



Community Composition and Threats Status of Ornithofauna of Bakhira Bird Sanctuary: A Wetland Ecosystem

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Abstract

Understanding the diversity and structure of bird communities is indispensable to delineate the importance of regional or local landscapes for avian conservation. The aim of the present study was to appraise community composition and threat status of avifauna of Bakhira Bird Sanctuary. The various species of birds were identified by using key references. During the study period 84 species of birds were identified. Maximum 15 species of birds were found to be belonging to order Anseriformes followed by minimum 2 species in Bucerotiformes and Gruiformes. We have enlisted 22 species of wetland birds in family Anatidae. However, only 1 species has been recognized in 11 different families. The documentation of the residential status of avifauna showed that 47 resident species (R), 28 migrant species (M) and 9 as resident migrant species (RM). According to the IUCN based categorization, maximum 86.90% species were recorded as least concerned (LC), followed by 1.19% endangered (EN), 4.76% near threatened (NT) and 7.14% vulnerable (VU). Guild based classification uncovered that maximum (44) birds were carnivorous and minimum (1) piscivorous. The result of our study concluded that Bakhira Bird Sanctuary is facing huge anthropogenic threats which include trapping and hunting of birds, habitat destruction by soil erosion, sedimentation and extension of crop fields, water pollution and eutrophication.

Keywords: Anthropogenic Threats, Bakhira Bird Sanctuary, Biodiversity, Residential Birds.

1. Introduction

Biodiversity is the variability of organisms in a particular area and its quantitative estimation is an important aspect of ecology. Grimmet *et al.*, (1998) pointed out that the Indian subcontinent encompasses about 1300 species out of more than 9000 species of birds in the world. Birds are reported as ideal bio-indicator that may disclose the condition of the ecosystem. In the ancient times, the study of bird communities was mainly intended for describing the patterns in homogenous habitats (Enemar, 1959). Therefore, researchers restricted their study without considering any factors regarding habitat fragmentation, apart from the so-called edge effect (Pianka, 1974; Helle and Helle, 1982). The diversity of birds make up the

major part of the natural ecosystem and are highly valuable as the key agents in breaking seed dormancy, play role in seed dispersal, flower pollination and constituent of food chain (Nason, 1992).

The water birds fall into two categories including wetland specialists and generalist. Specialists are those that nest, feed and roost in wetlands, dependent on aquatic habitats and also cannot survive in other habitats (Airinatwe, 1999). Generalists often visited wetlands, but seen in other habitats too. Gibbs (1993) documented that wetlands are the most productive and biologically diverse ecosystem in the world but are exceptionally delicate. In the year, 1971, first meeting of convention in Ramsar, Iran the wetland was declared as 'area of marsh, fen, peat lands or water, whether natural or artificial, permanent or tem-

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porary, with water that is static or flowing, fresh, brackish or salt including areas of marine water, the depth of which at low tide does not exceed 6 meters.

Wetlands have been widely investigated for their ecology, management, conservation and restoration (Keddy, 2000; Mitsch and Gosselink, 2000; Fraser and Keddy 2005; Gupta *et al.*, 2013). The birds which inhabit wetlands for nesting, feeding and roosting are defined as water birds. Wetlands and waterbirds are the elements being always together and support a rich variety of water bird communities (Grimmett and Inskipp, 2007). They occupy several trophic levels in the food web of wetland nutrient cycles. Activities of these water birds are primarily considered as indicator of quality of the wetland ecosystem and they form the terminal links in many aquatic food chains that is why they reflect changes originating in several different ecosystems (Custer and Osborne, 1977).

The comprehensive diversity of birds is decreasing persistently due to the anthropogenic activities (Rapoport, 1993). The Population of water birds is an indicator of pollution in both terrestrial and aquatic ecosystem (Gaston, 1975; Haedy *et al.*, 1987). The estimation of local densities of ornithofauna helps to understand the abundances of various species of other organisms (Turner, 2003). One of the major priorities in conserve animals is the monitoring of the populations to come across the methods for their long-term survival (Caughley, 1982). The main ecological factors that affect the richness and abundance of water birds in a particular wetland ecosystem are depth and quality of water, availability of food, shelter and influence of predators.

