

Assessment of Bird Diversity and Abundance in Karra River Basin, Hetauda, Makawanpur Kanchan Parajuli¹

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Abstract

The main objective to carry out this study was to determine seasonal diversity, abundance, and ongoing threats to birds of the Karra river belt, Hetauda, Nepal. This study is based on observation. The bird survey methods and threat assessment techniques were used to analyse the data. A total of 153 bird species were recorded belonging to 15 orders and 38 families. Order Passeriformes was found dominating order with 70 species. Among 153 species, 98 species were residents, 37 species were winter visitors, 17 species were summer visitors, and one species was found, vagrant. One-way ANOVA revealed that there was a significantly different ($F = 0.8872$, $df = 2$, $P < 0.0422$) in bird diversity in three different blocks in two different seasons. The Shannon winner diversity index shows that the winter season ($H=1.86$) was more diverse than the summer season ($H=1.62$). The evenness index showed that birds were evenly distributed in the winter season ($E=0.8815$) and then summer ($E=0.8761$). Bird species richness was found high (126) in moderately disturbed land use type (block 2) than other supporting intermediate disturbance hypotheses. Out of 153 birds recorded, 26 were common in their relative abundance. Habitat destruction, pollution in the industrial belt, mining, overfishing, poaching, and keeping of cage birds, and lack of awareness were the major threats to birds around the study area.

Keywords: abundance, bird diversity, Hetauda, Karra River, threats

1. Introduction

Birds are ecologically important creatures and Nepal is remarkably blessed with prosperous avian diversity. A total of 886 bird species have been recorded in Nepal (DNPWC and BCN 2018). The reason for richness in avian diversity is due to amazingly diverse climatic and topographical variations within the country that have provided a variety of forest and ecosystem types.

Birds occupy an extremely diverse range of niches within riparian systems and are sensitive indicators of environmental conditions (Temple and Wiens, 1989). Riparian habitats are also called as ‘ribbons of life’ since they are considered among the most productive habitat (Johnson et al. 1977, Chaney et al. 1990). Rivers are the important ecological corridors that play an important role in the life of water-dependent species such as water birds, crustaceans, fishes and herpetofauna (Ambrose et al. 2000, Kopij 2001). Floodplain and riparian habitat is very important water bird breeding habitat and a better understanding of this area is an important research priority (Anthony 1997). Research has shown that riverine zone must meet certain minimum width criteria to provide suitable habitat for most bird species (Fischer 2000). That is why studies on bird diversity and its relation to river width are very essential for bird conservation. Lowland river basin of Nepal is a paradise for many species of flora and fauna. More than half of the birds are found in low land alluvial floodplain of Nepal.

So, this study was carried out to collect baseline data on the species richness, seasonal diversity, relation of river width to bird diversity, and major threats to birds which give an

important contribution to a better understanding of water birds of Karra River and also provide basic information necessary for the conservation of avifauna of this area.

2. Objectives

The main objective was to explore the seasonal diversity and relative abundance of birds in different land use types around the Karra River. The specific objectives were:

- To explore the seasonal variation in bird diversity around the Karra river
- To compare bird diversity and relative abundance on three different land use type
- To identify major threats and threatened species of Karra river

3. Study Area:

Study area lies in Hetauda Sub-metropolitan city of Makwanpur district which is surrounded by the Mahabharat range in the north and the Churia range in the south. It is also called Inner Tarai region of Rapti valley and average elevation is 450 m from sea level (UNDP/ERRRP 2009). Climate of Hetauda valley is humid subtropical monsoon. Temperature condition of Hetauda varies from quite hot in summer and warm in winter. The average annual precipitation is little more than 2,200 mm of which about 80% falls during the monsoon period in mid-June to October (UNDP/ERRRP 2009).

Lithologically, the region consists of sandstones, mudstone and conglomerate UNDP/ERRRP (2009) moreover flood plain deposits consist of boulder to sand size sediments of quartzite, gneiss, dolomites and limestone of the lesser Himalayan rocks and sandstone of the Siwalik rocks. Karra River is a small sized perennial river originated from North-eastern Siwalik Hill and flows towards west to join with the Rapti River, near Hetauda city. The Karra River flows towards North-west and receives water from several streams. The flow of the Karra River during the pre-monsoon months is $0.84\text{m}^3/\text{s}$ and minimum flow was reported to vary within 0.65 and $0.75\text{m}^3/\text{s}$ during April-May (Pradhanang, 2010). It is polluted river of Makwanpur district. The study shows that upstream of the River water sample is good but as it enters the industrial belt, it gets loaded with pollutants mainly from industrial effluent (Pradhanang, 2010).

