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

January–March 2021

Programme supported by

Ministry of Environment, Forest & Climate Change

National Authority,
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Report submitted by

Bombay Natural History Society
Hornbill House, S.B. Singh Road
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Progress report

January to March, 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, three progress reports and one annual report have been submitted. This is the fourth progress report which covers the period from January to March, 2021.

2 STUDY PERMISSIONS FROM THE STATE GOVERNMENTS

Requisition for study permission along with necessary details was sent to Chief Wildlife Wardens of the 17 concerned states. In the case of a few states like Tamil Nadu, Madhya Pradesh and Maharashtra, the requisitions were re-sent in the prescribed format provided by the state governments. So far permissions have been received from 10 states and for four states oral permission was obtained and the final permissions yet to be received. Due to COVID-19 pandemic, many of the state forest department offices have been working with a minimum number of staff. Hence, there has been a delay in processing the permission requests. The list of states and status of study permission is given in Table 1.

Table 1. List of states with status of study permission

State	CAMPA study permission status	Existing other project permission for bird monitoring/ringing
Andhra Pradesh	Received for three years	
Odisha	Received for one year, and follow up is on for the next years	
Maharashtra	Received for three years	
Himachal Pradesh	Received for three years	
Rajasthan	Received for three years	
Jammu & Kashmir	Received for three years	
Punjab	Received for three Years	
Tamil Nadu	Received for three years	
Kerala	Received permission till March 2022.	
Sikkim	Received for one year	
Puducherry	Temporarily Provided for surveys	
Madhya Pradesh	Processed. Final approval yet to receive	
Uttar Pradesh	Processed. Final approval yet to receive	
Gujarat	Processed. Final approval yet to receive	
West Bengal	Yet to receive	
Assam	Yet to receive	
Arunachal Pradesh	Yet to receive	

3 FIELD SURVEYS

The Covid-19 restrictions were relaxed in many states during the reporting period, hence intensive field surveys were conducted during this period wherever possible. Field surveys were conducted in nine states namely Andhra Pradesh, Assam, Gujarat, Rajasthan, Maharashtra, Kerala, Odisha, Uttar Pradesh, and Puducherry (UT). Overall 38 sites were surveyed between December 2020 and March 2021 (Table 2). The field survey reports have been 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.

Table 2. State wise list of sites surveyed

S.No	State	Site type	Site Name
1	Andhra Pradesh	Major Wetland	Kolleru
2	Andhra Pradesh	Major Wetland	Pulicat
3	Andhra Pradesh	Major Wetland	Coringa
4	Andhra Pradesh	Landbird Site	Sriharikota Island
5	Assam	Wetland Cluster	Majuli Island
6	Assam	Wetland Cluster	Pani-Dihing
7	Assam	Wetland Cluster	Sibsagar Tanks
8	Gujarat	Major Wetland	Nal Sarovar Bird Sanctuary
9	Gujarat	Wetland Cluster	Khijadia
10	Gujarat	Wetland Cluster	Marine National Park and Wildlife Sanctuary
12	Gujarat	Landbird Site	Great Rann of Kachchh (Banni Grasslands &Kala Dungar)
13	Kerala	Landbird Site	Parambikulam Wildlife Sanctuary
14	Maharashtra	Major Wetland	Jaikwadi
15	Maharashtra	Major Wetland	Gangapur Dam and Grassland
16	Maharashtra	Major Wetland	Nandur-Madhmeshwar
17	Maharashtra	Wetland Cluster	Mahul Sewri Mudflats
18	Maharashtra	Wetland Cluster	Alibagh
19	Maharashtra	Wetland Cluster	Thane Creek
20	Maharashtra	Wetland Cluster	Uran
21	Odisha	Major Wetland	Chilika
22	Odisha	Major Wetland	Bhitarkanika
23	Puducherry	Wetland Cluster	Ousteri Lake
24	Puducherry	Wetland Cluster	Bahour Lake
25	Puducherry	Wetland Cluster	Kaliveli Tank
26	Rajasthan	Major Wetland	Keoladeo
27	Rajasthan	Major Wetland	Sambhar

28	Rajasthan	Wetland Cluster	Alniya Dam
29	Rajasthan	Wetland Cluster	Bardha Dam
30	Rajasthan	Wetland Cluster	RamSagar (Hindoli)
31	Rajasthan	Landbird Site	Jaisalmer (Desert National Park, Mohangarh, Pokhran)
32	Tamil Nadu	Major Wetland	Point Calimere & Great Vedaranyam Swamp
33	Tamil Nadu	Major Wetland	Gulf of Mannar Marine National Park -Adam's Bridge
34	Tamil Nadu	Major Wetland	Karaivetti Bird Sanctuary
35	Tamil Nadu	Wetland Cluster	Saltpans of Puthalam
36	Tamil Nadu	Wetland Cluster	Kovalam
37	Uttar Pradesh	Wetland Cluster	Kurra Jheel
38	Uttar Pradesh	Wetland Cluster	Saman

4 ANDHRA PRADESH

4.1 Pulicat Wildlife Sanctuary

Survey was carried out from February 27 to March 01, 2021. The areas covered during the survey was Tada, Sulurpeta-Sriharikota road, Venadu, Pernadu, and Mijuru. The satellite wetlands such as Kudiri tank and Nelapattu Bird Sanctuary were also covered. Surveys were conducted by following the general protocol prepared for the project. Birds encountered were counted, and habitat parameters such vegetation cover, presence of invasive were noted.

4.1.1 Site description

Pulicat lake is located in Nellore district of Andhra Pradesh (13º 40′ 00″ N; 80º 11′ 00″ E). The lake is 10 km from Sullurpet Railway Station by road, and 50 km from Chennai on the Chennai-Kolkata National Highway (NH5).

Pulicat lake is an extensive brackish to saline lagoon. It has two openings to connect to the sea: in general, sea water enters the lagoon through a channel at the northern end of Sriharikota Island, and flows back into the Bay of Bengal through a channel at the southern end. The backwaters attract large congregations of Greater Flamingo *Phoenicopterus roseus* and Lesser Flamingo *Phoeniconaias minor*, Grey Pelican *Pelecanus philippensis*, Painted Stork *Mycteria leucocephala*, Grey Heron *Ardea cinerea*, and species of ducks, terns, gulls, and waders. Pulicat is the third most important coastal wetland for migratory shorebirds located in the eastern board of India. Pulicat was declared as a Wildlife Sanctuary in 1976.

Pulicat lake is rich in biodiversity with about 500 species of macro fauna (Sanjeeva Raj 2006). Over 80 to 100 thousand waterbirds belonging to 80 different species, mostly migrants, use the lake during winter. About 50,000 traditional fisherfolk live in 65 villages all around the lake and another 50,000 Dalits live in about 45 hamlets on the mudflats within the northern region of the lake and its surrounding. They all live by fishing on the lake, mining molluscan shells around the Venadu and Irakkam islands, salt extraction near Tada, charcoal burning, livestock and farming in the north (Sanjeeva Raj *et al*. 2009).

Sriharikota Island, well-protected as it is the satellite launching station of the Indian Space Research Organisation (ISRO), has remnants of Tropical Dry Evergreen Forest of considerable botanical interest (Suryanarayana *et al*. 1989, 1998). On the other islands in the lake, where protection is negligible, the exotic *Prosopis chilensis* has invaded many areas (Scott 1989). In

the elevated mudflats, succulent halophytes such as *Anthrocnemum indicus, Sesuvium portulacastrum, Salicornia brachiata, Suaeda maritima, S. monoica*, and *S. nudiflora* occur. Submerged macrophytes include species of *Enteromorpha, Hypnea, Ulva, Halophila,* and *Enhalus* (Oswin 1987).

Islam and Rahmani (2008) recommended Pulicat Lake as a Ramsar Site as it qualifies for Ramsar Criteria 2 (wetland supports threatened ecological communities), Criteria 5 (wetland regularly supports 20,000 or more waterbirds), and Criteria 6 (wetland regularly supports 1% of the individuals in a population of one species or subspecies).

4.1.2 Habitat /Vegetation

Fifty-three species of phytoplanktons and 29 species of zooplanktons were reported by Chacko *et al*. (1953). Gradually, it has been declining due to chemical production from the south, while plankton in Pulicat Lake may be just half that of the species reported earlier (Basha *et al*. 2012). Aquatic macroflora of this lake was described by Chacko *et al*. (1953). Macrophytes like *Halophila ovalis* popularly called sea grass and *Syringodium isoetifolium* are more common in the central zone, around the Kuuvithittu mudflat.

A total of 180 plant species were found in the wetland, of which 117 species were dicotyledonous, 51 species were of monocotyledonous plants and 12 are of mangroves (Rajyalakshmi and Basha 2016).

The Pulicat Lake has several islands. Of which the larger islands are the Sriharikota, Venadu, Irrakam and Peranadu. The islands have a significant forest type called as Southern Tropical Dry Evergreen Forest (TDEF). Sriharikota Island has large tract of TDEF, it is sparse in Venadu, and Pernadu has a small patch thick TDEF growth. *Prosopis julifolora* invasion is severe in the edges of the islands. Almost all the small islets found in the sanctuary are completely covered with *P. juliflora* thickets. Edges of the sanctuary in all the survey areas are with luxuriant growth of this invasive species.

Mangroves were found near Kallur village, Chinamangalu village, Kuruvitthitu Island, Arambakum village, Varagali village. Four species of mangroves belonging to four families are prominent here. They include *Aegiceras corniculatus* (Myrsiraceae), *Avicennia marina*

(Aviceiniaceae), *Excoecaria agallocha* (Euphorbiaceae), and *Lumintzera racemosa* (Combretaceae). At present mangrove plants of *Avicinia* species are sparsely distributed in Pulicat Lake. (Saraswathy and Pandian 2016).

4.1.3 Water sources for the wetland

Pulicat Lake receives freshwater through three major rivers, namely, Swarnamukhi, Kalangi, and Arani.

4.1.4 Ownership

Forest Department, Andhra Pradesh.

4.1.5 Management issues

Conservation measures suggested from field survey and based on litreature survey (Saraswathy and Pandian 2016)

- Silt should be removed periodically, without the loss of molluscans and submerged weeds. The submerged weeds are habitats for micro-fauna and rejuvenators of the oxygen level in lake area, as well as serve as food for a variety of aquatic organisms.
- Groynes, stone wall, heaps of stones or tidal inlet walls should be constructed to prevent closure of sea mouth, followed by sand removal for ensuring the brackish water regime which is necessary for survival of migratory birds, aquatic fauna and lives of fisherman.
- Mitigation measures should be carried out by constructing parallel jetties on both sides of the inlets of Ennore Creek and Pulicat Lake to keep the inlet alive.
- Earthen road between Sullurpet and Sriharikota Island should be converted into a concrete bridge with vast space for free flow of water instead of cement pipes along 9.5 km length to prevent quick drying in the southern half of shallow water regimen.
- The silt should be detached from catchment areas of Swarnamukhi, and from other rivers that deposit silt into the lagoon. The siltation of lagoon has caused the reduction of its original depth and consequently affected its ecology.
- Silt yield reduction should be implemented in the catchment area by taking measures for various soil and water conservation, in order to regulate the drainage outlets from the agricultural areas around the lagoon. This includes their treatment and periodical dredging of the silted-up areas.
- Strict measures should be taken not to disturb natural dune and beach deposits

- Maintenance and enhancement of the diversity and distinctive nature of flora and fauna population in Pulicat Sanctuary should be done.
- Studies should be done on the habits and needs of the winter visitors especially flamingos, pintails, garganeys, Caspian terns, avocets and other species so as to provide them suitable habitats.
- Maintenance of shallow water regime should be done near Rayadoruvu, Attakanithippa, and Venadu with optimum salinity of brackish water regime during monsoon and also during the post-monsoon period up to April.
- Water storing pits of 100x100 feet with 1.5 feet depth should be installed near Attakanithippa on either side of 9.5 km road bridge where a few fishes survive during the post-monsoon period (January to April) to act as food for painted storks and pelicans.
- The status of forests and favourable conditions for the main occupation of the people especially for fishing and agriculture should be monitored.
- The periodical phenomenon of birds in relation to weather conditions should be examined.
- Mangroves should be planted at the littoral area of the islands and sand bar edges instead of Casuarina, to provide nutrition to aquatic fauna as it acts as food for plankton which in turn act as food for fishes, shrimps in food chains.
- Mangroves should be planted on the islands at the littoral region of lake.
- Aquaculture farm effluent release into Buckingham canal which ultimately reaches Pulicat lake in Nellore district should be restricted.
- Impart awareness of responsible fishing.
- Promotion of ecotourism should be done to benefit the local community.

4.1.6 Threats to the habitat and birds

The following are the major threats for habitat and birds in Pulicat lake,

- Fishing activities
- Illegal prawn farming
- Industrial development on the shores of the lagoon (thermal power plant, port, petrochemical complex)
- Siltation (In lake and sea mouth closure)
- *Prosopis juliflora* invasion was found in all the islands and edges of the lake

Prosopis juliflora growth found on edges of Pulicat

The Kattupalli port expansion plan in the vicinity of Pulicat lake has gained lot of attention due to strong protest from villagers and fishermen community.

4.1.7 Account on avifauna

A total of 12,119 waterbirds of 40 species were recorded in Pulicat during the survey. Northern Shoveler *Spatula clypeata*, Northern Pintail *Anas acuta* and Greater Flamingos *Phoenicopterus roseus* were the most abundant birds. Among the 40 species recorded, 16 are migratory species, two species of resident waterbirds with migratory population and others are residents. Four species are listed under Near Threatened category of IUCN (Table 3.).

A total of 1,095 individuals of 24 waterbird species were recorded in Kudiri tank (Table 4). Seventeen species of waterbirds were recorded in Nelapattu Bird Sanctuary during our visit on March 01, 2021. Of these, six species were recorded to breed in this wetland. Total number of birds counted was 4,847 (Table 5). Our observations revealed that most of the birds that breed in Nelapattu visit Pulicat to feed and other purposes.

View of heronry in Nelapattu Bird Sanctuary

Table 3: Details of birds recorded in Pulicat between February 27 and March 01, 2021

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Number
1	White-breasted Kingfisher	*Halcyon smyrnensis*	Alcedinidae	R	LC	4
2	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	R	LC	1
3	Northern Pintail	*Anas acuta*	Anatidae	M	LC	2700
4	Northern Shoveler	*Spatula clypeata*	Anatidae	M	LC	2500
5	Garganey	*Spatula querquedula*	Anatidae	M	LC	300
6	Grey Heron	*Ardea cinerea*	Ardeidae	R	LC	41
7	Indian Pond-heron	*Ardeola grayii*	Ardeidae	R	LC	89
8	Little Egret	*Egretta garzetta*	Ardeidae	R	LC	336
9	Great White Egret	*Ardea alba*	Ardeidae	R	LC	31
10	Intermediate Egret	*Ardea intermedia*	Ardeidae	R	LC	30
11	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	100
12	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	1
13	Cinnamon Bittern	*Ixobrychus cinnamomeus*	Ardeidae	R	LC	1
14	Little Ringed Plover	*Charadrius dubius*	Charadriidae	R	LC	43
15	Grey Plover	*Pluvialis squatarola*	Charadriidae	M	LC	152
16	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	R	LC	10
17	Painted Stork	*Mycteria leucocephala*	Ciconiidae	R	NT	25

18	Asian Openbill	*Anastomus oscitans*	Ciconiidae	R	LC	10
19	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	R	LC	40
20	Caspian Tern	*Hydroprogne caspia*	Laridae	M	LC	1
21	Whiskered Tern	*Chlidonias hybrida*	Laridae	M	LC	26
22	Common Gull-billed Tern	*Gelochelidon nilotica*	Laridae	M	LC	4
23	Brown-headed Gull	*Larus brunnicephalus*	Laridae	M	LC	400
24	Spot-billed Pelican	*Pelecanus philippensis*	Pelecanidae	R	NT	92
25	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	R	LC	74
26	Greater Flamingo	*Phoenicopterus roseus*	Phoenicopteridae	R & M	LC	2650
27	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	20
28	Purple Swamphen	*Porphyrio porphyrio*	Rallidae	R	LC	50
29	Common Coot	*Fulica atra*	Rallidae	R & M	LC	2
30	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	R	LC	52
31	Little Stint	*Calidris minuta*	Scolopacidae	M	LC	1375
32	Common Greenshank	*Tringa nebularia*	Scolopacidae	M	LC	156
33	Common Redshank	*Tringa totanus*	Scolopacidae	M	LC	48
34	Wood Sandpiper	*Tringa glareola*	Scolopacidae	M	LC	14
35	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	M	LC	2
36	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	M	LC	20
37	Ruff	*Calidris pugnax*	Scolopacidae	M	LC	150
38	Black-tailed Godwit	*Limosa limosa*	Scolopacidae	M	NT	500
39	Eurasian Spoonbll	*Platalea leucorodia*	Threskiornithidae	R	LC	50
40	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	R	NT	19
	Total					**12,119**

Note: R- Resident; R & M – Resident with migratory population; M – Migratory; LC – Least Concern; NT – Near Threatened

Table 4: Details of birds recorded in Kudiri Tank in February 2021

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN	Number
1	Western Marsh-harrier	*Circus aeruginosus*	Accipitridae	Migratory	LC	1
2	Clamorous Reed-warbler	*Acrocephalus stentoreus*	Acrocephalidae	R & M	LC	1
3	Northern Pintail	*Anas acuta*	Anatidae	M	LC	10
4	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	R	LC	2
5	Garganey	*Spatula querquedula*	Anatidae	M	LC	86
6	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	3
7	Indian Pond-heron	*Ardeola grayii*	Ardeidae	R	LC	15
8	Grey Heron	*Ardea cinerea*	Ardeidae	R	LC	2
9	Great White Egret	*Ardea alba*	Ardeidae	R	LC	3
10	Intermediate Egret	*Ardea intermedia*	Ardeidae	R & M	LC	1
11	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	1
12	Little Egret	*Egretta garzetta*	Ardeidae	R	LC	8
13	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	R	LC	6
14	Asian Openbill	*Anastomus oscitans*	Ciconiidae	R	LC	100
15	Painted Stork	*Mycteria leucocephala*	Ciconiidae	R	NT	4
16	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	R	LC	100
17	Whiskered Tern	*Chlidonias hybrida*	Laridae	M	LC	6
18	Spot-billed Pelican	*Pelecanus philippensis*	Pelecanidae	M	NT	10
19	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	R	LC	12
20	Grey-headed Swamphen	*Porphyrio porphyrio*	Rallidae	R	LC	42
21	Common Coot	*Fulica atra*	Rallidae	R & M	LC	42
22	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	R	LC	20
23	Black-tailed Godwit	*Limosa limosa*	Scolopacidae	M	NT	120
24	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	R & M	LC	500
	Total					**1,095**

Note: R- Resident; R & M – Resident with migratory population; M – Migratory; LC – Least Concern; NT – Near Threatened

Table 5: Details of birds recorded in Nelapattu Bird Sanctuary on March 01, 2021

Sl. No	Common Name	Scientific Name	Family	Migratory status	IUCN Status	Number	Remarks
1	Little Egret	*Egretta garzetta*	Ardeidae	R	LC	50	-
2	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	31	-
3	Indian Pond-heron	*Ardeola grayii*	Ardeidae	R	LC	30	-
4	Black-crowned Night-heron	*Nycticorax nycticorax*	Ardeidae	R & M	LC	200	-
5	Grey Heron	*Ardea cinerea*	Ardeidae	R	LC	1	-
6	Asian Openbill	*Anastomus oscitans*	Ciconiidae	R	LC	1000	Breeding noted
7	Spot-billed Pelican	*Pelecanus philippensis*	Pelecanidae	M	NT	2000	Breeding noted
8	Indian Shag	*Phalacrocorax fuscicollis*	Phalacrocoracidae	R	LC	600	Breeding noted
9	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	R	LC	400	Breeding noted
10	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	R & M	LC	2	
11	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	30	
12	Common Coot	*Fulica atra*	Rallidae	R & M	LC	20	
13	Common Moorhen	*Gallinula chloropus*	Rallidae	R	LC	30	
14	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	R	LC	2	
15	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	R	LC	1	
16	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	R	LC	50	Breeding noted
17	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	R	NT	400	Breeding noted
	Total					**4,847**	

Note: R- Resident; R & M – Resident with migratory population; M – Migratory; LC – Least Concern; NT – Near Threatened

4.2 Coringa Wildlife Sanctuary

4.2.1 Site description

Coringa Wildlife Sanctuary, named after a tiny village Korangi, is located 20 km (15º 17′ N; 76º 26′E) south of the port city, Kakinada; on the Kakinada-Yanam State Highway, nestled on the deltaic branches of Gouthami and Godavari rivers at Kakinada Bay. It is the second largest surviving stretch of mangrove forests in India with 35 species that belong to 24 families (Madhu 2013). At its widest portion, the area is in east-west direction with a length of 30 km in the north-south direction. Approximately 50% of the area is backwaters in the northern half which includes a stretch of sand bar of 20 km in length, running in the north-south direction.

Two rivers namely Coringa and Gaderu and their deltaic branches cris cross the entire region, which along with other water channels draining in them or directly into the sea, from an area of about 332.7 sq. km of marsh vegetation. In addition to these major channels, a lot of creeks emanate to cris cross the entire marsh, thus ensuring water supply to the interior areas during high tides, which recede by draining at ebb tide. The maudflats in this region get submerged under 5 m of water during monsoon. A total of 235.70 sq. km of Godavari Mangroves was notified as a Wildlife Sanctuary by the Government of Andhra Pradesh vide G.O.Ms.No:484, Forest and Rural Development (For.III) Department dated 5-7-1978 and was declared as a Sanctuary by the Government of India in 1998.

The mangroves are subjected to a specific hydrologic regime chiefly by the important role played by the river floods whereas the marine influence is reduced simultaneously. The period of high floodwater corresponds to the monsoon (July–September) when it rains in the Western Ghats where the Godavari River takes its source. The high pluviometry of cyclonic origin, which hits the coast in October and November, brings to these regions torrential rains exceeding 200 mm in a few hours. During this five-month period, freshwater covers the halophytic formations. The average salinity of the waters is thus feeble (at this time of the year 4.6%) and average temperature relatively low (31.9 ºC). On the other hand, in hot season (April–June; average temperature 36.1ºC). The mean monthly air temperature at Kakinada varied between 19.7 ºC and 38.4 ºC and the total rainfall is 2,400 mm, most of which (71%) occurs during May–October.

The dominant fauna of Coringa Wildlife Sanctuary are Indian Smooth-coated Otter *Lutra perspicillata* and Fishing Cat *Felis viverrinus*. Besides these, Jackal *Canis aureus* and sea turtles are also commonly seen. The sanctuary has rich avifauna and marine biodiversity.

4.2.2 Habitat /Vegetation:

Vegetation is basically of mangrove type. In Coringa, in all 36 pant species were recorded. Of them, 16 are true mangroves, 18 are mangrove associates and two are sea grass species. Major flora of the sanctuary are *Aegiceras corniculatum, Avicennia alba, Avicennia marina, Avicennia officinalis, Bruguiera gymnorrhiza, Ceriops decandra, Lumnitzera racemosa, Rhizophora apiculata, Scyphiphora hydrophyllacea, Sonneratia apetala, Sonneretia caseolaris, Xylocarpus granatum, Acanthus ilicifolius, Barringtonia acutangula,*

Clerodendrum inerme, *Dalbergia horrida*, *Derris trifoliata*, *Hibiscus tiliaceus*, *Ipomoea violacea*, *Salvadora persica*, *Cressa cretica*, *Sesuvium portulacastrum*, and *Suaeda maritima*. Interestingly, *Hibiscus tiliaceus*, a malvaceous shrub is found nowhere except in this locality as an element of mangroves (Venkanna 1991). Along the creeks *Avicennia* spp. and *Barringtonia acutangula* are found densely growing. Over exploitation of mangroves since last five decades has resulted in extensive damage to the overall habitat of this area, thus providing a large extent of mudflats.

Satyanarayana *et al*. (2002) carried out detailed mangrove floristic and zonation pattern in Coringa. They have also given tree density that varied between 47 and 1,731 stems/0.1 ha and basal area 0.1 and 10.9 m^2/0.01 ha. Their research also found that tidal elevation and ambient salinity appeared important in determining the observed zonation.

4.2.3 Management issues:

Habitat destruction, excessive harvesting and resource consumption, pollutants from industry, aquaculture, and urban wastes, port and its expansion activities and aquaculture are considered as major threats.

4.2.4 Potential future threats

Notable among the potential future threats to the Coringa Wildlife Sanctuary is tourism development and climate change. At present, tourism is not placing significant pressures, but it has the potential to do so. The clearing of mangrove forests for tourism developments is a major factor behind mangrove loss around the world. For example, mangrove forests and sea grass meadows have been removed to create open beaches, and nesting sites for endangered marine turtles have been destroyed and disturbed by large numbers of tourists on the beaches. The annual revenue from the tourists to the CWLS used to be less than ₹1,000 till 2011. The sanctuary has seen a metamorphosis in the last one decade on the tourist turnout front. Media glare coupled with the installation of basic amenities has been attracting a good number of visitors every year, and the CWLS earned about ₹40 lakh from the entry fare in 2020 (The Hindu 2020). Developmental activities in and around the Hope Island is also highlighted as a major threat for the biodiversity of the region.

Climate change, particularly sea level rise and change in salinity too poses a threat to mangroves as described earlier in this document under the section on Climate Change Context.

Finally, the rapidly growing urban agglomerations in Kakinada, also pose the issue of generation of large quantity of waste and sewage that may ultimately find their way into the Godavari Estuary in the business-as-usual scenario and escalate the degradation of the mangrove ecosystem.

4.2.5 Other Threats

From construction of the Polavaram irrigation project to the rapid industrialisation along the Kakinada coasts, the flora and fauna have been facing many challenges. Water flowing in the creeks of the mangrove is a perfect mix of the outcomes of the Godavari and the Bay of Bengal. Any change in this balance may alter the water quality, which in turn is going to have a cascading effect on the flora and fauna. The prime concern from the environmentalists is the possible reduction in the share of water from the Godavari flown to the CWLS once Polavaram project is built. Unless the irrigation officials consider this factor and maintain the discharge levels, there is every chance of the waters getting saline.

4.2.6 Account on avifauna

Overall, 272 bird species of 64 families have been reported from Coringa (Rao *et al*. 2004; Sathiyaselvam and Sreedhar 2014). Of these, 29 species are listed in IUCN red data book. Sathiyaselvam and Sreedhar (2014) has provided list of waterbirds whose numbers exceed 1% of the biogeographical threshold in EGREE.

Coringa Wildlife Sanctuary is the second largest mangrove forest in the East Coast of India after Sundarban. It is providing shelter for 272 bird species in which 107 species are migratory. Kakinada bay located within the sanctuary and tidal mudflats in and around the sanctuary supports large congregations of water birds. It is one of the non-breeding and stop over sites for migratory waterbirds along the east coast of India. Regular waterbird surveys were conducted in Coringa and adjoining areas from 2012 to 2021.

The bird number varied over years and highest number of 43,718 was counted in 2017. A total of 105 species was recorded during the Asian Waterbird Census Programme carried out by the Forest Department of Andhra Pradesh from January 05–07, 2021 (Appendix 1). Later, the BNHS team carried out survey during February 03–11, 2021 and counted a total 7,420 waterbirds and 59 different species (Table 6). The Black-tailed Godwits *Limosa limosa* and Black-winged stilts *Himantopus himantopus* were the most abundant and recorded over 1,000 birds each during this latest survey.

The first record of Endangered Great Knot *Calidris tenuirostris* was in 2016, numbering 25 birds in tidal mudflats of Kakinada. The number shown increase in following years (Appendix 1). Another Endangered species, Indian Skimmer *Rhynchops albicollis* was reported for the first time in 2013 and has become a regular visitor during winter to the sanctuary for past seven years and their number has reached close to 270.

Table 6:List of birds recorded during our survey in February 2021 in Coringa Wildlife Sanctuary

Sl. No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total
1	Black Kite	*Milvus migrans*	Accipitridae	R	LC	**1**
2	White-breasted Kingfisher	*Halcyon smyrnensis*	Alcedinidae	R	LC	**23**
3	Black-capped Kingfisher	*Halcyon pileata*	Alcedinidae	R	LC	**4**
4	Small-blue kingfisher	*Alcedo atthis*	Alcedinidae	R	LC	**9**
5	Ruddy Shelduck	*Tadorna ferruginea*	Anatidae	R & M	LC	**14**
6	Garganey	*Spatula querquedula*	Anatidae	M	LC	**45**
7	Northern pintail	*Anas acuta*	Anatidae	M	LC	**6**
8	Northern Shoveller	*Spatula clypeata*	Anatidae	M	LC	**16**
9	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	R	LC	**1**
10	Oriental Darter	*Anhinga melanogaster*	Anhingidae	R	NT	**2**
11	Little Egret	*Egretta garzetta*	Ardeidae	R	LC	**322**
12	Grey Heron	*Ardea cinerea*	Ardeidae	R	LC	**40**
13	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	**2**
14	Large Egret	*Egretta garzetta*	Ardeidae	R	LC	**122**
15	Intermediate Egret	*Ardea intermedia*	Ardeidae	R	LC	**1**
16	Western Reef egret	*Egretta gularis*	Ardeidae	R	LC	**58**
17	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	**100**
18	Indian Pond-Heron	*Ardeola grayii*	Ardeidae	R	LC	**161**
19	Black-crowned Night-Heron	*Nycticorax nycticorax*	Ardeidae	R	LC	**2**
20	Yellow Bittern	*Ixobrychus sinensis*	Ardeidae	R	LC	**3**
21	Black Bittern	*Ixobrychus flavicollis*	Ardeidae	R	LC	**1**

Sl. No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total
22	Striated Heron	*Butorides striata*	Ardeidae	R	LC	**6**
23	Pacific Golden-Plover	*Pluvialis fulva*	Charadriidae	M	LC	**881**
24	Grey Plover	*Pluvialis squatarola*	Charadriidae	M	LC	**8**
25	Little Ringed Plover	*Charadrius dubius*	Charadriidae	R	LC	**10**
26	Lesser Sand Plover	*Charadrius mongolus*	Charadriidae	M	LC	**681**
27	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	R	LC	**2**
28	Painted Stork	*Mycteria leucocephala*	Ciconiidae	R	NT	**43**
29	Asian Openbill	*Anastomus oscitans*	Ciconiidae	R	LC	**520**
30	Small Pratincole	*Glareola lactea*	Glareolidae	R	LC	**36**
31	Eurasian Oystercatcher	*Haematopus ostralegus*	Haematopodidae	M	NT	**5**
32	Barn Swallow	*Hirundo rustica*	Hirundinidae	M	LC	**3**
33	Red-rumped Swallow	*Cecropis daurica*	Hirundinidae	R	LC	**12**
34	Brown-headed Gull	*Larus brunnicephalus*	Laridae	M	LC	**142**
35	Pallas's Gull	*Larus ichthyaetus*	Laridae	M	LC	**430**
36	Whiskered Tern	*Chlidonias hybrida*	Laridae	M	LC	**139**
37	Lesser Crested Tern	*Thalasseus bengalensis*	Laridae	M	LC	**8**
38	Caspian Tern	*Hydroprogne caspia*	Laridae	M	LC	**210**
39	Indian Skimmer	*Rynchops albicollis*	Laridae	LM	EN	**120**
40	Osprey	*Pandion haliaetus*	Pandionidae	M	LC	**2**
41	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	R	LC	**123**
42	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	**8**
43	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	R	LC	**2**
44	Purple Swamphen	*Porphyrio porphyria*	Rallidae	R	LC	**2**
45	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	R	LC	**1245**
46	Common Snipe	*Gallinago gallinago*	Scolopacidae	M	LC	**1**
47	Black-tailed Godwit	*Limosa limosa*	Scolopacidae	M	NT	**1251**
48	Whimbrel	*Numenius phaeopus*	Scolopacidae	M	LC	**96**

Sl. No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total
49	Eurasian Curlew	*Numenius arquata*	Scolopacidae	M	NT	**14**
50	Common Redshank	*Tringa totanus*	Scolopacidae	M	LC	**86**
51	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	M	LC	**28**
52	Common Greenshank	*Tringa nebularia*	Scolopacidae	M	LC	**78**
53	Ruddy Turnstone	*Arenaria interpres*	Scolopacidae	M	LC	**16**
54	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	M	LC	**1**
55	Curlew Sandpiper	*Calidris ferruginea*	Scolopacidae	M	LC	**76**
56	Little Stint	*Calidris minuta*	Scolopacidae	M	LC	**128**
57	Ruff	*Calidris pugnax*	Scolopacidae	M	LC	**44**
58	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	R	NT	**32**
	Total					**7.420**

Note: R- Resident; LM-Local Migrant ; M – Migratory; LC – Least Concern; NT – Near Threatened

4.3 Kolleru Wildlife Sanctuary

4.3.1 Site description

Kolleru (16º 30′–16º 45′ N; 81º 05′-81º 20′ E) is one of the Asia's largest freshwater lakes, spreading over an area of 90,100 ha and located between the Godavari and Krishna river basins of Andhra Pradesh, is rich in biodiversity and supports livelihoods of large population living in and around. The lake serves as a natural flood-balancing reservoir catchment area between these two mighty rivers. The lake receives water from seasonal Budumeru, Tamilleru, Ramileru, Gunderu rivers and over 67 inflowing drains and channels. It has also been serving as the habitat for various resident and migratory birds besides sustaining fishing, agriculture and related occupations of the people dependent on it for livelihood. Apart from Forest Department, other government departments such as Irrigation, agriculture, fisheries, Public Work Department and Revenue Department also have activities in the lake area.

Kolleru, being located in the Central Asian Flyway of migratory birds, is an ideal wintering as well as transits ground for migratory birds. The Wetland of 900 sq. km area provides heterogenous habitats for numerous migratory waterbirds, many of which use this wetland as a stopover during their migration. As a result, 308.55 sq. km area was delared as Wildlife Sanctuary on October 04, 1999, by the Government of Andhra Pradesh under the Wildlife (Protection) Act, 1972. This bird sanctuary was created to protect the bird diversity in the area

and also conserve the ecosystem functions as one of the most important wetlands in the landscape.

The Kolleru is easily accessible from Vijayawada. This is around 60 km away and the nearest place with airport, rail and bus links. Eluru, located around 50 km away from Vijayawada is also an important town to reach Kolleru. Eluru is well-connected by bus and rail and Kolleru Wildlife Sanctuary is about 15 km away.

4.3.2 Habitat /Vegetation:

The lake supports huge variety of both aquatic and terrestrial vegetation. The common tree species of the area includes *Borassus flabellifer*, *Acacia nilotica*, and *Azadiracta indica*. The shrubs and herbs are of typical coastal vegetation. The entire vegetation of this area can be classified into Aquatic or wetland vegetation and Terrestrial vegetation. The lake is covered by littoral vegetation, predominantly of hydrophytes. The natural vegetation of the lake comprises emergent, floating and submerged plant species distributed almost throughout the lake and form associations of different species. Their distribution is essentially related to water regimes. The rooted floating-leaf types commonly found in the wildlife sanctuary area are: *Nymphaea stellata*, *Nelumbium speciosum*, *Nymphoides indicum*, *Ipomoea aquatica*, *Neptunia oleracea*, *Ludwigia adscendens*, *Pseudoraphis spinosus*, and *Echinochloa colonum*. Overall it has been reported that among the aquatic communities submerged and the free floating macrophytes are less productive compared to other plant communities in spite of their prolific growth and spread in the aquatic systems, as they contain very little dry matter. Very few studies have been carried out on flora of the lake. Rao and Vijayalakshmi (2017) studied diversity, frequencies, relative frequency, abundance, relative abundance of some common herbaceous species.

4.3.3 Management issues

Water diversion, heavy use of chemical fertilizers and pesticides, habitat destruction in catchment areas; interventions in the only outlet, i.e. Upputeru, intensified aquaculture practices, lack of boundary marking, pollution, agricultural run off, solid waste dumping, weed infestation are the major conservation issues in Kolleru Wildlife Sanctuary.

4.3.4 Account on avifauna

Through literature survey, it is found that over 270 bird species have been reported from Kolleru. Of these, 26 species are listed in IUCN red data book. We could receive results of Asian Waterbird Count (AWC) carried out by the Forest Department in 2020. A total of 1,02,633 birds were recorded during this count. The major migratory species recorded were

ducks, Black-tailed Godwit *Limosa limosa*, Marsh Sandpiper *Tringa stagnatilis*, Common Greenshank *Tringa nebularia*, Wood Sandpiper *Tringa glareola*, Little Stint *Calidris minuta*, and Whiskered Tern *Chlidonias hybrida*.

The BNHS team has carried out bird surveys in March 2020 and February 2021 in Kolleru. A total of 1,24,776 and 21,123 waterbirds were recorded during these surveys respectively. As mentioned above, ducks, waders and terns dominated among the migrants during these surveys also (Appendix 2). Overall, 87 water and water-dependent bird species were recorded in AWC and during our surveys. Among these, 40 birds are migratory and four are resident with having migratory populations (Appendix 2).

5 PUDUCHERRY

The sites in Puducherry, i.e. Bahour, Kaliveli, and Ousteri were surveyed to gather information on bird population and habitat details on February 18 and 19, 2021. The findings are given below,

5.1 Bahour

5.1.1 Site description

Bahour lake (12° 02′ 07"/ N and 79° 51′ 19" E) is the second largest wetland in Puducherry. It is located near Bahour village, *c*. 20 km from Puducherry city, north of the Pennaiyar river. The lake spreads over for an area of 618 ha. It is a seasonal freshwater wetland that receives water during the monsoon between September and March. The lake is dry for about five months. The annual rainfall is 1,225 mm and temperature ranges from 28 ºC to 39 ºC.

Bahour Lake is getting water during north-east monsoon and may reach >1 m depth towards the year end and dries up almost completely between May and September leaving only a narrow channel along its boundaries. The water depth and duration of dry months depends on the duration and strength of consecutive northeast monsoons. While drying up, the lake transforms itself into a variety of swampy, marshy and grassland habitats that support abundant waterfowl populations. There are paddyfields on either side of the lake and its Puducherry side is less inhabited. The bund along this side is lined with large trees soon giving way to Palmyra Palms.

As this is a wetland surrounded by agricultural fields and human habitation, no mammal or reptile of conservation concern is found here. However, the abundance of plant species like *Cadaba fruticosa, Maerua* sp., *Capparis zeylanica, Azima tetracantha*, and *Tragia involucrata* along the lake margin has resulted in high diversity and abundance of certain butterflies like Plain Orange-Tip, White Orange-Tip, Yellow Orange-Tip, Crimson Tip, Small Salmon Arab, and Angled Castor which are rare elsewhere in Puducherry. Bahour has been recognised as one of the Important Bird Areas (IBA) of India under A4i (≥1% of biogeographical population), A4iii (≥20,000 waterbirds) IBA categories.

5.1.2 Habitat /Vegetation

The wetland is surrounded by human habitation and croplands. The waterbody has about 30% open water and rest of the area was covered with floating and emergent vegetation (mainly by lily – 40% and *Eichornia* – 30%). The periphery of the wetland is dominated with native tree

species such as *Borassus flabellifer*, *Azadirachta indica*, *Tamarindus indica*, and *Pithecellobium dulce.* Apart from these, exotic tree species such as *Peltophorum pterocarpum* and *Delonix regia* are also found in the wetland vicinity. The *Prosopis juliflora* growth was observed in a few open places. *Lantana camara* spread was also observed in the vicinity during our survey in February 2021.

