

## Distribution of Migratory and Resident Water Birds of some selected wetlands from Eastern India and their Diversity Analysis

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### Publication History

Received: 05 October 2014

Accepted: 18 November 2014

Published: 7 January 2015

### Citation

Shubhasree Ganguly, Mukhopadhyay AD. Distribution of Migratory and Resident Water Birds of some selected wetlands from Eastern India and their Diversity Analysis. *Species*, 2015, 12(32), 17-23

### ABSTRACT

Distribution of water birds (both resident and migratory) was conducted in six major wetlands of Eastern India. Biodiversity indices such as Simpson's dominance index and Shanon diversity index were calculated for the fourteen available migratory ducks while Sorensen's similarity indices were calculated for all migratory species (including waders).

### Key words

Migratory birds, Simpson's dominance index, Shanon diversity index, Sorensen's similarity index

### 1. INTRODUCTION

The Southern part of West Bengal in Eastern India comprises of a gentle gradation from lateritic tracts (tracts consisting of iron rich soils) on the west through an alluvial tract in the central portion to a coastal stretch on the east along Bay of Bengal. Entire tract is characterized by wetlands of various characteristics. These wetlands host resident as well as migratory birds of various species. The present work involves diversity analysis (Simpson's Dominance Index, Simpson's Diversity, Shanon Index and Normalized Shanon Index) of fourteen available migratory birds. Sorensen's similarity indices were calculated for all migratory species (including waders) for analyzing the diversity of migratory ducks. These analyses were calculated only for the five wetlands of Birbhum district in Eastern India. But in case of Dabur Char situated in South 24 Parganas in Eastern India, biodiversity indices were not calculated because migratory birds are not coming to this wetland from the year 1998.

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<http://www.discovery.org.in/s.htm>

The wetlands of Birbhum lie in the lateritic tract whereas Dabur Char is a brackish water estuary which has an average depth of 1 mt. (maximum depth in monsoon is 1.25mts.). Among the five wetlands of Birbhum, three are situated within the Ballavpur Sanctuary of Shantiniketan and two others in the barriages of Tilpara and Bakreswar regions.

A detailed survey of water birds is conducted in all six major wetlands mentioned above. The survey was conducted from 1999 to 2010 to ascertain the trend of changes of the migratory birds in these wetlands. These wetlands host resident as well as migratory birds of veritable species composition.

It is worth mentioning the fact that Dabur Char hosted migratory birds till the year 1997. After 1997, migratory birds are not coming to this particular wetland, the reason of which is elaborated in the results and discussion attempted below.

## 2. MATERIAL AND METHODS

### Description of the study area

Among the five wetlands of Birbhum, Bakreswar Reservoir has been the result of a barrage erected across Bakreswar River to ensure constant water supply for cooling the Bakreswar Thermal Power Units. Tilpara Reservoir was the result of a barrage built across the River Mayurakshi. It is situated 4 km north-west of Suri and 10 km north-east of Bakreswar Reservoir and it was the result of a barrage built across the River Mayurakshi. Ballavpur Tank 1 is located on the northern boundary of the Ballavpur Wildlife Sanctuary, and in the recent years it is becoming more and more favourable site for the population of birds. Ballavpur Tank 2 is situated adjacent to the north western boundary of Ballavpur Wildlife Sanctuary. Ballavpur Tank 3 is situated adjacent to the western boundary of Ballavpur Wildlife Sanctuary. This is the largest water body of the sanctuary.

The present study commenced as early as in the winter of 1999. The observations on assemblage of different avian species are furnished along with their frequency. Total number of 55 species was encountered in the five wetlands under study. 26 migratory species and 31 species of resident birds observed are shown in Table 1 and the wetland wise frequencies of migratory and resident birds are furnished in Table 2.

The observations of the resident and migratory birds were undertaken by using a telescope (3 PT /20X Russian telescope) covering known compartments of particular wetlands. This is done by selecting markers at fixed distances permitted by the viewing field of telescope. The placement of marker was done according to width of viewing lens, the distance which it could cover. Normally a vantage point was selected from which the entire wetland could be covered by rotating the telescope. Birds are counted in each view and summed up as the total count. White and yellow ringed bamboo staffs are used as markers as far as possible. In case of very large distances prominent trees are also used as the marker trees. Particularly this is required in case of Bakreswar reservoir. Usually all three sites (Tilpara, Ballavpur, Bakreswar) were covered on the same date of each visit. Hence there is no possibility of any double count. Moreover, the month of count always remained during January when maximum congregation takes place. Birds were identified by following the methodology of (Grimmet et al., 2001) and (Ali and Ripley, 2001).