Wetlands are facing tremendous anthropogenic pressures (Prasad *et al.*, 2002) due to the rapid urbanization which leads the native species to become and finally extinct in a specific region (Godefroid, 2001). There is a closer relationship between the distance to human-built structure and bird habitats. Closer the human structures to bird's habitats, fewer will be the abundance of different bird species (Rottenborn, 1999). It causes a negative effect on biodiversity, especially in term of habitat fragmentation and loss, the extermination of native and migratory bird species (Mackinnee, 2002). The increase of human disturbances towards these ecosystems causes threats to avian biodiversity. Jorvinen and Vaisenen, (1978) and Bowden, (1990) revealed that an assessment of diversity and abundance of water bird species serve as a good indication of the health of the environment in a particular ecosystem.

The enlisting of avian species was considered from Bakhira Bird Sanctuary because it supports a huge number of residential as well as migratory birds for feeding, nesting and breeding purposes. Assessment of diversity of ornithofauna and current threats affecting to these birds was done for the very first time.

2. Methods

2.1 Study area

The present study was carried out in Bakhira tal, which was declared a bird sanctuary in 1990 by the Forest Department, Government of Uttar Pradesh, India. The map of study area is depicted in Figure 1 based on the GPS coordinates (N 26° 54' 390" E 83° 6' 264") of Bakhira tal. It is the largest natural flood plain in Uttar Pradesh with a vast water body expanding over an area of 29 km². The landscape and terrain of the wetland are almost flat having an average height of 100 meters representing a typical Terai landscape.

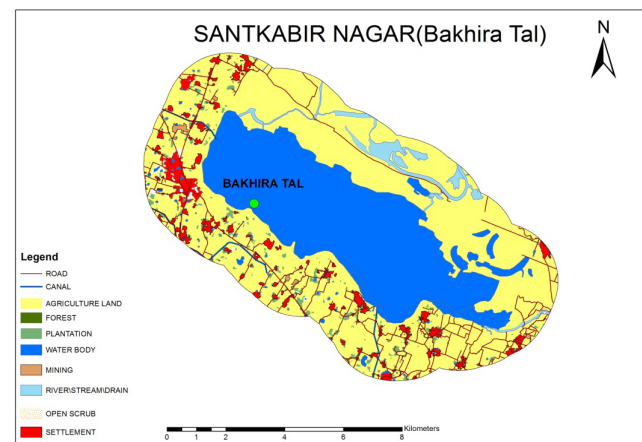


Figure 1. GPS map of Bakhira Bird Sanctuary.

2.2 Identification

The entire study was carried out from April 2015 to January 2017. The field survey was completed by using binoculars at an interval of 10-15 day. Birds were identified by a pertinent literature 'Birds of the Indian subcontinent' a field guide to the birds of India and identification by the key reference books of Grewal (2002), Ali (2002) and Grimmett *et al.*, (2007). Representative image of Bakhira Tal (Bakhira Bird Sanctuary) has been enshrined in Figure 2.



a



b

Figure 2. (a, b) Bakhira Bird Sanctuary

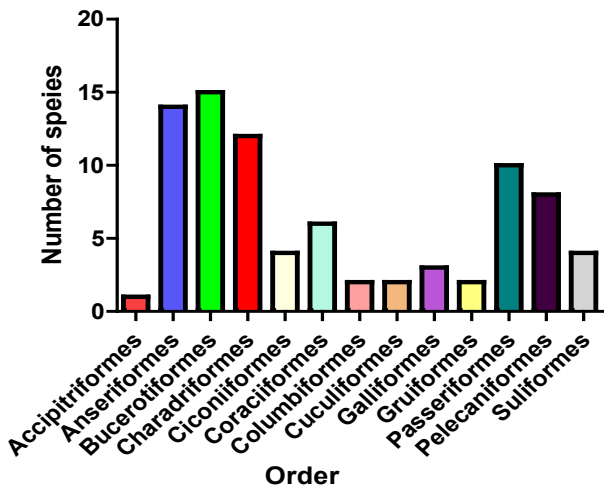


Figure 3. Number of species at order level in Bakhira Bird Sanctuary.

