

## INVENTORY OF AQUATIC BIRDS WITH SPECIAL REFERENCE TO URBAN AND DESERT WETLANDS, NORTH-WESTERN GUJARAT, INDIA

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**Abstract:** Wetlands assume great significance as they hold 0.5% of all fresh water that circulates through the global hydrological cycle and sustains all life. Birds are always considered as the best indicators of wetlands. Bird counts and inventories are the significant components for monitoring a wetland. The present study was carried out as a part of a wetland monitoring programme during 2011 - 2012 in the scattered wetlands of arid and semi-arid land including the saline deserts of Kachchh, the north-western part of Gujarat, India. All of the 34 wetlands of the region have been surveyed, out of which 18 (53%) were urban wetlands and 16 (47%) were desert wetlands. Birds were observed by the direct visual count method. Data was classified according to family and residential status. A total of 92 species of aquatic and wetland obligatory birds were observed belonging to 21 families and 59 genera. The study shows that the desert wetlands revealed the higher congregation of 81 bird species due to the low biotic pressure and more availability of food to wintering waterfowl. Monitoring of migratory birds through regular bird counts and regulation of human activities in such wetlands were suggested for conservation of wetland obligatory birds and the management of wetland habitats in the region.

**Keywords:** arid zone, migratory birds, monitoring, urban wetland

### Introduction:

All the aquatic birds of wild species, which are ecologically dependent on water are called wetland birds or waterfowl (Campbell and Lack 1985). According to this categorization, 273 species fall under the category waterfowls in India (Ali and Ripley 1983). Wetland birds are a good biological indicator of the human environment reflecting the health of the natural ecosystem and giving early warning of harmful

changes. Migratory birds and their assemblage with other components of wetland may also provide several ideas for better wetland monitoring and management.

Wetlands assume great significance as they hold 0.5% of all fresh water that circulates through the global hydrological cycle and sustains all life. Wetlands perform key ecosystem functions that maintain the ecological integrity of wetland ecosystems. They provide a wildlife habitat, recharge ground water and deep aquifers, recycle nutrients, ameliorate downstream flooding, protect water quality and produce biomass (Ullah and Faulkner 2006). Wetlands also filter, clean and store water, and act like kidneys for other ecosystems. These wetlands also provide habitat to the large number of local and migratory waterfowls as

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well as animals. These serve as well a number of important environmental functions. Urban wetland is highly degraded; nevertheless, ecologically it may still be providing a residual ecological service like flood storage or water quality improvement at moderate or greater levels (Gamble et al. 2007).

Many studies have been carried out on wetlands especially on wetland birds and their role in sustaining the aquatic ecosystems. The region of Gujarat of western India falls on the migratory route of many migratory birds migrating from Himalayas, Bangladesh etc. Due to the considerable congregation of migratory birds, two wetlands in Gujarat state, the Thole Lake of Mehsana district and Nalsarovar of Surendranagar district have been declared bird sanctuaries. Patel et al. (2007) have undergone a comparative study of avifaunal composition in these two bird sanctuaries and found a significant impact of the migratory bird community on the wetland ecosystem.

Apart from these sanctuaries, other areas of North eastern Gujarat also receive a significant number of migratory waterfowls. The present inventory has been carried out in Patan district of Gujarat. The land configuration of Patan district is semi arid to arid with some very important wetlands in the saline desert area. The important wetlands are visited regularly by migratory waterfowls. Being a semi arid zone, water scarcity has also encouraged people to build village ponds and check dams as a watershed management and conservation process. Such water bodies also provide habitats for a variety of resident and migratory water birds (Gajera et al. 2007).

The basic objective of this study was to identify such important water bodies in the district and prepare baseline data of the bird species with their residential status and feeding preference.