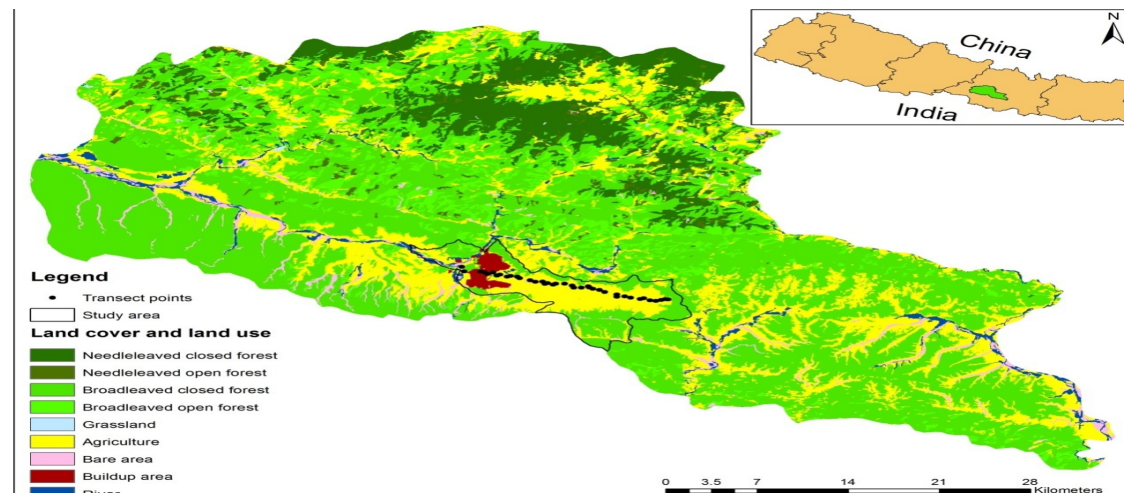


Fig 1: Study area

4. Materials and Methods:

4.1. Bird survey methods:

Line transect methods are highly adaptable and efficient methods for surveying birds of extensive open habitats, e.g. shrub-steppe and moorland, offshore seabirds, and water birds (Sutherland 2006). Therefore, line transect methods were used for recording the birds that have been seen or heard on either side of the river. Only the birds observed in front or on

either side of the observer were recorded, those behind were not. To minimize the disturbance, line transects were walked alone at a constant speed. Care was taken to avoid double-counting mobile species like aerial foragers, raptors, etc. In each sharp turn of the river, each new direction was treated as a new start to the next transect.

Birds were observed within the months of December/January (winter) and May/June 2015 (summer) during the study. Birds were observed from 7:00 am to 10:00 am in the morning. Three days were spent in each block and 27 hours were spent in each season in the field. Only the bird heard and seen within the band up to 50m on either side of the transect were recorded. Bird censuses were not carried out on rainy, windy, and cloudy days to avoid biases due to changes in the intensity of bird activities.

Bushnell binoculars of magnification 10×40 were used for confirming identification and Canon camera 50X for photography. Birds were identified by using field guide books of Birds of Nepal (Grimmet et al. 2003). Unknown photographs and calls were recorded and identified later with the help of a bird expert in Kathmandu.

The statuses of residential and migratory birds, terrestrial and aquatic birds, were assessed with the help of a field guidebook of birds of Nepal.

4.2. Threat Assessment

Based on the preliminary survey, possible threats were categorized into five major types of habitat fragmentation and degradation, industrial and household effluents, poaching, fishing, and mining. Extents of threats were identified by counting the total sites where the sign of each threat type was observed. Threats like grazing; cutting trees, fire, etc. were categorized in the title Habitat fragmentation and degradation. Similarly, other threats were also categorized in respective threat titles.

The category of threatened birds' status was identified with the help of the IUCN and CITES threat categories. It was categorized as critically endangered, endangered, vulnerable, near threatened, and to respective CITES appendix.

4.3. Data analysis

All the collected data were entered into an excel sheet and analyzed using appropriate statistical tools. Shannon Weiner's diversity index was used to calculate the species diversity of a particular area which is calculated as: $H' = -\sum (n_i/N) \log (n_i/N)$ Or, if $P_i = n_i/N$. Where, H' = Index of species diversity, P_i = the proportion of individuals in the i^{th} species, n_i = Importance value for each species (number of individuals), N = Total importance value (Total number of individuals).

To calculate whether species were distributed evenly across seasons and across different land use types, an evenness index was used. It was determined by the equation, $E = H'/\log S$. Where H' = Shannon-Wiener's diversity index, S = Species richness is the total number of species.

The relative abundance of avian species was determined by using encounter rates that give crude ordinal scales of abundance (abundant, common, frequent, uncommon, and rare) (Bibby et al. 1992, 1998). The encounter rate was calculated for each species by dividing the number of birds recorded by the number of hours spent searching, in order to get a figure of birds per hour for each species. These were categorized in crude ordinal scales of abundance as follows:

Table 1 Using encounter rates to give a crude ordinal scale of abundance

Abundance category (number of individuals/10 field hours)	Abundance score	Ordinal scale
<0.1	1	Rare
0.1 - 2.0	2	Uncommon
2.1 - 10.0	3	Frequent
10.1 - 40.0	4	Common
40.0 +	5	Abundant

Source: (Lowen et al. 1996)

5. Result and Discussion

5.1. Seasonal diversity and variation of birds of Karra River

A total of 153 species of birds were recorded from Karra River belonging to 15 orders and 38 families (Appendices 1). Order Passeriformes has the highest diversity (70 species from 11 families) followed by Ciconiforme (23 species and five families), Coraciiform (ten species and five families), Falconiformes (nine species and three families), Cuculiform and Anseriforme (eight species in each family), Pisiforms (four species and two families), Psittaciforme (four species and one family) Columbiforme (four species and one family), Strigiform (three species and one family), Gruiforme (three species and one family), Galliforme (two species and one family), Apodiforme (two species and two families), Pelecaniforme (two species and one family) and Upipiforme one species and one family (Appendices 3). Similarly, the family Corvidae had a higher number of bird species (17).

Significant variation in diversity ($F = 0.8429$, $df = 2$, $P < 0.04316$) was found between summer and winter seasons with one hundred thirty species in winter seasons belonging to 15 orders and 38 families and seventy-four species in summer seasons belonging to 14 orders and 28 families. Shannon winner diversity index shows that the winter season ($H = 1.86$) had a more diverse bird assemblage than the summer season ($H = 1.62$) (Table: 3). Evenness index also showed that birds were more evenly distributed in the winter season ($E = 0.8815$) than summer ($E = 0.87$).

