A Comparative Study on Avifaunal Diversity, Threats and Conservational Requirements of Wetlands of Uttar Pradesh

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ABSTRACT: Wetlands are important bird habitats that provide important livelihood to the local inhabitants. Wetlands occupy a unique position by being one of the most productive and biologically rich ecosystems and yet being one of the most endangered. The wetlands provide ecological and livelihood services. The present study is aimed the distribution, the assessment, the causes and consequences of the loss and helps to maintain a record of water bird to restore and maintain the present condition of wetland. Study is done in Faizabad, Hardoi, Raibareily and Kannauj Districts of Uttar Pradesh during January 2013 to December 2014. Total 18 unprotected wetlands, 7 in Hardoi, 2 in Kannauj, 6 in Faizabad and 3 in Raibaeili districts exposed during study and all are unprotected sites. All these wetlands harbor variety of flora and fauna and can be good ecotourism habitation and biologically have significant value for water birds and their survival. During 2013 the number of species recorded district-wise are Hardoi (80), Kannauj (85), Faizabad (58) and Raibareli (63). In 2014, 76 species from Hardoi, 83   from Kannauj, 51 from Faizabad and 64 from Raibareli districts were recorded. The various developmental and anthropogenic threats of wetland are also studied.

Key-words: Wetlands, Uttar Pradesh, Waterbirds species, and Threats

INTRODUCTION

Wetlands are important bird habitats that provide important livelihood to the local inhabitants. Wetlands occupy a unique position by being one of the most productive and biologically rich ecosystems and yet being one of the most endangered (Mamta *et al.,* 2015). However, man has caused demolition and deprivation of wetlands worldwide (Moser *et al.,* 1996). The livelihoods of millions of people in India also depend on these ecosystems. Most of the world's civilizations have developed and flourished near wetlands. Wetlands have accessible significant economic, ecological and cultural values. Some wetlands are exclusively used by people for food, fodder and building materials. The ecological functions of wetlands turn round around maintenance of water quality, hydrology, flood control, carbon cycle, climate stability, water cycle, shore stabilization, recharge of ground water etc. These values are difficult to assess and quantify economically. Comprehensive diversity of birds is falling incessantly primarily due to anthro-pogenic disturbances (Rapports 1993: Dongre 2017: Rao *et al.,* 2014) and climate change (Chen *et al.,* 2011, Sekercioglu *et al.,* 2012). 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 (Bird Life International 2010). Nally *et al.* (2004) explain that birds have been widely regarded as key elements in monitoring biodiversity and relation to different habitat.

Nawabganj Bird Sanctuary, Sandi Bird Sanctuary, Samaspur Bird Sanctuary and Lakh Bahosi Bird Sanctuary are such most important areas that harbour large numbers of local and migratory birds (KK Jha 2013, Kanaujia and Kumar 2014, 2015). The objective of the present study is to describe the diversity, dominance, structure and composition of four district's wetlands in Uttar Pradesh succeeding to a disturbance gradient and also to reveal the diversity and similarity existing among the birds' species.

MATERIALS AND METHODS

A. Study Area
Study is done in Hardoi, Kannauj, Faizabad, and Raibareli Districts of Uttar Pradesh during January 2013 to December 2014.Survey is being carried out seasonally, on foot or vehicle according to the area. Observations are being carried out using line transect method with the aid of 10×50 binoculars and data is supported with photography using Canon EOS 1000 D SLR camera.

Fig. 1. Map of Study Area.

The method to estimate the bird diversity in this type of habitat is Belt transects. Transects of the size 1000m × 1000m, was laid in the cover of each wetlands. All birds species including ducks, cranes, waders and storks which are present in the transect were identified to the species level and their number was counted in all the 18 wetlands of four districts. Bird species present in were identified and systematic enumeration was made with the available relevant literatures and taxonomic revisions (Ali & Ripley, 1995; Grimmett *et al.,* 1998; Salim Ali, 2002).

Species similarity among the fauna was computed using Sorenson's index (Wilson M.V. *et al.,* 1984). I = 2J/A+B. Where I=similarity, J=Common species of both the series a and b. A = Total number of species in series a and B= Total number of species in series b.

