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SPECIES DIVERSITY, DISTRIBUTION AND RELATIVE ABUNDANCE OF AVIFUANA IN THE MANGROVE OF KARAMJAL FOREST STATION, SUNDARBANS

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ABSTRACT: Study on bird species diversity, distribution and relative abundance is important for conservation efforts in local and national scale. However, bird diversity, distribution and relative abundance are little known in Karamjal Forest Station, Sundarbans. Ecological appraisal of bird species diversity, distribution and relative abundance of the avifauna of the Karamjal Forest Station were conducted from June 2015 to April 2016. A total of 156 bird species was recorded during the study period. Of which, one was globally Critically Endangered, *Gyps bengalensis* and two were Near Threatened *i.e., Gyps himalayensis* and *Luscinia pectardens*. The distribution of bird among habitat type was significantly different ($f = 22.069$, $p<0.05$, $df = 2$). Walking trail was inhabited the highest species diversity ($H' = 3.77$) with the highest evenness ($J=0.823$) while water body was recorded the lowest species diversity ($H' = 2.93$) with the lowest evenness ($J=0.804$), it could have a relation to the availability of food items in the habitat. This study showed that despite huge tourist pressures this forest station harbour diverse avian species and thus this area should be managed in order to enhance the population of avian species.

KEY WORDS: species diversity, distribution, relative abundance, mangrove, birds and Karamjal forest station.

INTRODUCTION

The Sundarbans is a unique ecosystem of global importance. The Bangladesh portion of the Sundarbans alone covers an area of some 6000 km^2 while the total area is 10,000 km^2 and it is considered as the largest expanse of mangrove forests in the world which is the home to a great diversity of species. Several studies on the birds of Bangladesh Sundarbans have been conducted in the past. Rashid *et al.* (1994) listed 315 species but this included species of hypothetical occurrence. Thompson and Johnson (1996) produced lists of birds in Bangladesh and indicated species that are found in the Sundarbans. Subsequent reports on notable birds (Thompson *et al.* 1993, Thompson and Johnson 2003) have updated the knowledge of the status and distribution of many species and Islam *et al.* (1999) listed winter birds of Sundarbans, Bangladesh. M. H. Khan (2005) published a list of 198 birds from Sundarbans East Wildlife Sanctuary, Bangladesh. And very recent Chowdhury *et al.* (2014) reported 17 species of waders including three very notable species- *Numenius arquata, Esacus recurvirostris* and the locally very rare *Haematopus ostralegus longipes* from the whole coastline of the Sundarbans, Bangladesh.

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Though it is a very important tool for an ecologist to study species diversity, distribution and abundance to understand the community structure and critically important for conservation efforts of an area, there is no scientific study regarding species diversity, distribution and abundance of birds of Karamjal Forest Station yet. Besides, there were some reasons behind choosing this area as our study site- a) easily accessible, b) insufficient funding, c) insufficient logistics, d) time consuming and this place is sort of interesting in term of distance from human area and huge tourists. Hence, this present study was carried out for new inventory, to assess the diversity and distribution of bird species and to document their relative abundance and seasonal variation throughout the year in Karamjal Forest Station. And also efforts have been made to investigate specialist birds in human-dominated mangrove patch of this area.

Thus, the result of this finding is valuable for protected area managers, area-specific management planners, conservationists, ecologists and provides baseline information for different scientific communities for further studies of this area as well as the total Sundarbans and to create awareness for their conservation.

MATERIAL AND METHODS

Study area: The Sundarbans which is the largest single tract of tidal halophytic mangrove forest in the world covers approximately 10,000 square kilometres in the Ganges-Brahmaputra delta of Bangladesh and India at 21°30′-22°30′ N and 80°05′-89°55′E. It is a natural region roughly comprising 60% of southern Bangladesh and a small portion in Eastern part of the Indian state of West Bengal and it is designated as the first RAMSAR site of Bangladesh and is also a UNESCO World Heritage Site (Iftekhar & Islam 2004).

Karamjal Forest Station is one of the major entry points to the Sundarbans. Located about 5 km from Mongla Sea Port. This research survey has been conducted through 5 $km^2$of Karamjal Forest Station, Sundarbans that is positioned between the coordination of longitude 89.589351° N and latitude 22.427849° E. Similar to the whole sundarbans area, this area is also surrounded by waterbody, but this area is mostly mangrove dominated by Heritierafomes, Excoecariaagallocha, and Sonneratiaapetala. And it is one of the most human-dominated areas of Sundarbans and every day hundreds of tourists visit this area.

Methodology: Data collection was carried out from June 2015 to April 2016 including wet and dry seasons of the year. According to the rainfall distribution of the area from October to March were considered as the dry season, while April to September were considered as the wet season.

Study design and data collection method: For this study, the area was stratified into three habitat types based on the land cover feature. Those habitat types were deep forest (deep inside the forest dominated by large trees), walking trail

(tourist trails mostly located less dense areas) and water body (includes all water bodies surrounding the study area). A stratified random sampling design across the three habitat types was used to assess diversity and abundance of bird species.

