



Research Report on

Mid-winter Waterfowl Census at Important Wetlands of Sindh

January- 2017



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(Cover Photo by Fahad Siddiqi)

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Annual Mid-winter Waterfowl Census at Important Wetlands of Sindh

January 2017

Introduction: -

The mid-winter waterfowl census is a coordinated international scheme for the collection and dissemination of knowledge on water birds and wetland. This activity is conducted globally since 1970's and had previously been coordinated by International Waterfowl Research Bureau (IWRB) and Asian wetlands bureau, results of which are being published since 1987. Presently wetlands International are coordinating these activities (Wetlands International 2007).

The main objectives of these surveys are to monitor waterfowl population annually and also study the trends of their population at various wetlands during migratory season i.e. winter (non-breeding). In addition to monitor the status and condition of wetlands and also create awareness and interest among local communities about water birds especially migratory water birds and wetlands and thereby promote their conservation.

In Pakistan these surveys have been carried out since 1972 and Zoological Survey of Pakistan (ZSP) is actively conducting these surveys. For better management and conservation of waterfowl, it is necessary to monitor their migratory pattern, analyze population trends, status and distribution of waterfowl species, assessing wetland values and identification of important sites for protection of threatened species.

For the last two years, the Zoological Survey of Pakistan has been conducting these surveys along with coordination and team of Sindh Wildlife Department. The current report deals with the estimates of waterfowl population on some major wetlands of Sindh, these includes: -

Karachi Coast, Zero Point Badin including Nurri Lake, Haleji Lake, keenjhar Lake, Hudero Lake, Manchar Lake, Hammal Lake, Lungh Lake, Drigh Lake, Mehrano Reserve, Deh Akro Wetland Complex, Phoosana Lake and Hitbar Lake (Chotiari Reservoir).

SITE DESCRIPTION

Hawks Bay

Hawks bay is situated west of Karachi stretching from Sandspit through Younus Abad Goth, Hawks bay, Buleji and Paradise Point to Cape Montz, the coastal area (west of Karachi) consists of 20 km mainly of sandy beaches with small rocky areas, cliffs and raised mud plateaus. The beaches, Sandspit and Hawks Bay are mostly lined with beach huts built between the road and the top of the sand dunes. Both areas are significant as a nesting place for the green turtles (*Chelona mydas*).

The back waters extend into the area behind Sandspit beginning from Younusabad Goth and reaching the Naval Officers Housing Society at a couple of points. A large area of backwaters supports a dense mangrove vegetation comprising *Avicennia marina*. Much of the mangrove are dwarf and stunted owing to grazing, cutting and high salt concentration in the area. The mudflats are generally barren except for some very stunted bushes of mangroves.



Fig. 1: Flock of Greater Flamingo and Common Shelduck at Hawks Bay

The backwater contains a very rich and complex food web of algae, invertebrates living in the mud, such as worms, shrimps, crabs and juvenile fish. In this particular area, the diversity of species may be curtailed by the extensive pollution which must be swept back by the tide from the sewage and industrial waste being discharged untreated from the Lyari River.

Due to rich food, many species of migratory and resident water birds are found in the area.

Nurri

Nurri is coastal wetland which is located at (68° 41' E, 24° 20' N) 30 km south of Golarchi District Badin in lower Sindh. The lagoon was considered as an important wetland and declared as Ramsar Site. The Nurri wetland is a combination of brackish coastal and inland lagoons and mud flats.

Due to severe drought in lower Sindh and cyclone in 1999, the water regime is completely changed in this lagoon. In addition, the fresh water supply to this lagoon has completely stopped after the modification and deepening of Phulelli/ Guni out fall drain. Thus the fresh water supply to the wetland through these two main sources has almost stopped. Although the wetland is still a refuge and breeding ground of resident water birds and thousands of migratory birds visit the wetland annually.

Phoosana Lake

Phoosana Lake is situated (68° 54' E, 24° 50' N) in District Badin Sindh. The lake is a fresh water lake and spread over an area of 500 hacters. The main source of water is surrounding fields and distributaries, which supply the excessive water to the lake throughout the year. The lake is surrounded by agricultural lands while, the lake has thick vegetation consisting of Typha and Juncus species in and around the lake. This habitat provides an ideal ground for breeding and resting site for residential water bird species. Besides this a number of migratory bird species annually visit the lake.

