



A COMPARATIVE STUDY OF ABUNDANCE AND DIVERSITY OF WATER BIRD ASSEMBLAGES IN AND AROUND JUNAGADH, GUJARAT, INDIA

Vibhakar A. Jani¹ and Dr. Chiragbala M. Gosai²

¹Research Scholar, BKNM University, Junagadh, Gujarat, India.

²Professor (Zoology), Government Science College, Veraval, BKNM University, Junagadh, Gujarat, India.

ABSTRACT-

The present study was designed to look into the abundance and trophic groups of birds inhabiting in and around the ponds of Dhandhusar Village (location I The golden lake) and Junagadh city (location II Narsinh Mehta Talav) of district Junagadh, Gujarat from January to December, 2022. The study results revealed a total bird count of 4108 individuals of 35 bird species belonging to 13 orders at location I and 2284 individuals of 24 bird species belonging to 8 orders at location II. The relative abundance (%) of water dependent birds was 70.44% and 37.30% at location I and II respectively. Detailed analysis showed significant difference between the water dependent birds at both the locations (Student's t-test, $t = 2.66$, $P = 0.05$). The higher tree diversity and absence of weeds in and around the ponds at location I seemed to support higher avian species richness and abundance. Involvement of local community might help to check the anthropogenic activities for pond management and water bird conservation.



KEYWORDS: Abundance, Village ponds, Water birds, Pelecaniformes, Gruiformes, Passeriformes.