Among 153 species, 64% species of birds were resident, 24% of species were winter visitor, 10% species were summer visitor, and the remaining 2% was irregular visitor (Appendices 1). Among resident birds, Common Myna, Plain Martin, Grey-breasted Prinia, Cattle Egret, House Crow, Asian Pied Starling, Red-vented Bulbul, Pied Bushchat, Indian Pond Heron, Common Tailorbird, Spotted Dove, Rose-ringed Parakeet, Plum-headed Parakeet, and Blue Rock Pigeon were very common birds in all three blocks in both seasons with more than 100 individuals in each species (Appendice1). Most of the migratory birds were wetland birds like Ruddy Shelduck, Bar-headed Goose, Mallard, Garganey, Common Merganser, Cotton Pigmy Goose, Eurasian Wigeon, Greater Cormorant, Common Greenshank, Common Sandpiper, Common Snipe, Grey-headed Lapwing, Little-ringed Plover, Common Coot, Common Moorhen, Striated Heron, Cinnamon Bittern, Black Stork, Pallas's Fish Eagle, Osprey, White-capped Water Redstart, Plumbeous Water Redstart, Black-capped Kingfisher, etc. Fifty-three of the total migratory birds were wetland birds.

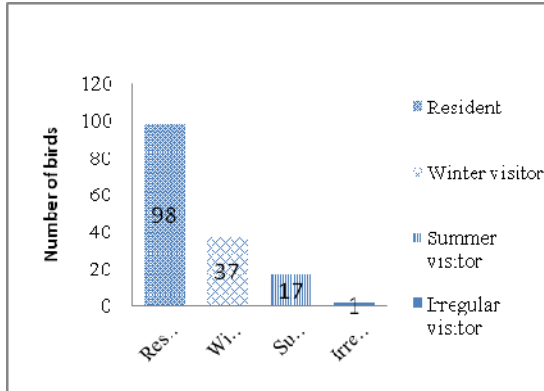


Figure 2: Migration Status of Birds recorded in graph shows the Karra River, Hetauda of species seen during of species seen during winter seasons.

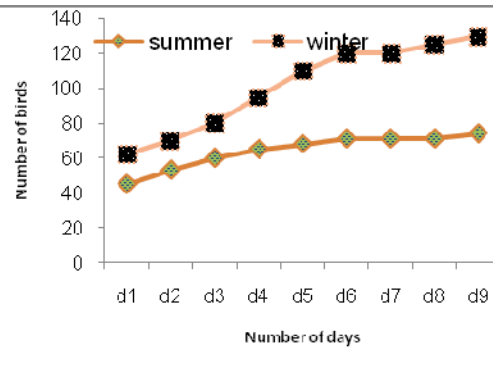


Figure 3: Species discovery curve: the cumulative total number the summer and winter seasons.

The species discovery curve showed that the frequency of adding new birds to the list was more in the winter season than summer season (fig 3). Curves show a rapid rise in the winter season and a slow rise in the summer season. At the start of the field survey, every species recorded was new species and as the time spent increased, fewer new species were recorded. The curve is not saturated and still rising upward. So there are still chances to record new birds.

5.2. Bird diversities and relative abundance in different land use types

Out of 153 bird species, 26 were common in its relative abundance with encounter rates 10-40, 49 species were frequent with encounter rates 2-10, 73 species were uncommon with encounter rates 0.1-2 and one species- Common Myna (encounter rate- 47.77) were found abundant.

Bird abundance was higher during winter season than summer season. Out of 130 winter species, 41 species were uncommon, 50 species were frequent, 35 species were common and four species were abundant (Figure 5). Common Stonechat, Pied Bushchat, Common Myna and Grey-breasted Prinia were more abundant during winter season (Appendices 1). Out of 74 summer species, 24 species were uncommon, 24 species were frequent, 25 species were common and one species Plain Martin (43.70) was abundant (Figure 5).

Among three different blocks, block 2 was found more diverse and abundant than other blocks (Table 2) which were moderately disturbed land use types with assorted vegetation types. The intermediate disturbance hypothesis also claims that higher species richness is found in moderately disturbed habitats. The presence mixed vegetation types in block 2 with patchy woody vegetation, grasslands, fruiting trees around the settlements, and farmlands might have supported a large number of birds. The heterogeneous vegetation cover in the disturbed habitat might provide various prey species for insectivorous birds and also provide more niches and diverse way of exploiting environmental resources thus increasing species diversity (Bazzaz, 1975).

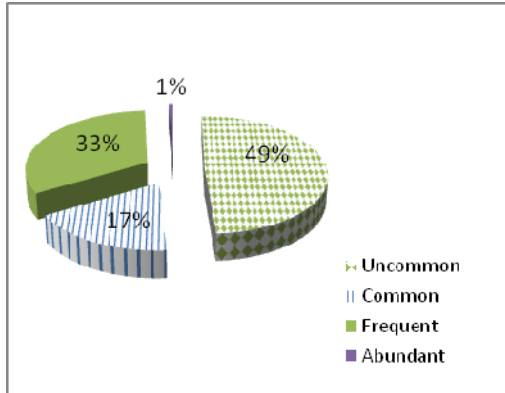


Figure 4: Pie chart showing percentage of Local of bird species abundance status of birds