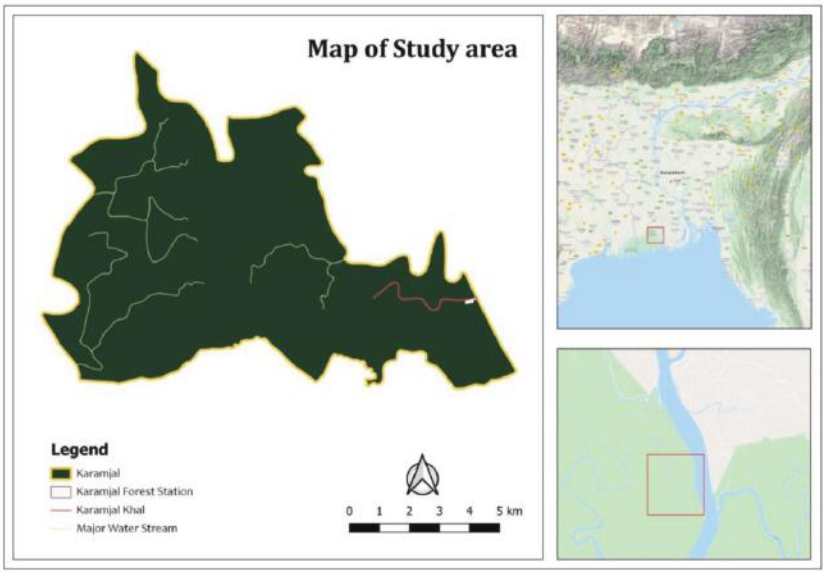

Fig. 1. Map of the study area

Bird identifications and counting of individuals were conducted by direct observations with the aid of binoculars (8×42) and bird guide books. Observations were made by standing in the middle of the point transect and observing gently up to a distance of 30 m radius. Observation at each point transects lasted for 15 min (Girma *et al.* 2017). The English or local and scientific names of the birds have been taken during field observation. The following three characteristics were applied to identify the bird species. 1) External morphology (Color, shape, size, beak, leg and tail), 2) song and calls and 3) Habitat type (Hossain and Baki 2015).

Point survey of birds' species was carried out in the morning time from 6:00 a.m. to 11:00 a.m. and 3:00 p.m. to 5:30 p.m. in the early evening (Brower et al. 1990; Pomeroy 1992). Replicated point counts and a presence-absence approach were used for bird censuses. All observed bird species were recorded with a prepared datasheet. Also, the identified birds were grouped under migrant, rare, uncommon, fairly common, common and abundant in ascending order (Ian and Peter 2003; Mengesha and Bekele 2008). While surveying birds, double-counting the same species or individual birds at a point was avoided by using simultaneous counting, careful observation in roosting and nesting site of birds.

Data Analysis: All data were summarized per habitat types during the study period in the table. Shannon diversity index (Magurran1988; Jarvis and Robertso 1999), evenness, relative abundance and encounter rate (Bibby *et al.* 1992) were calculated to evaluate the diversity and abundance of bird . One-way ANOVA has been conducted to assess the variation among the habitat type.

RESULTS AND DISCUSSION

Species Richness and Abundance of Birds: 156 species under 15 order has been documented from the study area. Among them, Passeriformes order represented 50% of the species which is the highest one and the lowest number from three orders: Pelecaniformes, Galliformes and Bucerotiformes which represented 0.64% of the total species.

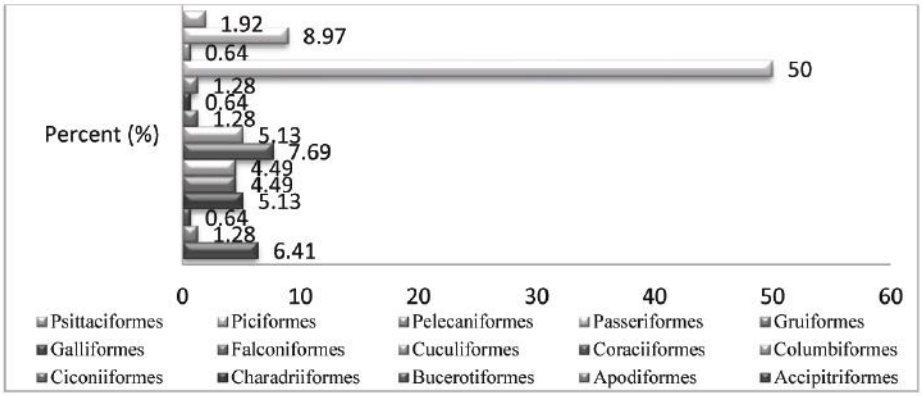

Fig. 2.Proportion of different orders of birds

According to the occurrence rate during the study period, highest number of species was considered as rare which represented 66.6% of the total species and lowest number as common represented as 8.9% of the total species. For instance, two species from family Accipitridae viz., *Gyps bengalensis, Gyps himalayensis* and a species from family Muscicapidae viz., *Luscinia pectardens* were recorded from the study area. The sighting of *L. pectardens* was so far the second record of this bird from Karamjal after Monirul H. Khan (2004).

