

Inventory of migratory waterbirds in the coastal areas of Purba Medinipur district, West Bengal, India

Inventario de las aves acuáticas migratorias de las zonas costeras del distrito de Purba Medinipur, Bengala Occidental, India

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ABSTRACT

The purpose of this study was to document the status and abundance of various migratory water birds in the coastal and surrounding areas of Purba Medinipur, West Bengal, India, from July 2020 to June 2022. A total number of 51 migratory water bird species belonging to seven orders and 10 families were recorded during this study. Among the records, 45 species were Least Concern (LC), four were Near Threatened (NT), one was Vulnerable (VU) and one Endangered (EN), according to the last IUCN Red List. The Scolopacidae family was found to be dominating with 16 species during the winter, a season when the winter bird migration reaches its maximum in this region of the world. The Shannon Evenness (J') score was 0.226, while the overall Shannon Diversity Index (H') was 0.892. The diversity index (D) for the Simpson's index was 0.286. The recorded total count of Lesser Whistling-duck *Dendrocygna javanica* (Horsfield, 1821) from the coastal wetlands and fishery ponds was all together 9015 in those two years which makes it the most dominant species among all. In the future, more focus will be put on Ghersai Waterbody, Shankarpur Seabeach, Tajpur Bheri, Kanaichatta Sea-beach and wetland, Hijli Sea-beach and Haldia Ranibandh area, as there are many places still not properly explored. Apart from these, there are several wetlands and sea beaches in the coastal area which need to be studied more thoroughly for a better understanding of the migratory avian diversity.

Keywords: Purba Medinipur; Coast; Water birds; Bird migration; Waders

RESUMEN

El propósito de este estudio fue documentar el estado y la abundancia de varias aves acuáticas migratorias en las áreas costeras y circundantes de Purba Medinipur, Bengala Occidental, India, desde julio de 2020 hasta junio de 2022. Un total de 51 especies de aves acuáticas migratorias pertenecientes a siete órdenes y 10 familias fueron registradas durante el estudio. Entre los registros, 45 especies eran de Preocupación Menor (LC), cuatro Casi Amenazadas (NT), una Vulnerable (VU) y una En Peligro (EN), según la última Lista Roja de UICN. La familia Scolopacidae resultó ser la dominante, con 16 especies durante el invierno, estación durante la cual la migración de las aves alcanza su máximo en esta región del mundo. El índice de uniformidad de Shannon (J') fue de 0,226, mientras que el índice de diversidad de Shannon (H') general fue de 0,892. El índice de diversidad (D) de Simpson fue de 0,286. Los registros totales de pato silbador menor, *Dendrocygna javanica* (Horsfield, 1821), en los humedales costeros y estanques de pesca ascendieron a 9015 ejemplares en esos dos años, lo que la convierte en la especie más dominante de todas. En el futuro, se prestará más atención a Ghersai Waterbody, Shankarpur Seabeach, Tajpur Bheri, playa costera y humedal de Kanaichatta, playa costera de Hijli Sea-beach y Haldia Ranibandh, ya que hay muchos lugares que aún no se han explorado adecuadamente. A parte de estos, hay varios humedales y playas costeras que necesitan ser estudiadas más a fondo para una mejor comprensión de su diversidad de aves migratorias.

Palabras clave: Purba Medinipur; Costa; Aves acuáticas; Migración de aves; Limícolas.

INTRODUCTION

Bird migration is the seasonal movement of many bird species (Ramachandra *et al.*, 2016). India falls into three flyway zones: Central Asian Flyway (CAF), East-Asian Australasian Flyway (EAAF) (covering parts of eastern India), and Asian East African Flyway (AEF) (covering parts of western India) (Vaithianathan, 2022). By these flyways they move hundreds and thousands of Kilometres to find the best ecological conditions and habitats for feeding, breeding and raising young (Newton 2010). Globally, birds are also one of the major ecological indicators and most studied taxonomic group. (Temple & Wiens, 1989; Canterbury *et al.*, 2000). Our state, West Bengal, is one of the richest in India in terms of bird diversity. Many specialized habitats of the state, like the Neora Valley National Park, Singalila National Park, Buxa Tiger Reserve, and Sundarban Biosphere Reserve (ENVIS) host the maximum avian diversity. But areas like Purba Medinipur, Purulia, and other districts also play a very important role for the same.

