IMPLEMENTING THE CENTRAL ASIAN FLYWAY NATIONAL ACTION PLAN WITH SPECIAL FOCUS ON PREPARATION OF SITE-SPECIFIC ACTIVITY PLAN, CAPACITY BUILDING, DEVELOPING BIRD SENSITIVITY MAP FOR SETTING UP OF WIND ENERGY AND SPECIES ACTION PLANS

Progress Report

April–June 2021

Programme supported by

Ministry of Environment, Forest & Climate Change

National Authority,
Compensatory Afforestation Fund Management and Planning Authority (CAMPA),
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Report submitted by

Bombay Natural History Society
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Progress report

April to June, 2021

1 BACKGROUND

A total of 48 wetlands and 31 landbird areas across different landscapes of India have been prioritized in the India's National Action Plan for Conservation of Migratory birds and their Habitats along Central Asian Flyway (2018–2023) as important sites for the survival of migratory waterbirds and landbirds. The Ministry of Environment, Forest and Climate Change (MoEF&CC), New Delhi, has granted a project 'Implementing the Central Asian Flyway National Action Plan with special focus on preparation of site-specific activity plan, capacity building, developing bird sensitivity map for setting up of the wind energy and species action plans' to Bombay Natural History Society (BNHS). The objectives/components of the project are:

1) Developing site-specific actions and objectives related to the conservation of migratory bird species and their habitats in protected area plans (both management and working plans) and details of action to be taken for the non-protected areas.
2) Imparting training to forest staff and other stakeholders in various aspects of migratory bird conservation
3) Preparing bird sensitivity maps for setting up of the windfarms and energy sectors in India
4) Preparing a Single Species Action Plan for the 20 species prioritized in the National Action Plan.

This project covers all 48 wetlands and 31 landbird sites across 17 states in the country. The project was initiated in February 2020. So far, five progress reports have been submitted. This is the sixth progress report which covers the period from April to June, 2021.

2 SITE SPECIFIC RECOMMENDATIONS

2.1 Field Surveys

During this reporting period as second wave of Covid-19 was on peak, field surveys were restricted to the sites based on the guidelines given by the state governments. Field surveys were conducted in D'Ering Memorial Wildlife Sanctuary, Arunachal Pradesh. The field survey report is summarised in this report, the data gathered will be used in preparing site-specific recommendations for the conservation of the prioritised sites as given in component 1 of the project. In addition to this, survey report of Nalsarovar and Bhitarkanika conducted in February 2021 is also summarised here.

2.1.1 D'Ering Memorial Wildlife Sanctuary, Arunachal Pradesh

2.1.1.1 Study Area

Daying Ering Memorial Wildlife Sanctuary also popularly known as D'Ering Wildlife Sanctuary is located between 95° 22′–95° 29′ E and 27° 51′–28° 5′ N in the East Siang district of Arunachal Pradesh in India. D'Ering Wildlife Sanctuary (WLS) lies on the border of Assam and Arunachal Pradesh in the flood plain between the Rivers Siang and Sibia covering an area of 190 sq. km. The Sanctuary has three ranges-Borguli, Sibiamukh, and Anchalghat. The altitude ranges from 100–150 m above msl. A tropical type of climate prevails in the region with hot and humid summers and cold winters. About 80% area of the Sanctuary is covered with grassland and rest are semi-evergreen forests and wetlands. The grasslands of the Sanctuary can be divided into two broad categories - Dry Alluvial Grasslands and Tall Wet Grasslands. *Imperata cylindrica,* and *Saccharum spontaneum* are the dominant grasses in dry areas while *Phragmites karka, Arundo donax,* and *Saccharum narenga* in wet areas.

Ziziphus mauritiana, Bombax ceiba, Ficus sp, and *Gmelina arborea* are the major trees characterising the semi-evergreen woodland (Chakraborty *et al*. 2014). Large grassland patches were invaded by some invasive alien plants, like *Chromolaena odorata, Leea acuminata*, and *Lantana camara*. The grassland habitat in the Sanctuary supports elephants, buffaloes, and hog deer. Furthermore, the river provides a good habitat for many resident and migratory bird and fish species. The Sanctuary is known for one of the best habitats for critically endangered Bengal Florican *Houbaropsis bengalensis* and many other globally threatened species of birds.

2.1.1.2 Methodology

We carried out bird survey in D'Ering WLS following transect and point count methods during April 10–19, 2021. The survey was carried out in grassland habitats throughout the Sanctuary. We surveyed eight transects and 13-point counts which were randomly selected. Transects of varying lengths and widths were laid on existing grassland trails. The width of transects were different based on the visibility of the grassland patch. Transects were laid on homogeneous habitat. Transects were placed well apart from each other to avoid double count of birds. Point Counts with no fixed radius were also carried out in grasslands. Individual(s) of bird species seen during the transect or point count survey were recorded with ocular distance from the observer, sighting angle and vertical height if the individual(s) was/were not flying. We also recoded the activity of the bird when first sighted. Opportunistic sightings were recorded for preparing of checklist.

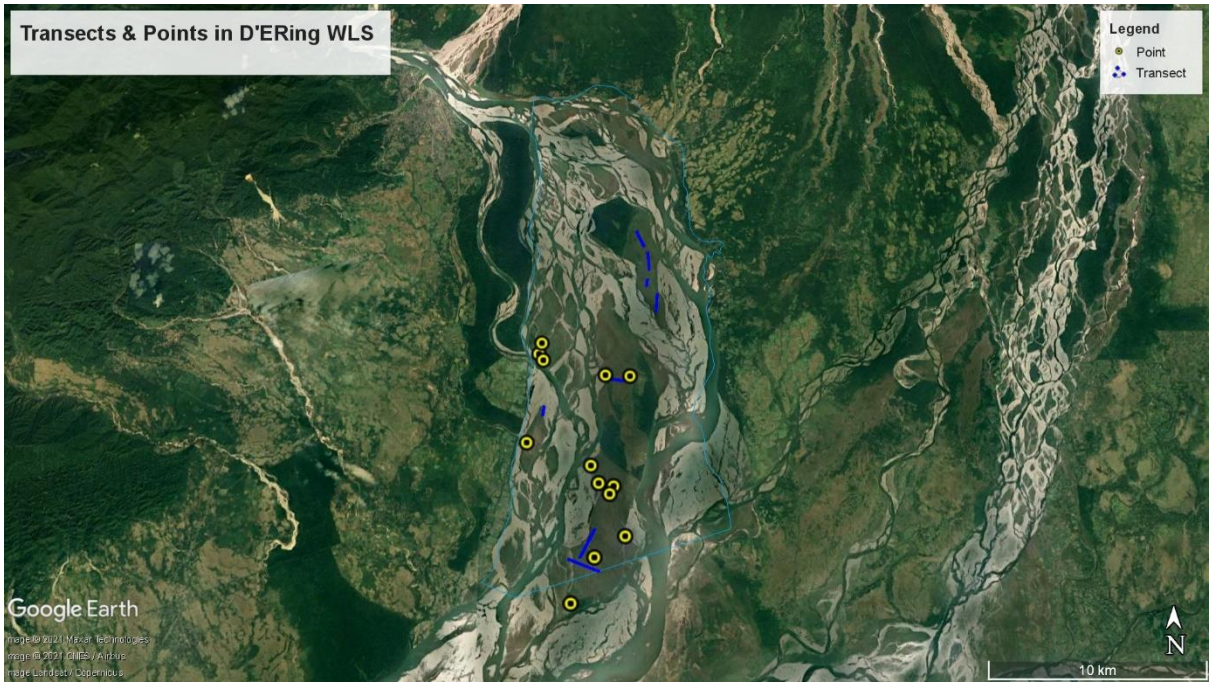

Figure 1: Transects and point count locations in D'Ering Memorial Wildlife Sanctuary, Arunachal Pradesh

2.1.1.3 Results

A total of **66** bird species has been recorded from D'Ering WLS during April 10–19, 2021. Of these **66 species**, **60 species** were recorded **from Transect and point count survey**, and others

were recorded from opportunistic sightings. We recorded 26 species of birds in transect survey and 46 species in Point counts with some speceis recorded in both surveys.

The bird diversity was high in both transect (H′= 2.55) and point count (H′ = 3.16) surveys. During our short survey, we recorded four globally threatened birds namely, Bengal Florican *Houbaropsis bengalensis*, Slender-billed Vulture *Gyps tenuirostris*, Swamp Francolin *Francolinus gularis*, Jerdon's Babbler *Chrysomma altirostre*, and one Near-Threatened species Cinereous Vulture *Aegypius monachus*.

Citrine Wagtail *Motacilla citreola* and Large-billed Crow *Corvus macrorhynchos* were the most abundant; Black Drongo *Dicrurus macrocercus* and Paddyfield Pipit *Anthus rufulus* were most common birds recorded in Point counts (Table 2). In Transect survey, Black Kite *Milvus migrans* and Baya Weaver *Ploceus philippinus* were most abundant, and Golden-headed Cisticola *Cisticola exilis* and Red Junglefowl *Gallus gallus* were most common (Table 3).

Grasslands surveyed were mostly dominated by *Imperata cylindrica* and *Saccharum spontaneum* grasses with scattered *Ziziphus* sp. and *Bombax ceiba* trees. In some grassland patches, *Leea* sp., *Chromolaena odorata*, and *Lantana camara* were highly spread.

Table 1: Bird diversity indices recorded in transect and point count survey

Diversity Indices	**Transect**	**Point**
No. of Species	**26**	**46**
Individuals	166	300
Shannon-Wiener Index (H′)	2.55	3.16
Margalef's Richness Index	4.89	7.89
Equitability (J)	0.78	0.82

Table 2: Relative abundance (%) & Frequency (%) of birds recorded from Grasslands of D'Ering WLS by Transect method

Sl. No.	**Common Bird Name**	**Species**	**No. of Individuals**	**Relative Abundance (%)**	**Frequency (%)**
1	Ashy Prinia	*Prinia socialis*	1	0.6	12.5
2	Asian Green Bee-eater	*Merops orientalis*	1	0.6	12.5

Sl. No.	Common Bird Name	Species	No. of Individuals	Relative Abundance (%)	Frequency (%)
3	Barred Buttonquail	*Turnix suscitator*	2	1.2	12.5
4	Bengal Florican	*Houbaropsis bengalensis*	6	3.6	37.5
5	Black Drongo	*Dicrurus macrocercus*	13	7.8	62.5
6	Cattle Egret	*Bubulcus ibis*	2	1.2	12.5
7	Cinereous Vulture	*Aegypius monachus*	1	0.6	12.5
8	Citrine Wagtail	*Motacilla citreola*	50	30.1	12.5
9	Common Stonechat	*Saxicola torquatus*	5	3	25
10	Common Tailorbird	*Orthotomus sutorius*	2	1.2	12.5
11	Eurasian Collared-dove	*Streptopelia decaocto*	2	1.2	12.5
12	Greater Flameback	*Chrysocolaptes guttacristatus*	1	0.6	12.5
13	Large-billed Crow	*Corvus macrorhynchos*	19	11.4	75
14	Lesser Coucal	*Centropus bengalensis*	6	3.6	37.5
15	Lineated Barbet	*Psilopogon lineatus*	2	1.2	25
16	Paddyfield Pipit	*Anthus rufulus*	10	6	62.5
17	Pied Harrier	*Circus melanoleucos*	1	0.6	12.5
18	Red Junglefowl	*Gallus gallus*	4	2.4	25
19	Red-vented Bulbul	*Pycnonotus cafer*	3	1.8	12.5
20	Red-wattled Lapwing	*Vanellus indicus*	2	1.2	12.5
21	Rufous Treepie	*Dendrocitta vagabunda*	2	1.2	12.5
22	Rufous-necked Laughingthrush	*Garrulax ruficollis*	4	2.4	12.5
24	Shikra	*Accipiter badius*	1	0.6	12.5
25	Striated Babbler	*Turdoides earlei*	16	9.6	37.5
26	Tickell's Leaf Warbler	*Phylloscopus affinis*	1	0.6	12.5
27	Zitting Cisticola	*Cisticola juncidis*	9	5.4	37.5

Table 3. Relative abundance (%) & Frequency (%) of birds recorded from Grasslands of D'Ering WLS by Point Count method