### **Materials and methods:**

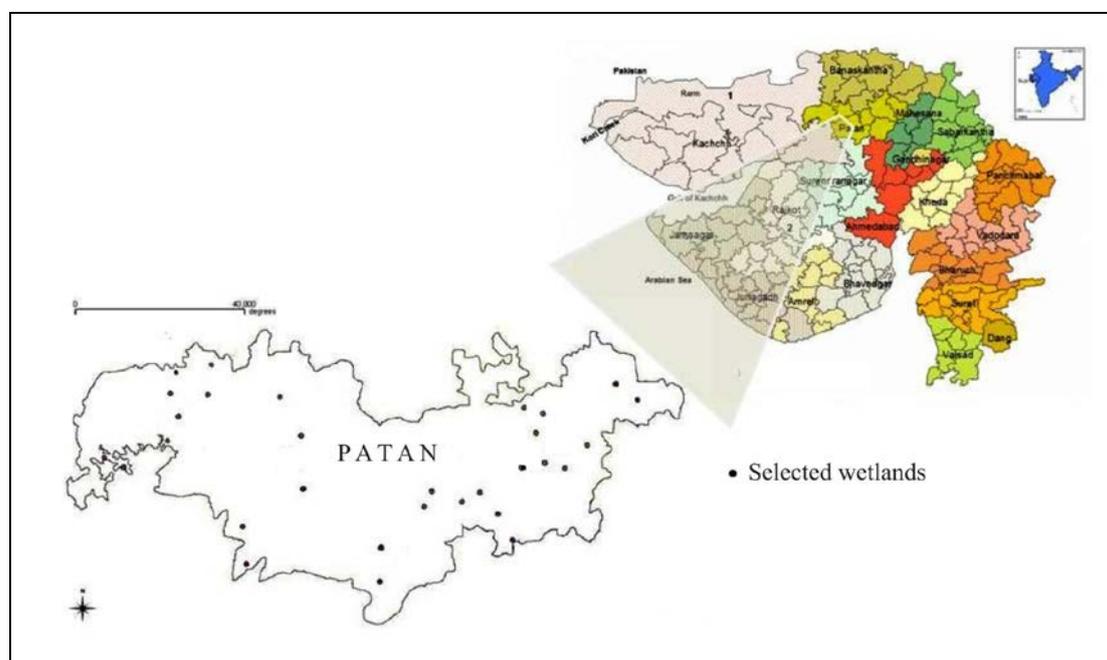
The study has been conducted in Patan district, located in the northern Gujarat between 20° 41' to 23° 55' North latitudes and 71° 31' to 72° 20' East longitude. The district is composed of seven sub districts (taluka), viz. Santalpur, Patan, Chanasma, Harij, Sami, Radhanpur and Sidhpur. We selected a total of 34 wetlands from the entire district for the survey (Fig. 1). The area of Patan district is semi arid to arid with some highly saline lands adjoining the Little Rann of Kachchh. The total geographical area of the district is around 5600 sq. km. The climate is typically a desert type with temperature ranging from 7 °C in winter and up to 45 °C in summer. The average rainfall recorded in the district is around 600 mm. According to the space application center (SAC) of ISRO, the major wetland categories in the district are Mud flats, Rivers/Streams, Reservoirs and Tanks/Ponds. The present study has been carried out in 34 wetlands in the urban and desert areas of Patan district. These wetlands are known to have a high number of migratory and resident waterfowls.

All the 34 wetlands were selected for data collection and visited during the migratory season during 2011-2012. Both desert and urban wetlands were regularly visited and the observations were recorded in the mornings between 6:00hrs to 9:00hrs and in the evenings between 16:00hrs to 18:00hrs. The birds were observed using 10 x 45 binoculars and a spotting scope. The species were counted by direct visual counts (Bhuva and Soni 1998) and identified using the standard reference book (Ali and Ripley 2011) to prepare a check list of the birds so that it serve as a baseline data for further study.

The species were also categorized into resident, migratory and resident-migratory status and their feeding guilds were recorded through standard references (Ali and Ripley 2011; Mukherjee 1995) to know the dependency of avifauna on the wetland and surroundings. Data analyses include the classification of bird species according to their family, migratory status and

conservation status, which is compared for both urban and desert wetlands.

**Figure no. 1** Map showing Patan district and the selected wetlands for survey



**Results and discussion:**

The present study is a preliminary survey of a long-term wetland monitoring programme (Asian Water Bird Census Programme) and it will continue for the next three years. In a preliminary study for the first year, we recorded a total of 92 species of wetland obligatory birds belonging to 21 different families and 59 genera (Tab. 1, Annexes).

Out of 34 wetlands surveyed 18 (52.94%) were categorized as urban wetlands as they are located in an urban area and used exclusively for domestic purposes, and 16 (47.06%) were categorized as desert wetland according to their location in the study area (Tab. 2).

The previous studies in the study area (Patel et al. 2007; Patel et al. 2008; Gajera et al. 2009) and some other records have suggested that Anatidae, Ardeidae, Scolopacidae, Accipitridae, Threskiornithidae and Recurvirostridae

families are represented in the wetlands of arid to semi arid areas of Gujarat.