Prior to this study, Patra and Chakrabarti (2014) reported 86 bird species belonging to 10 orders and 35 families from the Digha region. Payra *et al.*, (2017) listed a total of 171 species of birds

representing 18 orders and 54 families from the six coastal sites of the district. Further Payra (2020) compiled all the birds and recorded 225 species under 17 orders and 61 families. But this study was based on all bird species, including terrestrial and aquatic birds, but in the present study, our primary objective was to document the migratory water birds and their habitat use in the coastal and adjoining areas of Purba Medinipur district.

METHODOLOGY

Study area

In the coastal belt of West Bengal there are two districts, namely South 24 Parganas and Purba Medinipur. The total coastline is about 160 km long. Purba Medinipur geographically has significant coastal belts and various inland water bodies (Payra *et al.*, 2017; Payra 2020). The Purba Medinipur coastal zone is sandy rather than muddy in nature with a low density of mangrove vegetation. The study was done in seven sites of both static waterbodies and tidal influence areas (Table 1 and Figure 1) of Purba Medinipur district in West Bengal, where lots of migratory water birds gather.

Table 1: Name, location, and habitats of the study sites for water birds in the district of Purba Medinipur, West Bengal, India.

Study Site	Geographic coordinates	Habitats
Ghersai Waterbody	21°38'14"N 87°31'55.6"E	It is mainly a big lake beside the road with no aquatic vegetation. There is a long earthen embankment. Scattered big and medium size trees are also present around the lake which is the roosting site of different bird species.
Shankarpur Seabeach	21°38'08.50"N 87°34'36.36"E	It is also a tourist spot. Regular activity of boating for fishing here. Tourists can't get off that much. Fishes are dried on the bank of beaches.
Tajpur Bheri	21°40'38"N 87°36'11"E	Long stretches of fisheries pond and on the earthen embankment in the middle of those, present at one side of the motorable road. Some of these water bodies are covered with big trees. On the opposite side of the road, there is an irrigation canal.

Study Site	Geographic coordinates	Habitats
Kanaichatta Sea-beach	21°45'47.43"N 87°52'28.41"E	It is also a long stretch of the sea beach. Regular activity of boating for fishing, but not a popular tourist spot.
Kanaichatta Wetland	21°46'26"N 87°52'28"E	This wetland is present beside the village and close to the seashore. There are a few small waterbodies that were mainly covered by reed beds of Hoghla (<i>Typha</i> sp.) and aquatic vegetation. Villagers are engaged in unorganised fishing activities on a regular basis in this area.
Hijli Sea-beach	21°47'47.9"N 87°53'54.9"E	A long stretch of the sea beach. One of the popular tourist spots in Purba Medinipur. The water line shifts considerably during low tide. At that time many wader birds are observed foraging on the exposed muddy beach. Regular activity related to fishing and crab collection is evident in this area.
Haldia Ranibandh and the surrounding area	22°02'58"N 88°04'55"E	Open waterbody and a medium size wetland covered by aquatic vegetation present just beside the industrial belt.