The climate of the area is dry sub-tropical monsoonal with very hot summers and mild winters. The average annual rainfall is 175mm most of which falls during the summer monsoon. Temperatures range from an average minimum of 1.5°C in January to a maximum of 47°C in summer.

Mehrano

The Mehrano wildlife refuge is situated (68° 40' E, 27° 16' N) near Kot Deji town of District Khairpur Mirs and was established in 1790 during Talpur Mirs era of Sindh. This is basically a captive breeding center of ungulates especially the Black Buck and Hog Dear. Besides this a number of wild animals like, Wild Boar, Asiatic Jackal, Fox, Porcupine and Rabbits are also found abundantly in the breeding center.

There is also a small fresh water lake surrounded by thick vegetation and reeds like, Typha and Saccharin species and large trees of Babul *Acacia senegalensis* and Tamarix. The wetland is almost full of birds especially migratory ducks because the feed for birds also arranged by local staff at breeding center.



Fig. 2: A large flock of ducks at Mehrano wetland)

Lungh Lake

Lungh Lake (68° 21' E, 27° 56' N) is an important wetland and a globally declared Ramsar Site of Pakistan at Sindh, located in district Larkana and was declared Wildlife Sanctuary in 1982.

The lake is spread over an area of 3 kilometers. Continuous efforts by Sindh Wildlife Department for habitat management and its improvement have made the lake an ideal refuge for migratory waterfowl in the wintering months.

Every year the lake receives large variety of migratory waterfowl because of its ideal location on Indus Flyway, it is considered as the best wetland in Northern Sindh.

Habitat of the lake can be divided in three types; open water with Typha and Juncus on edge, swampy area dominated by Tamarix and surrounding rice fields with predominant Juncus species.



Fig. 3: Different species of water birds at Lungh Lake

Drigh Lake

Drigh Lake is situated (67° 53' E, 27° 35' N) in District Qambar Shadadkot of Sindh Province is a small with slightly brackish water lake with extensive marshes on the flood plain of Indus River, formerly an ancient arm of the Indus, but now about 30 km from the River, approximately 7 km long and about 350 feet wide.

The sanctuary was listed as "Wetland of international importance" under the Ramsar Convention in 1976. The lake is fed by monsoon rains, several small streams entering along the western side and water from a small canal in the north. The size of the lake has decreased in recent years due to diversion of flood water for irrigation purposes and now completely overgrown with emergent vegetation, mainly Tamarix and Typha.

The climate of the area is arid subtropical with an average annual rainfall of about 175 mm, mostly during summer monsoon. The summers are hot with maximum temperatures of 53 °C while, the winters are cool with minimum temperature in January -1 °C.

Currently a local influential person claims that the lake is his property and there is no control of Government on the lake.

Manchar Lake

Manchar Lake is one of the largest fresh water lakes of Asian sub-continent located at a distance of about 18 km from Sehwan town of district Jamshoro, Sindh (longitude. 67°-43' E and latitude 26°-23' to 26°-28' N). The lake covers an area of approximately 200 km², in district Jamshoro at one side and district Dadu on the other. During Monsoon season (July-September), water from Indus River and other seasonal streams originating from Kirthar Range i.e. NaiGaj,Nai angai and several other small streams fall in the lake spreading over an area up to 300 km². The surrounding area of the lake is classified as arid subtropical with very hot summers and cold winters (Scoot and Poole, 1989).

Manchar lake is wintering place and / or home for thousands of water birds. Some of them live at this wetland throughout the year, while others visit the lake either in winter or in summer.

Due to high salinity of water and other polluting factors, most of the aquatic plants species i.e. *Scrupus littoralis, Scripus linaneatus., Scripus debitis, Nymphea slallata, Typha elephant, Typha domecilus, phargmites kakra and Nymphea nouchali* are on the verge of extinction in the Lake and resulting in loss of habitat for different birds (Scott and Poole 1989). The Lake now serves only as a transit for waterfowl and other migratory water birds which used it as feeding ground in the past.

Hammal Lake

Spread over an area of 50,000 hectors the unprotected lake situated at (27°26'54"N 67°39'10"E) is a complex of shallow freshwater lakes and marshes on the west bank of the Indus extending for almost 100 km from Kubo Said Khan to the region of Nasirabad Sindh.