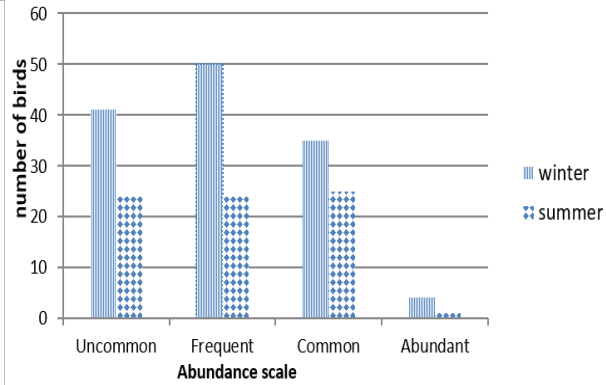


Figure 5: status of local abundant category between two seasons

Table 2 Status of birds in winter and summer season with their diversity index and evenness index

Seasons	Block	Family	Order	Number of species	Number of individuals	Shannon's index	Evenness index
summer	B1	28	14	53	638	1.59	0.929
	B2			63	731	1.62	0.909
	B3			43	624	1.48	0.911
winter	B1	38	15	75	964	1.74	0.931
	B2			100	1186	1.81	0.906
	B3			71	897	1.72	0.920

Forty-eight species (1034 individual) of aquatic and 105 species (4006 individuals) of terrestrial birds were recorded. Shannon winner diversity index showed that terrestrial species were more diverse ($H=1.723$) than aquatic ($H=1.2988$). Many aquatic species including winter migratory ducks were observed in block 2 and 3. Some rare aquatic raptor like Pallas's Fish Eagle and Osprey were recorded in block 2 near Fisheries development center, Hetauda (FDCH). Cormorant and whistling duck were found common around the Kampadanda site of Block 2 which was near to FDCH. Single Black Bittern were also observed inside the dense grasslands at the river edge on block 2. Siberian duck like Ruddy Shelduck, Common Merganser, Bar-headed Goose, Mallard, and Eurasian Wigeon were observed in downstream of Block 3 although upstream of block 3 was highly disturbed and less diverse. Some birds like Cotton Pigmy Goose, Black-capped Kingfisher, Red-breasted Parakeet, Black Stork, Lesser Adjutant Stork, Striated Heron, Oriental Honey Buzzard, Collared Falconet, Grey-billed Cuckoo, Common Moorhen and Large Wood Shrike were recorded only from block 1 showing their elusive nature and indicator of good ecosystem. Similarly, bird species richness was found high in the area where the river width is buffered with good vegetation structure. Vegetation at the edge of river protect water quality and provide good habitat for plant and animals and also provide corridors for movement of wild life from one habitat to other.

5.3. Major threats to Karra's birds

Habitat fragmentation and degradation were found as serious threats to avian community in all block. Block 3 was seriously affected which lies in industrial belt. Industrial and household effluents was high in block three, low in block two and no any effluents were observed in block one. Poaching activities were observed in all blocks however it was high in

block two and three. Local ethnic group mainly below the age of twenty were found engaged in poaching by using catapult. Mining was found high in block 3 than other block. Mining activities includes trade of sand, soil, gravel etc. Many people were found involved in fishing by using net, electricity, dhadiya, etc. fishing were high in block three in comparison to other block. Overfishing leads to mark decline in fish which poses serious threats to all fish-eating birds such as Pallas’s Fish Eagle, Black-bellied Tern, Indian Skimmer, and Tawny Fish Owl (BCN and DNPWC 2011), so the Karra river is definitely not away from the problem.

The upstream belt of the Karra river habitat is good for birds but as it enters the industrial belt, it gets loaded with industrial effluents, household effluents and other dumped pollutants from the urban site posing serious threats to aquatic birds.

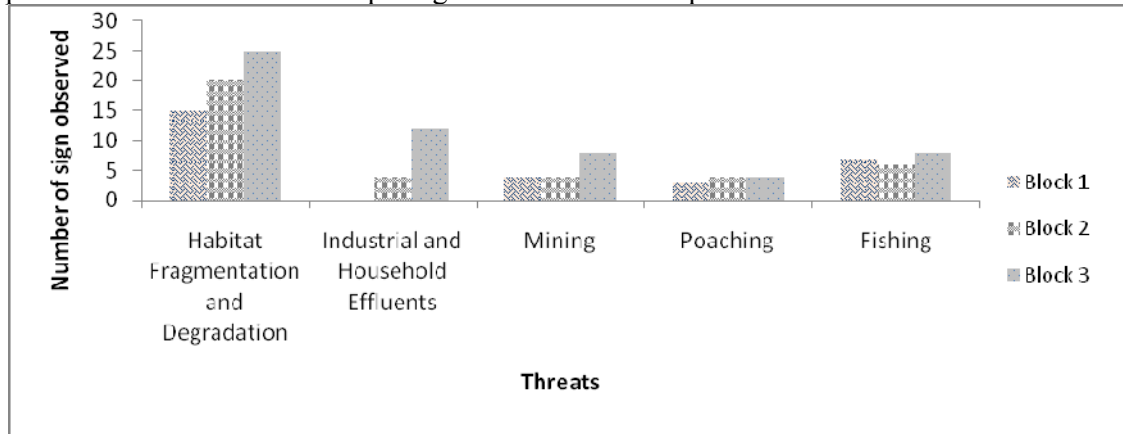


Figure 5: Chart showing extent of threats in each block which show number of sign observed in each threats title in all block



Figure 6: Threats observed in Karra’s Birds.

1. Plum-headed Parakeet in cage.
2. People fishing in the river
3. Mining of sand and gravel

Sixteen nationally threatened bird species and sixteen species of birds listed in CITES category II were recorded. Among sixteen species of nationally threatened birds, two were globally threatened (Pallas’s fish Eagle and Lesser Adjutant Stork) (Table 3).