Sl. No.	Common Bird Name	Scientific Name	No. of Individuals	Relative Abundance (%)	Frequency (%)
1	Asian Green Bee-eater	*Merops orientalis*	5	1.7	23.1
2	Asian Pied Starling	*Sturnus contra*	18	6	7.7
3	Baya Weaver	*Ploceus philippinus*	25	8.3	7.7
4	Bengal Florican	*Houbaropsis bengalensis*	2	0.7	15.4
5	Black Drongo	*Dicrurus macrocercus*	5	1.7	23.1
6	Black Kite	*Milvus migrans*	65	21.7	15.4
7	Black Redstart	*Phoenicurus ochruros*	2	0.7	7.7
8	Blue-throated Barbet	*Psilopogon asiaticus*	2	0.7	7.7
9	Chestnut-headed Bee-eater	*Merops leschenaultia*	4	1.3	15.4
10	Chestnut-tailed Starling	*Sturnus malabaricus*	2	0.7	7.7
11	Citrine Wagtail	*Motacilla citreola*	15	5	15.4
12	Common Hawk-cuckoo	*Hierococcyx varius*	1	0.3	7.7
13	Common Hoopoe	*Upupa epops*	1	0.3	7.7
14	Common Myna	*Acridotheres tristis*	10	3.3	7.7
15	Common Stonechat	*Saxicola torquatus*	6	2	23.1
16	Eastern Spotted Dove	*Spilopelia chinensis*	2	0.7	7.7
17	Eurasian Sparrowhawk	*Accipiter nisus*	2	0.7	15.4
18	Golden-headed Cisticola	*Cisticola exilis*	12	4	38.5
19	Great Cormorant	*Phalacrocorax carbo*	1	0.3	7.7
20	Green-backed Heron	*Butorides striata*	4	1.3	7.7
21	House Sparrow	*Passer domesticus*	2	0.7	7.7
22	Indian Cuckoo	*Cuculus micropterus*	2	0.7	15.4
23	Indian Thick-knee	*Burhinus indicus*	4	1.3	15.4

Sl. No.	Common Bird Name	Scientific Name	No. of Individuals	Relative Abundance (%)	Frequency (%)
24	Large-billed Crow	*Corvus macrorhynchos*	5	1.7	30.8
25	Lesser Coucal	*Centropus bengalensis*	1	0.3	7.7
26	Little Pratincole	*Glareola lactea*	3	1	7.7
27	Oriental Darter	*Anhinga melanogaster*	1	0.3	7.7
28	Oriental Honey-buzzard	*Pernis ptilorhynchus*	1	0.3	7.7
29	Pacific Golden Plover	*Pluvialis fulva*	20	6.7	7.7
30	Paddyfield Pipit	*Anthus rufulus*	4	1.3	15.4
31	Pied Kingfisher	*Ceryle rudis*	2	0.7	7.7
32	Red Junglefowl	*Gallus gallus*	7	2.3	38.5
33	Red-vented Bulbul	*Pycnonotus cafer*	10	3.3	30.8
34	Red-wattled Lapwing	*Vanellus indicus*	3	1	15.4
35	Red-whiskered Bulbul	*Pycnonotus jocosus*	2	0.7	7.7
36	Rosy Pipit	*Anthus roseatus*	5	1.7	7.7
37	Ruddy Shelduck	*Tadorna ferruginea*	4	1.3	7.7
38	Rufous Treepie	*Dendrocitta vagabunda*	2	0.7	7.7
39	Shikra	*Accipiter badius*	2	0.7	15.4
40	Slender-billed Vulture	*Gyps tenuirostris*	3	1	7.7
41	Striated Babbler	*Turdoides earlei*	6	2	15.4
42	Swamp Francolin	*Francolinus gularis*	4	1.3	15.4
43	Tickell's Leaf-warbler	*Phylloscopus affinis*	2	0.7	7.7
44	Western Koel	*Eudynamys scolopaceus*	1	0.3	7.7
45	White-cheeked Starling	*Spodiopsar cineraceus*	19	6.3	7.7
46	Yellow-bellied Prinia	*Prinia flaviventris*	1	0.3	7.7

2.1.1.4 Threats

We recorded following major threats to birds of Grassland obligate species in D'Ering Memorial WLS.

- ***Overgrazing by Livestock***

Overgrazing by domesticated livestock is one of the major threats to the grassland birds in the Sanctuary. Several thousand cow from cattle sheds graze on grassland of the Sanctuary.

Figure 2. Cattle overgrazing in D'Ering Memorial WLS

- ***Spread of Invasive Alien Plants and trees***

Spread of invasive plants like *Chromolaena odorata*, *Lantana camara* has degraded the grassland of the sanctuary. High spread of *Ziziphus mauritiana*, *Bombax ceiba* also altered the grassland quality.

Spread of *Chromolaena odorata* and *Ziziphus* sp. in Jeepghat, D'Ering Memorial WLS

Oriental Honey-buzzard

Eurasian Sparrowhawk

Black Redstart

Little Pratincole

Chestnut-headed Bee-eater

Western Yellow Wagtail

Some birds recorded in D'Ering Memorial WLS

2.1.2 Nalsarovar Bird Sanctuary, Gujarat

2.1.2.1 Study Area

A field visit was planned for Nalsarovar Bird Sanctuary in Gujarat. However, due to covid situation, of the 120 sq. km area, only 6 sq. km area was surveyed. The access to inner beyts was not available and hence data related to birds only has been covered during the survey. The majority area covered was from the edges of Ranagadh and Kathechi village boundaries.

2.1.2.2 Methodology

To estimate the bird population within the wetland, two main strategies were implied A) Head Count: Each individual bird was counted within the wetland in case of low density whereas B) Block counts were performed when the density of birds was high.

2.1.2.3 Results

In total 88 avian species were recorded of which 4 were birds of prey (Appendix 2). Whereas the total bird count of the area surveyed was 58,090 birds. This is a small representative figure of the entire sanctuary and may have more than 3 lakh birds (source: local staff and bird guides).

2.1.3 Bhitarkanika, Odisha

2.1.3.1 Site Description

Bhitarkanika National Park and Sanctuary is located on the east coast of India and represents one among the remaining patches of mangrove forests next to Sunderbans in India. Bhitarkanika Wildlife Sanctuary (WLS) encompassing the main island dominated by mangroves were the traditional hunting grounds for the erstwhile King of Kanika. The hunting tower and temples are still intact in the area and are among the tourist attraction for the place. The mangroves forest of Bhitarkanika is situated in the deltaic region of Brahmani and Baitarani rivers in the Kendrapara district. The eastern boundary of the Sanctuary bounded by 35 km coast line along the Bay of Bengal harbours the largest colony of Olive Ridley Turtles in the world at Gahirmatha. The area has creek, creek lets, rivulets, mangroves, tidal mudflats, sandy beach, cultivated land, aquaculture ponds, and human settlements. The area is prone to cyclones and presence of mangroves play a huge role in protecting the coastline of the Sanctuary.

The avifauna of Bhitrakanika is widely known for its heronry which is among the largest and oldest mixed species colony in India (Subramanaya 1996). The breeding birds in this mixed species colony are Oriental Darter *Anhinga melanogaster* (NT), Black-headed Ibis *Threskiornis melanocephalus* (NT) Asian Openbill *Anastomus oscitans* (LC), Great Egret *Ardea alba* (LC), Intermediate Egret *Ardea intermedia* (LC), Little Egret *Egretta garzetta* (LC), Cattle Egret *Bubulcus ibis* (LC), Grey Heron *Ardea cinerea* (LC), Purple Heron *Ardea purpurea* (LC), Black-crowned Night-Heron *Nycticorax nycticorax* (LC) and Little Cormorant *Microcarbo niger* (LC). In this heronry, over 30,000 birds are reported to breed every year with an approximate area of less than 5 ha comprising 3800 – 4200 trees which are used for nesting (Gopi, 2010). Other species like the vulnerable Lesser Adjutant Stork *Leptoptilous javanicus* and White-bellied Sea-Eagle *Haliaeetus leucogaster* also breed in the area. Sympatric occurrence of seven species of kingfishers, Black-capped *Halcyon pileata*, White-breasted *H. smirnensis*, Brown-winged *H. amauroptera*, Collared *Todiramphus chloris* Common *Alcedo atthis*, Stork-billed *Pelargopsis capensis*, and Pied *Ceryle rudis* are recorded from the Park (Gopi, 2010). Apart from this Heronry, migratory and residents' waders can be seen in the fresh water pool inside the Bhitarkanika island, intertidal zones between Maipura and Dhamra, mudflats and marshy areas along the eastern border near to Sathabaya and other major and minor creek lets traversing through the protected area boundary. Heavy congregation of

waterfowl are recorded from coastal wetlands along the eastern boundary, south of Satabhaya village, Bhitarkanika Forest Block (Gopi, 2010) which includes aqua culture ponds also.

2.1.3.2 Methods

The survey at Bhitarkanika was carried out between February 9–11, 2021. The ideal time to carry out the bird surveys in this area is during mid-November to January when maximum congregations are recorded from these areas according to locals.

2.1.3.3 Sathabaya Wetlands

This wetland harbours 70,000–80,000 winter migrants every year (Gopi & Pandav 2007). The waterfowl area is dominated by fallow lands (without cultivation) and aquaculture ponds. During the survey most of the waterfowl were recorded from the aquaculture ponds. Species like Common Teal, Northern Pintail, Brahminy Shelduck were recorded in greater numbers. A total of 8,000 waterfowl were counted from the wetlands. This number will be easily surpassed during pick season from November to January.

From these aquaculture ponds moving towards the coast, the salty marshes harbour small flocks of waders. More congregation of waders are recorded at the adjacent mudflat to the Sathabaya old village. The waders were concentrated in one particular mudflat mostly consisting of Curlew Sandpiper, Dunlin, Temminck's Stint, Common Redshank in a flock size of about 1000 individuals. Many waders were seen in small flocks spread out across the area. The low numbers and scattered flocks could be due to the fact that most of the birds would have already left by February.

This area is also characterised by sand dunes adjoining the coast. The old village of Sathabaya had been moved to another location because of the coast erosion. The ingression of sand towards mainland is also a looming concern for the waterbird congregation sites. Some notable vegetation on these dunes includes *Spinifex littoreus*, *Ipomea pescaprae*, *Hydrophylax maritima*. Some old growth and damaged patches of Casuarina is also seen which is being used for nesting by White-bellied Sea-eagle, parakeets among other species.

2.1.3.4 Bhitarkanika

It is an island surrounded by mangroves at the periphery or bordering the island while terrestrial vegetation dominates the island centre with creation of open grassland by the forest department. The open grassland is made to increase the sightings of ungulates and birds mostly for tourism purposes and annual census.

During the half day survey of Bhitrakanika island, colonial nesting activities or nest were not recorded at Matha-Adia heronry, as February doesn't coincide with nesting activates. Old nest of birds could be recorded in the heronery with sparse sightings of resident birds. Some of the trees where old nest was observed are *Heritiera fomes*, *Excoecaria agallocha, and Tamarix troupii.* Matha-Adia heronry is located in the core area of Bhitrakanika island. Migratory birds like Ruff, Black-tailed Godwit, Common Greenshank, Common Redshank, Little Egret, Common Teal, Northern Shoveler, Garganey occurred in small flocks ranging from 10-50. These species were recorded in the freshwater ponds within the islands. As per the management plan by Forest department only activities related to habitat improvement like climber cutting, removal of unwanted growth, digging and renovation of fresh water ponds are being carried out.

Although during the survey high counts of any bird species were not recorded however the area seems to support good numbers of land and waterbirds. Additional surveys during November to December may reveal more about the migratory birds in the region.

2.1.3.5 Kalibhanja Diha

It is located on the northern part of the National Park in between Taluchua and Dharma port situated on delta region of Dhamra River. The island is eight km long with an average width of about one km. The area is locally known to harbour high diversity of mangrove forest in Bhitrakanika National Park. The area is protected by forest department with no tourism or local movement allowed currently. Here also the forest department is creating blocks called meadows and some small-scale plantation activity. As such birds were not recorded during the island survey probably due to late morning. As per local information there are few tidal mudflats in the near vicinity where wader and tern congregations are seen.

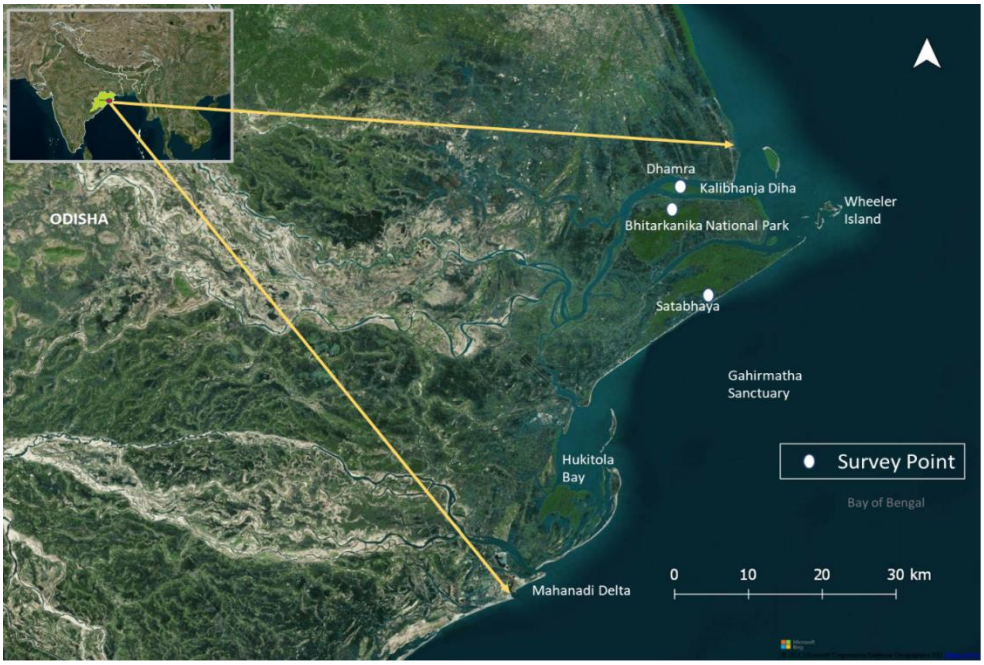

Figure 2: The coastal part starting from the Dhamra area to Mahanadi Delta comes under the Bhitarkanika Conservation Area (BCA). The representative survey points are shown in the map.