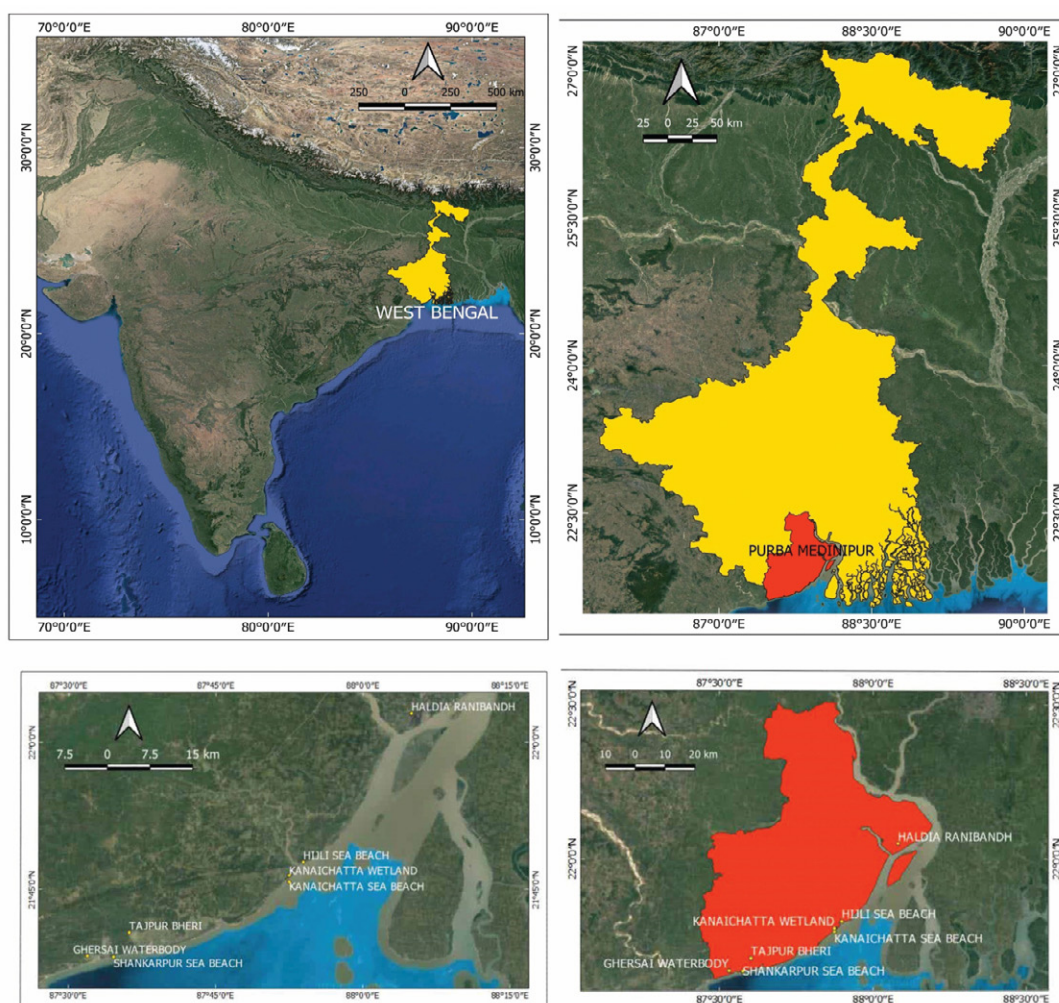


Figure1: Map of the study area consisting of seven sites in the Purba Medinipur district, West Bengal, India.

Survey details

The survey was done from July 2020 to June 2022. The average annual temperature during the daytime was about 36°C. Annual rainfall varies from 1400 to 1700 mm (Payra, 2020). During the survey time, the overall weather was clear and sunny except for the morning fog on some days in the winter season. The study has been done using two census methods. One was the Line Transect method (Emlen, 1971; Anderson *et al.*, 1979; Buckland & Turnock, 1992) and the other was the Point count method (Hutto *et al.*, 1986; Alldredge *et al.*, 2007). The point count method was applied for the static water bodies and the line transect method was applied for the tidal influence areas. All transects were about 700 m long. For the line transect method at tidal influence areas, the survey time was selected during the mid-period of high to low tide because the accessibility and visibility of the coastal birds were comparatively high. Also, birds forage mostly during that period in the exposed intertidal zone. The checklist of species was prepared following Grimmett & Inskipp (1998, 2011) and Pandit & Basu Roy (2019). The equipment that was used for the study was a GPS Device (Garmin eTrex 10) for location mapping. Spotting scope (Vanguard Endeavour XS 80A, 20-60x) with a stand was used to count birds in case of significantly big-size water-bodies. Photographs were taken using the Cameras Nikon D750 with 200-500, Nikon P600, P900. Binoculars (Olympus 8x40, Nikon 7x35, 10x50) were used for close observation of long-distance objects. With the help of these devices, a checklist of migratory water birds with their preferable habitat and activity was also prepared. Additionally, the conservation status of each species was included in the checklist according to the IUCN Red List (2023).

