

Diversity and population status of waders (Aves) of Bakhira Tal, a natural wetland in District Sant Kabir Nagar, Uttar Pradesh, India

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ABSTRACT

Present study was conducted from April 2015 to March 2016 to assess diversity of waders (Aves) and its population status in Bakhira Tal. The study area was Bakhira Tal, located in District Sant Kabir Nagar U.P., India. Counting of waders was carried out during early morning from 6 am to 9 am with the help of binoculars and SLR cameras. Point count method was applied to count total number of individuals of each species of waders. Identification of birds was done with the help of key reference books. A total of 28 species of waders were recorded and identified. Bronze winged Jacana (178) outnumbered rest of the species and minimum number was shown by Wood Snipe (6). Maximum species diversity was recorded in winter season ($H=3.13$ and $D=0.048$) followed by minimum in summer ($H=2.72$ and $D=0.073$). The data collected were analysed using one way ANOVA. All the calculations were done with the help of Graph Pad Prism5. Result of analysed data was found to be significant ($p<0.05$) in case of winters. Seasonal mean values were compared by applying Tukey's test. The outcome of this test clearly indicates similarity in diversity of waders between rain and winter.

KEY WORDS

Bakhira Tal; diversity; point count; population; waders.

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INTRODUCTION

Waders are defined as a group of medium sized wading birds, which have a wide variety of bill structures and possess long legs and toes enabling them to live and feed in shallow water habitats. Waders are belonging to following families, viz. Ardeidae, Charadriidae, Recurvirostridae, Gruidae, Rallidae, Ciconidae, Jacanidae, Threskiornithidae and Burhinidae. Waders represent the greatest species diversity (Tak et al., 2003). Water birds and wetlands are inseparable elements (Grimmett & Inskipp, 2007). Wetlands are the main custodians

of the water birds (Weller, 1999; Stewart, 2001). Wetlands attract a large number of migratory and resident bird species. Wetlands are defined as transitional zone between terrestrial and aquatic ecosystem where land is covered by shallow water (Mitsch & Gosselink, 1986). They are also known as biological supermarkets because they provide extensive food chain and rich in biodiversity. Waders have been seen wading through the shallow waters and occasionally probing along dry margins of the wetland. They prefer shallow muddy banks of the pond and close by small water spots. The migratory waders need adequate food supply and safety

(Bharat Lakshmi, 2006). Almost all of them leave the wetland by march-end or early April. Habitats used by waders are diverse ranging from aquatic habitat to dry upland meadows, pastures and crop fields. They usually inhabit in wet lands where they feed and breed even some species are migratory, breeding in northern latitudes and migrating to tropics and south of the equator (Howes & Bakewell, 1989). Most of waders migrate to India during autumn, mainly through the north and north-west (Balachandran, 2006). They are primarily gregarious in nature. Waders commonly feed on fish, aquatic and terrestrial invertebrates, amphibians and crustaceans. Most waders are opportunistic feeders, capturing food items using bills adapted to probe mud and animal burrows. Asian water bird census (Mohan & Gaur, 2008), collects data which is used as vital tool nationally and internationally for conservation and protection of wetlands as water bird habitat.

In India 243 species of water birds and 67 species of wetland dependent and associated birds have been reported (Kumar et al., 2005). They form vital prey base for many living organism in the food webs of wetlands and are important component of wetland ecosystem. Waders are also important component of nutrient cycle. Bakhira Tal is a natural wetland which has been converted into Bird Sanctuary in 1990. It is the largest natural flood plain in U.P. (Uttar Pradesh). It is vast stretch of water body expanding over an area of 29 km². Due to high nutritional value and productivity; it provides a long stretch of feeding and breeding ground for the huge number of migratory and resident wader's species. But among the various habitats, wetlands are considered as one of the most threatened one in the world (Prasad et al., 2015). During the last century the world has lost over 50% of wetlands due to various anthropogenic activities (Ma et al., 2010). Wetland habitat is being lost owing to constant spreading of villages, expansion of crop fields, discharging of domestic sewage, discharging of industrial effluent, dumping of solid waste, and over exploitation of their natural resources and conversion of wetlands into barren lands. This results in to the loss of biodiversity and disturbance of wetland services (Ramachdran, 2006). Moreover, shortage of wetlands during the dry season forces water birds to gather in dense concentrations, which are probably highly vulnerable to drought, hunting or

other threats. In Bakhira Tal Sarus crane are forced to feed in the fields, causing major economic losses and antagonism between farmers and birds. The loss of wetland reduces the number of stop over sites for migrating birds as well as nesting species (Prasad et al., 2004). The present study was carried out to prepare a checklist as well as current population status of waders in study area.

