

# Impacts of human disturbance on the avifaunal density and diversity

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As the population accelerates, the avifaunal diversity is greatly getting affected. Khodiyar wetland located in Anand, Gujarat, India was selected as the study area wherein a survey was conducted in 2011 to assess how human disturbance, influence the diversity of wetland bird communities. A total of 71 avifaunal species were recorded in the survey. The human activities causing high disturbances were mud excavation, cutting of trees, encroachment, hunting, etc. The impacts of such activities include effect on the topography and vegetation structure of the wetland which in turn influences the avifaunal communities. Conversely, the presence of agricultural fields in the locale of the wetland had a positive influence on certain avifaunal species as plant remains and grains scattered after harvesting along with the wetland water draws these birds to this region. It may be possible to mitigate the negative impacts of human activities on these birds by maintaining or restoring vegetation structure and composition, and by imposing limits on human disturbance in this habitat.

## INTRODUCTION

Wetland is a generic term for water bodies of various types and includes diverse hydrological entities as marshes, swamps, bogs, and similar areas (1). Wetlands of India, estimated to be 58.2 million hectares, are important store houses of aquatic biodiversity (2). Wetlands constitute sites where numerous avian species concentrate and several globally threatened waterbirds depend on them (3). Waterbirds comprise a large group of species including Anseriformes, Charadriiformes, Ciconiiformes, Gaviiformes, Gruiformes, Pelecaniformes, Podicipediformes and Procellariiformes (4). These species are often referred to as bioindicators, because they quickly respond to small changes in habitat structure and composition as compared to other animals (5). The biodiversity mapping of wetland avifauna has been carried out by many researchers; however limited work has been carried out on the influence of anthropogenic activities on these species. Thus, the study highlights the effect of anthropogenic activities on the water bird population of a sewage fed wetland. The paper also puts forward an insight into the environmental issues to be addressed successfully for safeguarding, preserving and conserving these water bird species.

## MATERIAL AND METHODS:

### Study Area

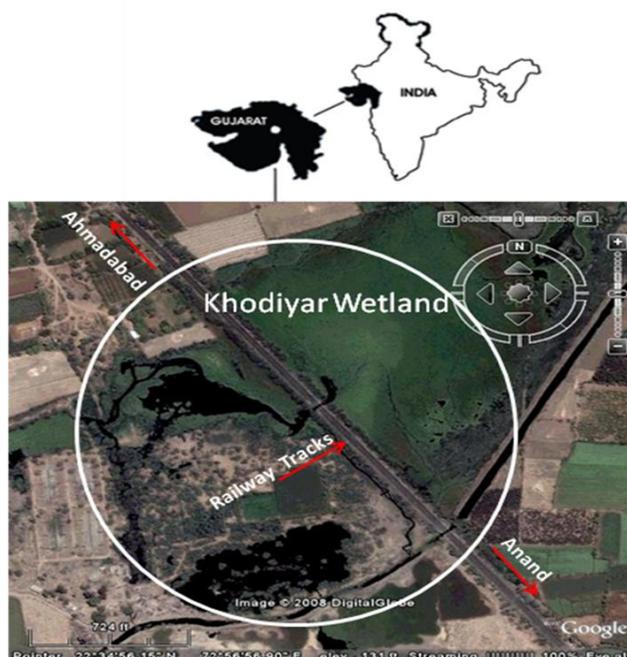


Figure 1 Study Area

Khodiyar wetland is located between 22°34' 56.15'' N latitude and 72° 56' 56.90'' E longitude and situated 5 km away from Anand, Central Gujarat (Fig. 1). The wetland is fully down pour of sewage water received from Municipal sewage lines of Vallabh Vidya nagar and Anand Town, so called 'sewage fed wetland'. The sewage fed wetland gains its importance due to the presence numerous species of waterbirds, especially during cooler months of the year. The acute pressures affecting the waterbirds are a railway line which passes in between the wetland, cattle interferences, irrigation, soil excavation and poaching by local folk. Municipal solid waste is also dumped on the periphery of the wetland. Terrestrial vegetation like *Prosopis juliflora*, *Acacia* spp. and *Zizyphus jojoba* are found on the banks of Khodiyar. The vegetation provides the nesting and hatching grounds to many avian species (Fig 1).

## Waterbird Survey

The sewage fed wetland was visited monthly (Jan 2010 – Dec 2010) to make counts of water birds present. Only settled birds present in and around each site, were counted using binoculars and did not include flying individuals in order to minimize over- or underestimation. Water bird abundance was calculated during the morning feeding between sunrise and 0900 a.m. by point count method (6). Some Passerines and purely terrestrial birds were not taken into consideration. Each bird species seen was identified using standard literature (7, 8).