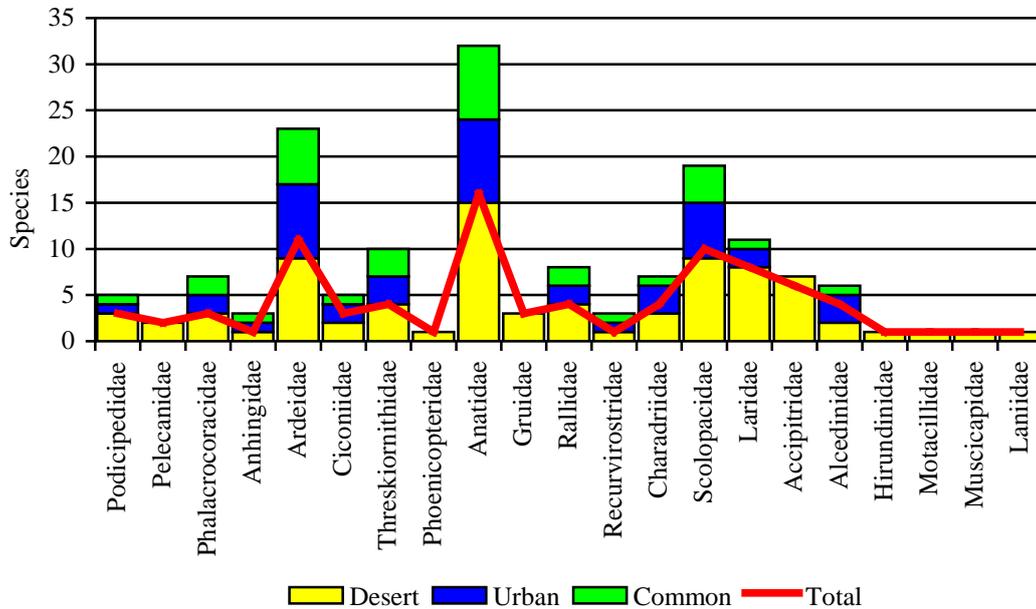
**Table no. 2** Number of wetlands classified according to their location

Total wetlands	Urban wetlands	Desert Wetlands
34	18	16

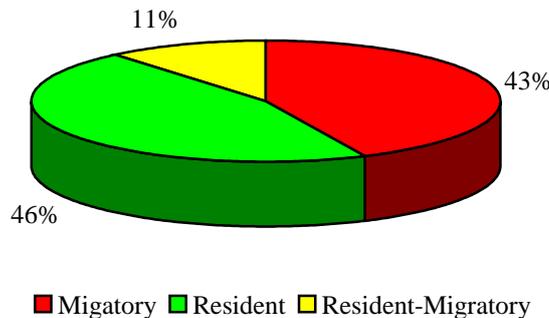
In the present study, the Anatidae family has been reported as having the highest number of species in both urban and desert wetlands, followed by Ardeidae and Scolopacidae; however several other families are represented by either one or two species in the study sites (Fig. 2). Figure 2 also shows that 32 species have been found common to both urban and desert wetlands; whereas 49 species have been recorded exclusively in desert wetlands. The residential status of all recorded waterfowls

reveals that 46% of bird species are resident-migratory (Fig. 3). migratory, 43% are resident and 11% are

**Figure no. 2** Family wise classification of aquatic birds recorded in urban and desert wetlands



**Figure no. 3** Residential status of aquatic birds in the study area



Compared to the urban wetlands the congregation of water birds has been found more in desert wetlands due to less human disturbance as the urban wetlands in the study area are mainly used by villagers for various domestic purposes like bathing, washing of clothes, cattle bathing, fishing etc (Fig. 4). Some urban wetlands are also used for farming of water caltrop (*Trapa natans*) (locally called Shingada) and this might be

causing disturbance to the birds. The higher congregation of migratory water birds in desert wetlands (46%) reflects the importance of these wetlands for migratory waterfowls.

