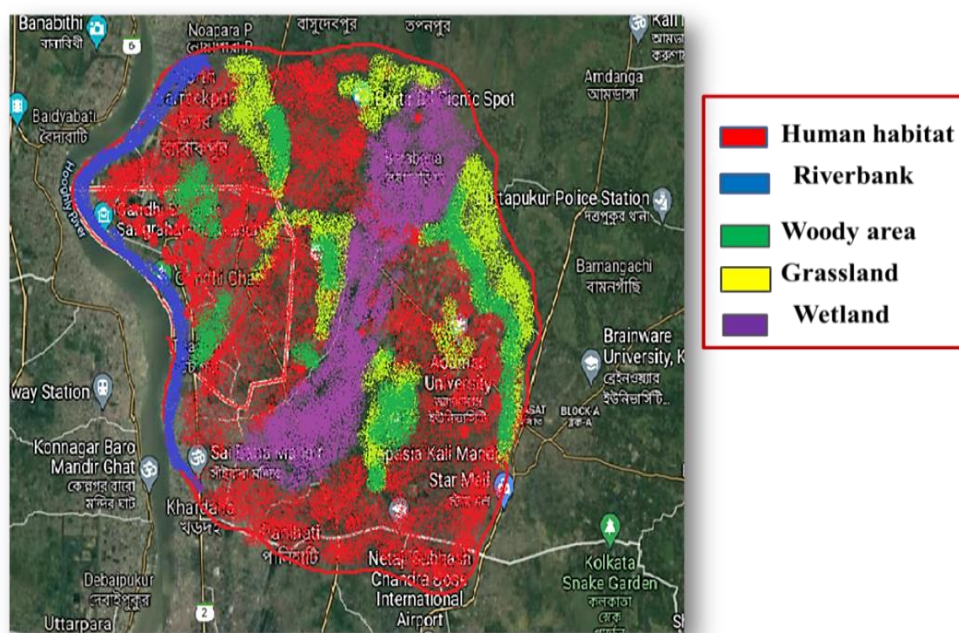


Fig. 1. Map - Study area.



Study was done in five different habitats

Fig. 2. Five different habitats within study area.

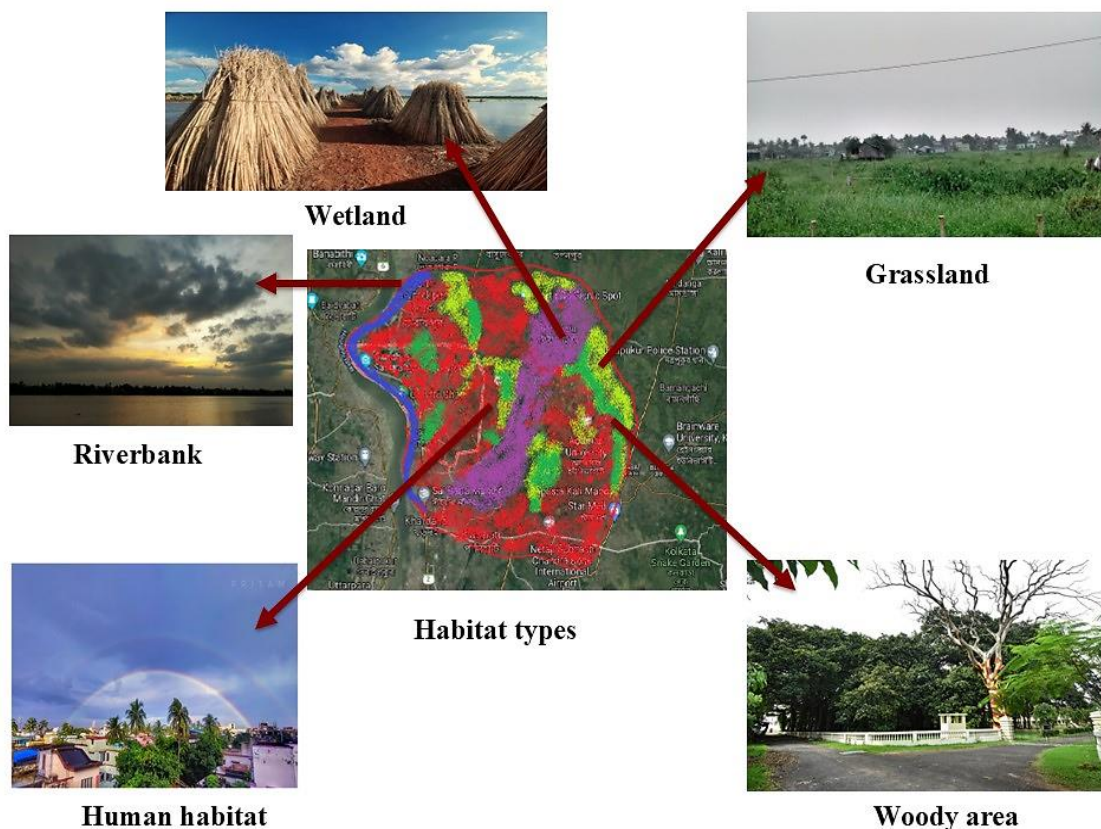


Fig. 3. Glances of five different habitats.

2. MATERIALS & METHODS

Table 2. Formulae of Diversity Indices.