3. Results

During the study period a total of 84 species of birds were recorded and enlisted in Table 1.

Number of species recorded at the order level had been depicted in figure 3.

Maximum 15 species of birds were documented belonging to order Anseriformes followed by minimum 2 species in Bucerotiformes and Gruiformes. We placed 22 species of wetland birds in family Anatidae. Only 1 species had been reported in 11 different families of birds. The residential status of ornithofauna was summarized in Figure 4.

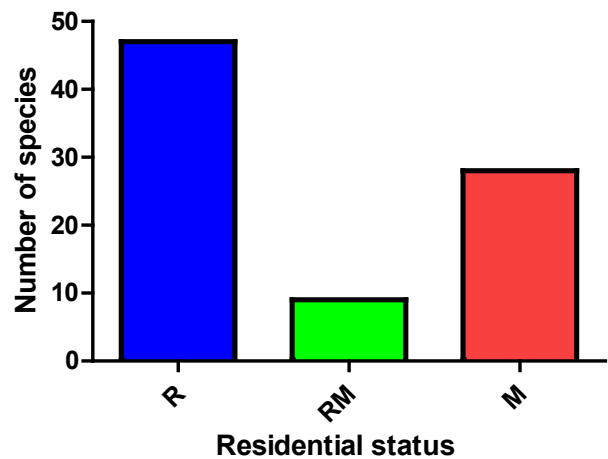


Figure 4. Residential Status of Ornithofauna.

Residential status analysis revealed that maximum 47 species were resident birds (R), 28 migrant (M) and 9 resident migrant (RM). The extant IUCN status of birds was depicted in Figure 5.

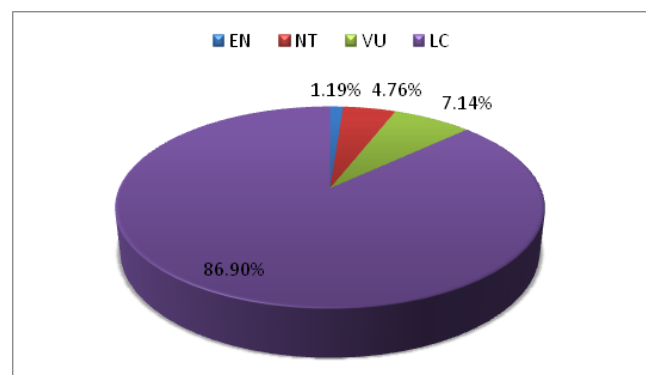


Figure 5. IUCN Status of Ornithofauna of Bakhira Bird Sanctuary.

Table 1. IUCN, Guild, and Residential Status of Avifauna of Bakhira Bird Sanctuary.

