

Avifaunal assemblages at Gorumara and Jaldapara National Parks in India with reference to habitat association and feeding guild

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ABSTRACT

128 avifaunal taxa belonging to 49 families were recorded from Gorumara and Jaldapara National Park, West Bengal, India in a seasonal field survey (2013 and 2014). The forest understory found to be the most preferred nesting niche for birds. Insectivores were most prominent feeding guilds. Survey showed that these Himalayan foothill landscapes are frequently visited by 2 Vulnerable (Lesser Adjutant and Pallas's Fish Eagle) and 1 Near Threatened species (River Lapwing). The study documented Kalij Pheasant (*Lophura leucomelanos*) which is probably new sighting from this region. In this attempt, latest and perennial causes of bird habitat loss were highlighted to draw conservation design for future.

Key words: Birds of North Bengal, Jaldapara National Park, Gorumara National Park, Feeding guild, Nesting niche, Open forest

INTRODUCTION

Bird community have been widely used as reliable "bioindicators" as they show associations with forest vegetation, involves wide range of feeding niches and in its natural ambit they actively serve the role of pollinators or scavengers that indirectly signify the environmental stability (Bock & Jones, 2004; Padoa-Schioppa *et al.*, 2006). Since couple of decades, many forested areas throughout the globe have been converted for agricultural uses and urbanization (Dobson *et al.*, 1997) which affect the abundance, quality and availability of food resources for birds (Tucker, 1992). The most threatened groups of birds are "totally dependent" upon forest and those species tolerant to habitat change, the "survivor" groups, are less likely to decline (Harris & Pimm, 2004). It was evident that, 0.8 °C of average temperature rise globally occurred over the past century had strong negative impacts on avifaunal population as they are pioneer indicators of climate change (Both *et al.*, 2006). According to an estimate, there were 9,787 known living species of birds inhabited the world, of which multiple threats made 21% (2,055 species) extinction-prone (Sekercioglu, 2004).

West Bengal (WB) an Indian state contributes 13.4% forest area (11,879 km²) of the total geographical area and 1.5% of Indian forest area (WB State Forest Report, 2011). A luxuriant avian biodiversity is supported by diversified forest biomes, variegated climatic conditions sustain in the state. Out of 57 Vulnerable avian species listed in India, 23 species were found in

West Bengal (BirdLife International, 2001). IBCN (2011) found 14 Near Threatened species in the Important Birding Areas (IBAs) of West Bengal. Gorumara National Park (GNP) and Jaldapara National Park (JNP) in the Sub-Himalayan zone are important IBAs fall under jurisdiction in Jalpaiguri district of West Bengal, India. The recorded forest area of Jalpaiguri was 6,227 km² including 23.32 km² degraded forest and shared 28.75% forest coverage of total geographic area. BirdLife International had listed 112 bird species under Biome-7 (Sino-Himalayan Temperate Forest), of which 88 had been found in West Bengal similarly, Biome-8 (Sino-Himalayan Subtropical Forest) had 95 species out of which 63 had been reported from this state (IBCNC 2011).

Various workers documented avifaunal populations in Gorumara, Jaldapara NP and its adjacent forests in a scattered manner (Inglis *et al.*, 1918-1920; Allen *et al.*, 1996; Kumar, 1998; Sivakumar & Prakash, 2004; Sivakumar *et al.*, 2006; Datta, 2011; Roy *et al.*, 2012) however systematic associations with its natural processes are scanty. Noteworthy Roy *et al.*, (2012) documented that these regions were subjected to huge pressure due to anthropogenic activity which caused significant habitat alterations. In continuation to the fact, the objectives of the present study are documentation of avifaunal diversity and comparing the community structure of different forest strata at GNP and JNP with special reference to their feeding guild structure and nesting ecology in present setting.

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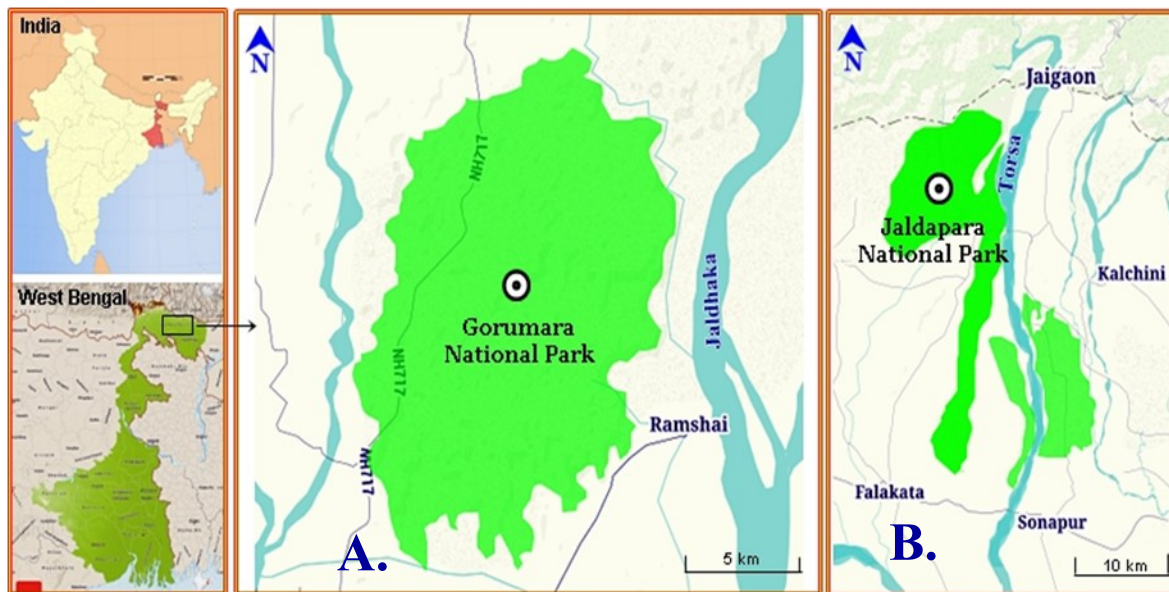


Figure 1 (A&B). Maps showing distribution of two protected areas in Himalayan Terai region of West Bengal; A. Gorumara National Park, B. Jaldapara National Park.

