

## **BIOSURVILANCE OF WETLANDS IN EASTERN INDIA (BIRBHUM, WEST BENGAL) FOR WISE USE**

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**Abstract:** Biodiversity encompasses the grand total of all the different life forms of our planet. This study represents an in depth assessment of key biological components in 20 wetlands of Birbhum district, West Bengal, India during 2010 to 2014. Total 26 families and 57 species of macrophytes, 25 species of birds and 35 species (16 families and 7 orders) of fishes were observed. Cyperaceae (17%), Lemnaceae (15%) and Poaceae (15%) encompasses higher abundance among macrophytes. Anatidae represented by 6 species, dominated the wetland bird community and maximum number of fish species were catalogued under the order Cypriniformes (15).

**Keywords:** Conservation Biology, Wetland Biodiversity, West Bengal.

### **1. INTRODUCTION**

Wetland ecosystems are beauty of nature and wealth for future. These are diverse ecosystems that link people, wildlife and environment in special and interdependent ways through the essential life-support functions of water (Maltby and Barker, 2009). A modified definition given by The World Conservation Union (IUCN), which is accepted by many, has been considered for defining the wetlands in this study. This definition was adopted at the first meeting of convention in Ramsar, Iran in 1971, which stated that “*areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, 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*”. Wetland ecosystem forms an important environment for aquatic, semi-aquatic and moisture loving floral and faunal associations. Wetlands have been extensively investigated for their ecology, management, conservation and restoration (Keddy 2000, Mitsch and Gosselink 2000, Fraser and Keddy 2005, Gupta et al 2013).

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Macrophytes serve as a connection between the sediment, water, and (sometimes) atmosphere in wetlands, lakes, and rivers. The most notable function that plants serve is as primary producers. However, macrophytes are also involved in ecosystem processes such as biomineralization, transpiration, sedimentation, elemental cycling, materials transformation, and release of biogenic trace gases into the atmosphere. Studies on macrophytes of Birbhum are well documented (Mukherjee and Palit, 2001, 2002).

The water birds which inhabit wetlands for nesting, feeding and roosting are broadly defined as water birds. In this paper, water birds, wetland dependent and associated birds are collectively termed as wetland birds. Wetland factors that affect birds include availability, depth, and quality of water; availability of food and shelter and presence or absence of predators. However, wetlands in India, are facing tremendous anthropogenic pressures (Prasad et al. 2002), which can adversely influence the structure of bird communities (Kler 2002; Verma et al. 2004; Therefore detail study on wetland avifauna is important to protect them. However, few studies have been carried out on the status and diversity of wetland birds in this eco region (Mukherjee and Gupta 2012).

Fishes are one of the important elements in the economy of many nations as they have been a stable item in the diet of many people. Study on fish fauna in India has been well investigated through some good and novel studies pioneered by (Talwar and Jhingran 1991; Kar and Dey 2002; Kar et al 2004).

According to IUCN (2004) the total number of known species world wise is about 1.5 million. Many more are yet to be discovered. For many taxonomic groups the species of temperate zones have been fully recorded. But in tropical zones with highest biodiversity the biodiversity data is far from complete. In this context, the present study on wetlands in Birbhum District for cataloguing extent of key wetland biota was carried out to support the philosophy of wise use for these wetlands in future.

## **2. MATERIALS AND METHODS**

### **2.1 STUDY AREA**

Birbhum District (Fig 1) lying within  $23^{\circ}32'30''$  and  $24^{\circ}35'0''$  N latitude and  $88^{\circ}01'40''$  and  $87^{\circ}05'25''$  E longitude covers an area of 454.00 sq km. It is traditionally a very important district in relation to agriculture, education and culture. Wetlands herein are of both natural and man-made origin. Birbhum district is formed by three subdivisions and nineteen blocks. Almost all parts (at block level) of Birbhum District were surveyed from 2010 to 2014.

