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Species diversity of water birds in Deepor Beel, Assam

Authors:
Jyotismita Das[1] and Saikia PK[2].

Institution:
[1] Research Scholar, Department of Zoology, Gauhati University.
[2]Associate Professor, Department of Zoology, Gauhati University.

Corresponding author:
Jyotismita

Email:
deeporbeel@gmail.com

ABSTRACT:

Study has been carried out to assess the water bird diversity in Deepor Beel Ramsar site of Assam from March 2007 to March 2010. Study revealed the presence of 39 species of water birds belonging to 16 families. The family Anatidae represented highest of eight species followed by seven species in the family Ardeidae whereas other 14 species represented by rest of the family. However, there were marked variation of species abundance in different years of study, of which, the family Anatidae represented the highest abundant family throughout the study period. The analysis of species diversity index using Shannon diversity index showed that the diversity was highest during 3rd year study period. Study also highlighted the threat factors prevailing in the Deepor Beel Ramsar Site.

Keywords:
Diversity, water birds, Shannon Diversity index, Threats factor, anthropogenic, Deepor Beel.

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INTRODUCTION

Wetlands are widely recognized as fragile ecosystems with diverse attributes including distinct avifauna (Burger, 1985). Wetlands have many ecological roles and are of importance to birds (Gill, 1994). Wetlands are highly important because they serve as critical breeding, staging and wintering grounds for wide array of globally important bird species (Kristen and Brander, 2004). The It has been estimated that freshwater wetlands hold more than 40% of bird species of the entire world and 12% of all animal species (Zakaria *et al.* 2009).Wetlands are important because they serve as critical breeding, staging and wintering grounds for wide array of globally important bird species (Kristen and Brander, 2004). The species richness and relative abundance of birds depend upon wetland characteristics such as size, water level, quality of water, availability and distribution of food resources, presence of suitable roosting and nursery sites (Wiens,1989).Variation in habitat condition may also cause changes in relative abundance of bird species composition (Garcia *et al*.2007;Caziani and Derlindati,2000). Birds are bio -indicators as they notify us of certain changes occurring in our environment. They are among the numerous fauna that may be at risk by the use of Agricultural pesticides (Mineau *et al*. 1990).Besides, the beauty of birds but also, particularly, water birds has made bird watching a very useful way of spending leisure and gathering revenue from both local and international tourists. Avian distribution and abundance are expected to respond seasonal changes in wetlands (Colwell and Dodd, 1997; Farmer and Parent, 1997).