Diversity indices were calculated for each wetland during the time of study. The reason for calculating the diversity indices is basically to determine the nature of species congregation in the wetlands.

Following indices were calculated:

1. Simpson's Dominance Index :  $\sum p^2$  where p is the percentage of number of individuals of species
2. Simpson's Diversity:  $\sum 1-p^2$
3. Shanon Index:  $\sum p * \ln(p)$
4. Normalised Shanon Index:  $(p * \ln(p)) / \ln(S)$  where S is the total number of species
5. Sorenson's Similarity Index has been calculated for only migratory species:  $2C / (2C + A + B)$  where C=Common Species, A=Exclusive species for wetland A, B= Exclusive species for wetland B.

## 3. RESULTS

During the period of study it is observed that all the five wetlands do not host the avian population every year. Such as in case of Tank2, there was no avian population in the year 2010 due to mist netting necessitated for the prevention of bird flu. On the other hand, Bakreswar reservoir was established in the year 2001 and the regular avian congregation started from the year 2004. Thus in case of each of the wetlands, number of years considered are different which has been shown in Table 2. Accordingly the average of the total bird count has been calculated and used in Table 1. Distribution of water birds (both resident and migratory) in different water bodies of Birbhum District; West Bengal has been depicted in Table 1.

Diversity Indices of major migratory species namely Greylag Goose, Bar-headed Goose, Ruddy Shelduck, Eurasian Wigeon, Falcated Teal, Gadwall, Common Teal, Northern Pintail, Garganey, Northern Shoveler, Red-crested Pochard, Common Pochard, Tufted Duck and Ferruginous Pochard are calculated which is shown in Table 3. Sorensen's Similarity Index (SSI) Matrix as calculated is shown in Table 4.

In case of Dabur Char, the distribution of water birds (both resident and migratory) is shown in table 5 till the year 1997 (Mookherjee, 1999). Moreover in Dabur Char, the population of the migratory birds slowly diminished with the ongoing afforestation programme in the area within inter tidal zone. This will be apparent from the comparison of the two satellite imageries of the area during the year 2001 and 2009 (Figure 1).

In the above mentioned satellite imageries, the red areas on the river sides represent the mangrove vegetation. The mangrove area clearly increased at Dabur Char from 2001 to 2009 resulting in drastic reduction of migratory avian population. It may be mentioned that before the year 2000, a large number of migratory birds had visited Dabur Char but now no migratory birds visit this wetland. This might be due to the habitat alteration caused due to extensive afforestation due to which the resting place of the migratory birds has been hampered.

#### 4. DISCUSSION

Among the fourteen migratory birds observed, the Bar-headed Goose is the highest flying bird. Greylag Geese and Bar-headed Geese are almost exclusively vegetarian (Ali and Ripley, 2001) whereas the other twelve species of migratory birds are almost omnivorous.

A type of shallow water duck which gets food from the surface of the water are infrequent divers and are usually found in small ponds, rivers and other shallow waterways. Dabbling ducks also forage on land for seeds and insects. Physically, they have flat, broad bills and float high on the water while swimming and they tend to be very vocal birds. Eurasian Wigeon, Falcated Teal, Common Teal and Garganey are the dabbling ducks whereas Bar-headed Goose and Greylag goose are the geese.

The diving ducks, commonly called pochards or scaups, are a category of duck which feed by diving beneath the surface of the water. They are part of the diverse and very large Anatidae family that includes ducks, geese, and swans. Common Pochard, Tufted Duck, Ferruginous Pochard and Red-crested Pochard are the diving ducks.

No particular dominance of a migratory duck could be noticed in four of the wetlands except Tank 2 of Ballavpur Wildlife Sanctuary which is markedly dominated by Greylag Goose.

Shanon Weiner species diversity index (shown in Table 3) shows the highest diversity of migratory ducks in Bakreswar wetland because anthropogenic disturbances are much less here compared to that of Tilpara wetland. It is interesting to note the highest similarity between Tank 1 and Tank 3 of Ballavpur Wildlife Sanctuary (SSI=0.78).