Aquatic vegetation of the wetland comprises of Cyperus alternifolius, Hydrilla verticillata, Najas minor, Scripus littoralis, Impomoea aquatic, Juncus articulates, J. marilimus, Polamogelon peclinalus, Typha angusiata and Tamarix dioica.

Arid sub-tropical climate prevails with an average annual rainfall of about 150mm. The summers are hot, with maximum temperatures of 53°C. Winters are cool, with an average minimum temperature of -1°C.

Irrigation, fishing and harvesting of weeds and bushes for local cottage industries, livestock grazing, forestry and agriculture in surrounding areas are major land use activities.



Fig. 4: Flock of ducks at Hammal Lake

Keenjhar Lake

Kheenjhar (24°54'56"N 68°04'15"E) is a large freshwater lake with very extensive reed – beds, particularly in the shallow western and northern parts. The lake is 24 km long by 6 km at its widest and has an irregular shoreline of about 192 km. It was created in the 1930's from two smaller lakes, Keenjhar and Kairi, by the construction of dam at Chilia Bangla and a 12 km long embankment (bund) along the east side. The lake is fed by the KB feeder canal, which enters at the north western corner, and by many small seasonal streams entering on the western and northern shores. The only outlet is through the dam and the Jam branch canal at the southeast corner of the lake. The maximum depth of the lake is 8m.

The lake has dry sub-tropical monsoonal climate with very hot summers and mild winters. The average annual rainfall is 175mm most of which falls during the summer

monsoon. Temperatures range from an average minimum of 1.5°C in January to a maximum of 47°C in summer.

Extensive reed-beds of *Phargmites karka*, *Typha angustata* and *Juncus articulates*, and a rich growth of submerged and floating aquatic vegetation including *Hydrilla verticillata*, *Potamogetonpec tinatus*, *P. perfoliatus*, *Polygonumbardatum*, *Nymphaea lotus*, *Vallisneri aspiralis and Zannichelli apalustris*. *Tamarix dioica* grows along the shoreline. The natural vegetation of the region is tropical thorn forest with species such as *Acacia nilotica*, *A.Senegal*, *Commiphora Salvadoraoleoides and mukul*, *Prosopis cineraria*, *Euphorbia caducifolia*, *Cenchrus ciliaris*, *Dicanthiumannulatum*.

The lake was first protected as Game Sanctuary in 1971 under Section 15/1 of the West Pakistan Wildlife Ordinance of 1959. The site was listed as a Wetland of International Importance under the Ramsar Convention in July 1976, and declared a Wildlife sanctuary in March 1977 under Section 14 of the Sind Wildlife Protection Ordinance.

Major activities on the site include the commercial fishing, domestic water supply for Karachi City, scientific research and public recreation.

Hudero Lake

Hudero Lake (24°49'N 67°52'E) is a brackish water lake, spreading at an area of 1321 hectares. The lake is situated on stony desert at the distance of 10 km north-west of Thatta City. The main source of water at the lake is seepage from Jam Branch which passes adjacent to lake. The lake has few species of water plants which includes, *Phargmites karka, Typha angustata* and *Juncus articulates*.

The area has dry sub-tropical monsoonal climate with very hot summers and mild winters. The average annual rainfall is 175mm most of which falls during the summer monsoon. Temperatures range from an average minimum of 1.5°C in January to a maximum of 47°C in summer like that of Keenjhar and Haleji Lakes. Once the lake was

home to thousands of water birds especially Pelicans and migratory ducks but now only a few water birds are found at the lake.

Haleji Lake

Haleji lake is an artificial and sub-tropical lake situated (60° 47' E, 24° 48' N) in Thatta district about 70 Km from Karachi and 21 km from Thatta city spreading at an area of 1704 hectares. The lake was basically a natural depression and only source of water was rains. During the World War II, additional supply of water was required for British troops stationed at Karachi. The salt water was drained out from Haleji lake and an Embankment was constructed all around. The fresh water was spplied in the lake from the Indus at Kotri barrage by K.B. Feeder via Jam Branch. From that time, Haleji Lake continued to be a main source of drinking water for Thatta District, Noori abad Industrial area and Karachi city.

The lake was declared as wildlife sanctuaries by the Government of Sindh and also defined under Article-2 of Ramsar Convention. This wetland is of international importance because it is staging and wintering site for thousands of waterfowls. Previously the lake was considered as water bird paradise but now it supports only a few species of migratory and resident water birds. The scarcity of fresh water is considered as a major factor of decreasing waterfowls. Once again the lake has become saline and this increasing salinity of water has badly affected fauna and flora of the lake.