The wetlands in saline desert have displayed high productivity that provides ample food resources for macrofauna as well as the aquatic birds. Desert wetlands in the

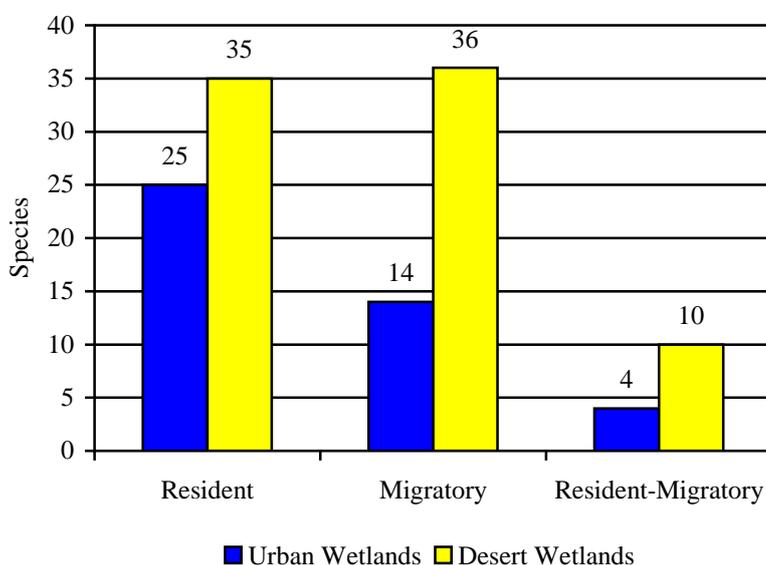
area support high number of prey and omnivorous bird species (Tab. 3).

Salinity in the water of desert wetlands increases in the post monsoon season resulting in higher primary productivity and macroinvertebrates in the wetlands attracting more numbers of birds (Gajera et al. 2012). High primary productivity and salinity enable the growth of aquatic plants, phytoplanktons and aquatic macrofauna (Rajesh et al. 2002).

**Table no. 3** Feeding guilds of aquatic birds in urban and desert wetlands

		Species	
		Urban Wetlands	Desert Wetlands
Feeding preference	Carnivores	27	51
	Herbivores	3	2
	Omnivores	13	28

**Figure no. 4** Comparative analysis of aquatic birds observed in urban and desert wetlands



**Conclusions:**

Wetlands in the arid areas of Gujarat support a considerable number of resident and migratory water bird species. The desert wetlands show the high species richness compared with that of the urban water bodies due to more availability of food resources, less disturbance and high primary productivity. We highlight 10% of all the recorded bird species as threatened or nearly threatened as per the IUCN red list (ver. 3.1). 40% of the total are migratory and vulnerable species recorded from the desert wetlands during the study period. Hence, it is

also suggested that such wetlands need further attention with special emphasis on monitoring the migratory birds and lake productivity for better conservation and management practice.

**Rezumat:**

INVENTARUL PĂȘĂRILOR ACVATICE  
 CU REFERIRE LA ZONELE UMEDE  
 URBANE ȘI ARIDE DIN  
 NORD-VESTUL GUJARATULUI,  
 INDIA

Mlaștinile au o mare semnificație deoarece ele dețin 0.5% din totalul de apă dulce care circulă prin ciclul hidrologic global și susține întreaga viață. Păsările sunt întotdeauna considerate drept cei mai buni indicatori ai zonelor umede. Recensământul și inventarierea păsărilor sunt componente importante în monitorizarea unei zone umede. Prezentul studiu reprezintă o parte dintr-un program de monitorizare a zonelor umede, realizat între anii 2011-2012 în ecosistemele acvatice dispersate în ținuturile aride și semi-aride, incluzând și deșerturile saline de la Kachchh, din partea de nord-vest a Gujaratului, India. Toate cele 34 de ecosisteme acvatice ale regiunii au fost monitorizate, dintre care 18 (53%) sunt reprezentate de zone umede urbane și 16 (47%) zone umede deșertice. Păsările au fost observate prin metoda de numărare vizuală directă. Datele au fost clasificate potrivit cu apartenența la o familie taxonomică și cu statutul rezidențial. Au fost semnalate un total de 92 de specii de păsări acvatice și specifice zonelor umede, aparținând la 21 de familii și 59 de genuri. Studiul indică faptul că ecosistemele acvatice deșertice prezintă o concentrație de 81 specii de păsări ca urmare a unei presiuni biotice scăzute și a disponibilității unei mai mari resurse de hrană pentru păsările de apă pe timpul iernii. Monitorizarea păsărilor migratoare prin recensăminte regulate și reglementarea activităților antropice în astfel de zone umede, au fost sugerate pentru conservarea ecosistemelor acvatice în care păsările sunt prezente, precum și a managementului habitatelor acvatice din zonă.