S.N.	Common Name	Scientific name	Order	Family	Status	IUCN Status	Guild Status
1	Oriental Honey buzzard	<i>Pernis ptilorhyncus</i> (Temminck,1821)	Accipitriformes	Accipitridae	RM	LC	I
2	Black kite	<i>Milvus migrans</i> (Boddaert,1783)	Accipitriformes	Accipitridae	R	LC	C
3	Black baza	<i>Aviceda leuphotes</i> (Dumount ,1820)	Accipitriformes	Accipitridae	M	LC	C
4	White eyed buzzard	<i>Bustastur teesa</i> (Franklin ,1931)	Accipitriformes	Accipitridae	R	LC	C
5	Brahminy kite	<i>Haliastur indicus</i> (Boddaeat, 1783)	Accipitriformes	Accipitridae	R	LC	C
6	Black eagle	<i>Ictinaetus malayensis</i> (Teminck ,1822)	Accipitriformes	Accipitridae	R	LC	C
7	Grey headed fish eagle	<i>Ichthyophaga ichthyaeus</i> (Horsfield ,1821)	Accipitriformes	Accipitridae	R	NT	C
8	Shikra	<i>Accipiter badius</i> (Gmelin,1788)	Accipitriformes	Accipitridae	R	LC	C
9	Egyptian vulture	<i>Neophron percnopterus</i> (Linnaeus,1758)	Accipitriformes	Accipitridae	RM	EN	C
10	Tawny eagle	<i>Aquila rapax</i> (Temminck ,1828)	Accipitriformes	Accipitridae	RM	LC	C
11	Hen harrier	<i>Circus cyaneus</i> (Linnaeus ,1766)	Accipitriformes	Accipitridae	M	LC	C
12	Black winged kite	<i>Elanus caeruleus</i> (Desfontaines,1789)	Accipitriformes	Accipitridae	M	LC	C
13	Greater spotted eagle	<i>Aquila clanga</i> (Pallas,1811)	Accipitriformes	Accipitridae	M	VU	O
14	Lesser spotted eagle	<i>Aquila pomarina</i> (Brehm,1831)	Accipitriformes	Accipitridae	M	LC	C
15	Eurasian teal	<i>Anas crecca</i> (Linnaeus, 1758)	Anseriformes	Anatidae	M	LC	O
16	Spot bill duck	<i>Anas poecilirhycha</i> (Forster, 1781)	Anseriformes	Anatidae	RM	LC	H
17	Mallard	<i>Anas platyrhchos</i> (Linnaeus ,1758)	Anseriformes	Anatidae	M	LC	O
18	Gadwall	<i>Anas strepera</i> (Linnaeus ,1758)	Anseriformes	Anatidae	M	LC	I
19	Eurasian wigeon	<i>Anas Penelope</i> (Linnaeus, 1758)	Anseriformes	Anatidae	M	LC	H
20	Garganey	<i>Anas guerquedula</i> (Linnaeus 1758)	Anseriformes	Anatidae	M	LC	O
21	Common pochard	<i>Aythya ferina</i> (Linnaeus, 1758)	Anseriformes	Anatidae	M	VU	O
22	Tufted duck	<i>Aythya fuligula</i> (Linnaeu, 1758)	Anseriformes	Anatidae	M	LC	O

23	Ruddy shelduck	<i>Tadorna ferruginae</i> (Pallas,1764)	Anseriformes	Anatidae	M	LC	O
24	North shoveler	<i>Anas clypeats</i> (Linnaeu, 1758)	Anseriformes	Anatidae	M	LC	O
25	Cotton pygmy goose	<i>Nettapus coromandeli</i> (Gmelin, 1789)	Anseriformes	Anatidae	RM	LC	H
26	Knob billed duck	<i>Sarkidornis melanotos</i> (Pennant ,1769)	Anseriformes	Anatidae	RM	LC	O
27	Graylag goose	<i>Anser anser</i> (Linnaeus,1758)	Anseriformes	Anatidae	M	LC	H
28	Bar headed goose	<i>Anser indicus</i> (Latham, 1790)	Anseriformes	Anatidae	M	LC	O
29	Northern pintail	<i>Anas acuta</i> (Linnaeus, 1758)	Anseriformes	Anatidae	M	LC	O
30	Hoopoe	<i>Upupa epops</i> (Linnaeus, 1758)	Bucerotiformes	Upupidae	R	LC	O
31	Indian grey hornbill	<i>Ocyrceral birostris</i> (Scopoli,1786)	Bucerotiformes	Bucerotidae	RM	LC	O
32	Common Sand piper	<i>Actitis hypoleucos</i> (Linnaeus, 1758)	Charadriiformes	Scolopacidae	M	LC	C
33	Red wattled Lapwing	<i>Vanellus indicus</i> (Boddaert, 1783)	Charadriiformes	Charadriidae	R	LC	C
34	Yellow wattled Lapwing	<i>Vanellus malabaricus</i> (Boddaert, 1783)	Charadriiformes	Charadriidae	R	LC	C
35	River Lapwing	<i>Vanellus duvaucelii</i> (Lesson, 1826)	Charadriiformes	Charadriidae	R	NT	O
36	Wood Snipe	<i>Gallinago namoricola</i> (Hodgson, 1836)	Charadriiformes	Scolopacidae	M	VU	C
37	Bronze winged Jacana	<i>Metopidus indicus</i> (Latham, 1790)	Charadriiformes	Scolopacidae	R	LC	C
38	Pheasant tailed Jacana	<i>Hydrophasianus chirurgus</i> (Scopoli,1786)	Charadriiformes	Jacanidae	R	LC	C
39	Spotted Redshank	<i>Tringa erythroptus</i> (Pallas, 1764)	Charadriiformes	Scolopacidae	R	LC	C
40	Common Redshank	<i>Tringa tetanus</i> (Linnaeus, 1758)	Charadriiformes	Scolopacidae	M	LC	C
41	Longed toed Stint	<i>Calidris subminuta</i> (Middenorff, 1853)	Charadriiformes	Scolopacidae	M	LC	O
42	Little Stint	<i>Calidris minuta</i> (Lesisler, 1812)	Charadriiformes	Scolopacidae	M	LC	C
43	Common Tern	<i>Sterna hirundo</i> (Linnaeus, 1758)	Charadriiformes	Sternidae	R	LC	P
44	Asian Open bill Stork	<i>Anastomas oscitans</i> (Boddaert,1783)	Ciconiiformes	Ciconiidae	R	LC	C
45	Painted Stork	<i>Mycteria leucocephala</i> (Pennat,1769)	Ciconiiformes	Ciconiidae	R	NT	C
46	European White stork	<i>Ciconia ciconia</i> (Linnaeus,1758)	Ciconiiformes	Ciconiidae	M	LC	C