DESCRIPTION OF THE STUDY SITES

GNP and JNP are the mosaic of grasslands-woodlands and can be classified into moist-dry deciduous forest, semi-evergreen forest, riverine forest and savannah grassland (Champion & Seth, 1968). The average temperature of November to February varies between 10°C to 21°C and humidity ranges between 80 to 100% throughout the year. The soil types are alluvial, with coarse gravel and sandy clay to loam and annual rainfall exceeds 2000 mm. GNP (88° 51.58' E longitude and 26° 49.20' N latitude) comprises of 7,995 ha area in the flood plain of Murti, Jaldhaka, Garati and Indong river with 25 m - 275 m altitude (Figure 1). It is an Indo Himalayan eco-region within the Gangetic Plain (biogeographic zone 7B), a Terai habitat of Jalpaiguri district. GNP was protected since 1895, and became a Wildlife Sanctuary in 1949, which finally got NP status in 1994. JNP (25° 58' N to 27° 45' N latitude and 89° 05' E to 89° 55' E longitude) comprises of 21,651 ha area in the flood plains of the river Torsa (Figure 1) and broadly falls within the Indo-Gangetic and Brahmaputra floodplain (biogeographic zone 7B) having altitude of 60 - 130 m. Jaldapara Wildlife Sanctuary was established in 1941 to conserve *Rhinoceros unicornis* and in May 2012 it was upgraded to NP status. These protected networks have IBA site code of IN-WB-03 with A1 (Globally Threatened Species) and A2 (Restricted Range Species) criteria. A small portion of GNP encompasses Eastern Himalayas Endemic Bird Area (EBA 130) and Assam Plains Endemic Bird Area (EBA 131) (Stattersfield *et al.*, 1998), while a small fraction of JNP falls in Assam Plains Endemic Bird Area (EBA 131) (IBCN, 2011).

Mandal (2007) recorded 326 plant species comprised of 158 trees and 32 grasses in GNP. The riverine grassland and savannah woodland occupy about 20% of the total green cover. The core area has a closed canopy of considerable height and a fully shaded forest floor covered with leaf litter and mainly composed of tall trees such as *Shorea robusta* (Sal), *Tectona grandis* (Teak),

Bombax ceiba (Simul), *Dalbergia sissoo* (Sissu), *Terminalia arjuna* (Arjun), *Dillenia indica* (Chalta), *Ficus bengalensis* (Bot), *Amoora wallichii*, *Sterculia villosa* etc. (Pratihar & Chakraborty, 1996). The grasslands of JNP are defined as low alluvium savannah woodland and eastern alluvial grassland by Champion and Seth (1968). The major floral composition of JNP is *Shorea robusta* (Sal), *Chukrassa tabularis* (Chikrasi), *Schima* sp and *Amoora wallichii* etc. (Biswas & Mathur, 2003). GNP sustains one of the existing breeding populations of Great one-horned Indian Rhinoceros (*Rhinoceros unicornis*) and North-eastern populations of Asiatic Elephant (*Elephas maximus*) and serves as crucial migratory corridors towards Sikkim. Other mega-mammalian fauna includes Gaur (*Bos frontalis*), Leopard (*Panthera pardus*), Malayan Giant Squirrel (*Ratufa bicolor gigantean*), Spotted Deer (*Axis axis*) and highly-endangered Hispid Hare (*Caprolagus hispidus*) (Pratihar & Chakraborty, 1996). JNP sustains the key mammalian fauna like Great One-horned Indian Rhinoceros (*Rhinoceros unicornis*), Gaur (*Bos frontalis*), Sloth Bears (*Melursus ursinus*), Wild Boar (*Sus scrofa*), Indian Muntjak (*Muntiacus muntjak*), Hog Deer (*Axis porcinus*), Sambar (*Cervus unicolor*), Hispid Hare (*Caprolagus hispidus*) and Pigmy Hog (*Porcula salvania*). A small resident population of Asian Elephant (*Elephas maximus*) is also seen throughout the year and Leopard (*Panthera pardus*) is occasionally found here (Bell & Oliver 1992; Maheswaran, 2006).

BIRD SURVEY METHODOLOGY

According to Sutherland (2006), Point Count Method (PCM) or Fixed Radius Methodology (FRM) is the most efficient sampling technique for estimating avian density. The observer team resided at a point and recorded avifaunal occurrence within concentric zones of 50 m beyond which the birds were not detectable. While Line Transect Method (LCM) was applied in case of denser habitats with limited visibility and to avoid double counting (Bibby *et al.*, 1992). Seasonal field surveys were

Table 1. Avifauna recorded from Jaldapara (JNP) and Gorumara National Park (GNP) during the study period with notes on their status, habitat, feeding guild and conservation status.