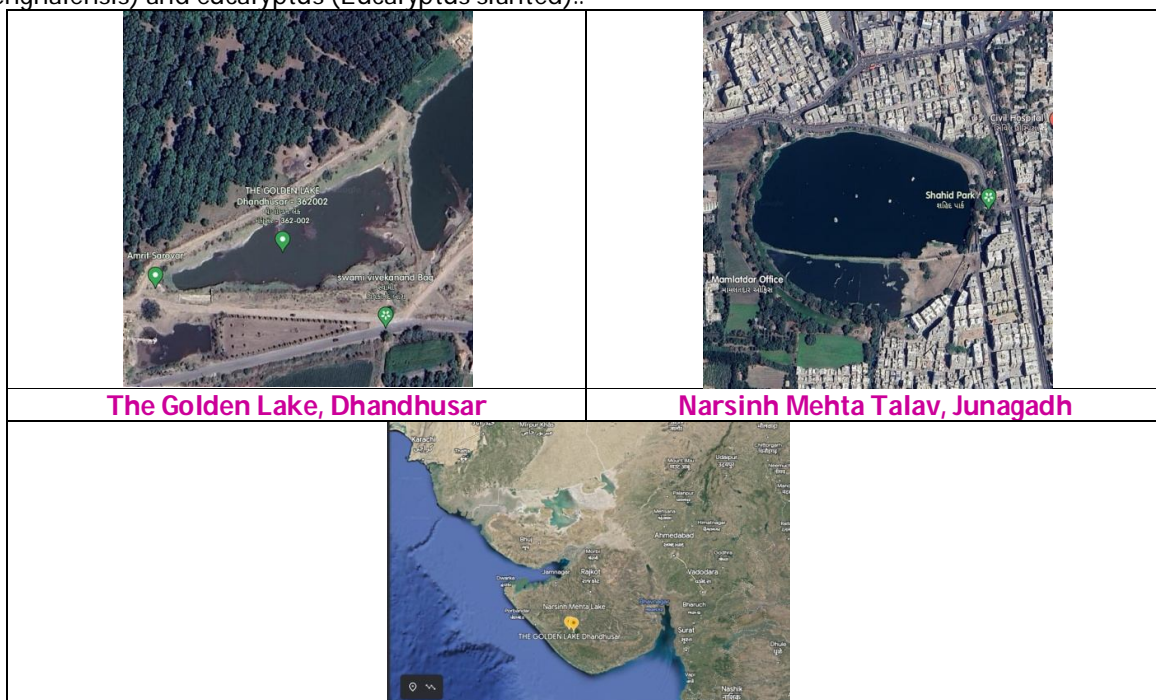
INTRODUCTION

Water birds stand out of open and researchers in view of their excellence, overflow, perceivability and social way of behaving. They address various societies and can be utilized as marks of ecological changes. Out of 1340 bird species found in India, 310 species are known to rely upon various water bodies. Kler recorded 14 types of water birds out of tested 51 species having a place with 25 families in 13 orders. Water bodies like stream, lakes, channels and so on are the principal rummaging regions for these water bird species and are viewed as used broadly for settling and perching. Their high efficiency decides concurrence of a few animal types. Water birds involve a huge gathering of animal groups including Anseriformes, Charadriiformes, Ciconiiformes, Gruiformes, Gaviformes, Pelecaniformes and Procellariiformes. Town lakes structure a fundamental piece of rustic India which is essentially built for reaping precipitation water and washing of homegrown livestock. They have been generally utilized as a monetarily proficient method for holding water for water system. Town lakes are visited by homegrown steers and furthermore get homegrown waste from town families. Water bird gathering on these lakes relies on states of the lake. Lakes support huge number of transitory and inhabitant bird species because of high dietary benefit. The birds secure

significant supplements by benefiting from benthic fauna and microscopic fishes. Expanded release of waste water from families, combined with a low invasion rate has immersed these lakes. Numerous lakes have been lost and remaining face expanding strain because of farming area seepage, contamination and metropolitan turn of events. The current review was intended to investigate the species variety of birds occupying in the lakes of Junagadh city and Dhandhusar town in Gujarat state, India. This would be useful in giving data on the impacts of anthropogenic exercises on the earthbound and water-subordinate birds.

**METHOD:
STUDY AREA:**

The current examination was embraced in the lakes of two locales specifically Brilliant lake, Dhandhusar town (scope 21.540N and longitude 70.360E) as area I and Narsinh Mehta Talav, Junagadh (scope 21.510N and longitude 70.450E) as area II of region Junagadh, Gujarat, India. The perceptions were required in the months from January to December, 2022. The distance between two areas was 12.2 kilometers. Area I contained open-shade lakes liberated from water weeds arranged inside the neighborhood. The encompassing area of lake was larger part covered by congress grass (*Parthenium hysterophorus*), and some blossom plants. There were a few nine types of trees to be specific baval (*Acacia nilotica*), neem (*Azadirachta indica*), peepal (*Ficus religiosa*), eucalyptus (*Eucalyptus slanted*), banyan (*Ficus benghalensis*), palash (*Butea monosperma*), ber (*Zizipus maurtiana*) at area I. The lake at area II, arranged close to human settlement, was to some degree covered by drifting oceanic vegetation and the encompassing region had comparable kind of vegetation as area I. The tree ranch of the area comprises of neem (*Azadirachta indica*), kikar (*Acacia nilotica*), peepal (*Ficus religiosa*), banyan (*Ficus benghalensis*) and eucalyptus (*Eucalyptus slanted*).



The observations were taken once in a week in the morning and evening time. During each visit, bird census was carried out. The point transect method was used to study the bird assemblage in the selected ponds. Identification of birds inhabiting and visiting the study area was done on the basis of visual observations on their morphological characters by using binocular (10 x 47). The movements of the birds was noted as precisely as possible so as to avoid pseudo replication. Bird photography was

also done using Canon powershot SX 70 HS digital camera. Birds were identified on the basis of keys described by Ali. The checklist was prepared using standardized common and scientific names of the birds following. Data collected on occurrences and abundance of bird was subjected to relative abundance as per Shannon-Wieners Index. The bird species were divided into different trophic groups based on their food type: P- feeds on plant material; V/I- feeds on both vertebrates and invertebrates; I- invertebrates; and P/I- on both plants and invertebrates. The trophic groups were represented according to the proportion of number of individuals as well as number of species at both the locations.

