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Study on avifaunal diversity from three different regions of North Bengal, India

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ABSTRACT

A rapid avifaunal diversity assessment was carried out at three different locations of north Bengal *viz.* Gorumara National Park (GNP), Buxa Tiger Reserve (BTR) (Jayanti/Jainty range) and Rasik Beel Wetland Complex (RBWC) during 2nd November and 14th November 2008. A total of 117 bird species belonging to 42 families were recorded during the present short span study. The highest bird diversity was recorded in GNP with 87 bird species, followed by RBWC (75) and BTR (68). The transition zones between GNP and BTR, BTR and RBWC and GNP and RBWC were represented by 51, 41 and 57 common bird species, respectively. A total of 36 bird species were recorded in all three study sites. This diverse distribution of bird species was reflected in the study of diversity indices where the highest Shannon–Wiener diversity index score of 3.86 was recorded from GNP followed by RBWC (3.64) and BTR (2.84). The similar trend was also observed for Simpson's Dominance Index, Pielou's Evenness Index and Margalef's Richness Index. Consequently in the dendrogram analysis, we found that GNP and RBWC were much closer to each other while BTR remained distantly located form this cluster. The present study recorded two birds *viz.* Black-naped oriole (*Oriolus chinensis*) and Marshall's iora (*Aegithina nigrolutea*) previously not reported from the present study location. Like other protected areas of the country the present study location is also facing conservation challenges and more intensive studies will certainly reveal the impact of anthropogenic alteration of the habitats in and around the present study location along with the enrichment of knowledge for the avifaunal diversity.

Key words: Birds, Diversity Indices, Gorumara National Park, Buxa Tiger Reserve, Rasik Beel Wetland Complex.

INTRODUCTION

Study of avifaunal diversity is an essential ecological tool which acts as an important indicator to evaluate different habitats both qualitatively and quantitatively (Bilgrami, 1995). Unfortunately global diversity of birds is decreasing incessantly primarily due to anthropogenic disturbances (Rapoport, 1993) and climate change (Chen *et al.,* 2011; Sekercioglu *et al*., 2012). No surprise that IUCN Red List of endangered birds has already recognized 1226 bird species as threatened globally and India with 88 threatened bird species is ranked at seventh position (BirdLife International 2010). According to Hughes *et al*., (1997) in tropical forests on an average 1800 populations are being destroyed per hour while 16 million annually! Gaston and Blackburn (2003) estimated that since pre–agricultural levels overall global bird population has declined by a fifth to a quarter due to change in land–use pattern alone.

The northern part of West Bengal encompasses a number of sanctuaries, national parks, reserve forests and wetlands and supports enormous biodiversity (Islam and Rahmani, 2004). Gorumara National Park (GNP), Buxa Tiger Reserve (BTR) (National Park) and Rasik Beel Wetland Complex (RBWC) are three such most important areas that harbours large numbers of local and migratory birds (Islam and Rahmani, 2004). Sadly, ever accelerating anthropogenic activities especially mounting pressure from tourism have caused significant habitat alteration. Thus the objective of the present study was to prepare a checklist of birds and to compare the bird diversity of these three different regions of north Bengal that are subjected to various degrees of pressures from human disturbances.

MATERIALS AND METHODS

Study sites

The study was conducted in two most popular forests of North Bengal *viz.* Gorumara National Park (26°42' N, 88° 48'E; 275 m) and Jayanti/Jainti range, Buxa Tiger Reserve (26°39'N, 89°34'48"E; 1,800 m) and a large wetland complex *viz.* the Rasik Beel Wetland Complex (26°21′ N, 89° 40 E)(Figure 1). These are the places of major tourist attraction in north Bengal and the resulting disturbances together with the pressure for livelihood development of local people are forcing the conversion of this region. Due to the intense anthropogenic influence most of the forest has already been destroyed here and ever increasing demand of tourism are engulfing the remaining.