## 2.2 ASSESSMENT OF WETLAND BIOTA

Observations on the aquatic macrophytes, wetland birds and pisci faunal occurrence at 20 wetlands distributed over 19 Blocks in Birbhum District were carried out through frequent field surveys at seasonal intervals which comprises pre-monsoon (April-May), monsoon (August-September) and post-monsoon (December-January). The annual assemblage (presence or absence) of macrophyte species were noted and plants were identified using standard literature by Cook's (1996). The Birds were photographed by CANON Power Shot (SX 150 IS) and identified using "Pocket Guide to the Birds of the Indian Subcontinent" (Grimmett & Inskipp 2007). Fishes were identified up to the species level, with the help of standard keys (APHA 2005), books (Talwar and Jhingran 1991) and online databases (Fish Base, 2012). Site specific relative abundance (here after will be noted as three categories: a) Common1/Most abundant2: +++ (birds1/fish2 observed in >50-% of study sites); b) Uncommon/Less abundant: ++ (25-50%) and c) Less common/Rare: + (<25%) were derived for wetland birds and fishes. Threat category and population trend of these communities were adopted from IUCN Red List of Threatened Species (IUCN, 2013).

## 3. RESULTS AND DISCUSSION

### 3.1 MACROPHYTES ASSEMBLAGE

Total 26 families and 57 species (Table 1a) of macrophytes were observed. Cyperaceae (17%), Lemnaceae (15%) and Poaceae (15%) showed higher abundance followed by Nymphaeaceae (8%), Pontederiaceae (7%), Hydrocharitaceae (6%), Araceae (5.5%), Asteraceae (5%) and Amaranthaceae (4%) with moderate abundance. Lower abundant families were as follows Trapaceae (3%), Nelumbonaceae (3%), Marsileaceae (3%), Apiaceae (2%), Salviniaceae (2%) Ranunculaceae (1%), Acanthaceae (1%) and Polygonaceae (1%) etc. Uncommon families (less than 1% abundance) were represented by Euphorbiaceae, Convolvulaceae, Papilionaceae, Potamogetonaceae. The plant families are categorized under three major wetland plant type-emergent (65.5%), floating (25%) and submerged (9.5%). The results of present study agree with earlier findings investigated by Palit et al. (2007, 2012).

### 3.2 WETLAND BIRDS COMPOSITION

Twenty five species of wetland birds belonging to 20 genera and 9 families were recorded. The list of recorded bird species along with their scientific name, is given in Table 1b. The family Anatidae represented by 6 species, dominated the wetland bird community of the study area. It accounted for 24% of the total number of wetland bird

species of the studied wetlands (Fig. 2). Among the recorded species, 15(60%) were Common (+++), 8(32%) Uncommon (++) and 2(8%) were less common (+) species according to SSRA (Fig. 3). Maximum wetland birds with common status (+++) were *A. atthis*, *H. smyrnensis*, *D. bicolor*, *D. javanica*, *A. purpurea*, *A. grayii*, *B. ibis*, *E. garzetta*, *A. oscitans*, *M. indicus*, *M. alba*, *M. flava*, *M. citreola*, *P. niger*, *G. chloropus*. Population trend of these water bird species revealed 10 species (40%) with unknown (UN) status followed by 9 species (36%) with decreasing (DE), 3 species (12%) with stable (ST) and 3 species (12%) with increasing (IN) status.

### 3.3 PISCI FAUNAL STATUS

During the study period the thirty five fish species, under 25 Genera, 16 families and 7 orders were collected and identified from the wetlands of Birbhum District, West Bengal, India (Table 1c). Maximum number of species was found under the order Cypriniformes (15) whereas Osteoglossiformes, Mugiliformes and Cyprinodontiformes comprised minimum number (1) among seven orders (Fig. 4). Fig 5 depicts the SSRA category of fish species in which Rare (+) group (Relative frequency 14.28%) comprised of five fish species namely *H. molitrix*, *A. nobilis*, *A. testudineus*, *M. favus*, *M. pancalus*. Abundant (+++) group of fishes includes the following 8 fishes namely *L. bata*, *C. catla*, *C. carpio*, *C. mrigala*, *L. rohita*, *A. panchax*, *O. mossambicus* and *W. attu* with a total relative frequency 22.85%.

During this entire tenure of work a very brief idea about the current scenario of the wetlands with special emphasis on biodiversity, use pattern etc) in this district is generated. Further extensive research, investigation, seasonal monitoring, pilot scale study with socioeconomic purview will produce valuable research findings.