Diversity Indices	Formulae	Notation
Margalef's Index	$e = (S-1)/\ln N$	S = Total Number of Species N = Total number of individuals in the sample ln = Natural Logarithm
Simpson Index (Dominance Index)	$D = 1 - \frac{\sum n(n-1)}{N(N-1)}$	n = Total number of individuals of a particular species N = Total number of individuals of all species
Shannon -Wiener Index	$H' = \sum_{i=1}^S p_i \ln p_i$	S = Number of species or species richness Pi = Proportion of total sample represented by species I (Division no. of individuals of species I by the total number of samples) H max = ln(S) E = Evenness = H / Hmax

Jaccard's Similarity Index	$S_j = a/a+b+c \times 100$	a = no. of species the two habitat have in common, b = species unique in habitat 1, c = species unique in habitat 2
Pielou's Evenness index	$(e) = H / \ln S$	H = Shannon – Wiener diversity index, S = total number of species in the habitat
Species Richness	$\frac{\text{Total no. of species}}{\sqrt{\text{Total no. of individuals}}}$	-----

Observations were made in the morning during 6 am to 8 am following sunrise to coincide with peak singing activity of birds from August 2021 to July 2022. Surveys were conducted at different locations like human habitats, river banks, wetlands, grasslands and woody areas. At each sighting birds were observed and counted using a binocular (Olympus 7 × 35 DPS I) and identified following [10, 11].

Photographs were taken with a DSLR camera (Nikon d3500 Lens – 70-300 mm) for documentation (Figs. 4 & 5). Point Count method and opportunistic observations were used for sampling. A fixed radius circular plot method was used. The birds are divided into habitat specialist (species that use only one habitat) and habitat generalist (species that use more than one habitat). Abundance % were also analysed from pooled data and finally enumerating avifaunal diversity by applying biodiversity indices [12] (Table 2).



Field Binocular



DSLR Camera with tele lens

Equipments used



Fig. 4. Equipments used.



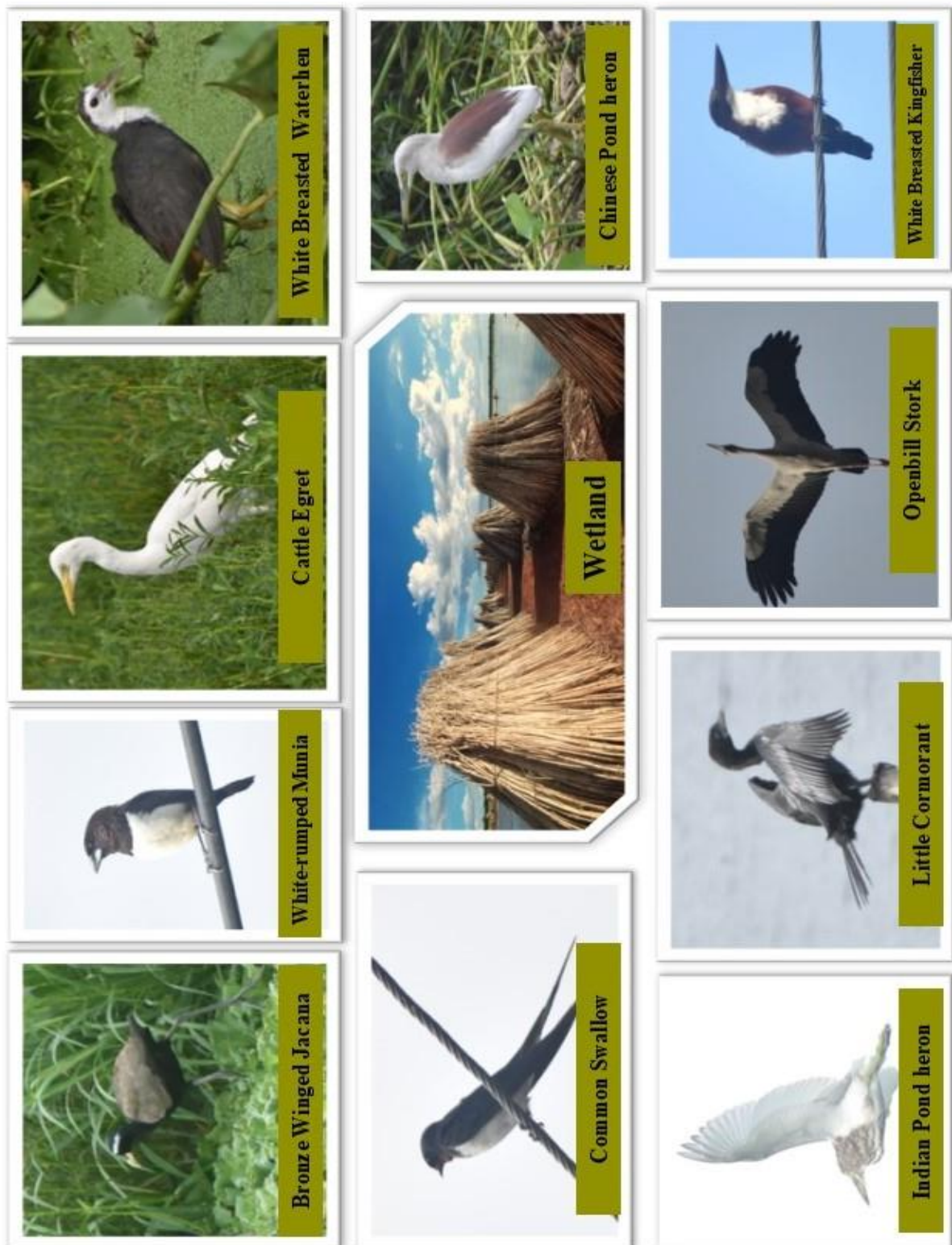
**During Field
Work**

Fig. 5. Birds sighting.