Gorumara National Park (GNP) encompassing almost 80 Km^2 area is situated in the flood plain of Murti and Jaldhaka River of Jalpaiguri District of West Bengal with mild elevations of 25 m – 250 m. Harbouring huge natural resources the park has been under protection since 1895 and finally became a national park on January 31, 1994. The park falls in Indomalaya ecoregion within Gangetic Plain biogeographic zone having IBA site code of IN–WB–03 with A1 (sites that harbours significant

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numbers of a globally threatened species, or other species of global conservation concern as categorized by the IUCN Red List) and A2 sites that harbours restricted range species separated geographically in terms of breeding area distribution) criteria (Birdlife International, undated). Fraction of this IBA falls within the Eastern Himalayas Endemic Bird Area (EBA 130) which consists of 21 restricted range species (Islam and Rahmani, 2004). The site also shares a small portion with Assam Plains Endemic Bird Area (EBA 131) Stattersfield *et al.*, (1998). The phytogeography of this region consists of Tropical moist deciduous forest, Tropical dry deciduous forest and Tropical semi evergreen forest (Champion and Seth, 1968). The park harbours almost 326 species of plants which includes 158 species of trees and 32 species of grasses (Anon., 1998) The park has recorded 48 species of mammals, 193 species of birds, 22 species of reptiles, 7 species of turtles, 27 species of fishes and other macro and micro fauna (Ali and Ripley 1987; Pratihar and Chakraborty, 1996; Anon., 1998; Maheswaran, 2002). This park is also known for the one–horned rhinoceros *Rhinoceros unicornis* and in 1996, 16 individuals were reported from Gorumara (Pratihar and Chakraborty, 1996).

Buxa Tiger Reserve (BTR), in the Alipurduar Sub–Division of Jalpaiguri District was setup as the 15th Tiger Reserve in the country in 1983 at the northeastern corner of West Bengal bordering Bhutan and Assam. The present studies were conducted at or near Jayanti/Jainti, a picturesque forested area inside BTR. The area of the BTR encompasses 760.87 Km^2 having a sanctuary of 269 Km^2 and a National Park of 117.01 Km^2 of pristine forests and is situated in the transition zone between Biome–8 (Sino-Himalayan Subtropical Forest) and Biome–12 (Indo-Gangetic Plain) (Islam and Rahmani, 2004). This picturesque reserve with its Terai (transitional zone