Table 3: Status of threatened birds on the basis of National Red List Series 2015 and CITES category. Regionally Extinct (RE), Threatened (Critically Endangered (CR), Endangered (EN) and Vulnerable (VU)) and Near Threatened (NT).

RE	CR	EN	VU	NT	CITES category
	Pallas’s Fish Eagle	Black Bittern	Red-breasted Parakeet	Bar-headed Goose	Common Kestrel II
			Lesser Adjutant	Alexandrine Parakeet	Collared Falconet II
			Gargany	Greater Cormorent	Common Buzzard II
			Cotton-pigmy Goose	Ruddy Shelduck	Crested Serpent Eagle II
			Black Stork	Collared Falconet	Pallas’s Fish Eagle II
			Asian Openbill	Yellow-bellied Prinia	Black Kite II
				Plain Martin	Black-shouldered Kite II
				Baya Weaver	Osprey II
					Spotted Owlet II
					Jungle Owlet II
					Asian Barred Owlet II
					Black Stork II
					Red-breasted Parakeet II
					Plum-headed Parakeet II
					Alexandrine Parakeet II
					Rose-ringed Parakeet II

6. Conclusion and Recommendations

The study area was found rich in avian diversity. Variations of bird diversity were observed in different seasons in different land use types. Bird diversity and abundance were found significantly affected by different land use types and vegetation. Block two which contain assorted vegetation types with moderately disturbed habitats were found highly diverse supporting the intermediate disturbance hypothesis as compared to another block.

Bird species richness was found high in the area where river width is buffered with good vegetation structure. 64 percent of the total bird recorded residents, 24 percent of the total birds recorded were winter visitors and 10 percent were summer visitors. In addition, from the 154 identified bird species, Common Myna (*Acridotherestrictis*) was found numerically the most abundant bird species with an abundance scale of 47.78, indicating an adaptation of the species to different types of habitat.

The data clearly shows that the region is a good wintering ground for many winter migratory birds including Siberian ducks and furthermore the record of critically endangered bird-like Pallas’s Fish Eagle and least sighting birds like Black-capped Kingfisher has expanded its importance. The region is also a good habitat with pristine vegetation covering

with few exception and farmlands along the belt supports good number of resident and summer migratory birds. Habitat fragmentation and degradation, pollution at the industrial belt, overfishing, poaching, mining and lack of awareness were the major threats to birds around the study area. Based on this research, following recommendation were made which will be useful for the conservation and further study of avian fauna of Karra river belt, Hetauda.

- To encourage a diverse avian community along riparian habitat, buffer strip of vegetation should be maintained on both side of river. Buffer strip should be as wide as possible and relatively free from human land use that potentially impacts on birds. Landowner /farmer along the edge of the river should be encouraged to replant and protect tree.
- Waste water from industry and household effluents should be treated effectively before discharging out to river. There is an urgent need of Strict policy and monitoring from the government sector for effluent discharge from industry and household into the river
- Poaching, keeping of cage birds, overfishing, and use of pesticides should be controlled and an awareness program about the importance of birds should be launched for long-term conservation of birds.

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Appendices 1

1. Checklist of bird species recorded during field visit

S. N	C.N	Scientific name	No	Abu.	L. Abu .C	W V	SV	CS	M.S	Habitat
		Order: Galliformes								
		Family: Phasinadae								
1	Black Francolin	<i>Francolinus francolinus</i>	38	7.037	F	+	+	LC	R	T
	Red-jungle Fowl	<i>Gallus gallus</i>	7	1.296	U	+	+	LC	R	T
		Anseriformes								
		Anatidae								
3	Bar-headed Goose	<i>Anser indicus</i>	1	0.185	U	+		NT	WV/PM	A
4	Cotton Pigmy Goose	<i>Nettapus coromandelianus</i>	1	0.185	U		+	VU	SV	A
5	Ruddy Shelduck	<i>Tadorna ferrogenea</i>	12	2.22	F	+		NT	WV	A
6	Eurasian Wigeon	<i>Anas penelope</i>	5	0.925	U	+		LC	WV/PM	A
7	Mallard	<i>Anas platyrhynchos</i>	3	0.56	U	+		LC	WV/PM	A
8	Garganey	<i>Anas querquedula</i>	4	0.74	U	+	+	VU	PM/RWV	A
9	Common Merganser	<i>Mergus merganser</i>	6	1.1	U	+		LC	WV	A
		Dendrosygnidae								
10	Lesser Whistling Duck	<i>Dendrocygna javanica</i>	20	3.7	F	+		LC	R	A
		Piciformes								
		Picidae								
11	Rufous Woodpecker	<i>Celeus brachyurus</i>	3	0.56	U	+	+	LC	R	T
12	Grey-capped Pigmy Woodpecker	<i>Dendrocopos canicapillus</i>	2	0.37	U		+	LC	R	T
		Megalaimidae								
13	Great Barbet	<i>Megalaima virens</i>	2	0.37	U	+		LC	R	T
14	Coppersmith Barbet	<i>Megalaima haemacephala</i>	13	2.407	F	+	+	LC	R	T
		Upupiformes								
		Upupidae								
15	Common Hoopoe	<i>Upupa epops</i>	31	5.74	F	+	+	LC	R	T
		Coraciiformes								
		Coraciidae								
16	Indian Roller	<i>Coracias bengalensis</i>	51	9.45	F	+	+	LC	R	T
		Alcedinidae								
17	Common Kingfisher	<i>Alcedo atthis</i>	23	4.259	F	+		LC	R	A