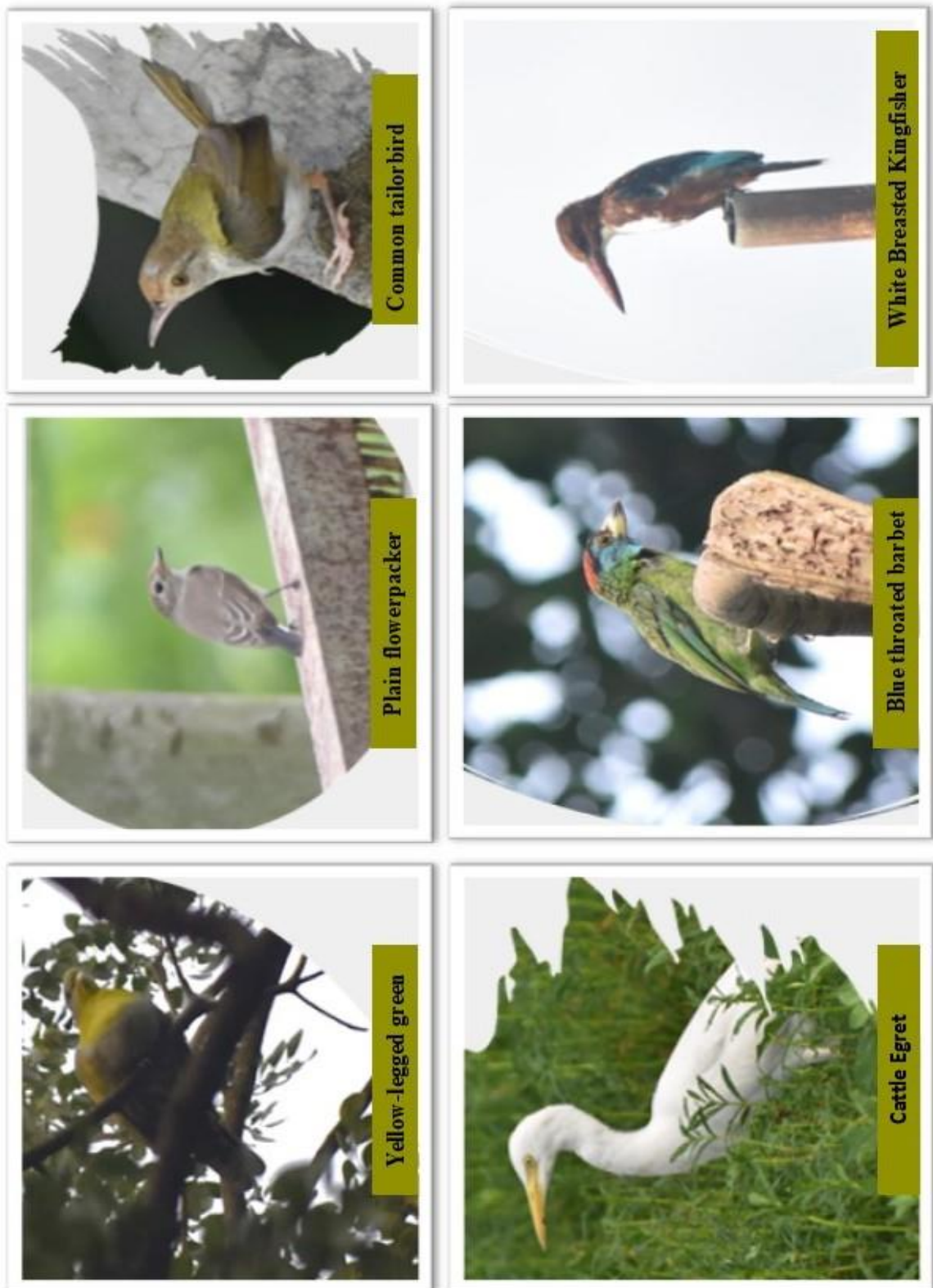
3. RESULTS & DISCUSSION

During the present survey 50 bird species and 552 individuals distributed over 37 genera and 29 families were observed and identified (Table 3; Fig. 6). When the bird community of five different habitats were compared, it was found that 6 birds were found in all 5 habitats (Spotted dove, House crow, Black drongo, Jungle babbler, Red vented Bulbul & Common myna), 4 species were found in 4 types of habitat, 14 from 3 types of habitats, 18 from 2 types of habitats and 7 species were found only in Wetland where most of them are aquatic as well as wading birds (Table 7, Fig. 7). No. of habitat specialist species (species that use only one habitat) found in this study is 7 and no. of habitat generalist species (species that use more than one habitat) is 43 (Table 7).