Statistical analysis

Shannon index was used to measure the diversity when species are counted independently in an area (Shannon and Weaver, 1949; Hill, 1973; Bibi & Ali, 2013).

$$\text{Shannon Index } (H') = -\sum P_i \ln P_i$$

Where P_i is the proportion of each species and $\ln P_i$ is the natural logarithm of P_i .

Shannon evenness index quantifies how the species are equally distributed in the habitat.

$$\text{Shannon Evenness index } (J') = H' / \ln(S)$$

Where S is the total number of species. Ranges of Evenness index is 0-1.

Simpson's Diversity index is a measure of diversity that considers the number of species present, as well as the relative abundance of each species (Simpson, 1949).

$$\text{Simpson's Diversity Index } (D) = 1 - \sum (n_i * (n_i - 1)) / (N * (N - 1))$$

Where n_i is the number of individuals for each species and N is the total number of all individuals.

RESULTS

A total of 51 migratory water birds belonging to seven orders and 10 families were recorded from the seven sites of the coastal zone of Purba Medinipur district (Table 2). Among them the order Charadriiformes, with 30 species, was dominant (Figure 2). Scolopacidae was represented as a dominant family with 16 species which are the migratory waders. Besides, we observed that the Lesser Whistling-duck, *Dendrocygna javanica*, was the dominant species amongst all, with a total number of 9015 in those two years. Among the observed birds 45 species were Least Concern (LC), four were Near Threatened (NT), one was Vulnerable (VU) and one was Endangered (EN) (Figure 3). The Near Threatened (NT) species were the Ferruginous Duck *Aythya nyroca*, the Black-headed Ibis *Threskiornis melanocephalus*, the Eurasian Curlew *Numenius arquata*, and the Curlew Sandpiper *Calidris ferruginea*. The Vulnerable (VU) bird was the Black-capped Kingfisher *Halcyon pileata* and the Endangered (EN) species was the Great Knot *Calidris tenuirostris*. The migration status of the recorded birds shows that 76% were Trans-boundary Migrants (TM) (birds that are not residents of the area but are occasionally sighted during the winter season) and 24 % were Local Migrants (LM) (birds that breed in one region during one season and migrate to other regions within the states or country during a different season) (Figure 4). The type of habitat and activity during the survey are shown below (Table 2). During the winter season, the species richness value was highest for these migratory wader birds.

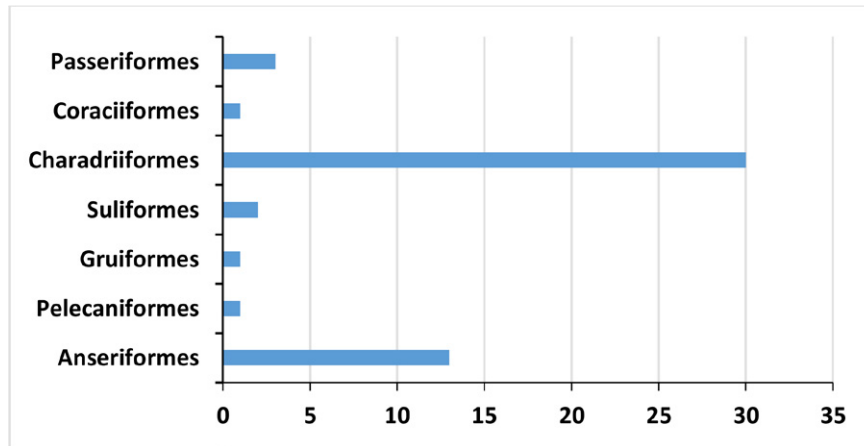


Figure 2: Order-wise abundance of the aquatic avifauna recorded during the study in the coastal area of Purba Medinipur, West Bengal, India.