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#### References:

- ALI S., RIPLEY S.D. (1983), *Handbook of the Birds of India and Pakistan* (Compact Edition), University Press, Bombay, India.
- ALI S., RIPLEY D. (2011), *Birds of the Indian subcontinent*, Oxford University Press, Bombay.
- BHUYA V.J., SONI V.C. (1998), Wintering population of four migratory species of waders in the Gulf of Kachchh and human pressures, *Wader Study Group Bull.*, 86: 48-51.
- CAMPBELL B., LACK E. eds. (1985), *A dictionary of birds*, Calton (Staffordshire, U.K): T. and A.D. Poyser.
- GAJERA N., DAVE S.M., DHARAIYA N.A. (2009), Nesting patterns of some terrestrial birds in Danta Forest Range, northern Gujarat, India, *Journal of Threatened Taxa*, 1(3): 170-173.
- GAJERA N., DHARAIYA N., SONI V.C. (2007), Avifaunal community in the village ponds adjoining the wild ass sanctuary, *Gujarat. Adv. bio. Sci.* Vol. 6 (1&2) (95-97).
- GAJERA N., PATEL D., DHARAIYA N. (2012), Assessment of wetland status in arid areas of Gujarat using migratory birds as a key indicator, In Proceedings of International Wetland Symposium 2012, Pokhra, Nepal, 36-41.
- GAMBLE D., GRODY E., UNDERCOFFER J., MACK J.J., MICACCHION M. (2007), An ecological and functional assessment of urban wetlands in central Ohio, Volume 2 of Technical Report, Ohio Environmental Protection Agency, Wetland Ecology Group, Division of Surface Water, Columbus, Ohio.
- MUKHERJEE A.K. (1995), *Birds of arid and semi-arid tracts*, Zoological Survey of India, Calcutta.
- PATEL S., SHINGALA P., DAVE S.M., DHARAIYA N. (2007), A comparative study of avifaunal composition in two bird sanctuaries of Gujarat, In Proceeding of XXI Gujarat Science Congress 2007, Patan (Gujarat).
- PATEL D., PATEL P., DHARAIYA N. (2008), *Impact of migratory birds on the wetland ecosystem with special reference to the nutrient load and primary productivity of an*

- urban wetland: a preliminary study: Conservation and Restoration of Lakes*, p. 563-571.
- RAJESH K.M., GOWDA G., MENDON M.R. (2002), Primary productivity of the brakishwater impoundments along Nethravathi estuary, Mangalore in relation to some physico-chemical parameters, *Fishery Technology*, 39(2): 85-87.
- ULLAH S., FAULKNER S.P. (2006), Functional assessment of urban forested wetlands, *Proc. Pakistan Acad. Sci.*, 43(1): 15-28.

## Annexes:

**Table no. 1** Checklist of the birds recorded during the study period in the study area

No.	Common name	Scientific name
1	Little Grebe	<i>Tachybaptus ruficollis</i>
2	Great Crested Grebe	<i>Podiceps cristatus</i>
3	Black-necked Grebe	<i>Podiceps nigricollis</i>
4	Great White Pelican	<i>Pelecanus onocrotalus</i>
5	Dalmatian Pelican	<i>Pelecanus crispus*</i>
6	Great Cormorant	<i>Phalacrocorax carbo</i>
7	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>
8	Little Cormorant	<i>Microcarbo niger</i>
9	Oriental Darter	<i>Anhinga melanogaster**</i>
10	Black-crowned Night-heron	<i>Nycticorax nycticorax</i>
11	Indian Pond-heron	<i>Ardeola grayii</i>
12	Purple Heron	<i>Ardea purpurea</i>
13	Grey Heron	<i>Ardea cinerea</i>
14	Cattle Egret	<i>Bubulcus ibis</i>
15	Little Egret	<i>Egretta garzetta</i>
16	Intermediate Egret	<i>Ardea intermedia</i>
17	Great White Egret	<i>Ardea alba</i>
18	Yellow Bittern	<i>Ixobrychus sinensis</i>
19	Black Bittern	<i>Ixobrychus flavicollis</i>
20	Painted Stork	<i>Mycteria leucocephala**</i>
21	Asian Openbill	<i>Anastomus oscitans</i>
22	Black-necked Stork	<i>Ephippiorhynchus asiaticus**</i>
23	Black-headed Ibis	<i>Threskiornis melanocephalus</i>
24	Red-naped Ibis	<i>Pseudibis papillosa</i>
25	Glossy Ibis	<i>Plegadis falcinellus</i>
26	Eurasian Spoonbill	<i>Platalea leucorodia</i>
27	American Flamingo	<i>Phoenicopterus ruber</i>
28	Lesser Whistling-duck	<i>Dendrocygna javanica</i>
29	Greylag Goose	<i>Anser anser</i>
30	Ruddy Shelduck	<i>Tadorna ferruginea</i>
31	African Comb Duck	<i>Sarkidiornis melanotos</i>
32	Eurasian Wigeon	<i>Mareca penelope</i>
33	Gadwall	<i>Mareca strepera</i>
34	Common Teal	<i>Anas crecca</i>
35	Mallard	<i>Anas platyrhynchos</i>
36	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>
37	Northern Pintail	<i>Anas acuta</i>
38	Garganey	<i>Spatula querquedula</i>
39	Northern Shoveler	<i>Spatula clypeata</i>
40	Red-Crested Pochard	<i>Netta rufina</i>
41	Common Pochard	<i>Aythya ferina*</i>