MATERIAL AND METHODS

Study area

Present study was carried out in Bakhira Tal, which was declared a bird sanctuary in 1990 (Forest and Wild Life Department, Government of Uttar Pradesh, India). It is the largest natural flood plain in U.P. (Uttar Pradesh). It is a vast water body expanding over an area of 29 km². The landscape and terrain of the wetland is almost flat having an average height of 100 meter representing a typical terai landscape. The central coordinates of Bakhira Tal are N 26° 34' 0" - E 83° 0' 00". Bakhira Tal provides a wintering and staging ground for a number of migratory waterfowls and breeding ground for resident birds.

Identification

Bird survey was done by using binoculars at 5-6 day intervals. Entire study was carried out from April 2015 to March 2016. Waders were counted by 4 main observers to avoid double counting. They were identified by '*Birds of the Indian subcontinent*' (Inskipp et al., 2011) a field guide to the birds of India. Moreover, identification of birds with the help of key reference books (Grewal et al., 2002, Ali, 2002 and Grimmett & Inskipp, 2007) was done successfully.

Census

Bird counting was carried out during early morning from 6 am to 9 am with the help of binoculars and SLR cameras. Point count method was used while total number of bird from each wader species was recorded. Block count method was adapted for estimating waders present in flocks either in flight or on ground.

S.N.	Common Name	Species Name	Spring	Summer	Rain	Winter	Annual	Mean±Sd
1	Wood Snipe	<i>Gallinago nemoricola</i> (Hodgson, 1836)	00	00	00	06	6	1.5±3
2	Bronze winged Jacana	<i>Metopidius indicus</i> (Latham, 1790)	38	40	45	55	178	44.5±7.59
3	Pheasant tailed Jacana	<i>Hydrophasians chirurgus</i> (Scopoli, 1786)	36	43	47	38	164	41±4.96
4	Spotted Redshank	<i>Tringa erythropus</i> (Pallas, 1764)	00	00	00	20	20	5± 10
5	Common Redshank	<i>Tringa totanus</i> Linnaeus, 1758)	00	00	00	25	25	6.25±12.5
6	Yellow wattled Lapwing	<i>Vanellus malabaricus</i> (Boddaert, 1783)	12	23	28	23	86	21.5±6.757
7	River Lapwing	<i>Vanellus duvaucelii</i> (Lesson, 1826)	15	29	28	25	97	24.25±6.39
8	Red wattled Lapwing	<i>Vanellus indicus</i> (Boddaert, 1783)	25	36	34	38	133	33.25±5.73
9	Darter	<i>Anhinga melanogaster</i> (Pennant, 1769)	20	22	35	30	107	26.75±6.99
10	Long toed Stint	<i>Calidris subminuta</i> (Middenorff, 1853)	00	00	00	14	14	3.5±7
11	Little Stint	<i>Calidris minuta</i> (Lesisler, 1812)	00	00	00	36	36	9± 18
12	Common Tern	<i>Sterna hirundo</i> (Linnaeus, 1758)	25	30	40	45	140	35±9.12
13	Common Sand piper	<i>Actitis hypoleucos</i> (Linnaeus, 1758)	08	00	24	28	60	15±13.21
14	Asian Open bill Stork	<i>Anastomas oscitans</i> (Boddaert, 1783)	32	25	50	40	147	36.75±10.75
15	Painted Stork	<i>Mycteria leucocephala</i> (Pennat, 1769)	28	21	24	38	111	27.75±7.41
16	European White stork	<i>Ciconia ciconia</i> (Linnaeus, 1758)	00	00	00	12	12	3±6
17	White necked Stork	<i>Ciconia episcopus</i> (Boddaert, 1783)	05	03	02	09	19	4.75±3.095
18	Water Rail	<i>Rallus aquaticus</i> (Linnaeus, 1758)	04	04	09	13	30	7.5±4.35
19	Common Moorhen	<i>Gallinula chloropus</i> (Linnaeus, 1758)	18	24	30	21	93	23.25±5.12
20	Purple Moorhen	<i>Porphyria porphyria</i> (Linnaeus, 1758)	21	21	46	37	125	31.25±12.39
21	Grey Heron	<i>Ardea cinerea</i> (Linnaeus, 1758)	00	00	00	34	34	8.5±17
22	Cattle Egret	<i>Bubulcus ibis</i> (Linnaeus, 1766)	24	35	38	35	132	33±6.16
23	Little Egret	<i>Egretta garzetta</i> (Linnaeus, 1766)	18	33	35	20	106	26.5±8.736
24	Intermediate Egret	<i>Mesophoyx intermedia</i> (Wagler, 1827)	22	31	33	26	112	28±4.96
25	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i> (Gmelin, 1789)	08	06	14	11	39	9.75±3.5
26	Yellow Bittern	<i>Ixobrychus sinensis</i> (Gmelin, 1789)	06	04	06	08	24	6±1.63
27	Black Bittern	<i>Ixobrychus flavicollis</i> (Latham, 1790)	14	10	12	18	54	13.5±3.41
28	Black Crowned night Heron	<i>Nycticorax nycticorax</i> (Linnaeus, 1758)	04	12	15	10	41	10.25±4.64
Total			383	452	595	715	2145	536.25 ±148.30

