

# Winter Diversity of Birds from a Shoreline Ecotone: Henry's Island, Sundarban Biosphere Reserve, India

P. K. Ghosh<sup>1</sup>, D. Ghosh<sup>2</sup>, R. Mohanta<sup>1</sup>, S. Ray<sup>1</sup>, A. Mondal<sup>1</sup>, S. Sarkar<sup>1</sup>, R. Ghosh<sup>1</sup> and S. Sardar<sup>1\*</sup>

<sup>1</sup> Department of Zoology, Ramakrishna Mission Vivekananda Centenary College (Autonomous), P.O. Rahara, District- North 24 Parganas, Kolkata 700118, W.B., India

<sup>2</sup> Research Assistant, Sundarban Tiger Reserve, West Bengal, India

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## ABSTRACT

Study of avifaunal diversity is one of the reliable ecological attribute by which ecosystem structure, services and health are indicated from time to time. The present study was carried out in the shoreline ecotone region of Henry's Island in Sundarban Biosphere Reserve from South 24 Parganas, West Bengal during early winter months of 2021. A total of 63 avian species belonging to 31 different families and 13 orders were recorded in the winter season following standard field ecology protocols and then foraging guilds were analyzed. Family-wise relative diversity index has been constructed with standard mathematical equation. Six major categories with other seven overlapping foraging guilds were also observed in the present study. Most bird species were found to be insectivorous followed by other foraging guilds.

**Key words:** Avifauna, Henry's Island, Sundarban, Foraging, Guild

## Introduction

Ecotones which are transitional ecological sensitive zones, forms a unique biological diversity due to its high spatial heterogeneity than its neighbouring communities (Kark, 2013). Mangroves are excellent example of ecotone with its rich biological diversity which attracts the assemblage of different faunal species for its resource availability. The largest mangrove delta on Earth is the Sundarbans, encompassing the Meghna-Padma-Brahmaputra delta of India and Bangladesh. The Indian part of Sundarbans encompassing around 4000 sq. km. area have prestigious conservation jewels on its crown namely, UNESCO World Heritage Site, Ramsar Wetland, Biosphere Reserve and IBA (Important Bird Area) zones. With a total aviandiversity of 428 species, this area is bird watcher's paradise, after Chandra *et al.*,

2017. Avian diversity is one of the most important ecological indicator to appraise the habitat quality both qualitatively and quantitatively, by Bilgrami (1995), Manjunath and Joshi (2012) in a given ecosystem.

Henry's Island is a popular weekend tourist destination of extreme south of West Bengal situated just 130 km from the bustling metropolis Kolkata on western border of Indian Sundarbans and thus falls under the mangrove- estuarine ecosystem.

The island is located between the Sundarban mangroves and the marine ecosystem in the Bay of Bengal encompassing a large number of both natural and man-made wetlands, which are regularly irrigated by tidal actions. Other than the vast sandy sea beach (Kiran beach, 21.57306 N, 88.29947 E) and mangrove thickets, the area is mostly dominated by fish ponds of fishery department and sparse rural

(<sup>1</sup>Research Scholars, <sup>1\*</sup>Assistant Professor, <sup>2</sup>Research Assistant)

habitats. The flora pattern of this area is mostly dominated by indigenous mangrove communities along with cultivated varieties of lower Bengal plants and trees in human settlement dominated areas (Paddy, seasonal vegetables, oil seeds, banana and coconut palms). Other than this, in plain land and in road side areas, one can observe abundant bushes of Vilayti babul (*Prosopis juliflora* (Sw.)), different wild types of jujubes (*Ziziphus oenopila* L., and *Z. mauritiana* Lam.), Subabul (*Leucaena leucocephala* Lam.), Indian Date palm (*Phoenix sylvestris* L.), Lantanas (*Lantana camara* L.). Grassy patches are also very common in areas between adjacent ponds.

Earlier avian diversity of Digha coast and East Midnapore located opposite westside to Indian Sundarbans was studied by Patra and Chakrabarti (2014). Habitat study and migratory status of numerous bird species and their associated foraging sites were also studied from South Bengal and associated coastal areas by Payra *et al.* (2017). But this present study was focused on the avian diversity with their general foraging guild during post-monsoon season from a shoreline ecotone of Indian Sundarban landscape which was not earlier studied in this island habitat.