5.1.3 Water sources for the wetland

Bahour Lake is an interstate freshwater tank of 618 ha located mostly in Puducherry and is part of a poorly drained coastal flood plain in the catchment of Pennaiyar River (Bureau of Statistics & Evaluation 1976). The main source of water to the Lake is run off and flood water released to the river from Sathanar Dam located 105 km upstream.

5.1.4 Ownership

The lake is maintained and water level is regulated by the irrigation division of the Public Work Department (PWD) of the Puducherry Union Territory.

5.1.5 Management practices

The major maintenance work of recent years was carried out through the National Adaptation Fund for Climate Change (NAFCC) scheme of Ministry of Environment, Forest and Climate Change, Government of India. The work was implemented by the Public Work Department (PWD) in two stages, i.e., phase-I in 2016 with the amount of Rs. 9,92,878/- and phase-II in 2018 with Rs. 48,31,097/-.

5.1.6 Threats to the habitat and birds

The following are some of the major threats to the lake

1. Agricultural intensification and expansion
2. Poaching
3. Fisheries
4. Livestock grazing

View of Bahour lake with growth of invasive species such as *Prosopis juliflora* and *Lantana camara* seen on the periphery

Pictures showing native vegetation and cropland in the vicinity of Bahour lake

Bahour is the main source of irrigation for the surrounding fields. Agricultural runoff from the surrounding fields, pesticides and fertilizers from the agriculture fields, and washing clothes in the lake in dry months pollute the lake. There are instances of poaching, and the lake is under no formal protection.

After April the water is drained for fishing, but by that time most of the migratory birds move out. The impact of draining of water on resident birds needs to be studied to be able to provide management recommendations. In summer months intense fishery activities cause constant disturbance in the lake water. Rice bran and other powdered fish feed are added at regular intervals for improving fish harvest, which could have some effect on lake eutrophication. Buffalo and cow dung released in the lake during grazing and agricultural runoff further enhance the nutrient load of the lake (Rahmani *et al*. 2016).

5.1.7 Account on avifauna

Balachandran & Alagarrajan (1995), and Jhunjhunwala (1998) conducted surveys of the wetlands of Pondicherry (now Puducherry) and recorded over 25,000 waterbirds in Bahour, belonging to 16 species. Over 10,000 Eurasian Wigeon *Anas penelope* and over 3,000 Little Grebe *Tachybaptus ruficollis* have been recorded (Balachandran and Alagarrajan 1995). Both occur much above the 1% population threshold estimated by Wetlands International (2012). For instance, according to Wetlands International (2012), the non-breeding population of Eurasian Wigeon wintering in South Asia is 250,000. This means that at least 4% of this population used to be found in Bahour lake.

In March which is the outward migration period, Bahour Lake provides staging and feeding sites for thousands of migratory waterfowl, waders, and terns. For example, in March 1995, Balachandran & Alagarrajan (1995) counted about 25,000 waterbirds. In the subsequent decade, such high population influx was not observed. During April–May 2014, Whiskered Terns *Chlidonias hybrida* and waders such as Black-tailed Godwit *Limosa limosa*, Black-winged Stilt *Himantopus himantopus*, Common Sandpiper *Actitis hypoleucos*, Green Sandpiper *Tringa ochropus*, Wood Sandpiper *Tringa glareola*, Common Greenshank *Tringa nebularia*, Little Stint *Calidris minuta*, and Grey Heron *Ardea cinererea* congregated at Bahour (Lekshmi 2014). February–April is the best season to sight Glossy Ibis (70+), Eurasian Spoonbill *Platalea leucorodia* (31), Black-winged Stilt *Himantopus himantopus* (150+), Indian Spot-billed Duck *Anas poecilrhyncha* (80), and Black-headed Ibis *Threskiornis melanocephalus* (13) at Bahour.

Birds such as White Stork *Ciconia ciconia*, Shaheen Falcon *Falco peregrinus peregtinator*, Montagu's Harrier *Circus pygargus*, European Roller *Coracias garrulus*, Pacific Golden Plover *Pluvialus fulva*, Comb-Duck *Sarkiodornis melanotus*, Black-tailed Godwit, Ferruginous Pochard *Aythya nyroca*, Common Pochard *Aythya ferina*, Black Bittern *Dupetor*

flavicollis, and Grey-headed Lapwing *Vanellus cinereus* are uncommon visitors sighted only once in the last decade, mostly in 2013 and 2014 (as Lekshmi and Atma, unpubl. in Rahmani *et al*. 2016).

However, a few waterbird species were recorded during the present survey. A total of 447 birds and 14 bird species were recorded (Table 7).

Table 7: Details of birds recorded in Bahour during the survey on February 18, 2021

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Number
1	White-throated Kingfisher	*Halcyon smyrnensis*	Alcedinidae	R	LC	2
2	Lesser Whistling Duck	*Dendrocygna javanica*	Anatidae	R	LC	60
3	Indian Pond-hHeron	*Ardeola grayii*	Ardeidae	R	LC	100
4	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	2
5	Intermediate Egret	*Ardea intermedia*	Ardeidae	R	LC	12
6	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	22
7	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	R	LC	12
8	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	R	LC	86
9	Whiskered Tern	*Chlidonias hybrida*	Laridae	M	LC	40
10	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	R	LC	10
11	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	30
12	Grey-headed Swamphen	*Porphyrio porphyrio*	Rallidae	R	LC	50
13	Common Moorhen	*Gallinula chloropus*	Rallidae	R	LC	20
14	White-brreasted Waterhen	*Amaurornis phoenicurus*	Rallidae	R	LC	1
	Total					**447**

Note: R- Resident; M – Migratory; LC – Least Concern

5.2 Ousteri Lake

5.2.1 Site Description

Ousteri Lake, (11° 56′–11°58′ N and 79° 44′–79°45′ E) is a large shallow wetland situated along the eastern boundary of Puducherry. It is an inter-state lake with the water-spread area almost equally shared between the states of Puducherry and Tamil Nadu. The lake is situated at a distance of 10 km from Puducherry town in the western side on Puducherry-Villupuram-Valuthavur main road. The lake covers an area of about 800 ha (spread across both Tamil Nadu

and Puducherry), of which 390 ha is in Puducherry and the rest in Tamil Nadu (Alexander and Pusharaj 2010). Much of the Ousteri bank along the Tamil Nadu side consists of rural settlements, the Puducherry side of the lake is predominantly urban or suburban (Abbasi and Chari 2008), causing special stresses on the lake.

Ousteri is the largest lake in Puducherry and is also one of the important wetlands of Asia (Alexander 2010). In the recent past Ousteri lake has also been identified as a wetland of national importance under the National Wetland Conservation Programme of Ministry of Environment, Forest and Climate Change (MoEF&CC), New Delhi. This lake is also an Important Bird Area (IBA) identified by the Bombay Natural History Society (BNHS), Mumbai. The Asian Wetland Bureau declared Ousteri as one of the 115 significant wetlands in Asia (Anon 2009).

The landform of the area is marine, fluvial and fluvio marine regimes each sustaining individual soil assemblages. Geologically, Oussudu and its surroundings comprise mostly of alluvium, Manaveli clay stone, and Vanur sand stone. The lake is a major wintering ground for a large number of migratory birds. Considering the area having adequate ecological, faunal, floral, geomorphological, natural or zoological significance, it was declared as a sanctuary vide GO Ms No. 17. Ag, dated October 07, 2008 for the purpose of protecting, propagating and developing wildlife and its environment.

The climate of Oussudu watershed is humid. The average annual rainfall of Puducherry region is 1,200 mm, of which around 63% occurs in north east monsoon from October to December, while the remaining is scattered sporadically throughout the year. The mean number of annual rainy days is 55 and the mean monthly temperature ranges from 21.3 °C to 30.2°C.

5.2.2 Habitat /Vegetation

The predominant land use category around Ousteri Lake is agriculture. Vast stretches of agricultural fields are seen around the lake, as many of the villagers in the surrounding villages practice agriculture. The major land use categories in the catchment of Ousteri are Agriculture followed by settlements and other urban land use; water resources, open scrub, plantations, and open land (Abbasi and Chari 2008; Nobi *et al*. 2009).

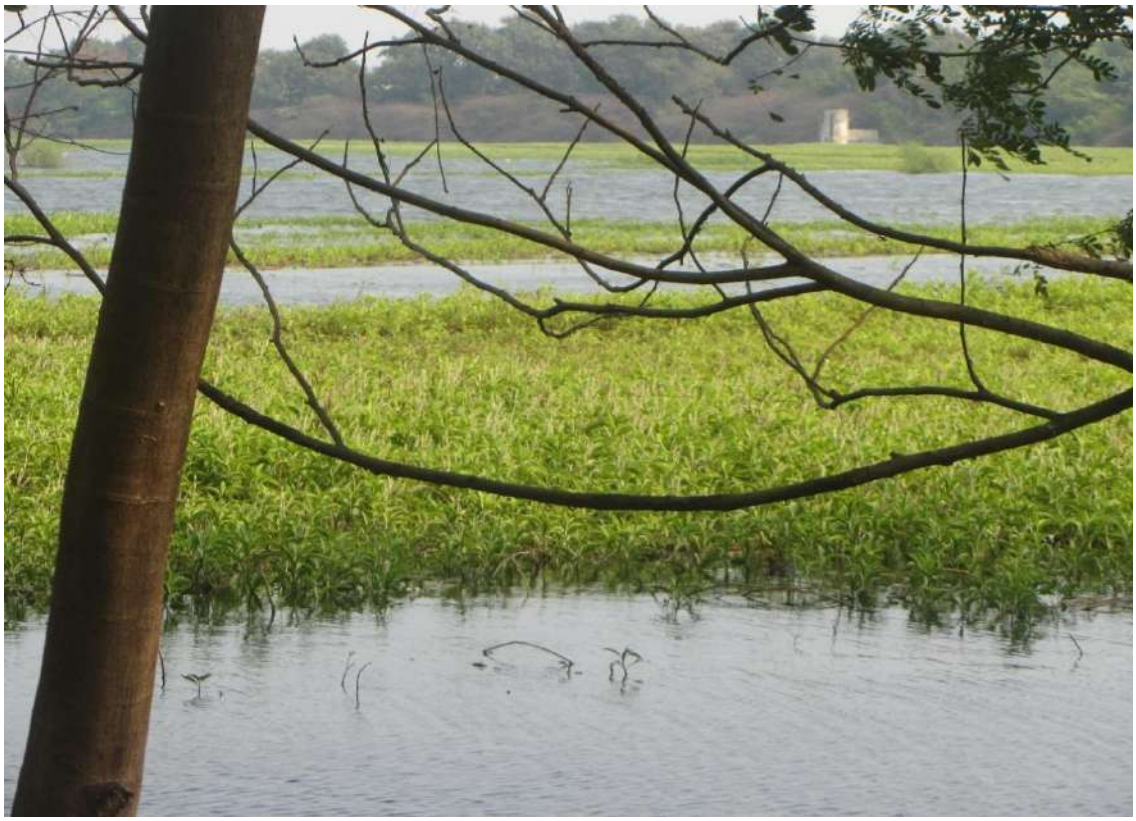
A total of 480 plant species has been identified in Ousteri Lake and its environs. Among 480 plant species, 191 are herbs (41%), 103 are trees (21%), 63 are shrubs (13%), 40 species are climbers (8%), 20 are stragglers (4%), and 63 species are grasses (13%) (Devabalane 2014).

The periphery was dominated with native tree species such as *Borassus flabellifer, Ceiba pentandra, Azadirachta indica, Samanea saman* and *Tamarindus indica*. Exotic species such as *Delonix regia* and *Peltophorum pterocarpum* was also seen on the bunds. Spread of invasive *Prosopis juliflora* was also observed.

5.2.3 Water sources for the wetland

The total catchment area of the lake is 15.54 sq. km. It receives water mainly from Suthukeni check dam through Suthukeni canal and the run-off from the Lake basin. The Suthukeni check dam is constructed across the river Sankaraparani. The major water source for the Suthukeni dam is the excess water from Veedur dam, Viluppuram District of Tamil Nadu state. the Ousteri Lake was a dynamic seasonal wetland which went almost completely dry during the months of June to September every year. However, the outflow was restricted from the year 2004 onwards and the lake has never been dry ever since. This is likely to have affected the lake ecology and has also contributed to the accumulation of pollutants including silt and other settled biological matter.

Pictures showing visitors facility developed in Ousteri Bird Sanctuary



Thick aquatic vegetation growth found in the Ousteri Bird Sanctuary

5.2.4 Ownership

Forest Department, Puducherry.

5.2.5 Other stakeholders

Irrigation, agriculture and fisheries departments

5.2.6 Management issues

Maintenance of water level, fishing, vehicular movement, boundary demarcation and enforcement of rules, dumping of solid wastes on the lake embankments, disposal of sewage and weed infestation are considered as major management issues.

Interaction with the forest department staff showed that hunting of birds and other wildlife by nomadic tribal called "*Narikuravas*" is a major conservation issue. Lack of man power, especially uniformed staff is a major limitation to control hunting of wildlife.

5.2.7 Threats to the habitat and birds

Accelerated and increasingly diverse human land-use patterns in the Oussudu catchment appear to have led to the degradation of Oussudu and the impoverishment of its bird community

(Chari and Abbasi 2001). The lake has become eutrophic, with poor transparency and low dissolved oxygen. Its fish diversity has declined over the years (Chari and Abbasi in press (a), (b)) which appears to have had a direct effect on piscivorous birds such as cormorants, raptors, and kingfishers.

Ousteri Lake has been facing serious threats from multiple fronts such as reclamation, agriculture, siltation, weed invasion, and poaching. The lake is infested by the aquatic weed *Ipomoea carnea* (Water hyacinth), which is presently covering almost 14% of the water spread area of the lake. Encroachments in the form of paddy cultivation, land reclamation and plantations are on the rise. Runoff from agricultural fields can add substantial amounts of nitrates and phosphate to the lake waters that stimulates the growth of aquatic macrophytes and planktons, resulting in eutrophication. The ecologically sensitive zones such as roosting areas of birds are located in close proximity of humans. Illegal fishing and poaching of wild birds are quite frequent in the area. These trends if not checked can soon result in rapid eutrophication, siltation, and ultimate death of the lake (Azeez *et al*. 2008, 2009).

Alexander (2010) has mentioned that the birds are exposed to unchecked poaching. He also mentioned excessive grazing of littoral vegetation by domestic animals may also pose threat to birds and their habitat. Using poison to catch birds was also observed in the lake (Alexandar *et al.* 2018).

5.2.8 Account on avifauna

During our survey on February 18, 2021, very few birds were recorded in the sanctuary. A total of 140 birds and 12 waterbird species were sighted (Table 8).

5.2.9 Other observations during our survey

The water level was full in the lake during our survey. Indigenous Biodiversity Foundation, a local NGO along with Puducherry forest department has raised 15 earthen mounds of about 12.192 m by 45.72 m each. *Terminalia arujuna*, *Barringtonia asiatica*, *Madhuca longifolia*, *Albizia lebbeck*, *Pithecellobium dulce*, and bamboo were planted on these mounds. Due to high water level, only half heights of these plants on these mounds were visible. The forest department informed that they are also planning to make more such mounds.

Boundary demarcation: A small portion of the lake is fenced with metal wire and the forest department is targeting to complete this for entire stretch of the boundary to restrict illegal activities in the sanctuary area. A small area is developed for visitors with facility such as

children play area, seating arrangements, canteen and boating (11º 56′ 29.93" N; 079º 44′ 48.06" E).

Table 8: Birds recorded in Ousteri Bird sanctuary during our survey on February 18, 2021

Sl. No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Number
1	Common Kingfisher	*Alcedo atthis*	Alcedinidae	R	LC	1
2	Eurasian Wigeon	*Mareca penelope*	Anatidae	R	LC	1
3	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	30
4	Intermediate Egret	*Ardea intermedia*	Ardeidae	R	LC	2
5	Indian Pond-heron	*Ardeola grayii*	Ardeidae	R	LC	30
6	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	R	LC	20
7	Whiskered Tern	*Chlidonias hybrida*	Laridae	M	LC	2
8	White-browed Wagtail	*Motacilla maderaspatensis*	Motacillidae	R	LC	2
9	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	R	LC	30
10	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	10
11	Eurasian Coot	*Fulica atra*	Rallidae	R	LC	2
12	Grey-headed Swamphen	*Porphyrio porphyrio*	Rallidae	R	LC	10
	Total					**140**

Note: R- Resident; M – Migratory; LC – Least Concern

5.3 Kaliveli

5.3.1 Site description

Kaliveli (12° 5′-12° 3′ N; 79° 47′-79° 53′ E), the second largest brackish water lake in southern India is located 18 kilometers north of Puducherry in the Viluppuram district of Tamil Nadu. It receives most of its freshwater from an intricate and age-old network of 225 tanks and their channels. Mismanagement, changing socio-economics and policies have led to degradation of these rainwater-harvesting structures, thus altering the properties of the wetland itself (Gopinath and Srinivas 2004).

Kaliveli has been described as one of the two most important wetlands along the southeastern seaboard of India (Perennou 1987; Perennou and Santharam 1990). Being a birding hotspot,

the avifauna has received much attention (Balachandran 1994; Gopinath and Srinivas 2004; Prennou 1987, 1989, 1990; Perennou and Santharam 1990; Pieter 1987). The wetland is situated amidst an agricultural lands and an arid thorn scrub and it is broadly divided in three distinct zones. It is broadly divided in three distinct zones, Kaliveli floodplain (12º 5′ - 12º 3′- 12º 9′N; 79º 47′- 79º 51′- 79º 53′E), Uppukalli creek (12º 9′ - 12º 12′N & 79º 53′- 79º 56′E) and Yedayanthittu estuary (12º 12′ - 12º 15′ N & 79º 56′ - 80º 0′ E).

5.3.2 Habitat /Vegetation

Reed *Typha augustata* is the predominant form of vegetation found in most parts of the lake and other grasses occupy the lakebed during the dry season. Mangroves found commonly along the coasts. The estuarine part of Kalivelli was under mangrove cover earlier, but this is now reduced to a few mud flats with small bushes interspersed among the salt pans. A possible reason for the degradation of mangrove cover is the ever-increasing need for firewood and timber, and the conversion of the estuarine part to salt pans.

In the recent past, mangrove restoration programs have been initiated in and around the Yedayanthitu estuary. But the lack of effective management and protection has resulted in most of the saplings ending up as cattle feed. The last surviving patches of mangroves if not protected and restored will soon become history (Gopinath and Srinivas 2004).

In the past, a sizeable area around the lake was under what is botanically referred to as a Tropical Dry Evergreen Forest (TDEF). Today, only remnants of these are found in the area, with most having been cleared for agriculture and settlements (Gopinath and Srinivas 2004).

The common aquatic vegetation plants found in this wetland area are *Aponogeton natans, Eichhornia crassipes, Hydrilla verticillata, Limnophyton obtusifolium, Monochoria vaginalis, Vallisneria spiralis, Aristida adscensionis, Chloris barbata, Chloris montana, Polygala arvensis, Lindernia crustacea, Scoparia dulcis, Waltheria indica, Acacia nilotica, Alternanthera sessilis, Bacopa monnieri, Coldenia procumbens, Cyperus distans, Eclipta prostrata, Heliotropium indicum, Hygrophila angustifolia, Ludwigia perennis, Phyla nodiflora, Polygonum barbatum, Typhya angustata, Prosopis juliflora, Barringtonia* sp., *Acacia nilotica,* and *Avicennia marina* (Ramanujam 2005).

An 18th century stone unearthed in a village bears inscriptions of a king hunting elephants in this region and historic indications are that the area was heavily forested as recently as 1960 (Pieter 1987).

5.3.3 Ownership

Revenue Department, Puducherry (Gopinath and Srinvas 2004).

5.3.4 Other stakeholders

Irrigation, agriculture and fisheries

5.3.5 Management issues

Gopinath and Srinivas (2004) has listed the following management issues in Kaliveli tank.

Poaching, reed collection, fishing, grazing, agriculture, invasive species, shrimp farming, and saltpans are major conservation issues in Kaliveli.

Kaliveli also faces other threats and problems. Ever increasing encroachment of land for various commercial activities is one of the serious problems threatening the existence of Kaliveli. Urbanization in the region for its part also exerts a lot of pressure on the wetland. The threat from the industrial sector is menacing and there have been proposals in the past for a thermal power station, a sugar refinery and a fertiliser-manufacturing unit. There have also been proposals to convert the wetland into a fresh water source to supply drinking water to Chennai. Though none of these projects have been executed, the threat still remains.

Views of different habitats in Kaliveli

Abandoned aquafarms and growth of *Prosopis juliflora* in Kaliveli

5.3.6 Threats to the habitat and birds:

Gopinath and Srinivas (2004) has listed following threats to the habitat and birds,

- Kaliveli receives water through a network of channels in the adjoining areas. When catchments are subject to deforestation, soil erosion increases, resulting in build-up of sediments in channels and impairing the free flow of water into the lake. Reduced water flow directly affects the health of the wetland.
- Improper land use like agricultural encroachment, rob the lake of its land. Shrimp farms pose a serious threat to the lake, as effluents from these farms alter the nature of soil and water. Their numbers are fast increasing.
- Over the last three decades the saltpans have doubled in extent and now cover about 60% of the estuary. Almost all salt marshes are converted into saltpans.
- Ever increasing encroachment of land for various commercial activities is one of the serious problems threatening the existence of Kaliveli.

- The threat from the industrial sector is menacing. There have been proposals in the past for a thermal power station, a sugar refinery and a fertiliser-manufacturing unit. Though none of these projects have been executed, the threat remains very much at large.
- Urbanisation for its share exerts a lot of pressure on the wetland. There have been proposals to convert the wetland into a fresh water source to supply drinking water to Chennai.
- Use of banned pesticides in the encroached agricultural lands poisons animals at every level of the food chain.
- Nitrates and phosphates used in encroached agricultural land induce excessive plant and algal growth.
- Bad management of natural resources has resulted in over exploitation, adversely affecting Kaliveli.
- Poaching and poisoning of birds are common.
- One of the most crucial factors responsible for Kaliveli's sustained degradation is the absence of a management policy and the lack of political will to fin a viable solution to the problems facing it.

5.3.7 Account on avifauna

During our survey six different points were covered to count the birds. A total of 1,788 birds of 36 waterbird species were recorded during the survey on February 19, 2021. Among the migratory birds, Wood Sandpiper *Tringa glareola*, Pacific Golden Plover *Pluvialis fulva*, Ruff *Philomachus pugnax*, and Whiskered Tern *Chlidonias hybrida* were most abundant. Indian Pond-heron *Ardeola grayii*, Little Egret *Egretta garzetta*, and Painted Storks *Mycteria leucocephala* were the most abundant resident waterbird species recorded in the survey (Table 9.).

Scattered *Acacia nilotica* (around 30 to 40 trees for about 1 km long stretch) growth was found in a spot (12º 06/ 57.04// N, 079º 52/ 34.24// E). Around 100 nests of Painted Storks were found in the place.

Table 9: Details of birds recorded in Kaliveli on February 19, 2021

Sl. No	Common Name	Scientific Name	Family	IUCN Status	Migratory Status	Number
1	White-throated Kingfisher	*Halcyon smyrnensis*	Alcedinidae	LC	R	2
2	Pied Kingfisher	*Ceryle rudis*	Alcedinidae	LC	R	8
3	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	LC	R	6
4	Oriental Darter	*Anhinga melanogaster*	Anhingidae	NT	R	4
5	Indian Pond-heron	*Ardeola grayii*	Ardeidae	LC	R	115
6	Cattle Egret	*Bubulcus ibis*	Ardeidae	LC	R	36
7	Little Egret	*Egretta garzetta*	Ardeidae	LC	R	161
8	Grey Heron	*Ardea cinerea*	Ardeidae	LC	R	1
9	Great White Egret	*Ardea alba*	Ardeidae	LC	R	18
10	Intermediate Egret	*Ardea intermedia*	Ardeidae	LC	R	58
11	Purple Heron	*Ardea purpurea*	Ardeidae	LC	R	6
12	Green Heron	*Butorides striata*	Ardeidae	LC	R	1
13	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	LC	R	50
14	Pacific Golden Plover	*Pluvialis fulva*	Charadriidae	LC	M	220
15	Painted Stork	*Mycteria leucocephala*	Ciconiidae	NT	R	264
16	Asian Openbill	*Anastomus oscitans*	Ciconiidae	LC	R	70
17	Whiskered Tern	*Chlidonias hybrida*	Laridae	LC	M	115
18	Spot-billed Pelican	*Pelecanus philippensis*	Pelecanidae	NT	R	24
19	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	LC	R	86
20	Indian Shag	*Phalacrocorax fuscicollis*	Phalacrocoracidae	LC	R	34
21	Common Coot	*Fulica atra*	Rallidae	LC	R & M	25
22	Grey-headed Swamphen	*Porphyrio porphyrio*	Rallidae	LC	R	30
23	Common Moorhen	*Gallinula chloropus*	Rallidae	LC	R	20
24	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	LC	R	30
25	Wood Sandpiper	*Tringa glareola*	Scolopacidae	LC	M	120
26	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	LC	M	30
27	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	LC	M	2
28	Common Redshank	*Tringa totanus*	Scolopacidae	LC	M	20
29	Common Greenshank	*Tringa nebularia*	Scolopacidae	LC	M	2
30	Black-tailed	*Limosa limosa*	Scolopacidae	NT	M	30

Sl. No	Common Name	Scientific Name	Family	IUCN Status	Migratory Status	Number
	Godwit					
31	Eurasian Curlew	*Numenius arquata*	Scolopacidae	NT	M	2
32	Ruff	*Calidris pugnax*	Scolopacidae	LC	M	140
33	Little Stint	*Calidris minuta*	Scolopacidae	LC	M	14
34	Black-headed Ibis	*Plegadis falcinellus*	Threskiornithidae	LC	R	30
35	Glossy Ibis	*Threskiornis melanocephalus*	Threskiornithidae	NT	R & M	6
36	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	LC	R	8
	Total					**1788**

Note: R- Resident; R & M – Resident with migratory population; M – Migratory; LC – Least Concern; NT – Near Threatened

6 MAHARASHTRA

6.1 Jaikwadi Bird Sanctuary

6.1.1 Wetland Information and site survey

Jaikwadi Bird Sanctuary, also known as Nath Sagar Reservoir is a human-made reservoir created after construction of a dam in the upper reaches of Godavari in 1975. The reservoir stretches across an area 55 km long and 27 km wide. The catchment area is 21,750 sq. km which lies in Ahmednagar and Aurangabad districts.

The main purpose of the reservoir is to overcome irrigation and drinking water scarcity in the drought prone region of the Marathwada. So, water from this wetland is extracted mainly for irrigation and domestic supply. Fishing is also prevalent in this wetland as several communities living along the banks depend on the fish catch for livelihood. The depth of the catchment ranges from 1 m to 30 m. The shoreline of backwater is wavy and there is perennial supply of water at varying levels across the season. The depth of the water varies from 0.1 m to 2.0 m at most places along the shore of the reservoir. There are marshes and mud flats as well as wet meadows and dry grasslands, which are creating a unique habitat for variety of birds. The overall slope of the reservoir is gentle, running from West to East.

This wetland hosts resident and migratory birds and also has rich diversity of freshwater fishes, molluscs, crustaceans, and other fauna. Considering its importance as a prominent habitat for thousands of migratory and local birds, the Govt of Maharashtra declared this area as 'Jaikwadi Bird Sanctuary' vide in 1986.

The site survey was carried out in February, during which, the waterbird count was collected at seven locations (Dahigaon, Shirasgaon, Uttar Galnimb, June Dhanora, Mahalaxmi Kheda Pump House, MIDC Bramh Gavhan, and Shevta) along with collecting data on the visible disturbances and waypoints for landcover (Figure 1)

The reservoir has as many as 30 islands. Most of which are exposed when the water level recedes. As the year 2020 experienced good monsoon, most of the islands were not exposed even by the time the survey was conducted in February 2021. Ducks and Coot were seen in largest numbers throughout the survey. At Uttar Galnimb site, a congregation of almost 30,000 ducks and coot was seen, at Mahalaxmi Kheda Pump House, a congregation of 11,300 and at Shevta, a congregation of 6,600. As the birds were not approachable, the numbers of each

species was unable to be estimated, but the flocks comprised Common Coot *Fulica atra*, Northern Shoveler *Spatula clypeata*, Eurasian Wigeon *Mareca penelope*, Garganey *Anas querquedula*, and Little Grebe *Tachybaptus ruficollis*. Eleven species of ducks and geese were recorded during the survey, of which, Northern Shoveler and Eurasian Wigeon dominated the count. Common Coot *Fulica atra* was also seen in large numbers in the open waters. In the small pools created by receding water, shorebirds such as Black-tailed Godwit *Limosa limosa* (176), Little Stint *Calidris minuta* (123) and Ruff *Philomachus pugnax* (52) were seen, along with Temminck's Stint *Calidris temminckii*, Wood Sandpiper *Tringa glareola*, Little-ringed Plover *Charadrius dubius*, Kentish Plover *Charadrius alexandrines*, and Common Sandpiper *Actitis hypoleucos* were also reported. A roosting flock of Small Pratincole *Glareola lactea* (225) was seen at Shevta. A few species which were frequently sighted from most points during the survey were Glossy Ibis *Plegadis falcinellus* (615), Black-winged Stilt *Himantopus Himantopus* (171), and Whiskered Tern *Childonias hybridus* (140).

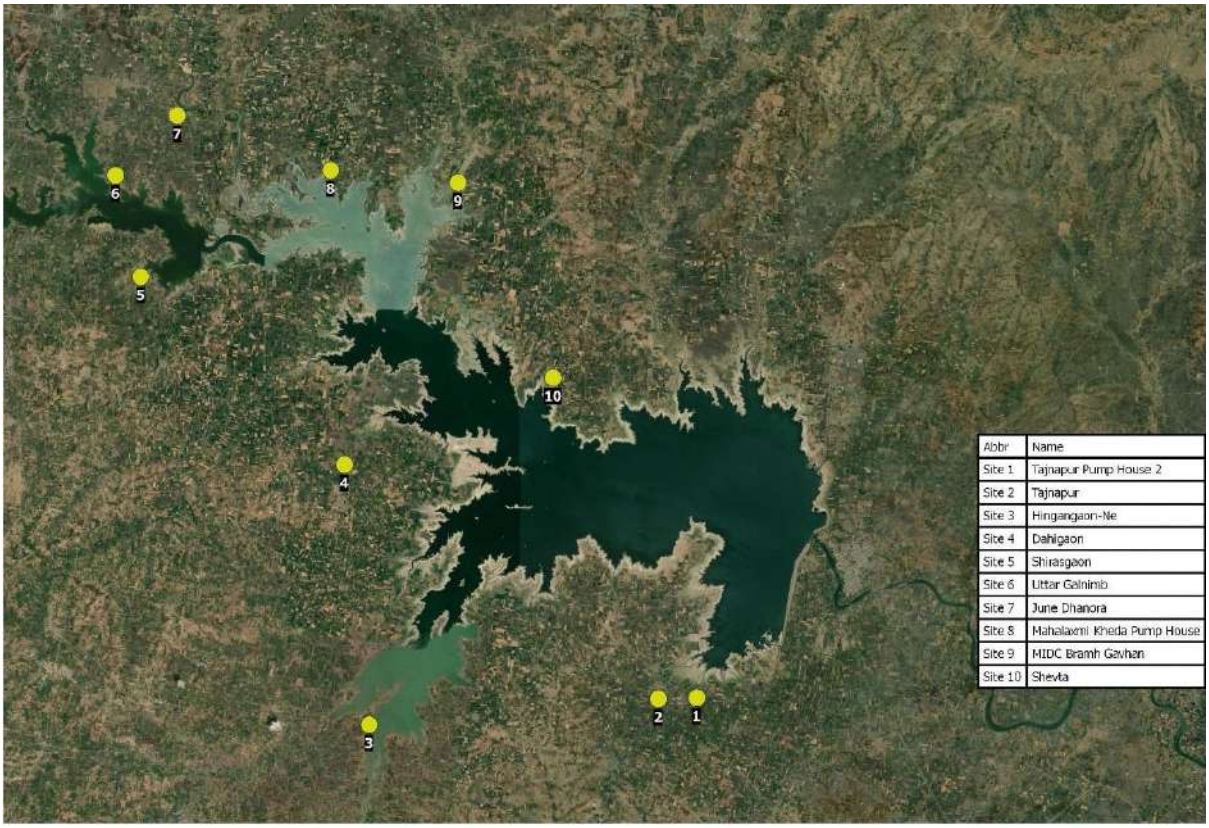


Figure 1: Jaikwadi Survey points

During the survey, there was no direct disturbance recorded to the birds. But there are some observations about potential disturbances. At sites such as Shevta Pump House and Bramha Gavan, there were hundreds of electric pumps to lift water from the reservoir floating in water. These cause vibrations and sound disturbing birds, and more so may cause electrocution.

Fishing was seen at several sites, but the bird congregations were not seen to be affected by the movement of manual boats. Galpera was recorded along the shores of the reservoir where the water had receded. The major crop types recorded along the banks were Sugarcane, Wheat, and Banana, along with small interspersed cotton and fruits and vegetable farms. Species such as egrets, Black-headed Ibis *Threskiornis melanocephalus*, Asian Openbill *Anastomus oscitans*, and Bar-headed Goose *Anser indicus* were seen feeding in the galpera crops. List of birds recorded during the survey is given in Table 10.

Waterbird congregation mainly comprising Northern Shoveler (*Spatula clypeata*), Common Coot (*Fulica atra*) and Common Pochard (*Aythya ferina*) at Uttar Galanimb (February 2021)

6.1.2 Types of Vegetation

The wetland is mainly surrounded by perennial and seasonal croplands. Based on the vegetation studies carried out by the Forest Department and mentioned in the Management Plan for Jaikwadi Bird Sanctuary Paithan 2018–2019 to 2027–2028, the list of major aquatic plants and aquatic angiosperms is given below:

Aquatic Plants

1. *Jussiaea repens* Linnaeus
2. *Ipomea aquatica* Forsk
3. *Ipomea* sp.
4. *Hyrilla verticillata* Route

5. *Vallisnaria spiralis* Linnaeus
6. *Ottelia alismoides* Pers
7. *Lemna minor* Linnaeus
8. *Potamogeton indicus* Roxb
9. *Najas indica* Cham
10. *Azolla pinnata* Roxb
11. *Ceratophyllum demersum* Linnaeus
12. *Eichhornia crassipes* Mark

Aquatic angiosperms

1. *Spirodela polyrhiza*
2. *Scirpus roylei*
3. *Hydrilla verticillata*
4. *Ottelia alismoides*
5. *Vallisneria natans*
6. *Najas indica*
7. *Potamogeton crispus*
8. *P. nodosus*
9. *P. perfoliatus*
10. *Typha domingensis*
11. *Ceratophyllum demersum*
12. *Ipomoea carnea* subsp. *fistulosa*
13. *I.aquatica*
14. *Nelumbo nucifera*
15. *Polygonum glabrum*
16. *Bacopa monnieri*
17. *Phyla nodiflora*

6.1.3 Threats

The reservoir has immense economic and livelihood dependence for the people of Marathwada region. The access to wetland is permitted in a way to have least impact on the wildlife. The three major threats identified by the Forest Department (Management Plan For Jaikwadi Bird Sanctuary, Paithan 2018–2019 to 2027–2028) are *Galpera* or the seasonal cultivation on the

reservoir fringes, fishing, irrigation, poaching and pollution. The details of which are given below.

6.1.3.1 Galpera (seasonal cultivation)

As the water level recedes post-monsoon, the locals use this exposed land within the sanctuary boundary for *galpera* (seasonal cultivation). Currently, there is lack of scientific data on the impact of *galpera* on the migratory and local birds. But this practice raises concerns over the indiscriminate use of chemical fertilizers and insecticides in the crops that eventually drain and leach into the reservoir.

The movement of these farmers and their cattle might cause disturbance to those aquatic birds that feed along the shore in shallow waters.

The farmers planting sugarcane and cotton set fire to agricultural waste after harvesting, as a result of which aquatic birds are driven inside the water body.

In context of *galpera* a study was carried out by Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, during which it was reported that the toxicity levels evaluated from the samples of water, fish and sediment residue show the presence of toxic substances below detectable level. It was also mentioned that growing crops like Chana, Jowar, Safflower, Sunflower, Soyabean, and Peas would attract insects, which the birds could feed on. But this did not consider the disturbance and chemical pollution caused by the cultivation. Senior ornithologist Dr. Dilip Yardi and BNHS have highlighted that banning *galpera* may lead to invasion by *Prosopis* and *Ipomea*, and that the decision to challenge the practice of *galpera* should be a scientifically informed one.

6.1.3.2 Fishing

Hon. Bombay High Court, Aurangabad Bench, vide its order dated 7.11.98 in the writ petition no. 3423/97, had prohibited fishing in the sanctuary and hence no order allowing any fishing can be passed without first obtaining the permission of the Hon. High Court. The Government decision in this regard is awaited.

6.1.3.3 Irrigation

The waterbody in the sanctuary area is under the control of the Irrigation Department, which regulates the utilization of the water from the notified area.

The cooperative lift irrigation schemes, government lift irrigation schemes, drinking water supply schemes and industrial water supply schemes operate in the reservoir. For day-to-day maintenance, the engines and pipeline, are moved as and when required, even during the night.

This movement and noise of the electric and diesel pumps could cause disturbance to the aquatic birds.

6.1.3.4 Poaching

Jaikwadi dam is a vast waterbody (55 km in length & 27 km in width) with different tribal communities residing along the bank. People from *Pardhi, Bhil* and *Kahar* tribal communities in the adjoining areas are known to be involved in poaching of birds. They usually poach quails and partridges. Sometimes even ducks are sold on bazaar days in adjoining villages. They also cause damage to the eggs and nest of aquatic birds on islands in the reservoir, thereby disturbing the very habitat of the birds.

6.1.3.5 Pollution

A total of 61 villages are situated on the banks of the Jaikwadi reservoir. The sewage water from these 61 villages, as well as from Aurangabad, Paithan and Maharashtra Industrial Development Corporation (MIDC) area of Waluj and Paithan is released into the reservoir. Effluents from paper mills and cooperative sugar factories are also released into the reservoir, resulting in eutrophication. The chemicals and fertilizers used in agriculture fields in and around the acquired area are also leached out in the reservoir.

No systematic observations and study on the concentration levels of pesticides in the reservoir has been carried out.

6.1.4 Management Activities carried out/proposed by the Forest Department

6.1.4.1 Galpera (Seasonal Cultivation)

The following prescriptions are given by the Forest Department:

1. *Galpera* to be allowed only in case of cultivators with land up to 2 hectares and for traditional (non-commercial) crops. The type of crops to be grown need to be decided in consultation with the agriculture experts, wildlife wings and bird expert, and the cultivators to be educated about reducing the use of chemical fertilizers, pesticides and insecticides. by encouraging organic farming in galpera area.
2. The area upto 500 m from the upper water level of the contour 1,510 ft is to be maintained as buffer area.
3. *Galpera* is allowed in certain conditions between 1522–1510 ft contour level only.
4. *Galpera* should be on rain-fed basis only. *Galpera* for cash crop for commercialization to be banned.

