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Diversity of waterbirds in Wainganga river basin at Waghala near Armori, Maharashtra India

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Abstract

We had undertaken monthly survey of waterbirds at Waghala site of Wainganga river (20°46'31.37"N and 79 °94'73.43"E) the man-made water reservoir, situated near Armori in the eastern part of Vidarbha of Maharashtra State in India between Nov. 2022 to Oct. 2023 in order to explore seasonal fluctuations in diversity and relative abundance (RA). The dominant waterbird species in other water reservoirs are the representative of particular foraging guild, the changes in the factors due to the change in season makes conditions favourable for their survival and breeding. Data on Waterbird community observed seasonal fluctuations as it is revealed by the fact that, order- Pelicaniformes shows domination during both winter and monsoon season. Data on Waterbird community observed seasonal fluctuations as it is revealed by the fact that, order- Pelicaniformes shows domination during both winter and monsoon season. It was followed by order – Ciconiformes and order - Anseriformes in winter season, and in monsoon season, order – Ciconiformes and Order –Suliiformes. The sudden rise of overall density of waterbirds during monsoon season, especially that belongs to Orders, Ciconiformes and Peliconiformes attributed to approximation of habitat in the vicinity of Waghala nesting colony.

Keywords: *Ciconiformes, Peliconiformes, Ardeidae and Suliiformes.*

Introduction

The gradual losses of wetlands due to habitat loss or degradation have caused population decline in many waterbirds species around the world (Carpenter et al., 2011). Many waterbirds species are under heavy pressure and at risk of extinction due to degradation and habitat loss that caused the degradation of breeding and feeding sites (Ferrarini et al., 2024). Wetland birds are the most threatened species as compared to terrestrial birds. It has been estimated that around 41% of waterbirds population had declined (Carpenter et al., 2011). Therefore, there is an urgent need to determine the ideal landscape for migratory birds in each geographical region of the world, where landscape-scale conservation is key to the protection of migratory birds. Here lies the significance of the present study which has explored the habitats of the waterbirds inside the sub-Himalayan forest tracts, both pristine and heavily interfered by the human activities. This study has aimed at finding out the importance of habitat profitability of the waterbirds in terms of easier landing accessibility, foraging status and nutrients resources and sense of security. Dutta in 2011 studied two wetlands of sub-Himalayan region and pointed out the anthropogenic threats of waterbird colonization like fishing, and agricultural practices. (Ferrarini et al., 2024).

The proximity of flooded rice fields in the periphery of monsoon nesting site at Waghala village provides ample amount of food especially to water birds like Asian Openbill Stork, and Black Headed Ibis during fingerling stages, results in high relative abundance and density. Most of the studies on the diversity of waterbirds in Vidarbha region of Maharashtra were focused on the Tadoba Andhari Tiger Reserve (TATR), while there is paucity of data regarding waterbirds diversity of riverine habitat. Riverine habitat site at Waghala on Wainganga river located at approximately 68 Km. downstream to Gosikhurd Dam on Wainganga river near Pauni town in Bhandara district of Maharashtra. To address this data gap, we had conducted survey at Waghala riverine habitat of Wainganga River basin in order to study the fluctuations in the abundance of waterbirds during different seasons in order to plan conservation strategy of this wonderful wetland habitat.