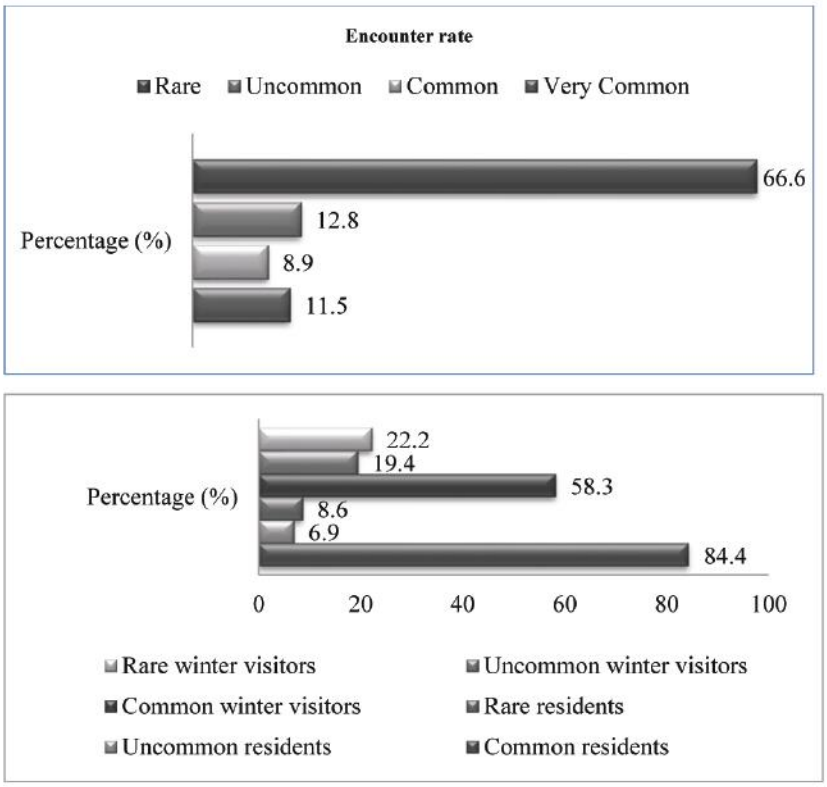

Fig. 3. Encounter rate (general & seasonal)

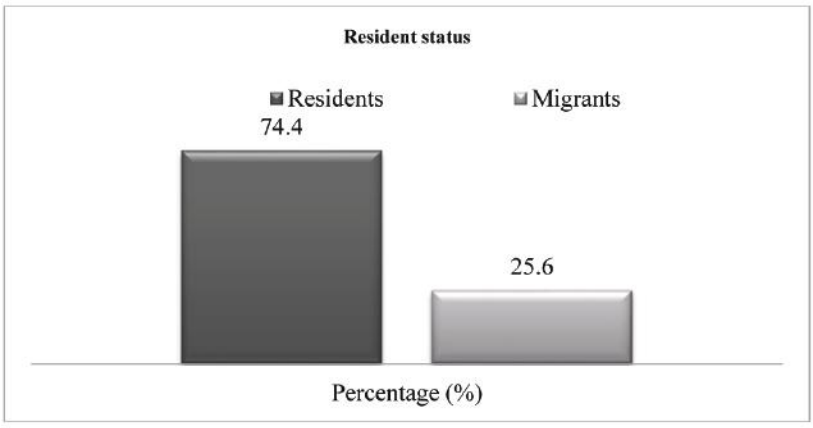

Fig. 4. Resident status of bird species of study area

of the identified bird species, 74.4% were found as residents and 25.6% migratory species of Bangladesh. Among all those resident species, most of them were common residents.

And of those all migrants, majority of them were winter migrants and a very few were summer migrants.

Among all identified species from the study area, one was globally considered as Critically Endangered, *Gyps bengalensis*. Besides, two were considered as Near Threatened i.e., *G himalayensis* and *L. pectardens* . The remaining 153 recorded species as Least Concern.

Diversity and Distribution of Bird Species: The abundance of bird species among habitat type was significantly different (f= 22.069, p =1.1921E-09, df= 2). Walking trail was recorded the highest distribution (28.89±43.68) while water body recorded the lowest distribution (4.27±12.36). Walking trail was inhabited the highest species richness, water body was harbored the lowest species richness in the study area (Table 1).

Table 1.Bird species distribution across habitat types (ANOVA: Single Factor)

SUMMARY						
Groups	**Count**	**Sum**	**Arith.mean**	**Variance**	**Std.Dev**	
Deep forest	98	680	6.93877551	373.1920892	19.3181803	
Walking trail	98	2832	28.89795918	1907.803913	43.6784147	
Waterbody	98	418	4.265306122	152.7123922	12.3576856	
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	35806.61224	2	17903.30612	22.06916757	1.1921E-09	3.02678493
Within Groups	236069.7143	291	811.2361316			
Total	271876.3265	293				

Walking trail recorded the highest species diversity of birds (H'= 3.77) with the highest evenness (J=0.822) followed by Deep forest (H'= 2.97). Waterbody was recorded the lowest species diversity (H'= 2.93) and had the lowest evenness index (J=0.804) in the study area.

Table 2.Bird species diversity index along habitat types

Habitat types	**No. of species**	**Diversity (H')**	**Evenness (J)**
Deep Forest	40	2.971382	0.80549
Water body	38	2.925857	0.80434
Walking trail	98	3.772327	0.82276

The reason for high bird diversity around the trail area is beyond our study scope. It might be due to the abundance of different food items beside the walking trail or due to the accessibility of these three habitats for bird watching. With this study we tried to compare three types of habitat and showcase which habitat harbours more bird species. From conservation perspective long term multidisciplinary study is required to understand the bird community ecology in Sundarbans.

CONCLUSION

Despite having tourist pressure during the winter season, walking trail of this forest harbour a significant number of bird species. Besides this, Karamjol forest area has a remarkable bird diversity compare to the other part of Sunarbans. We also found that despite of human disturbance, walking trail has the highest species diversity than the deep forest and water body. This could be happened due to the availability of different types of food item beside the walking trails or due to the difference of visibility among those three habitats. However, the area is possible to qualify the criteria of an important bird diversity area of Sundarbans. So, this study area should be given to further conservation measure to keep existing bird species diversity. Moreover, since this study was the first investigation of this area, there might be some limitations to discover cryptic and nocturnal bird species. We recommend to conduct long term ecological study to understand the bird community of Karamjol forest areas.