5. Chemical farming with use of chemicals, insecticides and pesticides to be strictly banned and only bio-fertilisers and bio-pesticides for galpera to be used.

6.1.4.2 Fishing

The following restrictions are laid by the Forest Department on fishing activities in the sanctuary boundaries:

1. No mechanized boats.
2. No shoreline fishing.
3. Mesh size should not be less than 1.5 inch.
4. No fishing activity in the 50 m periphery of the island.
5. Fishes less than 300 gm not be trapped.
6. Fishing during breeding season i.e in monsoon is totally banned.
7. Smaller fishes are popular food of birds; as well as carnivorous fishes also prefer them. Considering this aspect the seed of local fishes should be released every year in the reservoir.
8. The following nets/fish capture methods are banned for use in the Sanctuary: -*Dolnet*, *Ghagaria jal*, mosquito nets, gill nets, chemical poison for fishing, fishing by bombs, crackers to be banned.
9. 

Galpera (seasonal farming) active once the water level receded.

6.1.4.3 Irrigation

There is a recommendation to retain minimum 20% of the water in the reservoir for the birds in drought condition. The Forest Dept is to study how the problems of access to the water by the local cultivators can be controlled without harming the birds.

6.1.4.4 Pollution

For controlling pollution in the reservoir, the pollution control board authorities are to be consulted. Aurangabad Corporation and MIDC as well as muncipalties of cities like Paithan to be compelled for installation of sewage water treatment plants. Regulations are to be put in place to prohibit paper mills and sugar factories from releasing untreated wastewater in the reservoir. The farmers around the sanctuary are to be persuaded to switch to organic farming in phase-wise manner.

6.1.4.5 Habitat creation/enhancement

The activities proposed in the habitat creation and habitat enhancement are as follows:

1. Control and eradication of invasive aquatic plant species along the shore and on the islands.
2. Creation of perching facilities made up of bamboo rafters of the size 3 x 3 metres which will float on the surface of the reservoir will be provided for the aquatic birds for basking.
3. Periodical removal of weed along the shore of water. The removal is to be done manually. *Ipomea* and *Prosopis* to be removed in summer season from shoreline up to 15 m inside the water body to create a habitat for waders.
4. Six of the 30 islands which are near to the outer boundary of Jaikwadi Bird Sanctuary to be developed to provide habitat for roosting, nesting, and breeding.
5. Babhul (ramkathi) on the periphery and Kadamb at the centre of the island to be planted at a distance of 10 x 10 metres .
6. Some islands to be kept without any change in their habitat.
7. Perches to be erected and grasslands, grooves, islands and bushes to be protected for breeding birds.
8. Depressions of size 10 m x 50 m and maximum depth of 1.5 m proposed near boat house, as feeding sites for ducks and waders.

6.1.4.6 Research and Monitoring

Experts from eminent environmental institutions to be called upon from time to time to carry out specific studies and research on various aspects of the sanctuary such as:

1. Collection of base line information of wetland (Mapping, water quality, macrophytes, plankton, sediments, benthic organisms, fish and other vertebrates, avifauna, socio-economic aspects)
2. To study ecological interaction between the biological, physical, and chemical components of wetland.
3. To study the significance of site fidelity, biometrics and molting patterns of the migratory and resident waterfowl.
4. To study the carrying capacity of the wetland for specific species or group of species.
5. To study the population structure of the waterfowl.
6. To study Galpera activity for conservation of birds and to identify threats existing, if any.
7. Monitoring of different parameters (i.e. Hydrology, Water Quality, Sediments, Vegetation, Water fowl, Fish, Other Biota) to ascertain the efficiency of management to be carried out on annual basis and based on the evaluation of data further corrective action will be taken.
8. Annual mid-winter waterfowl census will be conducted every year in the month of January.

6.1.5 Recommendations based on the survey

The survey was carried out in late mid-winter, during a year of good monsoon due to which several sites were still submerged. Another survey during early and mid-winter as well as early summer would give a better clarity on the conditions and threats of the wetland.

1. 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 on 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. This can then be correlated with the access to the habitat based on the water level.
2. A breeding bird survey needs to be conducted to record the species breeding, the extent and success level of breeding and threats faced.

3. 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.
4. 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.
5. Roosting perches to be planted at one site on pilot basis to know the species they attract and if some species avoid the sites, these perches also serve as good vantage points for raptors. If the roosts and trees are accepted as heronries then more such can be planted.

Table 10. Details of birds recorded in Jaikwadi Bird Sanctury on February 10–11, 2021

Sl. No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total Count
1	Western Marsh-Harrier	*Circus aeruginosus*	Accipitridae	M-LD	LC	8
2	White-breasted Kingfisher	*Halcyon smyrnensis*	Alcedinidae	R & M	LC	5
3	Bar-headed Goose	*Anser indicus*	Anatidae	LM	LC	23
4	Brahminy (Ruddy) Shelduck	*Tadorna ferruginea*	Anatidae	R & M	LC	6
5	Cotton Teal	*Nettapus coromandelianus*	Anatidae	R & M	LC	4
6	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	R	LC	79
7	Garganey	*Spatula querquedula*	Anatidae	M	LC	61
8	Common Pochard	*Aythya ferina*	Anatidae	M	VU	40
9	Comb Duck	*Sarkidiornis melanotos*	Anatidae	R & M	LC	4
10	Eurasian Wigeon	*Mareca penelope*	Anatidae	M-LD	LC	140
11	Gadwall	*Mareca strepera*	Anatidae	M	LC	2
12	Northern Shoveler	*Spatula clypeata*	Anatidae	M-LD	LC	446
13	Red-crested Pochard	*Netta rufina*	Anatidae	M	LC	120
14	Unidentified ducks		Anatidae			47900
15	Grey Heron	*Ardea cinerea*	Ardeidae	R	LC	12
16	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	4
17	Great White Egret	*Ardea alba*	Ardeidae	R	LC	0
18	Intermediate Egret	*Ardea intermedia*	Ardeidae	R & M	LC	81
19	Little Egret	*Egretta garzetta*	Ardeidae	R	LC	5
20	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	0
21	Indian Pond-heron	*Ardeola grayii*	Ardeidae	R	LC	11

22	Yellow-wattled Lapwing	*Vanellus malabaricus*	Charadriidae	R	LC	0
23	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	R	LC	5
24	Little Ringed Plover	*Charadrius dubius*	Charadriidae	R	LC	19
25	Kentish Plover	*Charadrius alexandrines*	Charadriidae	M	LC	26
26	Asian Openbill	*Anastomus oscitans*	Ciconiidae	R	LC	412
27	Small Pratincole	*Glareola lacteal*	Glareolidae	M	LC	254
28	Wire-tailed Swallow	*Hirundo smithii*	Hirundinidae	R & M	LC	20
29	Red-rumped Swallow	*Cecropis daurica*	Hirundinidae	M	LC	3
30	Brown-headed Gull	*Larus brunnicephalus*	Laridae	M	LC	66
31	Unidentified gulls		Laridae			6
32	Whiskered Tern	*Chlidonias hybrid*	Laridae	M	LC	140
33	River Tern	*Sterna aurantia*	Laridae	R	VU	30
34	Unidentified terns		Laridae			0
35	Yellow Wagtail	*Motacilla flava*	Motacillidae	M-LD	LC	15
36	Osprey	*Pandion haliaetus*	Pandionidae	R	LC	3
37	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	R & M	LC	3
38	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	R	LC	20
39	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	18
40	Purple Swamphen	*Porphyrio porphyrio*	Rallidae	R	LC	31
41	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	R	LC	0
42	Common Coot	*Fulica atra*	Rallidae	R & M	LC	1950
43	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	R	LC	171
44	Black-tailed Godwit	*Limosa limosa*	Scolopacidae	M	NT	176
45	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	M	LC	1
46	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	M	LC	**0**
47	Wood Sandpiper	*Tringa glareola*	Scolopacidae	M	LC	36
48	Little Stint	*Calidris minuta*	Scolopacidae	M	LC	123
49	Temminck's Stint	*Calidris temminckii*	Scolopacidae	M	LC	16
50	Ruff	*Calidris pugnax*	Scolopacidae	M	LC	52
51	Red-naped Ibis	*Pseudibis papillosa*	Threskiornithidae	M	LC	2
52	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	R	LC	3
53	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	R	NT	5
54	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	R & M	LC	615
55	Unidentified shorebirds					13
TOTAL						53,185

Note: R- Resident; R & M – Resident with migratory population; M – Migratory; M-LD – Long-Distance Migrant; LM- Local Migrant; LC – Least Concern; NT – Near Threatened, Total coverage: 10 locations along the shorelines

6.2 Alibag (Akshi Beach and Alibag Jetty)

6.2.1 Site information and survey

Alibag Beach and Akshi Beach: The sites are approximately at 30–35 km aerial distance from Mumbai. These locations are characterized by long sandy beach with few isolated but prominent rocky patches. The habitat shows dominance of bivalves in the intertidal zone. The major wetland where migratory waterbirds are recorded are the intertidal mudflats between Alibag, Akshi, and Nagaon. Every winter, several species of migratory shorebirds and seabirds are recorded here between August and March. During the surveys, species such as Bar-tailed Godwit *Limosa lapponica* and Eurasian Oystercatcher *Haematopus ostralegus* (mostly hatch year individuals) were seen mainly during early winter. Species such as Curlew Sandpiper *Calidris ferruginea* and Great Knot *Calidris tenuirostris* were recorded only during mid-winter at this site. The change in species composition from the arrival time to winter suggests that this site could be used as a stop-over site by some species during the southward journey.

Alibag is at an aerial distance of less than 50 km from Thane Creek. The creek supports a population of over 1,00,000 migratory shorebirds every winter. However, from the pilot bird banding carried out in September 2019, where 100 individuals were banded, 30 of them were resighted at Akshi in the subsequent winter. Two of the birds tagged in Thane creek during late winter were also recorded to spend the next winter in Akshi. One Great Knot tagged in Yalujiang in August 2020 was recorded at Akshi from November 2020 to February 2021. One Lesser Crested Tern *Thalasseus bengalensis* ringed at Nakhilu Island in the Persian Gulf in August 2009 was recorded at this beach in January 2010.

Bird survey was carried out in February 2021, during an approaching high-tide in the morning in order to record the shorebirds, gulls and terns at the sites. During the survey, a total of 20 species were recorded, majority of which were Lesser Sandplover *Charadris mongolus* and Kentish Plover *Charadrius alexandrinus* among shorebirds, and Black-headed Gull *Larus ridibundus*, Common Tern *Sterna hirundo*, and Lesser Crested Tern *Thalasseus bengalensis* among larids. List of birds recorded during the survey is given in Table 11.

The waypoints were colleceted from the sandy shore and adjoining areas. A narrow patch of land on the fringe of the beach is planted with *Casuarina equisetifolia* for wind breaking.

Great Knot *Calidris tenuirostris* tagged in Ylujiang, China in August 2020, resighted at Akshi in January 2021. *P.C. Deepak Nalawade*

Tagged Lesser Sandplover *Charadrius mongolus* ringed at Akshi in September 2019, resighted at Akshi in March 2021. *P.C. Deepak Nalawade*

There is sparse settlement near Akshi beach, which is surrounded by Coconut and Betelnut plantations. The site adjoining Alibag jetty has settlements of fisher communities and is in close proximity to Alibag city. The intertidal area along the creek between Akshi and Alibag has muddy shores which are covered with mangrove.

6.2.2 Disturbances and Threats

In the last three years, the earlier studies and the current survey carried out at this site recorded the following threats.

6.2.2.1 Plastic Pollution

Plastic litter by locals and tourists was recorded at the beach. Plastic waste was categorised in three major forms: i) Plastic litter strewn by public (locals and tourists) ii) Dumped solid waste iii) Plastic debris deposited by the sea.

The fishermen at Alibag informed that the plastic debris at the sea has greatly hampered their active fishing time and efficiency, causing a cascading impact on their livelihood. With every fishing trip, they spend hours cleaning the plastic waste stuck in the fishing nets and the propellers of the motor boats. Much of their time was spent removing the waste from the nets, and as a consequence, they had experienced reduced catch of fishes in recent years. They attributed the root cause of the problem to the plastic litter dumped in and around Mumbai City. The fishermen were found dumping the marine debris cleaned from their nets along the boat landing areas. As there was no waste disposal mechanism in place, the removed plastic wastes made their way back into the sea.

In addition to the solid and plastic wastes on the beaches, the resultant pressure due to free ranging dogs at these sites also posed a threat to the foraging and roosting shorebirds.

6.2.2.2 Disturbance by tourists

The mid-winter season is the peak tourist season as well. During that time, several temporary recreational facilities, such as All Terrain Vehicles (ATVs), Horse Carts, food stalls and Speed Boats are set up at the beach. The shorebirds recorded at this site use this beach for feeding as well as roosting. Ignorant tourists are frequently seen trying to chase the birds for photo opportunities. Though no mortality was recorded due to such recreational, it was observed that they impacted the feeding time of the birds and frequent escaping activities led to increase in the energy budget.

6.2.2.3 Free Ranging Dogs

Free ranging dogs that feed on the solid waste were recorded chasing birds in the observed sites. Gulls injured by these dogs were also recorded during the surveys.

6.2.2.4 Fishing

The fishing boats are docked at Alibag Jetty and there is no direct disturbance recorded. The gulls in fact are seen following these boats in pursuit of bycatch the fisherfolk discard. A lot of oil and grease is recorded near the jetty. When the boats are undergoing maintenance, spilt oil and grease is seen all over the beach. During some surveys, shorebirds were recorded with their legs covered in oil.

6.2.3 Recommendations based on the survey

1. Extensive monitoring needs to be carried out to understand the species composition and the seasonality of their site use pattern in the migratory pathway.
2. Large-scale bird ringing and colour tagging is needed to understand the migratory pattern of waterbirds wintering at this site. Weight change across the months needs be noted and compared between the years to know if it is impacted by the disturbances. Morphometry to be studied to differentiate different populations. This will also give insight on whether there is inter-wetland movement between Alibag and wetlands of Mumbai during winter.
3. Local and regional birdwatchers and photographers to be encouraged to look for tagged birds at important wetlands and also to report them in a standardised manner. This will help understand the movement pattern, seasonality and network of habitats used.
4. Interaction needs to be developed with the local community and students to understand their interaction with the habitat and their indigenous knowledge about the migratory birds wintering at Akshi beach. The importance of safeguarding a network of habitats for conservation of migratory birds to be discussed by highlighting the importance of Akshi and Alibag beach for the migratory shorebirds. A basic training can be imparted on concepts of migration, need for monitoring and conservation, and different migration study techniques to interested candidates who wish to conduct birdwatching trails and sessions for tourists.
5. The local community seeks tourist inflow as a source of income. A detailed framework is to be developed by encouraging ethical activities in an environmentally conscious tourism practice. Interactions with experts from other eco-tourism sites is needed to help strengthen the understanding of needs of tourists while maintaining the means of

achieving environmentally friendly forms of engaging tourists. This will help tackle the issue of disturbance caused by tourists and also help in reducing plastic waste strewn by them.

Table 11. Details of birds recorded in Akshi Beach on January 26, 2021

Sl. No	Common Name	Scientific Name	Family	Migratory Status	IUCN status	Total Count
1	Kentish Plover	*Charadrius alexandrinus*	Charadriidae	M	LC	300
2	Greater Sandplover	*Charadrius leschenaultia*	Charadriidae	M	LC	6
3	Lesser Sandplover	*Charadrius mongolus*	Charadriidae	M	LC	2500
4	Pallas's Gull	*Larus ichthyaetus*	Laridae	M	LC	4
5	Black-headed Gull	*Larus ridibundus*	Laridae	M	LC	300
6	Caspian gull	*Larus cachinnans*	Laridae	M	LC	11
7	Slender-billed Gull	*Larus genei*	Laridae	M	LC	4
8	Common Gull-billed Tern	*Gelochelidon nilotica*	Laridae	M	LC	6
9	Caspian Tern	*Hydroprogne caspia*	Laridae	M	LC	11
10	Common Tern	*Sterna hirundo*	Laridae	M	LC	290
11	Greater Crested Tern	*Thalasseus bergii*	Laridae	M	LC	1
12	Lesser Crested Tern	*Thalasseus bengalensis*	Laridae	M	LC	200
13	Heuglin's Gull	*Larus fuscus heuglini*	Laridae	M	LC	11
14	#N/A	*Unidentified gulls*	Laridae	N/A	N/A	210
15	Unidentified waders	Unidentified waders	N/A	N/A	N/A	3400
16	Terek Sandpiper	*Xenus cinereus*	Scolopacidae	M	LC	4
17	Ruddy Turnstone	*Arenaria interpres*	Scolopacidae	M	LC	34
18	Great Knot	*Calidris tenuirostris*	Scolopacidae	M	EN	2
19	Little Stint	*Calidris minuta*	Scolopacidae	M	LC	60
20	Sanderling	*Calidris alba*	Scolopacidae	M	LC	4
21	Dunlin	*Calidris alpina*	Scolopacidae	M	LC	7

Note: M – Migratory; LC – Least Concern; EN – Endangered

6.3 Gangapur Dam and adjoining reservoirs

6.3.1 Site information and survey

The Important Bird Area of Gangapur Dam covers a large freshwater reservoir and the surrounding grasslands. The dam was constructed in 1956–57 to supply drinking water to Nashik. It is nearly 15 km away from Nashik, and extending over an area of 50 sq. km. There are nearly 14 villages, 24 hamlets, and numerous temporary dwellings of farmers, workers and fishermen surrounding the lake. This wetland is known to support large congregation of Common Pochard *Aythya ferina* (10,000) and Little Cormorant *Microcarbo niger* (2,000) along with ducks and other waterbirds. The adjoining grasslands have been good breeding ground for many grassland bird species, i.e., courser, larks, partridges, quails, and lapwings.

The survey was conducted in January and February 2021. The waypoints of different habitats were collected for mapping (Figure 2). Majority of the area surrounding Gangapur and adjoining reservoirs was under fruit and vegetable cultivation.

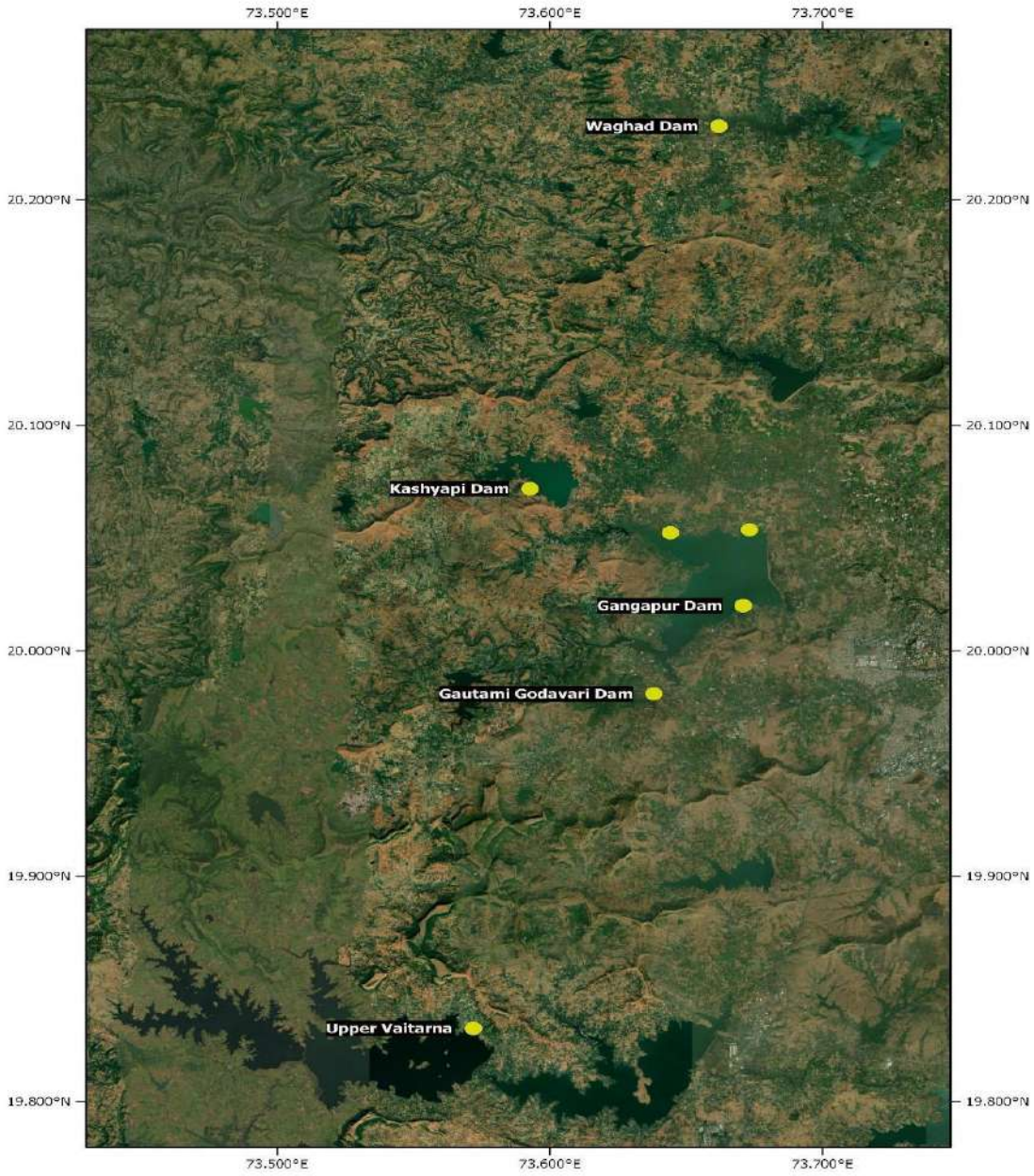


Figure 2: Gangapur survey points

During the survey, a congregation of over 2,500 ducks was recorded at this reservoir, along with cormorants, grebes, gulls and a few waders; it was noted that at Gangapur Dam the ducks and Coots kept shifting their roosting locations continuously, owing to disturbances. . It was predicted that these waterbirds could also be using adjoining reservoir for feeding and roosting. Hence, a rapid survey of the adjoining wetlands was also conducted. Along with Gangapur Dam, the other sites which were surveyed were Kashyapi Dam, Alandi Dam, Upper Vaitarna Dam, Gautami Godavari Dam and Waghad Dam. Of these sites, no birds were recorded during

the survey at Alandi Dam, but the locals mentioned that birds are frequently seen in the reservoir early morning, but moving out as the day progresses. Gautami Godavari is a small reservoir which is surrounded by vegetable fields. Only a few waterbirds were recorded here, and the locals also mentioned that large congregations of waterbirds are usually not seen here. At Upper Vaitarna and Kashyapi Dam, mainly duck species (majorly Common Pochard *Aythya ferina* and Northern Pintail *Anas acuta*) and coot were recorded. At Waghad Dam, a total of 1,400 Common Teal *Anas crecca* and 650 Common Pochard were seen along with other ducks. The ducks were seen feeding in the shallow areas around the shore quite close to the settlement. Based on the information collected from birdwatchers, this reservoir normally supports good congregations of ducks. On the banks of Waghad Dam, eight Bar-headed Geese *Anser indicus* were recorded. In the agricultural fields nearby, over 120 Common Crane *Grus grus* were also seen, their number according to local experts, goes up to 500 during mid-winter. As in case of Gangaur Dam, the terrestrial area around Waghad Dam also shows good potential for migratory and resident landbirds. Several flocks of buntings were also recorded in the adjoining vegetation. List of birds recorded during the survey is given in Table 12.

Common Pochard *Aythya ferina* recorded at Kashyapi Dam

Congregation of Northern Pintail *Anas acuta*, Eurasian Wigeon *Mareca penelope* and Common Teal *Anas crecca* recorded at Waghad Dam

6.3.2 Threats

Little is known about the pollution in the reservoirs, but run-off of the chemicals used in the cultivations could contaminate the water, with higher concentration along the banks.

6.3.2.1 Landuse Landcover change (LULC)

The land surrounding the reservoir is fertile and the access to water makes them preferred sites for farmimg. In the past 30 years, there has been a drastic shift of landcover from grassland to agricultural lands; this was evident in the LULC maps that were generated. The process of converting grassland to agricultural land is carried out by upturning soil by mechanized equipment and bulldozer in summer. This destroys the nesting sites of several ground-nesting grassland species using these habitats. The land under infrastructure in on rise, specially along the southern bank of the reservoir. The grasslands along the periphery of the reservoir are now also being converted to built-up areas, for holiday homes and resorts. This may result in fragmenting the grassland and destroying the habitat for ground nesting birds.

6.3.2.2 Soil extraction

The reservoir needs to be desilted periodically. During this process, a lot of fertile soil is also extracted from the adjoining areas. This creates a lot of disturbance as well as threatening the breeding sites of ground nesting birds.

6.3.2.3 Disturbance

The ducks and waterbirds in the lake were recorded shifting in response to the movement of fishermen. Along the bank of the reservoirs, water extraction pumps are laid, which when operated create loud noise as well as vibrations. As a result of which, the birds kept getting displaced. A resort by Maharashtra Tourism Department has come up on the banks of Gangapur Dam, which conducts water sport activities. These activities have been known to disturb the waterbirds.

6.3.3 Recommendations based on the survey

1. A comprehensive study is needed to understand the inter-wetland movement of the waterbirds in the network of reservoirs. This will give clarity on the network of wetlands of importance as well as the driving factors for the need for movement.
2. Based on the information obtained from the study mentioned above, the Gangapur wetland should be considered as a wetland complex and not just an isolated wetland. This will enable the consideration to have conservation of all the involved wetlands holistically in order to conserve the habitat.
3. A study should be carried out to understand the nature of pollution and its impact on the waterbirds.
4. Workshops to be conducted in the local schools and with communities to sensitize them about the importance of these wetlands and adjoining areas for migratory birds.
5. A breeding bird survey and threat assessment survey needs to be carried out in order in the wetlands and adjoining terrestrial habitats.

Table 12: Details of birds recorded in Gangapur during February 2021

Sl.No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total
1	Western Marsh-Harrier	*Circus aeruginosus*	Accipitridae	M-LD	LC	2
2	White-breasted Kingfisher	*Halcyon smyrnensis*	Alcedinidae	R & M	LC	1
3	Bar-headed Goose	*Anser indicus*	Anatidae	LM	LC	8
4	Brahminy (Ruddy) Shelduck	*Tadorna ferruginea*	Anatidae	R & M	LC	41
5	Common Shelduck	*Tadorna tadorna*	Anatidae	M	LC	1
6	Northern Pintail	*Anas acuta*	Anatidae	M-LD	LC	309
7	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	R	LC	81
8	Common Teal	*Anas crecca*	Anatidae	M-LD	LC	1400
9	Garganey	*Spatula querquedula*	Anatidae	M	LC	4
10	Common Pochard	*Aythya ferina*	Anatidae	M	VU	1113
11	Comb Duck	*Sarkidiornis melanotos*	Anatidae	R & M	LC	1
12	Eurasian Wigeon	*Mareca penelope*	Anatidae	M-LD	LC	54
13	Gadwall	*Mareca strepera*	Anatidae	M	LC	79
14	Northern Shoveler	*Spatula clypeata*	Anatidae	M-LD	LC	60
15	Red-crested Pochard	*Netta rufina*	Anatidae	M	LC	24
16	Unidentified ducks		Anatidae			3000
17	Grey Heron	*Ardea cinerea*	Ardeidae	R	LC	5
18	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	1
19	Great White Egret	*Ardea alba*	Ardeidae	R	LC	2
20	Intermediate Egret	*Ardea intermedia*	Ardeidae	R	LC	1
21	Little Egret	*Egretta garzetta*	Ardeidae	R	LC	4
22	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	1
23	Indian Pond-heron	*Ardeola grayii*	Ardeidae	R	LC	4
24	Little Ringed Plover	*Charadrius dubius*	Charadriidae	R	LC	2
25	Asian Openbill	*Anastomus oscitans*	Ciconiidae	R	LC	5
26	Black-headed Bunting	*Emberiza melanocephala*	Emberizidae	M	LC	162
27	Red-headed Bunting	*Emberiza bruniceps*	Emberizidae	M	LC	100
28	Common Crane	*Grus grus*	Gruidae	M	LC	124
29	Barn Swallow	*Hirundo rustica*	Hirundinidae	M	LC	50
30	Red-rumped Swallow	*Cecropis daurica*	Hirundinidae	M	LC	20
31	Barn Swallow	*Hirundo rustica*	Hirundinidae	M	LC	50
32	Long-tailed Shrike	*Lanius schach*	Laniidae	M	LC	2
33	Brown-headed Gull	*Larus brunnicephalus*	Laridae	M	LC	61
34	Whiskered Tern	*Chlidonias hybrida*	Laridae	M	LC	4
35	River Tern	*Sterna aurantia*	Laridae	R	VU	3

Sl.No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total
36	Yellow Wagtail	*Motacilla flava*	Motacillidae	M-LD	LC	21
37	Siberian Stonechat	*Saxicola maurus*	Muscicapidae	M	LC	11
38	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	R & M	LC	31
39	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	R	LC	145
40	Black-breasted Weaver	*Ploceus benghalensis*	Ploceidae	R	LC	70
41	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	44
42	Common Coot	*Fulica atra*	Rallidae	R & M	LC	260
43	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	R	LC	22
44	Common Greenshank	*Tringa nebularia*	Scolopacidae	M	LC	1
45	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	M	LC	1
46	Green Sandpiper	*Tringa ochropus*	Scolopacidae	M-LD	LC	2
47	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	M	LC	2
48	Wood Sandpiper	*Tringa glareola*	Scolopacidae	M	LC	6
49	Little Stint	*Calidris minuta*	Scolopacidae	M	LC	1
50	Temminck's Stint	*Calidris temminckii*	Scolopacidae	M	LC	3
51	Red-naped Ibis	*Pseudibis papillosa*	Threskiornithidae	M	LC	7
52	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	R & M	LC	3
53						7413

Note: R- Resident; R & M – Resident with migratory population; M – Migratory; M-LD – Long-Distance Migrant; LM- Local Migrant LC – Least Concern; VU – Vulnerable

6.4 Nandur Madhmeshwar Wildlife Sanctuary

6.4.1 Site information and survey

This wetland is formed due to the construction of a weir for irrigation at the confluence of two rivers (Godavari and Kadwa). The sanctuary is spread across an area of 100.12 sq. km. surrounded by 11 villages namely Nandur Madhameshwar, Kurudgaon, Chapadgaon, Khangaon-Thadi, Dindori, Katargaon, Karanjgaon, Kothure, Pimplas, Manjargaon, and Shivare. Of the total area, an area of 1,176.457 ha is under the jurisdiction of the Forest Department, along with the Revenue Department and Irrigation Department, the remaining 8,177.74 ha which is considered as a buffer area is under Revenue Department. The reservoir is downstream from Gangapur and Darna dams, and receives water when it is released from these two dams. The water from Nandur Madhmeshwar dam is released for irrigation and domestic use for Aurangabad and Ahmednagar districts. As a result of which, the water level in Nandur Madhmeshwar keeps fluctuating based on the water released upstream and demand

downstream. This has provided biological conditions that have favoured growth and stabilisation of aquatic vegetation and fauna.

The reservoir is an important staging and wintering ground for migratory waterfowl, and more than 20,000 waterbirds are recorded during winter months. Species such as White Stork and Demoiselle Crane have been recorded in numbers above the 1% biogeographic population. This wetland supports staging and wintering waders, ducks, and other waterbirds.

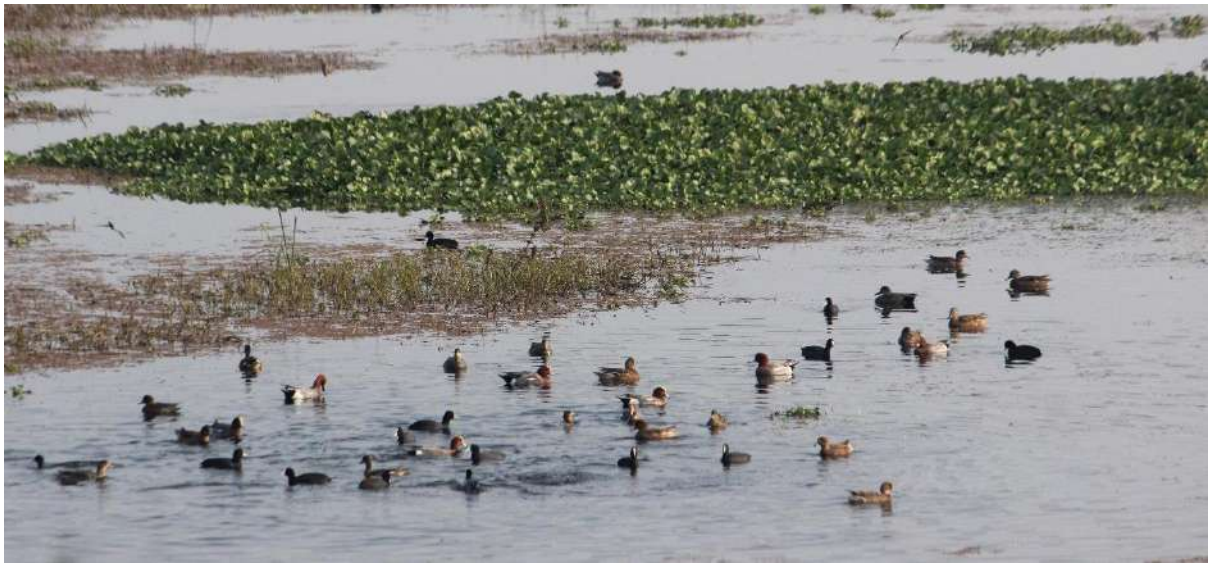
About 23 small satellite lakes are present within a radius of 25 km around the reservoir. The birds can use the network of wetlands for feeding.

In January 2021 survey, a landcover survey was carried out to mark the waypoints of the different landcover classes. It was noted that almost entire area surrounding the sanctuary is under cultivation. The cranes wintering in the wetland were also seen foraging in the agricultural fields. The land around the wetland is covered by large stretches of *Typha*. The locals mentioned that the *Typha* had encroached extensively in the last few decades. This has reduced the open area which was used by waders. Zonation was seen in the waterbirds recorded in the wetland. A coordinated waterbird count was done from eight locations, covered by eight teams. Each team had two forest department staff, one BNHS staff and two birdwatchers.

In the openwater in the centre of the wetland, almost 10,000 Common Coot *Fulica atra* were recorded, along with Northern Shoveler *Spatula clypeata* in large numbers (3,000). A total of 12 species of ducks were seen (Appendix 3). Of the 14 species of waders seen here, Red-wattled Lapwing was the dominant species (101), followed by Little Stint (87). According to senior ornithologist Mr Ugaokar who has been involved in conducting Asian Waterbird Census (AWC) at the site since 1980s, the waterbird numbers have gone up, specially the ducks, but the diversity has declined. The perches installed by the Forest Department were seen to be used mainly by cormorants, and the trees on the islands had active nests of Painted Stork *Mycteria leucocephala* and Asian Openbill *Anastomus oscitans*. The Forest Department staff informed that species such as River Tern *Sterna aurantia*, Whiskered Tern *Chlidonias hybrida* and Cotton Pygmy-goose *Nettapus coromandelianus*are are breeding in summer.

Streak-throated Swallow *Petrochelidon fluvicola* nesting colony

Duck congregation recorded at Nandur Madhmeshwar



Eurasian Wigeon *Mareca penelope* and Common Coot *Fulica atra* seen at Nandur Madhmeshwar

6.4.2 Vegetation within and around Nandur Madhmeshwar

The pictoral guide to Floral Diversity of Nandur Madhmeshwar Wildlife Sanctuary by Dr Rajendra Shinde describes the vegetation of the region

Majority of the area surrounding the sanctuary is under cultivation, almost one third of which is sugarcane. Other major crops are wheat and bajra, besides which, grape, onion, tomato, cauliflower, cabbage, potato, brinjal, and lady's finger are also grown.

The general vegetation of the sanctuary changes according to the season. During monsoon, almost half of the reservoir is covered with thickets of *Eichhornia*, which are periodically removed.

The three main categories of aquatic flora recorded here are submerged hydrophytes (*Hydrilla verticillate, Otellia alismoides, Vallisneria natans*, and *Potamogeton perfoliatus*), free-floating hydrophytes (*Spirodela polyrhiza*, *Eichhornia crassipes*, and *Azolla pinnata*) and reed-swamp association (*Rotala serpyfolia, Ipoemia aquatica, Bacopa monnieri*, and *Hydrophila auriculata* among others)

There are two major islands in the reservoir, and the plants on these islands are mainly mesophytes and halophytes. Few of the common species on these islands are *Capparis sepiaria, Cleome viscosa, Hibiscus ovalifolius, Urena lobata, Triumfetta rotundifolia, Taverniera cuneifolia*, and *Caesalpinia decapetala*.

The area along the Godavari canal is dominated by tees such as *Pongamia pinnata, Dalbergia sissoo, Tamarindus indica, Acacia nilotica*, and *Ficus* spp. The vegetation along the river banks is dominated by herbs and a few shrubs. The major herbs are *Alysicarpus tetragonolobus, Goniogyna hirta, Glossocardia bosvallia, Gnaphalium polycaulon*, and *Vernonia cinerea.*

The area downstream of the dam mainly comprises herbaceous plants such as *Polygala arvensis, Indigofera cordifolia, Ammania baccifera, Cucumis melo, Glinus lotoides, Cyathocline purpurea* among others.

Along with the species mentioned above, a prominent area adjoining the waterbody is covered by *Typha angustifolia*.

6.4.3 Management activities proposed and implemented by the Forest Department

6.4.3.1 Zonation

To systematically manage the wetland, the sanctuary is proposed to be divided under three zones, Development zone, Ecotourism zone, and Multiple Eco-development activity zone.

Development zone: The areas with large density of waterbirds are proposed to be demarcated as the Development Zone. Only protection, surveillance and monitoring to be permitted in this zone. Tourists will not have direct access to this area. Birdwatching will be permitted from a distance, at designated points.

Eco-tourism zone: The area under the Forest Department at Manjargaon submergence and adjoining the dam site, where eco-tourism activities will be permitted.

Multiple Eco-Development activity zone: This zone is on private land which will also be used as a buffer area and an area for eco-development programmes to protect and conserve the wetland with awareness programmes.

6.4.3.2 Protection

Patrolling is being carried out on foot and by vehicle. Check *nakas* to be managed for tourists and patrolling to be carried out from the five watch towers that are at vantage points.

6.4.3.3 Avian health and disease monitoring

Treatment cages and medical facility to be made available for incidences of bird injury and bird disease that need immediate intervention. Veterinary care facility to be provided and training

to be imparted for field staff for preliminary treatment of birds & overall management of habitat .

6.4.3.4 Training of frontline staff and local stakeholders

Training workshops on wetland conservation along with field visits to be conducted for the field staff as well as local communities. Installing informative sign boards and a library facility in the interpretation centre will be beneficial for the visitors to understand more about the wetland and birds.