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**Table 1(a,b,c):** List of macrophytes, wetland birds and fish species documented from wetlands of Birbhum district.

<b>Table 1(a): List of macrophytes documented from wetlands of Birbhum district.</b>	
<b>Family</b>	<b>Scientific names of macrophyte species</b>
Acanthaceae	<i>Hygrophila difformis</i> <sup>b</sup>
Alismataceae	<i>Sagittaria guyanensis</i> <sup>a</sup>
Amaranthaceae	<i>Alternanthera paronychoides</i> <sup>b</sup> , <i>Alternanthera sessilis</i> <sup>b</sup> , <i>Amaranthus spinosus</i> <sup>c</sup>
Apiaceae	<i>Centella asiatica</i> <sup>b</sup>
Aponogetonaceae	<i>Aponogeton natans</i> <sup>a</sup>
Araceae	<i>Pistia stratiotes</i> <sup>d</sup>
Asteraceae	<i>Enydra fluctuans</i> <sup>a</sup>
Ceratophyllaceae	<i>Ceratophyllum demersum</i> <sup>a</sup>
Convolvulaceae	<i>Ipomoea aquatic</i> <sup>a</sup> , <i>Ipomoea cornea</i> <sup>a</sup> , <i>Ipomoea obscura</i> <sup>a</sup>
Cyperaceae	<i>Bulbostylis barbata</i> <sup>b</sup> , <i>Cyperus castaneus</i> <sup>b</sup> , <i>Cyperus compressus</i> <sup>b</sup> , <i>Cyperus difformis</i> <sup>c</sup> , <i>Cyperus pilosus</i> <sup>d</sup> , <i>Eleocharis dulcis</i> <sup>a</sup> , <i>Fimbristylis dichotoma</i> <sup>a</sup> , <i>Fimbristylis aestivates</i> <sup>a</sup> , <i>Schoenoplectus articulatus</i> <sup>d</sup>
Euphorbiaceae	<i>Croton bonplandianum</i> <sup>a</sup>
Hydrocharitaceae	<i>Hydrilla verticillata</i> <sup>d</sup> , <i>Ottelia alismoides</i> <sup>a</sup> , <i>Vallisneria spiralis</i> <sup>a</sup>

Lemnaceae	<i>Lemna acquinocialis</i> <sup>d</sup> , <i>Spirodela polyrrhiza</i> <sup>d</sup>
Lentibulariaceae	<i>Utricularia gibbosa</i> <sup>a</sup> , <i>Utricularia stellaris</i> <sup>a</sup>
Menyanthaceae	<i>Nymphoides indica</i> <sup>c</sup>
Nelumbonaceae	<i>Nelumbo nucifera</i> <sup>c</sup>
Nymphaeaceae	<i>Nymphaea nouchali</i> <sup>d</sup> , <i>Nymphaea pubescens</i> <sup>c</sup>
Onagraceae	<i>Lindwigia perennis</i> <sup>b</sup>
Papilionaceae	<i>Aeschynomene aspera</i> <sup>a</sup> , <i>Alysicarpus monilifer</i> <sup>a</sup>
Poaceae	<i>Coix lachryma-jobi</i> <sup>a</sup> , <i>Digittaria ciliaris</i> <sup>c</sup> , <i>Digittaria longifolia</i> <sup>b</sup> , <i>Echinochloa colona</i> <sup>c</sup> , <i>Echinochloa crusgalli</i> <sup>d</sup> , <i>Eragrostis gangetica</i> <sup>a</sup> , <i>Eragrostis tenella</i> <sup>a</sup> , <i>Leptochloa chinensis</i> <sup>d</sup> , <i>Oryza rufipogon</i> <sup>b</sup> , <i>Phragmites karka</i> <sup>a</sup>
Polygonaceae	<i>Polygonum barbatum</i> <sup>a</sup> , <i>Polygonum orientale</i> <sup>a</sup> , <i>Polygonum plebeium</i> <sup>a</sup>
Pontederiaceae	<i>Eichhornia crassipes</i> <sup>d</sup> , <i>Monochoria vaginalis</i> <sup>a</sup> , <i>Monochoria hastata</i> <sup>a</sup>
Potamogetonaceae	<i>Potamogeton nodosus</i> <sup>a</sup>
Ranunculaceae	<i>Ranunculus seleratus</i> <sup>b</sup>
Salviniaceae	<i>Salvinia cuculata</i> <sup>b</sup>
Trapaceae	<i>Trapa bispinosa</i> <sup>c</sup>
Code used for relative abundance of macrophyte species: a=0-1%, b=1-2%, c=2-3%, d=>3%	