## RESULTS AND DISCUSSION

### Water bird diversity

The water birds of Khodiyar wetland were studied with an objective to evaluate the influence of anthropogenic

**Table 1: List of water birds observed at Khodiyar wetland**

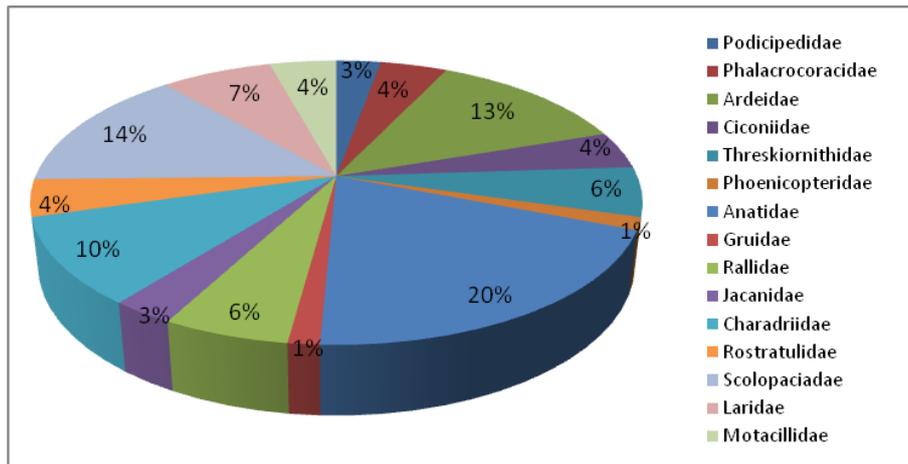
Sr. No.	Group/Common name	Family/Species	AS*	MS
	Grebes	Podicipedidae		
1	Great crested grebe	Podiceps cristatus	R	mi
2	Little grebe	Tachybaptus ruficollis	C	resi
3	Great cormorant	Phalacrocorax carbo	R	resi
4	Indian cormorant	Phalacrocorax fuscicollis	C	resi
5	Little cormorant	Phalacrocorax niger	C	resi
	Hérons, Egrets	Ardeidae		
6	Grey heron	Ardea cinerea	C	resi
7	Purple heron	Ardea purpurea	C	resi
8	Indian pond heron	Ardeola grayii	C	resi
9	Little green heron	Butorides srtiatus	R	resi
10	Black crowned night heron	Nycticorax nycticorax	R	resi
11	Cattle egret	Bubulcus ibis	C	resi
12	Large egret	Casmerodius albus	C	resi
13	Little egret	Egretta garzetta	A	resi
14	Median egret	Mesophoyx intermedia	C	resi
	Storks	Ciconiidae		
15	Asian openbill	Anastomus oscitans	C	resi
16	White necked stork/ Asian Woollyneck	Ciconia episcopus	R	resi
17	Painted stork	Mycteria leucocephala	C	resi
	Ibises, Spoonbill	Threskiornithidae		
18	Black ibis/Red Naped Ibis	Pseudibis papillosa	C	resi
19	Glossy ibis	Pegaldis falcinellus	A	resi
20	Oriental white ibis/ Black headed Ibis	Threskiornis melanocephalus	C	resi
21	Eurasian spoonbill	Platalea leucorodia	C	resi
	Flamingos	Phoenicopteridae		
22	Greater flamingo	Phoenicopterus roseus	A	resi
	Geese, Ducks	Anatidae		
23	Greylag Goose	Anser anser	C	mi
24	Lesser Whistling Duck	Dendrocygna javanica	C	resi
25	Ruddyshell Duck	Tadorna ferruginea	C	mi
26	Nakta or Comb Duck	Sarkidiornis melantos	C	resi
27	Gadwall	Anas strepera	C	mi
28	Eurasian Wigeon	Anas penelope	C	mi
29	Common teal	Anas crecca	C	mi
30	Garganey	Anas querquedula	A	mi

activities on the species composition, abundance and distribution of these species. 71 different species of water birds belonging to 48 genera and 15 families, including 38 year round resident species and 33 migratory species were documented (Table 1).

The most representative families noted during the study were Anatidae with 14 species, Scolopaciadeae (10 species), Ardeidae (9 species), Charadriidae (7 species), Laridae (5 species) and Threskiornithidae, Rallidae (4 species each). Rostratulidae, Phalacrocoracidae, Ciconiidae and Motacillidae each were represented by 3 species and Jacanidae and Podicipedidae were represented by 2 species each during the entire study period. During the entire study period the families Phoenicopteridae, Gruidae were represented by only one species (Figure 2).