MATERIAL AND METHODS

Study area

Deepor Beel is a large natural wetland having great biological and environmental importance (Deka and Goswami, 1992). This large water body is a great food source and breeding ground for a variety of migratory birds, amphibians, reptiles, insects, micro and macrophytes, terrestrial weeds and important taxa of ecological and economic importance (Bera *et al.,* 2008). This is endowed with both floral and faunal biodiversity. The Deepor Beel Ramsar site has a total area of 40 Km^2 of which 4.14 Km^2 had declared as a Bird Sanctuary. In November 2002, it was listed as a Ramsar site owing to its rich wetland biodiversity and sociocultural importance. Again, considering the varieties of bird species found in the Beel, Birdlife International has also declared Deepor Beel as an Important Bird Area (IBA). At maximum flooding the Beel becomes above 4 meters in deep and during the dry season the depth drops to about 1-1.5 meter. Deepor Beel (Coordination: 26°03′26″ –26°09′26″N and 90°36′39″–90°41′25″E) is situated on the Southern bank of the river Brahmaputra and Village Maj Jalukbari, Pachim Jalukbari, Dharapur and National Highway No.37 lie on the North; Dakhin Jalukbari, Tetelia and Pachim Baragoan to the East; Gorbhanga Reserve Forest, Chakardew Hill and Chilla Hill to the South West and the Village Azara and Kahikuchi to the west. Owing to its high biological diversity, this was included in the Directory of Asian wetlands. Deepor Beel has a meso-thermal climate, characterized by high humidity and moderate temperature. The temperature ranges between 10.6° C to 30°C. The pre-monsoon season (March-May) has a maximum temperature of 27° C and minimum of 24° C, and relative humidity between 50.5-76.8 %. (Saikia and Kakati, 2010). The monsoon season (May -September) has a maximum temperature of 32°C and minimum of 27.3°C. The relative humidity is 82.5%. The retreating monsoon (September to October) has maximum and minimum temperatures of 27° and 25° C respectively. (Saikia and Kakati, 2010). The relative humidity is 82% and the rainfall gradually decreases to average as the season advances. The winter season begins in November and continues until January. The average field temperature during this period remains at 20 ± 2°C and the relative humidity measures about 77.5%. January is the coldest month, with a lowest temperature of 7 ^{o}C but sometimes the temperature falls to 6 ^{o}C. At least 232 species of avian fauna from 72 different families were recorded in previous studies from this wetland (Saikia and Kakati, 2010). Apart from these; the Beel is associated with a rich variety of other flora and fauna. Deepor Beel appears to be relatively high with respect to the biodiversity of free floating, emergent and submerged aquatic macrophyte (Saikia and Bhattacharjee, 1987).The free floating plant species are identified as *Eicchornia crassipes*, *Azolla pinnate, Pistia stratiotes, Lemna minor, Lemna major*. Again the emergent water plants so far recorded are *Trapa bispinosa, Utricularia flexuosa, Eleocharis pantaginea, Nelumbo nucifera, Nymphaea alba, Euryale ferox. Ipomea reptans*. The submerged plants which are so far identified are *Potamogeton crispum, Valisnaria spiralis, Hydrilla verticillata, Najas foveolata.*

Data Collection

Avian data were collected from March 2007 to March 2010.Data were collected in the early morning (5a.m-9 p.m) and in the afternoon time (4p.m-5p.m).For data collection four to five days were allotted in one month. For watching, counting and identifying birds Binocular (10X50), telescope (25-40X), camera (Cannon 110 PS), note book, guide book, pen, pencil etc were used. Meteorological data (Temparature, Rainfall, and Humidity) were collected from the Central Meteorological Department, Borjhar, Assam. Photographs and videos were taken to justify the species type for those species that are difficult to identify. Birds were identified by seeing their characteristics feature in accordance with the identification keys involved in Ali and Ripley (1983), Grimmett *et al*. (1999). Counts were not made on days with fog, rain or strong wind to lessen the bias caused by the effect of extreme weather (Verner, 1985).

Data analysis

The diversity of water birds were analyzed using species diversity and richness software (3.02 version).The Shannon diversity index (H) was calculated to analyze the water bird diversity in the study area. Bootstrap method was used to calculate 95% confidence intervals. In order to test the difference in diversity between the three successive years of study (First year, Second year and third year) pair-wise randomization test was carried out based on 10,000 re-sample of species abundance based on Solow (1993).

RESULTS

Water bird composition of the study area

Altogether 35,555 individuals from 39 species of 16 different families were found during the study period **(Fig.1**). The highest number of species (8) was found to be in the bird family Anatidae which is followed by the family Ardeidae containing seven numbers of species. The families Ciconiidae, Alcidinidae and Rallidae were represented by three numbers of species respectively. The families Accipitridae, Jacanidae and Passeridae are represented by two numbers of species respectively. Again one species of each of the families Phalacrocoracidae, Corvidae, Charadridae, Apodidae, Hirundinidae, Upopidae, Meropidae and Laridae were reported during the study period.