A diversity index takes into account the number of species present, as well as the abundance of each species. Ecologists are interested in species diversity because diversity is usually proportional to the stability of the ecosystem: the greater the diversity the greater the stability. The most stable communities have large numbers of species which are fairly evenly distributed in good-sized populations. Pollution often reduces diversity by favoring a few dominant species. Diversity is therefore a factor in successful conservation management. Thus from the diversity indices obtained above it can be clearly mentioned that all the five wetlands of Birbhum in Eastern India have a good conservation management.

It may be mentioned that before the year 2000, a large number of migratory birds had visited Dabur Char which has now dwindled down to practically nil. This might be due to the habitat alteration caused due to extensive afforestation due to which the resting place of the migratory birds has been hampered.

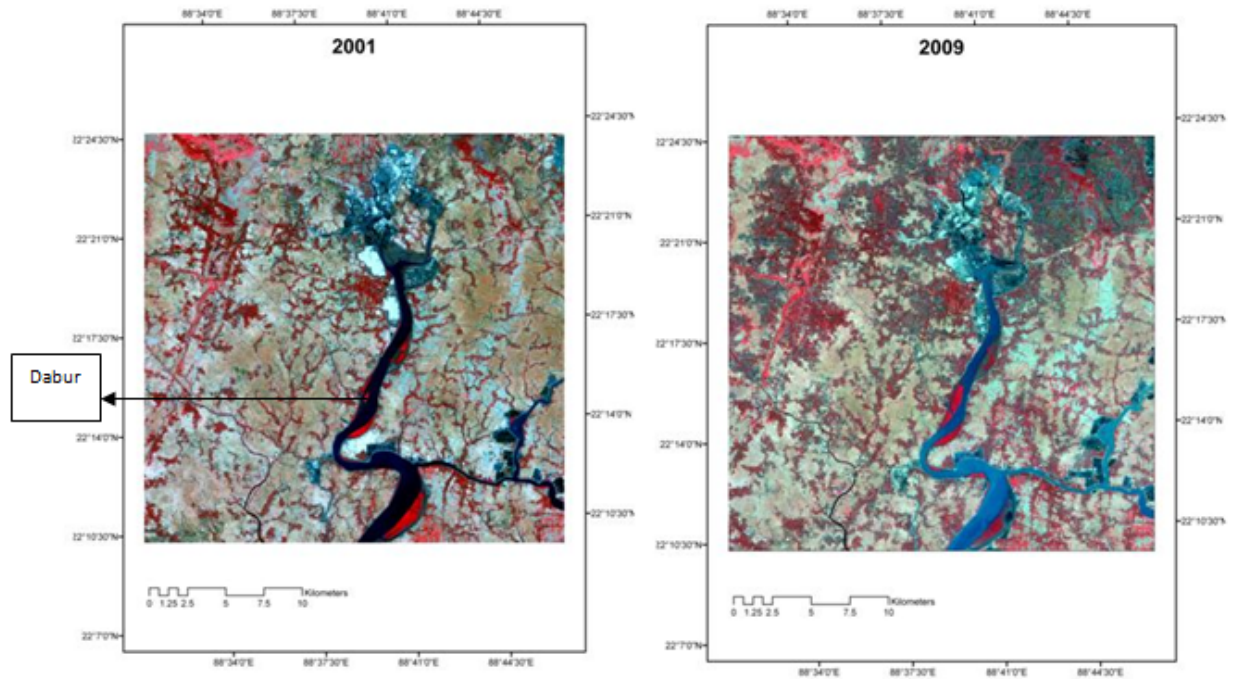
#### ACKNOWLEDGEMENTS

The authors acknowledge University Grant Commission, India for financial support of this work.

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# DABUR CHAR



**Figure 1**  
Satellite imagery of Dabur Char of the year 2001 and 2009

**Table 1**

Distribution of water birds (both resident and migratory) in different water bodies of Birbhum District, West Bengal

	Scientific name		Family	Tilpara	Bakreswar	Tank 1	Tank 2	Tank 3
Greylag Goose	Anser	anser	Anatidae	178	62	11	362	477
Bar-headed Goose	Anser	indicus	Anatidae	31	28	0	0	0
Ruddy Shelduck	Tadorna	ferruginae	Anatidae	20	165	0	0	0
Comb Duck	Sarkidiornis	melanotos	Anatidae	0	1	0	0	0
Cotton Teal	Nettapus	coromandelianus	Anatidae	188	71	304	0	46
Eurasian Wigeon	Anas	penelope	Anatidae	364	119	3	0	12
Falcatad Teal	Anas	falcata	Anatidae	0	0	0	0	0
Gadwall	Anas	strepera	Anatidae	711	302	143	88	423
Common Teal	Anas	crecca	Anatidae	351	144	2	0	411
Spot-billed Duck	Anas	poecilorbyncha	Anatidae	0	0	0	0	191
Northern Pintail	Anas	acuta	Anatidae	462	449	66	122	1817
Garganey	Anas	querquedula	Anatidae	56	15	1	0	78

