# 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-

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 (Mackinne, 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 km$^2$. The landscape and terrain of the wetland are almost flat having an average height of 100 meters representing a typical Terai landscape.
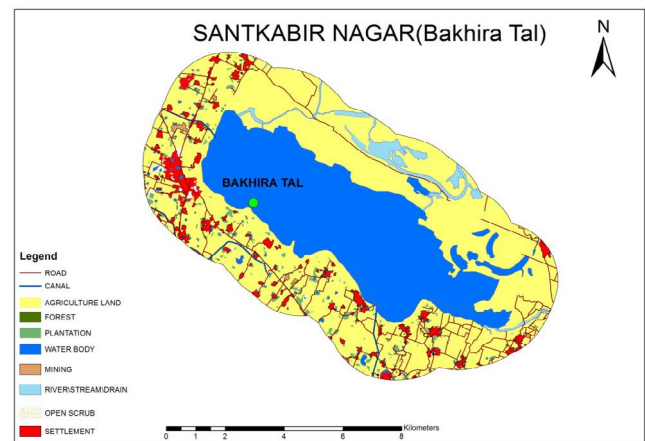


**Figure 1.** GPS map of Bakhira Bird Sanctuary.

### 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.
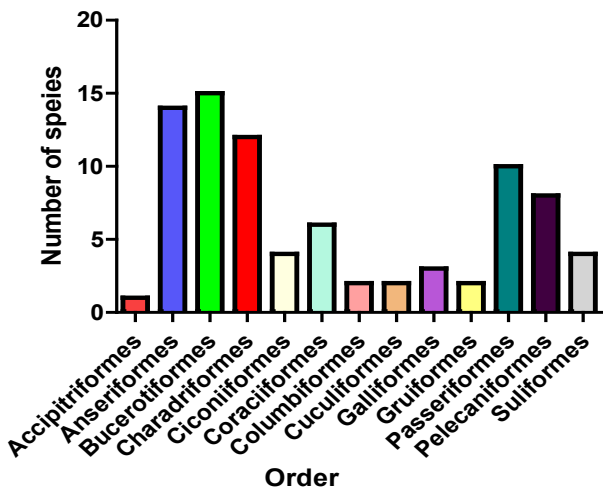
a



b

**Figure 2.** (a, b) Bakhira Bird Sanctuary



**Figure 3.** Number of species at order level in **Bakhria 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 ornithofanuan was summarized in Figure 4.
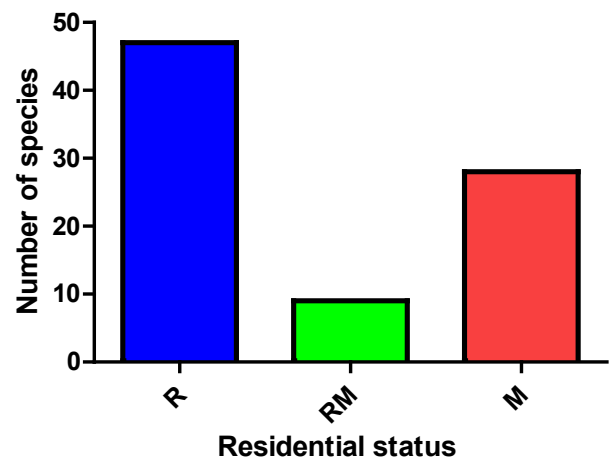


**Figure 4.** Residential Status of Ornithofauna.

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.
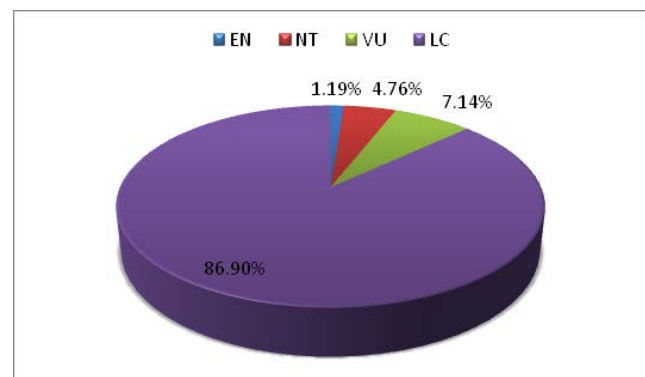