Sl	Family and Common name	Scientific name	Status	Habitat Strata	Feeding guild	IUCN Status	JNP	GNP
Phasianidae								
1	Black Francolin	<i>Francolinus francolinus</i>	R	WS	OM	LC	-	+
2	Red Junglefowl	<i>Gallus gallus</i>	R	S, FG	OM	LC	+	+
3	Indian Peafowl	<i>Pavo cristatus</i>	R	S, FG	OM	LC	+	+
4	Kalij Pheasant	<i>Lophura leucomelanos</i>	R	S, FG	OM	LC	+	-
Anatidae								
5	Ruddy Shelduck	<i>Tadorna ferruginea</i>	WV	FG, WC	OM	LC	-	+
6	Lesser whistling duck	<i>Dendrocygna javanica</i>	R	FG	OM	LC	+	+
Ciconiidae								
7	Lesser Adjutant	<i>Leptoptilos javanicus</i>	R	WLM	CN	VU	+	-
8	Asian Openbill	<i>Anastomus oscitans</i>	R	WLM	CN	LC	-	+
9	Painted Stork	<i>Mycteria leucocephala</i>	R	FP	CN	LC	-	+
Threskiornithidae								
10	Red-naped Ibis	<i>Pseudibis papillosa</i>	R	WLM	OM	LC	+	-
Ardeidae								
11	Cinnamon Bittern	<i>Ixobrychus cinna- momeus</i>	R	WLM	PI/IN	LC	-	+
12	Striated Heron	<i>Butorides striata</i>	R	WC	PI/IN	LC	+	+
13	Indian Pond Heron	<i>Ardeola grayii</i>	R	FG, WC	PI/IN	LC	+	+
14	Cattle Egret	<i>Bubulcus ibis</i>	R	FG, P	PI/IN	LC	+	+
15	Intermediate Egret	<i>Egretta intermedia</i>	R	FP	PI/IN	LC	+	+
16	Little Egret	<i>Egretta garzetta</i>	R	FP	PI/IN	LC	+	+
Phalacrocoracidae								
17	Little Cormorant	<i>Phalacrocorax niger</i>	R	WC	PI	LC	+	+
Accipitridae								
18	Oriental Honey Buz- zard	<i>Pernis ptilorhynchus</i>	R	LWF	CN	LC	+	+
19	Black Kite	<i>Milvus migrans</i>	R	FE	CN	LC	-	+
20	Pallas's Fish Eagle	<i>Haliaeetus leucoryphus</i>	R	LWF	CN	VU	-	+
21	Crested Serpent Eagle	<i>Spilornis cheela</i>	R	LWF	CN	LC	+	-
22	Shikra	<i>Accipiter badius</i>	R	LWF	CN	LC	-	+
Rallidae								
23	White-breasted Water- hen	<i>Amaurornis phoenicurus</i>	R	WLM	AF/OM	LC	+	+
24	Common Moorhen	<i>Gallinula chloropus</i>	R & WV	WS	AF/OM	LC	+	+
25	Eurasian Coot	<i>Fulica atra</i>	R & WV	WC	AF/OM	LC	-	+
Charadriidae								
26	River Lapwing	<i>Vanellus duvaucelii</i>	R	RB	AF/CN	NT	-	+
27	Red-wattled Lapwing	<i>Vanellus indicus</i>	R	S	CN	LC	+	+
28	Little Ringed Plover	<i>Charadrius dubius</i>	R & WV	RB	IN	LC	-	+
Jacanidae								
29	Bronze-winged Jacana	<i>Metopidius indicus</i>	R	WLM	AF/OM	LC	+	-
Scolopacidae								
30	Common Snipe	<i>Gallinago gallinago</i>	WV	RB	CN	LC	-	+
31	Common Sandpiper	<i>Actitis hypoleucos</i>	WV	RB	CN	LC	+	+
Glareolidae								
32	Small Pratincole	<i>Glareola lactea</i>	R	RB	IN	LC	-	+

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Columbidae								
33	Common Pigeon	<i>Columba livia</i>	R	FE, FG	GN	LC	+	+
34	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	R & WV	BLF	GN	LC	+	+
35	Spotted Dove	<i>Streptopelia chinensis</i>	R	OF, FG	GN	LC	+	+
36	Yellow Footed Green Pigeon	<i>Treron phoenicopterus</i>	R	OF	FG	LC	+	+
37	Wedge-tailed Green Pigeon	<i>Treron sphenurus</i>	R	OF	FG	LC	+	-
38	Green Imperial Pigeon	<i>Ducula aenea</i>	R	BLF	FG	LC	+	+
39	Emerald Dove	<i>Chalcophaps indica</i>	R	BLF	GN	LC	-	+
Psittacidae								
40	Alexandrine Parakeet	<i>Psittacula eupatria</i>	R	LWF	FG	LC	+	+
41	Rose-ringed Parakeet	<i>Psittacula krameri</i>	R	LWF	FG	LC	+	+
42	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	R	LWF	FG	LC	+	+
43	Red-breasted Parakeet	<i>Psittacula alexandri</i>	R	LWF	FG	LC	+	+
Cuculidae								
44	Common Hawk Cuckoo	<i>Cuculus varius</i>	R & PM	FC	IN	LC	+	+
45	Asian Koel	<i>Eudynamys scolopaceus</i>	R	FC	OM	LC	+	+
46	Green-billed Malkoha	<i>Rhopodytes tristis</i>	R	BLF	CN	LC	-	+
47	Lesser Coucal	<i>Centropus bengalensis</i>	R	FG, S	CN	LC	+	+
Tytonidae								
48	Barn Owl	<i>Tyto alba</i>	R	BLF	CN	LC	-	+
Strigidae								
49	Jungle Owlet	<i>Glaucidium radiatum</i>	R	BLF	CN	LC	+	-
50	Spotted Owlet	<i>Athene brama</i>	R	FE	CN	LC	+	+
Apodidae								
51	Little Swift	<i>Apus affinis</i>	R	OF	IN	LC	+	+
52	Asian Palm Swift	<i>Cypsiurus balasiensis</i>	R	OF	IN	LC	+	+
Coraciidae								
53	Indian Roller	<i>Coracias benghalensis</i>	R	OF	IN	LC	+	+
Alcedinidae								
54	Stork-billed Kingfisher	<i>Pelargopsis capensis</i>	R	WLM	PI/IN	LC	+	+
55	Ruddy Kingfisher	<i>Halcyon coromanda</i>	R	FG, WC	PI/IN	LC	-	+
56	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	R	FG, WC	PI/IN	LC	+	+
57	Common Kingfisher	<i>Alcedo atthis</i>	R	WLM	PI	LC	+	+
58	Pied Kingfisher	<i>Ceryle rudis</i>	R	FG, WC	PI	LC	-	+
Meropidae								
59	Green Bee-eater	<i>Merops orientalis</i>	R	OF	IN	LC	+	+
60	Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	R	WLM	IN	LC	+	+
Upupidae								
61	Common Hoopoe	<i>Upupa epops</i>	R	OF	IN	LC	+	+
Bucerotidae								
62	Oriental Pied Hornbill	<i>Anthracoceros albirostris</i>	R	BLF	CN	LC	+	+
Ramphastidae								
63	Lineated Barbet	<i>Megalaima lineata</i>	R	OF, BLF	FG/IN	LC	+	+
64	Blue-throated Barbet	<i>Megalaima asiatica</i>	R	OF, BLF	FG	LC	+	+
65	Blue-eared Barbet	<i>Megalaima australis</i>	R	OF, BLF	FG	LC	+	+