STATISTICAL ANALYSIS

Spearman rank correlation analysis was used to compare the number of individuals at both the locations. Mann-Whitney test was used to find significant variation among the number of individuals at both the locations. Student's t-test was carried out to find any significant difference between the numbers of individuals of water dependent birds at both the locations.

RESULTS

A total of 36 species of birds belonging to 24 families distributed in 13 orders were recorded from the study area. There were counted 4108 birds belonging to 35 species at location I. Out of this, 15 species of birds were water dependent and 20 were terrestrial bird species. At location II, a total of 2284 birds were observed belonging to 24 species, out of which 9 species were water dependent and the rest were terrestrial bird species. There were twelve bird species exclusive to location I as compared to only one species exclusive to location II. Six water-dependent bird species were recorded only at location I. The bird species found at both the locations belonged to orders Charadriiformes, Gruiformes, Pelecaniformes, Anseriformes, Coraciiformes, Podicipediformes, Passeriformes, Psittaciformes, Columbiformes, Strigiformes, Cuculiformes, Apodiformes and Piciformes (Table 1). All the thirteen orders were present in the avian fauna of location I but only 8 orders were represented in the avian fauna of location II. Order Apodiformes, Strigiformes, Anseriformes, Podicipediformes and Piciformes were observed only at location I.

Table 1: Bird species composition observed at The golden lake, Dhandhusar village

S. No	Name of the species	Scientific names	Order	Trophic level
1.	Black-winged Stilt	<i>Himantopus himantopus</i>	Charadriiformes	I
2.	Red-wattled Lapwing	<i>Vanellus indicus</i>	Charadriiformes	I
3.	Cattle Egret	<i>Bulbulcus ibis</i>	Pelecaniformes	V/I
4.	Smaller Egret	<i>Egreta garzetta</i>	Pelecaniformes	V/I
5.	Larger Egret	<i>Casmerodius albus</i>	Pelecaniformes	V/I
6.	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	Gruiformes	P/I
7.	White-breasted Kingfisher	<i>Halcyon smyrensis</i>	Coraciiformes	V/I
8.	Indian Pond Heron	<i>Ardeola grayii</i>	Pelecaniformes	V/I
9.	Common Red Shank	<i>Tringa tetanus</i>	Charadriiformes	I
10.	Common Moorhen	<i>Gallinula chloropus</i>	Gruiformes	P/I
11.	Purple Moorhen	<i>Porphyrio porphyrio</i>	Gruiformes	P/I
12.	Spot-billed Duck	<i>Anas poecilorhyncha</i>	Anseriformes	P
13.	Little Grebe	<i>Tachybaptus ruficollis</i>	Podicipediformes	I
14.	Common Coot	<i>Fulica atra</i>	Gruiformes	P/I
15.	Oriental White Ibis	<i>Threskiornis melanocephalus</i>	Pelecaniformes	P/I
16.	Black Ibis	<i>Pseudibis papillosa</i>	Pelecaniformes	P/I
17.	Asian Pied Starling	<i>Sturnus contra</i>	Passeriformes	P/I
18.	Common Myna	<i>Acridotheres tristis</i>	Passeriformes	P/I
19.	Bank Myna	<i>Acridotheres ginginianus</i>	Passeriformes	P/I
20.	House Crow	<i>Corvus splendens</i>	Passeriformes	P/I