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Annexure I. List of birds seen in Karamjal Forest Station, Sundarbans, Bangladesh

Scientific Name	Common Name	Order	Family	Feeding Habit	Habitat	Passerine/Nonpasserine	No. of Observation	Resident Status	National Status	Global Status	%	Relative Abundance
Anastomus oscitans	Asian Openbill	Ciconiiformes	Ciconiidae	Molluscivore	Waterbody	Nonpasserine	9	CR	NO	LC	11.6	R
Butorides striata	Striated Heron	Ciconiiformes	Ardeidae	Piscivore	Waterbody	Nonpasserine	6	CR	NO	LC	7.7	R
Ardeola grayii	Indian Pond Heron	Ciconiiformes	Ardeidae	Piscivore	Waterbody	Nonpasserine	10	CR	NO	LC	12.9	R
Bubulcus ibis	Cattle Egret	Ciconiiformes	Ardeidae	Piscivore	Waterbody	Nonpasserine	29	CR	NO	LC	37.6	UC
Ardea alba	Great Egret	Ciconiiformes	Ardeidae	Piscivore	Waterbody	Nonpasserine	12	CR	NO	LC	15.5	R
Ardea intermedia	Intermediate Egret	Ciconiiformes	Ardeidae	Piscivore	Waterbody	Nonpasserine	4	CR	NO	LC	5.1	R
Egretta garzetta	Little Egret	Ciconiiformes	Ardeidae	Piscivore	Waterbody	Nonpasserine	9	CR	NO	LC	11.6	R
Microcarbo niger	Little Cormorant	Pelecaniformes	Phalacrocoracidae	Piscivore	Waterbody	Nonpasserine	8	CR	NO	LC	10.3	R
Falco tinnunculus	Common Kestrel	Falconiformes	Falconidae	Carnivore	Waterbody	Nonpasserine	3	CM_w	NO	LC	3.8	R
Falco peregrinus	Peregrine Falcon	Falconiformes	Falconidae	Carnivore	Waterbody	Nonpasserine	1	RM_w	NO	LC	1.2	R
Pandion haliaetus	Osprey	Accipitriformes	Pandionidae	Carnivore	Waterbody	Nonpasserine	2	RM_w	NO	LC	2.5	R
Pernis ptilorhyncus	Oriental Honey Buzzard	Accipitriformes	Accipitridae	Carnivore	Deep forest	Nonpasserine	3	RR	DD	LC	3.8	R
Accipiter badius	Shikra	Accipitriformes	Accipitridae	Carnivore	Waterbody	Nonpasserine	4	CR	NO	LC	5.1	R
Haliastur indus	Brahminy Kite	Accipitriformes	Accipitridae	Carnivore	Waterbody	Nonpasserine	8	CR	NO	LC	10.3	R
Milvus migrans	Black Kite	Accipitriformes	Accipitridae	Carnivore	Waterbody	Nonpasserine	20	CR	NO	LC	25.9	UC
Haliaeetus leucogaster	White Bellied Sea Eagle	Accipitriformes	Accipitridae	Carnivore	Waterbody	Nonpasserine	14	CR	NO	LC	18.1	R
Nisaetus cirrhatus	Changeable Hawk Eagle	Accipitriformes	Accipitridae	Carnivore	Waterbody	Nonpasserine	3	RR	NO	LC	3.8	R
Spilornis cheela	Crested Serpent Eagle	Accipitriformes	Accipitridae	Carnivore	Waterbody	Nonpasserine	7	CR	NO	LC	9.1	R
Gyps bengalensis	White Rumped Vulture	Accipitriformes	Accipitridae	Carnivore	Waterbody	Nonpasserine	3	RR	CR	CR	3.8	R
Gyps himalayensis	Himalayan Griffon Vulture	Accipitriformes	Accipitridae	Carnivore	Waterbody	Nonpasserine	2	RR	CR	NT	2.5	R
Amaurornis phoenicurus	White-breasted Waterhen	Gruiformes	Rallidae	Crustacivore	Waterbody	Nonpasserine	7	UR	NO	LC	9.1	R
Gallirallus striatus	Slaty Breasted Rail	Gruiformes	Rallidae	Crustacivore	Waterbody	Nonpasserine	1	RR	NO	LC	1.2	R
Vanellus indicus	Red-wattled Lapwing	Charadriiformes	Charadridae	Crustacivore	Waterbody	Nonpasserine	2	CR	NO	LC	2.5	R
Actitis hypoleucos	Common Sandpiper	Charadriiformes	Scolopacidae	Crustacivore	Waterbody	Nonpasserine	106	CM_w	NO	LC	100	VC
Tringa ochropus	Green Sandpiper	Charadriiformes	Scolopacidae	Crustacivore	Waterbody	Nonpasserine	2	UM_w	NO	LC	2.5	R
Tringa totanus	Common Redshank	Charadriiformes	Scolopacidae	Crustacivore	Waterbody	Nonpasserine	1	CM_w	NO	LC	1.2	R
Tringa glareola	Wood Sandpiper	Charadriiformes	Scolopacidae	Crustacivore	Waterbody	Nonpasserine	2	CM_w	NO	LC	2.5	R
Larus brunnicephalus	Brown-headed Gull	Charadriiformes	Laridae	Omnivore	Waterbody	Nonpasserine	2	CM_w	NO	LC	2.5	R
Larus ridibundus	Black-headed Gull	Charadriiformes	Laridae	Omnivore	Waterbody	Nonpasserine	3	CM_w	NO	LC	3.8	R
Sterna albifrons	Little Tern	Charadriiformes	Sternidae	Piscivore	Waterbody	Nonpasserine	1	CR	NO	LC	1.2	R
Gallus gallus	Red Junglefowl	Galliformes	Phasianidae	Graminivore	Walking trail	Nonpasserine	6	CR	NO	LC	7.7	R
Columba livia	Common Rock Pigeon	Columbiformes	Columbidae	Frugivore+Graminivore	Walking trail	Nonpasserine	2	CR	NO	LC	2.5	R
Streptopelia decaocto	Eurasian Collared Dove	Columbiformes	Columbidae	Frugivore+Graminivore	Walking trail	Nonpasserine	40	CR	NO	LC	51.9	C
Streptopelia tranquebarica	Red Turtle Dove	Columbiformes	Columbidae	Frugivore+Graminivore	Walking trail	Nonpasserine	20	CR	NO	LC	25.9	UC
Spilopelia suratensis	Western Spotted Dove	Columbiformes	Columbidae	Frugivore+Graminivore	Walking trail	Nonpasserine	135	CR	NO	LC	100	VC
Chalcophaps indica	Common Emerald Dove	Columbiformes	Columbidae	Frugivore+Graminivore	Walking trail	Nonpasserine	5	CR	NO	LC	6.4	R
Treron bicinctus	Orange Breasted Green Pigeon	Columbiformes	Columbidae	Frugivore+Graminivore	Walking trail	Nonpasserine	9	RR	NO	LC	11.6	R