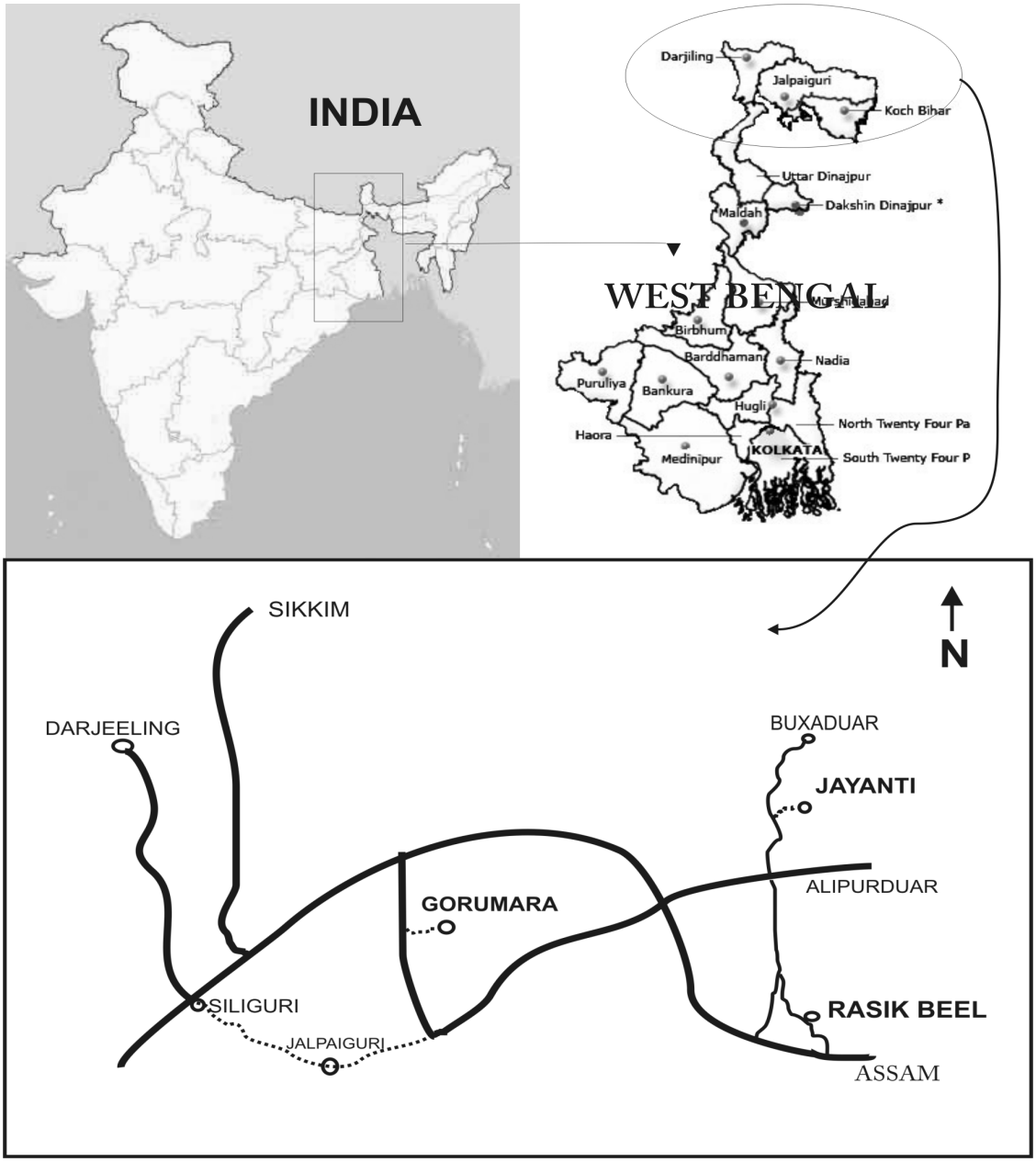

Figure 1. Map of the study areas (GNP, BTR and RBWC) in and around the present study location.

between forest belt and cultivated plains characterized by the presence of reeds and grasses), Bhabar (narrow forest belt characterized with complete absence of water sources) and hilly landscape mounts up to an altitude of 1800 m and is crisscrossed by numerous rivers and rivulets. IBA site code of this region is IN–WB–01 with A1 and A2 criteria. Fraction of this IBA also falls falls within the Eastern Himalayas Endemic Bird Area (EBA 130) which consists of 21 restricted range species Stattersfield *et al.*, (1998). Champion and Seth (1968) have subdivided this Moist Tropical Forest into eight Sub–types. The main floral and faunal composition of this forest are trees like Sal (*Shorea robusta*), Gamari (*Gmelian arborea*), Simul (*Bombax* sp.) and Chikrasi (*Chukrasia tabularis*) and animals like Asian Elephant (*Elephas maximus*), Tiger (*Panthera tigris*), Gaur (*Bos gaurusi)*, Wild boar (*Sus scrofa*) and Sambar (*Cervus unicolor*). This IBA supports huge avifaunal diversity 523 bird species were reported from this site by Wildlife Institute of India, deharadun. Other notable works on avifauna from this IBA includes those of Inglis *et al*., (1918–1920) who summarized the vertebrates list from Jalpaiguri District. Stevens (1923–1925)recorded a number of new species from Raidak river while Inglis (1952–69) has given details of some avaian species from Buxa area. Law (1953) and Sanyal (1995) have recorded one new bird species each from Buxa area. Allen *et al*., (1996) have recorded 227 birds from BTR while Prakash *et al*., (2001) have dealt with the role of avifauna as indicator species from BTR. Sivakumar and Prakash (2004) have recorded watervirds within BTR while Sivakumar *et al*., (2006) have reported 22 new bird apecies from BTR.

Rasik Beel Wetland Complex (RBWC) is the largest wetland complex in Coochbehar district of West Bengal covering around 18.40 Km^2 of area of which wetland occupies almost 1.78 Km^2 area. The Ministry of environment and Forests (MoEF), Government of India has identified 94 wetlands of national importance, many of which are protected areas, includes Rasik Beel (NWCP, 2009) The vast wetland complex constitutes water bodies of varying sizes namely, Rasik Beel, Nildoba Beel, Raichangmari Beel, Bochamari Beel and some others. The nature of the beels is of oxbow Lake and formed by meandering of Raidak, Sakobhanga and Ghoramara River. The floral composition of Rasik Beel includes Sal (*Shorea robusta*), Teak (*Tectona grandis*), Gammari (*Gmelina arborea*) Khair (*Bauhinia purpurea*), Arjun (*Terminalia arjuna*), Simul (*Bombax* sp.) etc along with a number of wetland plants. The faunal biodiversity recorded from this area comprises 13 species of mammals, 165 species of birds, 7 species of reptiles, 5 species of amphibians, 49 species of fishes, 3 species of mollusks, 24 species of arthropods and more than 15 species of butterflies. Rasik Beel also hosts a rescue center for leopard (*Panthera pardus*), python (*Python* sp.), gharial (*Gavialis gangeticus*), spotted deer (*Axis axis*), tortoise, birds and small rodents recognized by central zoo authority.