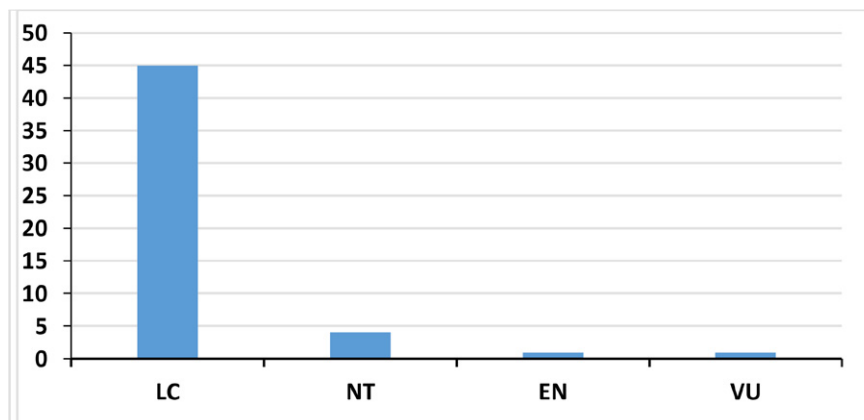


Figure 3: Details of water bird species from coastal areas of Purba Medinipur, West Bengal (India) as per IUCN Red List.

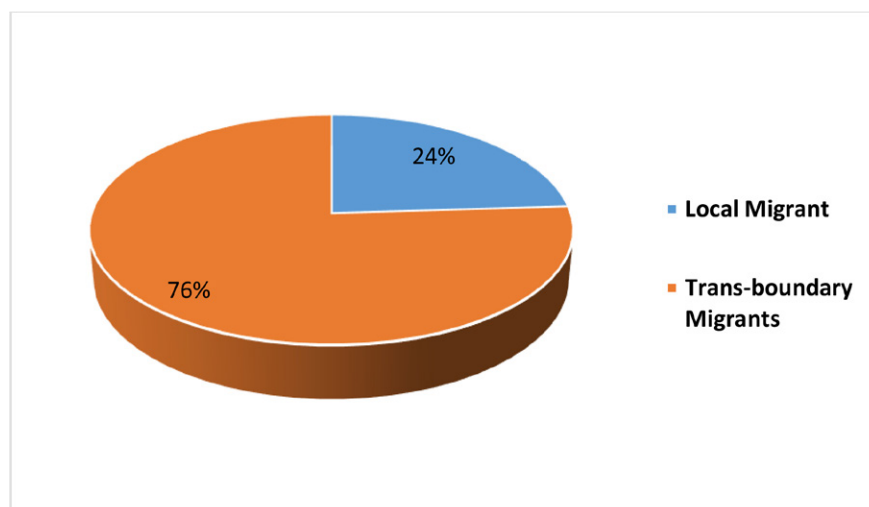


Figure 4: Ratio of Local Migrant and Trans-boundary Migrants for the water birds recorded in the coastal area of the Purba Medinipur, West Bengal, India.

The overall Shannon Diversity Index (H') was 0.892 and the Shannon Evenness (J') value was 0.226. The Simpson's Diversity Index (D) was 0.286. All these index values were decreasing due to domi-

nating species of Lesser Whistling-duck *Dendrocygna javanica* that groups in the coastal wetlands and fisheries pond.

Table 2: Checklist of migratory water birds in the coastal zone of Purba Medinipur, West Bengal, India. Legend: LC, Least Concern; NT, Near Threatened; VU, Vulnerable (IUCN Red List); LM, Local Migrant; TM, Trans-boundary, Migrant (Migration Status).