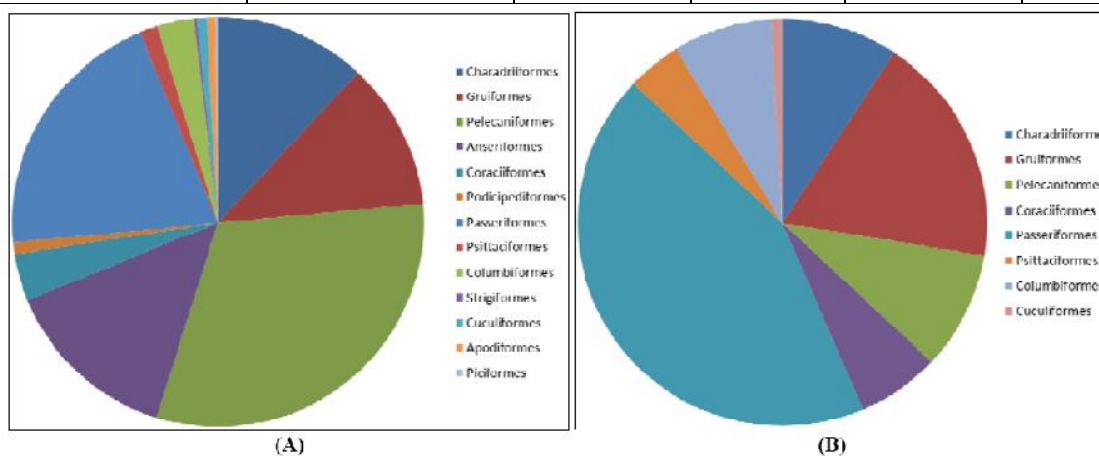
S. No	Name of the species	Scientific names	Order	Trophic level
21.	Rose-ringed Parakeet	<i>Psittacula krameri</i>	Psittaciformes	P
22.	Yellow-legged Green Pigeon	<i>Treron phoenicoptera</i>	Columbiformes	P
23.	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	Columbiformes	P
24.	Blue Rock Pigeon	<i>Columbia livia</i>	Columbiformes	P
25.	Little Green Bee-eater	<i>Merops orientalis</i>	Coraciiformes	I
26.	Red-vented Bulbul	<i>Pycnonotus cafer</i>	Passeriformes	P/I
27.	Spotted Owlet	<i>Athene brama</i>	Strigiformes	V/I
28.	Indian Robin	<i>Saxicoloides fulicata</i>	Passeriformes	I
29.	Purple Sunbird	<i>Nectarinia asiatica</i>	Passeriformes	P/I
30.	Black Drongo	<i>Dicrurus macrocercus</i>	Passeriformes	P/I
31.	Greater Coucal	<i>Centropus sinensis</i>	Cuculiformes	V/I
32.	Indian Chat	<i>Cercomela fusca</i>	Passeriformes	I
33.	House Swallow	<i>Hirundo tahitica</i>	Passeriformes	I
34.	House Swift	<i>Apus affinis</i>	Apodiformes	I
35.	Golden-backed Woodpecker	<i>Dinopium javanense</i>	Piciformes	I
36.	Asian Koel	<i>Endynamys scolopacea</i>	Cuculiformes	P/I

The general wealth of most various species nearby the lakes of area I was Spot-charged Duck (13.97%), Normal Moorhen (13.49%), White-breasted Waterhen (11.51%), Dairy cattle Egret (6.81%) and House Crow were having normal relative abundance of 6.11%. While among the most un-bountiful species were Yellow-legged Green Pigeon (0.19%) and Brilliant supported Woodpecker (0.19%). Purple Moorhen with relative wealth of 8.98%, House Crow (8.84%), Steers Egret (7.31%), Minimal Green Honey bee eater (6.26%) and Normal Myna (5.56%) were the predominant species at area II. More noteworthy Coucal and White-breasted Kingfisher were the most un-plentiful (Table 2).

Table 2: Characteristics of bird species composition observed at Narsinh Mehta Talav, Junagadh and The Golden Lake, Dhandhusar.