RESULTS AND DISCUSSION

Total 18 unprotected wetlands, 7 in Hardoi (Arni Talaab, Pasnikatalaab, Pabnatalaab, Sakahtalaab, Sikrohri wetland, Sundari Taal, Khuddipurtalaab), 2 in Kannauj (Nayapurwa Jheel, Bahadurpur, Muraiyan Jheel), 6 in Faizabad (Bharuataal, Chotijheel, Kathiyaarjheel, Amosajheel, Sarahi jheel, Amrawali-

Barauliajheel) and 3 in Raibaeili (Bela Tikai Jheel, Johvanatki Jheel, Nadaanjheel) Districts exposed during study and all are unprotected sites (Table 1). All these wetlands harbor variety of flora and fauna and can be good ecotourism habitation and biologically have significant value for water birds and their survival.During the study period 80 species from Hardoi, 85 from Kannauj, 58 species from Faizabad and 63 species from Raibareli districts and 76 species from Hardoi, 83 from Kannauj, 51 species from Faizabad and 64 species from Raibareli districts of water birds were recorded in 2013 and 2014 respectively (Table 2 and Fig. 2).

A total of 85 species belongs to 20 families were identified during the study. Among the four study area Kannauj district has more speciose (N=85) followed by Hardoi and Rai-bareli. Faizabad has less species compared to Kannauj; however, number of individuals is high in Kannauj followed by Hardoi and Rai-bareliin 2013 and in 2014 Kannauj district is also more speciose (N=83) followed by Hardoi and Rai-bareli. Faizabad has less species compared to Kannauj; however, number of individuals is in case of Kannauj followed by Hardoi and Rai-bareli.

Table 1: Details of Wetlands identified and being monitored.

SN	Name of district	Name of Wetlands	Types of Wetlands	Location	Area	Utility Value	Major Threats
1	**Hardoi**	Arni Talaab	Natural Pond	N-27° 09.386'' E-080° 20.590''	1.5 hectares	irrigation	Human encroachment, overgrowth of weed
2		Pasnika Talaab	Natural Pond	N-27° 09.882'' E- 80° 20. 058''	3.75 hectares	irrigation	Use of chemical fertilizers
3		Pabna Talaab	Natural Pond	N- 27° 09. 527'' E- 80° 19.534''	75 hectares	irrigation	Leveling of wetland
4		Sakah Talaab	Natural Pond	N- 27° 29. 303'' E- 80° 01.691''	12.5 hectares	Drinking, irrigation	Domestic effluents
5		Sikrohri Wetland	Man-made Wetland	N- 27° 24. 221'' E- 80° 14.873''	12.5 hectares	Pisciculture, irrigation	Excessive fish harvestation
6		Sundari Taal	Natural Pond	N- 27° 23. 180'' E- 80° 17.656''	125 hectares	Pisciculture	Leveling of wetlands and Soil digging
7		Khuddipur Talaab	Man-made Pond	N- 27° 22. 859'' E- 80° 17.378''	100 hectares	Pisciculture, irrigation	Excessive fish harvestation
8	**Kannauj**	Nayapurwa Jheel	Natural Lake	N-27°05.41'' E-079° 50.241''	10 hectares	Pisciculture	Excessive water chestnut cultivation, over-grazing
9		MuraiyanJheel	Natural Lake	N-27° 09.60'' E-079° 50.799''	7-8 hectares	Pisciculture	Leveling of wetland
10	**Faizabad**	BharuaTaal	Natural Pond	N26° 47'16.0'' E081° 44'25.0''	16.25 hectares	Pisciculture, irrigation	Weed infestation, leveling of Wetland
11		Choti Jheel	Natural Lake	N26° 47'6.5'' E 081° 44'40.6''	11.25 hectares	Pisciculture	Excessive irrigation
12		Kathiyaar Jheel	Natural Lake	N 26° 48' 44.3" E 081 42' 41.1"	250 hectares	Irrigation	Human encroachment
13		Amosa Jheel	Natural Lake	N 26°49'39.4" E 081° 43'17.5"	10 hectares	Pisciculture, irrigation	leveling of Wetland, over-grazing
14		Sarahi Jheel	Natural Lake	N 26° 55'24.5" E 081° 33' 47.4"	37 hectares	Irrigation	leveling of Wetland, over-grazing
15		Amrawali-Baraulia Jheel	Natural Lake	N 26° 59'41.0" E 081° 29' 22.0"	37 hectares	Irrigation	Agricultural conversion
16	**Rai-bareli**	Bela Tikai Jheel	Natural Lake	N 26 05.401'' E 081 12.614''	22 hectares	Irrigation	Human encroachment
17		Johvanatki Jheel	Natural Lake	N 26° 06.895'' E081°03.067''	900 hectares	Pisciculture	Levelling of wetland
18		Nadaan Jheel	Natural Lake	N26° 06.421'' E 081° 09.421''	58 hectares	Pisciculture, irrigation	Overgrazing, soil digging

Table 2: Overall scenario of Avifauna in district Hardoi, Kannauj, Faizabad and Raibareli during 2013 and 2014.