42	Ferruginous Duck	<i>Aythya nyroca</i> **
43	Tufted Duck	<i>Aythya fuligula</i>
44	Common Crane	<i>Grus grus</i>
45	Sarus Crane	<i>Grus antigone</i> *
46	Demoiselle Crane	<i>Anthropoides virgo</i>
47	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>
48	Common Moorhen	<i>Gallinula chloropus</i>
49	Purple Swamphen	<i>Porphyrio porphyrio</i>
50	Common Coot	<i>Fulica atra</i>
51	Black-winged Stilt	<i>Himantopus himantopus</i>
52	Yellow-wattled Lapwing	<i>Vanellus malarbaricus</i>
53	White-tailed Lapwing	<i>Vanellus leucurus</i>
54	Red-wattled Lapwing	<i>Vanellus indicus</i>
55	Grey Plover	<i>Pluvialis squatarola</i>
56	Little Ringed Plover	<i>Charadrius dubius</i>
57	Black-tailed Godwit	<i>Limosa limosa</i> **
58	Bar-tailed Godwit	<i>Limosa lapponica</i> **
59	Far Eastern Curlew	<i>Numenius madagascariensis</i> ***
60	Spotted Redshank	<i>Tringa erythropus</i>
61	Common Redshank	<i>Tringa totanus</i>
62	Marsh Sandpiper	<i>Tringa stagnatilis</i>
63	Common Greenshank	<i>Tringa nebularia</i>
64	Common Sandpiper	<i>Actitis hypoleucos</i>
65	Great Knot	<i>Calidris tenuirostris</i> ***
66	Dunlin	<i>Calidris alpina</i>
67	Curlew Sandpiper	<i>Calidris ferruginea</i> **
68	Ruff	<i>Calidris pugnax</i>
69	Pallas's Gull	<i>Larus ichthyaetus</i>
70	Little Gull	<i>Hydrocoloeus minutus</i>
71	Brown-headed Gull	<i>Larus brunnicephalus</i>
72	Black-headed Gull	<i>Larus ridibundus</i>
73	Common Gull-billed Tern	<i>Gelochelidon nilotica</i>
74	Caspian Tern	<i>Hydroprogne caspia</i>
75	River Tern	<i>Sterna aurantia</i> **
76	Little Tern	<i>Sternula albifrons</i>
77	Brahminy Kite	<i>Haliastur indus</i>
78	Pallas's Fish-eagle	<i>Haliaeetus leucoryphus</i> *
79	Pallid Harrier	<i>Circus macrourus</i> **
80	Western Marsh-harrier	<i>Circus aeruginosus</i>
81	Greater Spotted Eagle	<i>Clanga clanga</i> *
82	Stork-billed Kingfisher	<i>Pelargopsis capensis</i>
83	White-breasted Kingfisher	<i>Halcyon smyrnensis</i>
84	Black-capped Kingfisher	<i>Halcyon pileata</i>
85	Pied Kingfisher	<i>Ceryle rudis</i>
86	Wire-tailed Swallows	<i>Hirundo smithii</i>
87	Grey Wagtail	<i>Motacilla cinerea</i>
88	Bluethroat	<i>Luscinia svecica</i>
89	Black-winged Kite	<i>Elanus caeruleus</i>
90	Rufous-tailed Shrike	<i>Lanius isabellinus</i>
91	Black Kite	<i>Milvus migrans</i>
92	Green-backed Heron	<i>Butorides striata</i>

Note: \* Vulnerable; \*\* Near Threatened; \*\*\* Endangered (IUCN Red List Ver. 3.1).