47	White necked Stork	<i>Ciconia episcopus</i> (Boddaert,1783)	Ciconiiformes	Ciconiidae	R	VU	C
48	Indian roller	<i>Coracias benghalensis</i> (Linnaeus,1758)	Coraciiformes	Coraciidae	R	LC	C
49	Crested kingfisher	<i>Ceryle lugubris</i> (Temminck, 1834)	Coraciiformes	Cerylidae	R	LC	C
50	White throated kingfisher	<i>Halcyon smymensis</i> (Linnaeus,1758)	Coraciiformes	Halcyonidae	R	LC	C
51	Common king fisher	<i>Alcedo atthis</i> (Linnaeus,1758)	Coraciiformes	Alcedinidae	RM	LC	C
52	Lesser pied kingfisher	<i>Ceryle rubis</i> (Linnaeus,1758)	Coraciiformes	Cerylidae	R	LC	C
53	Small blue kingfisher	<i>Alcedo atthis</i> (Linnaeus,1758)	Coraciiformes	Alcedinidae	RM	LC	C
54	Oriental turtle dove	<i>Streptopelia orientalis</i> (Latham , 1790)	Columbiformes	Columbidae	M	LC	H
55	Blue rock pigeon	<i>Columba livia</i> (Gmelin,1789)	Columbiformes	Columbidae	R	LC	H
56	Asian koel	<i>Eudynamys scolopacea</i> (Linnaeus,1758)	Cuculiformes	Cuculidae	R	LC	C
57	Jacobin cuckoo	<i>Clamator jacobinus</i> (Boddaert,1783)	Cuculiformes	Cuculidae	M	LC	I
58	Swamp francolin	<i>Francolinus gularis</i> (Temminck , 1815)	Galliformes	Phasianidae	R	VU	O
59	Red jungle fowl	<i>Gallus gallus</i> (Linnaeus,1758)	Galliformes	Phasianidae	R	LC	O
60	Indian peafowl	<i>Pavo cristatus</i> (Linnaeus,1758)	Galliformes	Phasianidae	R	LC	O
61	Eurasian coot	<i>Fulica atra</i> (Linnaeus , 1758)	Gruiformes	Rallidae	M	LC	C
62	Sarus crane	<i>Grus antigone</i> (Linnaeus , 1758)	Gruiformes	Gruidae	R	VU	O
63	Bank myna	<i>Acridotheres ginginianus</i> (Latham, 1790)	Passeriformes	Sturnidae	R	LC	O
64	Asian pied starling	<i>Sturnus contra</i> (Linnaeus,1758)	Passeriformes	Sturnidae	R	LC	O
65	Fork tailed drongo	<i>Dicrurus adsimilis</i> (Bechstein, 1764)	Passeriformes	Dicruridae	M	LC	I
66	Common crested lark	<i>Galerida cristata</i> (Linnaeus,1758)	Passeriformes	Alaudidae	R	LC	O
67	House crow	<i>Corvus corax</i> (Vieillot,1817)	Passeriformes	Corvidae	R	LC	O
68	Jungle crow	<i>Corvus macrorhynchos</i> (Wagler,1827)	Passeriformes	Corvidae	R	LC	O
69	Red vented bulbul	<i>Pycnonotus cafer</i> (Linnaeus,1766)	Passeriformes	Pycnonotidae	R	LC	O
70	Red whiskered bulbul	<i>Pycnonotus jocosus</i> (Linnaeus,1758)	Passeriformes	Pycnonotidae	R	LC	O