	Decelonidae										
18	Stork-billed Kingfisher	<i>Pelargopsis capensis</i>	2	0.37	U	+		LC	R	A	
19	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	67	12.41	C	+	+	LC	R	A/T	
20	Black-capped Kingfisher	<i>Halcyon pileata</i>	2	0.37	U	+	+	LC	IV	A	
	Cerylidae										
21	Crested Kingfisher	<i>Megaceryle lugubris</i>	2	0.37	U	+		LC	R	A	
22	Pied Kingfisher	<i>Cerylerudis</i>	10	1.851	U	+		LC	R	A	
	Meropidae										
23	Green Bee-eater	<i>Merops orientalis</i>	53	9.81	F	+	+	LC	R/SV	T	
24	Blue-tailed Bee-eater	<i>Merops philippinus</i>	47	8.703	F		+	LC	SV	T	
25	Chestnut-headed Bee-eater	<i>Merops leschenaultia</i>	33	6.11	F		+	LC	SV	T	
	Cuculiformes										
	Cuculidae										
26	Pied Cuckoo	<i>Clamator jacobinus</i>	2	0.37	U		+	LC	SV	T	
27	Common Hawk Cuckoo	<i>Hierococyx varius</i>	10	1.85	U	+	+	LC	R/SV	T	
28	Grey-bellied Cuckoo	<i>Cacomantis passerinus</i>	1	0.18	U	+		LC	SV	T	
29	Banded Bay Cuckoo	<i>Cacomantis sonneratii</i>	2	0.3703			+	LC	R/SV	T	
30	Oriental Cuckoo	<i>Cuculus saturatus</i>	5	0.92	U		+	LC	SV	T	
31	Asian Koel	<i>Eudynamis scolopacea</i>	15	2.78	F	+	+	LC	R/SV	T	
	Centropodidae										
32	Greater Coucal	<i>Centropus sinensis</i>	22	4.074	F	+	+	LC	R	T	
33	Lesser Coucal	<i>Centropus bengalensis</i>	2	0.37	U	+		LC	R/SV	T	
	Psittaciformes										
	Psittacidae										
34	Alexandrine Parakeet II	<i>Psittacula eupatria</i>	37	6.85	F	+		NT	R	T	
35	Rose-ringed Parakeet II	<i>Psittacula krameri</i>	114	21.1	C	+	+	LC	R	T	
36	Plum-headed Parakeet II	<i>Psittacula cyanocephala</i>	112	20.74		+	+	LC	R	T	
37	Red-breasted Parakeet II	<i>Psittacula alexandri</i>	27	5		+		VU	R	T	
	Apodiformes										
	Apodidae			0							
38	House Swift	<i>Apus affinis</i>	55	10.18519	C	+	+	LC	R	T	
	Hemiprocnidae										
39	Crested Treeswift	<i>Hemiprocne coronata</i>	7	1.296	U	+		LC	R	T	

	Strigiformes									
	Strigidae									
40	Asian Barred Owlet II	<i>Glaucidium cuculoides</i>	4	0.74	U	+		LC	R	T
41	Jungle Owlet II	<i>Glaucidium radiatum</i>	2	0.37	U	+		LC	R	T
42	Spotted Owlet II	<i>Athene brama</i>	2	0.37	U	+	+	LC	R	T
	Columbiformes									
	Columbidae									
43	Rock Pigeon	<i>Columba livia</i>	112	20.74	C	+	+	LC	R	T
44	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	55	10.18	C	+		LC	R/WV	T
45	Spotted Dove	<i>Streptopelia chinensis</i>	118	21.85	C	+	+	LC	R	T
46	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	16	2.962	F	+		LC	R	T
	Gruiformes									
	Rallidae									
47	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	28	5.185	F	+	+	LC	R	A
48	Common Moorhen	<i>Gallinula chloropus</i>	6	1.1	U	+		LC	R/SV	A
49	Common Coot	<i>Fulica atra</i>	5	0.925	U	+		LC	WV/PM	A
	Ciconiiformes									
	Scolopacidae									
50	Common Snipe	<i>Gallinago gallinago</i>	50	9.259	F	+	+	LC	WV/PM	A
51	Common Greenshank	<i>Tringanebularia</i>	28	5.185	F	+		LC	WV/PM	A
52	Common Sandpiper	<i>Actitis hypoleucos</i>	68	12.59	C	+	+	LC	WV/PM	A
53	Common Redshank	<i>Tringa tetanus</i>	5	0.92	U	+		LC	WV/PM	A
54	Green Sandpiper	<i>Tringa ochropus</i>	3	0.56	U	+		LC	WV/PM	A
55	Little Stint	<i>Calidris alba</i>	3	0.56	U		+	LC	WV/PM	A
	Ardeidae									+
56	Little Egret	<i>Egretta garzetta</i>	98	18.148	C	+	+	LC	R	A
57	Cattle Egret	<i>Bubulcus ibis</i>	179	33.14	C	+	+	LC	R	T
58	Intermediate Egret	<i>Mesophoyx intermedia</i>	8	1.48	F	+		LC	R	A
59	Great Egret	<i>Casmerodius albus</i>	3	0.56	U	+		LC	R	A
60	Striated Heron	<i>Butorides striatus</i>	1	0.185	U		+	LC	SV/R	A
61	Grey Heron	<i>Ardeacinerea</i>	4	0.74	U	+	+	LC	WV/RR	A
62	Indian Pond Heron	<i>Ardeolagrayii</i>	132	24.45	C	+	+	LC	R	A
63	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	1	0.185	U		+	LC	SV/R	A
64	Black Bittern	<i>Dupetor flavicollis</i>	1	0.185	U		+	EN	R	A
	Threskiornithidae									
65	Black Ibis	<i>Pseudibis papillosa</i>	20	3.7	F	+		LC	R	A
	Ciconiidae									
66	Asian Openbill	<i>Anastomus oscitans</i>	41	7.59	F	+		VU	R	A
67	Black Stork	<i>Ciconia nigra</i>	2	0.37	U	+		VU	WV/PM	A
68	Lesser Adjutant	<i>Leptoptilos javanicus</i>	3	0.56	U	+		VU	R	A
	Charadriidae									
69	Little-ringed Plover	<i>Charadrius dubius</i>	32	5.925	F	+		LC	R/WV	A
70	River Lapwing	<i>Vanellus duvaucelii</i>	6	1.11	U	+		NT	R	A