S. No	Name of the species	Scientific names	Dhandhusar		Narsinh Mehta Talav	
			No. of individuals	Dominance	No. of individuals	Dominance
1.	Black-winged Stilt	<i>Himantopus himantopus</i>	234	5.70	126	5.52
2.	Red-wattled Lapwing	<i>Vanellus indicus</i>	153	3.72	84	3.68
3.	Cattle Egret	<i>Bulbulcus ibis</i>	280	6.82	167	7.31
4.	Smaller Egret	<i>Egretta garzetta</i>	38	0.93	0	0.00
5.	Larger Egret	<i>Casmerodius albus</i>	31	0.75	0	0.00
6.	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	473	11.51	118	5.17
7.	White-breasted Kingfisher	<i>Halcyon smyrensis</i>	30	0.73	7	0.31
8.	Indian Pond Heron	<i>Ardeola grayii</i>	119	2.90	14	0.61
9.	Common Red Shank	<i>Tringa tetanus</i>	102	2.48	0	0.00
10.	Common Moorhen	<i>Gallinula chloropus</i>	554	13.49	97	4.25
11.	Purple Moorhen	<i>Porphyrio porphyrio</i>	214	5.21	205	8.98
12.	Spot-billed Duck	<i>Anas poecilorhyncha</i>	574	13.97	0	0.00
13.	Little Grebe	<i>Tachybaptus ruficollis</i>	38	0.93	0	0.00
14.	Common Coot	<i>Fulica atra</i>	43	1.05	0	0.00

S. No	Name of the species	Scientific names	Dhandhusar		Narsinh Mehta Talav	
			No. of individuals	Dominance	No. of individuals	Dominance
15.	Oriental White Ibis	<i>Threskiornis melanocephalus</i>	0	0.00	34	1.49
16.	Black Ibis	<i>Pseudibis papillosa</i>	11	0.27	0	0.00
17.	Asian Pied Starling	<i>Sturnus contra</i>	69	1.68	71	3.11
18.	Common Myna	<i>Acridotheres tristis</i>	186	4.53	127	5.56
19.	Bank Myna	<i>Acridotheres ginginianus</i>	57	1.39	121	5.30
20.	House Crow	<i>Corvus splendens</i>	251	6.11	202	8.84
21.	Rose-ringed Parakeet	<i>Psittacula krameri</i>	57	1.39	98	4.29
22.	Yellow-legged Green Pigeon	<i>Treron phoenicoptera</i>	8	0.19	0	0.00
23.	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	76	1.85	97	4.25
24.	Blue Rock Pigeon	<i>Columbia livia</i>	35	0.85	81	3.55
25.	Little Green Bee-eater	<i>Merops orientalis</i>	122	2.97	143	6.26
26.	Red-vented Bulbul	<i>Pycnonotus cafer</i>	50	1.22	118	5.17
27.	Spotted Owlet	<i>Athene brama</i>	10	0.24	0	0.00
28.	Indian Robin	<i>Saxicoloides fulicata</i>	52	1.27	100	4.38
29.	Purple Sunbird	<i>Nectarinia asiatica</i>	56	1.36	89	3.90
30.	Black Drongo	<i>Dicrurus macrocercus</i>	71	1.73	100	4.38
31.	Greater Coucal	<i>Centropus sinensis</i>	10	0.24	8	0.35
32.	Indian Chat	<i>Cercomela fusca</i>	35	0.85	65	2.85
33.	House Swallow	<i>Hirundo tahitica</i>	12	0.29	0	0.00
34.	House Swift	<i>Apus affinis</i>	28	0.68	0	0.00
35.	Golden-backed Woodpecker	<i>Dinopium javanense</i>	8	0.19	0	0.00
36.	Asian Koel	<i>Endynamys scolopacea</i>	21	0.51	12	0.53
			4108	100	2284	100



There was a noticeable contrast in the general wealth of water-subordinate birds at both the areas. The relative overflow (%) of water subordinate birds was 70.44% and 37.30% at area I and II

separately while the overall wealth of earthly birds was 29.56% and 62.70% at area I and II separately. Definite examination showed massive distinction between the water-subordinate birds at both the areas (Understudy's t-test, $t = 2.66$, $P = 0.05$).