31	Northern pintail	<i>Anas acuta</i>	C	mi
32	Northern shoveler	<i>Anas clypeata</i>	A	mi
33	Spot billed duck	<i>Anas poecilorhyncha</i>	C	resi
34	Common pochard	<i>Aythya ferina</i>	C	mi
35	Cotton teal/ Cotton Pygmy Goose	<i>Nettapus coromandelianus</i>	C	resi
36	Tufted Duck	<i>Aythya fuligula</i>	R	mi
	Cranes	Gruidae		
37	Sarus crane	<i>Grus antigone</i>	R	resi
	Rails, Gallinules, Coot	Rallidae		
38	White breasted water hen	<i>Amaurornis phoenicurus</i>	C	resi
39	Indian moorhen/ Common Moorhen	<i>Gallinula chloropus</i>	C	resi
40	Purple swampphen	<i>Porphyrio porphyrio</i>	C	resi
41	Common coot	<i>Fulica atra</i>	A	mi
	Jacanas	Jacanidae		
42	Pheasant tailed jacana	<i>Hydrophasianus chirurgus</i>	C	resi
43	Bronze Winged Jacana	<i>Metopidius indicus</i>	C	resi
	Shorebirds - Waders	Charadriidae		
44	Red wattled lapwing	<i>Vanellus indicus</i>	C	resi
45	White tailed lapwing	<i>Vanellus leucurus</i>	R	mi
46	Yellow wattled lapwing	<i>Vanellus malarbaricus</i>	R	resi
47	Kentish plover	<i>Charadrius alexandrinus</i>	R	mi
48	Little ringed plover	<i>Charadrius dubius</i>	C	mi
49	Black winged stilt	<i>Himantopus himantopus</i>	A	resi
50	Pied Avocet	<i>Recurvirostra avosetta</i>	R	mi
	Shorebirds - Waders	Rostratulidae		
51	Common snipe	<i>Gallinago gallinago</i>	C	mi
52	Greater painted snipe	<i>Rostratula benghalensis</i>	R	resi
53	Pintail snipe	<i>Gallinago stenura</i>	R	mi
	Shorebirds - Waders	Scolopaciadae		
54	Common sandpiper	<i>Actitis hypoleucos</i>	C	mi
55	Wood sandpiper	<i>Tringa glareola</i>	C	mi
56	Marsh sandpiper	<i>Tringa stagnatilis</i>	R	mi
57	Green sandpiper	<i>Tringa ochropus</i>	R	mi
58	Little stint	<i>Calidris minuta</i>	C	mi
59	Spotted redshank	<i>Tringa erythropus</i>	C	mi
60	Common greenshank	<i>Tringa nebularia</i>	R	mi
61	Common redshank	<i>Tringa totanus</i>	R	mi
62	Black tailed godwit	<i>Limosa limosa</i>	A	mi
63	Ruff	<i>Philomachus pugnax</i>	A	mi
	Terns	Laridae		
64	Whiskered Tern	<i>Chlidonias hybridus</i>	R	mi
65	Common Gull-billed Tern	<i>Gelochelidon nilotica</i>	R	mi
66	Black-bellied Tern	<i>Sterna acuticauda</i>	R	resi
67	River Tern	<i>Sterna aurantia</i>	R	resi
68	Little Tern	<i>Sterna albifrons</i>	R	resi
	Wagtails	Motacillidae		
69	White wagtail	<i>Motacilla alba</i>	R	mi
70	Citrine wagtail	<i>Motacilla citreola</i>	R	mi
71	Yellow wagtail	<i>Motacilla flava</i>	R	mi

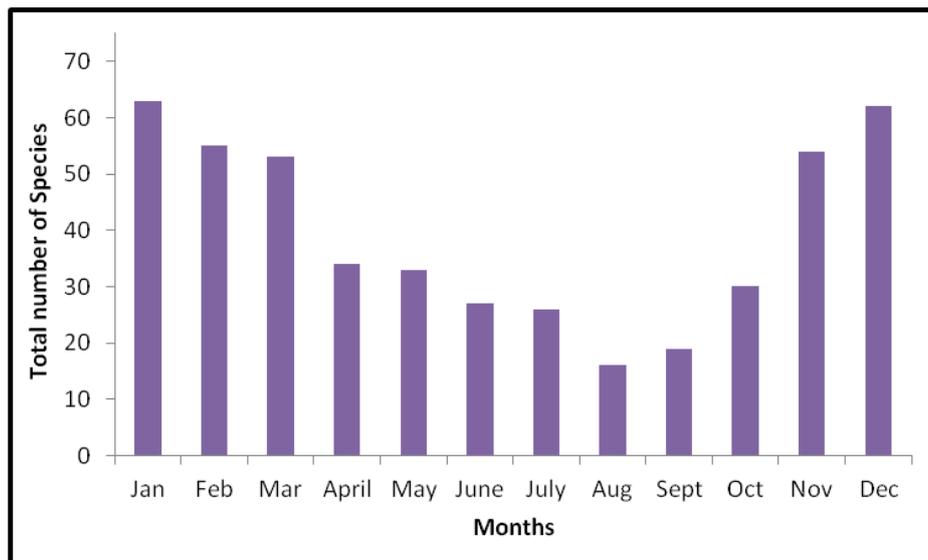
AS\* (based on number of individuals of species) : Abundance Status (A: Abundant; C : Common; R: Rare); MS : Migratory Status(resi: Resident; mi : Migratory)