71	Grey-headed Lapwing	<i>Vanelluscinereus</i>	23	4.25	F	+		LC	WV/PM	A
72	Red-wattled Lapwing	<i>Vanellusindicus</i>	32	5.92	F	+		LC	R	A
	Falconiformes									
	Pandionidae									
73	Osprey II	<i>Pandionhaliaetus</i>	2	0.37	U	+		LC	WV/PM	A
	Accipitridae									
74	Black-shouldered Kite II	<i>Elanuscaeruleus</i>	5	0.926	U		+	LC	R	T
75	Black Kite II	<i>Milvusmigrans</i>	28	5.185	F	+	+	LC	R	T
76	Pallas's Fish Eagle II*	<i>Haliaeetusleucoryphus</i>	1	0.185	U	+		CR	WV	A
77	Crested-serpent Eagle	<i>Spilornischeela</i>	10	1.85	U	+		LC	R	T
78	Oriental Honey-buzzard	<i>Pernisptilorhynchus</i>	3	0.56	U	+	+	LC	R/PM	T
79	Common Buzzard II	<i>Buteobuteo</i>	13	2.407	F	+		LC	WV/PM	T
	Falconidae									
80	Common Kestrel II	<i>Falco tinnunculus</i>	24	4.45	F	+		LC	R/WV/PM	T
81	Collared Falconet II	<i>Microhieraxcaerulescens</i>	1	0.185	U		+	NT	R	T
	Pelecaniformes									
	Phalacrocoracidae									
82	Little Cormorent	<i>Phalacrocoraxniger</i>	9	1.67	U	+		LC	WV/PM	A
83	Greater Cormorent	<i>Phalacrocoraxcarbo</i>	20	3.703	F	+		NT	WV	A
	Passeriformes									
	Laniidae									
84	Brown Shrike	<i>Laniusisabellinus</i>	4	0.74	U	+		LC	WV	T
85	Long-tailed Shrike	<i>Laniusschach</i>	54	10	F	+	+	LC	R	T
86	Grey-backed Shrike	<i>Laniustephronotus</i>	24	4.45	F	+		LC	R	T
	Corvidae									
87	Red-billed Blue Magpie	<i>Urocissaflavirostris</i>	4	0.74	U	+		LC	R	T
88	Rufous Treepie	<i>Dendrocittavagabunda</i>	6	4.81	F	+	+	LC	R	T
89	House Crow	<i>Corvussplendens</i>	172	31.85	C	+	+	LC	R	T
90	Large -billed Crow	<i>Corvusmacrorhynchos</i>	88	16.29	C	+	+	LC	R	T
91	Ashy Woodswallow	<i>Artamusfuscus</i>	15	2.78	F		+	LC	R	T
92	Eurasian Golden Oriole	<i>Oriolusoriolus</i>	8	1.481	U		+	LC	SV	T
93	Black-hooded Oriole	<i>Oriolusxanthornus</i>	16	2.96	F	+	+	LC	R	T
94	Large Cuckooshrike	<i>Coracinamacei</i>	25	4.62	F	+	+	LC	R	T
95	Scarlet Minivet	<i>Pericrocotusflammeus</i>	5	0.926	U	+		LC	R	T
96	White-throated Fantail	<i>Rhipiduraalbicollis</i>	3	0.56	U	+		LC	R	T
97	Black Drongo	<i>Dicrurusmacrocerus</i>	115	21.29	C	+	+	LC	R	T
98	Ashy Drongo	<i>Dicrurusleucophaeus</i>	21	3.89	F	+	+	LC	R	T
99	White-bellied Drongo	<i>Dicruruscaerulescens</i>	15	2.78	F	+	+	LC	R	T
100	Bronzed Drongo	<i>Dicrurusaeueus</i>	10	1.852	U	+		LC	R	T
101	Spangled Drongo	<i>Dicrurushottentottus</i>	3	0.56	U	+		LC	R	T
102	Greater Racket-tailed Drongo	<i>Dicrurusparadiseus</i>	6	1.11	U	+		LC	R	T
103	Asian Paradise Flycatcher	<i>Terpsiphoneparadise</i>	8	1.481	U		+	LC	SV	T
104	Large Woodshrike	<i>Tephrodornisgularis</i>	3	0.56	U		+	LC	R	T