Gruiformes had all the earmarks of being the most jam-packed request with relative wealth of 31.26% at area I and Passeriformes with relative overflow of 43.48% at area II. This was trailed constantly most bountiful request Passeriformes (20.42%) at area I and request Gruiformes (18.39%) at area II. Presence of plentiful open-shelter lakes, nonattendance of weeds and higher tree variety appeared to lean toward the Gruiformes at area I.

Correlation between the quantities of people of just those species which were available at both the areas was completed. Connection was viewed as critical at 1% degree of importance (Spearman relationship, $N=22$, $p=0.527$) (Table 3). There was no huge variety among the quantity of people at both the chose areas at 5% degree of importance (Mann-Whitney Test, $Z=0.957$).

Table 3: Results of Spearman rank correlation analysis among Number of individuals observed at The Golden lake, Dhandhusar and Narsinh Mehta Talav, Junagadh.

			Dhandhusar	Narsinh Mehta Talav
Spearman's rho	The Golden Lake	Correlation coefficient N	1.000 22	0.527** 22
	Narsinh Mehta Talav	Correlation coefficient N	0.527** 22	1.000 22

** Correlation is significant at the 0.01 level of significance (2-tailed)

The extent of species and people at both the areas from different trophic gatherings of birds is addressed graphically. Plants and spineless creatures (P/I) feeders were the predominant followed by spineless creatures (I) feeders at both the areas. The wealth of bird people benefiting from plants and spineless creatures (P/I) was 50.05% and 56.65%; overflow of people benefiting from spineless creatures was 19.08% and 22.68% at area I and II separately. The extent of species benefiting from plants and spineless creatures (P/I) was 37.14% and 50.00% at area I and II separately while the extent of species benefiting from spineless creatures was 28.57% and 20.83% at area I and area II individually.

DISCUSSION:

The current review had uncovered that the quantity of water-subordinate bird species, populace count and bird orders were higher in open-covering and oversaw lakes at area I when contrasted with weed filled lakes at area II. Gibbard et al. found that the unpolluted wetland kept up with higher water bird thickness and variety than dirtied ones. It was additionally referenced by him that anthropogenic exercises impacted environment construction of an area which thusly impacted normal property for crazy water, wetland and biodiversity. Kler had tracked down decrease in number of town lakes because of normal or man-made factors during a field overview directed in town lakes. Various laborers had expressed that the water birds being by and large at or close to the highest point of most wetland well established pecking orders were profoundly vulnerable to territory aggravations and thusly viewed as great signs of general state of oceanic environments. Briggs and Holmes noticed decline in water level and filling of the town lakes had adversely impacted the species lavishness and the species creation. Factors like precipitation, temperature stickiness and darkness had impacted the thickness and variety of water-subordinate birds.

In the current review, higher tree variety and nonattendance of weeds at area I appeared to give an assortment of food assets, cover from hunters, perching and settling locales and security from earthbound hunters. Creature squanders unloaded close to the lakes gave an extra and elective nourishment rich eating regimen for the meeting birds. As per Safran et al., the biology of water birds have been firmly connected with the appropriation and wealth of food assets and for some types of

water birds benthic spineless creatures were significant dietary parts that impacted environment determination.

Anthropogenic exercises, lesser tree variety and vicinity to street public thruway appeared to be the elements working adversely and brought about lesser overflow, variety and extravagance of birds at area II. Porte and Gupta expressed comparable discoveries and referenced that the unsettling influence because of different exercises like change of horticultural practices and anthropogenic practices by human settlement, trash unloading and so forth impacted avian fauna at lakes. Mohan and Gaur tracked down that extreme human exercises in and around lakes were one of the elements upsetting the water birds in the lakes. Manikannan et al. additionally found that the water bird extravagance and overflow had genuinely declined because of different biological and anthropogenic variables. The current review showed appropriate circumstances for Purple Moorhen at area II benefiting from trash loads. While the lakes at area I appeared to offer better circumstances for Spot-charged Duck, Normal Moorhen and White-breasted Water hen. Comparative outcomes were seen by Kumar et al. He recorded Purple Moorhen just in the lakes with water hyacinth as they gave reasonable perching and settling destinations.