SN	Observations	2013				2014			
		HD	KJ	FB	RB	HD	KJ	FB	RB
1	Number of Species	80	85	58	63	76	83	51	64
2	Number of total Individuals	4487	6056	2027	3428	4673	6113	1839	3300

Legends: HD = Hardoi, KJ = Kannauj, FB = Faizabad, RB = Rai-bareli
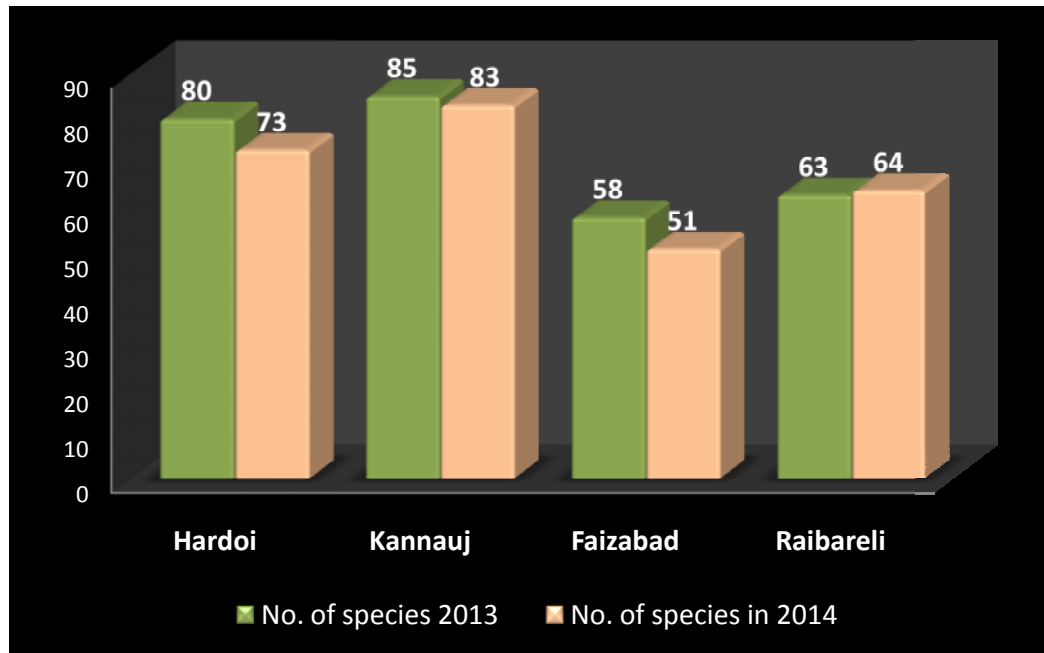
Fig. 2. District wise distribution of water birds species in 2013 and 2014.

Table 3: Statistical Analysis of Avifauna reported in different districts during 2013 and 2014.

Year	2013				2014			
Index	HD	KJ	FB	RB	HD	KJ	FB	RB
S Index	1.187	1.079	**1.259**	1.081	1.101	1.049	**1.189**	1.111
SW Index	-3.769	**-3.776**	-3.524	-3.618	**-3.787**	-3.768	-3.313	-3.655
Equity of Evenness	-21.981	**-49.934**	-15.287	-46.189	-39.318	**-79.234**	-19.175	-34.803
IOD	0.040	0.040	**0.046**	0.043	0.036	0.039	**0.061**	0.038

(S Index = Species richness Index, SW Index = Shonnon-Wiener diversity Index, IOD = Index of Dominance)

Table 4: Statistical Analysis of Avifauna reported in all districts during study period (2013-2014).

Index	HD	KJ	FB	RB
S Index	0.873	0.754	**1.350**	1.019
SW Index	**-3.785**	-3.771	-3.443	-3.667
Equity of Evenness	-27.904	-13.351	-11.459	**-190.857**
IOD	0.037	0.039	**0.053**	0.040

(S Index = Species richness Index, SW Index = Shonnon-Wiener diversity Index, IOD = Index of Dominance)

Table 5: Statistical Analysis of Avifauna reported in all districts combined during study period (2013-2014).