66	Coppersmith Barbet		<i>Megalaima haemacephala</i>	R	OF, BLF	FG	LC	-	+
Picidae									
67	Brown-capped Woodpecker	Pygmy	<i>Dendrocopos nanus</i>	R	OF, LWF	IN	LC	+	-
68	Fulvous-breasted Woodpecker	Woodpecker	<i>Dendrocopos macei</i>	R	OF, LWF	IN	LC	+	+
69	Greater Yellownape		<i>Picus flavinucha</i>	R	LWF	IN	LC	+	+
70	Lesser Goldenback		<i>Dinopium benghalense</i>	R	FE	IN	LC	+	+
71	Yellow Crowned Woodpecker		<i>Dendrocopos mahrattensis</i>	R	LWF	IN	LC	-	+
72	Greater Goldenback		<i>Chrysocolaptes lucidus</i>	R	FE	IN	LC	+	+
73	Roufous Bellied Woodpecker		<i>Dendrocopos hyperythrus</i>	R	LWF	IN	LC	+	-
Aegithinidae									
74	Common Iora		<i>Aegithina tiphia</i>	R	OF	IN	LC	+	-
Campephagidae									
75	Large Cuckooshrike		<i>Coracina macei</i>	R	OF, LWF	IN	LC	+	+
76	Small Minivet		<i>Pericrocotus cinnamomeus</i>	R	S, OF	IN	LC	+	+
77	Scarlet Minivet		<i>Pericrocotus speciosus</i>	R	S	IN	LC	+	+
Laniidae									
78	Brown Shrike		<i>Lanius cristatus</i>	W V	FE	CN	LC	+	+
79	Long-tailed Shrike		<i>Lanius schach</i>	R	S	CN	LC	+	+
80	Grey-backed Shrike		<i>Lanius tephronotus</i>	W V	S	CN	LC	+	+
Oriolidae									
81	Black-hooded Oriole		<i>Oriolus xanthornus</i>	R	LWF	IN/ CN	LC	+	+
82	Indian Golden Oriole		<i>Oriolus (oriolus) kundoo</i>	R	OF	IN	LC	+	-
Dicruridae									
83	Black Drongo		<i>Dicrurus macrocercus</i>	R	OF, FE	IN	LC	+	+
84	Ashy Drongo		<i>Dicrurus leucophaeus</i>	R	LWF	IN	LC	+	+
85	White-bellied Drongo		<i>Dicrurus caerulescens</i>	R	LWF	IN	LC	+	-
86	Bronzed Drongo		<i>Dicrurus aeneus</i>	R	BLF	IN	LC	+	+
87	Lesser Racket-tailed Drongo		<i>Dicrurus remifer</i>	R	BLF	IN	LC	+	-
88	Spangled Drongo		<i>Dicrurus hottentottus</i>	R	LWF	IN	LC	+	+
Rhipiduridae									
89	White-throated Fantail		<i>Rhipidura albicollis</i>	R	OF	IN	LC	+	-
90	Asian Paradise-flycatcher		<i>Terpsiphone paradisi</i>	R	OF	IN	LC	-	+
Monarchidae									
91	Black-naped Monarch		<i>Hypothymis azurea</i>	R	BLF	IN	LC	-	+
Corvidae									
92	Rufous Treepie		<i>Dendrocitta vagabunda</i>	R	LWF	OM	LC	+	+
93	House Crow		<i>Corvus splendens</i>	R	FE	OM	LC	+	+
94	Jungle Crow		<i>Corvus macrorhynchos</i>	R	OF	OM	LC	+	+
Paridae									
95	Great Tit		<i>Parus major</i>	R	FE	IN	LC	-	+
Hirundinidae									
96	Barn Swallow		<i>Hirundo rustica</i>	W V	OF	IN	LC	+	-
Alaudidae									
97	Ashy Crowned Sparrow Lark		<i>Eremopterix grisea</i>	R	TG	IN	LC	-	+
Cisticolidae									
98	Zitting Cisticola		<i>Cisticola juncidis</i>	R	TG	IN	LC	+	+
99	Common Tailorbird		<i>Orthotomus sutorius</i>	R	FE	IN	LC	+	+