Table 1. Seasonal variation in the number of waders, Bakhira Tal (District Sant Kabir Nagar U.P., India).

Statistical analysis

Mean and Standard deviation was calculated by using Microsoft excel. Simpson's diversity index (1-D) was used to estimate the biodiversity using the equations: $D = \sum ni (ni-1) / N (N-1)$, Where D =

Simpson's Index of Dominance, ni = total number of individuals of a particular species, N = the total number of individuals of all species (Simpson, 1949). Similarly Shannon diversity index was determined by $H' = - \sum (Pi) (\ln Pi)$, in which Pi = Proportion of total species belonging to i th species.

Biodiversity indices	Spring	Summer	Rain	Winter	Annual
Simpson's index(D)	0.062	0.064	0.059	0.044	0.051
Simpson's index of diversity(1-D)	0.937	0.935	0.941	0.955	0.948
Shannon diversity index (H)	2.88	2.82	2.90	3.21	3.08

Table 2. Diversity indices of waders in different season.

S.No.	Season	Mean and Standard deviation
1	Spring	13.68±12.01
2	Summer	16.14±14.76
3	Rain	21.25±17.48
4	Winter	25.54±12.74
5	Annual	76.61±52.57

Table 3. Seasonal Mean, standard deviation of waders.

ANOVA Table	SS	df	MS	F-Value	P-Value
Treatment (between columns)	22202	3	734.1	3.663	0.0147
Treatment (within columns)	21640	108	200.4		
Total	23850	111			

Table 4. Statistical description of parameters obtained by non-parametric test One way ANOVA.

Tukey's Multiple Comparison Test	Mean Diff.	q	Significant (p<0.05)	Summary	95% CI of diff.
Group A vs Group B	-2.464	0.921	No	Ns	-12.35 to 7.422
Group A vs Group C	-5.464	2.042	No	Ns	-15.35 to 4.422
Group A vs Group D	-11.86	4.432	Yes	*	-21.7 to -1.971
Group B vs Group C	-3.000	1.121	No	Ns	-12.89 to 6.886
Group B vs Group D	-9.393	3.511	No	Ns	-19.28 to 0.4936
Group C vs Group D	-6.393	2.390	No	Ns	-16.28 to 3.494

Table 5. Tukey's Multiple Comparison Test among all groups. Group A-Spring, Group B-Summer, Group C-Rain & Group D-Winter. Value * is significant less than 0.05, **less than 0.01 and *** less than 0.001.

The data collected were analyzed using one way ANOVA followed by Tukey's test. All the calculations were done with the help of Graph Pad Prism5.

RESULTS

In the present study a total of 28 species of waders were recorded and identified listed in Table 1 and represented in figure 3. Maximum species diversity was recorded in winters while least in summers. Bronzed winged Jacana outnumbered rest of the species with total count of 178 individuals while minimum annual count was 6 in case of Wood Snipe. Bird count was high during and just after breeding season in case of resident birds and during winters in case of migratory birds. Diversity indices are reported in Table 2 and represented in figure 5. It is apparent from the study that species diversity was high during the winter season due to plenty of water and food availability. A gradual rise was noticed in Simpson's index of diversity (1-D) from spring (0.937) to winters (0.955). Similarly, Shannon diversity index was maximum in winter (3.21) followed by minimum in summer (2.82). Seasonal mean and standard deviation of total species of waders are listed in Table 3. However, a detail of mean and standard deviation of individuals of each species of waders was also mentioned in Table 1. Outcome of one way ANOVA reveals significant value ($p > 0.05$) for winter season. Analyzed data is reported in Table 4. Turkey's test shows comparison among mean values of different season, listed in Table 5. Similar finding were reported by (Sharma & Saini Minakshi, 2014).