Index	2013	2014
S Index	0.659	0.662
SW Index	-3.740	-3.750
Equity of Evenness	8.981	9.093
IOD	0.041	0.038

(S Index = Species richness Index, SW Index = Shonnon-Wiener diversity Index, IOD = Index of Dominance)

On statistical analysis of avifaunal species reported in different districts shows that Shannon-Wiener diversity index and Simpson's index have not significant difference among different samples in 2013 and 2014, while equity of evenness and index of dominance is maximum in district Kannauj and Faizabad respectively in 2013 and 2014 (Table 3). During study period (2013-14) Simpson's index (1.350), Shonnon-Wiener diversity Index (-3.785), Equity of Evenness (-190.857) and Index of Dominance (0.053) were highest in Faizabad, Hardoi, Raibareli and Kannauj respectively

(Table 4). Statistical Analysis of Avifauna reported in all districts combined during study period (2013-2014) shown in Table 5.

We deliberated Sorenson's index for 2013 to compare the avifauna around wetlands of study areas. It is resulted that Faizabad and Raibareli are non-significantly associated with Kannauj (>80%) while in 2014 Faizabad and Raibareli are also non- significantly associated with Kannauj (>70% & 80% respectively) shown in table 6 and 7.

Table 6. Sorenson's index and correlation of species between different districts in 2013

Sorenson's Index	HD	KJ	FB	RB
HD	1.000			
KJ	0.969	1.000		
FB	0.818	0.803	1.000	
RB	0.861	0.859	0.909	1.000

Legends: HD = Hardoi, KJ = Kannauj, FB = Faizabad, RB = Rai-bareli

Table7. Sorenson's index and correlation of species between different districts in 2014

Sorenson's Index	HD	KJ	FB	RB
HD	1.000			
KJ	0.931	1.000		
FB	0.787	0.761	1.000	
RB	0.886	0.857	0.852	1.000

Legends: HD = Hardoi, KJ = Kannauj, FB = Faizabad, RB = Rai-bareli

Most of area of wetlands is encroached by local people. The various threats suchas excessive fish culture and harvesting, mining, overgrazing around the wetlands, use of pesticides and chemical fertilizers, draining water for irrigation, developmental activities (construction of road along wetlands), bird hunting, natural weed eradication through fire, excessive cultivation of water chestnut, cultivation along the marginal areas of wetland cause encroachment and reduction in water spreadare studied.

Our study indicates that stable decreasing or increasing avifaunal species in wetlands of these districts in accordance with stable, decreasing or increasing states of their major threats, food-bases, which might indicate a positive relationship with these variables. Stapanian *et al*. (2004) evaluated the avian species richness in wetlands using certain criteria to factor in habitat

heterogeneity affecting species richness. From the study it is clear that these wetlands support good avifaunal species which varied with fauna of this region faces severe restraints on conservation and the wetlands has to protect hence it retained wonderful diversity of avifauna in it. Out of all studied wetlands, wetlands of Kannauj and Hardoi are most productive and having great economic as well as biological value. The studies on the arrival, assemblage and departure, diversity of the migratory water birds and faunal diversity in the present study area by Kumar *et al.,* KK Jha (2013) and Adesh Kumar *et al.,* (2015) suggest that wetlands of these districts have the potential of to be an IBA.

Diversity indices showed that species diversity is maximum in Hardoi district, due to the presence of Sandi Bird Sanctuary in that area which harbours the variety of species whole year.

Sandi Bird Sanctuary are such most important areas that harbour large numbers of local and migratory birds and their number and diversity fluctuates according to various factors such as food, water availability rainfall (KK Jha, 2013). Moreover, the correlations between water birds and the wetland variables may be mere reflections of some critical habitat features, often correlated with food-bases, which are not willingly measured (Terborgh 1985). Therefore, authors are not told that to single out any individual factor responsible for the observed variety and diversity in water bird populations. However, rainfall, wetland area, wetland depth and major water bird food-bases have been suggested as the most important factors in this regard (Bartodziej & Weymouth 1995; Marra *et al.* 1998; Taft & Haig 2003; Bolduc & Afton 2004; Studds & Marra 2007). There is no special pattern observed in the association of species in between the different wetlands type studied.

Most of the wetlands are seasonal and farmers use their water for irrigation purpose, due to excessive use the ecosystem of wetlands is being highly disturbed. A review on the wetland status in India states about the wetlands declining pattern, threats and conservation of wetlands in India (Prasad *et al.,* 2002). The rapidity of development and the population pressure together with lack of knowledge on biodiversity are the major threats to the wetlands conservation in these areas which also fluctuate the conservational efforts and needs (Kumar and Kanaujia, 2015: Baliarsingh *et al,* 2013).

A detailed study should be carried out to uncover those environmental factors that may explain the absence or disappearance of some species. Research and monitoring of the dynamics of the avifauna status should be on continuous bases.

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