Pycnonotidae								
100	Black-crested Bulbul	<i>Pycnonotus flaviventris</i>	R	OF, LWF	IN	LC	+	+
101	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	R	FE	IN	LC	+	+
102	Red-vented Bulbul	<i>Pycnonotus cafer</i>	R	FE	IN	LC	+	+
Timaliidae								
103	Jungle Babbler	<i>Turdoides striata</i>	R	FE, FG	IN	LC	+	+
Zosteropidae								
104	Oriental White-eye	<i>Zosterops palpebrosus</i>	R	BLF	IN	LC	-	+
Sittidae								
105	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	R	LWF	IN	LC	+	-
Sturnidae								
106	Common Hill Myna	<i>Gracula religiosa</i>	R	LWF	OM	LC	+	+
107	Jungle Myna	<i>Acridotheres fuscus</i>	R	OF	OM	LC	+	+
108	Common Myna	<i>Acridotheres tristis</i>	R	FE	OM	LC	+	+
109	Asian Pied Starling	<i>Sturnus contra</i>	R	FE	OM	LC	+	+
110	Chestnut-tailed Starling	<i>Sturnus malabaricus</i>	R	OF	OM	LC	+	+
Turdidae								
111	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	R	TG	IN	LC	-	+
112	Blue Rock Thrush	<i>Monticola solitarius</i>	R	TG	IN	LC	+	-
Muscicapidae								
113	Oriental Magpie-Robin	<i>Copsychus saularis</i>	R	S	IN	LC	+	+
114	White-rumped Shama	<i>Copsychus malabaricus</i>	R	OF	IN	LC	+	+
115	Indian Robin	<i>Saxicoloides fulicatus</i>	R	S	IN	LC	+	+
116	Black-backed Forktail	<i>Enicurus immaculatus</i>	R	BLF	IN	LC	-	+
Nectariniidae								
117	Purple Sunbird	<i>Cinnyris asiaticus</i>	R	S	NE	LC	+	+
118	Crimson Sunbird	<i>Aethopyga siparaja</i>	R	S	NE	LC	+	+
Passeridae								
119	House Sparrow	<i>Passer domesticus</i>	R	FE	GN	LC	+	+
120	Eurasian Tree Sparrow	<i>Passer montanus</i>	R	OF	GN	LC	+	+
Ploceidae								
121	Baya Weaver	<i>Ploceus philippinus</i>	R	TG	IN	LC	+	+
Estrildidae								
122	Scaly-breasted Munia	<i>Lonchura punctulata</i>	R	S	IN	LC	+	+
123	Black-headed Munia	<i>Lonchura malacca</i>	R	S	IN	LC	+	+
Motacillidae								
124	Citrine Wagtail	<i>Motacilla citreola</i>	WV	RB	OM	LC	-	+
125	White Wagtail	<i>Motacilla alba</i>	WV	WLM	OM	LC	+	+
126	Grey Wagtail	<i>Motacilla cinerea</i>	WV	RB	OM	LC	+	+
127	White browed Wagtail	<i>Motacilla maderaspatensis</i>	R	TG	OM	LC	-	+
128	Paddy Field Pipit	<i>Anthus rufulus</i>	R	TG	IN	LC	+	+

Abbreviations used:

Status = Resident: R; Winter Visitor: WV; Partial migrant: PM

Habitat strata = Broadleaved forest: BLF; Flooded grassland: FLG; Forest canopy: FC; Forest edge: FE; Forest ground: FG; Forest pool: FP; Large wood forest: LWF; Open forest: OF; pasture: P; River bank: RB; Scrubs: S; Tall Grassland: TG; Water channel: WC; Water logged marshland: WLM; Watery scrubs: WS

Feeding guild = Aquatic Feeder: AF; Carnivore: CN; Frugivore: FG; Grainivore: GR; Insectivore: IN; Nectarivore: NE; Omnivore: OM; Piscivore: PI

IUCN status = Least Concern: LC; NT: Near Threatened; VU: Vulnerable

+ 'present'; - 'absent'

conducted at maximum of 261 point counts during the initial two hours after sunrise (7 to 9 AM), and in the afternoon (4 to 6 PM) during early breeding season (May-June), peak breeding season (July-August) and maximum abundance period (December-January) covering successive two years (2013 and 2014). The birds were identified either with unaided eye or using Olympus 10 x 50 DPSI binoculars and field guides like Ali (2012) and Grimmett *et al.*, (2011). The taxonomy and nomenclature was followed as per Inskipp *et al.* (1996). Bird species diversity indices like *Shannon–Wiener Diversity Index*, *Simpson's Dominance Index*, *Pielou's Evenness Index* and *Margalef's Richness Index* at family level were calculated using software PAST (version 3.01).

RESULTS AND DISCUSSION

128 avifaunal species belonging to 49 families were recorded (Table 1) from GNP and JNP of which 89% were resident (R), 7% winter visitor (WV), 3% resident and winter visitor (R and WV) respectively and 1% belonged to resident and partial migrant (R and PM) category. Family Columbidae and Picidae represented highest number of individuals (7 species) followed by family Ardeidae and Dicuridae (6 species), family Alcedinidae, Sturnidae, Motacillidae and Accipitridae (5 species) and family Psittacidae, Cuculidae, Ramphastidae, Muscicapidae and Phasianidae (4 species) respectively. Details of bird species, their habitat, conservation status etc were documented in Table 1. The highest bird diversity was found at GNP with 111 species distributed in 44 families followed by JNP with 99 species comprising 42 families. 82 bird species were common in both sites. According to the records of the WB Forest Department, 240 species of birds were known to occur at JNP (Kumar, 1998) and the Management Plan of GNP, prepared by the Wildlife Circle, WB Forest Department (Anonymous, 1998) listed 193 species, including many Red Data Book species. Roy *et al.*, (2012) documented 117 bird species from different important birding areas of North Bengal and 87 bird species from GNP especially in a short time span thus depicted a moderately healthy overall biodiversity and good forest quality left in GNP and JNP. Avian diversity indices were found higher at GNP in present study because this region is well protected since many years, despite being surrounded by dense human population and better visibility probably due to smaller in size in comparison with JNP (Table 2). BirdLife International (2014) estimated a total 1180 bird species in India of which 82 species are globally threatened. According to BirdLife International (2001), 9 species from threatened category (Critically

Endangered and Vulnerable) and 5 species from Near Threatened category were found here. Only 2 Vulnerable (Lesser Adjutant and Pallas's Fish Eagle) and 1 Near Threatened (River Lapwing) of them were detected in the present study. Present investigation documented Kalij Pheasant (*Lophura leucomelanos*) from JNP for the first time (Table 1 & Plate 1) which is basically endemic in eastern Himalayan landscape and fall under Schedule-I as per Wildlife Protection Act, 1972. During the study length Indian Peafowl, Herons, Egrets, Sandpipers, Green Pigeons, Parakeets, Kingfishers, Woodpeckers, Drongos, Orioles, Shrikes, Barbets, Indian Roller etc were abundantly found from the two landscapes.