2.1.3.6 Stakeholders and Management Perspectives:

1) The local people around Bhitarkanika are dependent on the mangroves for extracting food, medicine, timber, fuel wood, making handicrafts and traditional products (Pattanaik et al 2008). A People's Biodiversity Register (PBR) needs to be maintained or updated for Bhitarkanika.

2) The changing landscape around Bhitarkanika particularly the conversions of paddy field into less productive Aquaculture ponds and prawn farms could be the major threat for supporting the heronry as pointed out by previous research work (Gopi, 2010). The mapping of these landuse change needs to be focused.

3) Since the locals are dependent on the mangroves at least the once in the fringes if not the interior part of the national parks, an assessment about the health of these mangroves needs to be carried out.

4) The tidal mudflats ideal for shorebirds needs to be mapped to restrict any modifications to these habitats.

5) The waterfowl congregation is mostly seen in aquaculture ponds, fallow lands and roosting in agricultural fields. Any future modifications to these wetlands could be detrimental for this

population. Policy level interventions would be necessary to safeguard the sites supporting high congregation.

Duck Congregation near at the private fish ponds at Bhitarkanika

2.2 Review of Management Plans

One of the important components of the project is habitat conservation and sustainable management which deals with assessing the management measures/interventions required for the conservation of the sites (habitat restoration) and preparation / updating of Management Plans of selected wetlands and landbird sites.

A Management Plan is a document which sets out the management approach and goals, together with a framework for decision making, to apply in a specific protected area over a given period of time.

A Management Plan plays an important role in conservation of habitat and related species through identifying key issues, defining role & significance of an area within a system, setting out policy and zoning for protection, development and management of resources and attributes, ensuring that development and management are compatible with environmental protection, providing a basis for ongoing monitoring of PA development, facilitating

communication & understanding within organization & outside and providing continuity of the efforts.

There could be so many natural and anthropogenic factors like climate change, increasing human population and land use and land cover pattern which are affecting the health and structure of forest cover and wetlands. With changing time and current challenges faced by protected areas, management plans need to be reviewed to modify or add new solutions which help in protection and conservation of habitat and species.

During this progress period (April to June 2021), a total of seven managements plans from five states have been reviewed and based on that activities which can be considered for inclusion in the management plans are provided below. The site includes Kolleru Wildlife Sanctuary, Pulicat Wildlife Sanctuary from Andhra Pradesh, Jaikwadi Bird Sanctuary, Nandur Madhmeshwar Wildlife Sanctuary from Maharashtra, Bhitarkanika National Park from Odisha, Ousteri Lake from Puducherry and Saman Bird Sanctuary from Uttar Pradesh.

2.2.1 Kolleru Wildlife Sanctuary, Andhra Pradesh

Kolleru is the largest natural freshwater lake of India. It is located in the alluvial plains formed between two major rivers, the Godavari and the Krishna, in Andhra Pradesh, is rich in biodiversity and supports livelihoods of large population living in and around. The lake has undergone many changes in the past. The area under cultivation within the lake increased since 1940, when British government granted *pattas* (title deeds) on payment of market value for land. In 1954, the government initiated cooperative farming. By 1969, almost entire lake was brought under cultivation and huge bunds were constructed to keep water out to protect the crops. The roads and bridges that came up with agricultural development coupled with the increased demand for fish created a new livelihood opportunity and vast market for fish by 1978. Land use shifted to pisciculture which suddenly became profitable and by 1984, 5,000 acres of government land within the lake bed was converted to fish tanks under the management of cooperative societies. These developments impacted hydrological regimes and flushing pattern of the wetland system.

Realizing the rapid degradation of Kolleru Lake, Government of Andhra Pradesh constituted several committees to propose measures for its restoration. Most of these committees, however, suggested engineering solutions aimed at agriculture and fisheries development and flood control.

Mitra Committee (1966) was the most important among those and all major intervention in the water management was made so far based on the reccommendations of the committee.

Nilkanthan (1961) was amongst the first to highlight the importance of the wetland as a habitat for Spot-billed Pelicans. He recommended declaration of Kolleru as a pelican sanctuary and identified various regions in the north, south and east of the lake ranging 5 - 20 sq. km to be specifically reserved for their protection. Seshavtaram *et al* (1978) highlighted ecological importance of lake and recommended management of vegetation to control eutrophication. Department of Forests in its report of 1993 emphasized on biodiversity conservation particularly of waterbirds in addition to socio economic development of the communities living in the area (Forest Department, 1993). Based on the recommendations of this report, Kolleru was declared as a bird sanctuary in 1995. A draft notification to this effect was finally issued in 1999 under the provisions of the Wildlife (Protection) Act, 1972.

The State Government of Andhra Pradesh thereafter undertook Operation Kolleru for demolishing the illegal fish tanks within the sanctuary area as per the directions of Supreme Court and engaged Wetlands International South Asia (WISA) for formulation of integrated management plan (IMP) for Kolleru Wildlife Sanctuary. This plan was prepared in 2008 for the Plan period of 5 years (up to 2013). There was no plan prepared for the period from 2013 to 2020. After reviewing the Wetlands International (2008) Management Plan the following draft reccomendations are suggested to incorporate while revising the existing management plan

2.2.1.1 Species Conservation

- Regular monitoring of birds is essential to understand their species richness, abundance, their habitat preference, habitat quality and status of threats.
- Regular monitoring of bird population in selected sites of the place is very important to understand the dynamics in population status, species composition, habitat utilization.
- Apart from population monitoring, strengthening antipoaching force, check on other threats are also equally important to conserve species.
- Maintaining and analysis of poaching records are very important to understand the pattern, time of hunting (which months of the year), species hunted, etc. Details such as place of hunting, markets around the location, community involved hunting, date, species and their number, action taken may be maintained and also the data access at any point of time is ensured for further analysis and planning.
- The antipoaching team should be strengthened to have regular monitoring.

- regular disease surveillance is important to address this issue.
- Proper training to the field level staff is necessary to report bird mortalities and basic handling techniques of carcasses. Creation of basic facilities under supervision of a veterinary team, tying up with veterinary research institutes for sample analysis may be explored.

2.2.1.2 Habitat conservation and sustainable development

- Boundary marking, protection from encroachment, pollution monitoring, vegetation cover improvements, ensuring minimal level of water for ecological functions, maintaining water ways to keep the normal water flow are some of the necessary areas that need attention in the sanctuary.
- To maintain the water flow removal of water hyacinth, invasive and other weed growths in the canals that bring/empty water should be taken up on regular basis.
- To improve the habitat for colonial breeder's suitable tree species should be grown in these areas.
- To understand the changes, use of remote sensing and GIS technologies in analysis of land use and land cover changes over a period of time is essential and also to plan the suitable management activities. Using such analysis on regular intervals provide us updated information on the habitat quality.
- Habitat preference should be studied properly and areas are completely mapped for future monitoring.
- **Aquafarms:** The sanctuary area should be kept free of aqua-farms. The habitat alteration and chemical usage severely affects the habitat quality. So, necessary action is required to stop this aquafarm activities in the sanctuary area.
- **Satellite Port:** The site of the Ennore Satellite Port falls in Category I (No-Development Zone) of the Coastal Regulatory Zone (CRZ) classification. The Kattupalli port expansion plan by Adani ports in the vicinity of Pulicat lake has gained lot of attention due to strong protest from villagers and fishermen community. Proper impact assessment studies through reputed institution may be carried out prior the implementation of such projects in the viscinity of this sensitive area.
- Saraswathy and Pandian (2016) has observed that silt deposition, sea mouth closure, presence of large bridges, lack of enough waterflow, human intervention and degradation of mangrove as major management issues related to habitat management.

Hence suitable action required to dredge the excess deposits to maintain the water holding capacity of the lake.

2.2.1.3 Capacity development

- We recommend at least four to five such training programmes in a year with hands on training of survey methods and protocols. The forest department, other enforcement staff, policy, non-governmental agencies and locals may be included in such training programmes.
- The enforcement agency should be equipped with knowledge and material to implement all the components of CAF NAP in the ground level successfully. Officers in different level, ground level staff and people from other departments/agencies involved should be in the same level of understanding on the components and importance of implementing CAF NAP.
- Basic information on CAF NAP and its importance, bird migration, monitoring techniques, disease surveillance, disposal of dead birds, role and strategies of state government to implement CAF NAP, etc are covered in the training programmes.

2.2.1.4 Communication and outreach

- The target groups such as locals, school and college students, business establishments that have direct and indirect impacts on the sanctuary. Communication and outreach material such as posters, stickers, booklets, videos may be prepared.
- The interpretation centre and through mass medias, all walk of people in large numbers may be covered. Bird festivals are encouraged to popularize the place and create mass awareness.
- Topics such as importance of biodiversity, role of waterbirds in their ecosystem, bird migration, human-bird relationship and economic values of birds are covered in innovative way.
- Local art forms/artists, birding camps for school/college students and staff, celebration of important days such as World Environment Day, Bird World Migratory Bird Day, etc., and local festivals are also utilized to spread awareness.
- The communication and outreach can create significant positive changes among different stakeholders by this way.

2.2.1.5 Awareness

- The locals may be involved to provide information and suitable awareness programmes are arranged for people to know the importance of birds in the ecosystem. If necessary, skill development programmes are carried out for poacher communities for alternative livelihoods.

2.2.2 Pulicat Wildlife Sanctuary, Andhra Pradesh

2.2.2.1 Species Conservation

- The sanctuary is very important bird area and undergoing trenmendous changes due to developmental activities in and around the lake area. However, the regular, synchronized bird surveys are not carried out. Hence, regular bird monitoring is suggested (one synchronized count during AWC and regular record keeping by forest staff). This is essential to understand bird species richness, abundance, their habitat preference, habitat quality and status of threats. These information are vital to plan the conservation strategy for effective management.
- The lake is very important site for migratory waterbirds as well as landbirds as wintering and stopover site. So, regular bird monitoring is the basic immediate need for the site for better management.
- Regular monitoring of bird population in selected sites of the place is very important to understand the dynamics in populations status, species composition, habitat utilization, etc. This information is vital to make precise conservation measures.
- Apart from population monitoring, strengthening antipoaching force, check on other threats are also equally important to conserve species.
- Maintaining and analysis of poaching records are very important to understand the pattern, time of hunting (which months of the year), species hunted, etc. Details such as place of hunting, markets around the location, community involved hunting, date, species and their number, actin taken may be maintained and also the data access at any point of time is ensured for further analysis and planning.
- The antipoaching team should be strengthened to have regular monitoring.
- The locals may be involved to provide information and suitable awareness programmes are arranged for people to know the importance of birds in the ecosystem. If necessary,

skill development programmes are carried out for poacher communities for alternative livelihoods.

- Regular disease surveillance is very important to address this issue.
- Proper training to the field level staff is necessary to report bird mortalities and basic handling techniques of carcasses.
- Creation of basic facilities under supervision of a veterinary team, tying up with veterinary research institutes for sample analysis may be explored.

2.2.2.2 Habitat conservation and sustainable development

- Boundary marking, protection from encroachment, pollution monitoring, vegetation cover improvements, ensuring minimal level of water for ecological functions, maintaining water ways to keep the normal water flow are some of the necessary areas that need attention in the sanctuary.
- To maintain the water flow removal of water hyacinth, invasive and other weed growths in the canals that bring/empty water should be taken up on regular basis. To improve the habitat for colonial breeder's suitable tree species should be grown in these areas.
- To understand the changes, use of remote sensing and GIS technologies in analysis of land use and land cover changes over a period of time is essential and also to plan the suitable management activities. Using Such analysis using on regular intervals provide us up to date information on the habitat quality.
- Habitat preference should be studied properly and areas are completely mapped for future monitoring. Following are the major habitat related issues in Pulicat
- **Aquafarms:** The sanctuary area should be kept free of aqua-farms. The habitat alteration and chemical usage severely affect the habitat quality. So, necessary action is required to stop this aquafarm activities in the sanctuary area.
- **Satellite Port:** The site of the Ennore Satellite Port falls in Category I (No-Development Zone) of the Coastal Regulatory Zone (CRZ) classification. The Kattupalli port expansion plan by Adani ports in the vicinity of Pulicat lake has gained lot of attention due to strong protest from villagers and fishermen community. Proper impact assessment studies through reputed institution may be carried out before implementation such projects in the viscinity of this sensitive area.