6.4.3.5 Regulating fishing in the wetland

Some communities are dependent on fishing for livelihood. A study needs to be carried out to understand the level of dependence of the community and the impact of fishing on the habitat and birds to come up with appropriate regulations regarding fishing activity in the wetland.

6.4.3.6 Regulations on the Galpera practice

Galpera (seasonal cultivation on land exposed after water recedes) is practiced on both the banks of the reservoir. These areas are also used by roosting and feeding sites by some waterbirds. The major crops grown on galpera land are sugarcane, maize, wheat, grapes, groundnuts and vegetables and large quantities of chemical fertilizers and insecticides are used on these lands. These chemicals eventually leach out into the wetland. Detailed studies are needed elucidating the impact of galpera on the fauna of the wetland. There is also a proposition to adopt organic farming on this area, and to restrict cultivation only for barren land. Detailed regulations and framework is required to limit the threats and disturbances from this practice on the birds in the sanctuary.

6.4.3.7 Pollution

The sweage from the 11 villages surrounding the wetlands is released into the reservoir. Waste water of Eklahre Thermal Power plant and Niphad Co-operative Sugar Factory also finds its way into the reservoir. The chemicals and fertilizers used in agriculture fields in and around the acquired area are also leached out in the reservoir. There has not been a systematic study assessing the impact of these pollutants on the water quality. But eutrophication in the wetland is an indication of the chemical load in the wetland. Efforts are to be made to ensure that the sugarcane factories and other factories are not permitted to release untreated effluents into the wetland.

6.4.3.8 Controlling invasive species

The area under the cover of invasive species such as *Ipoemia* and *Parthenium* has seen a rapid rise. The weeds are to be controlled by eradicating them in phase-wise manner.

6.4.3.9 Research and Training

Research: Biodiversity documentation is needed to understand the species occurring and their requirements. A study is needed assessing the level of pollutants in the wetland and its impacts on the waterbirds. The water chemistry also needs to be correlated with the weed encroachment. The study of migratory birds using the habitat, their seasonality, and their migratory pattern needs to be studied.

The local community needs to be trained in bird and plant identification, and the field staff needs to be trained in bird monitoring and habitat management.

6.4.4 Recommendations based on the survey

Only a rapid assessment survey was carried out at this site. Further surveys and communication with the Forest Department staff as well as the local communities will be helpful in recommending more such management actions.

1. 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.
2. Extensive study on the migratory pattern of waterbirds wintering at the wetland will help understand the connectivity and the importance of the wetland. The Forest Department can look for the use of devices on some target species to obtain detailed information on the seasonality of site use and migratory pathway followed by these populations.
3. 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.
4. 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.

7 RAJASTHAN

7.1 Keoladeo National Park

7.1.1 Site Description

Keoladeo National Park (KNP), popularly known as Bharatpur Bird Sanctuary, is located at the confluence of the Gambhir and Banganga rivers in Bharatpur district of Rajasthan. The Park has a remarkable diversity of habitats and a unique wetland which is listed under UNESCO World Heritage Site. The area of this park has more vegetation compared to the semi-arid region of Bharatpur hence termed as 'Ghana' meaning 'thicket'. It is a temporarily rain-fed wetland which regulates its water level with the help of bandh on the outer periphery of the KNP.

It is one of the world-famous bird paradises for both the resident and migratory waterbirds. It is declared as a Bird Sanctuary which is one of the important areas of congregation of aquatic migratory birds and important CAF stopover in semi-arid region of Rajasthan. The mosaic of swamp, grasses, scrubs, and woodland of this park is home to a variety of fauna including birds, mammals, reptiles, amphibians, fishes, and invertebrates. It is also known for the wintering ground of critically endangered Siberian Cranes *Grus leucogeranus*. Altogether 104 bird species have been recorded breeding in this park. It has one of the world's spectacular heronries formed by 15 species of birds which nest in huge numbers.

Common Migratory ducks in the park are Northern Pintail *Anas acuta*, Common Teal *Anas crecca*, Northern Shoveler *Spatula clypeata*, Gadwall *Mareca strepera*, Greylag Goose *Anser anser*, Bar-headed Goose *Anser indicus*, Eurasian Wigeon *Anas penelope* while Common Pochard *Aythya ferina*, Marbled Teal *Marmaronetta angustirostris*, and Baikal Teals *Sibirionetta formosa* are the threatened species. Falcated Duck *Mareca falcata*, Baer's Pochard *Aythya baeri*, Common Shelduck *Tadorna tadorna*, and Greater Scaup *Aythya marila* are also rarely sighted.

Bombay Natural History Society was the first organisation who initiated a Research Project known as the Keoladeo National Park Ecology Study at Bharatpur (1980–1990). The main objective of the project was to collect data essential for the comprehensive management programme of the park. Bird migration studies and recoveries of ringed birds from Keoladeo is

among the high level research conducted during the 19th century which depicts it as a wetland of international importance.

7.1.2 Account on Migratory birds:

Bharatpur harbours around 343 species of bird (Venkitachalam *et al*. 2008) including migratory and resident birds with different families and conservation status. The strategic location of Keoladeo in the Central Asian Flyway, makes it an important wintering site for congregating waterfowl species such as ducks, geese, coots, and waders. KNP also provides a major stopover site for migratory birds to get their food and shelter after a long journey across Himalaya.

Survey in Keoladeo NP was conducted on February 24, 2021. Total of 60 bird species belonging to 17 families were recorded in which 26 species were long-distance migratory, three were local migratory while 31 were resident. Majority of the recorded bird species (57 species) were either waterbirds or water dependent species (Table 13). Four globally threatened and six Near-threatened (as per IUCN Redlist category) species of birds were recorded during the survey.

Bar-headed Goose *Anser indicus* feeding on grasses in the Keoladeo National Park

It has a diverse habitat for migratory species like vultures, terns, eagles, and ducks. It has majority population of birds falling under the IUCN threatened list which congregate in the park every year.

7.1.3 Observational points:

i. Fish population and aquatic vegetation seems to be good in the wetlands as good numbers in the waterbodies

ii. A good population of Bar-headed Goose *Anser indicus* are still found in the park and were not observed leaving the park during the evening.

iii. Nesting colonies of Painted storks *Mycteria leucocephala* (*c*. 100) were observed on *Acacia* species. Most of the juveniles have left the nest and were seen flying and feeding on their own; however, a few juveniles were still found to be using the nest and adults used to feed them.

7.1.4 Threats observed:

- No immediate threats were observed during the present survey. More visits could help in identifying the threats in future.

Habitat of Keoladeo NP

Left over nests of Painted Stork on *Acacia* species in the Keoladeo NP

Table 13: List of birds recorded at Keoladeo National Park during February 2021.

Sl. No.	Common Name	Species Name	Family	IUCN Status	Migratory status	Total
1	Eastern Imperial Eagle	*Aquila heliacal*	Accipitridae	VU	M-LD	1
2	Greater Spotted Eagle	*Clanga clanga*	Accipitridae	VU	M-LD	2
3	Steppe Eagle	*Aquila nipalensis*	Accipitridae	EN	M-LD	2
4	Western Marsh Harrier	*Circus aeruginosus*	Accipitridae	LC	M-LD	1
5	Eagle Spp		Accipitridae			2
6	Pied Kingfisher	*Ceryle rudis*	Alcedinidae	LC	R	10
7	Bar-headed Goose	*Anser indicus*	Anatidae	LC	LM	868
8	Common Teal	*Anas crecca*	Anatidae	LC	M-LD	2233
9	Eurasian Wigeon	*Mareca penelope*	Anatidae	LC	M-LD	262
10	Ferruginous Duck	*Aythya nyroca*	Anatidae	NT	M-LD	2
11	Gadwall	*Mareca strepera*	Anatidae	LC	M-LD	1312
12	Garganey	*Spatula querquedula*	Anatidae	LC	M-LD	280
13	Greylag Goose	*Anser anser*	Anatidae	LC	M-LD	59
14	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	LC	R	53
15	Northern Pintail	*Anas acuta*	Anatidae	LC	M-LD	691
16	Northern Shoveler	*Spatula clypeata*	Anatidae	LC	M-LD	2013
17	Red-crested Pochard	*Netta rufina*	Anatidae	LC	M-LD	8
18	Ruddy Shelduck	*Tadorna ferruginea*	Anatidae	LC	LM	27
19	Oriental Darter	*Anhinga melanogaster*	Anhingidae	NT	R	30
20	Black Bittern	*Ixobrychus flavicollis*	Ardeidae	LC	R	1
21	Cattle Egret	*Bubulcus ibis*	Ardeidae	LC	R	4
22	Great White Egret	*Ardea alba*	Ardeidae	LC	R	306
23	Grey Heron	*Ardea cinerea*	Ardeidae	LC	R	96
24	Indian Pond-heron	*Ardeola grayii*	Ardeidae	LC	R	50
25	Intermediate Egret	*Ardea intermedia*	Ardeidae	LC	R	14
26	Little Egret	*Egretta garzetta*	Ardeidae	LC	R	4
27	Purple Heron	*Ardea purpurea*	Ardeidae	LC	R	11
28	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	LC	R	50
29	White-tailed Lapwing	*Vanellus leucurus*	Charadriidae	LC	M-LD	19
30	Black-necked Stork	*Ephippiorhynchus asiaticus*	Ciconiidae	NT	R	2
31	Painted Stork	*Mycteria leucocephala*	Ciconiidae	NT	R	85
32	Indian Roller	*Coracias benghalensis*	Coraciidae	LC	R	1
33	Sarus Crane	*Grus antigone*	Gruidae	VU	R	2
34	Bronze-winged Jacana	*Metopidius indicus*	Jacanidae	LC	R	44

Sl. No.	Common Name	Species Name	Family	IUCN Status	Migratory status	Total
35	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	LC	R	2
36	Citrine Wagtail	*Motacilla citreola*	Motacillidae	LC	LM	2
37	Western Yellow Wagtail	*Motacilla flava*	Motacillidae	LC	M-LD	1
38	White Wagtail	*Motacilla alba*	Motacillidae	LC	M-LD	1
39	Wagtail Spp		Jacanidae			445
40	Wader Spp		NA			1500
41	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	LC	R	3
42	Indian Cormorant	*Phalacrocorax fuscicollis*	Phalacrocoracidae	LC	R	3
43	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	LC	R	20
44	Grey Francolin	*Francolinus pondicerianus*	Phasianidae	LC	R	3
45	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	LC	R	42
46	Common Coot	*Fulica atra*	Rallidae	LC	R	2516
47	Common Moorhen	*Gallinula chloropus*	Rallidae	LC	R	581
48	Purple Swamphen	*Porphyrio porphyria*	Rallidae	LC	R	82
49	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	LC	R	60
50	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	LC	R	181
51	Black-tailed Godwit	*Limosa limosa*	Scolopacidae	NT	M-LD	16
52	Common Greenshank	*Tringa nebularia*	Scolopacidae	LC	M-LD	2
53	Common Redshank	*Tringa tetanus*	Scolopacidae	LC	M-LD	3
54	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	LC	M-LD	9
55	Common Snipe	*Gallinago gallinago*	Scolopacidae	LC	M-LD	8
56	Green Sandpiper	*Tringa ochropus*	Scolopacidae	LC	M-LD	12
57	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	LC	M-LD	3
58	Ruff	*Calidris pugnax*	Scolopacidae	LC	M-LD	6
59	Wood Sandpiper	*Tringa glareola*	Scolopacidae	LC	M-LD	35
60	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	NT	R	75
61	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	LC	R	51
62	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	LC	R	97
	Total					14304

Note: R- Resident; R & M – Resident with migratory population; M – Migratory; M-LD – Long-Distance Migrant; LM- Local Migrant;LC – Least Concern; NT – Near Threatened;VU – Vulnerable; EN – Endangered

7.2 Alniya Dam

7.2.1 Site Description

Alniya is an irrigation tank which supports agriculture in the surrounding area canals. It fulfills the IBA criteria A1 (Threatened species) and A4iii (supports for ≥ 20,000 waterbirds) and a potential Ramsar Site also. Among the threatened species, Sarus Crane *Grus antigone* (Vulnerable) is a regular breeding species here. Dalmatian Pelican *Pelecanus crispus* (Vulnerable), is regularly seen at Alniya Dam. The Great White Pelican *P. onocrotalus* is also seen here. Earlier White-rumped Vulture G*ypys .bengalensis*, Long-billed Vulture *G. indicus* and Indian Skimmer *Rynchops albicollis* used to spot in the vicinity of Alniya Dam but there are no recent records while Egyptian Vulture *Neophron percnopterus* is fairly common in the area.

7.2.2 Account on Migratory birds

Survey was conducted on March 03, 2021. A total of 54 bird species of 20 families were recorded, of which 20 species were long-distance migratory, **3** were local migrants while **31** were resident. 51 species were found to be either waterbirds or water dependent birds. Of the 52 species recorded during the present survey, five species were globally threatened and seven species were Near-threatened as per IUCN Redlist category (Table 14).

7.2.3 Observational points

i. A flock of Black-tailed Godwit *Limosa limosa* observed during the survey, the count was estimated as 2,000 individuals
ii. Many wagtails were also seen in the evening foraging on the periphery of the wetland. This could be a roosting population.
iii. Fish population seems to be good in the wetlands as a good number of River Terns *Sterna aurantia*, cormorants were observed.
iv. A roosting flock of 300 individuals of Gulls and Terns were seen in the evening hours.
v. Indian and Little Cormorants come to the area for feeding only and leave the wetland by the evening.

7.2.4 Threats observed

- Expansion of agriculture on the fringes of wetlands.
- Use of pesticides and fertilizers could be a minor threat.
- Few fishing boats were seen during the visit which caused negligible disturbance to the birds. More surveys are required to understand the extents of this threat

Table 14: Details of birds recorded at Alniya Dam during March 2021

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory status	Total
1	Accipitridae	Egyptian Vulture	*Neophron percnopterus*	EN	R	2
2	Alcedinidae	Common Kingfisher	*Alcedo atthis*	LC	R	1
3	Anatidae	Bar-headed Goose	*Anser indicus*	LC	LM	34
4	Anatidae	Comb Duck	*Sarkidiornis melanotos*	LC	R	1
5	Anatidae	Common Pochard	*Aythya ferina*	VU	M-LD	256
6	Anatidae	Gadwall	*Mareca strepera*	LC	M-LD	21
7	Anatidae	Garganey	*Spatula querquedula*	LC	M-LD	3
8	Anatidae	Northern Pintail	*Anas acuta*	LC	M-LD	100
9	Anatidae	Northern Shoveler	*Spatula clypeata*	LC	M-LD	2
10	Anatidae	Ruddy Shelduck	*Tadorna ferruginea*	LC	LM	120
11	Ardeidae	Cattle Egret	*Bubulcus ibis*	LC	R	60
12	Ardeidae	Great White Egret	*Ardea alba*	LC	R	7
13	Ardeidae	Grey Heron	*Ardea cinerea*	LC	R	6
14	Ardeidae	Intermediate Egret	*Ardea intermedia*	LC	R	4
15	Ardeidae	Little Egret	*Egretta garzetta*	LC	R	100
16	Ardeidae	Purple Heron	*Ardea purpurea*	LC	R	1
17	Burhinidae	Great Thick-knee	*Esacus recurvirostris*	NT	R	2
18	Charadriidae	Kentish Plover	*Charadrius alexandrines*	LC	R	70
19	Charadriidae	Little Ringed Plover	*Charadrius dubius*	LC	R	7
20	Ciconiidae	Woolly-necked Stork	*Ciconia episcopus*	VU	R	2
21	Ciconiidae	Painted Stork	*Mycteria leucocephala*	NT	R	47
22	Coraciidae	Indian Roller	*Coracias benghalensis*	LC	R	1
23	Gruidae	Sarus Crane	*Grus Antigone*	VU	R	2
24	Laridae	River Tern	*Sterna aurantia*	VU	R	20
25	Laridae	Whiskered Tern	*Chlidonias hybrida*	LC	R	2
26	Laridae	Gulls & Terns spp.				300
27	Motacillidae	Citrine Wagtail	*Motacilla citreola*	LC	LM	2
28	Motacillidae	Western Yellow Wagtail	*Motacilla flava*	LC	M-LD	27
29	Motacillidae	White Wagtail	*Motacilla alba*	LC	M-LD	3
30	Motacillidae	Wagtail spp.				1000
31	Pandionidae	Osprey	*Pandion haliaetus*	LC	M-LD	1
32	Pelecanidae	Dalmatian Pelican	*Pelecanus crispus*	NT	M-LD	10

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory status	Total
33	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	LC	R	14
34	Phalacrocoracidae	Indian Cormorant	*Phalacrocorax fuscicollis*	LC	R	210
35	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	LC	R	100
36	Phoenicopteridae	Greater Flamingo	*Phoenicopterus roseus*	LC	R	13
37	Podicipedidae	Great Crested Grebe	*Podiceps cristatus*	LC	R	1
38	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	LC	R	3
39	Rallidae	Common Coot	*Fulica atra*	LC	R	7
40	Recurvirostridae	Black-winged Stilt	*Himantopus Himantopus*	LC	R	20
41	Recurvirostridae	Pied Avocet	*Recurvirostra avosetta*	LC	M-LD	146
42	Scolopacidae	Black-tailed Godwit	*Limosa limosa*	NT	M-LD	2000
43	Scolopacidae	Common Greenshank	*Tringa nebularia*	LC	M-LD	5
44	Scolopacidae	Common Redshank	*Tringa tetanus*	LC	M-LD	8
45	Scolopacidae	Common Snipe	*Gallinago gallinago*	LC	M-LD	1
46	Scolopacidae	Curlew Sandpiper	*Calidris ferruginea*	NT	M-LD	5
47	Scolopacidae	Eurasian Curlew	*Numenius arquata*	NT	M-LD	19
48	Scolopacidae	Green Sandpiper	*Tringa ochropus*	LC	M-LD	2
49	Scolopacidae	Little Stint	*Calidris minuta*	LC	M-LD	30
50	Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	LC	M-LD	1
51	Scolopacidae	Temminck's Stint	*Calidris temminckii*	LC	M-LD	7
52	Threskiornithidae	Black-headed Ibis	*Threskiornis melanocephalus*	NT	R	8
53	Threskiornithidae	Eurasian Spoonbill	*Platalea leucorodia*	LC	R	30
54	Threskiornithidae	Red-naped Ibis	*Pseudibis papillosa*	LC	R	1
Total						4845

Note: R- Resident; R & M – Resident with migratory population; M – Migratory; M-LD – Long-Distance Migrant; LM- Local Migrant;LC – Least Concerne; NT – Near Threatened; VU – Vulnerable; EN - Endangered

7.3 Bardha Dam

7.3.1 Site Description

Bardha Dam is a medium-sized irrigation dam with an extent of *c*. 300 ha. The reservoir is controlled by the State Irrigation Department, whose main purpose is to supply water to farmers. This wetland supports a large number of waterfowl, particularly migratory ducks, pelicans, flamingos, Eurasian Spoonbill *Platalea leucorodia*, Ruff *Calidris pugnax*, Gadwall *Mareca strepera*, Bar-headed Goose *Anser indicus*, and other waterbirds. Population of Great White Pelican *Pelecanus onocrotalus*, Gadwall, Eurasian Spoonbill , Ruff and Sarus Crane *Grus antigone* is more than 1% population of South Asia defined by Wetland International however, recent population status needs to be assessed.

7.3.2 Account on Migratory birds

Survey was conducted on March 04, 2021. During the survey, 40 species of birds from 17 families were recorded from the Bardha dam. Nineteen species out of 40 were long-distance migrants, 2 were local migrants while 19 were resident bird species. Four globally threatened (Vulnerable) and eight Near-threatened species of birds (as per IUCN Redlist category) were recorded during the present survey (Table 15).

7.3.3 Observational Points

i. Around 5,000 waders estimated foraging on the banks of the dam.
ii. Looking at the large number of gulls, terns and pelicans foraging in the wetland, it can be concluded that fish population will be good in the dam.
iii. Fishing activities continue throughout the year.
iv. A nest of Small Pratincole *Glareola lactea* was seen during the survey on a small emerging island. There is a possibility of locating nesting sites of River Terns *Sterna aurantia*, Whiskered Tern *Chlidonia hybrida* and Pratincoles during summer on the emerging islands.
v. Locals have observed nesting of birds on the islands as water level goes down. A survey in the month of May can confirm the nesting information.

7.3.4 Threats observed:

- Fishing pressure seems to be high on the wetland
- Human disturbance due to fishing activities
- Expansion of agriculture on the fringes of wetlands
- High tourism pressure during the monsoon season as people visit the dam for recreational activities.

Table 15: Details of birds recorded at Bardha dam during March 2021

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory status	Total
1	Accipitridae	Black Kite	*Milvus migrans*	LC	R	110
2	Anatidae	Bar-headed Goose	*Anser indicus*	LC	LM	150
3	Anatidae	Comb Duck	*Sarkidiornis melanotos*	LC	R	54
4	Anatidae	Common Pochard	*Aythya ferina*	VU	M-LD	4
5	Anatidae	Common Teal	*Anas crecca*	LC	M-LD	330
6	Anatidae	Eurasian Wigeon	*Mareca penelope*	LC	M-LD	4
7	Anatidae	Garganey	*Spatula querquedula*	LC	M-LD	10
8	Anatidae	Indian Spot-billed Duck	*Anas poecilorhyncha*	LC	R	8
9	Anatidae	Northern Pintail	*Anas acuta*	LC	M-LD	120
10	Anatidae	Northern Shoveler	*Spatula clypeata*	LC	M-LD	16
11	Anatidae	Ruddy Shelduck	*Tadorna ferruginea*	LC	LM	7
12	Ardeidae	Grey Heron	*Ardea cinerea*	LC	R	15
13	Burhinidae	Great Thick-knee	*Esacus recurvirostris*	NT	R	5
14	Charadriidae	Little Ringed Plover	*Charadrius dubius*	LC	R	7
15	Ciconiidae	Asian Openbill	*Anastomus oscitans*	LC	R	160
16	Ciconiidae	Asian Woollyneck	*Ciconia episcopus*	VU	R	13
17	Ciconiidae	Painted Stork	*Mycteria leucocephala*	NT	R	135
18	Glareolidae	Little Pratincole	*Glareola lactea*	LC	R	50
19	Gruidae	Sarus Crane	*Grus antigone*	VU	R	5
20	Hirundinidae	Wire-tailed Swallow	*Hirundo smithii*	LC	R	8
21	Laridae	Black-headed Gull	*Chroicocephalus ridibundus*	LC	M-LD	20
22	Laridae	Little Tern	*Sternula albifrons*	LC	R	5
23	Laridae	Pallas's Gull	*Ichthyaetus ichthyaetus*	LC	M-LD	380
24	Laridae	River Tern	*Sterna aurantia*	NT	R	30
25	Motacillidae	Western Yellow Wagtail	*Motacilla flava*	LC	M-LD	5
26	Motacillidae	Egrets spp.				120
27	Motacillidae	Pelican spp.				32
28	Motacillidae	Waders spp.				5000
29	Pelecanidae	Dalmatian Pelican	*Pelecanus crispus*	NT	M-LD	4
30	Pelecanidae	Great White Pelican	*Pelecanus onocrotalus*	LC	M-LD	16
31	Phalacrocoracidae	Cormorant spp.				300
32	Phalacrocoracidae	Indian Cormorant	*Phalacrocorax fuscicollis*	LC	R	210
33	Podicipedidae	Great Crested Grebe	*Podiceps cristatus*	LC	R	2

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory status	Total
34	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	LC	R	650
35	Scolopacidae	Black-tailed Godwit	*Limosa limosa*	NT	M-LD	1900
36	Scolopacidae	Common Greenshank	*Tringa nebularia*	LC	M-LD	200
37	Scolopacidae	Common Redshank	*Tringa totanus*	LC	M-LD	200
38	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	LC	M-LD	10
39	Scolopacidae	Curlew Sandpiper	*Calidris ferruginea*	NT	M-LD	1
40	Scolopacidae	Eurasian Curlew	*Numenius arquata*	NT	M-LD	6
41	Scolopacidae	Little Stint	*Calidris minuta*	LC	M-LD	200
42	Scolopacidae	Ruff	*Calidris pugnax*	LC	M-LD	1400
43	Threskiornithidae	Black-headed Ibis	*Threskiornis melanocephalus*	NT	R	15
44	Threskiornithidae	Eurasian Spoonbill	*Platalea leucorodia*	LC	R	100
Total						12,017

Note: R- Resident; M – Migratory; M-LD – Long-Distance Migrant; LM- Local Migrant; LC – Least Concern; NT – Near Threatened; VU – Vulnerable

7.4 Ram Sagar

7.4.1 Site Description

Ram Sagar is an irrigation tank which provides water to agricultural land in the surrounding areas through canal systems. The lake was constructed by the erstwhile Maharaja of Bundi. It is included in the IBA list because of its great potential to attract more than 20,000 waterfowl, and is a nesting site for the globally Threatened Sarus Crane.

7.4.2 Account on Migratory birds

Field visit to Ram Sagar dam was conducted on March 05, 2020. During the survey, 39 species of birds belonging to 16 families were recorded. Fifteen species out of 39 species of birds were Long-Distance migratory, and 24 were resident. Two globally threatened (Vulnerable) and four Near-threatened as per IUCN Redlist category were recorded during the survey (Table 16).

7.4.3 Observational points

i. Unlike the previous survey of BNHS in January 2018, the lake had good quantity of water due to prohibition of water pumping to the surrounding agricultural field.

ii. Flock of 450 Black-tailed Godwit *Limosa limosa* and 100 Ruff *Calidris pugnax*, were also seen during the survey.

iii. Fishing was also restricted in the wetland. Hence, no immediate threat was observed at the wetland.

iv. Availability of water has attracted more than 5,000 waterfowls during this season.

7.4.4 Threats

- Expansion of agriculture on the fringes of wetlands.

Table 16: Details of birds recorded at the Ramsagar Lake during March 2021

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory Status	Total
1	Alcedinidae	Pied Kingfisher	*Ceryle rudis*	LC	R	2
2	Anatidae	Comb Duck	*Sarkidiornis melanotos*	LC	R	160
3	Anatidae	Common Pochard	*Aythya ferina*	VU	M-LD	160
4	Anatidae	Common Teal	*Anas crecca*	LC	M-LD	210
5	Anatidae	Cotton Pygmy-goose	*Nettapus coromandelianus*	LC	R	3
6	Anatidae	Eurasian Wigeon	*Mareca penelope*	LC	M-LD	305
7	Anatidae	Ferruginous Duck	*Aythya nyroca*	NT	M-LD	25
8	Anatidae	Gadwall	*Mareca strepera*	LC	M-LD	50
9	Anatidae	Garganey	*Spatula querquedula*	LC	M-LD	162
10	Anatidae	Indian Spot-billed Duck	*Anas poecilorhyncha*	LC	R	55
11	Anatidae	Northern Pintail	*Anas acuta*	LC	M-LD	160
12	Anatidae	Northern Shoveler	*Spatula clypeata*	LC	M-LD	330
13	Anatidae	Red-crested Pochard	*Netta rufina*	LC	M-LD	2
14	Anhingidae	Oriental Darter	*Anhinga melanogaster*	NT	R	1
15	Ardeidae	Grey Heron	*Ardea cinerea*	LC	R	12
16	Ardeidae	Purple Heron	*Ardea purpurea*	LC	R	3
17	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	LC	R	7
18	Ciconiidae	Painted Stork	*Mycteria leucocephala*	NT	R	1
19	Jacanidae	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC	R	11
20	Laridae	River Tern	*Sterna aurantia*	VU	R	9
21	Motacillidae	Western Yellow Wagtail	*Motacilla flava*	LC	M-LD	4
22	Motacillidae	White Wagtail	*Motacilla alba*	LC	M-LD	3
23	Phalacrocoracidae	Indian Cormorant	*Phalacrocorax fuscicollis*	LC	R	7
24	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	LC	R	38
25	Podicipedidae	Great Crested Grebe	*Podiceps cristatus*	LC	R	3
26	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	LC	R	90
27	Rallidae	Common Coot	*Fulica atra*	LC	R	3510
28	Rallidae	Common Moorhen	*Gallinula chloropus*	LC	R	20
29	Rallidae	Purple Swamphen	*Porphyrio porphyrio*	LC	R	145
30	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	LC	R	2

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory Status	Total
31	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	LC	R	205
32	Recurvirostridae	Pied Avocet	*Recurvirostra avosetta*	LC	M-LD	2
33	Rostratulidae	Greater Painted-snipe	*Rostratula benghalensis*	LC	R	1
34	Scolopacidae	Black-tailed Godwit	*Limosa limosa*	NT	M-LD	450
35	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	LC	M-LD	1
36	Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	LC	M-LD	1
37	Scolopacidae	Ruff	*Calidris pugnax*	LC	M-LD	100
38	Scolopacidae	Wood Sandpiper	*Tringa glareola*	LC	M-LD	10
39	Threskiornithidae	Glossy Ibis	*Plegadis falcinellus*	LC	R	13
Total						**6273**

Note: R- Resident; M – Migratory; M-LD – Long-Distance Migrant; LC – Least Concern; NT – Near Threatened; VU – Vulnerable

7.5 Sambhar Lake

7.5.1 Site description

Sambhar is India's largest inland saltwater lake situated in the vicinity of Aravali mountain ranges. It is situated at 26º 52'–27º 02' N and 74º 54'–75º 14' E about 60 km west of Jaipur at the periphery of Salt Lake City - Sambhar, at an altitude of 360 m msl (Fig.3). The lake bed varies from 230 sq. km in monsoon to 190 sq. km in summer (Narwade *et al.* 2019).

The lake basin is spread at the confluence of three districts of Rajasthan namely Jaipur, Nagaur, and Ajmer close to the desert fringe line. The water is fed into the lake from the rivers Mendha, Runpangarh, Khandel, and Karian. With maximum depth of 3 m the lake bed is widespread and almost flat. The lake basin is divided into two sections by a stone-earthen dam (5.16 km) between Jhapok and Gudha settlements in the South and north respectively (Islam and Rahmani 2008). The western part is natural undisturbed water spread while the eastern part of the lake contains two large reservoirs which are used for salt extraction, canals and saltpans. The Sambhar Lake contributes around 8.7 percent of salt production in India and managed by Sambhar Salt Ltd (Narwade *et al.* 2019).

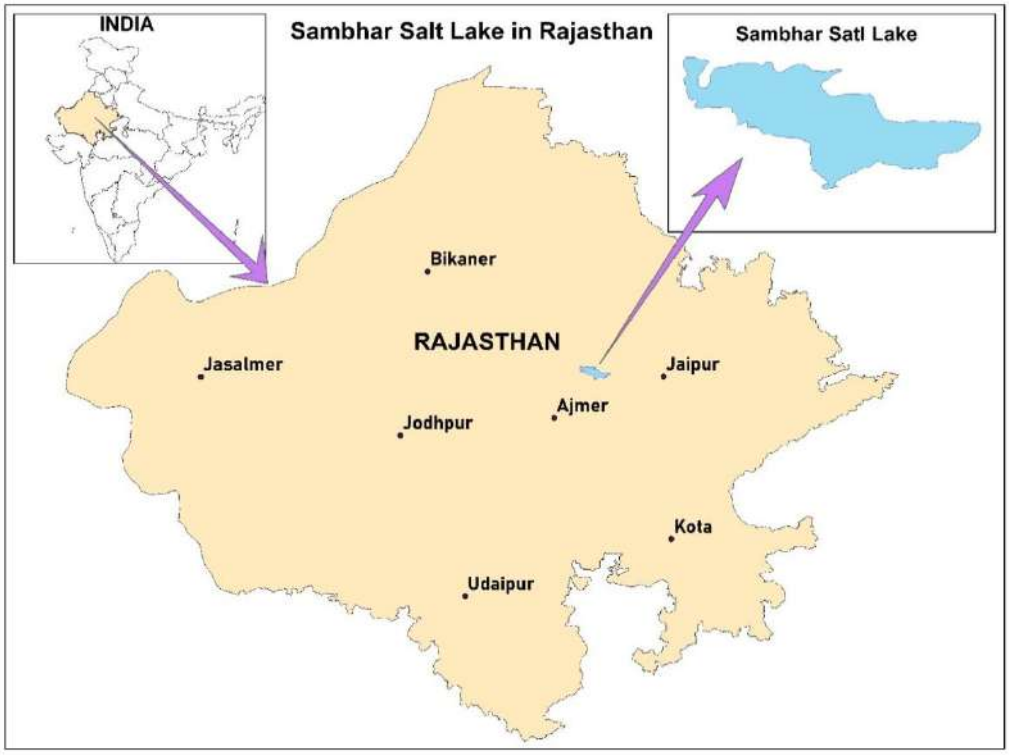


Figure 3: Map showing location of Sambhar Lake

The climate of Sambhar is dry throughout the year except for a short period of rainy season, which does not support dense vegetation but thorny scrub plants commonly found in catchment areas. Halophytes such as *Aleoropus lagopoides*, *Cressa cretica, Heliotropium curassavicum, Salsola baryosma, S. foetida, Suaeda fruticosa, Zygophyllum simplex*, and *Sporobolus helvolus* can be seen along with important shrubs like *Salvadora oleoides* and *S. persica*. Other plants struggle to adapt with high salinity, low rainfall and high temperature of Sambhar. Tree species occur in the lake catchment include *Acacia nilotica, Acacia senegal, Anogeissus pendula, Azadirachta indica, Boswellia serrata*, and *Prosopis juliflora* (Bhat 2017).

7.5.2 Account on avifauna

Sambhar Lake is economically important and also has very broad ecological value. It was declared as Ramsar site in 1990 due to its biological importance. The Sambhar lake attracts large number of birds along Central Asian Flyway and is one of the important stopover sites for the winter migratory birds in semi-arid landscape of Rajasthan which provide shelter and food. It is an IBA which meets criteria A1, A4i, A4iii (BirdLife International 2020) supporting threatened ecological communities including more than 20,000 waterbirds with high ecological values (Islam and Rahmani 2008; Singh 2013).

Around 192 species of aquatic birds (including ducks, geese, and shorebirds) have been recorded from the lake and its surroundings (Sangha 2008; Islam and Rahmani 2016; Bhat 2017; Narwade *et al.* 2019;

e-Bird 2019). Some of these include Sociable Lapwing *Vanellus gregarius* (CR), Cinereous Vulture *Aegypius monachus* (CR), Greater Adjutant *Leptoptilos dubius* (EN), Curlew Sandpiper *Calidris ferruginea* (NT), Dalmatian Pelican *Pelecanus crispus* (NT), Eurasian Curlew *Numenius arquata* (NT), Pallid Harrier *Circus macrocerus* (NT) and many other threatened and least concern migratory birds. Pelicans, Storks, Ibis, Spoonbills, Grebes, Cormorant, and Darters are regular visitors to this lake during winter. The most dominant component of avian fauna of this lake is the congregation of both the species of Flamingos: Greater and Lesser which are regular visitors for several decades (Agarwal 1951). Lesser Flamingos *Phoeniconaias minor* were also found to be breeding at Sambhar Lake in year 1995–1997 (Kumar 1996 and 2008; Kumar and Bhargava 1996). Flamingo feeds upon blue green algae and diatoms of high-salinity. This lake during post-monsoon period offers an important source of food for Flamingo population. The two species of crane: Demoiselle Crane *Grus virgo* and Common Crane *Grus grus* also arrives here.

Sambhar Lake supports 4 Critically Endangered, 1 Endangered, 7 Vulnerable, 12 Near Threatened and 166 Least Concern birds.

- **Critically Endangered**: White-rumped Vulture *Gyps bengalensis*, Long-billed Vulture *Gyps indicus*, Red-headed Vulture *Sarcogyps calvus*, Sociable Lapwing *Vanellus gregarius*
- **Endangered:** Egyptian Vulture *Neophron percnopterus*
- **Vulnerable:** Dalmatian Pelican *Pelecanus crispus*, Asian Woollyneck *Ciconia episcopus*, Greater Adjutant *Leptoptilos dubius*, Pallas's Fish-eagle *Haliaeetus leucoryphus*, Sarus Crane *Grus antigone*, Macqueen's Bustard *Chlamydotis macqueenii*, White-naped Tit *Machlolophus nuchalis*
- **Near Threatened**: Oriental Darter *Anhinga melanogaster*, Painted Stork *Mycteria leucocephala*, Lesser Flamingo *Phoeniconaias minor*, Ferruginous Duck *Aythya nyroca*, Cinereous Vulture *Aegypius monachus*, Pallid Harrier *Circus macrourus*, Red-headed Falcon *Falco chicquera*, Lagger Falcon *Falco jugger*, Great Thick-knee *Esacus recurvirostris*, Eurasian Curlew *Numenius arquata*, Black-tailed Godwit *Limosa limosa*, European Roller *Coracias garrulus*

Small railway line crossing the lake area for transport of salt © Neelkanth Bora

Most of the Sambhar lake was dry in year 2020–21

Few birds reported in satellite wetland of Sambhar during census conducted on January 24, 2021 © Unmesh Mitra

7.5.3 Threats and conservation

Being important as source of minerals, feeding and breeding grounds for many avian species, and aesthetic value, Sambhar Lake is facing serious threats resulting in rapid degradation of the aquatic environment and decrease in biological diversity of the lake.

7.5.4 Factors causing degradation of lake

1. Small dam construction in the catchment area.
2. Excessive grazing in catchment area.
3. Large-scale soil removal by private salt industries.
4. Vehicular trespass by villagers
5. Mushrooming of private salt industries.
6. Air and noise pollution.
7. Water pollution through agricultural runoff from nearby fields.
8. Biotic interference including human pressure.
9. Poaching of birds: poaching not only affects the breeding ground but also the feeding population of flamingos and other waterbirds.
10. Unregulated pilgrimage and tourism.

7.5.5 Conservation measures being implemented

1. Restriction on removal of top-soil from the lake bed by private salt industries.
2. Restriction on trespass by vehicular traffic.
3. Restriction and removal of private salt industries from the periphery of the lake in Gudha-Nawa stretch in the Nagaur district.
4. Restriction on small dam construction in the catchment area.
5. Minimization of biotic interference including human activities through bio-fencing the area.
6. Afforestation of the border areas of the lake by salt tolerant tree species to create a buffer for protection of avifauna.
7. Declaration of Sambhar Lake as a Wetland Reserve.