Northern Shoveler	Anas	clypeata	Anatidae	30	11	2	0	13
Red-crested Pochard	Rhodonessa	rufina	Anatidae	1170	467	14	0	2
Common Pochard	Aythya	ferina	Anatidae	31	0	0	0	8
Tufted Duck	Aythya	fuligula	Anatidae	323	539	0	0	35
Ferruginous Pochard	Aythya	nyroca	Anatidae	76	25	3	7	28
Black headed Gull	Larus	ridibundus	Laridae	1	0	0	0	0
Common Coot	Fulica	atra	Rallidae	478	386	9	0	38
Swamp Hen	Amaurornis	akool	Rallidae	0	0	0	0	0
Moorhen	Gallinula	chloropus	Rallidae	0	0	133	26	131
Purple Swampphen	Porphyrio	porphyrio	Rallidae	10	0	16	4	63
Pheasant-tailed Jacana	Hydrophasianus	chirurgus	Jacanidae	2	0	22	13	12
Bronze-winged Jacana	Metopidius	indicus	Jacanidae	0	0	32	9	19
Great Stone Plover	Esacus	recurvirostris	Burhinidae	0	0	0	0	0
Greater Painted Snipe	Rostratula	benghalensis	Rostratulidae	0	0	0	0	0
Lesser Whisling Duck	Dendrocygna	javanica	Dendrocygndiae	24	814	307	20	4182
Fulvous Whisling Duck	Dendrocygna	bicolor	Dendrocygndiae	0	63	0	0	1
Little Grebe	Tachybaptus	ruficollis	Podicipedidae	11	19	12	0	26
Great Crested Grebe	Podiceps	cristatus	Podicipedidae	16	23	0	0	0
Asian Openbill	Anastomus	oscitans	Ciconiidae	4	0	0	0	0
Great Cormorant	Phalacrocorax	carbo	Phalacrocoracidae	1	3	0	0	0
Indian Shag	Phalacrocorax	fuscicollis	Phalacrocoracidae	0	3	0	0	0
Little Cormorant	Phalacrocorax	niger	Phalacrocoracidae	83	15	6	6	32
Purple Heron	Ardea	purpurea	Ardeidae	1	1	1	2.5	2
Grey Heron	Ardea	cinerea	Ardeidae	1	4	0	1.5	1
Cattle Egret	Bubulcus	ibis	Ardeidae	0	0	0	0	1
Little Egret	Egretta	garzetta	Ardeidae	3	4	2	0	3
Median Egret	Mesophoyx	intermedia	Ardeidae	2	0	1	3.5	1
Large Egret	Casmerodius	albus	Ardeidae	0	0	0	0	0
Lesser Adjutant Stork	Leptoptilos	javanicus	Ciconiidae	0	0	0	0	0
Greater Adjutant Stork	Leptoptilos	dubius	Ciconiidae	0	0	0	0	0
Pond heron	Ardeola	grayii	Ardeidae	5	4	0	0	7
Grey headed lapwing	Vanellus	cinereus	Charadriidae	0	0	0	7	2
Darter	Anhinga	melanogaster	Anhingidae	0	0	0	0	0
Black winged Stilt	Himantopus	bimantopus	Charadriidae	1	0	0	0	0
Common Sandpiper	Actitis	hypoleucos	Scolopacidae	1	3	0	0	0
Whitewag tail	Motacilla	alba	Passeridae	1	1	0	0	0
Brown headed Gull	Larus	brunnicephalus	Laridae	0	3	0	0	0
Common green shank	Tringa	nebularia	Scolopacidae	0	0	0	0	0
Common Snipe	Gallinago	gallinago	Scolopacidae	0	0	0	0	0
Yellow wagtail	Motacilla	flava	Passeridae	0	1	0	0	0
Mallard	Anas	platyrhynchos	Anatidae	0	1	0	0	0
White breasted kingfisher	Halcyon	smyrnensis	Alcedinidae	0	0	0	0	0
Pied kingfisher	Ceryle	rudis	Cerylidae	0	0	0	0	0
Little ringed plover	Charadrius	dubius	Charadriidae	0	1	0	0	0
Common swallow	Hirundo	asiatica	Hirundinidae	0	4	0	0	0