Serial Number	Common Name	Scientific name	IUCN Status	Migration Status	Habitat	Activities
Family: Anatidae						
1	Lesser Whistling-duck	<i>Dendrocygna javanica</i> (Horsfield, 1821)	LC	LM	Open waterbody	Day roosting
2	Fulvous Whistling-duck	<i>Dendrocygna bicolor</i> (Vieillot, 1816)	LC	LM	Open waterbody	Day roosting
3	Common Shelduck	<i>Tadorna tadorna</i> (Linnaeus, 1758)	LC	TM	Sea Beach	Sitting at the sea bed at the time of high tide
4	Cotton Pygmy Goose	<i>Nettapus coromandelianus</i> (Gmelin, 1789)	LC	LM	Open waterbody	Day roosting
5	Gadwall	<i>Mareca strepera</i> (Linnaeus, 1758)	LC	TM	Open waterbody	Day roosting
6	Common Teal	<i>Anas crecca</i> (Linnaeus, 1758)	LC	TM	Open waterbody	Day roosting
7	Northern Pintail	<i>Anas acuta</i> (Linnaeus, 1758)	LC	TM	Open waterbody	Day roosting
8	Eurasian Wigeon	<i>Mareca penelope</i> (Linnaeus, 1758)	LC	TM	Open waterbody	Day roosting
9	Garganey	<i>Spatula querquedula</i> (Linnaeus, 1758)	LC	TM	Open waterbody	Day roosting
10	Red-crested Pochard	<i>Netta rufina</i> (Pallas, 1773)	LC	TM	Open waterbody	Day roosting

Serial Number	Common Name	Scientific name	IUCN Status	Migration Status	Habitat	Activities
11	Ferruginous Duck	<i>Aythya nyroca</i> (Güldenstädt, 1770)	NT	TM	Open waterbody, Sea Beach	Foraging
12	Bar-headed Goose	<i>Anser indicus</i> (Latham, 1790)	LC	TM	Sea Beach	Sitting at the sea bed at the time of high tide
13	Knob-billed Duck	<i>Sarkidiornis melanotos</i> (Pennant, 1769)	LC	LM	Open waterbody	Day roosting
Order: Pelecaniformes						
Famiy: Threskiornithidae						
14	Black-headed Ibis	<i>Threskiornis melanocephalus</i> (Latham, 1790)	NT	LM	Tree beside the waterbodies	Day roosting
Order: Gruiformes:						
Family: Rallidae						
15	Eurasian Coot	<i>Fulica atra</i> (Linnaeus, 1758)	LC	TM	Open waterbody	Foraging
Order: Suliformes						
Family: Phalacrocoracidae						
16	Great Cormorant	<i>Phalacrocorax carbo</i> (Linnaeus, 1758)	LC	TM	Tree beside the waterbodies	Sitting
17	Indian Cormorant	<i>Phalacrocorax fuscicollis</i> (Stephens, 1826)	LC	LM	Tree beside the waterbodies	Sitting
Order: Charadriiformes						
Family: Charadriidae						
18	Yellow-wattled Lapwing	<i>Vanellus malabaricus</i> (Boddaert, 1783)	LC	LM	Wetland	Foraging
19	Grey-headed Lapwing	<i>Vanellus cinereus</i> (Blyth, 1842)	LC	LM	Wetland	Foraging
20	Grey Plover	<i>Pluvialis squatarola</i> (Linnaeus, 1758)	LC	TM	Sea Beach	Foraging
21	Pacific golden Plover	<i>Pluvialis fulva</i> (Gmelin, 1789)	LC	TM	Sea Beach, Edge of the waterbodies	Foraging
22	Kentish Plover	<i>Charadrius alexandrinus</i> Linnaeus, 1758	LC	TM	Sea Beach, Edge of the waterbodies	Foraging
23	Little ringed Plover	<i>Charadrius dubius</i> Scopoli, 1786	LC	TM	Sea Beach, Edge of the waterbodies	Foraging