**Table 1(b): List of wetland birds species documented from wetlands of Birbhum district.**

Family	Scientific names of wetland birds species
Alcedinidae	<i>Alcedo atthis</i> <sup>a</sup> , <i>Halcyon smyrnensis</i> <sup>a</sup>
Anatidae	<i>Anas crecca</i> <sup>b</sup> , <i>Anas strepera</i> <sup>b</sup> , <i>Aythya ferialis</i> <sup>c</sup> , <i>Dendrocygna bicolor</i> <sup>a</sup> , <i>Dendrocygna javanica</i> <sup>a</sup> , <i>Nettapus coromandelianus</i> <sup>b</sup>
Ardeidae	<i>Ardea purpurea</i> <sup>a</sup> , <i>Ardeola grayii</i> <sup>a</sup> , <i>Bubulcus ibis</i> <sup>a</sup> , <i>Egretta garzetta</i> <sup>a</sup>
Charadriidae	<i>Charadrius dubius</i> <sup>b</sup> , <i>Charadrius alexandrinus</i> <sup>b</sup>
Ciconiidae	<i>Anastomus oscitans</i> <sup>a</sup>
Jacaniidae	<i>Hydrophasianus chirurgus</i> <sup>c</sup> , <i>Metopidius indicus</i> <sup>a</sup>
Motacillidae	<i>Motacilla alba</i> <sup>a</sup> , <i>Motacilla flava</i> <sup>a</sup> , <i>Motacilla citreola</i> <sup>a</sup>
Phalacrocoracidae	<i>Phalacrocorax niger</i> <sup>a</sup>
Rallidae	<i>Amaurornis phoenicurus</i> <sup>b</sup> , <i>Gallinula chloropus</i> <sup>a</sup> , <i>Porphyrio porphyrio</i> <sup>b</sup> , <i>Fulica atra</i> <sup>b</sup>

Code used for site specific relative abundance (SSRA) of wetland bird species:  
a= Most abundant: +++ (>50-%); b= Less abundant: ++ (25-50%), c= Rare: + (<25%)

**Table 1(c): List of fish species documented from wetlands of Birbhum district.**

Order	Scientific names of fish species
Cypriniformes	<i>Hypophthalmichthys molitrix</i> <sup>c</sup> , <i>Aristichthys nobilis</i> <sup>c</sup> , <i>Labeo bata</i> <sup>a</sup> , <i>Catla catla</i> <sup>a</sup> , <i>Cyprinus carpio</i> <sup>a</sup> , <i>Ctenopharyngodon idella</i> <sup>b</sup> , <i>Labeo calbasu</i> <sup>b</sup> , <i>Cirrhinus mrigala</i> <sup>a</sup> , <i>Amblypharyngodon mola</i> <sup>b</sup> , <i>Puntius puntio</i> <sup>b</sup> , <i>Puntius chola</i> <sup>b</sup> , <i>Puntius guganio</i> <sup>b</sup> , <i>Labio rohita</i> <sup>a</sup> , <i>Puntius sarana</i> <sup>b</sup> , <i>Puntius ticto</i> <sup>b</sup>
Cyprinodontiformes	<i>Aplocheilus panchax</i> <sup>a</sup>
Mugiliformes	<i>Liza parsia</i> <sup>a</sup>
Osteoglossiformes	<i>Notopterus notopterus</i> <sup>b</sup>
Perciformes	<i>Anabas testudineus</i> <sup>c</sup> , <i>Trichogaster chuna</i> <sup>b</sup> , <i>Chanda nama</i> <sup>b</sup> , <i>Channa gachua</i> <sup>b</sup> , <i>Channa punctatus</i> <sup>b</sup> , <i>Channa striata</i> <sup>b</sup> , <i>Oreochromis niloticus niloticus</i> <sup>b</sup> , <i>Oreochromis mossambicus</i> <sup>a</sup> , <i>Badis badis</i> <sup>b</sup>
Siluriformes	<i>Sperata aor</i> <sup>b</sup> , <i>Mystus vittatus</i> <sup>b</sup> , <i>Clarius batrachus</i> <sup>b</sup> , <i>Heteroneustes fossilis</i> <sup>b</sup> , <i>Lates calcarifer</i> <sup>b</sup> , <i>Wallago attu</i> <sup>b</sup>
Synbranchiformes	<i>Mastacembelus favus</i> <sup>c</sup> , <i>Macrognathus pancalus</i> <sup>c</sup>