- silt deposition, sea mouth closure, presence of large bridges, lack of enough waterflow, human intervention and degradation of mangrove as major management issues related to habitat management. Hence suitable action required to dredge the excess deposits to maintain the water holding capacity of the lake.

2.2.2.3 Capacity development

- We recommend at least four to five such training programmes in a year with hands on training of survey methods and protocols. The forest department, other enforcement staff, policy, non-governmental agencies and locals may be included in such training programmes.
- The enforcement agency should be equipped with knowledge and materials to implement all the components of CAF NAP in the ground level successfully. Officers in different level, ground level staff and people from other departments/agencies involved should be in the same level of understanding on the components and importance of implementing CAF NAP.
- Basic information on CAF NAP and its importance, bird migration, monitoring techniques, disease surveillance, disposal of dead birds, role and strategies of state government to implement CAF NAP, etc are covered in the training programmes.

2.2.2.4 Communication and outreach

- The target groups such as locals, school and college students, business establishments that have direct and indirect impacts on the sanctuary. Communication and outreach materials such as posters, stickers, booklets, videos may be prepared.
- The interpretation centre and through mass medias, all walk of people in large numbers may be covered. Bird festivals are encouraged to popularize the place and create mass awareness.
- Topics such as importance of biodiversity, role of waterbirds in their ecosystem, bird migration, human-bird relationship and economic values of birds are covered in innovative way.
- Local art forms/artists, birding camps for school/college students and staff, celebration of important days such as World Environment Day, Bird World Migratory Bird Day, etc., and local festivals are also utilized to spread awareness.

- The communication and outreach can create significant positive changes among different stakeholders by this way.

2.2.3 Jaikwadi Bird Sanctuary, Maharashtra

2.2.3.1 Species Conservation

- Investigate the occurrences of intentional poisoning or opportunistic hunting of birds (migratory and resident) in and around the wetland. If such instances are encountered prohibition enforcement to be implemented by creating an anti-poaching squad.
- Seasonal breeding bird surveys need to be conducted to record the species breeding, the extent and success level of breeding and threats faced.
- As the impact of chemical pollution in the wetland and resultant toxicity load is not clearly known, the toxicity assessment study needs to be conducted. Water samples from major chemical load inflow sites (effluents, sewage and agricultural runoff) need to be taken every month. Along with this, the samples from major congregation sites need to be taken and compared.
- Detailed surveys need to be carried out throughout the year to assess the nature and level of threats and disturbances to the waterbirds. The direct and indirect threats can be categorized as high-, medium- and low-intensity depending on the impact they have on the occurrence and health of the waterbirds (resident as well as migratory). The presence and seasonality of the following threats can be assessed:
    a. Illegal trapping or intentional poisoning
    b. Habitat loss (galpera/land encroachment, aquaculture)
    c. Pollution (Agricultural run-off, industrial effluents, sewage, plastic, eutrophication)
    d. Invasive plants
    e. Fishing (birds caught in unattended nets, disturbance/damage, resource depletion)
    f. Feral/domestic animals
- Every year coordinated waterbird count is carried out in January. But to get a better understanding of the site use pattern and the seasonality of wetland-use by migratory birds, an extensive study needs to be proposed. A two-year monitoring research with bi-monthly counts to be carried out covering all the major sites along the bank as well as the islands. This will help understanding the composition of migratory birds using this

wetland as a staging site during southward and northward passage and those found throughout the winter.

- The bi-monthly bird monitoring can be corelated with the access to the habitat and changing landcover based on the receding water level.

2.2.3.2 Habitat conservation and Sustainable management

- Roosting perches to be planted at one site on pilot basis to know which species use them. If raptors start occupying the perches, there is a chance that other waterbirds may start avoiding these sites altogether. If the roosts and trees are accepted as heronries then more such can be planted.
- Based on the site use pattern and the population monitoring studies carried out, the minimum water level necessary for the breeding birds as well as the migratory birds to be assessed. The minimum level is essential for migratory waterbirds in early summer as they need good feeding potential to put on the adequate amount weight. Only when the optimum weight is gained in form of fat can they commence the migratory journey. The minimum water requirement should be discussed to the Irrigation Department and maintained in the reservoir.
- Land-use Landcover map for the last 40 years to be analysed to establish the changes in the habitat, extension of area under galpera and other landcover changes.

2.2.3.3 Capacity Development

- The wetland is extensive with limited frontline staff to manage or monitor it. In order to effectively manage the threats and safeguard bird habitats, the staff strength could be increased.
- Training workshop needs to be conducted for the staff for orientation on the monitoring protocols, bird migration and basics of bird ringing. A bird ringing training workshop can also be conducted. The local NGOs can be involved in this training to give further assistance to the FD.
- The frontline staff needs to be trained in Disease surveillance protocol (Disease monitoring protocol, handling and containing, safe disposal, Sample collection, field signs and personal protection measures, inter-departmental setup).

2.2.3.4 Communication and outreach

- Local organisations, community-based organisations can be involved in the monitoring and management initiatives. Site guardians can be assigned from different villages and given basic training. These guardians can assist the FD in bird monitoring, threat monitoring and during disease surveillance studies
- The People's Biodiversity Register to be developed for the adjoining villages if not already done and strategies for conservation of migratory birds should feature as one of a key segment in the District Administrative Plans.
- Create awareness amongst local media on the importance of conservation of migratory birds and their habitats by releasing reports on interesting sightings, monitoring results, events conducted and seasonal updates.
- Annual Bird Fair can be conducted which can be budgeted in the management plan. The fair can coincide with important annual days or during the Asian Waterbird Counts to involve large scale participation.

2.2.3.5 Research and Knowledge-based development

- Students from institutes and colleges from adjoining cities could be encouraged to carry out studies on documentation of avifauna, other terrestrial and aquatic fauna, terrestrial and aquatic vegetation, temporal changes in the agricultural practices in the adjoining lands, threats and disturbances and conducting water quality tests.
- The long-term data collected needs to be assessed to understand the pattern of change in the avifaunal species recorded here. Based on the findings, specific management actions to be undertaken which give preference to the health and safety of non-generalist species.
- To study the site use pattern of the species using the wetland as well as to understand the connectivity and seasonality of sites used in the annual journey of migratory birds, banding of birds needs to be carried out. Bird ringing during migratory season will help determine the different sub-populations of the species arriving at the site, age composition as well as changes in weight. The Forest Department can investigate the use of GSM-GPS devices /data loggers/Satellite Transmitters to understand the inter wetland during the winter season to know the habitat preference. This can also help establish the migratory route and seasonality of migration of these species. This

information can be used on the flyway level for identifying the major sites in the flyway.

2.2.4 Nandur Madhmeshwar Wildlife Sanctuary

2.2.4.1 Species and habitat conservation

- Investigate the occurrences of intentional poisoning or opportunistic hunting of birds (migratory and resident) in the wetland and adjoining agricultural lands. If such instances are encountered prohibition enforcement to be implemented by creating an anti-poaching squad.
- The *Typha* growth around the wetland has seen an evident increase, and this has reduced the open areas that roosting birds and waders prefer. Phase-wise removal of *Typha* is needed.
- The impact of non-mechanical fishing should be assessed to understand the resultant disturbance caused. This will be helpful in developing guidelines of mesh size, seasonal ban on fishing and limiting the activity.
- Detailed surveys need to be carried out throughout the year to assess the nature and level of threats and disturbances to the waterbirds. The direct and indirect threats can be categorized as high-, medium- and low-intensity depending on the impact they have on the occurrence and health of the waterbirds (resident as well as migratory). The presence and seasonality of the following threats can be assessed:
    a. Illegal trapping or intentional poisoning
    b. Habitat loss (galpera/land encroachment, aquaculture)
    c. Pollution (Agricultural run-off, industrial effluents, sewage, plastic, eutrophication)
    d. Invasive plants
    e. Fishing (birds caught in unattended nets, disturbance/damage, resource depletion)
    f. Feral/domestic animals
- Monthly monitoring is already being carried out at the wetland. Data on the water level and pressures can also be collected. Additionally, data on the status and species in the satellite wetlands obtained with the help of birdwatchers will give a holistic picture of the migratory waterbird composition and their level of vulnerability.

- Breeding bird study specially of the heronry birds needs to be conducted every year with data on breeding success. In case of breeding failure, factors for failure should be documented. If needed, more plants assisting in nesting can be planted.
- Based on the site use pattern and the population monitoring studies carried out, the minimum water level necessary for the breeding birds as well as the migratory birds to be assessed. The minimum level is essential for migratory waterbirds in early summer as they need good feeding potential to put on the adequate amount weight. Only when the optimum weight is gained in form of fat can they commence the migratory journey. The minimum water requirement should be discussed to the Irrigation Department and maintained in the reservoir.
- Land-use Landcover map for the last 40 years to be analysed to establish the changes in the habitat, extention of area under *galpera* and other landcover changes.

2.2.4.2 Communication and outreach

- Local institutes, NGOs, community-based organisations can be involved in the monitoring and management initiatives. Site guardians can be assigned from different villages involved in eco-tourism activities. These guardians can assist the FD in bird monitoring, threat monitoring and during disease surveillance studies.
- The People's Biodiversity Register to be developed for the adjoining villages if not already done and strategies for conservation of migratory birds should feature as one of a key segment in the District Administrative Plans.
- Create awareness amongst local media on the importance of conservation of migratory birds and their habitats by releasing reports on interesting sightings, monitoring results, events conducted and seasonal updates. These can also be released on the official social media platforms.

2.2.4.3 Research and Knowledge-based development

- Students from institutes and colleges from adjoining cities could be encouraged to carry out studies on documentation of avifauna, other terrestrial and aquatic fauna, terrestrial and aquatic vegetation, temporal changes in the agricultural practices in the adjoining lands, threats and disturbances and conducting water quality tests.

- The long-term data collected needs to be assessed to understand the pattern of change in the avifaunal species recorded here. Based on the findings, specific management actions to be undertaken which give preference to the health and safety of non-generalist species.
- To study the site use pattern of the species using the wetland as well as to understand the connectivity and seasonality of sites used in the annual journey of migratory birds, banding of birds needs to be carried out. Bird ringing during migratory season will help determine the different sub-populations of the species arriving at the site, age composition as well as changes in weight. The Forest Department can investigate the use of GSM-GPS devices /data loggers/Satellite Transmitters to understand the inter wetland during the winter season to know the habitat preference. This can also help establish the migratory route and seasonality of migration of these species. This information can be used on the flyway level for identifying the major sites in the flyway.

2.2.5 Bhitarkanika National Park, Odisha

2.2.5.1 Species Conservation

- Satabhaya area apart from the duck congregation is also a remarkable area for the shorebirds. The mudflats, salt marshes and fallow lands need to be surveyed systematically to understand the seasonality, species diversity and abundance for the globally threatened shorebirds. Through the survey in early February 2021, it was understood that the survey in these areas is done once during mid-winter waterbirds count or more popularly known as the Asian Waterfowl census.
- A plan with datasheets in the local language can be created for the field staff to conduct bird count in these areas at least once a month.
- Many waders and bird species are seen on the banks of the creeks, many of these creeks are also used for tourism purposes which may disturb the roosting birds. Places of roosting in these areas need to be marked and boats can then be instructed to maintain a safe distance for bird observation.

2.2.5.2 Habitat Conservation and Sustainable management

- Water quality parameters are already being collected by the forest department.

- The freshwater areas inside the protected area are also being used by resident and migratory population of birds. The depth and shallowness of these ponds needs to be maintained to support the diverse fauna of the area including the birds. Specifications for maintaining shallowness or depth can be recommended on the basis of birds found in the area.
- The development of meadows for herbivores and birds is an interesting point in the management plan. As such, there is no strong reason given apart from supporting herbivores, birds, wildlife viewing for tourists. This recommendation needs to be revisited with supporting empirical data or a short-term study could be initiated about the importance of meadows and what is the optimum area needed for the same. This will support the creation of meadows which FD is planning in the current management plan.
- A survey covering the mangrove patches in Bhitarkanika Conservation area needs to be planned. If the communal nesting birds have a tendency of changing the nesting sites, then the other possible sites need to be mapped taking notes on habitat parameters to support colonies.
- The effluent discharge needs to be monitored. Hence the effective communications and management of these aquaculture ponds which directly impacts the dynamics of Bhitrakanika needs to be analysed.
- The existing foraging and roosting grounds of birds need to be identified and sampled for diversity and abundance of food availability. To maintain the optimum environment.

2.2.5.3 Capacity Development

- Training for the frontline staff in terms of avifauna needs to be added to the existing FD plan. For example- Disease monitoring, counting techniques, bird identification.