METHODOLOGY

According to Sutherland (2006), point count is the most efficient method of estimating avian density. This method entails the observers remaining at one point for a fixed time and recording the birds seen by the observers. Distances were recorded in terms of concentric zones around the point (example 50 m, 100 m) up to some limit beyond which the birds are not identifiable. Estimated density is calculated by the following formula: $\check{D} = (n_1 + n_2 / \pi r^2 m)$ loge $(n_1 + n_2/n_2)$ [where, r = radius of concentric zone from the point of observation (30 m and 50 m); n_1 = number of birds counted within r; n_2 = number of birds counted beyond r; m = number of replicate counts (6 in this case)]. A total of 324 point counts during the first two hours after sunrise (0600–0800 hr), during noon (1100–1300 hr) and in the evening (1600–1800 hr) between the 2nd November and 14th November 2008 were carried out from each study location. Six points were selected randomly in each study site with a minimum distance of 200m. Six study teams each comprising of three members simultaneously recorded avifaunal diversity from every study site. At each individual point count, observations were made for 10 minutes for all the birds seen and photographed if not identified immediately. After 10 minutes of study, teams changed their positions during the next 10 minutes keeping a minimum distance of 200m. Thus six individual readings were obtained by each team during their two hours of survey in the morning, during noon and in the evening. Sampling was done for three continuous days before moving to the next study location. The birds were identified using Olympus binoculars (10x50) and field guides of Ali and Ripley (1983) and Grimmett *et al*., (1998) and Kazmierczak and Perlo (2000). Statistical software PAST was used to calculate the Diversity indices of the sites. Hierarchical clusters analysis was done to construct Dendrogram by using SPSS 13.0 software.

RESULTS

During the present short period of study a total of 117 bird species belonging to 42 families were recorded which includes 11 winter visitors (Table 1). Among these, the family Corvidae contributed the highest number of

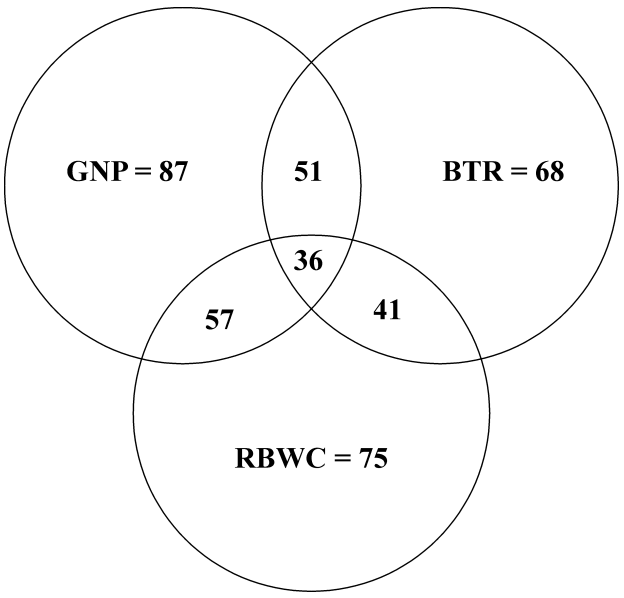

Figure 2. Graphical presentation of all the bird species from the three study sites (GNP, BTR and RBWC) based on commonality of occurrence.

Table 1. Checklist of birds with their relative abundance (Number of birds hectare^{-1}) from the three study sites under present investigation.