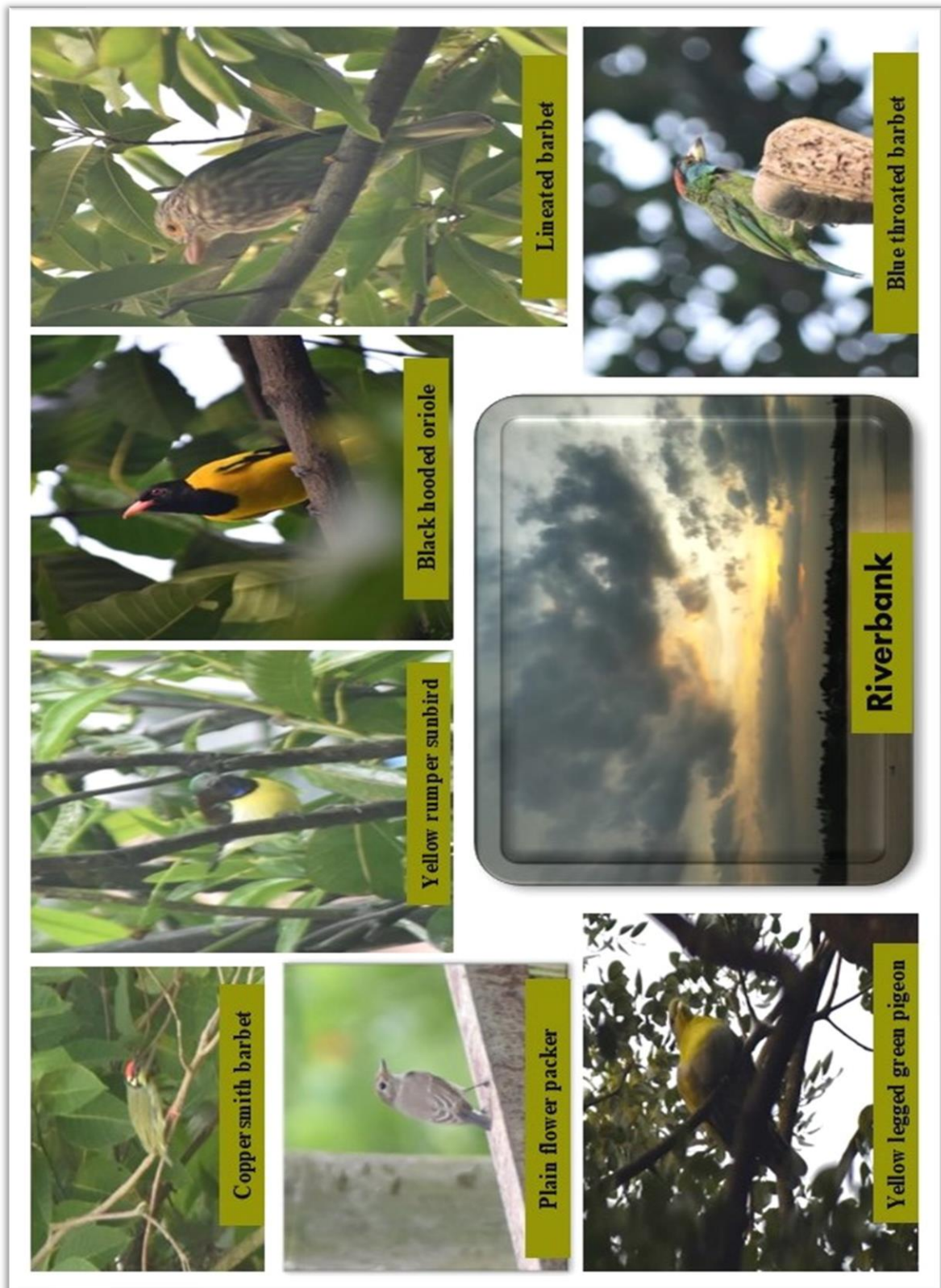
Due to loss of natural habitats habitat specialists are gradually replaced by habitat generalists. Site specific biodiversity indices reflect the occurrence pattern of avifauna. Shannon-Weiner Diversity Index values [except low value for wetland (2.80)] & Pielou's Evenness index values are almost similar in all the habitats (Table 4; Fig. 8). Species dominance is found high (0.61) in and around Grassland (Table 4). Though a very little differences are observed in all 5 habitats, no. of individuals are more in and around Riverbanks mainly for diverse vegetation. Riverbanks & Grassland have highest similarity index (61.29) in terms of species composition (Table 5).



(A)



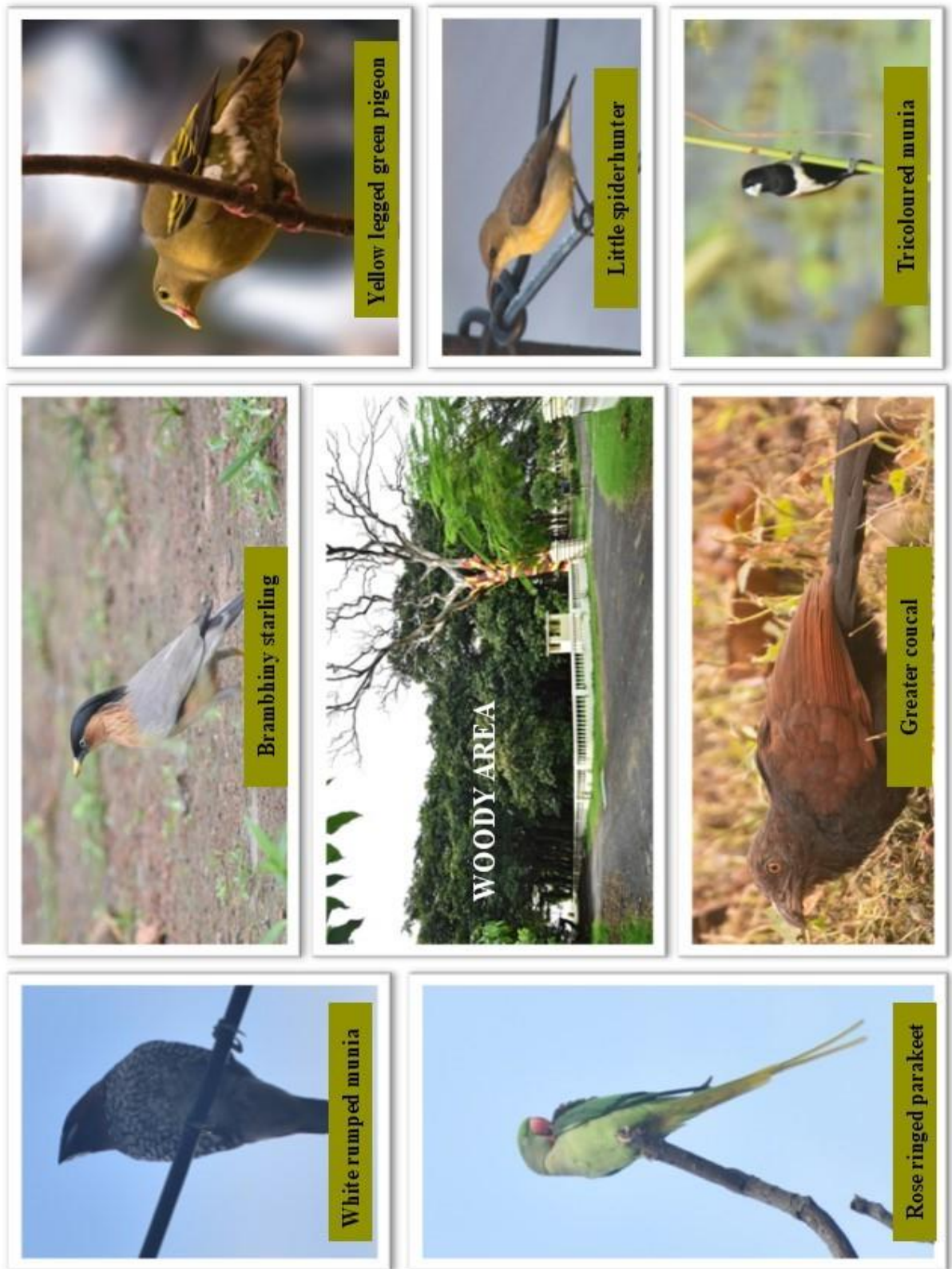
(B)