	Muscicapidae									
105	Orange-headed Thrush	<i>Zoothera citrine</i>	2	0.37	U		+	LC	SV	T
106	Grey-headed Canary Flycatcher	<i>Culicicapaceylonensis</i>	10	1.851	U	+		LC	PM	T
107	Pale-chinned Flycatcher	<i>Cyornispoligenys</i>	12	2.22	F	+	+	LC	R	T
108	Blue-throated Flycatcher	<i>Cyornisrubeculoides</i>	3	0.56	U		+	LC	SV/PM	T
109	Taiga Flycatcher	<i>Muscicapidaeficedula</i>	17	3.148	F	+		LC	WV/PM	T
110	Rufous-gorgetted Flycatcher	<i>Ficedulaastrophhiata</i>	5	0.925	U	+		LC	R	T
111	Bluethroat	<i>Lusciniasvecica</i>	13	2.407	F		+	LC	WV/PM	T
112	White-capped Water Redstart	<i>Chaimarrornisleucocephalus</i>	5	0.925	U	+		LC	WV	A
113	Plumbeous Water Redstart	<i>Rhyacornisfuliginosus</i>	16	2.962	F	+		LC	WV	A
114	Black-backed Forktail	<i>Enicurusimmaculatus</i>	3	0.56	U	+		LC	R	T
115	Oriental Magpie Robin	<i>Copsychussauraris</i>	47	8.703	F	+	+	LC	R	T
116	Common Stonechat	<i>Saxicolatorquata</i>	169	31.29	C	+	+	LC	R/WV/PM	T
117	Pied Bushchat	<i>Saxicolacapratta</i>	142	26.29	C	+	+	LC	R	T
	Sturnidae									
118	Chestnut-tailed Starling	<i>Sturnusmalabaricus</i>	12	2.22	F	+		LC	R	T
119	Common Myna	<i>Acridotherestrictis</i>	258	47.78	A	+	+	LC	R	T
120	Jungle Myna	<i>Acridotheresfuscus</i>	93	17.22	C	+	+	LC	R	T
121	Asian Pied Starling	<i>Sturnus contra</i>	163	30.185	C	+	+	LC	R	T
	Paridae									
122	Great Tit	<i>Parus major</i>	6	1.11	U		+	LC	R	T
	Hirundinidae									
123	Plain Martin	<i>Riapriapaludicola</i>	195	36.11	C	+	+	NT	R	A
124	Red-rumped Swallow	<i>Hirundodaurica</i>	44	8.148	F	+		LC	R	T
	Pycnonotidae									
125	Red-vented Bulbul	<i>Pycnonotuscafer</i>	143	26.48	C	+	+	LC	R	T
126	Himalayan Bulbul	<i>Pycnonotusleucogenys</i>	7	1.296	U	+		LC	R	T
	Cisticolidae									
127	Grey-breasted Prinia	<i>Priniahodgsonii</i>	180	33.33	C	+	+	LC	R	T
128	Yellow-bellied Prinia	<i>Priniaflaviventris</i>	3	0.56	U	+		LC	R	T
	Sylviidae									
129	Common Tailorbird	<i>Orthotomussutorius</i>	120	22.22	C	+	+	LC	R	T
130	ZittingCisticola	<i>Cisticolajuncidis</i>	87	16.11	C	+	+	LC	R	T
131	Brownish-flanked Bush Warbler	<i>Cettiapallidipes</i>	36	6.67	F	+		LC	R	T
132	Common Chiffchaff	<i>Phylloscopuscollybita</i>	40	7.407	F	+		LC	WV	T
133	Smoky Warbler	<i>Phylloscopusfulgiventor</i>	5	0.925	U	+		LC	R	T
134	Lemon-rumped Warbler	<i>Phylloscopuschloronotus</i>	6	1.11	U	+		LC	R	T
135	Dusky Warbler	<i>Phylloscopusfuscatus</i>	37	6.85	F	+		LC	WV	T
136	Grey-hooded Warbler	<i>Phylloscopusxanthoschistos</i>	5	0.92	U	+		LC	R	T
137	Striped Tit Babbler	<i>Macronousgularis</i>	7	1.296	U	+		LC	R	T
138	Jungle Babbler	<i>Turdoidessstriatus</i>	25	4.629	F	+		LC	R	T

139	Red-billed Leiothrix	<i>Leiothirxlutea</i>	4	0.74	U	+		LC	R	T
	Alaudidae									
140	Bengal Bushlark	<i>Mirafraassamica</i>	75	13.89	C	+		LC	R	T
141	Ashy-crowned Sparrow Lark	<i>Eremopterixgrisea</i>	9	1.67	U	+		LC	R	T
	Passeridae									
142	House Sparrow	<i>Passer domesticus</i>	55	10.19	C	+	+	LC	R	T
143	Eurasian Tree Sparrow	<i>Passer montanus</i>	5	0.925	U	+		LC	R	T
144	White-browed Wagtail	<i>Motacillamaderaspatensis</i>	69	12.78	C	+	+		R	T
145	Grey Wagtail	<i>Motacillacinerea</i>	21	3.89	F	+		LC	R	A
146	White Wagtail	<i>Motacilla alba</i>	4	0.74	U	+		LC	WV/PM	A
147	Rosy Pipit	<i>Anthusroseatus</i>	6	1.1	U	+		LC	R/PM	T
148	Olive-backed Pipit	<i>Anthushodgsoni</i>	36	6.67	F	+	+	LC	R/WV	T
149	Paddyfield Pipit	<i>Anthusrufulus</i>	64	11.86	C	+		LC	R	T
150	Richards Pipit	<i>Anthusrichardi</i>	6	1.1	U	+		LC	WV/PM	T
151	White-rumped Munia	<i>Lonchurastrata</i>	6	1.1	U		+	LC	R	T
152	Scaly-breasted Munia	<i>Lonchurapunctulata</i>	30	5.56	F	+	+	LC	R	T
153	Baya Weaver	<i>Ploceusphilippinus</i>	53	9.81	F	+	+	NT	R	T
	Total		5040							