Scientific Name	Common Name	Order	Family	Feeding Habit	Habitat	Passerine/Nonpasserine	No. of Observation	Resident Status	National Status	Global Status	%	Relative Abundance
Treron phoenicopterus	Yellow Footed Green Pigeon	Columbiformes	Columbidae	Frugivore+Graminivore	Walking trail	Nonpasserine	6	CR	NO	LC	7.7	R
Psittacula cyanocephala	Plum-headed Parakeet	Psittaciformes	Psittaculidae	Frugivore	Walking trail	Nonpasserine	6	RR	NO	LC	7.7	R
Psittacula roseata	Blossom Headed Parakeet	Psittaciformes	Psittaculidae	Frugivore	Walking trail	Nonpasserine	4	RR	NO	LC	5.1	R
Psittacula krameri	Rose-ringed Parakeet	Psittaciformes	Psittaculidae	Frugivore	Walking trail	Nonpasserine	4	CR	NO	LC	5.1	R
Centropus sinensis	Greater Coucal	Cuculiformes	Centropodidae	Omnivore	Walking trail	Nonpasserine	3	CR	NO	LC	3.8	R
Centropus bengalensis	Lesser Coucal	Cuculiformes	Centropodidae	Omnivore	Walking trail	Nonpasserine	4	CR	NO	LC	5.1	R
Eudynamys scolopaceus	Asian koel	Cuculiformes	Cuculidae	Frugivore	Walking trail	Nonpasserine	6	CR	NO	LC	7.7	R
Cacomantis merulinus	Plaintive Cuckoo	Cuculiformes	Cuculidae	Frugivore	Walking trail	Nonpasserine	2	CR	NO	LC	2.5	R
Hierococcyx varius	Common Hawk-Cuckoo	Cuculiformes	Cuculidae	Frugivore	Walking trail	Nonpasserine	3	CR	NO	LC	3.8	R
Cuculus micropterus	Indian Cuckoo	Cuculiformes	Cuculidae	Frugivore	Walking trail	Nonpasserine	1	M_s	NO	LC	1.2	R
Cuculus canorus	Common Cuckoo	Cuculiformes	Cuculidae	Frugivore	Walking trail	Nonpasserine	2	M_p	NO	LC	2.5	R
Phaenicophaeus tristis	Green Billed Malkoha	Cuculiformes	Cuculidae	Frugivore	Walking trail	Nonpasserine	6	CR	NO	LC	7.7	R
Cypsiurus balasiensis	Asian Palm Swift	Apodiformes	Apodidae	Insectivore	Walking trail	Nonpasserine	56	CR	NO	LC	72.7	C
Apus affinis	House Swift	Apodiformes	Apodidae	Insectivore	Walking trail	Nonpasserine	9	CR	NO	LC	11.6	R
Upupa epops	Common Hoopoe	Bucerotiformes	Upupidae	Insectivore+Graminivore	Walking trail	Nonpasserine	2	UR	NO	LC	2.5	R
Alcedo atthis	Common Kingfisher	Coraciiformes	Alcedinidae	Piscivore	Waterbody	Nonpasserine	32	CR	NO	LC	41.5	UC
Alcedo meninting	Blue Eared Kingfisher	Coraciiformes	Alcedinidae	Piscivore	Waterbody	Nonpasserine	1	RR	NO	LC	1.2	R
Ceryle rudis	Pied Kingfisher	Coraciiformes	Cerylidae	Piscivore	Waterbody	Nonpasserine	5	CR	NO	LC	6.4	R
Pelargopsis capensis	Stork-billed Kingfisher	Coraciiformes	Halcyonidae	Piscivore	Waterbody	Nonpasserine	3	CR	NO	LC	3.8	R
Halcyon pileata	Black Capped Kingfisher	Coraciiformes	Halcyonidae	Piscivore	Waterbody	Nonpasserine	21	CM_w	NO	LC	27.2	UC
Halcyon coromanda	Ruddy Kingfisher	Coraciiformes	Halcyonidae	Piscivore	Waterbody	Nonpasserine	5	CR	NO	LC	6.4	R
Halcyon smyrnensis	White-throated Kingfisher	Coraciiformes	Halcyonidae	Piscivore	Waterbody	Nonpasserine	23	CR	NO	LC	29.8	UC
Todiramphus chloris	Collared Kingfisher	Coraciiformes	Halcyonidae	Piscivore	Waterbody	Nonpasserine	24	CR	NO	LC	31.1	UC
Pelargopsis amauroptera	Brown Winged Kingfisher	Coraciiformes	Alcedinidae	Piscivore	Waterbody	Nonpasserine	23	CR	NO	LC	29.8	UC
Merops orientalis	Green Bee-eater	Coraciiformes	Meropidae	Insectivore	Walking trail	Nonpasserine	30	CR	NO	LC	38.9	UC
Merops leschenaultia	Chestnut-headed Bee-eater	Coraciiformes	Meropidae	Insectivore	Walking trail	Nonpasserine	8	CR	NO	LC	10.3	R
Merops philippinus	Blue-tailed Bee-eater	Coraciiformes	Meropidae	Insectivore	Walking trail	Nonpasserine	2	CR	NO	LC	2.5	R
Psilopogon haemacephala	Coppersmith Barbet	Piciformes	Megalaimidae	Frugivore	Walking trail	Nonpasserine	5	CR	NO	LC	6.4	R
Jynx torquilla	Eurasian Wryneck	Piciformes	Picidae	Insectivore	Walking trail	Nonpasserine	2	UM_w	NO	LC	2.5	R
Dinopium benghalense	Lesser Goldenback	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	3	CR	NO	LC	3.8	R
Chrysocolaptes guttacristatus	Greater Flameback	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	42	CR	NO	LC	54.5	C
Dinopium javanense	Common Flameback	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	1	CR	NO	LC	1.2	R
Micropternus brachyurus	Rufous Woodpecker	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	3	CR	NO	LC	3.8	R
Picus xanthopygaeus	Streak-throated Woodpecker	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	4	UR	NO	LC	5.1	R
Picus viridanus	Streak-breasted Woodpecker	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	1	UR	NO	LC	1.2	R
Dendrocopos macei	Fulvous-breasted Woodpecker	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	14	CR	NO	LC	18.1	R
Picus canus	Grey Headed Woodpecker	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	17	CR	NO	LC	22.1	R
Picoides canicapillus	Grey Capped Pygmy Woodpecker	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	53	CR	NO	LC	63.8	C
Picumnus innominatus	Speckled Piculet	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	16	CR	NO	LC	20.7	R