Eight different types of nesting habitat were detected during the present study. Forest understorey was widely used (29%) due to presence of several structurally complex forest strata, more feeding niches, better protection from predators, enemies and weather shield (Bhat & Murali, 2001), followed by tree branch (22%), tree hole (18%), open forest (10%), riverbed (8%), grassland (5%) respectively for nesting. Forest ground and canopy were occupied by 4% nesting habitat. Overall 15 habitats were identified within same ecological continuum profiling unique niche characteristics. Utmost bird species abundance was found in open forest (19%), large woody (15%) and broadleaved zones (12%) forest edge or transition zone (11%) containing habitat generalist and opportunistic bird species (basically synanthropic birds) and scrubs (8%). Grassland, river bank, water logged marshland and watery channels were occupied by 5% to 7% birds. Result showed that birds frequenting between GNP and JNP utilized eight different feeding guilds. Among them insectivorous birds (49%) were more abundant in different secondary forest strata because structural complexity of such forest is very suitable for insects (Chettri *et al.*, 2005), followed by omnivores (18%), carnivores (17%), piscivores (10%), frugivores (9%), grainivores (5%) aquatic feeders (4%) and nectarivores birds (2%). Insectivores were recorded from 13 out of 15 habitats and as dominant feeding guild in 07 of them (open forest, large wood forest, broadleaved forest, forest edge, scrubs, pastures and river bank) (Figure 2). Frugivorous birds were mainly dominated in open forest, large wood forest, and broadleaved forest habitat. Most of these habitat specialist bird species belonged to Psittacidae, Ramphastidae and Columbidae family. Zakaria *et al.* (2005) reported frugivorous birds were adapted to the seasonal availability of fruits and considered as good colonising species. Water logged marshland, flooded grassland, forest pool etc dominated by insectivorous, aquatic feeder and piscivorous birds. River bank habitat was dominated by mainly carnivorous followed by insectivorous and omnivorous birds. Although a seasonal change in species diversity and presence of migrants occurs in forests may result modifications of the feeding ecology of resident species (Robertson & Hackwell, 1995). However presence of 7% migratory birds in the present study demonstrated less impact on feeding guild structure. Although variations in foraging pattern depends on several factors like predation risk, physical structure of the habitat and microclimatic constraints as described by de Casenavea *et al.* (2008).

Table 2. Avian diversity indices Jaldapara (JNP) and Gorumara National Park (GNP)

Diversity indices	GNP	JNP
Shannon–Wiener Diversity Index	3.606	3.549
Simpson's Dominance Index	0.9689	0.9661
Pielou's Evenness Index	0.8367	0.8282
Margalef's Richness Index	9.13	8.942



A.



B.



C.



D.



E.



F.



G.



H.



I.



J.

Plate 1. Photographs of some major avifauna recorded from Jaldapara (JNP) and Gorumara National Park (GNP) during the study period. **A:** Kalij Pheasant (*Lophura leucomelanos*) male and female in pair; **B:** Kalij Pheasant (*Lophura leucomelanos*) male; **C:** Indian Peafowl (*Pavo cristatus*); **D:** Indian Roller (*Coracias benghalensis*); **E:** Asian Openbill (*Anastomus oscitans*); **F:** Common Hoopoe (*Upupa epops*); **G:** Green Imperial Pigeon (*Ducula aenea*) with Alexandrine Parakeet (*Psittacula eupatria*); **H:** Yellow Footed Green Pigeon (*Treron phoenicopterus*); **I:** Yellow Footed Green Pigeon (*Treron phoenicopterus*) in pair; **J:** Plum-headed Parakeet (*Psittacula cyanocephala*) male

The forest biome of northern part of West Bengal in India is facing numerous conservation challenges. Among them human-driven habitat alteration is a critical factor in widespread decline of specialist organism (Vitousek *et al.*, 1997). In last 10 years, the population of Jalpaiguri district has undergone 13.9 % increment by 2011 (622 people km⁻²) since 2001 (546 people km⁻²). Moreover, 72.6 % population of Jalpaiguri districts were found to live in rural belts close to reserve forests (Govt. of India, 2011) and a large proportion of them are direct

or indirect user of forest products. There are 13 revenue villages, 4 forested villages encircled GNP. JNP has always been under threat from the high densities of villages occupying the surrounding areas. Fringe villagers are often depends upon forests for Non Timber Forest Product (NTFP) and livestock grazing. Heavy traffic flow of NH-31(national highway) disturbs the natural environment of adjacent reserve. The natural heritage of North Bengal encountered 56.8% growth in tourism inflow from 2001 to 2008. All these exert tremendous