7.5.6 Recommendations based on ground surveys

1. Removal of carcasses of dead birds to keep the habitat clean
2. Regular monitoring and bird ringing
3. Long term monitoring with interdepartmental cooperation (e.g., wildlife managers, researchers and veterinarians) for disease diagnosis.
4. The intoxicated or sick birds should be collected and kept in a comfortable enclosure for treatment and if possible, release
5. A permanent bird rescue and treatment center should be established

6. Sampling protocol should be followed as per the standards provided by concerned laboratories
7. Limnological and other ecological investigations at Sambhar should be strengthened
8. The birds recovered at rescue center need to be ringed and flagged before release in the wild. Similarly, a significant number of healthy birds using Sambhar lake should be ringed and color flagged to be able to monitor them at Sambhar lake and other foraging, resting areas
9. Therefore, BNHS urge state government to issue trapping and bird ringing permission
10. Illegal wires laid across the lake area, borewells and pipe lines drawing water from lake should get removed

7.5.7 Other Recommendations and Observations

- Available surface as well as ground water also get extracted for the salt production. Apart from salt production disturbances like human activities are increased in the lake catchment area.
- The lake plays a major role as a stopover site for migratory birds of Central Asian Flyway (CAF). Though the site was declared as Ramsar, still needs conservation efforts to reduce anthropogenic pressure on its habitat.
- Activities like over exploitation of salt, trespassing of vehicles are disturbing factors, while powerlines and shrinkage of water spread in Lake Basin directly affecting the population of birds visiting over years.
- Some national as well as local NGOs are actively working for the conservation of these migratory species of the lake. Thus, site needs such research interventions for long term ecological monitoring along with certain policies for sustainable development. National Wetland Action Plan for CAF species will play major role for the species and lake conservation at ground level.
- Local people brought into notice the poaching of aquatic birds being done and marketed at Jaipur (Bhat 2017). Due to different type of threats posed on the wetland, there is a remarkable loss of breeding sites of animals, particularly of avifauna. Therefore, in order to develop a favourable ecological niche for breeding of flamingos, strategies are to be developed for conservation and restoration of Sambhar Lake.
- The Sambhar Lake is a wetland of international importance which has to be protected through ban of salt manufacture in the lake buffer zone, proper EIA, intensive habitat monitoring and through ecological studies on lake hydrology, feeding-breeding sites of water birds.
- An appropriate long-term management plan for the restoration of Sambhar Lake must include afforestation along with catchment area by state departments such as Irrigation, Forests, Revenue and Agriculture.

- Sustainable use of resources in the fringe area is required to enhance socioeconomic status of the people. Improved and efficient technology for exploration of resources may be applied.
- The ecotourism in the lake area can be a tool for conservation as well as an income generating source. Considering the international importance of the Sambhar Lake, a plan with provisions for ecological restoration and sustainable development of the lake and its surrounding area is to be prepared on priority basis.

7.5.8 Asian Waterfowl Census (AWC) conducted on January 24, 2021

Using simultaneous surveys conducted by multiple observers on January 24, 2021, entire lake area was crisscrossed using a four-wheeler vehicle. Team of 2-3 observers were deployed in 5 sites (Naliasar talab, Garbage dump point, Jhapok dam, Jail anicut point, and Shivsagar talab). Total 2,697 birds of 43 species were counted in lake as well as satellite wetlands (Table 17).

It was found that most of the parts of the wetland was dried up because of poor rainfall and resulted into a few numbers of avian species than year 2019 when more than 20,000 birds reported died because of Avian Botulism.

Table 17: Birds observed during Asian Waterfowl Census conducted in Sambhar Lake on January 24, 2021

SN	Family	Species Name	Scientific name	Total
1.	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	12
2.	Pelecanidae	Great White Pelican	*Pelecanus onocrotalus*	3
3.	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	13
4.	Ardeidae	Grey Heron	*Ardea cinerea*	6
5.		Great White Egret	*Ardea alba*	1
6.	Phoenicopteridae	Greater Flamingo	*Phoenicopterus roseus*	88
7.		Lesser Flamingo	*Phoeniconaias minor*	1010
8.	Anatidae	Northern Shoveler	*Spatula clypeata*	747
9.		Bar-headed Goose	*Anser indicus*	9
10.		Greylag Goose	*Anser anser*	39
11.		Garganey	*Anas querquedula*	2
12.		Common Teal	*Anas crecca*	16
13.		Northern Pintail	*Anas acuta*	8
14.		Indian Spot-billed Duck	*Anas poecilorhyncha*	11
15.		Common Pochard	*Aythya ferina*	9
16.		Red-crested Pochard	*Netta rufina*	6

SN	Family	Species Name	Scientific name	Total
17.		Comb Duck	*Sarkidiornis melanotos*	2
18.	Rallidae	Watercock	*Gallicrex cinerea*	2
19.		White-breasted Waterhen	*Amaurornis phoenicurus*	4
20.		Common Moorhen	*Gallinula chloropus*	4
21.		Common Coot	*Fulica atra*	37
22.	Charadriidae	Little Ringed Plover	*Charadrius dubius*	4
23.		Kentish Plover	*Charadrius alexandrinus*	9
24.		Red-wattled Lapwing	*Vanellus indicus*	16
25.	Scolopacidae	Wood Sandpiper	*Tringa glareola*	12
26.		Common Redshank	*Tringa totanus*	5
27.		Common Greenshank	*Tringa nebularia*	10
28.		Common Sandpiper	*Actitis hypoleucos*	34
29.		Ruff	*Philomachus pugnax*	262
30.		Black-tailed Godwit	*Limosa limosa*	13
31.	Recurvirostridae	Avocet	*Recurvirostra avosetta*	58
32.		Black-winged Stilt	*Himantopus himantopus*	132
33.	Alcedinidae	White-breasted Kingfisher	*Halcyon smyrnensis*	3
34.	Alaudidae	Crested Lark	*Galerida cristata*	6
35.		Ashy-crowned Sparrow-lark	*Eremopterix griseus*	4
36.	Hirundinidae	Plain Martin	*Riparia paludicola*	24
37.		Wire-tailed Swallow	*Hirundo smithii*	61
38.	Motacillidae	White-browed Wagtail	*Motacilla maderaspatensis*	6
39.	Motacillidae	White Wagtail	*Motacilla alba*	5
40.	Laniidae	Great Grey Shrike	*Lanius excubitor*	1
41.	Muscicapidae	Desert Wheatear	*Oenanthe deserti*	1
42.		Indian Robin	*Saxicoloides fulicatus*	1
43.	Dicruridae	Black Drongo	*Dicrurus macrocercus*	1
	Total			2,697

7.6 Desert National Park

Summary of Field surveys conducted was provided in the annual report 2020.

8 UTTAR PRADESH

8.1 Kurra Jheel

8.1.1 Site description

Kurra Jheel is located near Hajipura village in Kurra, Mainpuri district of Uttar Pradesh. This wetland has an area of about 200 ha with an unprotected status. The jheel lies in close proximity to human habitation and is flanked by a bifurcated road. There are several small, medium, and large wetlands interspersed with agricultural fields, providing an ideal habitat for waterbirds.

Kurra Jheel fulfills the following criteria of Ramsar Convention:

a. Criteria 2 (wetland supports threatened ecological communities), and
b. Criteria 5 (wetland regularly supports 20,000 or more waterbirds).

8.1.2 Ownership

Private Ownership

8.1.3 Bird population:

Kurra Jheel is known to attract a large number of migratory birds in winter, and also has resident bird fauna. Threatened birds like Sarus Crane *Grus antigone*, Sociable Lapwing *Vanellus gregarius*, Greater Spotted Eagle *Clanga clanga*, Black-necked Stork *Ephippiorhynchus asiaticus*, and Black-tailed Godwit *Limosa limosa* are recorded from the area (Rahmani *et al.* 2016).

8.1.4 Account on Migratory birds

Survey was conducted on 17th evening and 18th morning of February 2021. During the survey, a total of 24 bird species of 13 families were recorded. Of them 23 were waterbirds. Three species of birds were long distance migratory while 21 were resident to the area.

Out of the 24-species recorded, 4 species were found to be Near Threatened as per IUCN Redlist category (Table 18).

8.1.5 Observational Points:

i. Eutrophication of lake: the wetland has been divided into two parts due to road transecting the wetland into two unequal parts. One of the smaller wetlands is completely degraded due to growth of water hyacinth and was found to be dried during visit. The other part is comparatively bigger but it also faces eutrophication problems.

During interaction with locals, it revealed that the bigger waterbody is regularly removed from the lake for the purpose of fishing.

ii. Household waste and construction debris were seen dumped near the wetland.

iii. Waterbody was surrounded by agricultural fields from two sides while the other two sides were bound by settlement and road respectively.

iv. A pair of Black-necked Storks *Ephippiorhynchus asiaticus* was seen moving and feeding along the wetland.

v. Juveniles of Painted Stork *Mycteria leucocephala* and Bronze-winged Jacana *Metopidius indicus* were seen in the wetland along with other resident birds like Oriental Darter *Anhinga melanogaster*, Cormorants, Egrets and Purple Swamphen *Porphyrio porphyrio*.

vi. A flock of Paddyfield Pipit *Anthus rufulus* (about 69) was observed in the nearby agricultural field.

8.1.6 Threats

i. Overgrowth of Water Hyacinth in the lake reduces the water quality as well as open surface for the birds.

ii. Growth of *Prosopis* sp. along the sides of the pond.

iii. Agricultural lands on the lake edges: agricultural runoff which mixes with water in the lake; increasing the problem of eutrophication.

iv. Fishing in the lake which not only disturbs the bird population but also reduces the availability of food for the birds.

v. Dumping of solid waste such as bricks, household wastes, and plastics etc.

vi. Partially constructed infrastructure was also observed very close to the wetland.

vii. As the wetland is just adjacent to the Kurra village, drainage could be a threat to the wetland.

8.1.7 Conservation Measures required

i. Removal of Water Hyacinth to provide open surface for ducks.

ii. Removal of other exotic plants such as *Prosopis* sp. to stimulate growth of native plants.

iii. Demarcation of wetland is essential to maintain the area of the wetland.

iv. De-siltation of the wetland to maintain the size and depth of the wetland.

v. Restrictions on fishing practices in the wetland especially during migratory season to avail the food resources for migratory birds.

vi. Stop dumping of wastes near wetland.

vii. Regulation on expansion of agricultural land surrounding the wetland.

viii. Awareness regarding sustainable farming to reduce inflow of chemicals in the pond.

A pair of Black-necked Stork in Kurra Jheel

Construction of houses (Left) and dumping of debris (right) near the Kurra Jheel Wetland

Table 18: Details of birds recorded at Kurra Jheel during February 2021

Sr. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory Status	Count
1	Anhingidae	Oriental Darter	*Anhinga melanogaster*	NT	R	6
2	Ardeidae	Indian Pond-heron	*Ardeola grayii*	LC	R	52
3	Ardeidae	Purple Heron	*Ardea purpurea*	LC	R	9
4	Ardeidae	Little Egret	*Egretta garzetta*	LC	R	35
5	Ardeidae	Intermediate Egret	*Ardea intermedia*	LC	R	9
6	Ardeidae	Great White Egret	*Ardea alba*	LC	R	6
7	Ardeidae	Grey Heron	*Ardea cinerea*	LC	R	2
8	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	LC	R	2
9	Ciconiidae	Painted Stork	*Mycteria leucocephala*	NT	R	6
10	Ciconiidae	Black-necked Stork	*Ephippiorhynchus asiaticus*	NT	R	3
11	Coraciidae	Indian Roller	*Coracias benghalensis*	LC	R	1
12	Jacanidae	Bronze-winged Jacana	*Metopidius indicus*	LC	R	40
13	Motacillidae	White-browed Wagtail	*Motacilla maderaspatensis*	LC	R	2
14	Motacillidae	Western Yellow Wagtail	*Motacilla flava*	LC	M-LD	10
15	Motacillidae	White Wagtail	*Motacilla alba*	LC	M-LD	6
16	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	LC	R	24
17	Phalacrocoracidae	Indian Cormorant	*Phalacrocorax fuscicollis*	LC	R	5
18	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	LC	R	3
19	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	LC	R	2
20	Rallidae	Common Moorhen	*Gallinula chloropus*	LC	R	22
21	Rallidae	Purple Swamphen	*Porphyrio porphyrio*	LC	R	15
22	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	LC	R	6
23	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	LC	M-LD	1
24	Threskiornithidae	Black-headed Ibis	*Threskiornis melanocephalus*	NT	R	8
Total						275

Note: R- Resident;; M – Migratory;M-LD – Long-Distance Migrant; LC – Least Concern; NT – Near Threatened

8.2 Sauj Wetland

8.2.1 Site description

Sauj wetland lies close to the town of Saman, just before Saman Bird Sanctuary. The lake is a shallow depression in the landscape. A canal on the northern side of the lake brings in agricultural runoff, and another to the south takes away excess water to Saman Bird Sanctuary. Agriculture is restricted to two sides of the lake, the third side is bordered by Sauj village, and

the fourth is a flooded grassy meadow which provides habitat for a range of waterbirds throughout the year.

8.2.2 Ownership

Gram Panchayat (village council)

8.2.3 Bird population

Sauj is an excellent waterbody of western Uttar Pradesh, where more than 20,000 waterbirds are regularly seen. Lake is important for the Sarus Crane, Black-necked Stork, Painted Stork, Asian Openbill, Asian Woollyneck *Ciconia episcopus*. Among ducks, the Northern Shoveler Gadwall, Lesser Whistling Duck *Dendrocygna javanica*, and Garganey were common.

8.2.4 Account on Migratory birds

Surveys were conducted on 17th evening and 18th morning of February 2021. During the survey, a total of 30 bird species of 18 families were recorded. Of the total bird species recorded, six were long distance migratory birds and the rest were resident (24 species).

Of the **30 species** a single species was found to be globally threatened (Vulnerable) and two Near Threatened as per IUCN Redlist category (Table 19).

8.2.5 Observational Points

i. The site is an unprotected area mostly owned by the local people but has some dispute with the local government.
ii. The wetland is surrounded by agricultural fields.
iii. The water level of the lake was found to be low in some parts and bordered with Saccharum on one side, and with a few scattered clumps of *Ipomoea carnea*.
iv. During the evening survey, flocks of Lesser Whistling Teals were found in the lake but they left in late evening hours.
v. Eight pairs of Sarus Crane were seen during the morning survey.
vi. Grazing pigs: pigs were seen grazing on aquatic plants inside the wetland.

vii. ***Based on Secondary Survey*:**

a) According to the local people, bird count has decreased compared to previous years.
b) Bird numbers are found to be more during the early morning and late evening hours.

c) One of the locals informed that about 30 years ago the lake had a good amount of aquatic flora for the birds to feed on. Slowly these aquatic floras almost vanished so the birds are not using the wetland for feeding purposes.

d) People also said that once most part of the wetland was covered by *Nelumbo* sp. but now it has decreased drastically due to the practice of collecting seed pods and stems for food.

8.2.6 Threats

i. As the waterbody starts shrinking, the surrounding area is used for cultivation by the local farmers. There is a risk of eutrophication due to increased agricultural activity around the lake.
ii. Agricultural expansion on the lake edges.
iii. Use of water for nearby agricultural fields.
iv. Reports of poaching from the area.
v. Excess removal of lotus seeds, pods and stems from the wetland.
vi. Overuse of wetland by villagers for grazing pigs and livestock.

8.2.7 Conservation Measures required:

i. Demarcation of the pond is necessary to control agriculture in the area.
ii. Removal of Water Hyacinth and other exotic plants to stimulate growth of native plants.
iii. Regulation on cultivation inside and along the wetland.
iv. Grazing pressure from livestock from the surrounding villages should be regulated.
v. Collection of lotus tubers and other grass species also needs to be stopped to maintain the growth of lotus plants in the pond.
vi. Reintroduction of lotus *Nelumbo nucifera* and other local species in the wetlands to maintain its ecosystem.

A view of Sauj Wetland

Table 19: Details of birds recorded at Sauj wetland during February 2021

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory Status	Total
1	Accipitridae (Hawks, Eagles)	Eagle spp.				1
2	Alcedinidae	White-breasted Kingfisher	*Halcyon smyrnensis*	LC	R	1
3	Alcedinidae	Pied Kingfisher	*Ceryle rudis*	LC	R	2
4	Anatidae	Lesser Whistling-duck	*Dendrocygna javanica*	LC	R	100
5	Anatidae	Comb Duck	*Sarkidiornis melanotos*	LC	R	11
6	Anatidae	Greylag Goose	*Anser anser*	LC	M-LD	1
7	Anhingidae	Oriental Darter	*Anhinga melanogaster*	NT	R	1
8	Ardeidae	Grey Heron	*Ardea cinerea*	LC	R	1
9	Ardeidae	Purple Heron	*Ardea purpurea*	LC	R	1
10	Ardeidae	Indian Pond-heron	*Ardeola grayii*	LC	R	5
11	Ardeidae	Black-crowned Night-Heron	*Nycticorax nycticorax*	LC	R	1
12	Ardeidae	White Egret sp.				44
13	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	LC	R	15
14	Charadriidae	White-tailed Lapwing	*Vanellus leucurus*	LC	M-LD	8
15	Ciconiidae	Asian Openbill	*Anastomus oscitans*	LC	R	8
16	Ciconiidae	Painted Stork	*Mycteria leucocephala*	NT	R	3
17	Cisticolidae	Plain Prinia	*Prinia inornata*	LC	R	1

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory Status	Total
18	Dicruridae	Black Drongo	*Dicrurus macrocercus*	LC	R	25
19	Gruidae	Sarus Crane	*Antigone antigone*	VU	R	16
20	Jacanidae	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC	R	2
21	Jacanidae	Bronze-winged Jacana	*Metopidius indicus*	LC	R	5
22	Leiothrichidae	Large Grey Babbler	*Argya malcolmi*	LC	R	2
23	Passeridae	Chestnut-shouldered Bush-sparrow	*Gymnoris xanthocollis*	LC	R	2
24	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	LC	R	25
25	Picidae	Eurasian Wryneck	*Jynx torquilla*	LC	M-LD	1
26	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	LC	R	5
27	Scolopacidae	Green Sandpiper	*Tringa ochropus*	LC	M-LD	2
28	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	LC	M-LD	1
29	Scolopacidae	Wood Sandpiper	*Tringa glareola*	LC	M-LD	2
30	Sylviidae	Lesser Whitethroat	*Sylvia curruca*	LC	R	
Total						292

Note: R- Resident; M-LD – Long-Distance Migrant; LC – Least Concern; NT – Near Threatened, VU - Vulnerable

8.3 Sarsai Nawar Lake

8.3.1 Site description

Sarsai Nawar Lake is a natural depression that fills up during the monsoon. It has been declared as a Ramsar site in February 2020. The lake is important because it is the roosting area of the largest flock of Sarus Crane in the region, consisting of nearly 400 individuals. The name of the lake is derived from the Sarus (Sarsai = Sarus, Nawar = shallow wetland: Wetland for Sarus).

Sarsai Nawar Lake fulfils the following Ramsar Convention criteria:

a. Criteria 2 (Wetland supports threatened ecological communities),

b. Criteria 5 (wetland regularly supports 20,000 or more waterbirds) and

Criteria 6 (wetland regularly supports 1% of the individuals in a population of one species or subspecies).

8.3.2 Ownership

Village Council, Private

8.3.3 Bird population

In addition to Sarus, a vast number of waders, ducks, and geese visit the lake during winter. Three resident species of storks, namely the Painted Stork *Mycteria leucocephala*, Asian Woollyneck *Ciconia episcopus*, and Black-necked *Ephippiorhynchus asiaticus* storks are known to feed in the lake throughout the year (Rahmani *et al.* 2016).

8.3.4 Account on Migratory birds:

Surveys were conducted in the morning and evening hours of February 19, 2021. A total of 48 bird species of 24 families were recorded during the survey. Of the total species, 36 were either waterbirds or water dependent birds. Of the 48 species, 12 species of birds were long distance migratory to the area while the rest of them were resident.

Two species out of the recorded bird species were found to be globally threatened (Vulnerable) and six species were Near Threatened as per IUCN Redlist category (Table 20).

8.3.5 Observational Points:

i. About 250 Sarus Cranes were seen in the surrounding agricultural fields in the morning hours. During the evening, all of the individuals were seen coming to the wetland.

ii. Good congregation of ducks were seen during the survey. Duck count was estimated as 828 birds of which 55 were Northern Pintail *Anas acuta*, 360 Common Teal *Anas crecca*, 60 Gadwall *Mareca strepera*, 80 Northern Shoveler *Spatula clyptea*, 150 Lesser Whistling-duck *Dendrocygna javanica*, and 10 Mallard *Anas platyrhynchos*. Apart from ducks, 25 Black-headed Ibis *Threskiornis melanocephalus* and raptor species were recorded.

iii. Four species of storks, namely Painted, Asian Openbill, Asian Woollyneck, and Black-necked Stork were also recorded at the lake during the present survey.

iv. A pair of Black-necked stork *Ephippiorhynchus asiaticus* with 3 juveniles was seen in the wetland for the entire day.

v. Juveniles/ Subadults of Sarus crane *Grus antigone* were also seen with the adults in the wetland.

vi. The lake also serves as a roosting site of Sarus Crane and waterfowl, which assemble in the late evening in this wetland.

vii. Based on Interaction with local staff:

a) Birds use this wetland for roosting as well as feeding purposes and count more during late evening and early morning.

b) Cultivation of Water Chestnut *Trapa natans* has been stopped which was earlier cultivated in most parts of the lake.
c) Soil is removed to avoid siltation of the waterbody and the same soil is used to prepare mounds for birds.
d) Sarus cranes can be seen during the whole year. Breeding population of Sarus cranes are also present and nests can be seen in the nearby agricultural fields.
e) Incidents of electrocution of Sarus Crane in the area happen in rare cases. People are aware about birds, especially Sarus and they inform the forest department if any such incident happens.
f) A very old Shiva temple is located adjoining the lake and is visited by thousands of pilgrims each year, particularly during the Shivaratri festival in the first week of March.

8.3.6 Threats

i. Agricultural lands are present on the edges of the wetland that may lead to eutrophication. Although much of the wetland was found to be free of eutrophication currently.
ii. Water is drawn from the wetland for irrigation to nearby fields affecting the water level of the wetland.
iii. Agricultural expansion on the lake edges.
iv. Pilgrims and use of loudspeakers in the temple during migrating season might disturb the migratory species.

8.3.7 Conservation Measures required

i. Regular desiltation of the wetland to maintain the health of the wetland.
ii. Regulation on agricultural farming along the wetland.
iii. Awareness of sustainable farming to reduce use of chemicals.
iv. Looking at the area and capacity of the wetland to provide roosting and feeding grounds to such a wide number and species of birds in the area, there is a need to declare the wetland as a protected area to provide more protection through law enforcement.
v. Capacity building: looking at the potential of the area to harbour such a good number and diversity of bird species, the area can be developed for bird education, research and monitoring.

A view of Sarsai Nawar habitat

Sarus Crane *Grus antigone* in agricultural field (L) and Soil mounds in the wetland for bird made of soil from desiltation of wetlands (R)

Table 20: Details of bird species recorded at Sarsai Navar during February 2021

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory Status	Total
1	Accipitridae	Bonelli's Eagle	*Aquila fasciata*	NT	R	**2**
2	Alcedinidae	Mallard	*Anas platyrhynchos*	LC	M-LD	10
3	Alcedinidae	White-breasted Kingfisher	*Halcyon smyrnensis*	LC	R	9
4	Alcedinidae	Pied Kingfisher	*Ceryle rudis*	LC	R	2
5	Anatidae	Greylag Goose	*Anser anser*	LC	M-LD	64
6	Anatidae	Garganey	*Spatula querquedula*	LC	M-LD	2
7	Anatidae	Northern Shoveler	*Spatula clypeata*	LC	M-LD	80
8	Anatidae	Gadwall	*Mareca strepera*	LC	M-LD	60
9	Anatidae	Eurasian Wigeon	*Mareca penelope*	LC	M-LD	29
10	Anatidae	Northern Pintail	*Anas acuta*	LC	M-LD	55
11	Anatidae	Common Teal	*Anas crecca*	LC	M-LD	360
12	Anatidae	Lesser Whistling-duck	*Dendrocygna javanica*	LC	R	150
13	Anatidae	Comb Duck	*Sarkidiornis melanotos*	LC	R	18
14	Anhingidae	Oriental Darter	*Anhinga melanogaster*	NT	R	5
15	Ardeidae	Grey Heron	*Ardea cinerea*	LC	R	10
16	Ardeidae	Purple Heron	*Ardea purpurea*	LC	R	4
17	Ardeidae	Great White Egret	*Ardea alba*	LC	R	16
18	Ardeidae	Little Egret	*Egretta garzetta*	LC	R	6
19	Ardeidae	Indian Pond-heron	*Ardeola grayii*	LC	R	15
20	Bucerotidae	Indian Grey Hornbill	*Ocyceros birostris*	NT	R	2
21	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	LC	R	20
22	Charadriidae	White-tailed Lapwing	*Vanellus leucurus*	LC	M-LD	9
23	Charadriidae	Little Ringed Plover	*Charadrius dubius*	LC	R	1
24	Ciconiidae	Black-necked Stork	*Ephippiorhynchus asiaticus*	NT	R	3
25	Ciconiidae	Painted Stork	*Mycteria leucocephala*	NT	R	16
26	Ciconiidae	Asian Woollyneck	*Ciconia episcopus*	VU	R	4
27	Ciconiidae	Asian Openbill	*Anastomus oscitans*	LC	R	2
28	Cisticolidae	Plain Prinia	*Prinia inornata*	LC	R	3
29	Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	LC	R	2
30	Corvidae	House Crow	*Corvus splendens*	LC	R	50
31	Dicruridae	Black Drongo	*Dicrurus macrocercus*	LC	R	18
32	Jacanidae	Bronze-winged Jacana	*Metopidius indicus*	LC	R	40
33	Leiothrichidae	Large Grey Babbler	*Argya malcolmi*	LC	R	8

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory Status	Total
34	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	LC	R	29
35	Phasianidae	Indian Peafowl	*Pavo cristatus*	LC	R	2
36	Phasianidae	Grey Francolin	*Francolinus pondicerianus*	LC	R	2
37	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	LC	R	6
38	Psittaculidae	Rose-ringed Parakeet	*Psittacula krameri*	LC	R	2
39	Rallidae	Common Coot	*Fulica atra*	LC	R	76
40	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	LC	R	10
41	Scolopacidae	Common Greenshank	*Tringa nebularia*	LC	M-LD	1
42	Scolopacidae	Wood Sandpiper	*Tringa glareola*	LC	M-LD	7
43	Scolopacidae	Common Redshank	*Tringa totanus*	LC	M-LD	8
44	Sturnidae	Asian Pied Starling	*Gracupica contra*	LC	R	50
45	Threskiornithidae	Eurasian Spoonbill	*Platalea leucorodia*	LC	R	10
46	Threskiornithidae	Black-headed Ibis	*Threskiornis melanocephalus*	NT	R	25
47	Upupidae	Common Hoopoe	*Upupa epops*	LC	R	2
Total						1,305

Note: R- Resident; M-LD – Long-Distance Migrant; LC – Least Concern; NT – Near Threatened; VU - Vulnerable

8.4 Kudaiyya Marshland

8.4.1 Site description

Kudaiyya Marshland is situated along the Karhal-Kishni highway in Mainpuri district, Uttar Pradesh *c*. 8 km from Karhal town. The marsh is situated just beside Kudaiyya village from which it is named. Kudaiyya Marshland is formed by the flooding of a natural depression. It is mainly fed by rain. However, it is connected to a tributary of the right-wing Ganga canal, and frequently gets water through this source throughout the year. In summer, this marsh is the only source of water for the farmers of the surrounding fields.

The site is important as a stop-over point for thousands of ducks, waders, and pelicans, both at the beginning and the end of the winter.

According to Islam & Rahmani (2008), Kudaiyya marshland qualifies for two criteria of the Ramsar Convention:

a. Criteria 2 (wetland supports threatened ecological communities), and
b. Criteria 5 (wetland regularly supports 20,000 or more waterbirds).

As the marsh has now deteriorated due to biotic pressures, it may not be able to fulfill these criteria, but with proper management, it can be restored to its past ecological status.

8.4.2 Ownership

State, Village Panchayat, Private

8.4.3 Bird population

The marshland was known to provide the roosting area of a resident flock of more than 200 Sarus Crane *Grus antigone* (IBA 2016). The principal duck species recorded were Northern Pintail *Anas acuta*, Common Teal *A. crecca*, Wigeon *A. penelope*, Eurasian Coot *Fulica atra*, and Red-crested Pochard *Netta rufina*. The most common wader species that uses this wetland as a stopover site is the Black-tailed Godwit *Limosa limosa.* More than 150 species of birds have been recorded in and along the wetland which includes bitterns, crakes, moorhens, lapwings, spoonbills, and wagtails (Rahmani *et al.* 2016).

8.4.4 Account on Migratory birds during present survey

Survey was carried out in the evening of 18th February and morning hours of 20th February 2021. During the survey 21 species of birds belonging to 12 families were recorded; of which all were water or water dependent birds. Out of 21 species, 10 species are long distance migratory birds while 11 are resident.

Vulnerable Sarus Crane *Grus antigone* and three near threatened species (Ferruginous Duck *Aythya nyroca*, Oriental Darter *Anhinga melanogaster*, and Black-necked Stork *Ephippiorhynchus asiaticus*) were present during the survey (Table 21).

8.4.5 Observational Points

i. Although a part of the waterbody was found to be covered entirely with Water Hyacinth a small pond size open water surface was found to be available for the birds, which was in good condition.
ii. This small open waterbody was completely surrounded by agriculture fields from all the sides.
iii. Farmlands were present on the edges of the wetland which causes mixing of agricultural runoff in the water body.
iv. Totally 221 individuals of Ducks were found in the waterbody. The other species reported were Lesser Whistling-duck *Dendrocygna javanica* (117), Gadwall *Mareca strepera* (35), Northern Shoveler *Spatula clypeata* (28), Red-crested Pochard *Netta*

rufina (16), Ferruginous Duck *Aythya nyroca* (14), Northern Pintail *Anas acuta* (2), and Tufted Duck *Aythya fuligula* (1).

v. Sarus Cranes were seen moving in the nearby agricultural fields.

vi. During evening hours except Sarus Crane all other waterbird species (ducks, spoonbill, egrets, and cormorants) left the waterbody. This indicates that the birds use this waterbody as a feeding site and not for roosting.

vii. Stems of lilies, lotus, along with sedges, grasses, and aquatic plants were observed. Ipomoea patches were also present along the wetland.

8.4.6 Threats

i. Agricultural runoff (fertilizers, insecticides and pesticides) from the surrounding fields can lead to eutrophication of ponds.

ii. The marsh is hedged by crop fields on all sides, and agricultural expansion is the most serious threat to the waterbody.

iii. Use of water for irrigation in nearby fields (irregular irrigation practices), affects the water level of the pond.

iv. Villagers frequently move around in the area to collect lotus tubers and grass.

v. Birds might get disturbed due to the continuous movement of farmers in the nearby fields.

vi. Domestic animals such as cows and goats were seen grazing around the pond and drinking water from the same pond.

vii. A four-lane highway passing adjacent to the waterbody can cause disturbance for the birds.

8.4.7 Conservation Measures required

i. Removal of Water Hyacinth and other exotic plants to stop eutrophication of the pond.

ii. Desiltation of the wetland.

iii. Regulation on agricultural fields along the wetland.

iv. Demarcation of the pond is also necessary.

v. Collection of lotus tubers and other grass species also needs to be stopped to maintain the growth of lotus plants in the pond.

vi. Water level affects the bird population in an area so, there is a need to manage water level in the pond.

vii. Awareness of sustainable farming to reduce the use of chemicals in agricultural practices.

A view of Kudaiyya Marshland

Flock of ducks in open waterbody (left) and spoonbills sitting adjacent to the Kudaiyya marshland (right)

Table 21: Details of birds recorded at Kudaiyya Marshland during February 2021

Sl. No.	Family	Common Name	Scientific Name	IUCN Status	Migratory Status	Total
1	Accipitridae	Western Marsh Harrier	*Circus aeruginosus*	LC	M-LD	1
2	Accipitridae	Eagle spp.				1
3	Alcedinidae	Pied Kingfisher	*Ceryle rudis*	LC	R	2
4	Anatidae	Tufted Duck	*Aythya fuligula*	LC	M-LD	1
5	Anatidae	Northern Pintail	*Anas acuta*	LC	M-LD	2
6	Anatidae	Eurasian Wigeon	*Mareca penelope*	LC	M-LD	8
7	Anatidae	Ferruginous Duck	*Aythya nyroca*	NT	M-LD	14
8	Anatidae	Red-crested Pochard	*Netta rufina*	LC	M-LD	16
9	Anatidae	Northern Shoveler	*Spatula clypeata*	LC	M-LD	28
10	Anatidae	Gadwall	*Mareca strepera*	LC	M-LD	35
11	Anatidae	Lesser Whistling-duck	*Dendrocygna javanica*	LC	R	117
12	Anhingidae	Oriental Darter	*Anhinga melanogaster*	NT	R	4
13	Ardeidae	Purple Heron	*Ardea purpurea*	LC	R	1
14	Ciconiidae	Asian Openbill	*Anastomus oscitans*	LC	R	1
15	Ciconiidae	Black-necked Stork	*Ephippiorhynchus asiaticus*	NT	R	2
16	Gruidae	Sarus Crane	*Grus antigone*	VU	R	8
17	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	LC	R	7
18	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	LC	R	2
19	Rallidae	Common Coot	*Fulica atra*	LC	R	2
20	Scolopacidae	Common Redshank	*Tringa totanus*	LC	M-LD	1
21	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	LC	M-LD	2
22	Threskiornithidae	Eurasian Spoonbill	*Platalea leucorodia*	LC	R	17
Total						272

Note: R- Resident; M-LD – Long-Distance Migrant; LC – Least Concern; NT – Near Threatened; VU - Vulnerable

9 ASSAM

9.1.1 Study Sites

We surveyed eight wetlands in Sivasagar district, one wetland in Jorhat district and ten wetlands in Majuli district (Table 22). The size of the wetlands range from 1 ha to a few square kilometres. Only a few of the wetlands were protected. Sivasagar Tanks which includes three large, historic tanks Joysagar (60 ha), Sibsagar (50 ha), and Gourisagar (40 ha) is an Important Bird and Biodiversity Area (IBA). Beside this, Pani-Dihing Bird Sanctuary, Jhanjimukh-Kokilmukh and Majuli Island are also listed as IBAs (Rahmani *et al*. 2016).

Pani-Dihing Bird Sanctuary has an area of 3,393 ha and is located 17 km north of Sivasagar Town. Majuli Island is one of the largest river islands in the world. The islands have many small and large wetlands suitable for migratory waterbirds.

Table 22: Lists of wetlands surveyed for waterbirds count in Assam from 15th to– 20th February, 2021

Sivasagar District	Jorhat District	Majuli District
1. Sivasagar Tank 2. Rudrasagar 3. Joysagar 4. Pohugarh Beel 5. Na-pukhuri (Bhatiyapar) 6. Pani-Dihing Bird Sanctuary 7. Disangmukh area 8. Gourisagar	1. Kokilamukh	1. Dakhinpat Satra Beel 2. Jengraimukh Beel 3. Bhereki Beel 4. Balichapori Beel 5. Barunchuk Beel 6. Tuni River 7. Kalia Beel 8. Luhitghat 9. Switch Gate 10. Magurmari Beel

9.1.2 Methodology

We carried out survey in selected wetlands in three districts of Assam during 15th – 20th February 2021. We surveyed the wetlands which are in proximity in a single day to minimise the double counting of birds. Point counts from the periphery of the wetland were done to cover maximum area of the wetland. Each point was placed well apart to address the double counting. Surveys were carried out in morning (5:00 hrs to 10:00 hrs) and in afternoon (14:00 hrs- 17:00 hrs) using Spotting Scope and 10 x 40 Binoculars. Except for few wetlands where more time was spent for counting large congregation. Individuals of each waterbird species visible from the point were recorded. Each site is covered systematically by walking the route

near the wetland and doing point counts in every few hundred metres to document the avifauna.

9.1.3 Account on Avifauna

Totally 24,808 individuals of 57 waterbird species were recorded during the survey. Of the 57 species, one Critically Endangered, one Endangered, three Vulnerable and seven were Near Threatened. Greylag Goose *Anser anser*, Bar-headed Goose *Anser indicus* and Common Coot *Fuliga atra* were the most abundant birds. Little Cormorant *Microcarbo niger*, Purple Swamphen and Bronze-winged Jacana *Metopidius indicus* were most common. The bird species recorded during the survey are given in Table 23.

Species Richness (48 species) and species diversity (H' = 2.63) was highest in Kokilamukh wetland among all the wetlands surveyed. In Majuli district, the species richness was highest in Dakhinpat Satra Beel (24 species). Greylag Goose *Anser anser* and Bar-headed Goose *Anser indicus* were most abundant in Majuli.

In Sivasagar District, species diversity and species richness were more in Rudrasagar and Pani-Dihing Bird Sanctuary. However, abundance of birds was high in Pohugarh. Greylag Goose and Bar-headed Goose were most abundant in Sivasagar district.

9.1.4 Threats

The wetlands we surveyed in Assam are mostly non-protected. We have observed several anthropogenic threats to the wetlands and waterbirds.

9.1.4.1 Fishing by local communities

Different levels of fishing have been observed in most of the wetlands. Fishing activities were observed in Pani-Dihing Bird Sanctuary, Kokilamukh, Bhereki Beel, Dakhinpat Satra Beel and other large wetlands in Majuli. However, we didn't see any fishing in most of the tanks of Sivasagar. Livelihood of many local villagers are dependent on fishing in the wetlands of all the three districts.

Local villager fishing in Kokilamukh, Jorhat

9.1.4.2 Hunting and poaching

Though no direct observation of hunting and poaching of waterbirds was reported during our survey, some locals of Dakhinpat Satra, Majuli and Kokilamukh, Jorhat informed about hunting incidences in respective wetlands. There is also a news report of poisoning of waterbirds in Kokilamukh few years back.

9.1.4.3 Disturbance from tourism and recreational activities

Birds were disturbed in Joysagar Tank under Sivasagar District due to boating and swimming practices in the wetlands. Very few birds were observed in Sivasagar Tank near Shiva dol where vehicular traffic and human presence was high.

9.1.4.4 Pollutants

Pesticides and fertilizers from agriculture runoff were common in most of the wetlands of Majuli. Solid wastes mostly plastics were dumped in most of the tanks in Sivasagar namely Sivasagar Tank, Gourisagar Tank etc. Kokilamukh and other wetlands are also facing similar threats from plastic pollutions.

9.1.4.5 Developmental activities and encroachment for agriculture

One road was constructed connecting one Temple in Kokilamukh wetland. Due to this obstruction of water flow, one part of the wetland may dry out. Encroachment of wetlands was also observed in some of the non-protected wetlands.

9.1.4.6 Spread of invasive plant species

Invasion of Water hyacinth *Eichhornia crassipes* and *Ipomoea* sp. was very high in Kokilamukh wetland and Pani-Dihing Bird Sanctuary. Most part of the wetland was covered by Water Hyacinth. Spread of Water Hyacinth was also high in Rudra Sagar Tank and Na-Pukhuri of Sivasagar District.

9.1.4.7 Thatch and Fuelwood collection

Collection of thatch and fuelwoods by local communities are common in Kokilamukh wetland. Many globally threatened grassland birds are also found in Kokilamukh grassland patch bordering the wetland. Collection of fuelwoods was also recorded in Pani-Dihing Bird Sanctuary.

9.1.4.8 Overgrazing by livestock

Overgrazing by cows and buffaloes was high in Pani-Dihing Bird Sanctuary, Kokilamukh, Dakhinpat Satra beel and other large beels in Majuli. Several livestock sheds were noticed near Pani-Dihing Bird Sanctuary

9.1.4.9 Stray Dogs

We observed several stray dogs trying to catch waterbirds in Kokilamukh wetland, Jorhat and Bhereki Beel, Majuli.