Sl. No.	Family /Common name	Scientific name	Status	Number of birds he^{-1}		
	Phasianidae			**GNP**	**BTR**	**RBWC**
1	Indian peafowl	*Pavo cristatus*	R	34.4	3.9	0.0
	Anatidae					
2	Lesser whistling duck	*Dendrocygna javanica*	R	12.7	0.0	69.1
	Picidae					
3	Brown capped pygmy woodpecker	*Dendrocopos nanus*	R	1.6	1.9	4.1
4	Grey capped pigmy woodpecker	*Dendrocopos canicapillus*	R	1.9	3.0	4.1
5	Yellow crowned woodpecker	*Dendrocopos mahrattensis*	R	0.0	0.8	1.9
6	Greater yellownaped woodpecker	*Picus flavinucha*	R	3.3	0.8	1.9
7	Fulvous breasted woodpecker	*Dendrocopos macei*	R	4.1	0.0	0.8
8	Himalayan flameback woodpecker	*Dinopium shorii*	R	3.9	1.9	3.3
9	Greater flameback woodpecker	*Chrysocolaptes lucidus*	R	12.7	3.3	3.9
10	Roufous bellied woodpecker	*Dendrocopos hyperythrus*	R	5.7	0.8	1.9
11	Bay woodpecker	*Blythipicus pyrrhotis*	R	1.9	0.0	0.0
	Megalaimidae					
12	Blue eared barbet	*Megalaima australis*	R	13.5	1.6	0.0
13	Coppersmith barbet	*Megalaima haemacephala*	R	0.8	0.0	0.0
14	Blue throated barbet	*Megalima asiatica*	R	7.3	71.0	21.9
15	Lineated barbet	*Megalima lineata*	R	0.0	0.8	0.0
	Bucerotidae					
16	Oriental pied hornbill	*Anthracoceros albirostris*	R	0.0	1.9	0.0
	Upupidae					
17	Common hoopoe	*Upupa epops*	R	1.9	0.0	0.0
18	Indian roller	*Coracias benghalensis*	R	1.4	0.8	0.0
	Alcedinidae					
19	Common kingfisher	*Alcedo atthis*	R	4.3	1.9	3.9
	Dacelonidae					
20	Stork billed kingfisher	*Halcyon capensis*	R	5.1	0.8	0.0
21	White throated kingfisher	*Halcyon smyrnensis*	R	11.4	3.9	9.5
	Meropidae					
22	Chestnut headed beater	*Merops leschenaultia*	R	0.0	3.3	1.9
	Cuculidae					
23	Green billed malkoha	*Phaenicophaeus tristis*	R	4.1	0.0	0.0
	Centropodidae					
24	Lesser coucal	*Centropus bengalensis*	R	1.9	0.0	1.9
	Psittacidae					
25	Vernal hanging parakeet	*Loriculus vernalis*	R	1.9	0.0	0.8
26	Rose ringed parakeet	*Psittacula krameri*	R	48.7	3.0	0.0
27	Alexandrine parakeet	*Psittacula eupatria*	R	53.7	19.0	0.0
28	Red breasted Parakeet	*Psittacula alexandri*	R	85.7	16.1	10.2
	Apodidae					
29	House swift	*Apus affinis*	R	15.5	0.0	21.0
30	Asian palm swift	*Cypsiurus balasiensis*	R	4.7	0.0	14.5

	Tytonidae					
31	Barn owl	*Tyto alba*	R	0.0	0.0	0.8
	Strigidae					
32	Asian barred owl	*Glaucidium cuculoides*	R	0.0	0.0	1.9
33	Jungle owlet	*Glaucidium radiatum*	R	0.0	0.0	3.3
34	Collared scops owl	*Otus bakkamoena*	R	0.0	0.0	1.9
35	Oriental scops owl	*Otus sunia*	R	0.0	0.0	2.7
	Columbidae					
36	Green imperial pigeon	*Ducula aenea*	R	9.0	0.8	0.0
37	Yellow footed green pigeon	*Treron phoencoptera chlori-gaster*	R	3.9	1.9	0.8
38	Pin tailed green pigeon	*Treron apicauda*	R	0.0	0.8	0.0
39	Red collared dove	*Streptopelia tranquebarica*	R	27.8	25.8	20.0
40	Spotted dove	*Streptopelia chinensis*	R	36.1	73.0	42.4
41	Oriental turtle dove	*Streptopelia orientalis Agri-cola*	R	14.6	18.1	0.0
42	Emerald dove	*Chalcophaps indica*	R	4.1	0.0	0.0
	Rallidae					
43	White breasted waterhen	*Amaurornis phoenicurus*	R	1.9	0.0	13.1
44	Common coot	*Fulica atra*	R	0.0	0.0	1.9
45	Common moorhen	*Gallinula chloropus*	R	0.0	0.0	1.9
	Scolopacidae					
46	Common sandpiper	*Actitis hypoleucos*	WV	0.7	2.9	3.3
47	Temminck's Stint	*Calidris temminckii*		9.0	0.0	0.0
	Jacanidae					
48	Bronze winged jacana	*Metopidius indicus*	R	0.0	0.0	1.9
	Charadridae					
49	Little ring plover	*Charadrius dubius*	R	4.5	0.0	0.0
50	River lapwing	*Vanellus duvaucelii*	R	8.1	5.4	0.0
51	Red wattle lapwing	*Vanellus indicus indicus*	R	1.9	1.5	0.0
	Glareolidae					
52	Small Pratincole	*Galreola lactea*	R	0.8	0.0	0.0
	Accipitridae					
53	Crested serpent eagle	*Spilornis cheela davisoni*	R	0.8	0.0	0.8
54	Pallas's fish eagle	*Haliaeetus leucoryphus*	R	4.1	0.0	1.9
55	Besra sparrow hawk	*Accipiter virgatus*	R	0.0	0.0	4.1
56	Shikra	*Accipiter badius*	R	0.7	0.0	1.9
57	Pallid harrier	*Circus macrourus*	WV	0.0	0.0	4.1
	Phalacrocoracidae					
58	Little cormorant	*Phalacrocorax niger*	R	41.7	14.2	33.7
	Ardeidae					
59	Indian pond heron	*Ardeola grayii*	R	32.4	8.4	67.1
60	Cattle egret	*Bubulcus ibis*	R	34.3	1.4	26.6