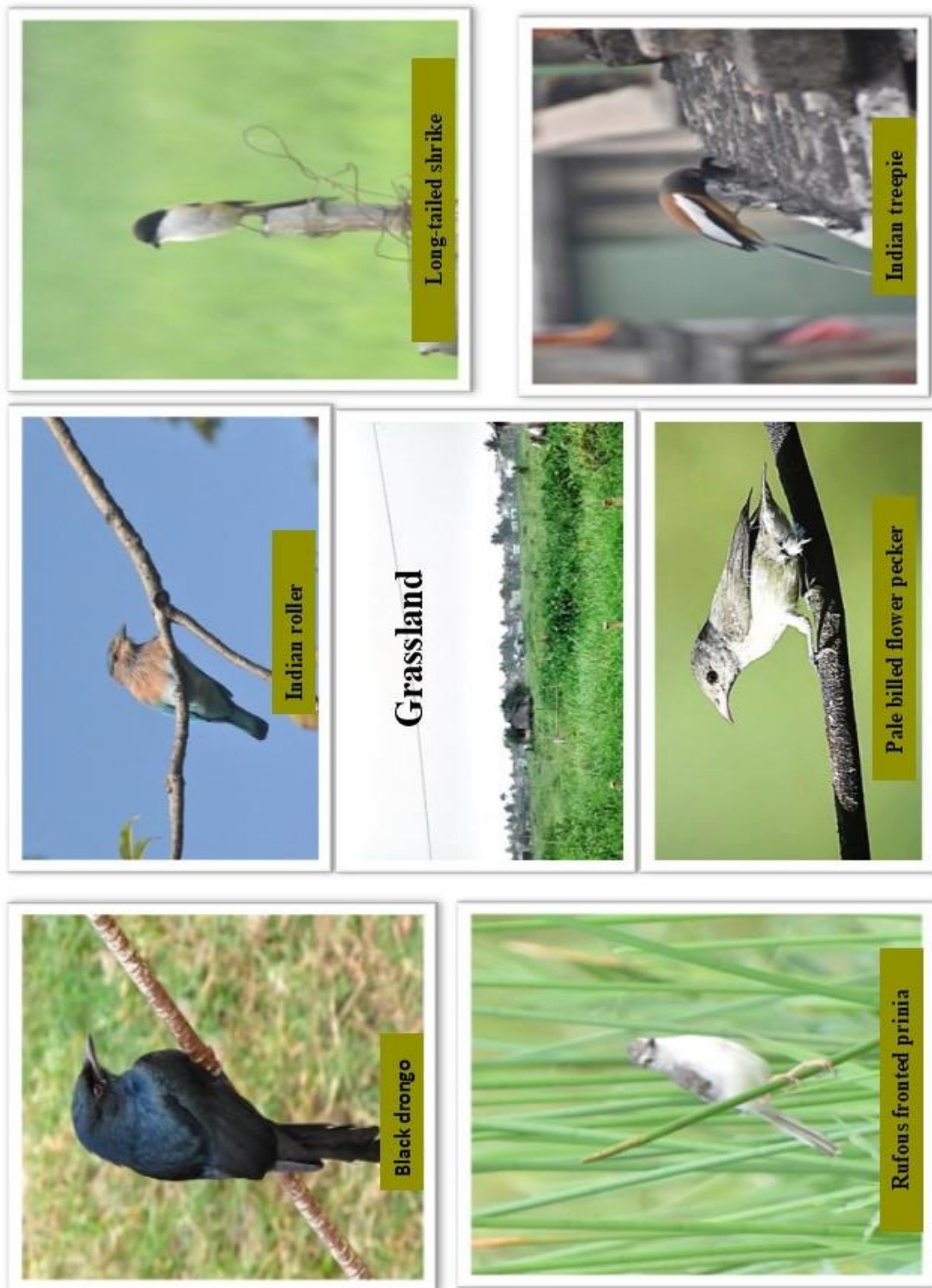
(C)



(D)



(E)



(F)

Figs. 6(A-F). Birds encountered during survey.

Human Habitat has highest species richness (2.97), followed by Woody Area (2.69) > Grassland (2.56) > Wetland (2.47) > Riverbank (2.31) (Table 4).