The misfortune and debasement of natural surroundings had been expressed to be the best danger to the drawn out endurance of water birds. Danger to the lakes because of filling, release of sewerage, tossing of homegrown trash, deliberate/accidental presentation of weeds like water hyacinth were the potential variables answerable for decrease in the avian local area in different lakes/water bodies. As per Gupta et al, the very dirtied water connected with unloading of every single disposed of thing in the lakes had been perceived as danger to the water birds. The lakes that needed human obstruction with less contamination alongside giving essential necessities for example food and asylum were found to have higher bird species. Kupekar et al. expressed that the significant danger influencing bird populace was the unlimited living space misfortune and debasement of sea-going encompassing because of human exercises.

The current review stressed the requirement for the restoration of town lakes, their administration, and upkeep of living space heterogeneity as vital piece of bird preservation projects to actually take a look at the downfall of water subordinate bird species in the farmlands of Gujarat. Public support ought to be given its expected significance in agrarian and natural strategies both for provincial restoration yet in addition for protection of water subordinate avian variety.

CONCLUSION:

It very well may be closed from the current review that the town lakes are a fundamental natural surroundings for the water birds giving them settling, taking care of and rearing locales. In this way, a viable method for saving these birds is to save their living spaces. The anthropogenic exercises like trash unloading, filling of lakes and release of sewage have adversely impacted the bird populace. The weed filled lakes alongside lower tree variety had lesser bird consider contrasted with open shade lakes. The review showed tremendous distinction between the water subordinate bird species at both the areas. The current review accentuated the requirement for the restoration of town lakes, their administration, and support of territory heterogeneity as basic piece of bird protection projects to really look at the downfall of water subordinate bird species in the farmlands of Gujarat. Public support ought to be given its expected significance in agrarian and natural approaches both for rustic revival yet additionally for preservation of water subordinate avian variety.

REFERENCES

- Ali S. The Book of Indian Birds. Oxford University Press, Bombay. 2002, 1-402.
- Ansal MD, Dhawan A, Kaur VI. Duckweed based bioremediation of village ponds: An ecologically and economically viable integrated approach for rural development through aquaculture. *Livestock Research for Rural Development*. 2010; 22(7):1.
- Briggs SV, Holmes JE. Bag size of water fowl research in New Southwales and their relation antecedent rainfall. *Australian Wildlife Research*. 1988; 15:459-468.