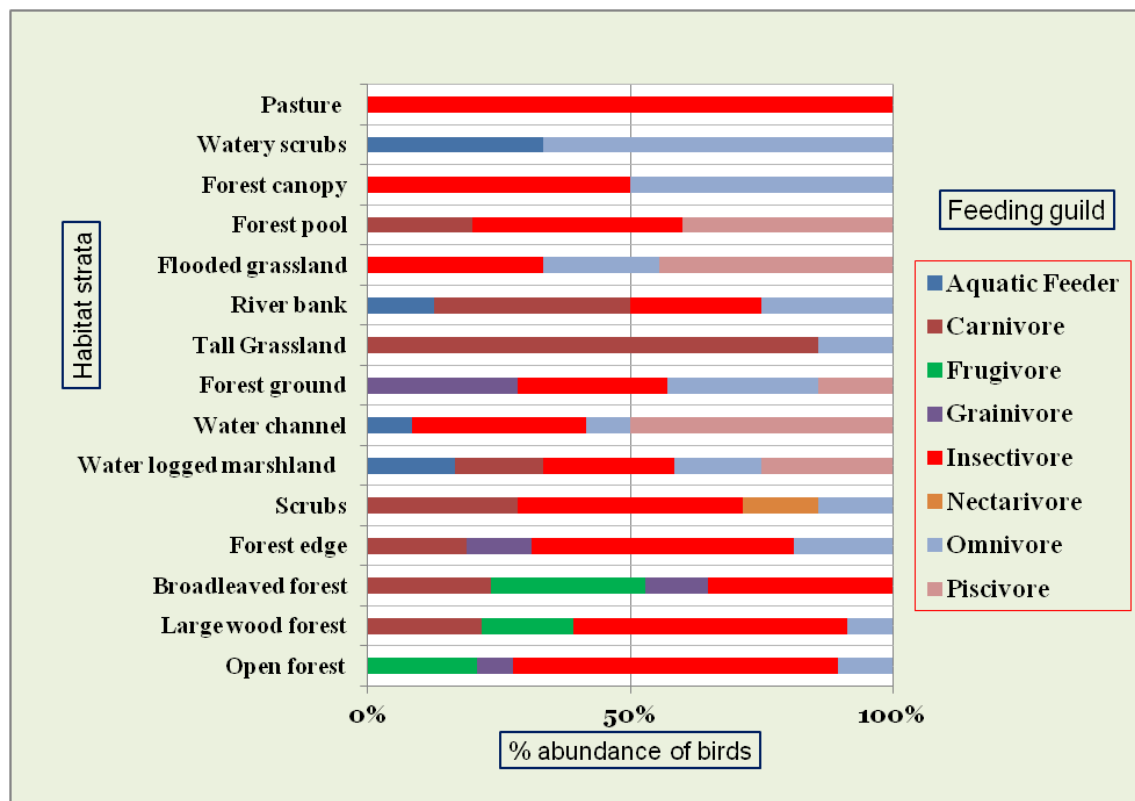


Figure 2. The percentage assemblage of feeding guild of avifauna in different habitat strata at GNP and JNP.

anthropogenic pressure on the forest landscape and cause qualitative degradation of natural habitat. The West Bengal state experienced an increase by 0.98°C of the mean maximum air temperature and by 1.56°C of the mean minimum air temperature during the period of 1980–2010, which predicted the average daily maximum and minimum air temperatures are both projected to rise by 2.2 °C in the 2050s (WBSAPCC, 2010). It is note that some bird species are adversely affected by temperature increases as small as 1°C (Hilbert *et al.*, 2004). Due to local and regional climatic warming, bird species are expected to shift their distribution range to get optimum food resources (Both *et al.*, 2006).

CONCLUSION

Short span biodiversity assessment using species checklists were widely used and considered to be one of the best tools for designing long-term conservation programme. This study involved only a few selected patches of forests; a more rigorous study might provide more species as well as their distribution in different forest patches. The effect of climatic variability as well anthropogenic activity on bird diversity in northern West Bengal also demands further intensive studies.

REFERENCES

- Ali, S. 2012. The books of Indian Birds. (13th edition, ed Daniel, J. C.). BNHS and Oxford University Press: New Delhi, India.
- Allen, D., Anderton, J. And Kazmierczak, K. 1996. Report on an ornithological visit to Buxa Tiger Reserve, West Bengal, India, 17 February to 6 March 1992. Forktail 12: 31-33.
- Anonymous. 1998. Management Plan of Gorumara National Park, West Bengal (1997–98 to 2006–07). Wild Life Circle, Government of West Bengal.
- Bell, D. J. and Oliver, W. L. R. 1992. Northern Indian Tall Grasslands: Management and Species Conservation with Special Reference to Fire. Pp. 109–123. In: Tropical Ecosystems: Ecology and Management. (eds Singh, K. P. and Singh, J. S.), Wiley Eastern, New Delhi, India.
- Bhat, D. M. and Murali, K. S. 2001. Phenology of understorey species of tropical moist forest of Western Ghats region of Uttara Kannada district in South India. Current Science 81 (7): 799-805.
- Bibby, C. J., Burgess, N. D. and Hill D. A. 1992. Bird Census Techniques. Academic Press, London.
- BirdLife International. 2001. Threatened Birds of Asia: The BirdLife International Red Data Book. (Ed Collar, N. J.), BirdLife International: Cambridge, U.K.
- BirdLife International. 2014. Country profile: India. Available from: <http://www.birdlife.org/datazone/country/india>. Cited 1 Nov 2014..
- Biswas, T. and Mathur, V. B. 2000. A review of the present conservation scenario of Hog Deer (*Axis porcinus*) in its native range. Indian Forester 126: 1068–1084.
- Bock, C. E. and Jones, Z. F. (2004). Avian habitat evaluation: should counting birds count? Frontiers in Ecology and the Environment 2 (8): 403–410.
- Both, C., Bouwhuis, S., Lessells, C. M. and Visser, M. W. (2006). Climate change and population declines in a long-distance migratory bird. Nature 441-481.