2.2.5.4 Communication and Outreach

- Most of the points regarding communication and outreach has been covered in the FD management plan.
- Information and topics for display and awareness can be planned out with consultation of respective experts for each taxa/subject

- Some individuals from the local community can also be identified for training in census methods of different taxa to encourage participation in systematic data collection. e-based development

2.2.5.5 Research Knowledge-based development

Apart from the mentioned topics, additional topics of interest could be:

- Sustainable aquaculture practices reducing the impacts on natural habitat
- Mapping of mudflats areas and review of the mangrove plantation in these regions
- Identifying roosting, nesting and foraging areas of migratory and resident birds respectively.
- Systematic data collection in Bhitrakanika Conservation Area which includes the non-protected area

2.2.6 Ousteri Lake, Puducherry

2.2.6.1 Species Conservation

- Apart from Regular population monitoring monitoring, strengthening antipoaching force, checks on other threats are also equally important to conserve species.
- The forest staff, locals (bird watchers, wildlife enthusiasts, and college / school students) are encouraged to take up the count. The data collected should be maintained properly for easy access at any point time.
- Maintaining and analysis of poaching records are very important to understand the pattern, time of hunting (which months of the year), species hunted, etc. Details such as place of hunting, markets around the location, community involved in hunting, date, species and their number, action taken may be maintained and also the data access at any point of time is ensured for further analysis and further planning.
- The antipoaching team should be strengthened to have regular monitoring.
- The locals may be involved to provide information and suitable awareness programmes are arranged for people to know the importance of birds in the ecosystem. If necessary, skill development programmes are carried out for poacher communities for alternative livelihoods.

- Since poaching of birds for routine livelihood is very common practice around the lake especially by the members of Narikurva community, engaging anti-poaching watchers are important. The local people can be engaged to assist in organizing special camps in the remote area and for regular patrolling of the area to prevent poaching activities. A few members from Narikurva community may be included as anti-poaching watchers. Necessary training may be given to them for alternative livelihood. They may be utilized as naturalists to accompany tourists/photographers/birders to the locality.
- Regular disease surveillance is very important to address this issue. Proper training to the field level staff is necessary to report bird mortalities and basic handling techniques of carcasses.
- Creation of basic facilities under supervision of a veterinary team, tying up with veterinary research institutes for sample analysis may be explored.

2.2.6.2 Habitat conservation and sustainable development

- Boundary marking, protection from encroachment, pollution monitoring, vegetation cover improvements, ensuring minimal level of water for ecological functions, maintaining water ways to keep the normal water flow are some of the necessary areas that need attention in the sanctuary.
- Since the wetland is declared as a bird sanctuary by the Department of Forest and Wildlife, Government of Pondicherry, bird watching may be encouraged, unchecked poaching may be prevented, and destruction of the habitat by the local people for the firewood collection and cattle grazing may be prohibited (Bassouvalingam et. al. 2012).
- Further GIS mapping can be useful to see the LULC pattern over the decades for better habitat management.
- The historic data reveals that the water level in the lake has been kept higher during the past several years since 2003. This has resulted in permanent flooding of potential bird habitats during the migratory season. Hence, there should be controlled release of water during the lean seasons (around May- Sep) so that the water level reaches near zero level before the NE Monsoon sets in. This would help in restoring the natural ecological dynamics prevailed in the wetland earlier and attract more migratory birds (Prusty *et.al*. 2011)
- **Sustainable Fishing:** Regular monitoring of the fishing activity, sustainable harvesting is some of the important management requirements. Creating opportunity for alternative livelihood will reduce the dependency of locals on fishing resource of the lake.

- **Boating:** Replacement of motor boats with paddled boats (having capacity of 4 or 6 persons) and coracles, which would help reduce disturbance to birds in the area marked for ecotourism activities. Boating should be strictly stopped during dawn and dusk hours in order minimize disturbance to the birds.
- **Boundary demarcation and prevention of encroachment:** Booming of real estate leading to the encroachment of wetlands is a very common. The parts of Ousteri wetland which have already been encroached should be identified and their protection and restoration measures should be immediately undertaken. Marking the protected area boundary with fencing or pillars are recommended in order to prevent further encroachment, and this will further help conservation activities. Subsequently the boundary wall needs to be designed in such a way that it doesn't disturb the natural flow of water, especially near the lake banks.
- **Dumping of solid wastes:** Several places near the lake were found as dumping ground for garbage and other municipal and domestic solid waste. Necessary action should be taken to avoid such solid waste dumping in the sanctuary premises. The waste created through tourism activity within the sanctuary should also be disposed properly to avoid any danger to the environment.
- **Disposal of Sewage:** The untreated effluent reaching Ousteri Lake is likely to lead to detoriation of water quality in the lake. Suthukeni canal is a source of sewage and other contaminants to the Ousteri Lake. The sewage water is proven to bring large quantity of pollutants and disease-causing germs. Necessary coordination with civic bodies and other government agencies should be made to make suitable arrangements such as installation of sewage treatment plans.
- **Control of Weed infestation:** The noteworthy growth of weed species such as *Eichhornia crassipes*, *Pistia stratoides*, *Salvinia molesta*, *Polygonum galbrum, P. hydropiper* and *Typha angustifolia* in the lake needs to be managed scientifically. Regular removal of these weeds will help sustain the canal, its habitat quality and species diversity, vegetation structure, water quality, salinity, etc. Initially physical removal of weeds may be necessary in the wetlands, its surroundings and the channel. Apart from the above-mentioned weeds, other weed species growing along with aquatic vegetation also need to be controlled / removed. Regular monitoring of these aquatic weeds in the vicinity of the study area and routine clean up strategy should be strictly

followed, to have a check on weed infestation. Total eradication programme may be adopted for *Prosopis juliflora* in phase.

- **Soil erosion and siltation:** Soil erosion and siltation is a major threat to the survival of any wetland. To overcome this problem, it is suggested to plant native trees at edges of Ousteri Lake and also Suthukeni canal. Further, systematic dredging can be followed during lean months in order to avoid sedimentation and siltation after consultation from experts

2.2.6.3 Capacity development

- We recommend at least four to five such training programmes in a year. The forest department, other enforcement staff, policy, non-governmental agencies and locals may be included in such training programmes. Basic information on CAF NAP and its importance, bird migration, monitoring techniques, disease surveillance, disposal of dead birds, role and strategies of state government to implement CAF NAP, etc are covered in the training programmes.
- Appropriate training programmes for the officials, general public as well as the members of local non-government organizations have to be formulated and should be carried out on a regular basis. Small film shows, posters and brochures on the biodiversity of the sanctuary and environs and its ecological importance is made available for visitors.

2.2.6.4 Communication and outreach

Nature Interpretation Centres

- A nature interpretation centre with all modern interpretation materials will help the visitors to know more about the place and its importance. The major faunal groups, ecological services, wetland services to human community are effectively displayed in a simpler way for all walk of people. The plant signages, sanctuary etiquettes, etc are displayed along the path way and other places where more people gather in the premises. An education officer may be appointed to assist the visitors, especially school/college students to provide information. A cadre of volunteers may be created to assist the education officer, especially during the large number pre-booked visitors visit the place or on important days when we have more visitors to the sanctuary.

2.2.6.5 Souvenir Shop

- Puducherry is destination for many foreign and native visitors due to presence of religious and international institutions. Puducherry is also known for wide range of artefacts and handicrafts. Training programme may be arranged for local community to create such handicrafts of wildlife from locally available materials. The materials such as post cards, posters, booklets, key chains, cups, animal models (stone sculptures or any other material, using local skills), T-shirts, etc may be tried here. The shop may be run jointly by the forest department and local community.
- Communication and outreach material such as posters, stickers, booklets, videos may be prepared.
- Bird festivals are encouraged to popularize the place to create mass awareness.
- Topics such as importance of biodiversity, role of waterbirds in their ecosystem, bird migration, human-bird relationship and economic values of birds are covered in innovative way. Local art forms/artists, birding camps for school/college students and staff, celebration of important days such as World Environment Day, Bird World Migratory Bird Day, etc., and local festivals are also utilized to spread awareness.
- There is a need to involve the people residing near or around the Ousteri Lake for the management purposes. This can be done by forming a committee for the lake. The committees should monitor the status of the lake and protect it against encroachment by public and dumping of solid wastes into the water bodies. These committees can also generate funds for the maintenance of parks, walkways, fountains, lighting, etc.
- Responsible stakeholders under the coordination of concerned departments can jointly manage the maintenance of the lakes. Engaging local people in the development and conservation initiatives will make more engaged in activities for lake restoration and in turn activities such as poaching and hunting can be minimized.
- People from communities like Narikurva may be employed for cleanliness works around the lake and as watch or security guards for watch tower. This would reduce their activities of killing birds for their subsistence (Prusty *et al*. 2011, Murugesan 2013).

2.2.7 Saman Bird Sanctuary, Uttar Pradesh

2.2.7.1 Species Conservation

- Identification of satellite wetlands of the Saman Bird Sanctuary and its conservation: It will help to know how far the birds disperse and usage of other wetlands for feeding and resting sites. This will be helpful in maintaining the regional connectivity of the area with other important wetland areas in the landscape.
- Monitoring and recording of migratory as well as residential birds should be done based on seasonal surveys. Registers can be maintained locally to document bird species and its number, congregation points, threats/ issues, breeding and other specific observations.
- Anti-poaching staff: although hunting of birds inside the sanctuary is not a threat but it has been reported from the adjoining wetlands (not a part of protected area network till now). Therefore, the protection related activities need to be continued on regular basis.
- Livestock grazing: grazing of domestic cattle and pigs (as they feed on aquatic plants) should be regulated.

2.2.7.2 Habitat conservation and sustainable management

- Problems related to encroachment of wetland area for agriculture and implementation of habitat improvement activities exists as the land settlement rights with local people are yet to be completed. The settlement process is needed to be completed on urgent basis.
- Water availability in the lake has been decreasing over the years and it dries up fast after post-monsoon months. Supplementation of water on a regular and planned basis is required to maintain water level in the wetland.
- Saunj (wetland) is a major source of natural water runoff to the lake, which has also reduced. It is also known to sustain migratory birds and currently suffering from agricultural encroachment. It has been planned to include in Saman wetland but some action needs to be taken to sustain the system.
- Watershed management could be adopted to maintain and restore the catchment functions and maintain water level in the wetlands.

- Hydrological study and mapping could be useful in determining drainage pattern of the area and its maintenance to make enough water flow into the wetland.
- De-siltation of lake should be done to maintain depth of wetland and increasing its water holding capacity.
- Water testing and analysis: as the Sanctuary is surrounded by agricultural field and suffering from encroachment, there is greater chances of chemical run off (insecticide and fertilizer) and deposition from nearby agricultural fields which can impact the ecology of the lake. Physical and chemical level testing should be done on seasonal basis to analyse its level and impact during the seasons.
- Developing sustainable farming: Workshops in association with agricultural department could be organized for peripheral farm owners to make them aware about ecologically sustainable farming practices like use of bi-fertilizers and bio-pesticides.
- Invasive species such as *Lantana camara, Parthenium hysterophorous, Prosopis juliflora, Eichornia crassipes, Ipomea aquatica* should be removed on periodic basis and post removal impacts on the birds should be monitored.
- Areas where removal activities have previously done should be planted with native, and fruit bearing species.
- **Fire control**: Controlled burning at the edges of the grassy patches, clearing of fire lines along the road side and other vulnerable places needs to be taken up in advance before summer to act as fire breaks.

2.2.7.3 Capacity development

- Training workshops for the field staffs covering bird identification, bird migration, monitoring, and disease surveillance and reporting of data should be scheduled.
- Some basic equipment's like GPS, camera, binocular and torches should be provided to increase protection level and keep records.
- **Strengthen the public participation:**
- Ecotourism: Ecotourism offers direct economic benefit to the local people; strengthening their economy and consent of wetland conservation.
- Local people could be selected to work as guides (after training) and labours (to perform management activities in the sanctuary).

2.2.7.4 Communication & outreach

- Bird fair or festival could be organized to generate awareness regarding the importance of wetlands and birds.
- Public awareness and support could be made to emphasize the importance of wetland, and association with bird conservation.
- Modern agricultural techniques such as drip irrigation, and close field distribution channels could be the effective solution for optimizing the utilization of the water in agricultural fields.

2.2.7.5 Research knowledge-based development

- Involving and encouraging scientific, educational and research organizations to carry out studies and research on avifauna within the sanctuary and nearby areas.
- Collecting and assessing long-term data to develop species specific conservation plans.

3 CAPACITY BUILDING

When the Covid pandemic restrictions were lifted off, tendative dates were fixed in consultation with the local state forest department to organize training programmes for the frontline staff. Letters were sent to the Chief Wildlife Wardens of Odisha, Andhra Pradesh, Rajasthan, and Maharashtra, and the communications were made with concerned officers. However, in all the four states the proposed workhops were postponed by the respective state forest department until further notice due to the second wave of COVID-19 in the country Further, dates will be worked out in consultation with the Chief Wildlife Warden office depending up on the COVID-19 restrictions. The status of organising workshops are given in the table 4.