Scientific Name	Common Name	Order	Family	Feeding Habit	Habitat	Passerine/Nonpasserine	No. of Observation	Resident Status	National Status	Global Status	%	Relative Abundance
Picus chlorolophus	Lesser Yellownape	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	14	CR	NO	LC	18.1	R
Chrysophlegma flavinucha	Greater Yellownape	Piciformes	Picidae	Insectivore	Deep forest	Nonpasserine	17	CR	NO	LC	22.1	R
Tephrodornis pondicerianus	Common Woodshrike	Passeriformes	Tephrodornithidae	Insectivore	Walking trail	Passerine	3	CR	NO	LC	3.8	R
Coracina melaschistos	Black-winged Cuckooshrike	Passeriformes	Campephagidae	Insectivore	Walking trail	Passerine	2	UM_w	NO	LC	2.5	R
Coracina melanoptera	Black-headed Cuckooshrike	Passeriformes	Campephagidae	Insectivore	Deep forest	Passerine	1	UR	DD	LC	1.2	R
Hemipus picatus	Bar Winged Flycatcher Shrike	Passeriformes	Campephagidae	Insectivore	Deep forest	Passerine	44	CM_w	NO	LC	57.1	C
Pericrocotus cinnamomeus	Small Minivet	Passeriformes	Campephagidae	Insectivore	Deep forest	Passerine	163	CR	NO	LC	100	VC
Pericrocotus speciosus	Scarlet Minivet	Passeriformes	Campephagidae	Insectivore	Deep forest	Passerine	7	CR	NO	LC	9.1	R
Chloropsis aurifrons	Golden Fronted Leafbird	Passeriformes	Chloropseidae	Insectivore	Walking trail	Passerine	17	CR	NO	LC	22.1	R
Sitta frontalis	Velvet Fronted Nuthatch	Passeriformes	Sittidae	Insectivore	Walking trail	Passerine	183	CR	NO	LC	100	VC
Pitta megarhyncha	Mangrove Pitta	Passeriformes	Pittadae	Insectivore	Deep forest+Walking trail	Passerine	26	CR	NO	LC	33.7	UC
Aegithina tiphia	Common Iora	Passeriformes	Aegithinidae	Insectivore	Walking trail	Passerine	25	CR	NO	LC	32.4	UC
Lanius cristatus	Brown Shrike	Passeriformes	Lanidae	Insectivore	Walking trail	Passerine	7	CM_w	NO	LC	9.1	R
Lanius schach	Long-tailed Shrike	Passeriformes	Lanidae	Insectivore	Walking trail	Passerine	7	CR	NO	LC	9.1	R
Lanius tephronotus	Grey-backed Shrike	Passeriformes	Lanidae	Insectivore	Walking trail	Passerine	7	UM_w	NO	LC	9.1	R
Oriolus oriolus	Eurasian Golden Oriole	Passeriformes	Oriolidae	Insectivore	Walking trail	Passerine	2	RR	DD	LC	2.5	R
Oriolus chinensis	Black-naped Oriole	Passeriformes	Oriolidae	Insectivore	Walking trail	Passerine	21	RM_w	NO	LC	27.2	R
Oriolus xanthornus	Black-hooded Oriole	Passeriformes	Oriolidae	Insectivore	Walking trail	Passerine	34	CR	NO	LC	44.1	UC
Dicrurus macrocercus	Black Drongo	Passeriformes	Dicruridae	Insectivore	Walking trail	Passerine	65	CR	NO	LC	84.4	VC
Dicrurus leucophaeus	Ashy Drongo	Passeriformes	Dicruridae	Insectivore	Walking trail	Passerine	2	UM_w	NO	LC	2.5	R
Dicrurus aeneus	Bronzed Drongo	Passeriformes	Dicruridae	Insectivore	Walking trail	Passerine	17	CR	NO	LC	22.1	R
Dicrurus paradiseus	Greater Racket-tailed Drongo	Passeriformes	Dicruridae	Insectivore	Walking trail	Passerine	30	CR	DD	LC	38.9	UC
Dicrurus hottentottus	Hair-crested Drongo	Passeriformes	Dicruridae	Insectivore	Walking trail	Passerine	3	CR	NO	LC	3.8	R
Dendrocitta vagabunda	Rufous Treepie	Passeriformes	Dicruridae	Omnivore	Walking trail	Passerine	17	CR	NO	LC	22.1	R
Corvus splendens	House Crow	Passeriformes	Corvidae	Omnivore	Walking trail	Passerine	48	CR	NO	LC	62.3	C
Corvus macrorhynchos	Large-billed Crow	Passeriformes	Corvidae	Omnivore	Walking trail	Passerine	63	CR	NO	LC	81.8	VC
Artamus fuscus	Ashy Woodswallow	Passeriformes	Artamidae	Omnivore	Walking trail	Passerine	106	CR	NO	LC	100	VC
Hirundo rustica	Barn Swallow	Passeriformes	Hirundinidae	Insectivore	Walking trail	Passerine	135	CM_w	NO	LC	100	VC
Prinia inornata	Plain Prinia	Passeriformes	Cisticolidae	Insectivore	Walking trail	Passerine	3	CR	NO	LC	3.8	R
Pycnonotus jocosus	Red-whiskered Bulbul	Passeriformes	Pycnonotidae	Insectivore+Frugivore	Walking trail	Passerine	60	CR	NO	LC	77.9	VC
Pycnonotus cafer	Red-vented Bulbul	Passeriformes	Pycnonotidae	Insectivore+Frugivore	Walking trail	Passerine	190	CR	NO	LC	100	VC
Acrocephalus dumetorum	Blyth's Reed-warbler	Passeriformes	Acrocephalidae	Insectivore	Walking trail	Passerine	4	CM_w	NO	LC	5.1	R
Acrocephalus stentoreus	Thick-billed Warbler	Passeriformes	Acrocephalidae	Insectivore	Walking trail	Passerine	1	CM_w	NO	LC	1.2	R
Acrocephalus aedon	Clamorous Reed-warbler	Passeriformes	Acrocephalidae	Insectivore	Walking trail	Passerine	1	RM_w	NO	LC	1.2	R
Phylloscopus fuscatus	Dusky Warbler	Passeriformes	Phylloscopidae	Insectivore	Deep forest+Walking trail	Passerine	55	CM_w	NO	LC	71.4	C
Phylloscopus reguloides	Blyth's Leaf-warbler	Passeriformes	Phylloscopidae	Insectivore	Deep forest+Walking trail	Passerine	142	CM_w	NO	LC	100	VC