- Champion, H. G. and Seth, S. K. 1968. A Revised Survey of the Forest Types of India. Manager of Publications, Government of India Press: New Delhi, India.
- Chettri, N., Deb, D. C., Sharma, E. and Jackson, R. 2005. The relationship between bird communities and habitat. *Mountain Research and Development* 25 (3): 235–243.
- Datta, T. 2011. Human interference and avifaunal diversity of two wetlands of Jalpaiguri, West Bengal, India. *Journal of Threatened Taxa* 3(12): 2253–2262.
- de Casenavea, J. L., Cuetoa, V. R. and Maroneb, L. 2008. Seasonal dynamics of guild structure in a bird assemblage of the central Monte desert. *Basic and Applied Ecology* 9: 78–90.
- Dobson, A. P., Bradshaw, A. D. and Baker, A. J. M. 1997. Hopes for the future: restoration ecology and conservation biology. *Science* 277:515–525.
- Grimmett, R., Inskipp, C., Inskipp, T. and Allen, R. 2011. *Birds of the Indian Subcontinent*. Oxford University Press, Christopher Helm, London.
- Government of India. 2011. Census, 2011. Ministry of Home Affairs, Office of the Registrar General and Census Commissioner, India. Available via <http://www.census2011.co.in/census/district/2-jalpaiguri.html>. Cited 3 Nov 2014.
- Harris, G. M. and Pimm, S. L. 2004. Bird species' tolerance of secondary forest habitats and its effects on extinction. *Conservation Biology* 18(6): 1607–1616.
- Hilbert, D.W., Bradford, M., Parker, T. and Westcott, D.A., 2004. Golden bowerbird (*Priondura newtonia*) habitat in past, present and future climates: predicted extinction of a vertebrate in tropical highlands due to global warming. *Biological Conservation* 116 (3): 367–377.
- Indian Bird Conservation Network (IBCN). 2011. Important Bird Areas in India - West Bengal. Available at http://ibcn.in/wp-content/uploads/2011/12/43-1087_1111-West-Bengal.pdf. Cited 14 Oct 2014.
- Inglis, C. M., Travers, W. L. and O'Donel, H. V. (1918–1920) A tentative list of the vertebrates of the Jalpaiguri District, Bengal. *Journal of Bombay Natural History Society* 24: 988–999; 27: 151–162.
- Inskipp, T., Lindsey, N. and Duckworth, W. 1996. An Annotated Checklist of the Birds of the Oriental Region. Oriental Bird Club, UK.
- Kumar, S. A. 1998. Birds of Jaldapara Wildlife Sanctuary. *Newsletter for Birdwatchers* 38: 7–8.
- Maheswaran, G. 2006. Ecology and Conservation of the Endangered Hispid Hare *Caprolagus hispidus* in Jaldapara Wildlife Sanctuary, West Bengal, India. *Journal of Bombay Natural History Society* 103: 191–201.
- Mandal, S., 2007. Wild fauna of Gorumara National Park, Jalpaiguri, West Bengal. *Intas Polivet* 8 (1): 257–261.
- Padoa-Schioppa, E., Baietto, M., Massa, R. and Bottoni, L. 2006. Bird communities as bioindicators: The focal species concept in agricultural landscapes. *Ecological Indicators*: 6: 83–93.
- Pratihari, S. and Chakraborty, S., 1996. An account of the mammalian fauna of Gorumara National Park, Jalpaiguri, West Bengal. *Records of the Zoological Survey of India* 95 (3-4): 229–241.
- Robertson, H.A. and Hackwell, K.R., 1995. Habitat preferences of birds in seral kahikatea *Dacrycarpus dacrydioides* (Podocarpaceae) forest of South Westland, New Zealand. *Biological Conservation* 71:275–280.
- Roy, U.S., Banerjee, P. and Mukhopadhyay, S. K. 2012. Study on avifaunal diversity from three different regions of North Bengal, India. *Asian Journal of Conservation Biology*, 1 (2): 120 -129.
- Şekercioğlu, Ç. H., Daily, G. C. and Ehrlich, P. R. 2004. Ecosystem consequences of bird declines. *Proceedings of the National Academy of Sciences of USA* 101: 18042–18047.
- Sivakumar, S. and Prakash, V., 2004. Water birds of Buxa Tiger Reserve, West Bengal. *Zoos' Print Journal* 19(4): 1451–1452.
- Sivakumar, S., Varghese J. and Prakash, V. 2006. Abundance of birds in different habitats in Buxa Tiger Reserve, West Bengal, India. *Forktail* 22: 128–133.
- Sutherland, W.J. 2006. *Ecological Census Techniques a handbook*. Cambridge University Press, New York.
- Stattersfield, A. J., Crosby, M. J., Long, A. J. and Wege, D. C. 1998. *Endemic Bird Areas of the World: Priorities for Biodiversity Conservation*. BirdLife Conservation Series No. 7. BirdLife International, Cambridge, U. K.
- Tucker, G. M. 1992. Effects of agricultural practices on field use by invertebrate-feeding birds in winter. *Journal of Applied Ecology* 29: 779–790.
- Vitousek, P.M., Mooney, H.A., Lubchenco, J. and Melillo, J.M. 1997. Human domination of the Earth's ecosystems. *Science* 277: 494–499.
- WBSAPCC., 2010. West Bengal State Action Plan on Climate Change. Available via <http://moef.nic.in/downloads/public-information/West-Bengal-SAPCC.pdf>. Cited 19 July 2014.
- West Bengal State Forest Report., 2011- 2012. Directorate of Forests, Government of West Bengal, Kolkata, pp 136. http://www.westbengalforest.gov.in/publication_pdf/sfr11-12.pdf. Cited 4 Sept 2014.
- Zakaria, M., Leong, P.C. and Yusuf, M. E., 2005. Comparison of species composition in three forest types: Towards using bird as indicator of forest ecosystem health. *Journal of Biological Sciences* 5(6): 734–737.