71	Large grey babbler	<i>Turdoides affinis</i> (Sykes,1832)	Passeriformes	Leiothrichidae	R	LC	I
72	Common myna	<i>Acridotheres tristis</i> (Linnaeus,1766)	Passeriformes	Sturnidae	R	LC	O
73	Grey Heron	<i>Ardea cinerea</i> (Linnaeus, 1758)	Pelecaniformes	Ardeidae	M	LC	C
74	Cattle Egret	<i>Bubulcus ibis</i> (Linnaeus, 1766)	Pelecaniformes	Ardeidae	R	LC	C
75	Little Egret	<i>Egretta gazetta</i> (Linnaeus, 1766)	Pelecaniformes	Ardeidae	R	LC	C
76	Intermediate Egret	<i>Egretta intermedia</i> (Wagler, 1827)	Pelecaniformes	Ardeidae	R	LC	C
77	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i> (Gmelin, 1789)	Pelecaniformes	Ardeidae	R	LC	C
78	Yellow Bittern	<i>Ixobrychus sinensis</i> (Gmelin, 1789)	Pelecaniformes	Ardeidae	R	LC	C
79	Black Bittern	<i>Ixobrychus flavicollis</i> (Latham, 1790)	Pelecaniformes	Ardeidae	R	LC	C
80	Black Crowned night Heron	<i>Nycticorax nycticorax</i> (Linnaeus, 1758)	Pelecaniformes	Ardeidae	R	LC	C
81	Darter	<i>Anhinga melanogaster</i> (Pennant, 1769)	Suliformes	Anhingidae	R	NT	P
82	Great cormorant	<i>Phalacrocorax carbo</i> (Linnaeus , 1758)	Suliformes	Phalacrocoracidae	R	LC	C
83	Indian cormorant	<i>Phalacrocorax fuscicollis</i> (Stephens , 1826)	Suliformes	Phalacrocoracidae	R	LC	C
84	Little cormorant	<i>Phalacrocorax niger</i> (Vielloti , 1817)	Suliformes	Phalacrocoracidae	R	LC	O

Maximum 86.90% species were recorded as least concerned (LC) followed by 1.19% minimum species endangered (EN). Moreover, 4.76 % were identified near threatened (NT) and 7.14% species as vulnerable (VU). Foraging guild status was represented in Figure 6.

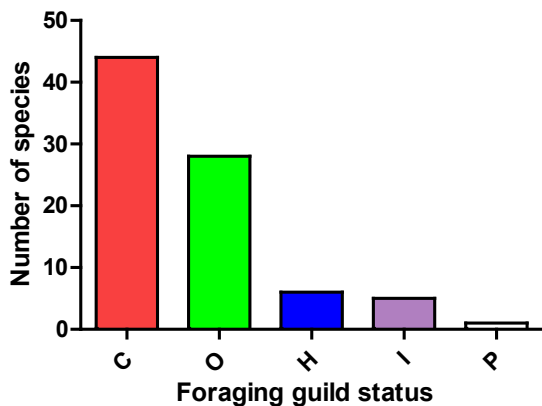


Figure 6. Foraging Guild Status of Ornithofauna.