Human habitats are enjoyed by most no. of species, probably due to presence of various resource materials (garbage & thrown away foods) in large amount that are exploited by the birds. Areas having human settlements showed more opportunistic ones (eg. jungle babblers, treepies, etc). An overall negative impact of human settlements on avian population and abundance is evidenced from the present study. No seasonal variations are observed in context to total species or individuals percentage (Table 6). However, more intensive study is needed to elaborate the explanation of diversity, distribution and abundance of avifauna in Barrackpore and its' surrounding areas.

Table 3. The bird species encountered in Barrackpore & surrounding areas, North 24 Parganas, West Bengal, India, along with respective habitats
[Legends: HH = Human habitat, RB = Riverbank, WA = Woody Area, GL = Grassland, WL = Wetland].

Common Name of Bird	Scientific Name of Bird	Family	Ecological status	HH	RB	WA	GL	WL
Lesser spotted eagle	<i>Clanga pomarina</i>	Accipitridae	Least Concern	✓		✓	✓	
White breasted kingfisher	<i>Halcyon smyrnensis</i>	Alcedinidae	Least Concern (Population increasing)		✓		✓	✓
Cattle egret	<i>Bubulcus ibis</i>	Ardeidae	least concern	✓	✓	✓		✓
Indian pond heron	<i>Ardeola grayii</i>	Ardeidae	Least Concern					✓
Chinese pond heron	<i>Ardeola bacchus</i>	Ardeidae	Least Concern					✓
Little egret	<i>Egretta garzetta</i>	Ardeidae	Least Concern	✓				✓
Night heron	<i>Nycticorax nycticorax</i>	Ardeidae	Least Concern (Population stable)					✓
Openbill Stork	<i>Anastomus oscitans</i>	Ciconiidae	Least Concern (Population stable)					✓
Common tailorbird	<i>Orthotomus sutorius</i>	Cisticolidae	Least Concern (Population stable)	✓	✓			
Rufous fronted prinia	<i>Prinia buchanani</i>	Cisticolidae	Least Concern (Population stable)			✓	✓	
Blue rock pigeon/Rock Dove	<i>Columba livia</i>	Columbidae	Least Concern	✓		✓		
Spotted dove	<i>Streptopelia chinensis</i>	Columbidae	Least concern	✓	✓	✓	✓	✓
Yellow legged green pigeon	<i>Treron phoenicoptera</i>	Columbidae	least concern		✓	✓		
Eurasian Collared dove	<i>Streptopelia decaocto</i>	Columbidae	Least Concern	✓		✓	✓	

Indian roller	<i>Coracias benghalensis</i>	Coraciidae	Least Concern		✓	✓	✓	
Indian Treepie	<i>Dendrocitta vagabunda</i>	Corvidae	Least Concern (Population stable)	✓	✓	✓	✓	
House crow	<i>Corvus splendens</i>	Corvidae	Least Concern	✓	✓	✓	✓	✓
Asian koel cuckoo	<i>Eudynamis scolopaceus</i>	Cuculidae	Least Concern (Population stable)	✓	✓			
Greater coucal	<i>Centropus sinensis</i>	Cuculidae	Least Concern (Population stable)	✓		✓		
Pale billed flowerpecker	<i>Dicaeum erythrorhynchos</i>	Dicaeidae	Least Concern	✓			✓	
Plain flowerpecker	<i>Dicaeum minullum</i>	Dicaeidae	Least Concern (Population stable)	✓	✓	✓	✓	
Black drongo	<i>Dicrurus macrocercus</i>	Dicruridae	Least Concern	✓	✓	✓	✓	✓
White-rumped munia	<i>Lonchura striata</i>	Estrildidae	Least Concern			✓	✓	✓
Tricolored Munia	<i>Lonchura malacca</i>	Estrildidae	Least Concern (Population stable)			✓	✓	✓
Common swallow	<i>Hirundo rustica</i>	Hirundinidae	Least Concern			✓		✓
Bronze winged jacana	<i>Metopidius indicus</i>	Jacaniidae	Least Concern					✓
Long tailed shrike	<i>Lanius schach</i>	Laniidae	Least Concern (Population stable)					✓
Jungle babbler	<i>Turdoides striata</i>	Leiothrichidae	Least Concern (Population stable)	✓	✓	✓	✓	✓
Blue throated barbet	<i>Megalaima asiatica</i>	Megalaimidae	Least Concern		✓	✓		
Lineated barbet	<i>Megalaima lineata</i>	Megalaimidae	Least Concern (Population stable)		✓		✓	
Coppersmith barbet	<i>Megalaima haemacephala</i>	Megalaimidae	Least Concern (Population stable)	✓	✓			
Green bee eater	<i>Merops orientalis</i>	Meropidae	Least Concern (Population stable)		✓	✓	✓	
Oriental magpie robin	<i>Copsychus saularis</i>	Muscicapidae	Least Concern (Population stable)	✓	✓	✓	✓	
Little spider hunter	<i>Arachnothera longirostra</i>	Nectariniidae	Least Concern	✓			✓	
Yellow rumped Sunbird	<i>Indet</i>	Nectariniidae	Least Concern	✓	✓			
Black headed oriole	<i>Oriolus xanthornus</i>	Oriolidae	Least Concern	✓	✓		✓	
House sparrow	<i>Passer domesticus</i>	Passeridae	Least Concern	✓	✓		✓	
Indian shag	<i>Phalacrocorax fuscicollis</i>	Phalacrocoracidae	Least Concern	✓				✓