Table 23: Details of birds recorded at the wetland clusters of Sivasagar, Jorhat and Majuli Districts

Sl. No.	Common Name	Scientific Name	IUCN Status	No. of Ind.
1	Asian Openbill	*Anastomus oscitans*	LC	86
2	Asian Woollyneck	*Ciconia episcopus*	VU	1
3	Baer's Pochard	*Aythya baeri*	CR	1
4	Bar-headed Goose	*Anser indicus*	LC	5382
5	Black-headed Gull	*Larus ridibundus*	LC	18
6	Black-headed Ibis	*Threskiornis melanocephalus*	NT	46
7	Black-necked Stork	*Ephippiorhynchus asiaticus*	NT	1
8	Black-winged Stilt	*Himantopus himantopus*	LC	211
9	Bronze-winged Jacana	*Metopidius indicus*	LC	234
10	Brown-headed Gull	*Larus brunnicephalus*	LC	11
11	Cattle Egret	*Bubulcus ibis*	LC	217
12	Common Coot	*Fulica atra*	LC	1249
13	Common Moorhen	*Gallinula chloropus*	LC	53
14	Common Pochard	*Aythya ferina*	VU	126
15	Common Redshank	*Tringa totanus*	LC	37
16	Common Sandpiper	*Actitis hypoleucos*	LC	11
17	Common Snipe	*Gallinago gallinago*	LC	44
18	Common Teal	*Anas crecca*	LC	844
19	Cotton Pygmy-goose	*Nettapus coromandelianus*	LC	111
20	Eastern Spot-billed Duck	*Anas zonorhyncha*	LC	9
21	Eurasian Wigeon	*Mareca penelope*	LC	687
22	Falcated Duck	*Mareca falcata*	NT	1
23	Ferruginous Duck	*Aythya nyroca*	NT	839
24	Fulvous Whistling-duck	*Dendrocygna bicolor*	LC	603
25	Gadwall	*Mareca strepera*	LC	244
26	Glossy Ibis	*Plegadis falcinellus*	LC	741
27	Great Cormorant	*Phalacrocorax carbo*	LC	73
28	Great Crested Grebe	*Podiceps cristatus*	LC	105
29	Great White Egret	*Ardea alba*	LC	19
30	Greater Adjutant	*Leptoptilos dubius*	EN	9
31	Grey Heron	*Ardea cinerea*	LC	9
32	Grey-headed Lapwing	*Vanellus cinereus*	LC	63

33	Greylag Goose	*Anser anser*	LC	8449
34	Indian Pond-heron	*Ardeola grayii*	LC	151
35	Indian Spot-billed Duck	*Anas poecilorhyncha*	LC	93
36	Intermediate Egret	*Ardea intermedia*	LC	125
37	Lesser Adjutant	*Leptoptilos javanicus*	VU	102
38	Lesser Whistling-duck	*Dendrocygna javanica*	LC	467
39	Little Cormorant	*Microcarbo niger*	LC	323
40	Little Egret	*Egretta garzetta*	LC	248
41	Little Grebe	*Charadrius dubius*	LC	174
42	Little Stint	*Calidris minuta*	LC	7
43	Mallard	*Anas platyrhynchos*	LC	115
44	Northern Lapwing	*Vanellus vanellus*	NT	96
45	Northern Pintail	*Anas acuta*	LC	279
46	Northern Shoveler	*Spatula clypeata*	LC	177
47	Oriental Darter	*Anhinga melanogaster*	NT	25
48	Osprey	*Pandion haliaetus*	LC	3
49	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC	56
50	Purple Heron	*Ardea purpurea*	LC	18
51	Purple Swamphen	*Porphyrio porphyrio*	LC	843
52	Red-crested Pochard	*Netta rufina*	LC	695
53	Red-wattled Lapwing	*Vanellus indicus*	LC	5
54	Ruddy Shelduck	*Tadorna ferruginea*	LC	177
55	Spot-billed Pelican	*Pelecanus philippensis*	NT	5
56	Tufted Duck	*Aythya fuligula*	LC	64
57	White-breasted Waterhen	*Amaurornis phoenicurus*	LC	27
	Total count			24809

Note: LC – Least Concern; NT – Near Threatened; VU – Vulnerable; EN – Endangered

10 GUJARAT

10.1 Marine National Park and Wildlife Sanctuary

The Marine National Park and Sanctuary (MNP&S) includes intertidal zones and 42 islands in Gulf of Kachchh of Gujarat State. It extends over 170 km along the Jamnagar Coast. The National Park was declared in 1983 of which 457.92 sq.km of Marine Sanctuary and 162.89 sq.km was announced as Marine National Park. Of the total 45,792 ha, 14,928 ha was covered by islands and 30,864 ha by the coastal zone (Rahmani *et al*. 2016).

The MNP&S is very famous for its Coral reefs and other marine fauna which attracts lots of tourist. A variety of habitats are available at the coast such as coral reefs, mudflats, creeks, mangroves, estuaries, sandy strands to saline grasslands, marshy areas and rocky shores (Chatterjee *et al*. 2015).

MNP&S attracts lots of winter migratory birds due to its vast intertidal habitat. The islands also habited by many birds. As MNP&S is well-known for the Coral reefs and marine fauna, bird studies are not much in the park. The area supports resident Near Threatened species like Black-necked Stork *Ephippiorhynchus asiaticus*, Black-headed Ibis *Threskiornis melanocephalus*, Great Thick-knee *Esacus recurvirostris*, Beach Thick-knee *Esacus magnirostris*, Red-necked Falcon *Falco chicquera*. This is one of the important areas supporting Black-necked Stork breeding population (Maheswaran *et al*. 2004; Bhatt 2006; Pathak *et al*. 2013).

Kumar (2012) records 196 species of birds. Of which, 84 residents, 57 migratory and 55 species hold both resident and migratory status. Heronries are also present on the islands (Kumar 2012).

Nesting colony of Painted Storks was recorded by Urfi (2002) discovered at Man Marodi Island. Heronries are also present on other islands which hold breeding birds such as Grey Heron, Great White Egret, Black-crowned Night-heron, Striated Heron, Black-headed Ibis, and Eurasian Spoonbill (Rahmani *et al*. 2016).

Kumar (2012) surveyed 22 major congregation sites of MNP&S. Among those, Charkhala, Okha, Narara, Ajad Island, Bet Dwarka, Chank Island, Bhaidar Island, Pirotan Island, Jodiya, Balachadi, Poshitra, KPT Jetty & Salt Pans are holding large populations of migratory waterbirds. Parts of MNP also supports major congregation of Crab Plover *Dromas ardeola*,

the highest numbers wintering in India. With the vast opening up of mudflats during low tides gives ample of food resources for migratory waders. MNP&S could be supporting majority of migratory waders of Central Asian Flyways using the western coast of India (for both passage and wintering population) as Gujarat is one of the entry points to India. Several publications are available which accounts for the species found in large numbers (Bhuva and Soni 1998, Urfi 2002, Chatterjee *et al*. 2015, Ganpule *et al*. 2015, Parasharya 2006). Some of the important long-distance migrants recorded in good numbers are Dalmatian Pelican *Pelecanus crispus,* Common Pochard *Aythya farina,* Eurasian Oystercatcher *Haematopus ostralegus,* Bar-tailed Godwit *Limosa lapponica,* Eurasian Curlew *Numenius arquata,* Great Knot *Calidris tenuirostris,* Curlew Sandpiper *Calidris ferruginea,* Greater Spotted Eagle *Clanga clanga.* The areas also support significant wintering population of Indian Skimmer *Rynchops albicollis*. Out the 242-bird listed in this report 79 are long distance migrants and 59 are local migrants. Regularly more than 20,000 waterbirds congregate here fulfilling one of the criteria for IBA (Rahmani *et al.* 2016).

Figure 4: Primary survey points of Marine National Park, Gujarat

Field work was carried out in different locations of MNP from March 09–20, 2020 (Figure 4) Description of each site is mentioned including both protected and non-protected areas. In addition to the survey the respective RFO's and forest guard for each site were consulted for

issues related to the management of the site. Avifauna recorded in each site is given in Appendix 4).

10.1.1 Site descriptions

Jodiya: (22° 44' 35.49" N, 70° 19' 5.04" E) This is the northern most section of the Marine National Park and Sanctuary. Some of the wetlands and saltpans in this area were visited for the survey. *Prosopis juliflora*, *Salvadora persica* and *Acacia nilotica* were the dominant species in the area. Mangroves and creeklets are found towards the coast.

The birds were also recorded congregating outside the protected area. The wetlands both protected and non-protected areas were dominated by mostly duck species and the saltpans by waders respectively. Some of the wader species were not recorded possibly due to the low tidal conditions. The area has matrix of tidal creeks, mudflats, fallow lands which may be holding good population of waders hence needs extensive surveys and monitoring during peak migratory season. During the survey a total of 70 species were recorded. As per the available habitat the survey was focused on waterbirds. Species like Northern Pintail *Anas acuta*, Great White Pelican *Pelecanus onocrotalus*, Northern Shoveler *Spatula clypeata*, and Eurasian Wigeon *Mareca penelope* were dominant species in freshwater wetlands. While the saltpans areas were dominated by shorebirds (seen in large flocks, species not identified) and Flamingos (both species) were recorded in thousands.

Pirotan Island: (22°35'55.75" N, 69°57'19.65" E) This island is located 22 km off the coast of Jamnagar (Bedi port) and have an area of 3 sq. km consisting of mangroves, seagrass, algae, invertebrates and low tide beach (Kumar *et al.* 2017). Mangrove at the fringes and mangrove associated trees within the island. The dominant species of mangroves is *Avicennia marina.* Other species like *Rhizophora* and *Ceriops* can also be seen. Since the area is also marked by intertidal zone, the island supports a wide variety and remarkable congregation of waders. During high tide the birds can be seen roosting over the sandy banks of the island. The island currently has limited staff stationed which includes forest department and light house staff. The tourism has been restricted by order of Gujarat Forest department and permission is needed to have access to the island. The island is popularly known for supporting high congregation of Crab-plovers *Dromas ardeola*. However, due to low disturbance and habitat availability, it also supports good congregation of other waders like Bar-tailed Godwits *Limosa lapponica*, Great Knots *Calidris tenuirostris*, and Grey Plovers *Pluvialis* squatarola. During the survey only one

portion of the sandy bank was covered in the given time but small flocks were seen towards the light house as well. A total of 27 species of shorebirds predominated.

Sachana-Balachadi beach: (22°35'15.81" N, 70°11'40.38" E) Part of this beach is under forest department and other part is now taken up by Gujarat Maritime board to reconstruct a shipbreaking yard which was partly functional a decade ago. Habitat includes sandy beach, mudflats, sparse mangroves and *Prosopis* thickets on landward side.

This beach is in close proximity to Pirotan island. It also supports good congregation of Crab-plovers and other waders. BNHS has been tagging certain species of shorebirds in this area since early 2018. Some of the tagged individuals have shown high rate of site fidelity to this area (Panigrahi *et al*. 2020). The survey was carried out twice during the rising tide. A total of 31 species of shorebirds were noted, dominant among them were Lesser Sand Plover *Charadirus mongolus*, Common Redshank *Tringa tetanus* and Crab-plover *Dromas ardeola*. Other notable species were Bar-tailed Godwit *Limosa lapponica*, Great Knot *Calidris tenuirostris*, and Curlew Sandpiper *Calidris ferruginea*.

Khijadiya Bird Sanctuary: (22°31'9.22" N, 70° 8'25.80" E) Khijadiya Bird Sanctuary is probably one of the smallest bird sanctuaries with an area of only 6.05 sq. km lies on the southern shore of the Gulf of Kachchh, about 10 km from Jamnagar. Dominant vegetation is *Prosopis* followed by *Salvadora persica* and *Acacia nilotica. The* habitat is also flanked by reed beds and emergent vegetation in the freshwater zones.

From early records of Zaveri and Bhatia (1981), Rahmani and D'silva (1984), and Chalapati (1997), it is known to harbour a significantly diverse and huge population of waterbirds. According to Joshi (2010), 304 species are reported from Khijadiya Bird Sanctuary and about 200 species are seen regularly. Of the 304 species, 149 species are reported to be resident to this area, 123 species are migratory and the remaining species are vagrants, local migratory or passage migrants. During the survey a total of 63 species were recorded, the survey was focused on waterbirds. Species like Great White Pelican, Eurasian Wigeon, and Northern Pintail were in higher numbers. The area is also known for remarkable roosting flocks of Rosy Starling.

Narara and Vadinar Saltpans: Narara (22°28'7.98"N, 69°43'25.15"E) is widely known for its rich coral reef which is a major attraction for tourist and researchers alike in Marine National Park and Sanctuary. Narara is dominated by mangroves around the seaward side mostly

Avicennia marina and *Prosopis* thickets towards the saltpans. Vadinar saltpans are flanked by mangroves near the coast and *Prosopois* towards the land.

The birds can be seen feeding on the exposed mudflats. Vadinar Saltpans (22°27'2.83" N, 69°43'2.41" E) on the other hand serves as high tide roost for these birds and it is in near vicinity to the Narara protected area. A total of 30 species were recorded during the survey, most dominant species like Greater Flamingo *Phoenicopterus roseus* mostly in the saltpans. The shorelines of Narara were dominated by species like Lesser Sand Plover *Charadrius mongolus*, Little Stint *Calidris minuta*, and Dunlin *Calidris alpina*.

Beyt Dwarka: (22°28'0.58" N, 69° 8'40.75" E) Beyt-Dwarka is an inhabited island at the mouth of the Gulf of Kachchh situated 3 km off the coast of Okha, Gujarat. The island extends up to13 km from northwest to southeast, with an average of 4 km in east-west direction. Beyt Dwarka is a partly muddy region with rocky bottom and partly sandy beach. The mudflats were low in species diversity and flocks are widely scattered. Sparse mangrove was found along the coast with heavy growth of *Prosopis*, arid shrubs and grasses along the coast.

A total of 42 species were recorded mostly consisting of shorebirds. Only protected area were covered during the survey, overall the abundance of shorebirds was also low.

Bhaidar Island:(22°27'35.11" N, 69°18'43.10" E) Bhaidar is an uninhabited island located in Marine National Park, Gujarat. Bhaidar comprises muddy and sandy tidal areas. Mangrove dominated mostly *Avicennia marina* also have sandy patches flanked by grassy patches.

It is one of the locations in India where large congregations of Crab-plovers are seen. For the survey only one side of the shoreline was covered. A total of 32 species were recorded mostly consisting of mixed species of waders. Significant among them were Crab-plover, Little Stint, Bar-tailed Godwit, Lesser Sand Plover and Dunlin.

Arambhada Mithapur Saltpans: (22°27'10.09" N, 69°3'7.39" E) Arambhada Mithapur Saltpans are in between Okha and Dwarka. The saltpans are known for good congregation of Greater Flamingo *Phoenicopterus roseus*, Lesser Flamingo *Phoeniconaias minor* and other waders. The fringes consist of *Prosopis juliflora*. Only a portion of the saltpans accessible by public roads were covered. A total of 38 species were recorded from the saltpans. Apart from Greater Flamingo the saltpans were dominated by different species of Gulls and terns.

Charakla Saltpans: (22°13'16.55" N, 69°10'3.24" E) Expanding to be about 8,200 ha near to Okhamandal, Gulf of Kachchh, this is possibly the biggest coverage of continuous saltpans of Tata Chemicals. It comprised of mangroves and shrub forest beginning from the sea and also surrounded by saline wastelands in vicinity and farms and freshwater lake on the fringes. Mangroves are found towards the coast and *Prosopis* and shruby growth at the fringes.

It is also an Important Bird Area because of supporting migratory birds in huge numbers. The bird diversity in the saltpans were low during the survey however duck congregation were recorded mostly from a nearby freshwater area outside the boundary of the saltpans. Inside the saltpans along with Greater Flamingo, species like Great Crested Grebe *Tachybaptus ruficollis* were noted in flock of 200 individuals. As the saltwork had already started inside the saltpans, this can probably be a reason for shorebirds being recorded in low numbers.

Gaga Bustard Sanctuary: (22° 6'45.02" N, 69°10'4.23" E) This sanctuary was declared as Gaga Great Indian Bustard Sanctuary in 1988, situated near Gaga village at Bhatiya. The sanctuary area is mostly known for harbouring grassland habitat. The area was once known for Great Indian Bustard which are not found any more in the region. However, the sanctuary still receives certain population of Houbara Bustard *Chlamydotis undulata* and other migratory birds. The bunds and boundaries are covered by *Prosopis juliflora*. Patches of reeds along the pond and open lands inside the protected area are dominated by grasses.

Due to accumulation of water in lower slopes of the otherwise even grassy area and close proximity to Charakla saltpans, the area also supports good population of migratory waterbirds. During the survey a total of 37 species were recorded mostly of waterbirds. Most dominant were Common Crane *Grus Grus* although Demoiselle Crane *Grus virgo* were noted in low numbers during the current survey, otherwise the area owing to the surrounding farm and grassland must be supporting significant population of Cranes. Waterbirds were recorded from both inside and non-protected area adjacent to the Sanctuary boundary. Eurasian Wigeon, Northern Pintail, and Northern Shoveler were noted in high numbers.

10.1.2 Wetland Types

Jodiya: Freshwater wetlands, marshes, mangroves, saltpans, fallow lands and agricultural lands.

Pirotan Island: Coastal island with tidal mudflats

Sachana-Balachadi: Coastal beach with tidal mudflats

Khijadiya Bird Sanctuary: It is an inland wetland near the coast. It is divided into two sections and mostly comprises of freshwater marshes. Along the boundary of the Sanctuary the habitat consist of intertidal mudflats, marshes, saltpans, mangroves, agricultural fields.

Narara and Vadinar Saltpans: Narara have intertidal zones, mudflats and mangroves. Vadinar saltpans are company-owned saltpan areas.

Beyt Dwarka: The northern part of the island is under forest department protection. This area consists of intertidal mudflats, sandy beach and rocky shores.

Bhaidar Island: The island consists of mangroves, grassy patches, marshes and sandy beach, and tidal mudflats

Arambhada, Mithapur Saltpans: Saltpans owned by Tata chemicals. Mostly surrounded by human habitat and roads.

Charakla Saltpans: Saltpans owned by Tata chemicals. The fringes consist of mangroves, fallow saline lands, agricultural patches and arid zones.

Gaga Bustard Sanctuary: Grassland area, inland temporary wetland depending upon monsoon.

10.1.3 Disturbances

Jodiya: Feral dogs, extraction of water for farming, breaking of causeways by the locals in relation to farming along the fringes. The protected area has low pollution levels. Agricultural and nearby industries could be a source of pollution, needs to be assessed. No threats as such but extraction of water for farming needs to be assessed and controlled. Protected area boundaries need to be properly defined to control the flow of people which may disturb the birds.

Pirotan Island: No threats as such because of the protection provided by forest department. Low pollution level, needs to be assessed as the shores of Jamnagar have many industries and port activities. Pollution from the shipping activities, needs to be assessed. Mangrove plantation in and around the islands needs to be assessed to compare any loss of existing mudflats. Protected area, tourism is restricted however there are proposals for building eco-tourism facilities on the island

Sachana-Balachadi: Feral dogs, unregulated recreational activities occasionally disturbing the roosting birds during the high tide. Medium pollution level, needs to be assessed. Ship-breaking yard under-construction in the vicinity of the roosting area might pose some threat.

Khijadiya Bird Sanctuary: Khijadiya Bird Sanctuary has both freshwater marshes and intertidal mudflats and marshes (divided by a 5,996 m earthen reclamation bund). Low pollution level, dumping seen in the outskirts, run off pollutants during monsoon from agricultural fields and near by settlements. Pesticide runoff from nearby farm lands pose threat.

Narara and Vadinar Saltpans: No disturbance as such. Low, however pollution load needs to be assessed as surrounded by industries. Industrial and port activities may pose a threat.

Beyt Dwarka: No disturbance in the protected area of the island. Low, no visible sign of pollution at the coastal area under forest department however due to very low numbers of waders the quality of the mudflats needs to be assessed.

Bhaidar Island: No disturbance**.** Low, no visible sign of pollution however pollution load due to local boat

Arambhada, Mithapur Saltpans: non-protected area and industry owned. The surrounding area of saltpans is being used as dumping grounds for solid and non-bio-degradable waste. Solid waste disposal in adjacent areas pose major threat.

Charakla Saltpans: non-protected area and industry owned. Low pollution, only saltpans activities

Gaga Bustard Sanctuary: Protected area, no disturbance noted as such needs to be assessed. Pesticide runoff from nearby farm lands might pose threat.

10.1.4 Wetland uses

Jodiya: Nearby areas have farms which depend upon the freshwater stored in these wetlands. The wetlands are partially under protection by forest department. Some of the wetland areas fall under non-protected area and hence are used by nearby locals for farming purposes. The freshwater wetlands are monsoon and river dependent. In case of saltpans, the sea water is pumped and the level in the pan depends upon on the salt extraction work. Causeways are in operation because of which freshwater is maintained in the wetland. The level of water depends upon the monsoon.

Pirotan Island: Protected area, no other activity is allowed. It's a coastal Island surrounded by the sea from all sides.

Sachana-Balachadi: It's a coastal beach with tidal mudflats. Ship breaking yard under construction in near vicinity. Partially under forest department protection.

Khijadiya Bird Sanctuary: No activity inside the protected area except tourism. Nearby areas have fallow and agricultural lands. Khijadiya Bird Sanctuary is monsoon dependent and main source of water is through a river. Khijadiya Bird Sanctuary has both freshwater marshes and intertidal mudflats and marshes (divided by a 5,996 m earthen reclamation bund).

Narara and Vadinar Saltpans: Narara is under protection by forest department hence no activity allowed except tourism. Vadinar area is in near vicinity to Narara and predominantly consist of saltpans and mudflats. Narara is coastal with tidal mudflats and Vadinar are saltpans having seawater as source. Vadinar saltpans are filled with seawater according to the salt production.

Beyt Dwarka: the northern portion of the island is under protection by forest department. Activities like isolated cases of local fishing were recorded. Rest of the part of island is revenue lands. It's a coastal area with tidal mudflats.

Bhaidar Island: The Island is under forest department protection. No activity is allowed inside as well as near vicinity of the island. It's a coastal area with tidal mudflats.

Arambhada, Mithapur Saltpans: The area is under Tata Chemicals and consist of saltpans activities for industrial purposes. Seawater is the source for these saltpans. Level of water depends upon the salt production and company management.

Charakla Saltpans: The area is under Tata Chemicals and consist of saltpans activities for industrial purposes. Seawater is the source for these saltpans. Level of water depends upon the salt production and company management.

Gaga Bustard Sanctuary: No activity inside the protected area. The wetland is monsoon and river-dependent. Causeways are made however, land is quite shallow and the water level depends on the monsoon and water extraction for farming outside the protected area boundary.

10.1.5 Pollution

Jodiya: The protected area has low pollution levels. Agricultural and nearby industries could be a source of pollution, needs to be assessed.

Pirotan Island: Low, needs to be assessed as the shores of Jamnagar have many industries and port activities. Pollution from the shipping activities needs to be assessed. Mangrove plantation in and around the islands needs to be assessed to compare any loss of existing mudflats

Sachana-Balachadi: Medium, needs to be assessed. Ship breaking yard under construction in immediate vicinity of the roosting area.

Khijadiya Bird Sanctuary: Low, dumping seen in the outskirts, run off pollutants during monsoon from agricultural fields and near by settlements.

Narara and Vadinar Saltpans: Low, however pollution load needs to be assessed as surrounded by industries.

Beyt Dwarka: Low, no visible sign of pollution at the coastal area under forest department however due to very low numbers of waders the quality of the mudflats needs to be assessed.

Bhaidar Island: Low, no visible sign of pollution however pollution load due to local boat

Arambhada, Mithapur Saltpans: The surrounding area of saltpans is being used as dumping grounds for solid and non-biodegradable waste

Charakla Saltpans: Low pollution, only saltpans activities

Gaga Bustard Sanctuary: Low, under protection

10.1.6 Activities around wetlands posing threats to the wetland

Jodiya: No threats as such but extraction of water for farming needs to be assessed and controlled. Protected area boundaries need to be properly defined to control the flow of people which may disturb the birds.

Pirotan Island: Protected area, tourism is restricted however, there are proposals for building eco-tourism facilities on the island

Sachana-Balachadi: Fishing, ship breaking yard may pose some threat

Khijadiya Bird Sanctuary: Pesticide runoff from nearby farm lands.

Narara and Vadinar Saltpans: Industrial and port activities may pose a threat.

Beyt Dwarka: No threats as such.

Bhaidar Island: No threats as such

Arambhada, Mithapur Saltpans: solid waste disposal in adjacent areas

Charakla Saltpans: No threats as such

Gaga Bustard Sanctuary: Pesticide runoff from nearby farm lands.

10.1.7 Water level manitanance

Jodiya: Depends upon the monsoon and requirement by nearby villages. Whether the water needs to be regulated needs to be assessed. Causeways are in operation because of which freshwater is maintained in the wetland. The level of water depends upon the monsoon.

Pirotan Island: not applicable for island

Sachana-Balachadi: Coastal beach with tidal mudflats

Khijadiya Bird Sanctuary: Khijadiya Bird Sanctuary has both freshwater marshes and intertidal mudflats and marshes (divided by a 5,996 m earthen reclamation bund).

Narara and Vadinar Saltpans: Narara is coastal wetland having tidal mudflats. Vadinar saltpans are filled with seawater according to the salt production.

Beyt Dwarka: Coastal beach with tidal mudflats and rocky shores

Bhaidar Island: Island with tidal mudflats and mangroves

Arambhada, Mithapur Saltpans: Level of water depends upon the salt production and company management.

Charakla Saltpans: Level of water depends upon the salt production and company management.

Gaga Bustard Sanctuary: Causeways are made however, land is quite shallow and the water level depends on the monsoon and water extraction for farming outside the protected area boundary.

10.1.8 Recommendations

Jodiya: Since many areas are interspread between the protected area and partially owned by revenue land, this needs to be assessed urgently so that the areas attracting waterbirds can be

taken under protection if needed. Some of the areas near the creeks seem to be good areas for roosting migratory birds which needs to be checked during the appropriate high tide. These are the areas which also share the boundaries with the saltpans. Jodiya needs urgent attention and areas attracting heavy congregation needs to be marked and proposed to extend the protected area status as they are in demand by the salt industries for extension of the salt works.

Due to the expanse of the area, it has combination of wetlands, saltpans and fallow lands are known for migratory bird congregation. The areas supporting high congregation needs to be mapped and the protection status of the area needs to be assessed. Wetlands depending upon the monsoon needs to be monitored for maintaining adequate water levels for both resident and migratory birds.

Pirotan Island: To evaluate the shrinking of mudflats (if any) because of the increasing mangrove cover. Evaluation of developing any kind of tourism infrastructure inside the island and regulating movement around the island to maintain the area for roosting or feeding migratory/resident birds.

Sachana-Balachadi: Coastal beach with tidal mudflats. With the construction of shipbreaking yard, there seems to be slight displacement of the roosting sites along the sandy beach. For maintaining the roosting sites, the beach area which is under forest department needs to be monitored. The spread of mangrove in this area needs to be assessed as to maintain the exposed mudflats in near vicinity of the beach.

Khijadiya Bird Sanctuary: Khijadiya Bird Sanctuary has both freshwater marshes and intertidal mudflats and marshes. The biggest management issue is removal of *Prosopis* which needs to be carried out regularly to maintain the spread of water during the monsoon and for rest of the year. However, in the current survey a large spread of reeds was observed which have taken over much part of the wetlands area. Hence selective and intermittent removal of reeds could also be planned for better management of the area.

Narara and Vadinar Saltpans: Narara is a protected area known for corals and marine life. During receding and approaching tide, wader congregation can be seen in good numbers. The mangrove areas in the near vicinity could be supporting small heronries which need to be identified. Mangrove planation activity in this area needs to be assessed.

Vadinar saltpans is near vicinity to Narara and KPT Jetty. The saltpans serve as high tide roost for the birds which feed at Narara during the low tide. The saltpans which support sizable congregation of waders can be identified for future monitoring.

Beyt Dwarka: The island didn't seem to support bird congregation at par with the nearby known bird congregation sites. The northern portion of the island which is under the forest department protection, needs to be monitored for bird congregation.

Bhaidar Island: The area along with the nearby islands needs to be monitored for migratory birds' congregation and possibility of small heronries among the mangrove patches. Inside the island the high tide roost for shorebirds needs to be mapped and monitored. The mangrove plantation needs to be assessed in the area in terms of mudflat encroachment.

Arambhada, Mithapur Saltpans: The saltpans support large congregation of migratory waterbirds and monitoring during migratory season is recommended.

Charakla Saltpans: These saltpans are known to support high congregation of birds and some reports of nesting of terns as well. No recommendations are to be made for the saltpans as they are privately owned except that monitoring especially during migratory season can be carried out. Some of the fringe areas like fallow saline lands and village ponds are supporting good number of migratory waterbirds which is recommended to be monitored and maintained.

Gaga Bustard Sanctuary: The sanctuary is primarily a grassland habitat and mostly have even slope. The Sanctuary is data deficient in terms of avifauna and needs to be surveyed in all season as specially grassland-dependent birds. There are areas where water gets accumulated and hence a temporary refuge for waterbirds but the management of this sanctuary should focus on maintaining the grassland habitat. Prosopis removal from the grassland areas needs to be carried out regularly which the forest department is already carrying it out. Older growth of *Prosopis* can be maintained as such with some intermittent removal to plant and replacement wth some fruit bearing trees like *Salvadora* and other local varieties. This area is drought prone and dry and hence the management needs to be devised taking care of water requirement inside the protected area and around the fringes. Additionally, it needs to demark the boundaries of the sanctuary. This sanctuary is currently closed for tourist and is advisable to remain so as the area is too small for tourist movement. However, a portion of the area where waterbirds were seen congregating is partially on revenue lands and can be accessed by locals. Farming in these areas were also seen.

Mixed flock of waders mostly of Crab-plovers *Dromas ardeola* and Lesser-crested Terns T*halasseus bengalensis*

Wader congregation at Bhaider Islands. (Pic: Ashley photograph)

10.2 Rann of Kachchh (Landbird Site)

10.2.1 Study Area and Methodology

A detailed field visit was planned for Kachchh the CAF Terrestrial bird site in Gujarat. This included:

1) Banni Grasslands including both eastern and western Banni

2) Kalo Dungar and

3) Dholavira including Chhapariya

In total 8 open width transects of 1 km each was laid in various study areas, 2 point counts (100 m radius) and one roost count was performed in the study area (Table 24).

Table 24: Study Area and sample numbers

Sr. No.	Study site	Transects	Point Count	Roost Count
1	Banni	4	1	1
2	Kalo Dungar	1	-	-
3	Dholavira	3	1	-

10.2.2 Habitat

The major habitat at Banni was dry saline grassland with sparse vegetation of *Suaeda* and *Salicornea*, whereas at Dholavira and Chhapariya was open forest with sparse shrubland dominated with *Prosopis juliflora* and *Salvadora persica.* Kalo Dungar is an elevated hillock with sparse *Prosopis*.

10.2.3 Results

A consolidated list of birds recorded during the surveys is given in Appendix 5. Maximum species (n = 37) were recorded in Dholavira near fossil park. However, the count of each species was very poor i.e. 1 or 2 individuals per species. Lowest diversity was recorded at Kalo Dungar (n=21). The roost count was done near Fulay village in the Chhari dhundh area of the Banni region. Over 35,000 Common Crane, 53 Marsh Harrier, 22 Montagu's Harrier and 10,000 plus unidentified Larks were recorded. However, this can be considered as an underestimate as the roosting population was arriving to the place even after dark, which was not estimated.

10.2.4 Threats

The major threat to the area is development activities such as road construction in the Banni area. There is a requirement of more number of Forest department staff for constant monitoring and vigilance. Also, scientific monitoring of these sites should be encouraged.

10.3 Khijadiya Bird Sanctuary

10.3.1 Site Details

Khijadiya Bird Sanctuary is located in Jamnagar district of Gujarat. The sanctuary is a freshwater wetland ecosystem, influenced by adjacent saline water ecosystem (saltpans, inter-tidal mudflats). The sanctuary and its adjoining areas bear a remarkable diversity of habitats and ecosystems such as marine habitat, fresh water habitat, open watrer surface, mangroves, vegetation cover like *Prosopis*, and *Salvadora*, salt pans, mudflats, creeks, and adjoining farmlands. Because of variation in habitats, the sanctuary supports diverse species of waterbirds, water dependent and land birds. The Sanctuary has been into two: Part 1 and Part 2. Vegetation consists of native species such as *Acacia nilotica, Salvadora persica* and invasive species like *Prosopis juliflora*. Sanctuary is known to harbour good number of migratory birds during winter. It also provides nesting and breeding grounds for many migratory and residential birds.

The site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern. Khijdadiya is known to hold, on a regular basis, ≥1% of a biogeographic population of a congregatory waterbird species, and ≥20,000 waterbirds (Rahmani *et al*. 2016). It is also identified under National Wetland Conservation Programme by Ministry of Environment, Forest and Climate Change (MoEF&CC).

10.3.2 Methods

Bird counting: Field survey was conducted during February 01–02, 2021. Waterbirds were surveyed using estimation count methods (Bibby *et al.* 1992). The number of birds in large flocks was estimated by mentally dividing the congregation into small groups of 5 to 100 depending on the size of the flock. Landbirds were also counted whenever encountered and no other standard methods were followed to count landbirds.

Bird names were followed as per BirdLife International (2018) nomenclature while global status for each species is considered as per IUCN Red list category (BirdLife International 2020).

Threat documentation: Anthropogenic pressures on the wetlands were observed visually and information was obtained from the local communities.

10.3.3 Account on Avifauna

During the present survey, a total of 104 species belonging to 41 families were recorded at Khijadiya Bird Sanctuary. Checklist of birds is provided in Annexure 1. Of these 104 bird species recorded during this survey, 70 were either waterbirds or water dependent birds and 34 species were terrestrial birds. Of the 70 wetland and wetland dependant species, 25 were long distance winter migrants and 8 were local migratory species. Anatidae was the most dominant family followed by Ardeidae, Scolopacidae, Motacillidae, Rallidae, and Threskiornithidae among the wetland birds. Out of the 104 species recorded, 7 species were found to be Near Threatened and 1 vulnerable as per IUCN Redlist category

Demoiselle cranes in Part II of Khijadiya BS

Flock of Greater flamingos in saltpans

Plantation of *Ficus* spp. along the trail in Sanctuary

Saltpans adjoining the Sanctuary

Different views of Khijadia Bird Santuary

10.3.4 Observational Points

i. Water level was found to be high in the wetland areas.
ii. Agricultural fields and saltpans were found in the adjoining areas of wetlands.
iii. Nesting of Oriental Darter was observed in Part I of the Sanctuary.
iv. A pair of Black-necked Storks was seen resting along the wetland.
v. Juveniles of Painted Stork were seen sitting and foraging in aquatic weeds in the wetland along with other birds like Cormorants, Egrets, Pelicans and Purple Moorhen.
vi. Number of flamingos and Black-tailed Godwits were found to be high in the saltpan areas.
vii. Flock of Demoiselle Cranes were seen in Part II during evening hours.
viii. Group of Bluebull were seen moving through the waterbodies disturbing the birds.
ix. *Prosopis* was found to be spread in many parts of the wetland area, along the trails and also within the waterbodies. Birds like Oriental Darter, Cormorants and Painted Storks were seen using the species for resting and perching.
x. New plantations of *Ficus* species were observed along the trail of Sanctuary.

10.3.5 Threats

i. Spread of Invasive Species: The exotic invasive species *Prosopis juliflora* is the most dominant species in the area and is spread along both side of the main trail and interior areas of the sanctuary.
ii. Saltpans are situated in the near vicinity of the freshwater wetlands of Khijadiya Bird Sanctuary near the salt marshes and creeks. These activities could be threats to the area in future.
iii. Salinity: Sea water intrusion into freshwater can increase salinity of the area and can lead to soil degradation and change in faunal diversity.
iv. As the area falls in the arid region, rainfall is low and evapotranspiration is very high. Water level fluctuation in the wetland could affect the population of waterfowls as well as other migrating species in the region.

Conservation measures required:

i. Dense growth of *Prosopis juliflora* was found along the trails in the sanctuary and encroaching in the wetland areas as well as open land. Waterbirds and terrestrial birds

were seen using the species for resting, hiding and perching but invasion of *Prosopis juliflora* should be regularly checked in this ecosystem.

ii. *P. juliflora* could be gradually replaced by native species such as *Acacia nilotica, Azadiracta indica, Ficus bengalensis, Prosopis cineraria, Capparis decidua* and *Salvadora persica* which already naturally exist in the area and enhance the potential of the area for congregation of avian diversity. Fruits of *Salvadora persica* provide source of food for the terrestrial birds and *Acacia* species could provide roosting/perching grounds for birds.

iii. Monthly monitoring of birds should be carried out in the areas from where *Prosopis* has been removed to know the utilization of the area by birds and its impact on birds.

iv. Optimal mix of vegetation cover and openness of wetland should be maintained to provide suitable habitat for foraging and roosting sites for waterbirds and water-dependent birds.

v. Groups of Nilgai were seen moving in open waterbodies as well, disturbing the bird congregations.

11 ODISHA

11.1 Chilika Lagoon

11.1.1 Methodology

BNHS extended the technical support to conduct the AWC in Chilika, which was organized jointly by Forest Department and Chilika Development Authority. For bird surveys, the Chilika Lagoon was divided strategically into 21 segments / units; of which 02 units were covered by road and 19 units were covered by boats. Each unit was led by a bird expert accompanied by three or five participants and one local guide. Each unit was provided with a status survey kit (map showing the area of the unit and route to cover, binocular / spotting scope, notebook with colour plates of 48 common waterbird species of Chilika, Kit bag, one T-Shirt & one cap with logo, bird reference books of CDA publication, annotated checklist of birds prepared by the DFO, Chilika Wildlife Division, Balugaon and waterbird status survey Form).

The total bird count was carried out for all waterbird species and wetland dependent birds which include Passerine birds. Actual number counts were made for smaller flocks, larger and conspicuous birds, and estimates were done for the species found in larger flocks. Time decided for bird count was 06:00 hrs to 12:00 noon.

11.1.2 Note on Avifauna

A totalof 12,04,351 individuals of 111 waterbird species and 38,475 individuals of 79 wetland dependent species were counted from the entire lagoon (Appendix 7). A total of 4,24,788 birds (113 species) were counted in Nalabana Sanctuary. Among the most three species of ducks, the Gadwall *Mareca strepera* (2,22,009) & Eurasian Wigeon *Mareca penelope* (2,10,403) were counted over two lakhs in numbers which is the highest contribution for this year count. Among the most common ducks of Chilika, the numbers counted was higher to previous year in Gadwall *Mareca strepera* and Eurasian Wigeon *Mareca penelope*. The increase noticed in other common ducks such as Northern Pintail *Anas acuta* was marginal. But, in case of Northern Shoveler it was marginal increase. The increase in total population was due to the increase noticed in the two dabbling ducks (Eurasian Wigeon, Gadwall) and the diving duck, Red-crested Pochard *Netta rufina*. The decline noticed in the Common Pochard *Aythya ferina* compared to the previous years was phenomenal. The decline in numbers for the Greater Flamingo *Phoenicopterus roseus* at Nalabana indicate that the mudflat restoration at Nalabana, is not enough although trend continued on the increase in Glossy Ibis *Plegadis falcinellus* and Asian Openbill *Anastomus oscitans* number, the decline in number of Cotton Pygmy-goose *Nettapus coramendelianus* and Lesser Whistling Duck *Dendrocygna javanica* is also noticed.