## Materials and Methods

Henry's Island located in between the marine ecosystem of Bay of Bengal and the Sundarban mangrove (21.57677 N, 88.27630 E) has diverse floral compositions and many fish ponds (Fig. 1) and backwater zone of estuaries (Fig. 2) where different molluscs, crabs and other invertebrate species are the resources for birds' abundance. Hence all the vegetations, ponds, estuarine regions and shoreline were sites for bird sampling.



Fig. 1. Henry's Island aquaculture ponds



Fig. 2. Back-water areas with mangroves

The study was conducted during early winter months (October to December) of 2021. The observer groups selected morning slot (06.00 am to 10.00 am) and afternoon slot (4.00 pm to 6.00 pm) for bird watching because during this span, foraging activities of birds were relatively higher than the rest of the day.

The following sampling techniques were followed to study the bird diversity in the island.

- Ad-libitum sampling method was used to record the general activities of birds (Altmann, 1974) in different locations of the island.
- Point count method and line transect method were followed to record the presence of species as per Sutherland (2006) and Ghosh *et al.* (2022). Birds were observed directly by using field binoculars (Olympus 7x21 PS III, Nikon Aculon A211 12 X 50) and photographs were taken using (Nikon Coolpix S9900 Optic30X, Nikon Coolpix L320). Identification of the birds were done using standard pictorial field guide books on birds of the beach front, Ali (2002) and Grimmett *et al.* (2016). The observers selected seven vantage points after every 500 meters (approximately) like any standard point count method on field and gathered data for 5 minutes by scanning the 360° around the point with an approximate radius of 10 meters.

Study area map (Fig. 3) was created using QGIS (3.24.2 Tisler). Graphical presentations and basic computational studies were carried out by using MS-Excel 2007®. Relative diversity (RDi) of different avian families was calculated using the following formula (Torre-Cuadros *et al.*, 2007).

$$RDi = \frac{\text{Number of bird species in a family}}{\text{Total number of species}} \times 100$$

The IUCN conservation status of recorded birds was taken from the current digital checklist of IUCN (IUCN, 2019). General feeding preferences of the observed birds were verified using standard literature sources, after Ali (2002), Grimmett *et al.* (2016) and Zakaria *et al.* (2009).

## Results and Discussion

From the whole study 63 species of birds belonging to 31 families, and 13 orders were observed during the study period. Table 1 below showed the different orders of birds with respective species numbers- Passeriformes (22 species); followed by Charadriiformes (15), Pelecaniformes (6), Coraciiformes (5), Columbiformes (4), Suliformes; Piciformes and Accipitriformes (2 species each), Psittaciformes; Apodiformes; Ciconiiformes; Cuculiformes and Gruiformes (single species each). The result admits with the findings that the order Passeriformes is the most predominant avian taxa in India (Praveen *et al.*, 2016). A significant number of wader birds were recorded during the study in this ecotone zone which admits with the diversity seen under the family Scolopacidae (8 species) and

Ardeidae (6 species) in the studied area. Among all the birds observed during the study, Greater sand plover, Eurasian Curlew are categorized under Near Threatened (NT) and Great Knot is under Endangered (EN) category while the remaining species are categorized as least concerned (LC) species as per the Red List of IUCN (IUCN 2019).

Analysis of field data on relative diversity (RDi) showed that Scolopacidae was the most diverse avian family present in the study area (8 species, RDi = 12.698) followed by Ardeidae (6 species, RDi = 9.523) Alcedinidae; Columbidae (4 species, RDi = 6.349), Corvidae; Sturnidae; Charadriidae; Laridae (3 species, RDi = 4.761), Hirundinidae; Cisticolidae; Motacillidae; Musciapidae; Phalacrocoracidae; Accipitridae (2 species, RDi = 3.174), while the rest 17 families, i.e. Meropidae; Megalaimidae; Nectariniidae; Passeridae; Pycnonotidae; Dicruridae; Leiothrichidae; Laniidae; Oriolidae; Artamidae; Rallidae; Jacanidae; Ciconiidae; Cuculidae; Psittaculidae; Apodidae and Picidae were represented in the study area with a only single species in each (RDi = 1.587) as shown in Table 2, Fig 4.