**Figure 5.** IUCN Status of Ornithofauna of Bakhira Bird Sanctuary.

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

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

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

| 71 | Large grey babbler | *Turdoides affinis* (Sykes,1832) | Passeriformes | Leiothrichidae | R | LC | I |
| 72 | Common myna | *Acridotheres tristis* (Linnaeus,1766) | Passeriformes | Sturnidae | R | LC | O |
| 73 | Grey Heron | *Ardea cinerea* (Linnnaeus, 1758) | Pelecaniformes | Ardeidae | M | LC | C |
| 74 | Cattle Egret | *Bubulcus ibis* (Linnaeus, 1766) | Pelecaniformes | Ardeidae | R | LC | C |
| 75 | Little Egret | *Egretta gazetta* (Linnaeus, 1766) | Pelecaniformes | Ardeidae | R | LC | C |
| 76 | Intermediate Egret | *Egretta intermedia* (Wagler, 1827) | Pelecaniformes | Ardeidae | R | LC | C |
| 77 | Cinnamon Bittern | *Ixobrychus cinnamomeus* (Gmelin, 1789) | Pelecaniformes | Ardeidae | R | LC | C |
| 78 | Yellow Bittern | *Ixobrychus sinensis* (Gmelin, 1789) | Pelecaniformes | Ardeidae | R | LC | C |
| 79 | Black Bittern | *Ixobrychus flavicollis* (Latham, 1790) | Pelecaniformes | Ardeidae | R | LC | C |
| 80 | Black Crowned night Heron | *Nycticorax nyctiorax* (Linnaeus, 1758) | Pelecaniformes | Ardeidae | R | LC | C |
| 81 | Darter | *Anhinga melanogaster* (Pennant, 1769) | Suliformes | Anhingidae | R | NT | P |
| 82 | Great cormorant | *Phalacrocorax carbo* (Linnaeus , 1758) | Suliformes | Phalacrocoracidae | R | LC | C |
| 83 | Indian cormorant | *Phalacrocorax fuscicollis* (Stephens , 1826) | Suliformes | Phalacrocoracidae | R | LC | C |
| 84 | Little cormorant | *Phalacrocorax niger* (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.
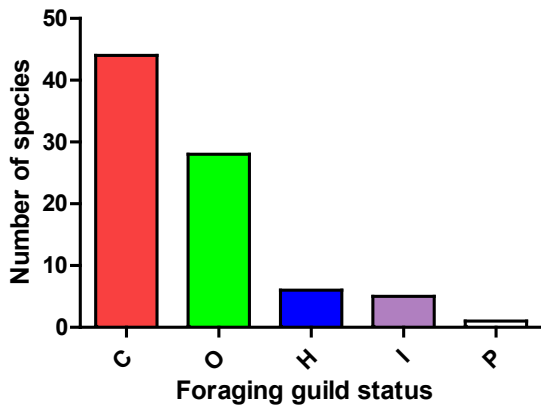
Guild based classification revealed that maximum birds were carnivorous (44) and minimum piscivorous (1). Moreover, other birds were classified as omnivorous (28), herbivorous (6) and insectivorous (5). Representative images of most key birds of Bakhira Bird Sanctuary have been given in figure 7.
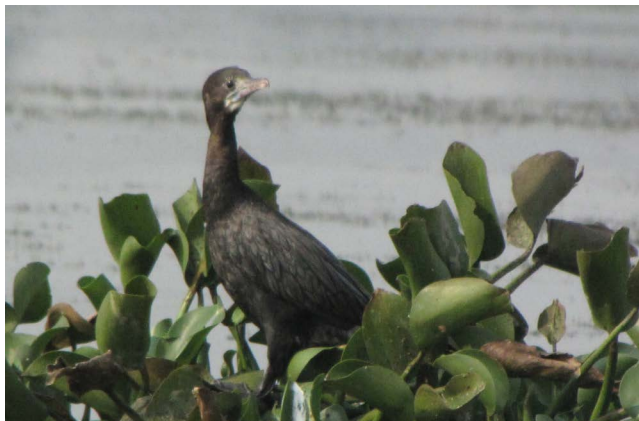
**Figure 6.** Foraging Guild Status of Ornithofauna.

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.

# 6. Acknowledgements

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