61	Little egret	*Egretta garzetta*	R	7.0	0.7	23.7
62	Grate egret	*Casmerodius albus*	R	3.9	0.0	4.7
	Threskiornithidae					
63	Black Ibis	*Pseudibis papillosa*	R	1.3	0.0	0.0
	Ciconidae					
64	Black stork	*Ciconia nigra*	WV	0.0	0.0	4.1
65	Asian openbill stork	*Anastomus oscitans*	R	7.3	0.0	17.8
	Irenidae					
66	Asian fairy bluebird	*Irena puella*	R	0.0	4.1	0.0
	Chloropseidae					
67	Golden fronted leaf bird	*Choloropsis aurifrons aurifrons*	R	14.2	30.1	0.0
	Lanidae					
68	Brown shrike	*Lanius cristatus*	WV	14.2	0.0	4.7
69	Long tailed shrike	*Lanius schach*	R	9.7	2.7	1.9
70	Grey backed Shrike	*Lanius tephronotus*	WV	1.9	0.0	0.0
71	Southern grey Shrike	*Lanius muridionalis*	R	0.8	0.0	0.0
	Corvidae					
72	Long tailed minivet	*Pericrocotus ethologus*	WV	7.0	13.9	6.5
73	Scarlet minivet	*Pericrocotus flammeus*	R	44.3	8.2	13.1
74	Large Cuckoo shrike	*Coracina macei*	R	7.1	0.0	1.9
75	House crow	*Corvus splendens splendens*	R	33.1	1.9	1.5
76	Large billed crow	*Corvus macrorhynchos*	R	38.7	7.8	0.0
77	Rufous treepie	*Dendrocitta vagabunda*	R	4.9	0.0	3.9
78	Spangled drongo	*Dicrurus hottentottus*	R	20.5	6.5	1.9
79	Black drongo	*Dicrurus macrocercus*	R	2.6	23.3	10.8
80	Bronzed drongo	*Dicrurus aeneus*	R	6.2	5.8	0.8
81	Lesser racket tailed drongo	*Dicrurus remifer*	R	0.0	1.9	0.0
82	Greater racket tailed drongo	*Dicrurus paradiseus*	R	10.3	3.5	1.9
83	White bellied drongo	*Dicrurus caerulescens*	R	0.0	1.9	4.1
84	Black hooded oriole	*Oriolus xanthornus*	R	14.6	1.9	2.7
85	Black napped oriole	*Oriolus chinensis*	–	3.9	0.8	0.0
86	Common iora	*Aegithina tiphia tiphia*	R	0.0	0.0	4.1
87	Marshall's iora	*Aegithina nigrolutea*	–	0.0	0.0	1.9
	Muscicapidae					
88	White throated redstart	*Phoenicurus schisticeps*	R	0.0	1.6	0.0
89	White winged redstart	*Phoenicurus erythrogaster*	R	0.0	6.5	0.0
90	Blue rock thrush	*Monticola solitarius*	WV	0.0	1.9	0.0
91	Blue whistling thrush	*Myophonus caeruleus*	R	0.0	222.2	0.0
92	Oriental magpie robin	*Copsychus saularis*	R	21.6	7.8	47.9
93	White rumped shama	*Copsychus malabaricus*	R	1.9	0.0	0.0
94	White crowned forktail	*Enicurus leschenaultia*	R	1.9	0.0	0.0
	Sturnidae					
95	Common myna	*Acridotheres tristis*	R	107.9	25.8	25.4