Material and Method

Study area

The present study was We had undertaken monthly survey of waterbirds at Waghala riverine site (20º46'31.37"N and 79 º94'73.43"E) located at around 68 Km. downstream to Ghosikhurd dam situated near Armori in the eastern part of Vidarbha of Maharashtra State in India between Nov. 2022 to Oct. 2023 in order to explore seasonal fluctuations in diversity and relative abundance (RA). (Fig.1). It spreads over an area of 1566133.43 mts^2 and located at an elevation of 241 mts from the mean sea level as per Google Earth data. This riverine habitat have situated in the vicinity of communal nesting site at Waghala village, which is provided by conspicuous canopy of *Tamarindus indica*. The region experiences strong seasonality with distinct winter (Nov. to Feb.), Summer (March to June), and Monsoon season (July to October). The total rainfall in the region averaged 550 mm. The highest temperature was 44 ℃ recorded in summer and lowest (13 ℃) in winter season. The landscape is dominated by the large trees of *Tamarandus indicus* all along the length and breadth of Waghala village. River basin is heavily explored for sand mining, apart from this fishing activity is carried out extensively. (Fig.2). Agriculture was the major land use, in which mainly paddy crop cultivated during both monsoon and summer season. Agriculture is supported by irrigation through natural as well as artificial wetlands including reservoirs, marshes, canals and village ponds within periphery of about 5Km. Region in the vicinity of study site had non-protected forest with mixed moist and dry deciduous tropical vegetation.

Bird Sampling and population estimation

Monthly surveys of water birds were carried out between the months of Nov. 2022 to Oct. 2023. Observation of birds was done by Olympus 118760 10x50 DPSI Wide-Angle Binocular and wherever possible photographed by digital camera Canon EOS 200D. The species identity, counting of birds, foraging habit, and feeding technique of water birds were recorded using the initial observation method (i.e. only the 1st foraging observation of each individual was considered). (Holmes and Robinson, 1988; Bibby, et al., 2000). Line transect method was adapted to record the waterbirds of different species and to calculate the density (D) and relative abundance (RA). (Bibby et al., 2000; Sutherland, 2006). The density of waterbirds per square acre (individuals/acre^2) were calculated by birds were also categorized according to their feeding guilds and migratory status based on bird observation guides. (Ali and Ripley, 2001; Grimmett *et. al*., 2011).

Result and Discussion

During present investigation on water birds of riverine lotic freshwater habitat of Wainganga river wetland, seasonal fluctuations in the diversity of waterbirds were observed along the different orders, families, and foraging guild structure of water birds.

These fluctuations along different hydrological gradients, due to the change in season correlated with the change in food resources, configuration of habitat, available surface area for waterbirds. (Goss-Custard, et al., 1995; McParland and Paszkowski, 2007). Sediment transport, bank erosion and associated channel mobility represent key physical processes of rivers along with the flow regime are the key drivers of river and floodplain ecosystem. (Bunn and Arthington, 2002). These elements collectively shape the dynamic environments essential for the health and ecosystem of complex riverine ecosystem. (Picco et al., 2023). The movement of organic humus, decomposing material such as algae, leaves and inorganic particles carried by flood water impacts greatly the availability of essential resources to waterbirds. (Bunn and Arthington, 2002).

The change in habitat surface, the amount and type of food resources available to water birds during the different seasons affects their foraging guild and community structure. (Nirmal Kumar, et al., 2007). In the same way proximity of human habitation to the water body and their interference also contributes to the maintenance of foraging waders on the mudflats and on hydrophytes. (Masero, et al., 2000). The data on the relative abundance (RA) of water birds (at Waghala riverine habitat of Wainganga river reveals that, Asian Openbill Stork (*Anastomus oscitans*) recorded maximum abundance throughout study period spanning winter (29.325), summer (37.696) and monsoon (27.173) season. It is followed by Little Egret (11.689) and Black Headed Ibis (9.812) in winter season, Little Cormorant (11.324) and Cattle Egret (8.235) in summer season, while in monsoon season, Black Headed Ibis (22.648) and Little Egret (14.340) respectively. Likewise, waterbirds belongs to Order - Pelicaniformes(n=10) dominates avian community at Waghala riverine habitat followed by Order- Ciconiformes (n=9) were illustrated in Fig.3. Seasonal fluctuation in avian community structure were observed, Family- Ciconidae (n=2) shows year-round domination in terms of relative abundance of waterbirds followed by Family - Ardeidae (n=7).