In this study, the observed bird species were also

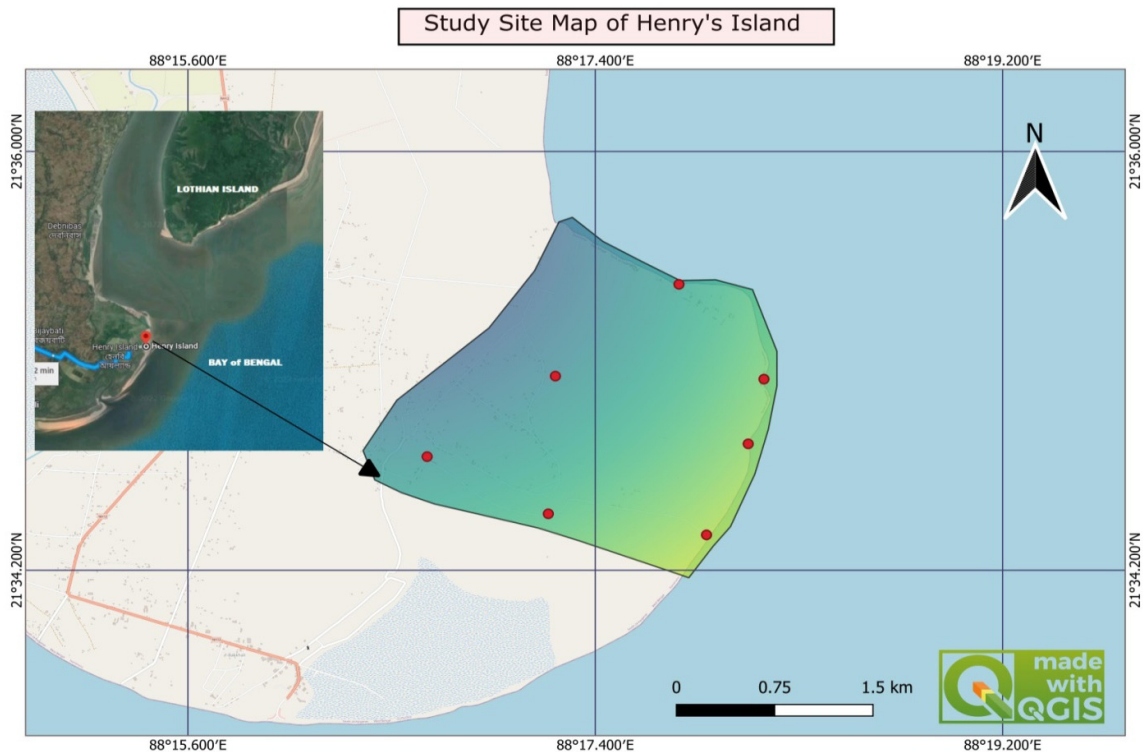


Fig. 3. Map of the study area (Henry's Island, South 24 Parganas, West Bengal with point count spots)