Table 4. Status of capacity workshop planinng in different states

States	**Status**
Odisha	-Planned during March 2021 but cancelled due to Covid. -Materials are dispatched by BNHS in March 2021 and currently placed in Chilika field office. -Manual is available and final copy printed in March 2021.
Madhya Pradesh	-Hindi Manual, print version is ready - to be printed - correspondence for the workshop has been discussed with FD
Tamil Nadu	-Manual in Tamil language is in process of finalization
Andhra Pradesh	Manual in Telugu is ready and Printed
Uttar Pradesh and Rajasthan	- Metting with the PCCF's of Uttar Pradesh and Rajasthan to explain the workshop
Maharashtra	-Manual print version is ready -Initially the workshop was planned during Feb-Mar 2021 but was cancelled due to Covid.

4 BIRD SENSITIVIY MAPPING

4.1 Litreature survey on Bird mortalities due to wind turbines and powerlines

An extensive search of literature was done to amass information on bird collisions and electrocutions with power lines and wind turbines in India. Published peer-reviewed literature was searched using the internet search engine Google™, Google Scholar™ (www.scholar.google.com) and scientific journal websites related to Biological sciences along with individual reports of casualities at collision hotspots such as wind farms or due to power transmission lines. This collection of studies was supplemented largely by the information available as "grey" reports in the form of news articles reporting casualties, study reports by websites of organisations (Sálim Ali Centre of Ornithology and Natural History, Wildlife Institute of India, Bombay Natural History Society) working on birds. For detailed reports not available in open literature, information was gathered on request from the author and institutes. Searches were also done to extract online regional newspaper accounts of casualities in Tamil, Hindi, Marathi, and Malayalam languages. Some information was also collected from social media Facebook™ pages birdwatcher groups.

The available, relevant literature was carefully reviewed and suitable information (journal details, year/month/date of collisions/electrocutions, study methodology, implicated species, species information and causes), whichever available, were extracted, tabulated and analysed. Studies which offered more information and detail relevant to the present study were tabulated in a comparable way and reviewed. As the compilation works are in process, the details of affected species would be present in the next interim report.

4.2 Results of Litreature Survey

A total of 915 mortalities, of which 819 were identified up to species-level (61 definitive species), were recorded. Of the total number of mortalities documented, 90.71% were accounted for by literature pertaining to collisions/electrocutions with transmission lines, while 9.3% mortalities a result of wind turbine collisions. Data was obtained from around 50 sources, of which 26% were peer-reviewed scientific publications and the rest 76% were "grey literature" records (reports, news articles and social media documentation). Data on wind

turbine mortality was extricated solely from three scientific publications, one report and one news article which were available.

4.2.1 State-wise records of bird mortality

The compiled records, from 1945 to early 2021, span across 13 states with the highest number of mortality records from Gujarat (26.5%), followed by Haryana (23%) and Rajasthan (22.1%). Seven states have less than 20 records. Power transmission line collisions/electrocution mortality has been recorded in 12 states, with the highest % mortality recorded in Haryana (25.4%), followed by Gujarat (23.4%) and Rajasthan (24.2%) as most of the records are mortalities due to collision with power lines rather than wind turbines.

It has to be noted that by nature of the studies – species, location and hazard specific, bird mortality (for eg: The high number of mortality reported in Haryana is skewed due to a single observation of 206 mortalities of Indian Peafowl attributed to collision with power lines) numbers might be skewed. Mortalities due to collision with wind turbines have been recorded in five states with the highest mortality represented in Gujarat (55.3%) followed by West Bengal (17.6%) and Maharashtra (15.3%) (Table & Figure)

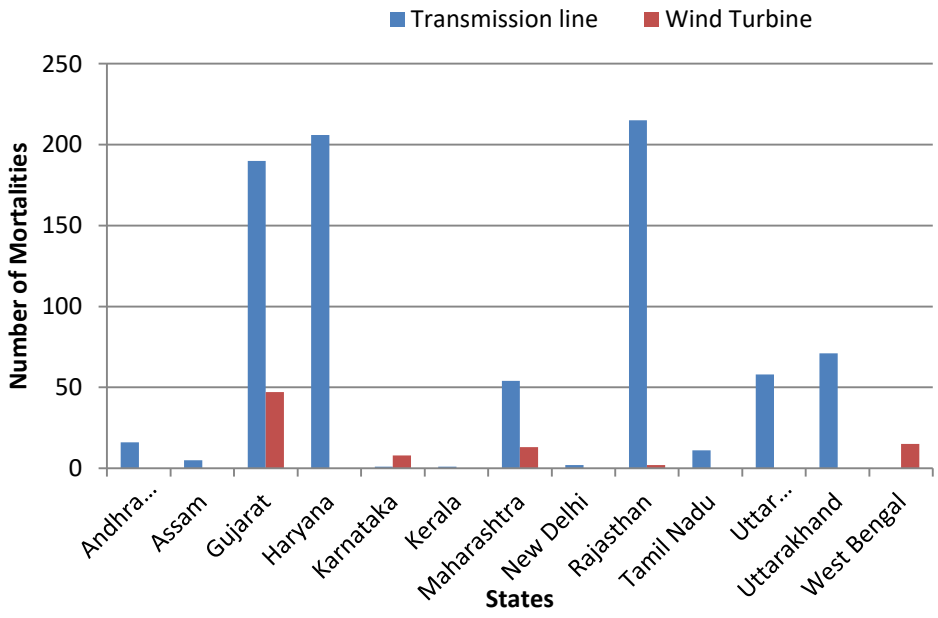

Figure 3. State wise bird mortatlites reported

4.2.1.1 Seasonal Pattern

Of the 915 mortality records, the month of collision/electrocution could be extracted only for 536 records. Based on these records, the highest percentage mortality (56.8%), due to collision/electrocution has been recorded during winter (December to February) followed by the monsoon season (June to September) where 22.3% records have been compiled (Figure 4). During the summer months (March to May) 8.1% instances of bird mortality have been recorded.

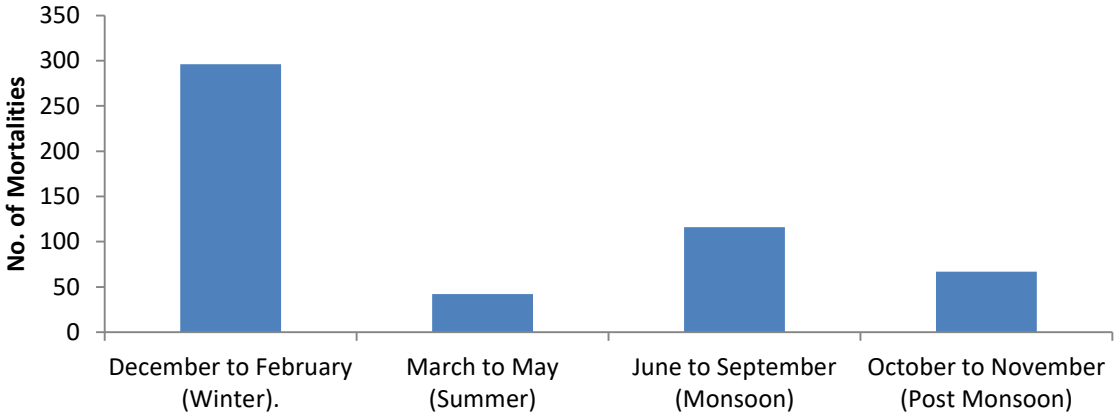

Figure 4. Seasonal Patterns of Bird Mortailtes reported

4.2.1.2 Overall mortality due to power transmission lines and renewable energy sources

Excluding the 16 unidentified individuals, 880 individuals belonging to 30 families were documented as collision/electrocution mortalities. The families Phasianidae (represented by one species – Indian Peafowl) and Phoenicopteridae (represented by 2 species – Greater Flamingo and Lesser Flamingo) had the highest number of mortalities with 24.8% and 24.2% respectively followed by Accipitridae (13.5%), Corvidae (7.3%) and Coraciidae (5.3%). Nine families, each represented by one species were one time records (Table 5)

4.2.1.3 Power Transmission Line Mortality

Of the total 811 mortality records that have been compiled, 805 individuals represent the 21 families recorded. 732 individuals of 36 species have been identified up to species level. The highest percentage mortality is seen in the family Phasianidae (27.2%) with 217 individuals of Indian Peafowl recorded, followed by Phoenicopteridae (26.5%), with 98 and 51 individuals of Greater and Lesser Flamingo recorded respectively while 64 individuals couldn't be identified up to the species level. Accipitridae with 12.9% mortality represents 9 species of which the

Himalayan Griffon has the highest mortality with 50 individuals recorded followed by the Steppe Eagle with 25 individuals. While Strigidae has a mortality of 1.6%, it is represented by four species of owls of which the Rock Eagle Owl has the highest mortality (five individuals).

On classifying the individual mortalities for the 805 records on basis of mode of death (collision/ electrocution), most studies had not given a clear distinction between collision and electrocution.

Based on the available records, it was found that in 51.5% of the cases, distinction between collision and electrocution was not drawn. However, power line collisions accounted for 46.5% mortality while electrocutions accounted for 1.7% of the mortality recorded.

Wind Turbine Mortality

Of the 85 cases of mortality recorded due to collisions with wind turbines, 69 individuals were identified up to species level and 75 individuals up to the family level. The highest percentage mortality was accounted for by Columbidae (22.7%) represented by 2 species (Blue Rock Pigeon – 7 individuals; Eurasian Collared Dove – 10 individuals) followed by Accipitridae (20%) represented by five species of which the highest mortality was 4 individuals of Black Kite (Table 5).

Table 5 List of Bird mortalties due to wind turbines and Powerlines

Common Name	Scientific Name	Power line	Wind Turbine	Total
Accipitridae sp.*	Accipitiridae sp.		6	6
American Black Duck**	Anas rubripes**		1	1
Asian Koel	Eudynamys scolopaceus		1	1
Bar-headed Goose	Anser indicus		1	1
Barn Owl	Tyto alba	7	1	8
Black drongo	Dicrurus macrocercus		1	1
Black Kite	Milvus migrans		4	4
Black-crowned Night Heron	Nycticorax nycticorax		1	1
Blue Rock Pigeon	Columba livia	8	7	15
Bonelli's Eagle	Aquila fasciata		1	1
Cattle Egret	Bubulcus ibis		5	5
Changeable Hawk Eagle	Nisaetus cirrhatus		1	1
Cinereous Vulture	Aegypius monachus	5		5
Common Crane	Grus grus	1		1
Common Kestrel	Falco tinnunculus	5	4	9
Common Myna	Acridotheres tristis	10		10
Common Sandpiper	Actitis hypoleucos		1	1

Common Name	Scientific Name	Power line	Wind Turbine	Total
Common Snipe	Gallinago gallinago		1	1
Crested Serpent Eagle	Spilornis cheela	1		1
Dalmation Pelican	Pelecanus crispus	2	2	4
Demoiselle Crane	Grus virgo	3		3
Dusky Craig-Martin	Ptyonoprogne concolor		2	2
Eastern Grass Owl	Tyto longimembris	2		2
Egyptian Vulture	Neophron percnopterus	10		10
Eurasian Collared Dove	Streptopedia decaocto	18		18
Eurasian Collared Dove	Streptopelia decaocto		10	10
Eurasian Griffon	Gyps fulvus	6		6
Flamingo sp	Flamingo sp	64		64
Great Egret	Ardae alba		1	1
Great Indian Bustard	Ardeotis nigriceps	9		9
Great Indian Hornbill	Buceros bicornis	1		1
Greater adjutant	Leptoptilos dubius	4		4
Greater Flamingo	Phoenicopterus roseus	98		98
Himalayan Vulture	Gyps himalayensis	50	2	52
House Crow	Corvus splendens	60	5	65
Indian Peafowl	Pavo cristatus	219		219
Indian pitta	Pitta brachyura		2	2
Indian Pond Heron	Ardeola grayii		1	1
Indian Roller	Coracias benghalensis	47		47
Indian Scops Owl	Otus bakkamoena		1	1
Lapwing sp	Vanellus sp	1		1
Lesser Flamingo	Phoeniconaias minor	51		51
Lesser Whistling Duck	Dendrocygna javanica		1	1
Lesser Whitethroat	Sylvia curruca	1		1
Little swift	Apus affinis		1	1
Long-legged Buzzard	Buteo rufinus	1		1
Motlled Wood Owl	Strix ocellata	1		1
Oriental Darter	Anhinga melanogaster	1		1
Oriental Honey Buzzard	Pernis ptilorhynchus		1	1
Osprey	Pandion haliaetus	1		1
Owl sp	Owl sp	1		1
Painted Stork	Mycteria leucocephala	3	1	4
Raptor sp	Raptor sp	2		2
Red-crested Pochard	Netta rufina		1	1
Red-rumped Swallow	Cecropis daurica		5	5
Red-wattled Lapwing	Vanellus indicus		1	1
Rock Eagle-Owl	Bubo benghalensis	6		6
Rose-ringed Parakeet	Psittacula krameri	3		3
Ruddy Shelduck	Tadoma ferruginea		1	1
Sarus Crane	Grus antigone	72		72

Common Name	Scientific Name	Power line	Wind Turbine	Total
Slaty-legged Crake	Rallina eurizonoides	1		1
Spot-billed Pelican	Pelecanus phillippensis	1		1
Spotted Owlet	Athena brama	4		4
Steppe Eagle	Aquila nipalensis	25		25
Tawny Eagle	Aquila rapax	9		9
Unitentified	Unitentified	6	10	16
Vulture sp	Vulture sp	5		5
White-backed Vulture	Gyps benghalensis	1		1
White-eyed Buzzard	Butastur teesa	4		4
White-throated kingfisher	Halcyon smyrnensis		1	1
Grand Total		830	85	915

*Identifeid to family level , ** Probably misidentified

5 SINGLE SPECIES ACTION PLAN

During the reporting period first internal review of the single speceis action plan for the Yellow-breasted Bunting was completed. As deceided earlier combined action plan is being finalised for 12 species which share similar habitats. Various threats in these habitats were listed based on the literature material and the expertise gained from the field studies conducted by BNHS. Similarly, the list of coastal and inland wetlands of India where these 12 wader species congregate was put together and the level of threats in each site was compiled. In addition to the population data for these species in each of this site also was compiled from litreature. An online meeting is secheduled in September 2021 with Indian Bird Conservation Network members, Bird watchers, Asian Waterbird Census state coordinators to gather more data on the populations of these species. In order to reach out to the birdwatchers for gathering information on the priority species a brochure has been developed (Fig 5).