Little cormorant	<i>Microcarbo niger</i>	Phalacrocoracidae	Least Concern	✓				✓
Lesser golden beaked woodpecker	<i>Dinopium benghalense</i>	Picidae	Least Concern	✓	✓	✓		
Streaked weaver bird	<i>Ploceus manyar</i>	Ploceidae	Least Concern (Population stable)			✓	✓	
Rose ringed parakeet	<i>Psittacula krameri</i>	Psittaculidae	Least Concern		✓	✓	✓	
Alexandrine parakeet	<i>Psittacula eupatria</i>	Psittaculidae	Least Concern		✓		✓	
Red vented Bulbul	<i>Pycnonotus cafer</i>	Pycnonotidae	Least Concern	✓	✓	✓	✓	✓
Red whiskered bulbul	<i>Pycnonotus jocosus</i>	Pycnonotidae	Least Concern (Population decreasing)	✓	✓	✓	✓	
White breasted waterhen	<i>Amaurornis phoenicurus</i>	Rallidae	Least Concern					✓
Common myna	<i>Acridotheres tristis</i>	Sturnidae	Least Concern	✓	✓	✓	✓	✓
Jungle myna/Javan myna	<i>Acridotheres javanicus</i>	Sturnidae	Least Concern	✓		✓	✓	
Asian pied starling	<i>Gracupica contra</i>	Sturnidae	Least Concern		✓	✓	✓	
Brambhiny Starling	<i>Sturnia pagodarum</i>	Sturnidae	Least Concern		✓	✓	✓	

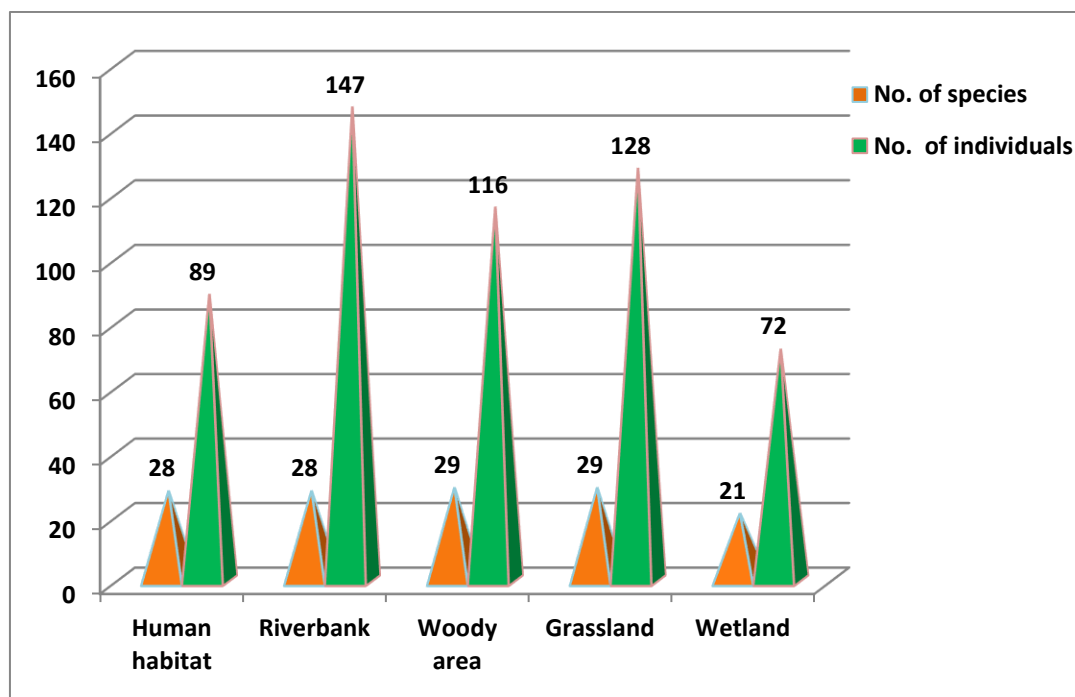
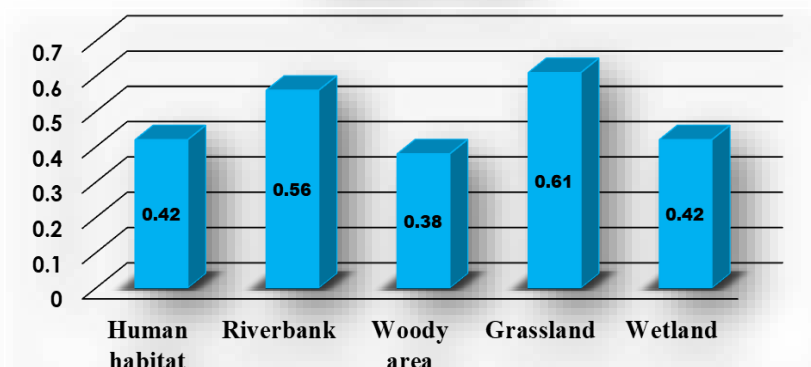


Fig. 7. Habitat wise total no. of recorded avian species & individuals.

Table 4. Habitat wise calculated diversity indices.