MATERIALS AND METHODS

The wetlands were surveyed during the months of January for mid-winter waterfowl census 2017. Each wetland was visited at least two to three times during the survey period and counts were made at different selected points. The birds were directly observed, identified and counted with the help of binoculars (Olympus 8-16 X 40, DPS I)

and spotting scopes (Nikon w/ 15-45 X). The GPS receiver (Magellan SporTrack) was also used to record the coordinates of each wetland. For the identification of water birds, Sonobe and Usui (1993) were referred. We paid great attention to the identification of each species of migratory water bird. Identifying as many species in each flock as possible, and then applying the observed ratios to unidentified members of the flocks to estimate total numbers of each species. The total number of the birds was determined by direct counts by selecting plots at each site of the wetlands and counting the number of species and birds in each plot and then multiplying each plot with total area of the wetland to determine the number of birds present at the total area of wetland. The data collected and then computed to find out the population estimates of migratory water birds at each wetland.

S. No	Scientific Name	Common Name	Hudero Lake	Hawks bay	Lungh Lake	Drigh Lake	Hammal Lake	Manchar Lake	Deh-Akro Lakes	Nurri Lake	Hitbar Lake	Mehrano Lake	Keenjhar Lake	Haleji Lake	Total
1	Tachybaptus	Little Grebe	10	0	36	17	138	84	329	0	184	13	29	24	864
2	Pelecanus. crispus	Dalmatian Pelican	8	7	0	0	0	0	0	176	0	0	0	12	203
3	Pelecanus. onocrotalus	Great White Pelican	62	0	0	0	0	0	0	1233	0	0	0	86	1381
4	Phalacrocoraxcar bo	Large Cormorant	0	0	82	36	617	217	0	0	224	0	0	42	1218
5	Phalacrocorax fuscicollis	Indian Shag	0	0	0	0	57	259	126	0	17	0	0	2	461
6	Phalacrocoraxnig er	Little Cormorant	17	0	215	230	939	631	275	416	1276	16	27	34	4076
7	Phoenicopterusru ber	Greater Flamingo	0	24	0	0	0	0	0	1250	0	0	0	0	1274
8	Phoenicopterus minor	Lesser Flamingo	0	0	0	0	0	0	0	452	23	0	0	0	475
9	Ardeola grayii	Indian Pond Heron	4	0	18	46	370	63	5	0	58	2	8	13	587

Table -1 showing the details of water birds on wetlands of Sindh 2017

10		Black	0	0	0	0	2	0	0	0	3	0	0	0	
	is	Bittern													5
11	Nycticoraxnycticor ax	Black crowned Night Heron	0	0	0	78	0	0	0	0	0	0	0	0	78
12	Plegadisfalcinellu s	Glossy ibis	0	0	0	7	0	0	2	0	0	0	0		9
13	Platalealeucorodi a	White Spoon bill	0	0	0	0	8	14	0	0	0	0	0	0	22
14	Bubulcus ibis	Cattle Egret	0	0	29	12	52	38	65	0	15	0	42	17	270
15	Egrettagarzetta	Little Egret	17	10	93	142	368	384	215	1532	134	0	38	49	2982
16	Egrettaintermedia	Intermediat e Egret	0	0	36	89	72	163	0	141	17	0	0	0	518
17	Egretta sacra	Reef Heron	0	54	0	0	0	0	0	0	0	0	0	0	54
18	Egretta alba	Large Egret	3	4	32	13	26	75	6	750	58	0	0	10	977
19	Ardeapurperia	Purple Heron	0	0	9	0	72	12	0	0	0	0	0	115	208
20	Ardeacineria	Gray Heron	6	0	36	5	280	67	0	54	27	0	10	342	827
21	Anseranser	Grey lag Goose	0	0	0	0	247	0	0	0	0	0	0	0	247
22	Tadornatadorna	Common Shelduck	0	62	0	0	0	0	0	0	0	0	0	0	62
23	Anas penelope	Eurasian Wigeon	25	0	2	0	4610	38	0	722	72	0	0	26	5495
24			0	0	174	0	313	164	0	2231	36	241	0	0	3159
	Anasstreptera	Gadwall													
25	Anascrecca	Common Teal	812	0	4739	0	9430	7384	253	7230	3983	1324	642	2865	38662
26	Anasplatyrhyncho s	Mallard	10	0	254	0	362	29	27	0	126	29	0	32	869
27	Anasacuta	Northern Pintail	315	0	425	0	864	1362	69	2780	1362	562	30	253	8022
28			432	0	413	0	1410	1179	13	8560	4590	4231	0	426	21254
	Anas clypeata	Shovler													
29	Marmaronettaang ustirostris	Marbled Teal	0	0	0	0	112	0	0	0	0	0	0	0	112