Serial Number	Common Name	Scientific name	IUCN Status	Migration Status	Habitat	Activities
24	Lesser sand Plover	<i>Charadrius mongolus</i> Pallas, 1776	LC	TM	Sea Beach, Edge of the waterbodies	Foraging
25	Greater sand Plover	<i>Charadrius eschenaultii</i> Lesson, 1826	LC	TM	Sea Beach	Foraging
Family: Recurvirostridae						
26	Black-winged Stilt	<i>Himantopus himantopus</i> (Linnaeus, 1758)	LC	LM	Edge of the waterbodies, Sea Beach	Foraging
27	Pied Avocet	<i>Recurvirostra avosetta</i> Linnaeus, 1758	LC	LM	Edge of the waterbodies, Sea Beach	Foraging
Family: Scolopacidae						
28	Whimbrel	<i>Numenius phaeopus</i> (Linnaeus, 1758)	LC	TM	Sea Beach	Foraging
29	Eurasian Curlew	<i>Numenius arquata</i> (Linnaeus, 1758)	NT	TM	Sea Beach	Foraging
30	Common Redshank	<i>Tringa totanus</i> (Linnaeus, 1758)	LC	TM	Sea Beach	Foraging
31	Common Greenshank	<i>Tringa nebularia</i> (Gunnerus, 1767)	LC	TM	Sea Beach	Foraging
32	Green Sandpiper	<i>Tringa ochropus</i> Linnaeus, 1758	LC	TM	Edge of the waterbodies, Sea Beach	Foraging
33	Terek Sandpiper	<i>Xenus cinereus</i> (Güldenstädt, 1775)	LC	TM	Sea Beach	Foraging
34	Wood Sandpiper	<i>Tringa glareola</i> Linnaeus, 1758	LC	TM	Edge of the waterbodies, Sea Beach	Foraging
35	Curlew Sandpiper	<i>Calidris ferruginea</i> (Pontoppidan, 1763)	NT	TM	Sea Beach	Foraging
36	Common Sandpiper	<i>Actitis hypoleucos</i> Linnaeus, 1758	LC	TM	Edge of the waterbodies, Sea Beach	Foraging
37	Marsh Sandpiper	<i>Tringa stagnatilis</i> (Bechstein, 1803)	LC	TM	Edge of the waterbodies	Foraging
38	Broad-billed Sandpiper	<i>Limicola falcinellus</i> (Pontoppidan, 1763)	LC	TM	Sea Beach	Foraging

Serial Number	Common Name	Scientific name	IUCN Status	Migration Status	Habitat	Activities
39	Ruddy Turnstone	<i>Arenaria interpres</i> (Linnaeus, 1758)	LC	TM	Sea Beach	Foraging
40	Great Knot	<i>Calidris tenuirostris</i> (Horsfield, 1821)	EN	TM	Sea Beach	Foraging
41	Sanderling	<i>Calidris alba</i> (Pallas, 1764)	LC	TM	Sea Beach	Foraging
42	Temminck's stint	<i>Calidris temminckii</i> (Leisler, 1812)	LC	TM	Edge of the waterbodies, Sea Beach	Foraging
43	Little Stint	<i>Calidris minuta</i> (Leisler, 1812)	LC	TM	Edge of the waterbodies, Sea Beach	Foraging
Family: Laridae						
44	Brown-headed Gull	<i>Larus brunnicephalus</i> Jerdon, 1840	LC	TM	Sea Beach	Foraging
45	Black-headed Gull	<i>Larus ridibundus</i> Linnaeus, 1766	LC	TM	Sea Beach	Foraging
46	Pallas's Gull	<i>Larus ichthyaetus</i> Pallas, 1773	LC	TM	Sea Beach	Foraging
47	Common Tern	<i>Sterna hirundo</i> Linnaeus, 1758	LC	TM	Sea Beach	Foraging
Order: Coraciiformes						
Family: Alcedinidae						
48	Black-capped Kingfisher	<i>Halcyon pileata</i> (Boddaert, 1783)	VU	TM	Sea Beach	Foraging
Order: Passeriformes						
Family: Motacillidae						
49	Citrine Wagtail	<i>Motacilla citreola</i> Pallas, 1776	LC	TM	Edge of the waterbodies, Sea Beach	Foraging
50	Western Yellow Wagtail	<i>Motacilla flava</i> Linnaeus, 1758	LC	TM	Edge of the waterbodies, Sea Beach	Foraging
51	White Wagtail	<i>Motacilla alba</i> Linnaeus, 1758	LC	TM	Edge of the waterbodies, Sea Beach	Foraging