96	Common hill myna	*Gracula religiosa*	R	19.0	284.8	0.0
97	Jungle myna	*Acridotheres fuscus*	R	60.2	0.0	28.7
98	Chestnut tailed starling	*Sturnus malabaricus blythii*	R	42.3	91.4	30.1
99	Asian pied starling	*Sturnus contra*	R	109.5	15.1	10.0
	Sittidae					
100	Chestnut bellied nuthatch	*Sitta castanea*	R	0.0	3.9	0.0
101	Velvet fronted nuthatch	*Sitta frontalis*	R	15.5	0.8	0.0
	Paridae					
102	Great tit	*Parus major*	R	0.0	0.8	0.8
	Hirundinidae					
103	Barn swallow	*Hirundo rustica*	WV	18.5	0.0	1.9
	Pycnonotidae					
104	Black crested bulbul	*Pycnonotus melanicterus*	R	0.0	29.7	0.0
105	Red whiskered bulbul	*Pycnonotus jocosus*	R	44.7	5.4	1.9
106	Red vented bulbul	*Pycnonotus cafer humayuni*	R	38.8	13.1	11.7
	Cisticolidae					
107	Grey hooded warbler	*Seicercus xanthoschistos*	R	7.8	0.0	13.1
108	Dusky warbler	*Phylloscopus fuscatus*	WV	14.2	0.0	0.0
	Zosteropidae					
109	Oriental white eye	*Zosterops palpebrosus*	R	0.0	0.8	0.7
	Silvidae					
110	Jungle babbler	*Turdoides striatus*	R	13.9	0.0	13.1
	Alaudidae					
111	Ashy crowned sparrow lark	*Eremopterix grisea*	R	0.0	1.9	0.0
	Nectarinidae					
112	Purple Sunbird	*Nectarinia asiatica*	R	19.7	0.0	9.5
	Passeridae					
113	Eurasian tree sparrow	*Passer montanus*	R	26.2	0.0	0.0
114	White wagtail	*Motacilla alba dukhunensis*	WV	39.3	25.8	28.7
115	Grey wagtail	*Motacilla cinerea*	WV	5.4	1.9	3.3
116	White browed wagtail	*Motacilla maderaspatensis*	R	4.6	0.8	1.9
117	Paddy field pipit	*Anthus rufulus*	R	19.6	0.0	9.0

Table 2. Diversity indices of birds from the three study sites under present investigation.

Diversity Indices	GNP	BTR	RBWC
Shannon–Wiener Diversity Index	3.86	2.84	3.64
Simpson's Dominance Index	0.97	0.88	0.96
Pielou's Evenness Index	0.55	0.25	0.51
Margalef's Richness Index	11.80	9.51	11.15

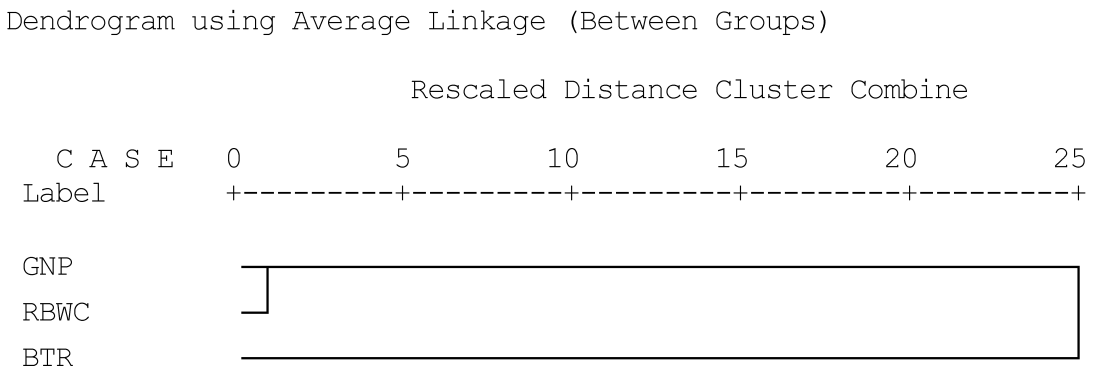

Figure 3. Dendrogram showing the relationship between the three study sites.

species (16) followed by the family Picidae (with 9 representatives), whereas 22 families were found to be represented by single bird species. The highest bird diversity was recorded in the GNP with 87 bird species, followed by RBWC (75) and BTR (68). The transition zones between GNP and BTR, BTR and RBWC and GNP and RBWC were represented by 51, 41 and 57 common bird species, respectively, where as total 36 bird species were recorded in all three study sites (Figure 2). Table 2 shows the diversity indices for the three study sites, where it was found that the highest Shannon diversity index was in GNP (3.86) whereas the lowest was in BTR (2.84); the evenness indices also showed a maximum value in GNP (0.97) and a minimum value in BTR (0.88). The richness index for the present study was highest in GNP (0.55) and lowest in BTR (0.25); dominance indices showed a maximum value in GNP (11.8) and a minimum value in Site II (9.5). In dendrogram analysis, we found that GNP and RBWC were much closer to each other while BTR remained distantly located form this cluster (Figure 3).