30	Nettarufina	Red- crested Pochard	0	0	0	0	6	0	0	15	0	0	0	0	21
31	Aythyaferina	Common Pochard	162	0	12	0	290	278	0	1645	216	0	0	27	2630
32	Aythyanyroca	White-eyed Pochard	0	0	5	0	165	38	0	0	0	0	0	0	208
33	Amaurornisphoeni curus	White- Breasted Water Hen	0	0	0	0	42	16	0	0	24	2	2	7	93
34	Galinulachloropus	Indian Moorhen	0	0	39	24	224	152	12	0	116	12	7	19	605
35	Porphyrioporphyri o	Purple Moorhen	0	0	0	0	12	0	0	0	42	0	0	5	59
36	Fulica atra	Common Coot	2650	0	79	0	14712	3529	0	12600	219	21	162	3652	37624
37	Hydrophasianschi rurgus	Pheasant tailed jacana	0	0	0	12	0	0	0	0	0	0	0	0	12
38	Himantopushiman topus	Black- winged Stilt	131	84	46	39	329	117	74	528	340	0	32	126	1846
39	Recurvirostraavos etta	Pied Avocet	0	0	0	0	134	0	0	0	0	0	106	0	240
40	Charadriusalexan drinus	Kentish Plover	6	0	0		16	34	0	0	0	0	0	0	56
41	Vanellusleucurus	White- Tailed Plover	0	0	0	9	62	118	58	0	6	0	0	0	253
42	Charadriushiaticul a	Ringed Plover	0	130	0	0	0	17	35	45	432	0	0	0	659
43	Charadriusdubius	Little Ringed Plover	0	452	0	0	0	126	0	0	15	0	0	0	593
44	Limosa limosa	Black-tailed Godwit	0	126	0	0	0	0	0	0	211	0	0	0	337
45	LimosaLapponica	Bar-tailed godwit	0	39	0	0	0	0	0	0	0	0	0	0	39
46	Holopterusindicus	Red-wattled Lapwing	15	0	23	0	24	38	28	0	32	0	12	0	172
47	Calidrisminuta	Little Stint	0	560	230	0	186	274	63	1170	174	0	0	0	2657

48	Philomachuspugn ax	Ruff	0	52	0	0	417	1264	0	0	0	0	122	0	1855
49	Calidristemminckii	Temminck's Stint	4	0	0	0	7	5	5	0	5	0	2	0	28
50	Gallinagogallinag o	Common Snipe	0	0	0	4	12	17	6	0	14	0	0	0	53
51	Tringaerythropus	Spotted Redshank	0	0	0	0	0	81	0	0	0	0	0	0	81
52	Tringatotanus	Redshank	0	24	12	0	39	115	136	136	15	0	4	4	485
53	Tringanebularia	- Greenshan k	0	6	0	0	12	16	4	22	8	0	5	3	76
54	Tringaochronus	Green Sandpiper	2	0	5	5	23	18	8	0	10	0	8	2	81
55	Tringaglareola	Wood Sandpiper	0	0	0	0	3	5	0	0	0	0	0	0	8
56	Actitishypoleucos	Common Sandpiper	6	0	6	0	430	63	8	142	29	0	0	0	684
57	Larusarguntatus	Herring Gull	0	0	0	0	29	163	0	0		0	0	0	192
58		Great Black Headed Gull	0	0	0	0	12	0	0	172	0	0	0	0	184
59	Larus ridibundus	Common Black- headed Gull	0	0	0	235	732	1628	0	372	192	0	3	12	3174
60	<u>Chilidoniashybrda</u>	Whiskered Tern	0	0	0	0	0	0	0	128	0	0	0	0	128
61	<u>Hydroprogreecas</u> <u>pia</u>	Caspian Tern	0	120	0	0	0	0	0	23	0	0	0	0	143
62	Sterna aurantia	Indian River Tern	0	0	48	137	190	418	7	142	0	0	0	12	954
63	Sterna hirundo	Common Tern	182	0	29	370	457	39	9	860	111	0	6	286	2349
64	Sterna albifrons	Little Tern	0	0	0	89	68	17	5	491	39	0	0	257	966
		Total	4879	175 4	7127	1599	38982	20749	1843	46018	14455	6453	1297	8760	153916

Results and Discussion

The annual waterfowl census 2017 was undertaken at the wetlands of Sindh along with team of Sindh Wildlife Department from 17th to 29th January 2017.