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Phylloscopus trochiloides	Greenish Warbler	Passeriformes	Phylloscopidae	Insectivore	Deep forest+Walking trail	Passerine	2	CM_w	NO	LC	2.5	R
Orthotomus sutorius	Common Tailorbird	Passeriformes	Sylvidae	Insectivore	Deep forest+Walking trail	Passerine	44	CR	NO	LC	57.1	C
Turdoides striata	Jungle Babbler	Passeriformes	Sylvidae	Insectivore	Deep forest+Walking trail	Passerine	57	CR	NO	LC	74.0	C
Mixornis gularis	Pin Striped Tit Babbler	Passeriformes	Timaliidae	Insectivore	Deep forest+Walking trail	Passerine	22	CR	NO	LC	28.5	UC
Malacocincla abbotti	Abbott's Babbler	Passeriformes	Pellorneidae	Insectivore	Deep forest+Walking trail	Passerine	45	CR	NO	LC	58.4	C
Zosterops palpebrosus	Oriental White-eye	Passeriformes	Zosteropidae	Insectivore	Deep forest+Walking trail	Passerine	41	CR	NO	LC	53.2	C
Acridotheres tristis	Common Myna	Passeriformes	Sturnidae	Omnivore	Walking trail	Passerine	72	CR	NO	LC	93.5	VC
Acridotheres ginginianus	Bank Myna	Passeriformes	Sturnidae	Insectivore	Waterbody	Passerine	5	CR	NO	LC	6.4	R
Acridotheres fuscus	Jungle Myna	Passeriformes	Sturnidae	Insectivore	Walking trail	Passerine	109	CR	NO	LC	100	VC
Sturnus malabaricus	Chestnut-tailed Starling	Passeriformes	Sturnidae	Insectivore+Frugivore	Walking trail	Passerine	190	CR	NO	LC	100	VC
Sturnus contra	Asian Pied Starling	Passeriformes	Sturnidae	Omnivore	Walking trail	Passerine	152	CR	NO	LC	100	VC
Luscinia calliope	Siberian Rubythroat	Passeriformes	Muscicapidae	Insectivore	Deep forest	Passerine	2	RM_w	NO	LC	2.5	R
Luscinia pectardens	Firethroat	Passeriformes	Muscicapidae	Insectivore	Deep forest	Passerine	1	UM_w	DD	NT	1.2	R
Copsychus saularis	Oriental Magpie-robin	Passeriformes	Muscicapidae	Insectivore	Walking trail	Passerine	82	CR	NO	LC	100	VC
Luscinia brunnea	Indian Blue Robin	Passeriformes	Muscicapidae	Insectivore	Deep forest	Passerine	2	RM_w	NO	LC	2.5	R
Phoenicurus ochruros	Black Redstart	Passeriformes	Muscicapidae	Insectivore	Walking trail	Passerine	1	RM_w	NO	LC	1.2	R
Monticola solitaries	Blue Rock-thrush	Passeriformes	Muscicapidae	Insectivore	Walking trail	Passerine	1	UM_w	NO	LC	1.2	R
Muscicapa daurica	Asian Brown Flycatcher	Passeriformes	Muscicapidae	Insectivore	Walking trail	Passerine	1	RM_w	NO	LC	1.2	R
Ficedula albicilla	Taiga Flycatcher	Passeriformes	Muscicapidae	Insectivore	Walking trail	Passerine	7	CM_w	NO	LC	9.1	R
Eumyias thalassina	Verditer Flycatcher	Passeriformes	Muscicapidae	Insectivore	Walking trail	Passerine	16	CM_w	NO	LC	20.7	R
Cyornis poliogenys	Pale Chinned Blue Flycatcher	Passeriformes	Muscicapidae	Insectivore	Deep forest+Walking trail	Passerine	14	CM_w	NO	LC	18.1	R
Cyornis rubeculoides	Blue-throated Flycatcher	Passeriformes	Muscicapidae	Insectivore	Deep forest+Walking trail	Passerine	15	RM_w	NO	LC	19.4	R
Zoothera citrine	Orange-headed Thrush	Passeriformes	Turdidae	Insectivore	Deep forest+Walking trail	Passerine	17	UR	NO	LC	22.1	R
Hypothymis azurea	Black-naped Monarch	Passeriformes	Monarchidae	Insectivore	Deep forest+Walking trail	Passerine	29	CR	NO	LC	37.6	UC
Rhipidura albicollis	White-throated Fantail	Passeriformes	Rhipiduridae	Insectivore	Walking trail	Passerine	14	CR	NO	LC	18.1	R