**Table 1.** Checklist of birds of the study area

Serial No.	Order	Family (with codes)	Common Names	Scientific Names	IUCN	WPA	Major FG
1	Pelecaniformes	Ardeidae (AR)	Cattle egret	<i>Bubulcus ibis</i> Linnaeus (1758)	LC	IV	P,C
2			Indian Pond heron	<i>Ardeola grayii</i> Sykes (1832)	LC	IV	P,C
3			Grey heron	<i>Ardea cinerea</i> Linnaeus (1758)	LC	IV	P,C
4			Little egret	<i>Egretta garzetta</i> (Linnaeus, 1766)	LC	IV	P,C
5			Striated heron	<i>Butorides striata</i> (Linnaeus, 1758)	LC	IV	P,C
6			Black Crowned Night Heron	<i>Nycticorax nycticorax</i> Linnaeus (1758)	LC	IV	P,C
7	Coraciiformes	Meropidae (ME) Alcedinidae (AL)	Asian Green bee eater	<i>Merops orientalis</i> Latham (1801)	LC	IV	I
8			Collard kingfisher	<i>Todiramphus chloris</i> Boddaert (1783)	LC	IV	P,I
9			White-throated kingfisher	<i>Halcyon smyrnensis</i> Linnaeus (1758)	LC	IV	P,I
10			Common kingfisher	<i>Alcedo atthis</i> Linnaeus (1758)	LC	IV	P,I
11			Pied kingfisher	<i>Ceryle rudis</i> Linnaeus (1758)	LC	IV	P,I
12	Passeriformes	Hirundinidae (HI)	Wire-tailed swallow	<i>Hirundos mithii</i> Leach (1818)	LC	IV	I
13			Barn swallow	<i>Hirundo rustica</i> Linnaeus (1758)	LC	IV	I
14		Nectariniidae (NE)	Purple sunbird	<i>Cinnyris asiaticus</i> Latham (1790)	LC	IV	N
15		Corvidae (CO)	Rufous Treepie	<i>Dendrocitta vagabunda</i> Latham (1790)	LC	IV	O
16			Jungle Crow	<i>Corvus macrorhynchos</i> Wagler (1827)	LC	IV	O
17			Indian House crow	<i>Corvus splendens</i> Vieillot (1817)	LC	V	O
18		Passeridae (PA)	House sparrow	<i>Passer domesticus</i> Linnaeus (1758)	LC	V	O
19		Cisticolidae (CS)	Common tailor bird	<i>Orthotomus sutorius</i> Pennant (1769)	LC	—	I
20			Jungle Prinia	<i>Prinia syloatica</i> Jerdon (1840)	LC	—	I
21		Pycnonotidae (PY)	Red-vented bulbul	<i>Pycnonotus cafer</i> Linnaeus (1766)	LC	IV	F,I
22		Sturnidae (ST)	Indian pied myna	<i>Gracupica contra</i> Linnaeus (1758)	LC	IV	O
23			Chestnut-tailed starling	<i>Sturnia malabarica</i> Gmelin (1789)	LC	IV	F,N,I
24			Common myna	<i>Acridotheres tristis</i> Linnaeus (1766)	LC	IV	O
25		Motacillidae (MO)	White wagtail	<i>Motacilla alba</i> Linnaeus (1758)	LC	—	I
26			Eastern yellow wagtail	<i>Motacilla tschutschensis</i> Gmelin (1789)	LC	IV	I
27		Dicruridae (DI)	Black drongo	<i>Dicrurus macrocercus</i> Vieillot (1817)	LC	IV	I
28	Muscicapidae (MU)	Verditer flycatcher	<i>Eumyias thalassinus</i> Swainson (1838)	LC	IV	I	
29		Oriental magpie robin	<i>Copsychus saularis</i> Linnaeus (1758)	LC	IV	I	
30	Leiotherichidae (LE)	Jungle babbler	<i>Argya striata</i> Dumont (1823)	LC	IV	I	
31	Laniidae (LN)	Brown shrike	<i>Lanius cristatus</i> Linnaeus (1758)	LC	IV	I,C	
32	Oriolidae (OR)	Black hooded oriole	<i>Oriolus xanthornus</i> Linnaeus (1758)	LC	—	F	
33	Artamidae (AT)	Ashy woodswallow	<i>Artamus fucus</i> Vieillot (1817)	LC	IV	N,I	
34	Columbiformes	Columbidae (CL)	Yellow footed green pigeon	<i>Treron phoenicopterus</i> Latham (1790)	LC	—	F
35			Eurasian collared dove	<i>Streptopelia decaocto</i> Frivaldszky (1838)	LC	—	O
36			Spotted dove	<i>Stigmatopelia chinensis</i> Scopoli (1786)	LC	—	O
37			Rock pigeon	<i>Columba livia</i> Gmelin (1789)	LC	IV	O
38	Gruidiformes	Rallidae (RA)	White-breasted water hen	<i>Amaurornis phoenicurus</i> Pennant (1769)	LC	IV	I,P
39	Charadriiformes	Charadriidae (CH)	Greater sand plover	<i>Charadrius leschenaultia</i> Lesson (1826)	NT	IV	I
40			Little ringed plover	<i>Charadrius dubius</i> Scopoli (1786)	LC	IV	I
41		Scolopacidae (SC)	Red-wattled lapwing	<i>Vanellus indicus</i> Boddaert (1783)	LC	IV	I
42			Great Knot	<i>Calidris tenuirostris</i> Horsfield (1821)	EN	IV	I
43			Common snipe	<i>Gallinago gallinago</i> Linnaeus (1758)	LC	IV	I
44			Sanderling	<i>Calidris alba</i> Pallas (1764)	LC	IV	I,C
45			Eurasian whimbrel	<i>Numenius phaeopus</i> Linnaeus (1758)	LC	IV	I,C
46			Eurasian Curlew	<i>Numenius arquata</i> Linnaeus (1758)	NT	IV	I,C
47	Terek sandpiper	<i>Xenus cinereus</i> Gldenstdt (1775)	LC	IV	I,C		



Table 1. Continued ...