Guild based classification revealed that maximum birds were carnivorous (44) and minimum piscivorous (1). Moreover, other birds were classified as omnivorous (28), herbivorous (6) and insectivorous (5). Representative images of most key birds of Bakhira Bird Sanctuary have been given in figure 7.



a. Asian open bill



b. Common duck (Gadwall)



d. Red crested pochard



c. Little cormorant



e. Common coot



f. Sarus crane

Figure 7. (a, b, c, d, e, f) Representative images of Ornithofauna of Bakhira Bird Sanctuary

4. Discussion

During the study period, 84 species of birds were documented. The present study shows that Bakhira Bird Sanctuary represents a tremendous avifaunal diversity. This sanctuary is recognized as a natural wetland in the district Sant Kabir Nagar in Uttar Pradesh. In Bakhira Bird Sanctuary the most attractive birds were distinguished as Gadwall (Common duck), Sarus crane, Common coot, Red-crested pochard, Asian open bill and little cormorant. Due to the availability of plenty of water throughout the year in this sanctuary, makes it suitable for residing species of birds. It is a classic example of natural wetland. Wetlands are distinct ecosystem and declared as land transitional between terrestrial and aquatic ecosystems, where the water table is frequently at or near the surface or the land is covered by shallow water (Mitsch and Gosselink, 1986). It is estimated that freshwater wetlands supports 20 % of the known ranges of biodiversity in India (Deepa and Ramachandra, 1999).

The result of our study showed that maximum species of birds were resident (R) while least as a resident migrant (RM). Bakhira Bird Sanctuary provides plenty of foods and suitable nesting grounds for resident as well as for migrant species of birds. The type of vegetation present in the wetland determines its capacity to support the various avifaunas. *Typha angustifolia*, *Phragmites karka*, *Eichhornia crassiper*, *Hydrilla verticillata*, *Vallisneria spiralis* and *Lemna minor* were the most prevailing plant species in the lake (Mishra and Narain, 2010). The presence of *Phragmites* species patches inside the wetland makes it appropriate for migratory and residential birds (Mishra and Narain, 2010). The vegetation linked with wetlands is one of the most peculiar features of aquatic ecosystems (Burton *et al.*, 2009; Mitsch and Gosselink, 2015). A group of researchers (Cronk and Fennessy, 2001; Clement and Proctor, 2009) have suggested that plants are the vital components of the aquatic systems and considered as a proficient indicator of ecological integrity. A various number of factors highlighted the significance of a particular wetland area for wintering birds and should be viewed in a landscape perspective (Moser, 1987; Kirby, 1995). The capability of wetland to support bird populations could be increased in a condition when the landscape comprise habitat patches with complementary resources (landscape complementation) or patches with substitutable resources (landscape supplementation) in close proximity (Dunning *et al.*, 1992).

Based on IUCN extant maximum species were recorded least concerned (LC) and minimum as endangered (ED). From this we can conclude that most of the species are sufficient in number and they are least prone to the various anthropogenic factors. However, increased anthropogenic pressure and change in various environmental factors may affect the population and health status of these birds. During the assessment, maximum species of birds were identified carnivorous (C) and least as piscivorous (P) in guild based classification.

The study on current threats affecting the avifauna showed that Bakhira Bird Sanctuary is facing huge anthropogenic pressures where water birds face a number of threats which includes trapping and hunting of birds, habitat destruction by soil erosion, sedimentation and extension of crop fields, water pollution and eutrophication.

Finally we can conclude that Bakhira Bird Sanctuary supports a good number of bird species. This is the first description on the avifauna of this area. Furthermore, more field work and scientific studies on birds are essential to prepare a suitable outline of the conservation plans for the study area. Livestock grazing should be excluded completely inside the sanctuary area. Continuous monitoring of avian fauna is an admirable means of monitoring wetland health, and it will also help to persuade a sustainable improvement of the habitat. In the future, with the expansion of the forest cover around the Bakhira Bird Sanctuary, proper management programs and strategies in the sanctuary will not only increase the number of resident bird species but will also attract migratory and vagrant species.

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