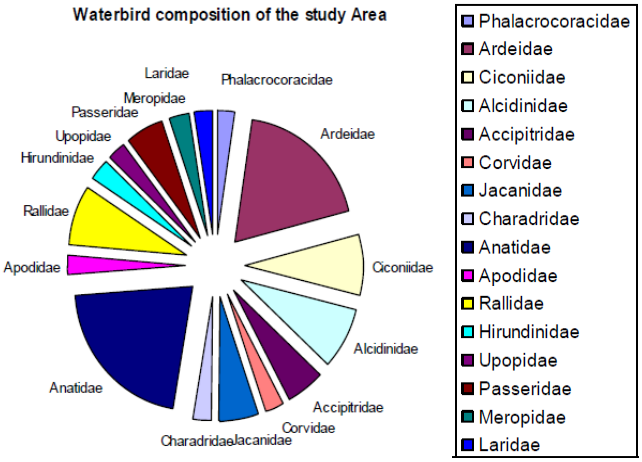

Figure 1. Water bird composition of the study area

During the study period declining trend was noticed regarding the presence of total numbers of individuals of the species in the three successive years. In 2007-08 the total numbers of individuals of water birds recorded were 14,104 numbers. In 2008-09 total numbers of individuals of species were recorded as 11,508 numbers and in 2009-10 the total number of birds were 10,380 (**Fig. 2**).

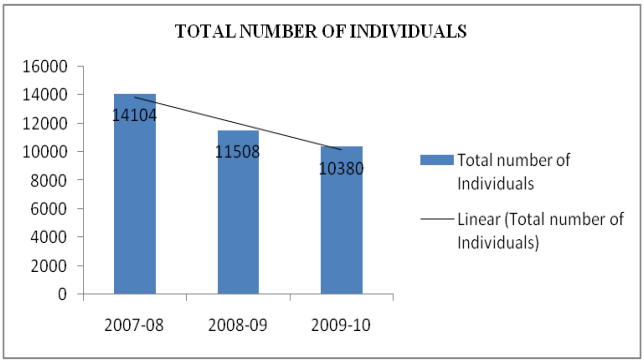

Figure 2. Total numbers of individuals recorded in three successive years

Percent occurrence of water birds in three successive years

While calculating the percentage of water birds in the study area in three successive years it was seen that in the first year the percent occurrence of the Anatidae family was found to be highest (67.6%) and the same value was found to be lowest (0.13%) in Passeridae family **(Fig.3**). Again in the second year the percent occurrence of the Anatidae family was highest (69.2%) as compared to the other families and the same was calculated to be lowest (0.15%) in Passeridae family (**Fig.4**). In the third year also the percent occurrence of Anatidae family was highest (69.2%) than other families (**Fig.5**). The percent occurrence of the