Overall, the local resident species such as Purple Swamphen *Porphyrio porphyrio*, Common Moorhen *Gallinula chloropus*, and Jacanas are observed in less numbers.

Among the waders, the decline in the Near Threatened Black-tailed Godwit *Limosa limosa* is conspicuous. The decline observed during last several years for the other common waders has shown further decline (Curlew Sandpiper *Calidris ferruginnea*, Little Stint *Calidris minuta* & Pied Avocet *Recurvirostra avosetta*).

The shifting of ducks from Northern Sectors to Southern Sector was so visible and nearly two lakh birds were recorded from Palur Canal to Panchakudi Side. Kalupadaghat, Nairi and the Kansari areas also the numbers were less when compared to previous years. A total of 4,24,788 birds of 113 species were counted which is around 18,000 more than the previous years. But this increase was due to the higher number of two duck species. The decline in wader numbers is compensated by the higher number observed in species like coot and Little Cormorant *Phalocrocorax niger*. The decline in Northern Shoveler *Spatula clyptea* at Nalabana, also indicates the degradation of mudflat at Nalabana as this species prefers the shallow mudflat area, which slowly replaced by terrestrial vegetation.

Two uncommon species to India, namely Falcated Duck *Mareca falcata* (Near Threatened) and Mallard *Anas platyrhynchos* has been sighted in Mangalajodi region. Among the last decade the Greater Flamingo count was recorded to be the lowest during the current season which can also be correlated with the shrinkage and degradation of mudflats and phenomenal expansion of grass patch in the area. Lesser Flamingo was not recorded for the second consecutive year from Chilika Lake. A decrease in the population of both Fulvous Whistling-Duck and Lesser Whistling-Duck from the previous year was recorded. Compared to the previous two years, the Tufted Duck *Aythya fuligula* population had shown about 20% decline. Among the diving ducks, the Red-crested Pochard *Netta rufina* population increased by 40% which is the highest recorded number from Chilika Lake in the last two decades. Among the Geese, the Bar-headed Goose *Anser indicus* number has decreased marginally but the Greylag Goose has shown a slight increase. The two arctic breeding wader species namely Curlew Sandpiper and Little Stint showed a decline of about 90% compared to the early year of 2000. The other common waders which showed a decline are Grey Plover *Pluvialis squatarola*, Pacific Golden Plover *Pluvialis fulva*, Ruff *Calidris pugnax*, Marsh Sandpiper *Tringa stagnatilis*, and Asian *Dowitcher Limnodromus semipalmatus.*

12 KERALA

12.1 Parambikulam Tiger Reserve

12.1.1 Site discription

Parambikulam Tiger Reserve is situated in Palghat District, Kerala, India, within the Anamalai Hills and borders Nelliyampathy Hills (76º 35′–76º 50′ E & 10º20′–10º 26′ N). The total extent of the Tiger Reserve is 643.66 sq. km, with a core zone of 390.89 sq. km and buffer zone of 252.77sq. km. The vegetation comprises of a variety of natural and man-made habitats. The former includes patches of Evergreen and Semi-evergreen forest, Secondary Moist Deciduous forest, which is widely distributed, and grasslands and marshes. The original Moist Deciduous vegetation in the eastern parts has been almost entirely replaced by teak plantations (Anon. 1982). The marshes, or vayals, with their dense grass cover, are the result of poor drainage and accumulation of loamy soil over a long period of time. Stands of Bamboo *Bambusa* sp. and reeds *Ochlandra* sp. occur in the natural forests.

It is part of a large area of forest comprising Anamalai, Nelliampathy, Sholayar High Ranges and Palni Hills. The area in general slopes towards the west, the highest peak being Karimala Gopuram (1,438 m) (triangulation station of the Survey of India), while the lowest area is 300 m above msl on the bank of Chalakudi. The altitude of the PKTR ranges from 300–1,438 m. The other major peaks are Pandaravarai (1,290 m), Vengoli (1,120 m) and Puliyarapadam (1,010 m). PKTR has three man-made reservoirs namely Parambikulam, Thunacadavu, and Peruvaripallam whose cumulative waterspread area is 20.66 sq. km. The PKTR forms the catchment of Chalakkudy River. Administratively, PKTR is divided into four ranges, the Karimala Range, Orukomban Range, Parambikulam Range, and Sungam Range (Jobin and Nameer 2012).

12.1.2 Methods

Bird Surveys were conducted between 9th March and 11th March, 2021 by a single observer assisted by a local assistant. Birds were counted by walking on existing and new trails/transects. In all, 9 such transects were covered. The transect lengths varied from 1.1 km to 5.8 km. The transects were in Karimala Range, Parambikulam Range and Sungam Range and in different habitats like semievergreen forests, moist mixed deciduous forests, dry mixed deciduous forests, moist bamboo brakes, reed brakes and southern montane wet temperate

forests. All the birds encountered were counted, doubtful species were photographed and identified later with Grimmet *et al.* (2011).

12.1.3 Account on Avifuana

In all, 74 species were recorded during the survey including two Near Threatened species Lesser Fish Eagle *Icthyophaga humilis*, River Tern *Sterna aurantia* (Appendix 8). **Three long distant migratory species** were recorded during the survey i.e. Verditer Flycatcher *Eumyias thalassinus,* Black-naped Oriole *Oriolus chinensis,* Brown Shrike *Lanius cristatus.* Local migratory birds recorded during the survey are Common Hoopoe *Upupa epops,* Grey Wagtail *Motacilla cinerea,* Indian Paradise-flycatcher *Terpsiphone paradisi,* Orange-headed Thrush *Geokichla citrina,* Asian Brown Flycatcher *Muscicapa dauurica* (Table 25). Bird species like Southern Hill Myna and White-cheeked Barbet were recorded in 7 of the 9 transects surveyed (Table 26). Among the transects, T1 and T3 having moist deciduous forest type had maximum number of species (Table 27). A list of birds recorded during the surveys is given in Appendix 7.

Table 25: Migratory species recorded during the survey

S.No	Common Name	*Scientific Name*	Migratory status
1	Asian Brown Flycatcher	*Muscicapa dauurica*	Local Migrant
2	Black-naped Oriole	*Oriolus chinensis*	Winter Visitor
3	Brown Shrike	*Lanius cristatus*	Winter Visitor
4	Common Hoopoe	*Upupa epops*	Local Migrant
5	Grey Wagtail	*Motacilla cinerea*	Local Migrant
6	Indian Paradise-flycatcher	*Terpsiphone paradisi*	Local Migrant
7	Orange-headed Thrush	*Geokichla citrina*	Local Migrant
8	Verditer Flycatcher	*Eumyias thalassinus*	Winter Visitor

Table 26. Bird species recorded in maximum number of transects

Common Name	Scientific Name	No. of Transects the bird recorded
Southern Hill Myna	*Gracula indica*	7
White-cheeked Barbet	*Psilopogon viridis*	7
Black Drongo	*Dicrurus macrocercus*	6
Greater Racket-tailed Drongo	*Dicrurus paradiseus*	6
Jungle Babbler	Turdoides striata	6
Malabar Whistling-Thrush	*Myophonus horsfieldii*	5
White-bellied Treepie	*Dendrocitta leucogastra*	5

Table 27: Major habitat Type and dominant plants in each survey transects

Transect Name	Number of Bird Species recorded	Major Habitat type	Dominant Plant Species
T1	27	Moist Deciduous	*Terminalia paniculata, Terminalia elliptica, Dalbergia latifolia,* Bamboo, *Bombax ceiba, Lagerstroemia microcarpa,Tectona grandis*
T2	18	Riverine	*Pongamia pinnata, Tectona grandis,* Bamboo, *Lagerstroemia microcarpa*
T3	29	Moist Deciduous	*Terminalia tomentosa, Terminalia paniculata, Anogeissus latifolia, Dalbergia latifolia,*Grass
T4	17	Riverine	Bamboo, *Pongamia pinnata, Diospyros* sp., *Neolamarckia cadamba, Bischofia javanica, Aquilaria malaccensis*
T5	13	Teak, Riverine, Vayal	Teak, *Pongamia pinnata, Xylia xylocarpa , Colacasia* spp.
T6	23	Teak, Moist Deciduous	Teak, Moist deciduous trees
T7	12	Shola, then riverine	Evergreen , Shola pakku (local name)
T8	6	Teak then semi evergreen	Teak
T9	25	Teak along stream then moist Deciduous	*Bischofia javanica*, *Ochlandra* Reed

12.1.4 Threats

The visible threats during the surveys include

- Plastic wastes found in the forests thrown by the tourists.
- Invasive *Lantana camara* in few locations
- Forest Fires

12.1.5 Recommendations

- Strict regulations and its implementation on disposal of plastic wastes in the forest should be done
- Detailed study on invasive plants on the bird population in Parambikulam should be conducted.
- More involvement of indigenous tribes in the bird habitat conservation should be done as they have more indigenous ecological knowledge
- A detailed study should be done on the migratory birds of the Parambikulam by reputed organisations like Bombay Natural History Society or Sálim Ali Centre for Ornithology and Natural History who are experts in ornithological research.

Riverine forest

Dry decideous forest

Evergreen Forest

Vayal

Parambikulam Reservoir

Teak Plantations

Different habitats of Parambikulam Tiger Reserve

13 CAPACITY BUILDING

When the Covid pandemic restrictions were lifted off, tenTative 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.

14 BIRD SENSITIVIY MAPPING

It is crucial for compiling the species affected by the renewable energy development in India for proceeding with the sensitivity mapping. Hence 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.

To locate the relevant peer-reviewed and non-peer reviewed literature, the following combinations of search terms were used in the internet – "bird* AND wind turbine*, bird* AND wind turbine in India*, windmill* AND bird collisions* AND India*, wind farm* AND bird deaths in India*, power lines* AND bird deaths in India*, power line* AND bird mortality* AND India*, solar power* AND bird mortality* AND India*, power line* AND

bird mortality* AND newspaper* AND India*, vulture electrocution* AND India*, egrets electrocution* AND India*, Sarus Crane* AND electrocution* AND India*, Demoiselle crane* AND electrocution* AND India*, eagle* AND electrocution* AND India*, myna* AND electrocution* AND India*, bird electrocution* AND northeast India*, drongo* AND electrocution* AND India*, pelican* AND electrocution* AND India*".

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.

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Appendix 1: Waterbirds recorded during Asian Waterbird Census from 2017 to 2021 in Coringa Wildlife Sanctuary (source: Andhra Pradesh Forest Department)

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN	2017	2018	2019	2020	2021
1	Brahminy Kite	*Haliastur indus*	Accipitridae	R	LC	0	32	16	77	59
2	Black Kite	*Milvus migrans*	Accipitridae	R	LC	0	0	62	0	0
3	Long-legged buzzard	*Buteo rufinus*	Accipitridae	M-LD	LC	0	0	0	1	0
4	Black baza	*Aviceda leuphotes*	Accipitridae	M	LC	0	0	0	1	0
5	Western Marsh-harrier	*Circus aeruginosus*	Accipitridae	M-LD	LC	0	0	0	1	0
6	White-breasted Kingfisher/ White-Throated Kingfisher	*Halcyon smyrnensis*	Alcedinidae	R & M	LC	0	65	48	79	92
7	Common Kingfisher	*Alcedo atthis*	Alcedinidae	R	LC	0	47	0	11	53
8	Black-capped kingfisher	*Halcyon pileata*	Alcedinidae	M	LC	0	17	2	38	35
9	Pied Kingfisher	*Ceryle rudis*	Alcedinidae	R	LC	0	29	11	74	143
10	Northern Shoveller	*Anas clypeata*	Anatidae	M	LC		11	22	46	12
11	Lesser Whistling-Duck	*Dendrocygna javanica*	Anatidae	R	LC	3193	3500	88	160	1080
12	Ruddy Shelduck	*Tadorna ferruuginea*	Anatidae	R & M	LC	12	25	48	35	113
13	Eurasian Wigeon	*Anas penelope*	Anatidae	M-LD	LC	4	0	2	20	3
14	Gadwall	*Anas strepera*	Anatidae	M	LC	20	0	0	15	5
15	Garganey	*Anas querquedula*	Anatidae	M	LC	10	50	96	66	0
16	Common Teal	*Anas crecca*	Anatidae	M-LD	LC	6	0	0	12	0
17	Cotton Pygmy-goose	*Nettapus coromandelianus*	Anatidae	R & M	LC	12	19	250	22	0
18	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	R	LC	8	10		18	4
19	Northern Pintail	*Anas acuta*	Anatidae	M-LD	LC	6	8	42	32	134
20	African Comb Duck / Knob-billed duck/ Comb Duck	*Sarkidornis melanotos*	Anatidae	R & M	LC	0	0	13	0	0

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN	2017	2018	2019	2020	2021
21	Oriental Darter	*Anhinga melanogaster*	Anhingidae	R	NT	182	30	17	36	39
22	Striated heron / Little Green Heron	*Butorides striatus*	Ardeidae	R	LC	16	23	0	14	46
23	Little Egret	*Egretta garzetta*	Ardeidae	R	LC	2640	1473	216	527	621
24	Western Reef-Egret	*Egretta gularis*	Ardeidae	M	LC	110	150	28	186	125
25	Grey Heron	*Ardea cinerea*	Ardeidae	R	LC	204	178	49	109	222
26	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	64	12	3	34	22
27	Great White Egret	*Casmerodius albus*	Ardeidae	R	LC	1032	945	123	1114	449
28	Intermediate Egret	*Mesophoyx intermedia*	Ardeidae	R & M	LC	690	340	184	411	94
29	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	338	605	6543	541	510
30	Indian Pond heron	*Ardeola grayii*	Ardeidae	R	LC	513	443	103	223	379
31	Black-crowned Night-Heron	*Nycticorax nycticorax*	Ardeidae	R & M	LC	126	4	7	31	55
32	Yellow Bittern	*Ixobrychus sinensis*	Ardeidae	R	LC	0	10	2	12	13
33	Black Bittern	*Dupetor flavicollis*	Ardeidae	R	LC	0	4	0		1
34	Cinnamon Bittern	*Ixobrychus cinnamomeus*	Ardeidae	R	LC	0	2	0	2	9
35	Pacific Golden Plover	*Pluvialis fulva*	Charadriidae	M	LC	2982	1480	857	1783	4259
36	Grey Plover	*Pluvialis squatarola*	Charadriidae	M	LC	197	250	7	341	376
37	Little Ringed Plover	*Charadrius dubius*	Charadriidae	R	LC	261	85	8	126	46
38	Kentish Plover	*Charadrius alexandrinus*	Charadriidae	M	LC	392	368	367	310	176
39	Lesser Sandplover	*Charadrius mongolus*	Charadriidae	M	LC	4342	4377	3445	2410	5318
40	Greater SandPlover	*Chardrius leschenaultii*	Charadriidae	M	LC	2	0	0	54	199
41	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	R	LC	62	62	53	97	120
42	Grey-headed Lapwing	*Vanellus cinerius*	Charadriidae	M	LC	44	50	10	45	35

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN	2017	2018	2019	2020	2021
43	Painted Stork	*Mycteria leucocephala*	Ciconiidae	R	NT	460	456	48	164	338
44	Asian Openbill	*Anastomus oscitans*	Ciconiidae	R	LC	1337	371	293	326	1657
45	Peregrine falcon	*Falco peregrinus*	Falconidae	M	LC	0	0	0	5	1
46	Little Pratincole / Small Pratincole	*Glareola lactea*	Glareolidae	M	LC	24	10	301	500	739
47	Eurasian Oystercatcher	*Haematopus ostralegus*	Haematopodidae	M	NT	0	10	6	10	13
48	Barn Swallow	*Hirundo rustica*	Hirundinidae	M	LC	0	130	2	306	217
49	Red-rumped Swallow	*Cecropis daurica*	Hirundinidae	M	LC	0		43	22	0
50	Bronze-winged Jacana	*Metopidius indicus*	Jacanidae	R	LC	26	2	6	11	13
51	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	R	LC	9	3	4	4	12
52	Pallas's Gull	*Larus ichthyeatus*	Laridae	M	LC	3851	710	703	1127	2450
53	Brown-headed Gull	*Larus brunnicephalus*	Laridae	M	LC	1513	743	2025	1311	1573
54	Black-headed Gull	*Larus ridibundus*	Laridae	M	LC	36	40	0	109	167
55	Whiskered Tern	*Chlidonias hybridus*	Laridae	M	LC	248	155	0	440	492
56	Common Gull-billed Tern / Gull-Billed Tern	*Gelochelidon nilotica*	Laridae	M	LC	78	18	1	151	268
57	Caspian Tern	*Sterna caspia*	Laridae	M	LC	555	763	620	350	827
58	Common Tern	*Sterna hirundo*	Laridae	M	LC	13	16	13	306	224
59	River Tern	*Sterna aurantia*	Laridae	R	VU	32	26	0	7	2
60	Lesser Crested Tern	*Sterna bengalensis*	Laridae	M	LC	89	125	1	139	216
61	Little Tern	*Sterna albifrons*	Laridae	M	LC	111	390	2	279	196
62	Greater Crested Tern	*Sterna bergii*	Laridae	M	LC	3	5	0	47	105
63	Indian Skimmer	*Rynchops albicollis*	Laridae	M	EN	0	0	200	163	175
64	Red-throated Pipit	*Anthus cervinus*	Motacillidae	M	LC	0	0	0	85	0
65	Water Pipit	*Anthus spinoletta*	Motacillidae	M	LC	0	10	0	0	0

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN	2017	2018	2019	2020	2021
66	Osprey	*Pandion haliaetus*	Pandionidae	R	LC	0	7	8	13	15
67	Spot-billed Pelican	*Pelicanus philippensis*	Pelecanidae	M	NT	0	60	80	54	0
68	Little Cormorant	*Phalacrocorax niger*	Phalacrocoracidae	R	LC	415	620	306	416	695
69	Indian Cormorant / Indian shag	Phalacrocorax fuscicollis	Phalacrocoracidae	R	LC	8	22	0	35	18
70	Greater Flamingo	*Phoenicopterus ruber*	Phoenicopteridae	M	LC	1	0	0	0	0
71	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	24	7	35	30	21
72	Grey-headed Swamphen / Purple Swamphen	*Porphyrio porphyrio*	Rallidae	R	LC	28	15	15	10	23
73	Watercock	*Gallicrex cinerea*	Rallidae	R	LC	0	1	0	1	2
74	Western Water Rail	*Rallus aquaticus*	Rallidae	R	LC	0	0	0	0	3
75	Ruddy-breasted Crake	*Porzana fusca*	Rallidae	M	LC	0	0	0	0	3
76	Common Moorhen /Indian Moorhen	*Gallinula chloropus*	Rallidae	R	LC	30	10	9	6	13
77	Eurasian Coot / Common Coot	*Fulica atra*	Rallidae	R & M	LC	70	4	72	5	53
78	Pied Avocet	*Recurvirostra avosetta*	Recurvirostridae	M	LC	0	5	22	28	2
79	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	R	LC	2702	323	4267	1229	1675
80	Dunlin	*Amaurornis phoenicurus*	Scolopacidae	M	LC	38	26	4	36	49
81	Common Snipe	*Gallinago gallinago*	Scolopacidae	M	LC	17	25	1	1	1
82	Black-tailed Godwit	*Limosa limosa*	Scolopacidae	M	NT	3060	90	435	582	1785
83	Bar-tailed Godwit	*Limosa lapponica*	Scolopacidae	M	NT	251	88	0	225	373
84	Whimbrel	*Numenius phaeopus*	Scolopacidae	M	LC	426	189	22	245	186
85	Eurasian Curlew	*Numenius arquata*	Scolopacidae	M	NT	258	184	124	138	158
86	Common Redshank	*Tringa totanus*	Scolopacidae	M	LC	1391	225	287	443	596

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN	2017	2018	2019	2020	2021
87	Spotted Redshank	*Trnga erythropus*	Scolopacidae	M	LC	2	0	1	8	2
88	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	M	LC	71	25	105	207	214
89	Common Greenshank	*Tringa nebularia*	Scolopacidae	M	LC	49	51	264	113	120
90	Wood Sandpiper	*Tringa glareola*	Scolopacidae	M	LC	297	18	5	94	101
91	Terek Sandpiper	*Xenus cinereus*	Scolopacidae	M	LC	163	51	6	31	377
92	Green sandpiper	*Tringa ochropus*	Scolopacidae	M-LD	LC	16	0	0	6	2
93	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	M	LC	144	34	11	83	87
94	Ruddy Turnstone	*Arenaria interpres*	Scolopacidae	M	LC	342	160	120	51	200
95	Great Knot	*Calidris tenuirostris*	Scolopacidae	M	EN	137	519	0	446	250
96	Sanderling	*Calidris alba*	Scolopacidae	M	LC	0		238	31	40
97	Little Stint	*Calidris minuta*	Scolopacidae	M	LC	1894	1975	461	1003	933
98	Dunlin	*Calidris alpina*	Scolopacidae	M	LC	0	0	9	0	25
99	Long-toed Stint	*Calidris subminuta*	Scolopacidae	M	LC	0	0	0	2	2
100	Temminck's Stint	*Calidris temminckii*	Scolopacidae	M	LC	17	5	0	206	52
101	Curlew Sandpiper	*Calidris ferruginea*	Scolopacidae	M	NT	2967	214	726	394	409
102	Ruff	*Philomachus pugnax*	Scolopacidae	M	LC	33	4	190	85	36
103	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	R	NT	232	99	75	187	414
104	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	R & M	LC	20		10	129	220
105	Eurasian Spoonbill		Threskiornithidae	R	LC	0	1	0	0	0
106	Unidentified Bitterns					4	0	0	5	1
107	Unidentified herons and egrets					70	0	0	0	0
108	Unidentified Ducks					0	0	9	0	0
109	Unidentified Shorebirds					1910	0	21	3200	0
110	Unidentified Gulls					736	5	310	1000	519

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN	2017	2018	2019	2020	2021
111	Unidentified Terns					0	0	225	977	0
	Total					**43718**	**23749**	**25460**	**26731**	**34207**

Note: R- Resident; R & M – Resident with migratory population; M – Migratory; M-LD – Long-Distance Migrant; LC – Least Concerned; NT – Near Threatened; VU – Vulnerable; EN – Endangered

Appendix 2: Birds recorded during AWC 2020 and BNHS surveys in 2020 and 2021 in Kolleru Wildlife Sanctuary (source: Andhra Pradesh Forest Department)

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	AWC 2020	March 2020	Feb 2021
1	Lesser Whistling-Duck	*Dendrocygna javanica*	Anatidae	R	LC	2405	12	75
2	Fulvous Whisling Duck	*Dendrocygna bicolor*	Anatidae	M	LC	10718	40	25
3	Ruddy Shelduck	*Tadorna ferruginea*	Anatidae	R & M	LC	0	31	34
4	Gadwall	*Mareca strepera*	Anatidae	M	LC	18	0	4
5	Garganey	*Spatula querquedula*	Anatidae	M	LC	95	30860	922
6	Cotton Pygmy Goose	*Nettapus coromandelianus*	Anatidae	M	LC	66	4	
7	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	R	LC	16	6	2
8	Northern Shoveller	Spatula clypeata	Anatidae	M	LC	470	2110	370
9	Northern Pintail	*Anas acuta*	Anatidae	M	LC	501	0	836
10	Red-crested Pochard	*Netta rufina*	Anatidae	M	LC	400	0	0
11	Common Pochard	*Aythya ferina*	Anatidae	M		410	0	0
12	Tufted Pochard	*Aythya fuligula*	Anatidae	M		80	0	0
13	African Comb Duck / Knob-billed duck/ Comb Duck	*Sarkidiornis melanotos*	Anatidae	R	LC	16	0	0
14	Oriental Darter	*Anhinga melanogaster*	Anhingidae	R		6	2	7
15	Little Egret	*Egretta garzetta*	Ardeidae	R	LC	1855	4903	76
16	Grey Heron	*Ardea cinerea*	Ardeidae	R	LC	285	312	107
17	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	241	23	8

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	AWC 2020	March 2020	Feb 2021
18	Great White Egret	*Ardea alba*	Ardeidae	R	LC	1020	605	110
19	Intermediate Egret	*Ardea intermedia*	Ardeidae	R	LC	1423	80	14
20	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	491	845	137
21	Indian Pond-Heron	*Ardeola grayii*	Ardeidae	R	LC	775	300	198
22	Black-crowned Night-Heron	*Nycticorax nycticorax*	Ardeidae	R	LC	0	50	60
23	Yellow Bittern	*Ixobrychus sinensis*	Ardeidae	R	LC	3	1	5
24	Black Bittern	*Ixobrychus flavicollis*	Ardeidae	R	LC	1	1	1
25	Chestnut Bittern	*Ixobrychus cinnamomeus*	Ardeidae	R	LC	4	2	0
26	Pacific Golden-Plover	*Pluvialis fulva*	Charadriidae	M	LC	40	3082	0
27	Little Ringed Plover	*Charadrius dubius*	Charadriidae	R	LC	3	18	0
28	Kentish Plover	*Charadrius alexandrinus*	Charadriidae	M	LC	465	15	0
29	Lesser Sand Plover	*Charadrius mongolus*	Charadriidae	M	LC		800	0
30	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	R	LC	159	18	40
31	Grey-headed Lapwing	*Vanellus cinereus*	Charadriidae	M	LC	11	8	7
32	Painted Stork	*Mycteria leucocephala*	Ciconiidae	R	NT	3150	15945	2557
33	Asian Openbill-Stork	*Anastomus oscitans*	Ciconiidae	R	LC	2388	6654	212
34	Peregrine falcon	*Falco peregrinus*	Falconidae	M	LC	1	0	0
35	Collard Pratincole	*Glareola pratincola*	Glareolidae	M	LC	0	5	0
36	Bronze-winged Jacana	*Metopidius indicus*	Jacanidae	R	LC	507	113	77
37	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	R	LC	663	311	129
38	Brown-headed Gull	*Larus brunnicephalus*	Laridae	M	LC	0	2	0
39	Whiskered Tern	*Chlidonias hybrida*	Laridae	M	LC	10320	2384	468
40	Gull-billed Tern	*Gelochelidon nilotica*	Laridae	M	LC	7	35	150
41	Caspian Tern	*Hydroprogne caspia*	Laridae	M	LC	0	3	0
42	Spot-billed Pelican	*Pelecanus philippensis*	Pelecanidae	R	NT	5173	10553	9054
43	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	R & M	LC	305	0	

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	AWC 2020	March 2020	Feb 2021
44	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	R	LC	2892	222	143
45	Indian Cormorant / Indian shag	*Phalacrocorax fuscicollis*	Phalacrocoracidae	R	LC	276	0	
46	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	49	69	7
47	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	R	LC	20	5	26
48	Grey-headed Swamphen	*Porphyrio porphyrio*	Rallidae	R	LC	272	625	115
49	Baillon's Crake	*Zapornia pusilla*	Rallidae	M	LC	1	0	
50	Ruddy-breasted Crake	*Zapornia fusca /Porzana fusca*	Rallidae	M	LC	7	0	14
51	Brown Crake	*Zapornia akool*	Rallidae	R	LC	2	0	0
52	Common Moorhen	*Gallinula chloropus*	Rallidae	R	LC	61	2	17
53	Eurasian Coot	*Fulica atra*	Rallidae	R & M	LC	90	75	60
54	Pied Avocet	*Recurvirostra avosetta*	Recurvirostridae	M	LC	0	125	0
55	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	R	LC	3521	1340	658
56	Greater painted snipe	*Rostratula benghalensis*	Rostratulidae	R	LC	2	0	2
57	Common Snipe	*Gallinago gallinago*	Scolopacidae	M	LC	15	9	1
58	Black-tailed Godwit	*Limosa limosa*	Scolopacidae	M	NT	8813	11305	925
59	Common Redshank	*Tringa totanus*	Scolopacidae	M	LC	118	45	61
60	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	M	LC	2313	648	30
61	Common Greenshank	*Tringa nebularia*	Scolopacidae	M	LC	1437	16	91
62	Wood Sandpiper	*Tringa glareola*	Scolopacidae	M	LC	1725	598	85
63	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	M	LC	71	2	6
64	Little Stint	*Calidris minuta*	Scolopacidae	M	LC	1520	20337	1308
65	Temminck's Stint	*Calidris temminckii*	Scolopacidae	M	LC	177	200	
66	Ruff	*Calidris pugnax*	Scolopacidae	M	LC	434	480	880
67	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	R	NT	6	212	90
68	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	R & M	LC	7619	7253	890
69	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	R	LC	0	42	0

Sl. No.	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	AWC 2020	March 2020	Feb 2021
70	Brahminy Kite	*Haliastur indus*	Accipitridae	R	LC	0	6	7
71	Black Kite	*Milvus migrans*	Accipitridae	R	LC	0	6	3
72	Western Marsh Harrier	*Circus aeruginosus*	Accipitridae	M	LC	11	0	0
73	Pied Harrier	*Circus melanoleucos*	Accipitridae	M		0	0	1
74	Black-shoulder kite	*Elanus caeruleus*	Accipitridae	R	LC	0	0	3
75	White-brested Kingfisher	*Halcyon smyrnensis*	Alcedinidae	R	LC	13	15	9
76	Small-blue kingfisher	*Alcedo atthis*	Alcedinidae	R	LC	6	2	6
77	Lesser pied kingfisher	*Ceryle rudis*	Alcedinidae	R	LC	9	9	0
78	Barn Swallow	*Hirundo rustica*	Hirundinidae	M	LC	3145	500	0
79	Red rumped swallow	*Cecropis daurica*	Hirundinidae	R	LC	0	150	0
80	Wire-tailed Swallow	*Hirundo smithii*	Hirundinidae	R	LC	1	0	0
81	White Wagtail	*Motacilla alba*	Motacillidae	M	LC	2	0	0
82	Yellow Wagtail	*Motacilla flava*	Motacillidae	M	LC	106	0	0
83	Citrine Wagtail	*Motacilla citreola*	Motacillidae	M	LC	46	0	0
84	Grey Wagtail	*Motacilla cinerea*	Motacillidae	M	LC	6	0	0
85	Unidentified Bitterns		Ardeidae			0	5	0
86	Unidentified herons and egrets		Ardeidae			13316	0	0
87	Unidentified Ducks		Anatidae			10040	0	0
88	Unidentified Terns		Laridae			0	300	0
	Total					**10263 3**	**124776**	**21123**

Note: R – Resident; R & M – Resident with migratory population; M – Migratory; LC – Least Concerned; NT – Near Threatened;VU – Vulnerable; EN – Endangered

Appendix 3 : Details of Birds recorded at Nandur Madhmeshwar Bird Sactury during January, 2021.

Sl.No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total Count
1	Western Marsh-harrier	*Circus aeruginosus*	Accipitridae	M-LD	LC	39
2	Greater Spotted Eagle	*Clanga clanga*	Accipitridae	M-LD	VU	6
3	Black Kite	*Milvus migrans*	Accipitridae	R	LC	2
4	Black-winged Kite	*Elanus caeruleus*	Accipitridae	R	LC	3
5	Booted Warbler	*Iduna caligata*	Acrocephalidae	R	LC	3
6	Paddyfield Warbler	*Acrocephalus agricola*	Acrocephalidae	M	LC	2
7	Rufous-tailed Lark	*Ammomanes phoenicura*	Alaudidae	R & M	LC	8
8	Common Kingfisher	*Alcedo atthis*	Alcedinidae	R	LC	6
9	White-throated Kingfisher	*Halcyon smyrnensis*	Alcedinidae	R & M	LC	11
10	Pied Kingfisher	*Ceryle rudis*	Alcedinidae	R	LC	7
11	Lesser Whistling-duck	*Dendrocygna javanica*	Anatidae	R	LC	361
12	Ruddy Shelduck	*Tadorna ferruginea*	Anatidae	R & M	LC	23
13	Cotton Pygmy-goose	*Nettapus coromandelianus*	Anatidae	R & M	LC	90
14	Northern Pintail	*Anas acuta*	Anatidae	M-LD	LC	20
15	Common Teal	*Anas crecca*	Anatidae	M-LD	LC	25
16	Western Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	R	LC	174
17	Garganey	*Spatula querquedula*	Anatidae	M	LC	35
18	Common Pochard	*Aythya ferina*	Anatidae	M	VU	20
19	Ferruginous Duck	*Aythya nyroca*	Anatidae	M-LD	NT	20
20	Eurasian Wigeon	*Mareca penelope*	Anatidae	M-LD	LC	714
21	Gadwall	*Mareca strepera*	Anatidae	M	LC	401
22	Northern Shoveler	*Spatula clypeata*	Anatidae	M-LD	LC	2995
23	Red-crested Pochard	*Netta rufina*	Anatidae	M	LC	3
24	Unidentified ducks		Anatidae	#N/A	#N/A	12692
25	Grey Heron	*Ardea cinerea*	Ardeidae	R	LC	28

Sl.No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total Count
26	Purple Heron	*Ardea purpurea*	Ardeidae	R	LC	42
27	Great White Egret	*Ardea alba*	Ardeidae	R	LC	24
28	Intermediate Egret	*Ardea intermedia*	Ardeidae	R & M	LC	96
29	Little Egret	*Egretta garzetta*	Ardeidae	R	LC	90
30	Cattle Egret	*Bubulcus ibis*	Ardeidae	R	LC	144
31	Indian Pond-heron	*Ardeola grayii*	Ardeidae	R	LC	112
32	Black-crowned Night-heron	*Nycticorax nycticorax*	Ardeidae	R & M	LC	50
33	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	R	LC	101
34	Pacific Golden Plover	*Pluvialis fulva*	Charadriidae	M	LC	19
35	Little Ringed Plover	*Charadrius dubius*	Charadriidae	R	LC	5
36	Kentish Plover	*Charadrius alexandrinus*	Charadriidae	M	LC	1
37	Painted Stork	*Mycteria leucocephala*	Ciconiidae	R	NT	15
38	Asian Openbill	*Anastomus oscitans*	Ciconiidae	R	LC	3
39	Ashy Prinia	*Prinia socialis*	Cisticolidae	R	LC	17
40	Plain Prinia	*Prinia inornata*	Cisticolidae	R	LC	3
41	Laughing Dove	*Spilopelia senegalensis*	Columbidae	R	LC	7
42	Indian Roller	*Coracias benghalensis*	Coraciidae	R	LC	2
43	Jungle Crow	*Corvus macrorhynchos*	Corvidae	R	LC	2
44	House Crow	*Corvus splendens*	Corvidae	R	LC	16
45	Thick-billed Flowerpecker	*Dicaeum agile*	Dicaeidae	R	LC	1
46	Black Drongo	*Dicrurus macrocercus*	Dicruridae	R	LC	46
47	Red-headed Bunting	*Emberiza bruniceps*	Emberizidae	M	LC	2
48	Red Avadavat	*Amandava amandava*	Estrildidae	R & M	LC	42
49	Peregrine Falcon	*Falco peregrinus*	Falconidae	M	LC	1
50	Common Rosefinch	*Carpodacus erythrinus*	Fringillidae	M	LC	5
51	Small Pratincole	*Glareola lactea*	Glareolidae	M	LC	51

Sl.No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total Count
52	Common Crane	*Grus grus*	Gruidae	M	LC	439
53	Barn Swallow	*Hirundo rustica*	Hirundinidae	M	LC	190
54	Wire-tailed Swallow	*Hirundo smithii*	Hirundinidae	R & M	LC	24
55	Unidentified Swift, Swallow and Martin		Hirundinidae	#N/A	#N/A	5067
56	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	R	LC	49
57	Brown Shrike	*Lanius cristatus*	Laniidae	M	LC	1
58	Bay-backed Shrike	*Lanius vittatus*	Laniidae	R	LC	2
59	Long-tailed Shrike	*Lanius schach*	Laniidae	M	LC	8
60	Whiskered Tern	*Chlidonias hybrida*	Laridae	M	LC	64
61	River Tern	*Sterna aurantia*	Laridae	R	VU	32
62	Large Grey Babbler	*Argya malcolmi*	Leiotrichidae	R & M	LC	5
63	White Wagtail	*Motacilla alba*	Motacillidae	M	LC	6
64	White-browed Wagtail	*Motacilla maderaspatensis*	Motacillidae	M	LC	8
65	Yellow Wagtail	*Motacilla flava*	Motacillidae	M-LD	LC	27
66	Citrine Wagtail	*Motacilla citreola*	Motacillidae	M	LC	3
67	Grey Wagtail	*Motacilla cinerea*	Motacillidae	M	LC	6
68	Tree Pipit	*Anthus trivialis*	Motacillidae	M	LC	9
69	Black Redstart	*Phoenicurus ochruros*	Muscicapidae	M	LC	1
70	Variable Wheatear	*Oenanthe picata*	Muscicapidae	M	LC	1
71	Bluethroat	*Cyanecula svecica*	Muscicapidae	M	LC	6
72	Common Stonechat	*Saxicola torquatus*	Muscicapidae	M	LC	14
73	Indian Robin	*Saxicoloides fulicatus*	Muscicapidae	R	LC	4
74	Pied Bushchat	*Saxicola caprata*	Muscicapidae	M	LC	12
75	Purple Sunbird	*Cinnyris asiaticus*	Nectariniidae	R	LC	2
76	Eurasian Golden Oriole	*Oriolus oriolus*	Oriolidae	M	LC	1
77	Osprey	*Pandion haliaetus*	Pandionidae	R	LC	2

Sl.No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total Count
78	House Sparrow	*Passer domesticus*	Passeridae	R	LC	14
79	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	R & M	LC	14
80	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	R	LC	213
81	Grey Francolin	*Francolinus pondicerianus*	Phasianidae	R	LC	17
82	Indian Peafowl	*Pavo cristatus*	Phasianidae	R	LC	3
83	Common Chiffchaff	*Phylloscopus collybita*	Phylloscopidae	M	LC	4
84	Sulphur-bellied Warbler	*Phylloscopus griseolus*	Phylloscopidae	R	LC	1
85	Eurasian Wryneck	*Jynx torquilla*	Picidae	M	LC	1
86	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	R	LC	55
87	Red-vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	R	LC	14
88	Ruddy-breasted Crake	*Zapornia fusca*	Rallidae	M	LC	2
89	Baillon's Crake	*Zapornia pusilla*	Rallidae	M	LC	3
90	Purple Swamphen	*Porphyrio porphyrio*	Rallidae	R	LC	147
91	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	R	LC	13
92	Common Moorhen	*Gallinula chloropus*	Rallidae	R	LC	14
93	Common Coot	*Fulica atra*	Rallidae	R & M	LC	6516
94	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	R	LC	10
95	White-browed Fantail	*Rhipidura aureola*	Rhipiduridae	R	LC	1
96	Wood Sandpiper	*Tringa glareola*	Scolopacidae	M	LC	9
97	Common Greenshank	*Tringa nebularia*	Scolopacidae	M	LC	5
98	Green Sandpiper	*Tringa ochropus*	Scolopacidae	M-LD	LC	3
99	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	M	LC	13
100	Common Snipe	*Gallinago gallinago*	Scolopacidae	M	LC	4
101	Little Stint	*Calidris minuta*	Scolopacidae	M	LC	87
102	Temminck's Stint	*Calidris temminckii*	Scolopacidae	M	LC	10
103	Ruff	*Calidris pugnax*	Scolopacidae	M	LC	2