DISCUSSION

Conservation of global biodiversity has become the issue of prime importance in recent decades (Turner *et al*., 1990; Ehrlich and Wilson, 1991). Conservationists around the globe are battling with conservation challenges under the ever accelerating threats of anthropogenic disturbances to biodiversity. Birds occupy almost all habitat types and diversity of birds often serves as a good indication of overall diversity of a given area (Furness and Greenwood, 1993). Birds are also known to be responsive to any kind of changes to their ambient conditions hence can be used as bioindicator (Schwartz and Schwartz, 1951; Padoa–Schioppa *et al*., 2006). Since holistic inventory of diversity needs impossible levels of time and effort (Lawton *et al*., 1998) scientists around the globe most recently have emphasized on performing rapid inventories (Noss, 1990; Roberts, 1991; Ryti, 1992;Anon., 1993; Pearson ,1994; Chakravarty and Sridhar, 1995; Roy *et al.*, 2011). Biodiversity estimation applying short span studies are becoming ever popular and in this regard preparation of checklists of birds on a wider scale has been given much importance (Charavarthy and Sridhar, 1995; Roy *et al*., 2011).

The present short span study which recorded 117 bird species reflects a moderately healthy overall biodiversity for the present study locations. But it must be mentioned that the study locations under present investigation are facing anthropogenic disturbances in the forms of urbanization, tourist pressure, livelihood dependence (mainly in the form of cattle grazing and fuel wood collection) and pollution (Islam and Rahmani, 2004; Mallick, 2010; Karmakar, 2011). Since British Raj most of the pristine forests of this region have been converted to monoculture land of timber producing trees, moreover, forests have been cleared off for making space for tea gardens and other types of cultivation purposes. To add salt to the wound poaching of wild animals and timber smuggling are major issues for north Bengal forests like most other parts of India. Natural calamities like forest fire also have disastrous effects on wildlife from the present study locations (Islam and Rahmani, 2004).

Though the present study revealed overall higher bird diversity from GNP over RBWC and BTR it must be mentioned that previous studies have reported higher bird diversity from BTR (Allen *et al*., 1996). Out of a total of 227 birds reported by Allen *et al*., (1996), 39 birds were recorded exclusively from Jayanti / Jainti range, 62 avian species were found to have common occurrences in both Jayanti and Buxa range while rest of the birds were solely recorded from Buxa range. Thus an overall decrease in bird diversity was observed when the present findings were compared with those of Allen *et al*. (1996) who had reported a total of 101 bird species from Jainti range as compared to 68 avian species recorded during the present study. It must be mentioned that the sampling duration were exactly same for Allen *et al*. (1996) and the present investigation where a continuous three days were spent for avifaunal sampling but the sampling seasons were different. The present study was undertaken in the months of November (early winter in this part of the world) while the study undertaken by Allen *et al*. (1996) was in the months of February (early spring in this part of the world). But surprisingly Naaz *et al*. (2005) had reported only 39 bird species from BTR conducted during the month of February using the same methodology applied during the present study. All these findings are indicative of an overall decrease of avifaunal diversity from the present study locations chiefly due to habitat alteration and anthropogenic disturbances. These findings corroborate well with those of Prakash *et al*. (2001) who have recognized monoculture plantations, tea gardens, tree cutting, firewood collection, grass cutting, fires and cattle grazing as the major threats to birds in this parts of the world.

Visibility of avifauna was much better in GNP and RBWC than BTR and this fact also leads to the results of cluster analysis where GNP and RBWC were found close to each other. The data were subjected to detailed diversity index analysis and it was found that the diversity, dominance and richness of bird species in GNP was nearly comparable with that of RBWC, whereas BTR seemed to be with slightly lower scores of diversity, dominance and richness of bird species. But the true reflection comes from the figure of commonality of occurrence where GNP and BTR were found to share higher common bird species than with RBWC. It must be noted that the present study was done on a rapid inventory basis. Thus the possibilities of recording most common species were much higher which automatically evoked the chance of missing rare bird species.

During the present investigation two bird species were found that were previously not reported from this region to the best of our knowledge and we would like to report Black-naped oriole (*Oriolus chinensis*) and Marshall's iora (*Aegithina nigrolutea*) as the two new records from this region.

To conclude it may be noted that only a few selected patches of forests were studied for shorter time spans, a more intensive study would surely result in identifying many more avifaunal species. The impact of anthropogenic alteration of the habitats in and around the present study location also needs intensive studies.

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