The current mid-winter waterfowl census was started from Karachi coast and Zero point wetland of Nurri District Badin coast, the lower Sindh. In order to count the migratory birds of coastal areas which were earlier not surveyed in 2016 census, at least 1 to 2 days were spent on each wetland to record the both resident and migratory water birds. During the current waterfowl census (2017), a total of 153916 water birds (both migratory and resident) were counted at the important wetlands of Sindh. This includes 64 species of water birds (both migratory and resident) were observed at the surveyed wetlands of Sindh. The Nurri coastal wetland had the largest population of water birds which estimated about 46018 birds and Hammal Lake had second highest population of 38982 migratory and resident water birds. Anas crecca (Common Teal or Green-winged Teal) was found most abundant duck species with highest numbers at almost all the wetlands i.e.38662, birds, while, Fulica atra (Common Coot) was observed second most abundant water bird at the wetlands of Sindh i.e.37624 birds. The Phoosana lake which is situated in District Badin has favorable habitat of migratory birds with both marshy area and shallow water. Currently 540 birds recorded from this wetland these include, Dalmatian Pelican, Mallard, gadwall and Common teal.

During the current survey some rare and globally threatened migratory water bird species were also recorded at different wetlands. The Lesser Flamingo (*Phoenicopterus minor*), was observed at Nurri Wetland and Hitbar Lake near Chotiari Reservoir. Grey lag Goose which was once common at the wetlands of Sindh once again observed in a large flock up to 250 plus individual birds at Hammal Lake. The Marbled Teal (*Marmaronetta angustirostris*) is a globally threatened duck species was also observed at Hammal Lake and in good numbers i.e. 115 individual birds. The White-eyed Pochard and Red-Crested Pochard were also observed at Hammal Lake.

If we compare present results with previous years, the number of water birds has decreased at few wetlands. During current census a few thousand migratory birds were observed at Lungh Lake as compared to previous year 20,000 plus birds were observed at this lake, because of some disturbance caused by fishing and other anthropogenic activities at the lake.

The other factors may be due to shifting of migratory birds to other wetlands. It has been also observed that duration of winter season (cold span) has decreased and the water birds start early back migration to colder regions (personal observation). This change in migratory pattern may be due to climate change.

Recommendations

- During the migratory season of water birds i.e. September to March, the Provincial Wildlife Departments may depute field staff at major wetlands to protect the migratory birds from illegal hunting and poaching
- Fishing and other anthropogenic activities at the wetlands should be banned during migratory season
- Detailed monitoring of migratory birds is required, so periodic surveys other than mid-winter may also be undertaken. In addition studies on resident and migratory breeding water birds may also be undertaken

- The wetlands like Manchar, Hammal, Haleji and keenjhar have been affected badly by saline, agricultural and Industrial waste water thus require immediate measures from Government for their rehabilitation
- Uncontrolled reed harvesting at wetlands deprives water birds from their habitat, so it may be controlled.

References

Ali .S 2002.The Book of Indian Birds. Oxford University Press, Bombay.

Azam MM, MA. Brohi and W. Ahmed 2008. Studies on the Population Status of Water Birds in Major Wetlands of Upper Punjab. Rec. Zoo. Sur. Pak. 18: 1-11.

JavedH I and Hassan, A.2004.Some observations on the status of and fishes in the Nurri wetland, Badin Sindh. Rec. Zoo. Sur. Pak. 15: 16-21.

Roberts TJ 1992. The Birds of Pakistan. Oxford University Press. Pakistan.

Scoot DA and CM Poole 1989. A Status Overview of Asian Wetlands. AWB, Kuala Lumpur, Malaysia no.53

Sonobe K and Usui S 1993. A Field Guide to the Water Birds of Asia. Wild Birds Society of Japan, Tokyo.