**Table 2**

No. of years considered for the respective wetlands-

Name of the wetlands	Number of years considered
Tilpara	9 (1999, 2003-2010)
Bakreswar	7 (2004-2010)
Tank 1	5 (2006-2010)
Tank 2	2 (2008-2009)
Tank 3	11 (1999, 2001-2010)

**Table 3**

Results of different diversity indices

Name of Wetlands	Simpson's Dominance Index	Simpson's diversity	Shanon Weiner's diversity	Normalised Shanon Index
Tilpara	0	1.00	-0.468	-0.18
Bakreswar	0.00	1.00	-0.58	-0.22
Tank 1	0.00	1.00	-0.35	-0.13
Tank2	0.11	0.89	(0.827)	(0.31)
Tank3	0	1	-0.3424	-0.13

**Table 4**

Sorensen's Similarity Index (SSI) Matrix

	T-3	T-2	T-1	Bak	Til
T-3	1	0.53	0.78	0.61	0.75
T-2	0.53	1	0.57	0.33	0.35
T-1	0.78	0.57	1	0.64	0.67
Bak	0.61	0.33	0.64	1	0.76
Til	0.75	0.35	0.67	0.76	1

**Table 5**

Distribution of water birds (both resident and migratory) in Dabur Char, South 24 Parganas District, West Bengal

	1990	1991	1992	1993	1994	1995	1996	1997
Greylag Goose	0	0	0	0	0	0	0	0
Bar-headed Goose	0	0	0	0	0	0	0	0
Ruddy Shelduck	0	0	0	0	0	0	0	0
Comb Duck	0	0	0	0	0	0	0	0
Cotton Teal	0	0	0	0	0	0	0	0
Eurasian Wigeon	0	113	87	409	209	262	54	10
Falcatad Teal	0	0	1	0	0	0	0	0
Gadwall	88	0	40	28	0	54	0	871
Common Teal	0	0	0	0	0	7	0	0
Spot-billed Duck	0		0	0	0	0	0	0
Northern Pintail	13	0	22	0	160	42	41	76
Garganey	0	0	0	0	0	15	0	0
Northern Shoveler	84	500	90	222	4	83	50	40
Red-crested Pochard	0	0	0	0	0	0	0	0
Common Pochard	0	54	40	30	4	0	0	0
Tufted Duck	605	427	380	0	201	601	865	50
Ferruginous Pochard	0	0	0	0	2	1	0	0
Black headed Gull	5	7	0	5	12	0	0	2
Brown headed Gull	0	5	70	39	0	41	33	0
Mallard	0	17	0	0	0	0	0	0
Black winged Stilt	0	0	0	0	1	0	0	0
Common Shelduck	0	50	0	12	29	0	81	6
Eastern Golden Plover	0	5	180	280	0	0	0	0
Kentish Plover	0	0	0	10	0	0	26	25
Whimbrel	70	112	20	61	7	36	69	32
Curlew	0	0	0	50	0	0	1	0
Blacktailed Godwit	0	0	0	0	58	0	0	0
Green Sandpiper	0	0	0	1	0	0	0	0
Whiskered Tern	10	4	148	3	2	26	270	1
Indian River Tern	0	0	0	0	1	0	2	0
Spurwinged Lapwing	0	0	0	0	0	1	0	0
Asian Openbill	0	0	0	26	0	34	0	11
Redwattled Lapwing	0	0	0	0	0	0	3	0
Indian Shag	0	0	0	0	0	27	50	0
Little Cormorant	8	10	7	55	32	113	4	41
Purple Heron	0	0	0	0	1	0	0	0
Grey Heron	0	0	0	0	0	0	18	7
Little Egret	15	0	5	53	9	49	37	4
Median Egret	0	0	0	0	0	0	3	0
Large Egret	2	4	1	1	0	0	1	5
Pond heron	0	17	30	51	17	56	5	13
Grey headed lapwing	0	0	0	70	0	3	0	9
Common Sandpiper	0	11	5	10	29	24	36	4
Common red shank	0	134	0	104	40	0	1	28
White Ibis	0	0	0	0	0	0	0	2