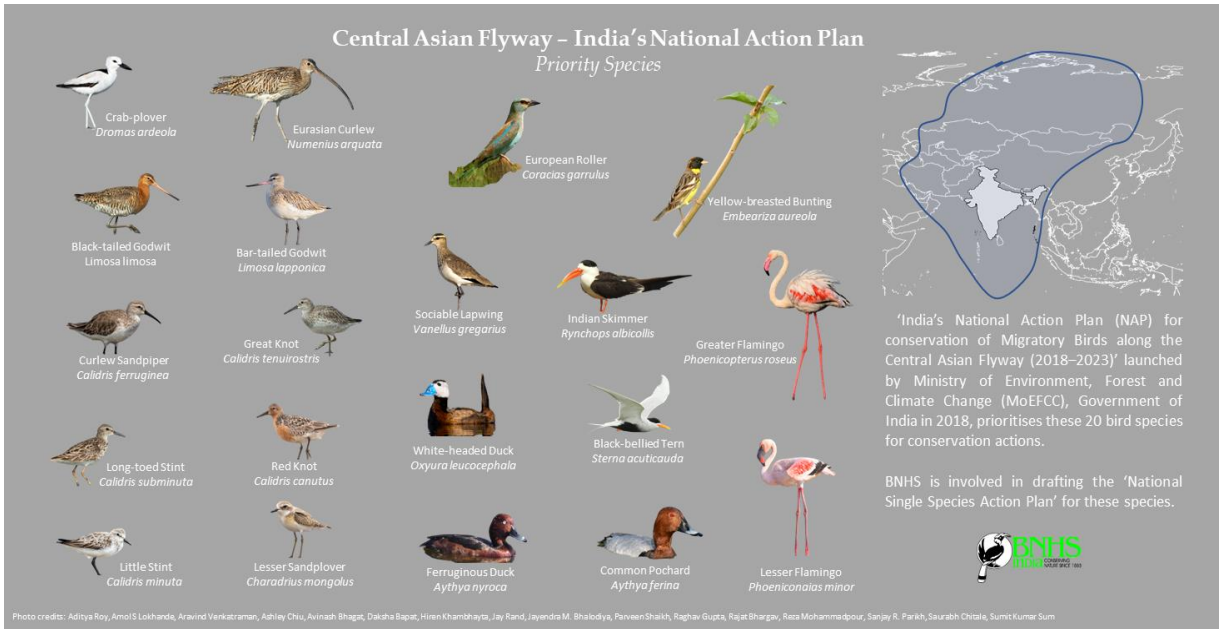

Figure 5. Design of brochure to reach out to the birdwatchers for gathering information on the priority species

6 REFERENCES

Chakraborty, R., P. Chakraborty, J. Borah & T. Mize (2014): Mammals of D'Ering Wildlife Sanctuary: A baseline survey report. WWF-India Report.

Gopi, G.V. (2010): Nesting ecology of colonial waterbirds at Bhitarkanika Mangroves, Orissa. PhD thesis, Saurashtra University.

Murugesan, M., R. Chandra, B. A. K., Prusty & P. R. Arun (2013): Avifauna of the Oussudu Lake and its environs, Puducherry, India and conservation concerns. *Bird Populations*: 12, 19-29.

Pattanaik, C., C.S. Reddy, N.K. Dhal & R. Das (2008): Utilisation of mangrove forests in Bhitarkanika Wildlife Sanctuary, Orissa.

Prusty, B. A. K., P. R., Arun, S.Bhupathy, M. Murugesan & R. Chandra (2011): Comprehensive Management Action Plan for Conservation of Oussudu Sanctuary, Puducherry. SACON Final Technical Report. 125pp.

Subramanya, S. (1996): Distribution, status and conservation of Indian heronries. *Journal of the Bombay Natural History Society 93(3)*: 459–486.

Appendix 1. List of Birds recorded in D'Ering Memorial Wildlife Sanctuary

Sl. No.	Common Bird Name	Scientific Name	IUCN Category
1	Ashy Prinia	*Prinia socialis*	LC
2	Asian Green Bee-eater	*Merops orientalis*	LC
3	Asian Pied Starling	*Sturnus contra*	LC
4	Barred Buttonquail	*Turnix suscitator*	LC
5	Baya Weaver	*Ploceus philippinus*	LC
6	Bengal Florican	*Houbaropsis bengalensis*	CR
7	Black Drongo	*Dicrurus macrocercus*	LC
8	Black Kite	*Milvus migrans*	LC
9	Black Redstart	*Phoenicurus ochruros*	LC
10	Blue-throated Barbet	*Psilopogon asiaticus*	LC
11	Cattle Egret	*Bubulcus ibis*	LC
12	Chestnut Munia	*Lonchura atricapilla*	LC
13	Chestnut-headed Bee-eater	*Merops leschenaulti*	LC
14	Chestnut-tailed Starling	*Sturnus malabaricus*	LC
15	Cinereous Vulture	*Aegypius monachus*	NT
16	Citrine Wagtail	*Motacilla citreola*	LC
17	Common Hawk-cuckoo	*Hierococcyx varius*	LC
18	Common Hoopoe	*Upupa epops*	LC
19	Common Kestrel	*Falco tinnunculus*	LC
20	Common Myna	*Acridotheres tristis*	LC
21	Common Stonechat	*Saxicola torquatus*	LC
22	Common Tailorbird	*Orthotomus sutorius*	LC
23	Eastern Spotted Dove	*Spilopelia chinensis*	LC
24	Eurasian Collared-dove	*Streptopelia decaocto*	LC
25	Eurasian Sparrowhawk	*Accipiter nisus*	LC
26	Golden-headed Cisticola	*Cisticola exilis*	LC
27	Great Cormorant	*Phalacrocorax carbo*	LC
28	Great Crested Grebe	*Podiceps cristatus*	LC
29	Greater Flameback	*Chrysocolaptes guttacristatus*	LC
30	Green-backed Heron	*Butorides striata*	LC
31	Grey Wagtail	*Motacilla cinerea*	LC
32	House Sparrow	*Passer domesticus*	LC
33	Indian Cuckoo	*Cuculus micropterus*	LC
34	Indian Short-toed Lark	*Calandrella raytal*	LC
35	Indian Thick-knee	*Burhinus indicus*	LC
36	Indochinese Roller	*Coracias affinis*	LC
37	Jerdon's Babbler	*Chrysomma altirostre*	VU
38	Large-billed Crow	*Corvus macrorhynchos*	LC
39	Lesser Coucal	*Centropus bengalensis*	LC

40	Lineated Barbet	*Psilopogon lineatus*	LC
41	Little Pratincole	*Glareola lactea*	LC
42	Oriental Darter	*Anhinga melanogaster*	LC
43	Oriental Honey-buzzard	*Pernis ptilorhynchus*	LC
44	Oriental Turtle-dove	*Streptopelia orientalis*	LC
45	Pacific Golden Plover	*Pluvialis fulva*	LC
46	Paddyfield Pipit	*Anthus rufulus*	LC
47	Pied Harrier	*Circus melanoleucos*	LC
48	Pied Kingfisher	*Ceryle rudis*	LC
49	Red Junglefowl	*Gallus gallus*	LC
50	Red-vented Bulbul	*Pycnonotus cafer*	LC
51	Red-wattled Lapwing	*Vanellus indicus*	LC
52	Red-whiskered Bulbul	*Pycnonotus jocosus*	LC
53	Rosy Pipit	*Anthus roseatus*	LC
54	Ruddy Shelduck	*Tadorna ferruginea*	LC
55	Rufous Treepie	*Dendrocitta vagabunda*	LC
56	Rufous-necked Laughingthrush	*Garrulax ruficollis*	LC
57	Shikra	*Accipiter badius*	LC
58	Slender-billed Vulture	*Gyps tenuirostris*	CR
59	Striated Babbler	*Turdoides earlei*	LC
60	Swamp Francolin	*Francolinus gularis*	VU
61	Tickell's Leaf-warbler	*Phylloscopus affinis*	LC
62	Western Koel	*Eudynamys scolopaceus*	LC
63	White-cheeked Starling	*Spodiopsar cineraceus*	LC
64	Yellow Wagtail	*Motacilla flava*	LC
65	Yellow-bellied Prinia	*Prinia flaviventris*	LC
66	Zitting Cisticola	*Cisticola juncidis*	LC

Appendix 2. Birds recorded in Nalsarovar

SI. No	Common Name	*Speceis Name*	Numbers Recorded
1	Great Crested Grebe	*Podiceps cristatus*	
2	Blacknecked Grebe	*Podiceps nigricollis*	
3	Little Grebe	*Podiceps ruficollis*	18
4	White or Rosy Pelican	*Pelecanus onocrotalus*	24
5	Spotbilled Pelican	*Pelecanusphilippensis*	
6	Dalmatian Pelica	*Pelecanuscrispus*	12
7	Large Cormorant	*Phalacrocorax carbo*	32
8	Indian Shag	*Phalacrocorax fuscicollis*	400
9	Little Cormorant	*Phalcrocorax niger*	2400
10	Darter	*Anhinga rufa*	4
11	Grey Heron	*Ardea cinerea*	22
12	Purple Heron	*Ardea purpurea*	40
13	Little Green Heron	*Butorides striatus*	
14	Pond Heron	*Ardeola grayii*	45
15	Cattle Egret	*Bubulcus ibis*	
16	Large Egret	*Ardea alba*	25
17	Intermediate Egret	*Egretta intermedia*	22
18	Little Egret	*Egretta grazetta*	45
19	Reef Heron	*Egretta gularis*	
20	Night Heron	*Nycticorax nycticorax*	20
21	Little Bittern	*Ixobrychus minutus*	1
22	Chestmut Bittern	*Ixobrychus cinnamomeus*	
23	Yellow Bittern	*Ixobrychus sinensis*	
24	Black Bittern	*Ixobrychus flavicollis*	
25	Bittern	*Botaurus stellaris*	
26	Painted Stork	*Mycteria leucocephala*	160
27	Openbill Stork	*Anastomus oscitans*	2200
28	Whitenecked Stork	*Ciconia episcopus*	10
29	White strok	*Ciconia ciconia ciconia*	
30	Black Stork	*Ciconia nigra*	
31	Balcknecked Stork	*Ephippiorhynchus asiaticus*	
32	White Ibis	*Threskiornis aethiopica*	132
33	Black Ibis	*Psendibis papillosa*	87
34	Glossy ibis	*Plegadis falcinellus*	4500
35	White Spoonbill	*Platalea leucorodia*	125
36	Greater Flamingo	*Phoenicopterus roseus*	450
37	Lesser Flamingo	*Phoenicopterus minor*	120