**Figure 2 Mean (%) composition families of water birds at Khodiyar wetland**

The total number of species exhibited distinct temporal variations. Community composition varied in response to change in season and climatic variations. The greater number of species, abundance and density of aquatic birds were observed during peak winter months, followed by the moderate population in summers, and the least abundance during monsoons (Fig 3). This

corroborates with the findings of certain researchers (9, 10), who have attributed minimum diversity of water birds in monsoons to heavy rain, increased flow of water leads to deep water body, non availability of food and return of migratory birds and maximum diversity to adverse living conditions in upper reaches of northern hemisphere.



**Figure 3 Temporal changes in species composition of water birds at Khodiyar wetland**

The wetland is an important habitat for certain water birds which are listed as endangered, vulnerable or threatened as per IUCN red List (Table 2).

**Table 2 IUCN status of water birds**

Sr. No.	Common name	Species	IUCN status
1	White necked stork/ Asian Woollyneck	<i>Ciconia episcopus</i>	Vulnerable
2	Painted stork	<i>Mycteria leucocephala</i>	Vulnerable
3	Oriental White Ibis/ Black headed Ibis	<i>Threskiornis melanocephalus</i>	Near Threatened
4	Sarus Crane	<i>Grus antigone</i>	Vulnerable
5	Black tailed godwit	<i>Limosa limosa</i>	Near Threatened
6	Black-bellied Tern	<i>Sterna acuticauda</i>	Endangered
7	River Tern	<i>Sterna aurantia</i>	Near Threatened

### Influence of Anthropogenic Activities

Wetland ecosystems have played a significant role in the development of human society. All over the globe, many ornithologically important wetlands are threatened. The water birds are facing major threat due to population explosion, socio-economic activities and man-induced adverse natural phenomena (11).

The detrimental anthropogenic activities include land reclamation, cutting of trees, agricultural intensification, throwing of garbage by passengers of passing trains, mud excavation and hunting.

The habitat loss is exacerbated due to land reclamation activity for agricultural and housing purposes. Certain water birds like cormorants and herons were found moving to large trees in neighbouring woodlands for breeding activity (9). Destruction of trees around this wetland in the recent past has decreased the water bird population for want of suitable perching, roosting and nesting sites.

Depth of any wetland is of vital importance as water bird density and diversity is generally higher at low water depth (12, 13). Mud excavation is deepening the wetland which will have an adverse effect on the water bird population.

The sewage fed wetland is surrounded by agricultural fields. In a earlier study conducted at Jajiwal wetland in Rajasthan (14) it was reported that plant remains and grains scattered after harvesting along with the wetland water allures water birds to that region. The agricultural fields form their feeding grounds and they return to the wetlands to breed (15). The nesting and breeding ground of Sarus crane (*Grus antigone*) had been observed at this wetland could be due to the proximity to agricultural fields. However, the ingestion of pesticides, hunting of the eggs and adults are responsible for the vulnerable status (as per IUCN Red List) of this species.

### CONCLUSION

This sewage fed wetland is a unique habitat endowed with a rich biodiversity of water birds; a stop over site for migratory birds and home to seven species listed as endangered, vulnerable or threatened as per IUCN red List. The study focused on the anthropogenic influences affecting the water birds. There is an urgent need of proper management steps for the conservation of this wetland and its water birds. The influx of nutrients from adjoining agricultural fields should be checked by constructing obstacles like check dams or side bunds. Cutting of emergent and fringed vegetation should be completely prohibited. Creation of profuse green belt around this wetland will facilitate easy means of roosting and perching and create a buffer zone from the pollution due to passing trains. Local community should be dissuaded from throwing plastic wastes or other wastes into the water body. The land reclamation is

leading to decrease in the area of the wetland, and hence should be truncated. Stringent laws should be framed against encroachment of wetland ecosystems. Regular patrolling and vigilance are essential to abridge activities such as hunting and poaching. This area can be designated as an **IBA (Important Bird Area)** by **Gujarat Forest Department** for the conservation of these water birds.

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