Serial No.	Order	Family (with codes)	Common Names	Scientific Names	IUCN	WPA	Major FG
48		Laridae (LA)	Common sand piper	<i>Actitis hypoleucos</i> Linnaeus (1758)	LC	IV	I,C
49			Ruddy turnstone	<i>Arenaria interpres</i> Linnaeus(1758)	LC	IV	F,I
50			Black-headed gull	<i>Chroicocephalus ridibundus</i> Linnaeus (1766)	LC	—	O
51			Brown-headed gull	<i>Chroicocephalus brunnicephalus</i> Jerdon (1840)	LC	—	O
52			Common tern	<i>Sterna hirundo</i> Linnaeus (1758)	LC	—	P,I
53	Jacaniidae (JA)	Bronze-winged jacana	<i>Metopidius indicus</i> Latham(1790)	LC	IV	I	
54	Ciconii-formes	Ciconiidae (CI)	Asian openbill	<i>Anastomus oscitans</i> Boddaert (1783)	LC	IV	C
55	Suliformes	Phalacrocoracidae (PH)	Little cormorant	<i>Microcarbo niger</i> Reichenbach (1850)	LC	IV	P
56			Great Cormorant	<i>Phalacrocorax carbo</i> Linnaeus (1758)	LC	IV	P
57	Accipitri-formes	Accipitridae (AC)	White-bellied sea eagle	<i>Haliaeetus leucogaster</i> Gmelin (1788)	LC	I (part III)	C
58			Black Kite	<i>Milvus migrans</i> Boddaert (1783)	LC	—	C
59	Cuculi-formes	Cuculidae (CU)	Greater coucal	<i>Centropus sinensis</i> Stephens (1815)	LC	—	I,C
60	Psittaci-formes	Psittaculidae (PS)	Rose ringed parakeet	<i>Psittacula krameri</i> Scopoli (1769)	LC	—	G,F,I
61	Piciformes	Megalaimidae (MG)	Coppersmith Barbet	<i>Psilopogon haemacephala</i> Muller (1776)	LC	—	F,I
62		Picidae (PC)	Black-rumped Flameback	<i>Dinopium benghalense</i> Linnaeus (1758)	LC	—	F,I
63	Apodi-formes	Apodidae (AP)	Asian palm- swift	<i>Cypsiurus balasensis</i> (Gray, 1829)	LC	—	I

FG= Feeding Guild, I—Insectivore; C—Carnivore; O—Omnivore; P— Piscivore; F—Frugivore; G— Granivore; N—Nectarivore; IUCN—International Union for Conservation of Nature | LC—Least Concern; NT—Near Threatened; EN— Endangered | WPA—Wildlife (Protection) Act 1972, Govt. of India.

categorized into seven major feeding guilds (Fig. 5) with the help of several literary sources and *ad libitum* data by Zakaria *et al.* (2009) and Ghosh *et al.* (2021). Analysis of the feeding guilds of the 63 species also revealed that insectivores (33%) are leading in feeding guild chart, followed by omnivores (16%); carnivores (5%); piscivores (4%); frugivores (3%);

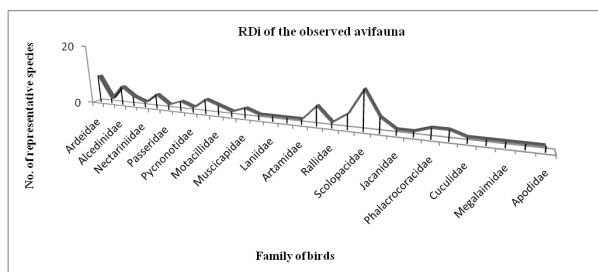


Fig. 4. Relative diversity index of different birds families

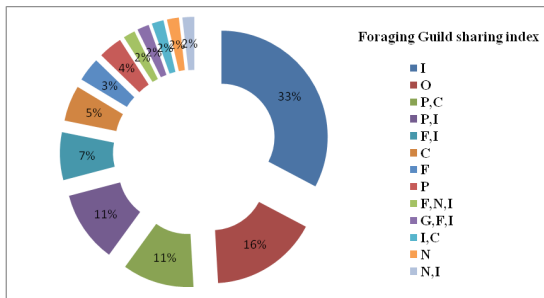
and nectarivores (2%). The combined share of foraging guilds was also studied as described in (Table 3) depicting piscivores –carnivores (P, C) is 11%; piscivores – insectivores (P, I) is 11%; frugivores- in-

Table 2. Relative Diversity indices (RDi) of the representative families of birds