DISCUSSION

This was a premier and scientific study of waders of this Sanctuary. Waders are considered as a good bio indicators and useful models of the wetlands for studying the various environmental problems (Mistry & Mukherjee, 2015). The study shows that Bakhira Tal is an important site for wintering waders. During the study period a total of 28 species of waders were recorded and identified in study area. Out of which 8 were recorded as winter visitor as reported in figure 4. Among these, Little Stint is most common migrant which breeds en-

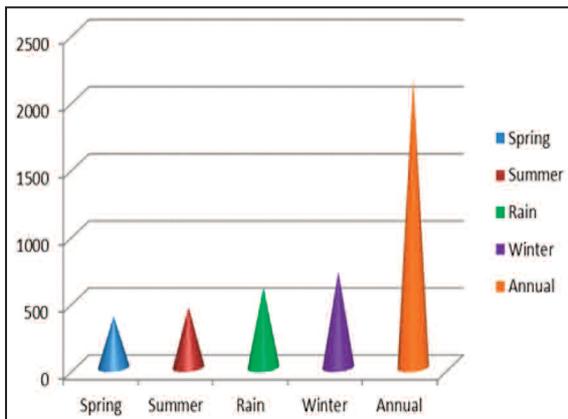


Figure 3. Total number of waders in different seasons.

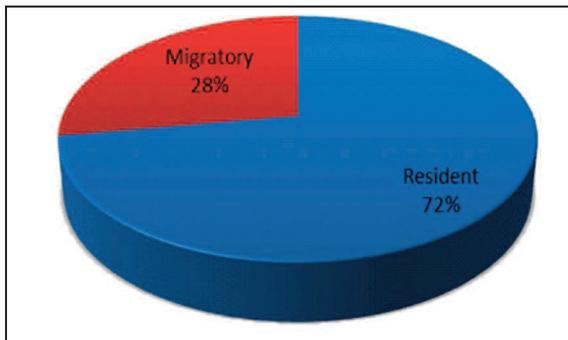


Figure 4. Status of waders of Bakhira Tal.

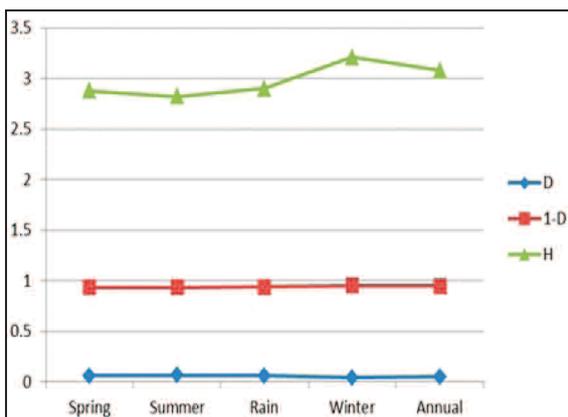


Figure 5. Diversity indices of waders in different seasons.

tirely in the Arctic (Zockler et al., 2005) while some wintering populations of the medium distance migrants, such as Redshank, Spotted Red shank might also originate partly from arctic breeding grounds. Maximum of waders were recorded in

winter season (Total No. 715) followed by minimum in spring (Total No. 351).

High abundance of waders in a particular wetland usually depends on availability of food, nesting sites and predation risk (Halse et al., 1993). Bakhira wetland is an important natural wetland of eastern U.P., rich in wader fauna because it provides ample of food items, sufficient water supply throughout the year, breeding and nesting grounds for large number of migratory and resident waders. Present study reports that Purple Moorhen is one of the most beautiful common water birds found in this wetland. This is the most common breeding resident of Bakhira Tal, also known as ‘Kaima’.

Grey heron, Common Red shank, Spotted Red shank, Long toed Stint, Little Stint, European White Stork and common Sand Piper were recognized as Wintering waders in Bakhira Tal, were highly susceptible to continuous anthropogenic pressures in the form of washing of cloths, cattle bathing, cattle grazing, and entry of domestic sewage, hunting, fishing, and expansion of crop lands. Since crop lands are being destroyed by waders to some extent, Man & Wild conflict was also observed among the local people of study area and waders. Consequently, villagers started scaring campaigns by exploding crackers near the waders to make them fly from the wetland.

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