- Custer TW, Osborne RG. Wading birds as biological indicators: 1975 Colony survey. U.S. Fish and Wildlife Service, Washington, D.C. 1977.
- Everard M, Noble D. The development of bird indicators for British fresh waters and wetlands. *Aquatic Conservation: Marine and Freshwater ecosystem*. 2010; 20:117-124.
- Finlayson CM, Rea N. Reasons for the loss and degradation of Australian wetlands. *Wetlands, Ecology and Management*. 1999; 7:1-11.
- Gatto A, Quintana F, Yorio P. Feeding Behavior and Habitat Use in a Waterbird Assemblage at a Marine Wetland in Coastal Patagonia, Argentina. *Waterbirds*. 2008; 31 (3):463-471.
- Gibbard SG, Calderia K, Bala G, Phillips TJ, Wickett M. Climate effects of global land cover change S. Geophysical research letters. University of California, California, 2005.
- Gupta RC, Kaushik TK, Gupta PK. Winter migratory wetland birds in Haryana are confronting adverse conditions in rural ponds resulting in reduction in arrival number: a case study of village amin in thanesar block in Kurukshetra district. *Indian Journal of Fundamental and Applied Life Sciences*. 2012; 2(1):1-7.
- Jayson EA, Mathew DN. Structure and composition of two bird communities in the Southern Western Ghats. *Journal of Bombay National History Society*. 2002; 97:52-61.
- Kler TK. Man-made threats to avian fauna of village ponds/ water bodies. *Pestology*. 2002; 26(11):39-41.
- Krebs JR, Wilson JD, Bradbury RB, Siriwardena GM. The second silent spring? *Nature*. 1985; 400:257-267.
- Kumar A, Sati JP, Tak PC, Alfred JRB. Handbook on Indian wetland birds and their conservation. Zoological Survey of India. 2005.
- Kumar P, Gupta SK. Diversity and Abundance of Wetland Birds around Kurukshetra, India. *Our Nature*. 2009; 7:212-217.
- Kumar P, Rai D, Gupta SK. Wetland bird assemblage in rural ponds of Kurukshetra, India. *Waterbirds*. 2016; 39(1):86-98.
- Kupekar S, Mangale V, Patil R. Aquatic and semi aquatic birds, threats and conservation of bird fauna of Ballaleshwar Lake, Panvel. Dist. Raigadn (Maharashtra). *Journal of Environmental Science, Toxicology and Food Technology*. 2015; 9(11):29-36.
- Kushlan JA. Population biology and conservation of colonial water birds. *Colonial Water Birds*. 1992; 15:1-7.
- Kushlan JA. Colonial waterbirds as bioindicators of environmental change. *Colonial Water Birds*. 1993; 16:223-251.
- Manakadan R, Pittie A. Standardised common and scientific names of the birds of the Indian subcontinent. *Buceros*. 2001; 6(1):1-37.
- Manikannan R, Asokan S, Ali AMS. Abundance and factors affecting population characteristics of waders (Charadriiformes) in Great Vedaranyam Swamp of Point Calimere Wildlife Sanctuary, South-east Coast of India. *International Journal of Ecosystem*. 2012; 2(1):6-14.
- Mistry J, Berardi A, Simpson M. Birds as indicators of wetland status and change in the North Rupununi, Guyana. *Biodiversity and Conservation*. 2008; 17:23832409.
- Mohan D, Gaur A. avian diversity around Jajiwal pond- a natural wetland. *Proceedings of taal 2007: The 12th World Lake Conference*. 2008, 542-546.
- Pailisson JM, Reeber S, Marion L. Bird assemblages as bio-indicators of water regime management and hunting disturbance in natural wet grasslands. *Biological Conservation*. 2002; 106:115-127.
- Paracuellos M. How can habitat selection affect the use of a wetland complex by water birds? *Biodiversity Conservation*. 2006; 15:4569-4582.
- Porte DS, Gupta S. Assessment of distribution patterns of wetland birds between unpolluted and polluted ponds at Ratanpur, district Blaspur, Chhattisgarh, India. *Indian Journal of Scientific Research*. 2017; 12(2):204-215.

-
- Safran RJ, Isola CR, Colwell MA, Williams OE. Benthic Invertebrates at foraging locations of nine waterbird species in managed wetlands of the northern San Joaquin valley, California. *Wetlands*. 1997; 17(3):407-415.
- Toor AS, Khurana MPS, Sidhu BS, Khera JS, Brar KK. Suitability of village pond waters for irrigation-a case study from district Ludhiana, India. *Environmental Monitoring and Assessment*. 2010; 172:571-579.
- Vishwakarma A, Hemrom A, Yadav KC. Status of Terrestrial and Wetland Birds in Kawardha, Kabirdham District in Chhattisgarh, India. *International Journal of Scientific and Research Publications*. 2014; 4(10):2250-3153



Vibhakar A. Jani
Research Scholar, BKNM University, Junagadh, Gujarat, India