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Nectarinia zeylonica	Purple-rumped Sunbird	Passeriformes	Nectariniidae	Nectarinivore	Deep forest+Walking trail	Passerine	40	CR	NO	LC	51.9	C
Nectarinia asiaticus	Purple Sunbird	Passeriformes	Nectariniidae	Nectarinivore	Deep forest+Walking trail	Passerine	85	CR	NO	LC	100	VC
Aethopyga siparaja	Crimson Sunbird	Passeriformes	Nectariniidae	Nectarinivore	Deep forest+Walking trail	Passerine	31	CR	NO	LC	40.2	UC
Chalcoparia singalensis	Ruby Cheeked Sunbird	Passeriformes	Nectariniidae	Nectarinivore	Deep forest+Walking trail	Passerine	30	CR	NO	LC	38.9	UC
Arachnothera longirostra	Little Spider Hunter	Passeriformes	Nectariniidae	Insectivore	Deep forest+Walking trail	Passerine	8	CR	NO	LC	10.3	R
Dicaeum cruentatum	Scarlet Backed Flowerpecker	Passeriformes	Diciaedae	Nectarinivore+ Insectivore	Deep forest+Walking trail	Passerine	24	CR	NO	LC	31.1	UC
Dicaeum trigonostigma	Orange Bellied Flowerpecker	Passeriformes	Diciaedae	Nectarinivore+ Insectivore	Deep forest+Walking trail	Passerine	23	CR	NO	LC	29.8	UC
Parus major	Great Tit	Passeriformes	Paridae	Insectivore	Walking trail	Passerine	71	CR	NO	LC	92.2	VC
Passer domesticus	House Sparrow	Passeriformes	Passeridae	Graminivore	Walking trail	Passerine	54	CR	NO	LC	70.1	C
Ploceus philippinus	Baya Weaver	Passeriformes	Ploceidae	Graminivore	Walking trail	Passerine	56	CR	NO	LC	72.7	C
Lonchura malabarica	Indian Silverbill	Passeriformes	Estrildidae	Graminivore	Walking trail	Passerine	11	UR	NO	LC	14.2	R
Lonchura striata	White-rumped Munia	Passeriformes	Estrildidae	Graminivore	Walking trail	Passerine	6	UR	NO	LC	7.7	R
Lonchura punctulata	Scaly-breasted Munia	Passeriformes	Estrildidae	Graminivore	Walking trail	Passerine	10	CR	NO	LC	12.9	R
Dendronanthus indicus	Forest Wagtail	Passeriformes	Motacillidae	Insectivore	Deep forest+Walking trail	Passerine	17	M_p	NO	LC	22.1	R
Motacilla alba	White Wagtail	Passeriformes	Motacillidae	Insectivore	Deep forest+Walking trail	Passerine	26	CM_w	NO	LC	33.7	UC
Motacilla madaraspatensis	Citrine Wagtail	Passeriformes	Motacillidae	Insectivore	Walking trail	Passerine	1	RR	NO	LC	1.2	R
Motacilla citreola	Western Yellow Wagtail	Passeriformes	Motacillidae	Insectivore	Walking trail	Passerine	8	CM_w	NO	LC	10.3	R
Motacilla flava	White-browed Wagtail	Passeriformes	Motacillidae	Insectivore	Walking trail	Passerine	7	CM_w	NO	LC	9.1	R
Anthus rufulus	Paddy field Pipit	Passeriformes	Motacillidae	Insectivore	Walking trail	Passerine	6	CR	NO	LC	7.7	R

VC= Very Common, C= Common, UC= Uncommon, R=Rare, CM_w=Common Winter Migrant, CR=Common Resident, M_p=Passage Migrant, UR=Uncommon Resident, RR=Rare Resident, RM_w=Rare Winter Migrant, UM_w=Uncommon Winter Migrant, M_s=Summer Migrant.