Family codes	No. of Representative Species	RDi value
SC	8	12.698
AR	6	9.523
AL, CL	4	6.349
CO, ST, CH, LA	3	4.761
HI, CS, MO, MU PH, AC	2	3.174
ME, NE, PA, PY, DI, LE, LN, OR, AT, RA, JA, CI, CU, PS, MG, PC, AP	1	1.587

**Table 3.** Major foraging guilds of avian fauna of Henry’s Island

Major Foraging Guild	I	O	P,C	P,I	F,I	C	F	P	F,N,I	G,F,I	I,C	N	N,I
No. of Species	18	9	6	6	4	3	2	2	1	1	1	1	1
Guild sharing	33%	16%	11%	11%	7%	5%	3%	4%	2%	2%	2%	2%	2%

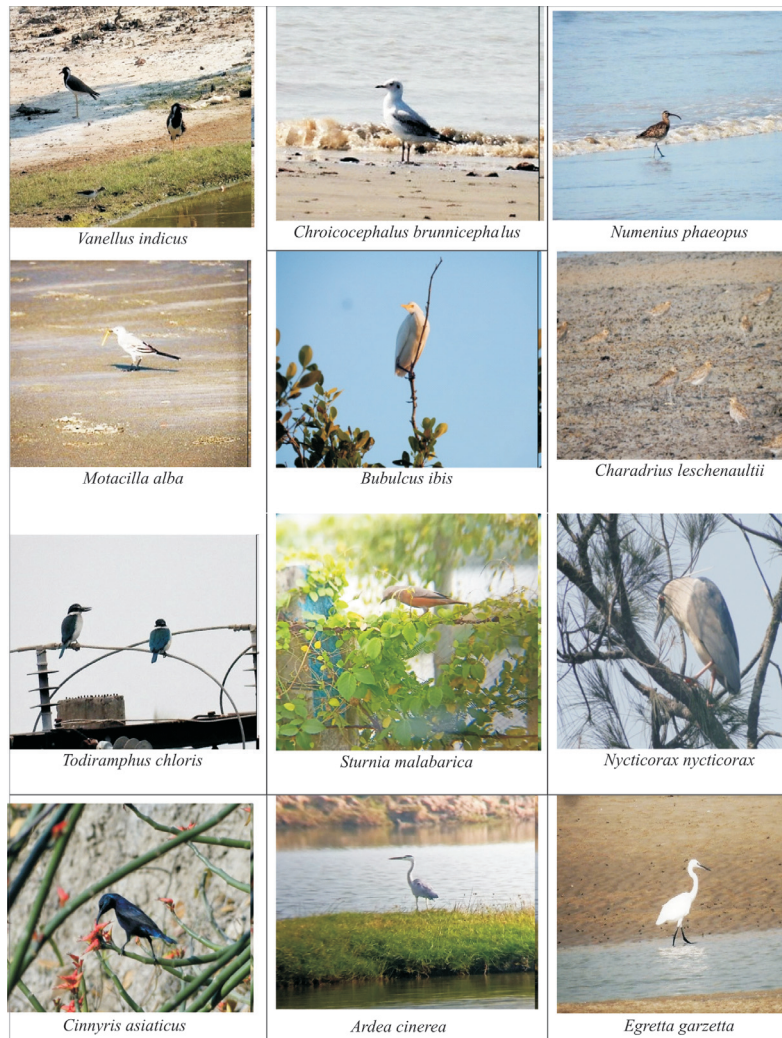


**Fig. 5.** Foraging guild sharing of the birds from Henry’s Island

sectivores (F,I) is 7%. The rest are frugivores – nectarivores- insectivores (F,N,I); granivores – frugivores- insectivores (G,F,I); insectivores- carnivores (I,C) and nectarivores- insectivores (N,I) guilds shared 2% with each other.

**Conclusion**

The above described work clearly showed that this wetland dominated ecotone area is a safe abode for a good number of bird species. Also frequent pres-



**Fig. 6.** Birds species observed in the Henry’s Island

ence of large waders like grey heron and open bill storks indicates that this area, despite being an aquaculture oriented landscape is a sanctuary for avian assemblages. Presence of several members of Ardeidae family (colonial breeder) and Red wattled lapwings (ground nest breeder) in this area during this early winter months showed that local migrant assemblage are also coexisting (Fig. 6). The presence of 15 birds species under order Charadriiformes are the major group of intertidal foragers that are associated with estuarine-coastal landscapes. In future more long term studies on island biogeography will surely deliver broader insight to know the avian assemblages in different islands of Sundarbans.

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### Conflict of Interest

The authors have no conflict of interest related to publication.

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