38	Greylag Geese	*Anser anser*	7500
39	Barheaded Geese	*Anser indicus*	120
40	Lesser Whistling Teal	*Dendrocygna javanica*	
41	Ruddy Sheduck	*Tadorna ferruginea*	42
42	Common Shelduck	*Tadorna tadorna*	
43	Pintail	*Anas acuta*	1200
44	Common Teal	*Anas crecca*	3200
45	Spot-billed Duck	*Anas poecilorhyncha*	220
46	Mallard	*Anas platyrhynchos*	
47	Gadwall	*Anas strepera*	850
48	Wigeon	*Anas penelope*	1750
49	Garganey Teal	*Anas querquedula*	2000
50	Shoveller	*Anas clypeata*	6500
51	Red crested Pochard	*Netta rufina*	
52	Common Pochard	*Aythya ferina*	45
53	White-eyed Pochard	*Aythya nyroca*	10
54	Tufted Duck	*Aythya fuligula*	22
55	Cotton Teal	*Nettapus coromandelianus*	
56	Comb Duck	*Sarkidiornis melanotus*	80
57	Common Crane	*Grus grus*	200
58	Sarus Crane	*Grus antigone*	4
59	Demoiselle Crane	*Anthropoides virgo*	5500
60	Water Rail	*Rallus aquaticus*	
61	Eastern Baillon's Crake	*Porzana pusilla*	
62	Brown Crake	*Amaurornis akool*	
63	Whitebreasted Waterhen	*Amaurornis phoenicurus*	12
64	Kora or Watercock	*Gallicrex cinerea*	
65	Indian Moorhen	*Gallinula chloropus*	60
66	Purple Moorhen	*Porphyrio porphyrio*	1100
67	Coot	*Fulica atra*	5000
68	Unidentified Rails	*Crakes and Coots*	
69	Pheasant-tailed Jacana	*Hydrophasinus chirurgus*	4
70	Bronzewinged Jacana	*Metopidius indicus*	8
71	White-tailed Lapwing	*Vanellus leucurus*	1
72	Sociable Lapwing	*Vanellus gregarius*	
73	Redwattled Lapwing	*Vanellus indicus*	35
74	Yellowwattled Lapwing	*Vanellus malabaricus*	2
75	Great Stone Plover	*Esacus recurvirostris*	
76	Grey Plover	*Phuvialis squatarola*	
77	Golden Plover	*Pluvialis dominica*	
78	Kentish Plover	*Chararius alexandrinus*	20

79	Greater Sand Plover	*Charadrius leschenaultii*	10
80	Ringed Plover	*Charadrius hiaticula*	
81	Little Ringed Plover	*Charadrius dubius*	35
82	Whimbrel	*Numenius phaeopus*	
83	Curlew	*Numenius arquata*	30
84	Blacktailed Godwit	*Limosa limosa*	300
85	Bartailed Godwit	*Limosa lapponica*	80
86	Spotted Redshank	*Tringa erythropus*	
87	Redshank	*Tringa totanus*	45
88	Green shank	*Tringa nebularia*	20
89	Marsh Sandpiper	*Tringa stagnatilis*	160
90	Green Sandpiper	*Tringa ochropus*	20
91	Wood Sandpiper	*Tringa glareola*	40
92	Terek Sandpiper	*Tringa terek*	
93	Common Sandpiper	*Tringa hypoleucos*	
94	Turnstone	*Arenaria interpres*	
95	Painted Snipe	*Rostratula benghalensis*	2
96	Common or Fantail Snipe	*Gallinago gallinago*	22
97	Jack Snipe	*Gallinago minima*	
98	Sanderling	*Calidris alba*	
99	Little Stint	*Calidris minuta*	300
100	Temminck's Stint	*Calidris temminckii*	20
101	Curlew Sandpiper	*Calidris testacea*	
102	Ruff	*Philomachus pugnax*	1000
103	Blackwinged Stilt	*Himantopus himantopus*	600
104	Avocet	*Recurvirostra avosetta*	750
105	Little Pratincole	*Glareola lactea*	
106	Oriental Pratincole	*Glareola maldivarum*	
107	Collared Pratincole	*Glareola Pretincola*	
108	Rednecked phalarope	*Phalaropuslobatus*	
109	Dunlin	*Calidris alpina*	
110	Herring Gull	*Larus argentatus*	
111	Lesser Black-backed Gull	*Larus fuscus*	
112	Great Black headed Gull	*Larus ichtyaetus*	
113	Brown-headed Gull	*Larus brunnicephalus*	4
114	Black headed Gull	*Larus ridibundus*	8
115	Slenderbilled Gull	*Larus genei*	30
116	Little Gull	*Larus minutus*	
117	Sooty Gull	*Larus hemprichii*	
118	Hueglin's Gull	*Larus Heuglini*	

119	Whiskered Tern	*Chlidonias hybrida*	30
120	White winged Black tern	*Chlidonias leucopterus*	
121	Gull-billed Tern	*Gelochelidon nilotica*	12
122	Caspian Tern	*Hydroprogne caspia*	20
123	Indian River Tern	*Sterna aurantia*	35
124	Common Tern	*Sterna hirundo*	
125	Blackbellied Tern	*Sterna acuticauda*	
126	Little Tern	*Sterna albifrons*	
127	Indian Skimmer	*Rynchops albicollis*	
128	Indian Pied Kingfisher	*Ceryle rudis leucomelanura*	10
129	Small Blue kingfisher	*Alcedo atthis pallasii*	4
130	White Brested Kingfisher	*Halcyon smyrnensis*	16
131	White Wagtail	*Motacilla alba*	
132	Large Pied Wagtail	*Motacilla maderaspatensis*	
133	Citrine Wagtail	*Motacilla citreola*	10
134	Yellow Wagtail	*Motacilla flava*	14
135	Grey Wagtail	*Motacilla cinerea*	
136	Red-throated Pipit	*Anthus cervinus*	
137	Water Pipit	*Anthus spinoletta*	
138	Greater Spotted Eagle	*Aquila clanga*	3
139	Pale Harrier	*Circus macrourus*	
140	Montagu's Harrier	*Circus pygargus*	8
141	Pied Harrier	*Circus melanoleucos*	
142	Marsh Harrier	*Circus aeruginosus*	10
143	Osprey	*Pandion haliaetus*	3

Appendix 3. Birds recorded in Bhitarkanika during the survey

Sl. No.	Common name	*Scientific name*	Migratory Satus	IUCN category	Number
1	Grey Francolin	*Francolinus pondicerianus*	Resident	LC	P
2	Red Junglefowl	*Gallus gallus*	Resident	LC	P
3	Lesser Whistling-duck	*Dendrocygna javanica*	Resident	LC	40
4	Bar-headed Goose	*Anser indicus*	Migratory-Local	LC	800
5	Ruddy Shelduck	*Tadorna ferruginea*	Migratory-Local	LC	250
6	Garganey	*Spatula querquedula*	Migratory-Long-Distance	LC	100
7	Northern Shoveler	*Spatula clypeata*	Migratory-Long-Distance	LC	600
8	Gadwall	*Mareca strepera*	Migratory-Long-Distance	LC	50
9	Eurasian Wigeon	*Mareca penelope*	Migratory-Long-Distance	LC	250
10	Northern Pintail	*Anas acuta*	Migratory-Long-Distance	LC	4000
11	Common Teal	*Anas crecca*	Migratory-Long-Distance	LC	80
12	Little Grebe	*Tachybaptus ruficollis*	Resident	LC	4
13	Pale-capped Pigeon	*Columba punicea*	Resident	VU	P
14	Oriental Turtle-dove	*Streptopelia orientalis*	Resident	LC	P
15	Eurasian Collared-dove	*Streptopelia decaocto*	Resident	LC	P
16	Eastern Spotted Dove	*Spilopelia chinensis*	Resident	LC	P
17	Asian Palm-swift	*Cypsiurus balasiensis*	Resident	LC	P
18	Little Swift	*Apus affinis*	Resident	LC	P
19	Greater Coucal	*Centropus sinensis*	Resident	LC	P
20	Western Koel	*Eudynamys scolopaceus*	Resident	LC	P
21	White-breasted Waterhen	*Amaurornis phoenicurus*	Resident	LC	P
22	Common Moorhen	*Gallinula chloropus*	Resident	LC	P
23	Lesser Adjutant	*Leptoptilos javanicus*	Resident	VU	6
24	Painted Stork	*Mycteria leucocephala*	Resident	NT	20
25	Asian Openbill	*Anastomus oscitans*	Resident	LC	60
26	Eurasian Spoonbill	*Platalea leucorodia*	Resident	LC	10
27	Black-headed Ibis	*Threskiornis melanocephalus*	Resident	NT	70
28	Indian Pond-heron	*Ardeola grayii*	Resident	LC	P
29	Cattle Egret	*Bubulcus ibis*	Resident	LC	P
30	Grey Heron	*Ardea cinerea*	Resident	LC	P
31	Purple Heron	*Ardea purpurea*	Resident	LC	P
32	Great White Egret	*Ardea alba*	Resident	LC	P
33	Intermediate Egret	*Ardea intermedia*	Resident	LC	P
34	Little Cormorant	*Microcarbo niger*	Resident	LC	10
35	Black-winged Stilt	*Himantopus himantopus*	Resident	LC	P
36	Pacific Golden Plover	*Pluvialis fulva*	Migratory-Long-Distance	LC	10
37	Little Ringed Plover	*Charadrius dubius*	Resident	LC	P
38	Lesser Sandplover	*Charadrius mongolus*	Migratory-Long-Distance	LC	100
39	Red-wattled Lapwing	*Vanellus indicus*	Resident	LC	P

Sl. No.	Common name	*Scientific name*	Migratory Satus	IUCN category	Number
40	Bronze-winged Jacana	*Metopidius indicus*	Resident	LC	P
41	Whimbrel	*Numenius phaeopus*	Migratory-Long-Distance	LC	15+
42	Eurasian Curlew	*Numenius arquata*	Migratory-Long-Distance	NT	20
43	Black-tailed Godwit	*Limosa limosa*	Migratory-Long-Distance	NT	80
44	Ruff	*Calidris pugnax*	Migratory-Long-Distance	LC	100
45	Curlew Sandpiper	*Calidris ferruginea*	Migratory-Long-Distance	NT	150
46	Temminck's Stint	*Calidris temminckii*	Migratory-Long-Distance	LC	50
47	Sanderling	*Calidris alba*	Migratory-Long-Distance	LC	P
48	Dunlin	*Calidris alpina*	Migratory-Long-Distance	LC	100
49	Little Stint	*Calidris minuta*	Migratory-Long-Distance	LC	40
50	Terek Sandpiper	*Xenus cinereus*	Migratory-Long-Distance	LC	P
51	Common Sandpiper	*Actitis hypoleucos*	Migratory-Long-Distance	LC	P
52	Green Sandpiper	*Tringa ochropus*	Migratory-Long-Distance	LC	P
53	Common Redshank	*Tringa totanus*	Migratory-Long-Distance	LC	500
54	White-bellied Sea-eagle	*Haliaeetus leucogaster*	Resident	LC	5
55	Brahminy Kite	*Haliastur indus*	Resident	LC	P
56	Indian Grey Hornbill	*Ocyceros birostris*	Resident	LC	2
57	Common Hoopoe	*Upupa epops*	Migratory-Local	LC	P
58	Indian Roller	*Coracias benghalensis*	Resident	LC	p
59	Common Kingfisher	*Alcedo atthis*	Resident	LC	P
60	Pied Kingfisher	*Ceryle rudis*	Resident	LC	P
61	Stork-billed Kingfisher	*Pelargopsis capensis*	Resident	LC	P
62	Ruddy Kingfisher	*Halcyon coromanda*	Migratory-Local	LC	P
63	White-breasted Kingfisher	*Halcyon smyrnensis*	Resident	LC	P
64	Fulvous-breasted Woodpecker	*Dendrocopos macei*	Resident	LC	P
65	Rose-ringed Parakeet	*Psittacula krameri*	Resident	LC	P
66	Indian Golden Oriole	*Oriolus kundoo*	Migratory-Local	LC	P
67	Black Drongo	*Dicrurus macrocercus*	Resident	LC	P
68	House Crow	*Corvus splendens*	Resident	LC	P
69	Large-billed Crow	*Corvus macrorhynchos*	Resident	LC	P
70	Blyth's Reed-warbler	*Acrocephalus dumetorum*	Migratory-Long-Distance	LC	P
71	Paddyfield Warbler	*Acrocephalus agricola*	Migratory-Long-Distance	LC	P
72	Red-whiskered Bulbul	*Pycnonotus jocosus*	Resident	LC	P
73	Red-vented Bulbul	*Pycnonotus cafer*	Resident	LC	P
74	Asian Pied Starling	*Gracupica contra*	Resident	LC	P
75	Orange-headed Thrush	*Geokichla citrina*	Migratory-Local	LC	P
76	Purple-rumped Sunbird	*Leptocoma zeylonica*	Resident	LC	P
77	Purple Sunbird	*Cinnyris asiaticus*	Resident	LC	P
78	Indian Silverbill	*Euodice malabarica*	Resident	LC	P
79	Tree Pipit	*Anthus trivialis*	Migratory-Local	LC	P

Sl. No.	Common name	*Scientific name*	Migratory Satus	IUCN category	Number
80	Western Yellow Wagtail	*Motacilla flava*	Migratory-Long-Distance	LC	P
81	Grey Wagtail	*Motacilla cinerea*	Migratory-Local	LC	P
82	Blue-tailed Bee-eater	*Merops philippinus*		LC	P

P- Present