Sl.No	Common Name	Scientific Name	Family	Migratory Status	IUCN Status	Total Count
104	Spotted Owlet	*Athene brama*	Strigidae	R	LC	3
105	Common Myna	*Acridotheres tristis*	Sturnidae	R	LC	4
106	Jungle Myna	*Acridotheres fuscus*	Sturnidae	R	LC	4
107	Rosy Starling	*Pastor roseus*	Sturnidae	R & M	LC	16
108	Brahminy Starling	*Sturnia pagodarum*	Sturnidae	M	LC	4
109	Asian Pied Starling	*Gracupica contra*	Sturnidae	M	LC	10
110	Lesser Whitethroat	*Sylvia curruca*	Sylviidae	M	LC	3
111	Yellow-eyed Babbler	*Chrysomma sinense*	Sylviidae	R & M	LC	10
112	Red-naped Ibis	*Pseudibis papillosa*	Threskiornithidae	M	LC	10
113	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	R	LC	14
114	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	R	NT	38
115	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	R & M	LC	88
116	Unidentified Shorebirds					60

Note: R- Resident; R & M – Resident with migratory population; M – Migratory; M-LD – Long-Distance Migrant; LC – Least Concerned; NT – Near Threatened; VU – Vulnerable; EN – Endangered

Appendix 4: Details of bids recorded at sites under the Marine National Park, Gujarat during March 2020

Sl.No	Common Name	Scientific Name	Family	1	2	3	4	5	6	7	8	9	10
1	Eurasian Wigeon	*Mareca penelope*	Anatidae	400			400					200	260
2	Gadwall	*Mareca strepera*	Anatidae	230			80					250	
3	Great White Egret	*Ardea alba*	Ardeidae	12	P	?	P		9		7		
4	Whiskered tern	*Chlidonias hybrida*	Laridae	?	30		P	?		?	40		
5	Black-winged stilt	*Himantopus himantopus*	Recurvirostridae	P	P	P	P	P	27		P		P
6	Northern Pintail	*Anas acuta*	Anatidae	600			300				8	45	250
7	Ruddy Shelduck	*Tadorna ferruginea*	Anatidae	10									
8	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	80	10		50		15		70	100	18
9	Garganey	*Spatula querquedula*	Anatidae	190			45						
10	Common Coot	*Fulica atra*	Rallidae	120			250						120
11	Whimbrel	*Numenius phaeopus*	Scolopacidae	20	50	60	3	70	5	18	10		
12	Great Crested Grebe	*Podiceps cristatus*	Podicipedidae	36			40					200	20
13	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	165			87					300	40
14	Northern Shoveler	*Spatula clypeata*	Anatidae	400			220				30	50	600
15	Common Pochard	*Aythya ferina*	Anatidae	200			260					70	100
16	Little Egret	*Egretta garzetta*	Ardeidae	P			P		P		P		P
17	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	10			8		P				10
18	Painted Stork	*Mycteria leucocephala*	Ciconiidae	170	P	10	100	36	P		27	40	P
19	Intermediate Egret	*Ardea intermedia*	Ardeidae	P	30		P	P	2				15
20	River tern	*Sterna aurantia*	Laridae	10			3						3
21	Eurasian Curlew	*Numenius arquata*	Scolopacidae	28	60	80	2	220	10	48	65		
22	Black-tailed Godwit	*Limosa limosa*	Scolopacidae	320			140						200
23	Waders sps			2000	100		500	800		900	600		

Sl.No	Common Name	Scientific Name	Family	1	2	3	4	5	6	7	8	9	10
24	Bar-headed Goose	*Anser indicus*	Anatidae										
25	Ducks sps			700									
26	Caspian Tern	*Hydroprogne caspia*	Laridae	5	40	20	3	6		60	42		
27	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	30	2		45	10	21		23	60	18
28	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	P			15						
29	Purple Swamphen	*Porphyrio porphyrio*	Rallidae	P			38						
30	Bronze-winged Jacana	*Metopidius indicus*	Jacanidae	P			P						
31	Purple Heron	*Ardea purpurea*	Ardeidae	1			P						
32	Lesser Whistling Duck	*Dendrocygna javanica*	Anatidae	P			P						P
33	Oriental Darter	*Anhinga melanogaster*	Anhingidae	35	8		40		8		3	100	3
34	Common Teal	*Anas crecca*	Anatidae	45			230				30		190
35	Greylag Goose	*Anser anser*	Anatidae	P			14						
36	Bar-tailed Godwit	*Limosa lapponica*	Scolopacidae	P	200	240		80	4	280			
37	Common Redshank	*Tringa totanus*	Scolopacidae	20	180	350	100		60	170			100
38	Grey Plover	*Pluvialis squatarola*	Charadriidae	17	150	80			10	130	36		
39	Lesser Crested Tern	*Thalasseus bengalensis*	Laridae	2	100	30		60	25	80	200		
40	Common Gull-billed Tern	*Gelochelidon nilotica*	Laridae	30	20	20	P	15	7	30	100		
41	Pallas's Gull	*Ichthyaetus ichthyaetus*	Laridae	28	25	40			2	40	38		
42	Lesser Sand Plover	*Charadrius mongolus*	Charadriidae	100	150	500	P	1000	80	300			
43	Greater Flamingo	*Phoenicopterus roseus*	Phoenicopteridae	260			280	1500	2	52	200	4000	40
44	Demoiselle Crane	*Grus virgo*	Gruidae	80			70					2	200
45	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	50	P		68	40	P		11	40	50
46	Common Greenshank	*Tringa nebularia*	Scolopacidae	P	60		20	38	P				55
47	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	P	75	70	110	40	20	?	P		140
48	Cormorants sps	*#N/A*	#N/A	700				60					48
49	Great White Pelican	*Pelecanus onocrotalus*	Pelecanidae	450			500				20		

Sl.No	Common Name	Scientific Name	Family	1	2	3	4	5	6	7	8	9	10
50	Little Tern	*Sternula albifrons*	Laridae	20	?		P			?	110		
51	Grey Heron	*Ardea cinerea*	Ardeidae	17	30		20	46	12	6	16		
52	Western Reef Egret	*Egretta gularis*	Ardeidae	10	114	6	30	19	18	14	9		4
53	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	280			30					60	80
54	Great Thick-knee	*Esacus recurvirostris*	Burhinidae	5	2	3	16						
55	Terek Sandpiper	*Xenus cinereus*	Scolopacidae	P	120	270		200	50	110	P		
56	Eurasian Oystercatcher	*Haematopus ostralegus*	Haematopodidae		40	80			12				
57	Great Knot	*Calidris tenuirostris*	Scolopacidae		170	200							
58	Curlew Sandpiper	*Calidris ferruginea*	Scolopacidae		50	210		220	30	190			
59	Dunlin	*Calidris alpina*	Scolopacidae		80	250		500	55	270	P		
60	Crab-plover	*Dromas ardeola*	Dromadidae		700	300			1	400			
61	Slender-billed Gull	*Chroicocephalus genei*	Laridae		10					33			
62	Black-headed Gull	*Chroicocephalus ridibundus*	Laridae		4						20		
63	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Laridae	10	40		P		16	28	150		
64	Lesser Black-backed Gull	*Larus fuscus*	Laridae	15	30	38		20	8	87	60		
65	Caspian Gull	*Larus cachinnans*	Laridae	26	?	?							
66	Kentish Plover	*Charadrius alexandrinus*	Charadriidae	P	10	30	P	P	P	50			
67	Lesser Flamingo	*Phoeniconaias minor*	Phoenicopteridae	20			30	500			35	65	10
68	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	P			P		P		P		P
69	Ruff	*Calidris pugnax*	Scolopacidae	P			50						90
70	Pied Kingfisher	*Ceryle rudis*	Alcedinidae	P			P						2
71	Little Stint	*Calidris minuta*	Scolopacidae	P		420	70	530	100	300			
72	Crested Lark	*Galerida cristata*	Alaudidae	P			P						P
73	Indian Cormorant	*Phalacrocorax fuscicollis*	Phalacrocoracidae	P			35						
74	Common Crane	*Grus grus*	Gruidae	300			90		75				800
75	Dalmatian Pelican	*Pelecanus crispus*	Pelecanidae	22			10				5		

Sl.No	Common Name	Scientific Name	Family	1	2	3	4	5	6	7	8	9	10
76	Osprey	*Pandion haliaetus*	Pandionidae	P			2				1		
77	Black-necked Grebe	*Podiceps nigricollis*	Podicipedidae				2?						
78	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	P			15						
79	Rosy starling	*Pastor roseus*	Sturnidae	P			1000						
80	Black-necked Stork	*Ephippiorhynchus asiaticus*	Ciconiidae	4			5						
81	Broad-billed Sandpiper	*Calidris falcinellus*	Scolopacidae		P	100		P	P	70			
82	Red-necked Stint	*Calidris ruficollis*	Scolopacidae			?		?	?	?			
83	Ruddy Turnstone	*Arenaria interpres*	Scolopacidae			42		30	14	42	22		
84	Saunders's tern	*Sternula saundersi*	Laridae			?				20 ?	?		
85	Terns & Gulls			75						130	230	300	
86	Greater Sand Plover	*Charadrius leschenaultii*	Charadriidae			60			P	50			
87	Siberian Stonechat	*Saxicola maurus*	Muscicapidae										3
88	Grey Francolin	*Francolinus pondicerianus*	Phasianidae	P									P
89	Western Marsh Harrier	*Circus aeruginosus*	Accipitridae	P			P		P			P	P
90	Flamingos			1200									
91	Peregrine Falcon	*Falco peregrinus*	Falconidae									P	
	Total			9558	2690	3509	5424	6040	698	3888	2218	5882	3469

*1. Jodiya, 2. Pirotan, 3. Sachana-Balachadi, 4. Khijadiya, 5. Narara & Vadinar Saltpans,
6. Beyt Dwarka, 7. Bhiader Island, 7. Arambhada, 8.Mithapur Saltpans,
9. Charakla Saltpans complex & 10. Gaga

Appendix 5: Birds recorded at the Great Rann of Kachchh during February 2021

Sl.No	Common Name	Species Name	Sites - Rann of Kachchh			
			Nakhatrana	Dholavira	Kalo Dungar	Banni
1	Ashy-crowned Sparrow-Lark	*Eremopterix griseus*	2		2	
2	Asian Desert Warbler	*Curruca nana*				2
3	Barn Swallow	*Hirundo rustica*				1
4	Barred Buttonquail	*Turnix suscitator*			2	
5	Baya Weaver	*Ploceus philippinus*		7		8
6	Bay-backed Shrike	*Lanius vittatus*	1	2		1
7	Besra	*Accipiter virgatus*		1		
8	Black Drongo	*Dicrurus macrocerus*		5		3
9	Black Redstart	*Poenicurus ochruruos*				1
10	Black-winged Kite	*Elanus caeruleus*		2	2	2
11	Bluethroat	*Cyanecula svecica*				1
12	Brown Rock Chat	*Oenanthe fusca*			3	
13	Cattle Egret	*Bubulcus ibis*	1			
14	Chestnut-bellied Sandgrouse	*Pterocles exustus*		11		
15	Citrine Wagtail	*Motacilla citreola*				1
16	Clamorous Reed Warbler	*Acrocephalus stentoreus*				2
17	Common Babbler	*Argya caudata*	1	4		2
18	Common Chiffchaff	*Phylloscopus collybita*		1		1
19	Common Crane	*Grus grus*		1		208
20	Common Tailorbird	*Orthotomus sutorius*	2			2
21	Common Woodshrike	*Tephrodornis pondicerianus*			2	
22	Crested Lark	*Galerida cristata*				8
23	Desert Wheatear	*Oenanthe deserti*		1		5
24	Eurasian Collared-Dove	*Streptopelia decaocto*		5	2	11
25	Eurasian Eagle-Owl	*Bubo bubo*	1			4
26	Eurasian Hoopoe	*Upupa epops*		2		1

Sl.No	Common Name	Species Name	Sites - Rann of Kachchh			
27	Common Kestrel	*Falco tinnusculus*		2		4
28	Western Marsh-Harrier	*Circus aeruginosus*		2		13
29	Graceful Prinia	*Prinia gracilis*				1
30	Grey Francolin	*Francolinus pondicerianus*	10	8	1	11
31	Grey-breasted Prinia	*Prinia hodgsonii*				1
32	Great Grey Shrike	*Lanius excubitor*		1		1
33	Great Grey Shrike (Indian)	*Lanius excubitor lahtora*		1		
34	Greater Coucal	*Centropus sinensis*	1			3
35	Greater Short-toed Lark	*Calandrella brachydactyla*				13
36	Greater Spotted Eagle	*Clanga clanga*				1
37	Green Bee-eater	*Merops orientalis*		1		9
38	Harrier sp.			1		
39	House Crow	*Corvus splendens*		5		13
40	House Sparrow	*Parus domesticus*		10		18
41	Eastern Imperial Eagle	*Aquila heliaca*				1
42	Indian Peafowl	*Pavo cristatus*	3	1		2
43	Indian Robin	*Saxicoloides fuclicatus*	2	3	2	4
44	Indian Roller	*Coracias benghalensis*		1		
45	Indian Silverbill	*Euodice malabarica*	8	1		2
46	Isabelline Shrike	*Lanius isabellinus*		1		5
47	Isabelline Wheatear	*Oenanthe isabellina*				5
48	Laughing Dove	*Spilopelia senegalensis*		7	2	12
49	Lesser Whitethroat	*Slyvia curruca*	2	1		2
50	Long-billed Pipit	*Anthus similis*				2
51	Long-legged Buzzard	*Buteo rufinus*				2
52	Montagu’s Harrier	*Circus pygargus*		1	1	22
53	Painted Sandgrouse	*Pterocles indicus*		2		
54	Pallid Harrier	*Circus macrourus*				2

Sl.No	Common Name	Species Name	Sites - Rann of Kachchh			
55	Phylloscopus sp.			1		
56	Prinia sp.			1		
57	Purple Sunbird	*Cinnyris asiaticus*	2	5		5
58	Red-rumped Swallow	*Cecropis dauria*		1	2	
59	Red-vented Bulbul	*Pycnonotus cafer*	4	6	4	9
60	Red-wattled Lapwing	*Vanellus indicus*	3	3	3	4
61	Rock dove (Feral Pigeon)	*Columba livia*		6	6	8
62	Rosy Starling	*Pastor roseus*		1		3
63	Rufous-tailed Lark	*Ammomanes phoenicura*	2		2	1
64	Saxicola sp.			1		
65	Shikra	*Accipiter badius*	2			
66	Short-toed Snake-Eagle	*Circaetus gallicus*				1
67	Siberian Stonechat	*Saxicola maurus*		1		
68	Small Minivet	*Pericrocotus cinnamomeus*	5			
69	Spotted Owlet	*Athene brama*	2			
70	Steppe Eagle	*Aquila nipalensis*				7
71	Streaked Weaver	*Ploceus manyar*				1
72	Tawny Pipit	*Anthus campestris*	2			2
73	Trumpeter Finch	*Bucanetes githagineus*			2	
74	Variable Wheatear	*Oenanthe picata*		3		8
75	Western Yellow Wagtail	*Motacilla flava*				2
76	White Wagtail	*Motacilla alba*	1		1	1
77	White-browed Wagtail	*Motacilla maderaspatensis*			2	
78	White-eared Bulbul	*Pycnonotus leucotis*	4	8	2	9
79	White-eyed Buzzard	*Butastur teesa*		1		
80	Marshall's Iora	*Aegithina nigrolutea*	2			1
81	Wire-tailed Swallow	*Hirundo smithii*			3	1
82	Yellow-crowned Woodpecker	*Leiopicus mahrattensis*			1	
83	Chestnut-shouldered Bush-Sparrow	*Gymnoris xanthocollis*		1		4

Sl.No	Common Name	Species Name	Sites - Rann of Kachchh			
Total			63	130	47	480

Appendix 6: List of bird species recorded at Khijadiya Bird Sanctuary during Feburary 2021

SI. No.	Common Name	Scientific Name	IUCN Status	Migratory Status	Count
Anatidae					
1	Lesser Whistling-duck	*Dendrocygna javanica*	LC	Resident	81
2	Ruddy Shelduck	*Tadorna ferruginea*	LC	LM	32
3	African Comb Duck	*Sarkidiornis melanotos*	LC	Resident	11
4	Tufted Duck	*Aythya fuligula*	LC	M	5
5	Garganey	*Spatula querquedula*	LC	M	37
6	Northern Shoveler	*Spatula clypeata*	LC	M	19
7	Gadwall	*Mareca strepera*	LC	M	43
8	Eurasian Wigeon	*Mareca penelope*	LC	M	76
9	Indian Spot-billed Duck	*Anas poecilorhyncha*	LC	Resident	21
10	Mallard	*Anas platyrhynchos*	LC	M	15
11	Northern Pintail	*Anas acuta*	LC	M	486
12	Bar-headed Goose	*Anser indicus*	LC	LM	19
13	Greylag Goose	*Anser anser*	LC	M	13
14	Common Teal	*Anas crecca*	LC	M	29

SI. No.	Common Name	Scientific Name	IUCN Status	Migratory Status	Count
Anhingidae					
14	Oriental Darter	*Anhinga melanogaster*	NT	Resident	53
Ardeidae					
16	Black-crowned Night-heron	*Nycticorax nycticorax*	LC	Resident	5
17	Indian Pond-heron	*Ardeola grayii*	LC	Resident	14
18	Purple Heron	*Ardea purpurea*	LC	Resident	8
19	Grey Heron	*Ardea cinerea*	LC	Resident	7
20	Cattle Egret	*Bubulcus ibis*	LC	Resident	46
21	Great White Egret	*Ardea alba*	LC	Resident	19
22	Intermediate Egret	*Ardea intermedia*	LC	Resident	10
23	Little Egret	*Egretta garzetta*	LC	Resident	19
24	Western Reef-egret	*Egretta gularis*	LC	Resident	13
Burhinidae					
25	Eurasian Thick-knee	*Burhinus oedicnemus*	LC	Resident	2
Charadriidae					
26	Red-wattled Lapwing	*Vanellus indicus*	LC	Resident	34
27	Little Ringed Plover	*Charadrius dubius*	LC	Resident	9
Ciconiidae					
28	Painted Stork	*Mycteria leucocephala*	NT	Resident	182
29	Asian Openbill	*Anastomus oscitans*	LC	Resident	13
30	Black-necked Stork	*Ephippiorhynchus asiaticus*	NT	Resident	5
Gruidae					
31	Common crane	Grus grus	LC	M	10
32	Demoiselle Crane	*Anthropoides virgo*	LC	M	353
Jacanidae					
33	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC	Resident	7

SI. No.	Common Name	Scientific Name	IUCN Status	Migratory Status	Count
34	Bronze-winged Jacana	*Metopidius indicus*	LC	Resident	4
Laridae					
35	Caspian Tern	*Hydroprogne caspia*	LC	LM	8
36	Whiskered Tern	*Chlidonias hybrida*	LC	LM	5
37	River Tern	*Sterna aurantia*	NT	LM	8
Motacillidae					
38	Citrine Wagtail	*Motacilla citreola*	LC	LM	2
39	White-browed Wagtail	*Motacilla maderaspatensis*	LC	Resident	1
40	Western Yellow Wagtail	*Motacilla flava*	LC	M	5
41	White Wagtail	*Motacilla alba*	LC	M	2
Pelecanidae					
42	Dalmatian Pelican	*Pelecanus crispus*	VU	M	17
43	Great White Pelican	*Pelecanus onocrotalus*	LC	M	109
Phalacrocoracidae					
44	Little Cormorant	*Microcarbo niger*	LC	Resident	159
45	Great Cormorant	*Phalacrocorax carbo*	LC	LM	13
46	Indian Cormorant	*Phalacrocorax fuscicollis*	LC	Resident	5
Phoenicopteridae					
47	Greater Flamingo	*Phoenicopterus roseus*	LC	M	81
48	Lesser Flamingo	*Phoeniconaias minor*	NT	LM	314
Podicipedidae					
49	Little Grebe	*Tachybaptus ruficollis*	LC	Resident	42
50	Great Crested Grebe	*Podiceps cristatus*	LC	Resident	19
Rallidae					
51	White-breasted Waterhen	*Amaurornis phoenicurus*	LC	Resident	2
52	Purple Swamphen	*Porphyrio porphyrio*	LC	Resident	22
53	Common Moorhen	*Gallinula chloropus*	LC	Resident	5

SI. No.	Common Name	Scientific Name	IUCN Status	Migratory Status	Count
54	Common Coot	*Fulica atra*	LC	Resident	457
Recurvirostridae					
55	Pied Avocet	*Recurvirostra avosetta*	LC	M	5
56	Black-winged Stilt	*Himantopus himantopus*	LC	Resident	42
Scolopacidae					
57	Black-tailed Godwit	*Limosa limosa*	NT	M	63
58	Ruff	*Calidris pugnax*	LC	M	9
59	Common Sandpiper	*Actitis hypoleucos*	LC	M	56
60	Wood Sandpiper	*Tringa glareola*	LC	M	41
61	Common Greenshank	*Tringa nebularia*	LC	M	11
62	Common Redshank	*Tringa totanus*	LC	M	7
63	Little Stint	*Calidris minuta*	LC	M	2
Threskiornithidae					
64	Black-headed Ibis	*Threskiornis melanocephalus*	NT	Resident	23
65	Red-naped Ibis	*Pseudibis papillosa*	LC	Resident	3
66	Glossy Ibis	*Plegadis falcinellus*	LC	Resident	4
67	Eurasian Spoonbill	*Platalea leucorodia*	LC	Resident	84
Accipitridae					
68	Western Marsh-harrier	*Circus aeruginosus*	LC	M	3
69	Black Kite	*Milvus migrans*	LC	Resident	1
Alaudidae					
70	Ashy-crowned Sparrow-lark	*Eremopterix griseus*	LC	Resident	7
71	Oriental Skylark	*Alauda gulgula*	LC	Resident	5
Alcedinidae					
72	Common Kingfisher	*Alcedo atthis*	LC	Resident	2
73	White-breasted Kingfisher	*Halcyon smyrnensis*	LC	Resident	3
74	Pied Kingfisher	Ceryle rudis	LC	Resident	2

SI. No.	Common Name	Scientific Name	IUCN Status	Migratory Status	Count
Caprimulgidae					
75	Indian Nightjar	*Caprimulgus asiaticus*	LC	Resident	1
Cisticolidae					
76	Ashy Prinia	*Prinia socialis*	LC	Resident	2
Columbidae					
77	Rock pigeon	*Columba livia*	LC	Resident	9
78	Eastern Spotted Dove	*Spilopelia chinensis*	LC	Resident	3
79	Laughing Dove	*Spilopelia senegalensis*	LC	Resident	7
Coraciidae					
80	Indian Roller	*Coracias benghalensis*	LC	Resident	4
Cuculidae					
81	Greater Coucal	*Centropus sinensis*	LC	Resident	1
82	Western Koel	*Eudynamys scolopaceus*	LC	Resident	1
Dicruridae					
83	Black Drongo	*Dicrurus macrocercus*	LC	Resident	3
Hirundinidae					
84	Barn Swallow	*Hirundo rustica*	LC	LM	11
Laniidae					
85	Bay-backed Shrike	*Lanius vittatus*	LC	Resident	1
86	Long-tailed Shrike	*Lanius schach*	LC	Resident	2
Leiothrichidae					
87	Jungle Babbler	*Turdoides striata*	LC	Resident	26
Megalaimidae					
88	Coppersmith Barbet	*Psilopogon haemacephalus*	LC	Resident	1
Meropidae					
89	Asian Green Bee-eater	*Merops orientalis*	LC	Resident	19
Muscicapidae					

SI. No.	Common Name	Scientific Name	IUCN Status	Migratory Status	Count
90	Bluethroat	*Cyanecula svecica*	LC	M	2
91	Desert Wheatear	*Oenanthe deserti*	LC	M	1
92	Brown Rockchat	*Oenanthe fusca*	LC	Resident	3
Nectariniidae					
93	Purple Sunbird	*Cinnyris asiaticus*	LC	Resident	3
Passeridae					
94	House Sparrow	*Passer domesticus*	LC	LM	14
Phasianidae					
95	Grey Francolin	*Francolinus pondicerianus*	LC	Resident	7
Psittaculidae					
96	Rose-ringed Parakeet	*Psittacula krameri*	LC	Resident	13
Pycnonotidae					
97	Red-whiskered Bulbul	*Pycnonotus jocosus*	LC	Resident	2
98	White-eared Bulbul	*Pycnonotus leucotis*	LC	Resident	4
99	Red-vented Bulbul	*Pycnonotus cafer*	LC	Resident	7
Rhipiduridae					
100	White-browed Fantail	*Rhipidura aureola*	LC	Resident	1
Sturnidae					
101	Rosy Starling	*Pastor roseus*	LC	M	208
102	Brahminy Starling	*Sturnia pagodarum*	LC	Resident	34
103	Common Myna	*Acridotheres tristis*	LC	Resident	19
Upupidae					
104	Common Hoopoe	*Upupa epops*	LC	LM	3

Appendix 7: Birds recorded at Chilika Lake in Odisha in January 2021

Sl. No.	Common Name	*Scientific Name*	Family	Total
1	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	4054
2	Spot-billed Pelican	*Pelecanus philippensis*	Pelecanidae	4
3	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	246
4	Indian Cormorant	*Phalacrocorax fuscicollis*	Phalacrocoracidae	40
5	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	39350
6	Oriental Darter	*Anhinga melanogaster*	Phalacrocoracidae	31
7	Eurasian Bittern	*Botaurus stellaris*	Ardeidae	10
8	Yellow Bittern	*Ixobrychus sinensis*	Ardeidae	120
9	Black Bittern	*Ixobrychus flavicollis*	Ardeidae	16
10	Malayan Night Heron	*Gorsachius melanolophus*	Ardeidae	48
11	Black-crowned Night Heron	*Nycticorax nycticorax*	Ardeidae	3506
12	Indian Pond Heron	*Ardeola grayii*	Ardeidae	12352
13	Cattle Egret	*Bubulcus ibis*	Ardeidae	11281
14	Green-backed Heron	*Butorides striata*	Ardeidae	1
15	Western Reef Egret	*Egretta gularis*	Ardeidae	1
16	Little Egret	*Egretta garzetta*	Ardeidae	15972
17	Intermediate Egret	*Ardea intermedia*	Ardeidae	11159
18	Great Egret	*Ardea alba*	Ardeidae	4874
19	Purple Heron	*Ardea purpurea*	Ardeidae	1313
20	Grey Heron	*Ardea cinerea*	Ardeidae	1130
21	Painted Storks	*Mycteria leucocephala*	Ciconiidae	236
22	Asian Openbill	*Anastomus oscitans*	Ciconiidae	29025
23	Black headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	2408
24	Red-naped Ibis	*Pseudibis papillosa*	Threskiornithidae	46
25	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	25784
26	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	26
27	Greater Flamingo	*Phoenicopterus roseus*	Phoenicopteridae	71
28	Fulvous Whistling Duck	*Dendrocygna bicolor*	Anatidae	172
29	Lesser Whistling Duck	*Dendrocygna javanica*	Anatidae	5733
30	Greylag Goose	*Anser anser*	Anatidae	915
31	Bar- headed Goose	*Anser indicus*	Anatidae	1216
32	Ruddy Shelduck	*Tadorna ferruginea*	Anatidae	17732
33	African Comb Duck	*Sarkidiornis melanotos*	Anatidae	50
34	Cotton Pygmy-goose	*Nettapus coromandelianus*	Anatidae	4421
35	Eurasian Wigeon	*Mareca penelope*	Anatidae	210403
36	Falcated Duck	*Mareca falcata*	Anatidae	1
37	Gadwall	*Mareca strepera*	Anatidae	222009
38	Green-winged Teal	*Anas carolinensis*	Anatidae	4452

Sl. No.	Common Name	*Scientific Name*	Family	Total
39	Mallard	*Anas platyrhynchos*	Anatidae	1
40	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	187
41	Northern Pintail	*Anas acuta*	Anatidae	166116
42	Gargeney	*Spatula querquedula*	Anatidae	23861
43	Northern Shovler	*Spatula clypeata*	Anatidae	45252
44	Red-crested Pochard	*Netta rufina*	Anatidae	29838
45	Common Pochard	*Aythya farina*	Anatidae	3491
46	Ferruginous Duck	*Aythya nyroca*	Anatidae	18
47	Tufted Duck	*Aythya fuligula*	Anatidae	33670
48	Water Rail	*Rallus aquaticus*	Rallidae	5
49	Slaty-breasted Rail	*Lewinia striata*	Rallidae	2
50	Baillon's Crake	*Zapornia pusilla*	Rallidae	31
51	Ruddy-breasted Crake	*Zapornia fusca*	Rallidae	177
52	Brown Crake	*Zapornia akool*	Rallidae	2
53	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	685
54	Watercock	*Gallicrex cinerea*	Rallidae	8
55	Common Moorhen	*Gallinula chloropus*	Rallidae	7861
56	Purple Swamhen	*Porphyrio porphyrio*	Rallidae	36757
57	Eurasian Coot	*Fulica atra*	Rallidae	92372
58	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Jacanidae	4367
59	Bronze-winged Jacana	*Metopidius indicus*	Jacanidae	5308
60	Greater Painted Snipe	*Rostratula benghalensis*	Scolopacidae	110
61	Eurasian Oystercatcher	*Haematopus ostralegus*	Haematopodidae	1
62	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	12960
63	Pied Avocet	*Recurvirostra avosetta*	Recurvirostridae	174
64	Great thick-knee	*Esacus recurvirostris*	Charadriidae	2
65	Oriental Pratincole	*Glareola maldivarum*	Glareolidae	525
66	Small Pratincole	*Glareola lactea*	Glareolidae	1829
67	Northern Lapwing	*Vanellus vanellus*	Charadriidae	2
68	Yellow-wattled Lapwing	*Vanellus malabaricus*	Charadriidae	1218
69	Grey-headed Lapwing	*Vanellus cinereus*	Charadriidae	577
70	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	1147
71	Pacific Golden Plover	*Pluvialis fulva*	Charadriidae	4022
72	Grey Plover	*Pluvialis squatarola*	Charadriidae	351
73	Kentish Plover	*Charadrius alexandrinus*	Charadriidae	253
74	Balck-tailed Godwit	*Limosa limosa*	Charadriidae	5466
75	Bar-tailed Godwit	*Limosa lapponica*	Scolopacidae	53962
76	Eurasian Whimbrel	*Numenius phaeopus*	Scolopacidae	2
77	Eurasian Curlew	*Numenius arquata*	Scolopacidae	65
78	Spotted Redshank	*Tringa erythropus*	Scolopacidae	146
79	Common Redshank	*Tringa totanus*	Scolopacidae	64

Sl. No.	Common Name	*Scientific Name*	Family	Total
80	Marsh Sandpiper	*Tringa stagnatilis*	Scolopacidae	1670
81	Common Greenshank	*Tringa nebularia*	Scolopacidae	2625
82	Green Sandpiper	*Tringa ochropus*	Scolopacidae	479
83	Wood Sandpiper	*Tringa glareola*	Scolopacidae	11
84	Terek Sandpiper	*Xenus cinereus*	Scolopacidae	2159
85	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	12
86	Ruddy Turnstone	*Arenaria interpres*	Scolopacidae	71
87	Pintail Snipe	*Gallinago stenura*	Scolopacidae	21
88	Common Snipe	*Gallinago gallinago*	Scolopacidae	28
89	Jack Snipe	*Lymnocryptes minimus*	Scolopacidae	348
90	Asian Dowltcher	*Limnodromus semipalmatus*	Scolopacidae	21
91	Great Knot	*Calidris tenuirostris*	Scolopacidae	2
92	Sanderling	*Calidris alba*	Scolopacidae	1
93	Little Stint	*Calidris minuta*	Scolopacidae	18
94	Temminck's Stint	*Calidris temminckii*	Scolopacidae	2127
95	Dunlin	*Calidris alpine*	Scolopacidae	255
96	Curlew Sandpiper	*Calidris ferruginea*	Scolopacidae	20
97	Ruff	*Calidris pugnax*	Scolopacidae	230
98	Heuglins Gull	This taxon is not recognised as a species by BirdLife International	Laridae	1593
99	Great Black-backed Gull	*Larus marinus*		5
100	Brown-headed Gull	*Larus brunnicephalus*	Laridae	1001
101	Black-headed Gull	*Larus ridibundus*	Laridae	3814
102	Whiskered Tern	*Chlidonias hybrida*	Laridae	284
103	Common Gull-billed Tern	*Gelochelidon nilotica*	Laridae	23139
104	Caspian Tern	*Hydroprogne caspia*	Laridae	318
105	River Tern	*Sterna aurrentia*	Laridae	238
106	Common Tern	*Sterna hirundo*	Laridae	395
107	Little Tern	*Sternula albifrons*	Laridae	54
108	Lesser Crested Tern	*Thalasseus bengalensis*	Laridae	274
109	Oriental Darter	*Anhinga melanogaster*	Anhingidae	45
Total				1204359

Appendix 8: List of species recorded in Parambikulam Tiger Reserve during the survey in March, 2021

S.No	Common Name	*Scientific Name*	Migratory Status	IUCN Status	Total Coun

					t
1	Asian Brown Flycatcher	*Muscicapa dauurica*	LM	LC	2
2	Asian Emerald Dove	*Chalcophaps indica*	R	LC	1
3	Asian Fairy-bluebird	*Irena puella*	R	LC	2
4	Black Drongo	*Dicrurus macrocercus*	R	LC	12
5	Black Eagle	*Ictinaetus malaiensis*	R	LC	1
6	Black-hooded Oriole	*Oriolus xanthornus*	R	LC	4
7	Black-naped Oriole	*Oriolus chinensis*	WV	LC	3
8	Blue-bearded Bee-eater	*Nyctyornis athertoni*	R	LC	1
9	Blue-faced Malkoha	*Phaenicophaeus viridirostris*	R	LC	4
10	Brahminy Kite	*Haliastur indus*	R	LC	1
11	Brahminy Starling	*Sturnia pagodarum*	R	LC	1
12	Brown Shrike	*Lanius cristatus*	WV	LC	1
13	Brown-capped Pygmy Woodpecker	*Dendrocopos nanus*	R	LC	1
14	Chestnut-tailed Starling	*Sturnia malabarica*	R	LC	6
15	Common Goldenback	*Dinopium javanense*	R	LC	1
16	Common Hawk Cuckoo	*Hierococcyx varius*	R	LC	5
17	Common Hoopoe	*Upupa epops*	LM	LC	1
18	Common Iora	*Aegithina tiphia*	R	LC	2
19	Common Myna	*Acridotheres tristis*	R	LC	13
20	Coppersmith Barbet	*Psilopogon haemacephalus*	R	LC	4
21	Crested Serpent Eagle	*Spilornis cheela*	R	LC	1
22	Dark-fronted Babbler	*Rhopocichla atriceps*	R	LC	4
23	Indian Roller	*Coracias garrulous*	R	LC	1
24	Flame-throated Bulbul	*Pycnonotus gularis*	R	LC	2
25	Great Tit	*Parus major*	R	LC	4
26	Greater Coucal	*Centropus sinensis*	R	LC	5
27	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	R	LC	8
28	Green Bee-eater	*Merops orientalis*	R	LC	1
29	Grey Junglefowl	*Gallus sonneratii*	R	LC	6
30	Grey Wagtail	*Motacilla cinerea*	LM	LC	1
31	Grey-fronted Green Pigeon	*Treron affinis*	R	LC	2
32	Indian Blackbird	*Turdus simillimus*	R	LC	3
33	Indian Paradise-flycatcher	*Terpsiphone paradisi*	LM	LC	5
34	Indian Peafowl	*Pavo cristatus*	R	LC	5
35	Indian Pond Heron	*Ardeola grayii*	R	LC	1
36	Jungle Babbler	*Turdoides striata*	R	LC	89
37	Jungle Owlet	*Glaucidium radiatum*	R	LC	3
38	Large-billed Crow	*Corvus macrorhynchos*	R	LC	9
39	Lesser Fish Eagle	*Icthyophaga humilis*	R	NT	1
40	Lesser Goldenback	*Dinopium benghalense*	R	LC	1
41	Little Egret	*Egretta garzetta*	R	LC	1
42	Malabar Grey Hornbill	*Ocyceros griseus*	R	LC	3

43	Malabar Parakeet	*Psittacula columboides*	R	LC	20
44	Malabar Starling	*Sturnia blythii*	R	LC	2
45	Malabar Trogon	*Harpactes fasciatus*	R	LC	1
46	Malabar Whistling Thrush	*Myophonus horsfieldii*	R	LC	7
47	Nilgiri Flycatcher	*Eumyias albicaudatus*	R	LC	1
48	Orange Minivet	*Pericrocotus flammeus*	R	LC	30
49	Orange-headed Thrush	*Geokichla citrina*	LM	LC	5
50	Oriental Honey Buzzard	*Pernis ptilorhynchus*	R	LC	1
51	Oriental Magpie Robin	*Copsychus saularis*	R	LC	3
52	Plum-headed Parakeet	*Psittacula cyanocephala*	R	LC	24
53	Purple Sunbird	*Cinnyris asiaticus*	R	LC	7
54	Red Spurfowl	*Galloperdix spadicea*	R	LC	2
55	Red-vented Bulbul	*Pycnonotus cafer*	R	LC	6
56	Red-wattled Lapwing	*Vanellus indicus*	R	LC	3
57	Red-whiskered Bulbul	*Pycnonotus jocosus*	R	LC	5
58	River Tern	*Sterna aurantia*	R	NT	2
59	Rufous Babbler	*Argya subrufa*	R	LC	3
60	Rufous Treepie	*Dendrocitta vagabunda*	R	LC	6
61	Southern Hill Myna	*Gracula indica*	R	LC	15
62	Spotted Dove	*Streptopelia chinensis*	R	LC	1
63	Stork-billed Kingfisher	*Pelargopsis capensis*	R	LC	5
64	Tickell's Blue Flycatcher	*Cyornis tickelliae*	R	LC	2
65	Velvet-fronted Nuthatch	*Sitta frontalis*	R	LC	4
66	Verditer Flycatcher	*Eumyias thalassinus*	WV	LC	1
67	White-bellied Treepie	*Dendrocitta leucogastra*	R	LC	10
68	White-bellied Woodpecker	*Dryocopus javensis*	R	LC	2
69	White-breasted Waterhen	*Amaurornis phoenicurus*	R	LC	2
70	White-browed Bulbul	*Pycnonotus luteolus*	R	LC	4
71	White-cheeked Barbet	*Psilopogon viridis*	R	LC	23
72	White-throated Kingfisher	*Halcyon smyrnensis*	R	LC	3
73	Yellow-browed Bulbul	*Acritillas indica*	R	LC	6
74	Yellow-legged Green Pigeon	*Treron phoenicopterus*	R	LC	1

R-Resident, LM- Local Migrant, WV-Winter Visitor; LC-Least Concern, NT-Near Threatned