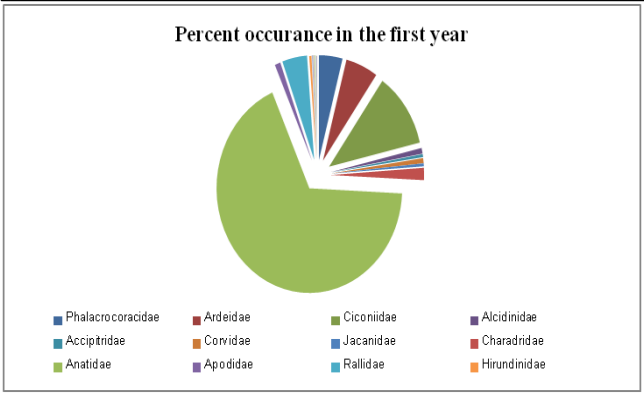

Figure 3. Percent occurrence of water birds in first year

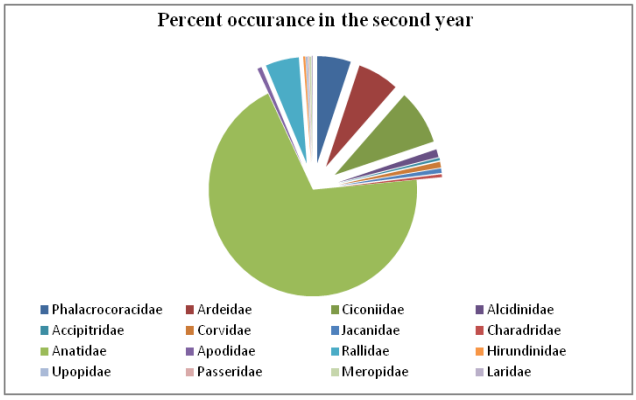

Figure 4. Percent occurrence of water birds in second year

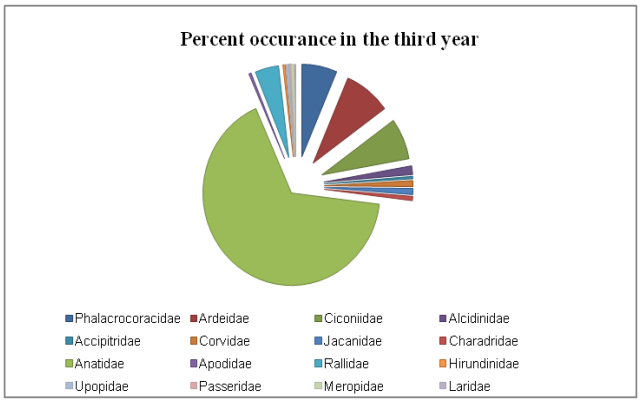

Figure 5. Percent occurrence of water birds in third year

Passeridae family was reported to be lowest (0.15%) during the study period. Overall it was seen that the percent occurrence of Anatidae family was reported to be highest in all the three successive years.

Comparison of diversity indices between first, second and third year

In these section Shannon diversity index (H) of the three successive years had been worked out to analyze the species diversity of water birds and it was presented in **Table 1.**

Table 1. The values of Shannon diversity indices (H) of three successive years

Sample	H	Variance H	Lower 95%	Upper 95%
First year	1.269	0.0001381	1.247	1.293
second year	1.228	0.0001703	1.2	1.253
Third year	1.335	0.0001902	1.308	1.36

Comparing Shannon index (H) between first year and second year showed that the first year was more diverse than the second year, at 5% level (pair wise randomized test based on 10,000 random samples; SI: First year: H=1.3; second year: H=1.2; ^=0.04). Again the comparison between second and third year had showed that in the third year of study diversity was found to be higher as compared to the second year, at 5% level (pair wise randomized test based on 10,000 random samples; SI: second year: H=1.2,third year: 1.3; ^=0.10). Again while comparing the diversity between first year and third year it was seen that the third year was more diverse than the first year, at 5% level (pair wise randomized test based on 10,000 random samples; SI: first year: H=1.2, third year: H=1.3; ^=0.06).Overall, the study showed that Shannon Diversity Index was reported to be highest (H=1.3) in third year of study period (**Fig.6**).

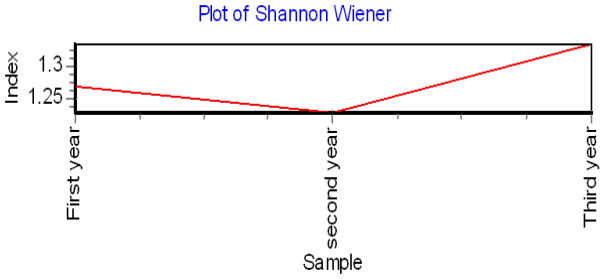

Figure 6. Shannon diversity indices (H) of avian fauna of three successive years

DISCUSSION

The results clearly showed the presence of 39 species of water birds from 16 different families in the study area. The present findings contradict the views of Saikia (2005) who had reported the presence of 232 species of aquatic avifauna from different families. Likewise, A. U. Choudhury (2000) had also recorded 150 species of birds in and around the Sanctuary. Barman (1995) had reported 62 species of water birds of which 16 species were of Anatidae family. Interestingly, they had also