Figure 5: Some photographs of recorded migratory bird species in Purba Medinipur coastal zone, India. 1. *Netta-pus coromandelianus* (Gmelin, 1789). 2. *Numenius arquata* (Linnaeus, 1758) 3. *Pluvialis fulva* (Gmelin, 1789). 4. *Xenus cinereus* (Güldenstädt, 1775). 5. *Tringa stagnatilis* (Bechstein, 1803). 6. *Arenaria interpres* (Linnaeus, 1758). 7. *Halcyon pileata* (Boddaert, 1783). 8. *Himantopus himantopus* (Linnaeus, 1758). 9. *Mareca strepera* (Linnaeus, 1758) (Photos: Arjan Basu Roy).



Figure 6: Some photographs of recorded migratory bird species in Purba Medinipur coastal zone, India. 1. *Aythya nyroca* (Güldenstädt, 1770). 2. *Charadrius mongolus* (Pallas, 1776). 3. *Dendrocygna javanica* (Horsfield, 1821). 4. *Motacilla citreola* (Pallas, 1776). 5. *Vanellus cinereus* (Blyth, 1842). 6. *Tringa nebularia* (Gunnerus, 1767). 7. *Tringa glaréola* (Linnaeus, 1758). 8. *Recurvirostra avosetta* (Linnaeus, 1758). 9. *Charadrius dubius* (Scopoli, 1786) (Photos: Arjan Basu Roy).

DISCUSSION

The result of our study shows that the study area harbours a good number of aquatic migratory birds which reflects the habitat availability and diversity. The presence of Near Threatened (NT), Vulnerable (VU), and Endangered (EN) species ensures the importance of these habitats. Payra (2020) updated a list of 225 species of birds in this coastal site prior to our study, however our analysis included 11 species that were not mentioned in his literature. These 11 species included the Fulvous Whistling-duck *Decrocygna bicolor* and the Knob-billed Duck *Sarkidiornis melanotos*, seen at Ghersai waterbody; the Northern Pintail *Anas acuta*, the Eurasian Wigeon *Mareca Penelope*, and the Garganey *Spatula querquedula*. at Tajpur Bheri; the Ferruginous Duck *Aythya nyroca*, saw at Ghersai waterbody, Kanaichatta Wetland, and Haldia; the Bar-headed Goose *Anser indicus*, the Common Shelduck *Tadorna tadorna*, the Broad-billed Sandpiper *Limicola falcinellus*, the Ruddy Turnstone *Arenaria interpres*, and the Great Knot *Calidris tenuirostris*, seen in Hijli sea beach.

The coastal region is being impacted by growing urbanization and climate change. Also, there was noticeable plastic pollution in the area, and it was also noted that some birds were accidentally trapped in a fishing net. It is essential to increase locals' understanding of environmental preservation in order to protect this rich biodiversity. This study found that many previously unknown locations have good wetland habitats that are home to a variety of noteworthy species. This muddy coastal habitat of the neighbouring district is also playing an important role as a destination for migratory avifauna, both local and transboundary, due to its proximity to the Sundarbans, the protected biosphere reserve and the largest coastal wetland in the world with over 300 bird species (Gopal & Chauhan, 2006). We acquired a sizable amount of data from this study that will help in future research. We anticipate finding many more unusual species and undiscovered terrain in the future by closely monitoring this region.

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