Code used for site specific relative abundance (SSRA) of wetland bird species:  
a= Most abundant: +++ (>50-%); b= Less abundant: ++ (25-50%), c= Rare: + (<25%)

Figure 1. Distribution of study sites in Birbhum district, W.B, India

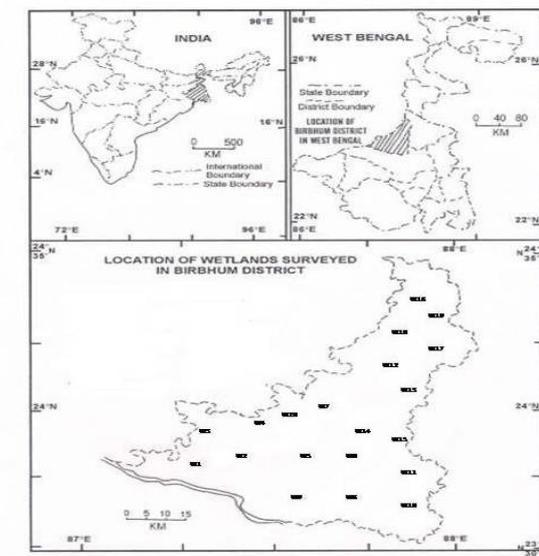


Figure 2. Bar Graph of avian families as represented by relative frequency of wetland bird species in wetlands of Birbhum District.

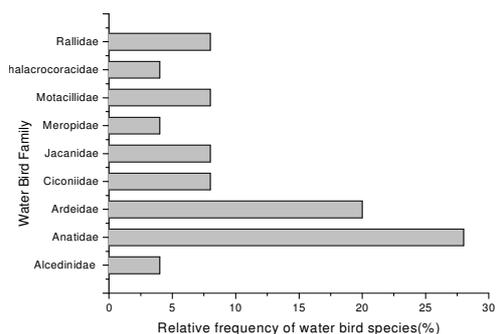


Figure 3. Bar graph representing the relative frequency of SSRA category of avian families in wetlands of Birbhum District (Species number is labeled).

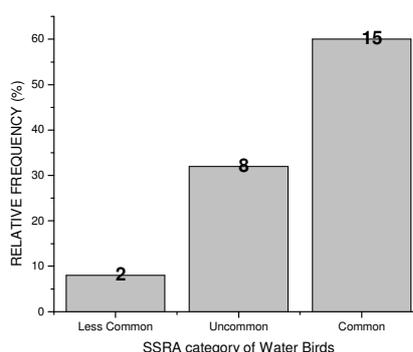


Figure 4. Bar graph of observed fish orders in Birbhum Wetlands.

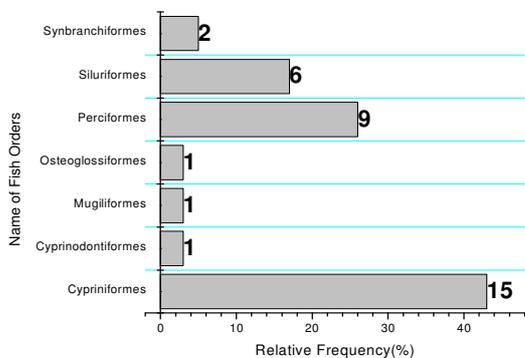


Figure 5. Column graph of SSRA categories of observed fish species in Birbhum Wetlands.