mentioned the presence of 1,018 individuals of *Aythya baeri* in their survey in 1988-89, but subsequently the population declined to 250 in 1989 - 90, 3 in 1990-91, 135 in 1991-92, and none in 1992-93. The decline in species content as reveled from the present study might be due to degradation and habitat fragmentation due to anthropogenic activities in and around the Beel ecosystem. Four factors impact on migratory birds population at their stop-over sites and winter quarters: restriction of habitats, hunting and trapping, disturbance, and effects of biocides (Berthold, 1994). Similarly the major threats to the water birds of Deepor Beel were encroachment, habitat fragmentation, hunting and trapping of water birds, Soil digging, over fishing, Application of pesticides in the agricultural field. Likewise in Yunnan province habitat destruction and over-hunting were the major threats to the wetland species (Wen *et al*. 1995). Bharatha Lakhmi (2006) had also revealed in his study that anthropogenic pressure affects the habitat of water birds. Apart from this hunting and trapping of water birds can also play a major role in declining of the water birds number in an alarming level. Poaching of water birds also greatly contributed in declining water bird species. This fact was also supported by Barman (1995) in his work by mentioning the highest threat factors in Deepor Beel as compared to other Beel. Saikia and Kakati (2010) had also mentioned about the heavy destruction process which was prevailing within the Beel periphery since last few years. Saikia (2005) had mentioned about the recent soil digging of the Beel bed in number of locations in northern boundaries and heavy encroachments for settlements caused tremendous loss of wetland area in their works. Apart from these he also mentioned different anthropogenic factors which promotes in degradation of the Beel in a quite high rate. Apart from this the Expert Team constituted by the Planning Commission, Government of India, to Review the status of implementation of the National Wetland Conservation and Management Programme (NWCMP) of the Ministry of Environment & Forests in 2008 had also reported that the past two decades had witnessed a lots of transformation in the ecological and social character of Deepor Beel.

Similar findings for the declining trend in various waterfowls in many regions of the world were observed by Korschgen and Dahlgren (1992), Vaisanen and Solonen (1996), Lebedeva and Markitan (2001), Houdkova (2003), Horn et al, (2008), Phillips (2008). Likewise year wise declining trend in population also might be attributed to different threat factors within Beel ecosystem. The percent occurrence of Anatidae family was reported to be highest in three successive years which was also supported by Saikia (2005). Among the members of Anatidae family the population of both lesser whistling teal (19,661) and large whistling teal (3,540) were reported to be highest in three successive years. Saikia (2005) also had reported the highest occurrence of large whistling teal in Deepor Beel. The high density of aquatic vegetation might be contributed in the high abundance of whistling teal in the study area as makhana act as a special food component of both the species of whistling teal. Saikia and Bhattacharjee (1987) had also reported high density of free floating, emergent and submerged aquatic macrophyte in Deepor Beel.

Shannon diversity index was reported to be highest in third year of study (H=1.3).This may be due to the fact that the diversity of wetland component and the adaption of different aquatic avian fauna to exploit the resources of wetland ecosystem might be the cause of supporting high diversity of water birds in the third year. Again different vegetation types as well as abundant food resources also might be playing a greater role in difference in habitat preference by bird species. The rich and high vegetation might be providing heterogeneous and suitable site for foraging, roosting and nesting of birds. Similar findings of high species diversity were reported by Macdonald (1977), Weller (1978) and Puttick (1984) in their work. Similar findings regarding the affect of vegetation diversity and richness on the bird population richness were studied by Karr and Roth (1971), Cody (1981), Canterbury *et al.* (1999), Soderstrom and Part (1999), Paracuellos (2006) had mentioned in his work that the bird assemblage is affected by various factors like food availability, the size of the wetland etc. Zakaria *et al.* (2009) had reported that diversity of flora subsequently affected the abundance and diversity of birds, insects, amphibians, fishes, reptiles and small mammals. Again, he mentioned that the abundance of insects, amphibians, reptiles and small mammals had also attracted waders and raptors. Similar findings were documented by the work of Lee & Rotenberry (2005) where they had reported that the distribution and abundance of many bird species are

determined by the composition of the vegetation that forms a major element of their habitats. As vegetation changes along complex geographical and environmental gradients, a particular bird species may appear, increase or decrease in number, and disappear as the habitat changes. Smith (1992) had also worked out that differences in feeding habits and habitats could also increase diversity, evenness and species richness.

CONCLUSION

Deepor Beel which is the lone Ramsar site in Assam is very rich in biodiversity. Apart from the extensive destruction processes which are continuously prevailing within the Beel, the water birds are still visiting the wetland body for its rich biodiversity. So, proper management practices should be taken for the proper conservation of the wetland ecosystem as well as the water birds.

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