Diversity Indices	Human habitat	Riverbank	Woody area	Grassland	Wetland
Margalef's index	6.01	5.41	5.89	5.77	4.67
Simpson index	0.42	0.56	0.38	0.61	0.42
Shannon Wiener index	3.14	3.17	3.15	3.13	2.8
Hmax	3.33	3.33	3.37	3.37	3.04
Pielou's Evenness index	0.94	0.95	0.94	0.93	0.92
Species Richness	2.97	2.31	2.69	2.56	2.47

Simpson Index



Margalef's Index

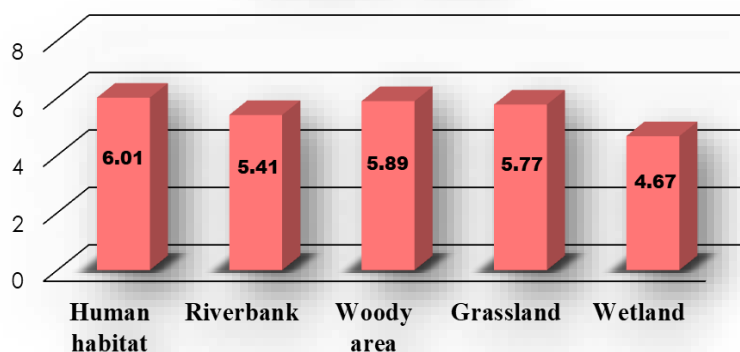


Fig. 8(A). Graphical representation of habitat wise diversity indices.

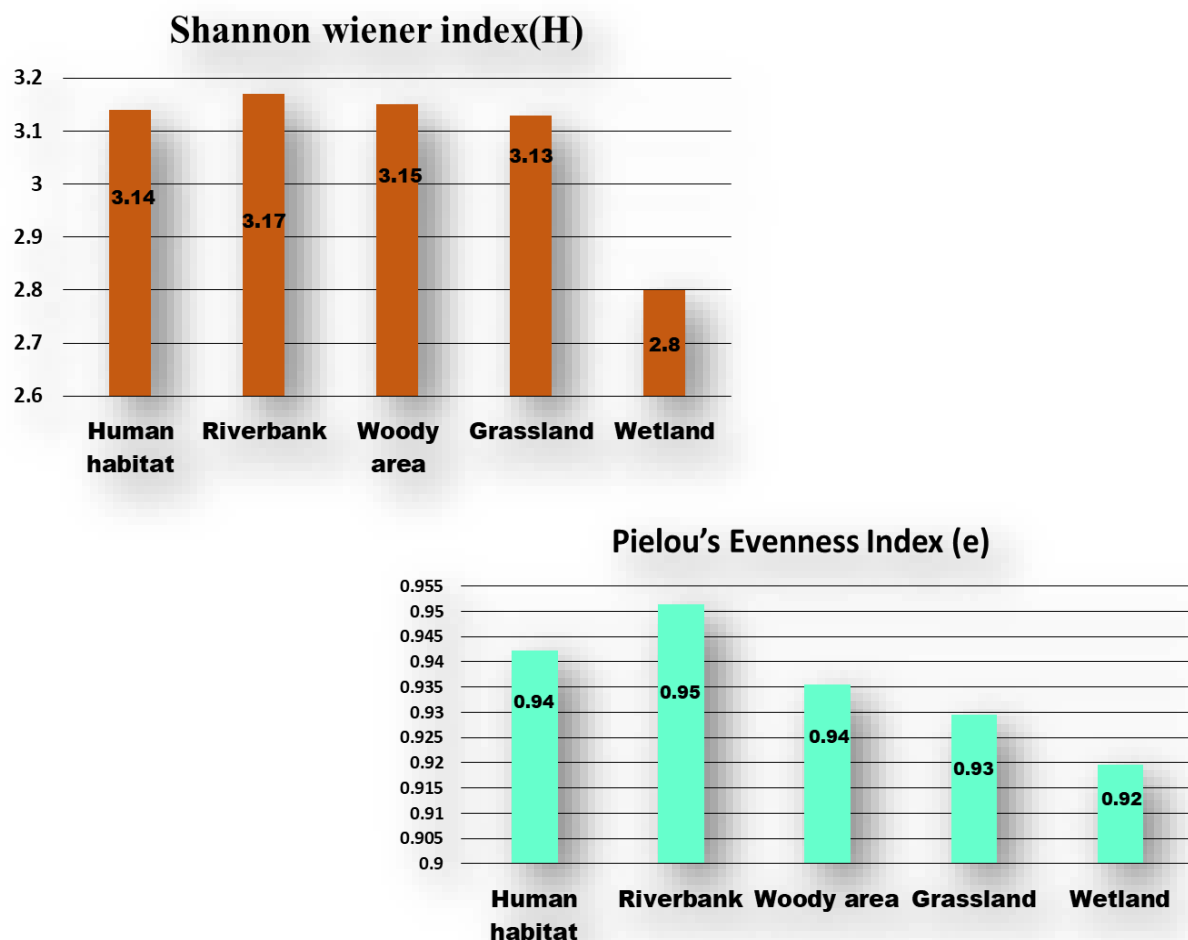


Fig. 8(B). Graphical representation of habitat wise diversity indices.

Table 5. Similarity Index of Habitat.

Habitat type	Human habitat	River bank	Woody area	Grassland	Wetland
Human habitat	-----	48.65	42.50	44.44	27.78
River bank		-----	50.0	61.29	19.51
Woody area			-----	60.00	23.08
Grassland				-----	21.43
Wetland					-----

Table 6. Species (Individual) Percentage (Season wise).

Season Habitat type	Pre-monsoon (%)	Monsoon (%)	Post-monsoon (%)
Human habitat	89.29 (39.33)	64.29 (23.60)	96.43 (37.08)
Riverbank	78.57 (28.57)	100.00 (36.73)	85.71 (34.69)
Woody area	93.10 (33.62)	51.72 (27.59)	89.66 (38.79)
Grassland	100.00 (35.16)	82.76 (22.66)	93.10 (42.19)
Wetland	76.19 (38.89)	85.71 (33.33)	57.14 (27.78)

4. CONCLUSION

One severe problem experienced during this study is that, the natural habitats for these avian species are being destroyed at an alarming rate due to anthropogenic activities. To save this urban avifaunal diversity, it is essential to raise awareness among the local people regarding the ecosystem and the environment.

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