Water birds are strong colonial in nature and choose areas for breeding after careful evaluation of prevailing nest safety from predators, climatic conditions that offers nesting resources, and seasonal availability of food for coming generations after successful breeding. (Kim et al., 2020). Season-wise fluctuations in the waterbird densities at riverine habitat site were recorded throughout year reveals particular pattern that is illustrated in Fig.3. Monsoon season recorded peak congregation of waterbirds (44.0622 ind.ha^{-1}) followed by winter (27.2481ind.ha^{-1}) and summer season (10.4289ind.ha^{-1}) at this riverine habitat situated near nesting site of Waghala village, that shows approximately 76.33% influx of birds during winter season as compared to summer season. Observations on avian community structure of waterbirds during different seasons reveals that, Asian Openbill Stork (*Anastomusoscitans*) dominates the density (D) of waterbirds population, that is 7.9904ind.ha^{-1}, 3.9313ind.ha^{-1} and 11.9728ind.ha^{-1} during winter, summer

and monsoon season respectively as illustrated in Fig.3. It was followed by Little Egret (3.1849ind.ha^{-1}) and Black Headed Ibis (2.6737ind.ha^{-1}) in winter season, Little Cormorant (1.1809ind.ha^{-1}) and Cattle Egret (0.8589ind.ha^{-1}) in summer season, while in monsoon season, Black Headed Ibis shows increasing trend in the density of population (9.9790 ind.ha^{-1}) and Little Egret (6.3187ind.ha^{-1}), belonging to ord- Ciconiformes (22.4017ind.ha$^{-1)}$. All these observations highlighted the change in the habitat structure which might have impacted the essential resources available to waterbirds during different seasons. These findings of ours finds its parallels in the research work in similar conditions. (Masero et al., 200). Data on Waterbird community observed seasonal fluctuations as it is revealed by the fact that, order- Pelicaniformes shows domination during both winter and monsoon season. It was followed by order – Ciconiformes (8.2869ind.ha^{-1}) and order - Anseriformes (2.6123ind.ha^{-1}) in winter season, and in monsoon season, order–Ciconiformes (14.4931ind.ha$^{-1)}$ and Order –Suliiformes (6.0120ind.ha^{-1}). The sudden rise of overall density of waterbirds during monsoon season, especially that belongs to Orders, Ciconiformes and Pelicaniformes attributed to approximation of habitat in the vicinity of Waghala nesting colony. The seasonal variations in relative abundance (RA) and density (D) among different orders and families at this study site related to their position along fresh water gradients, habitat types and human land use in the vicinity. (Ericia et al, 2005). The dominance of Asian Openbill Stork, *Anastomus oscitans* throughout study period spanning all the three seasons was in stark contrast with similar studies on lentic freshwater habitat like ponds and lakes and riverine habitat where, different waterbird species dominates during different seasons. (Chaterjee et al., 2019; Deshmukh and Chavan, 2024).). Proximity of nesting site having profusely branched large trees of *Tamarindus indica* with flooded agricultural landscape and riverine habitat would have provide ideal optimum required conditions for high breeding success of nesting colonial water birds. (Subramanya., 1996; Tourenq et al., 2009; Sunder and Subramanya., 2010; Koli et al., 2019; Kim et al., 2020).

The dominant waterbird species in other water reservoirs are the representative of particular foraging guild, the changes in the factors due to the change in season makes conditions favourable for their survival and breeding. (Masero et al, 2000; Deshmukh and Chavan, 2024). With the onset of winter there was influx of waders from order – Charadiformes, may be, mostly due to exposure of mudflat by receding water of monsoon flood, leaves behind plenty of food trapped available to mud probing waders. (Manikannan et al, 2012). Water birds from family – Anatidae like Northern Pintail, Common Teal, Bramhany Rudy Shelduck and Bar Headed Geese migrates to this habitat in large numbers during winters may be due to the fact that paddy fields after *kharip* harvest in the vicinity of Waghala riverine site, acts as perfect night roosting ground. (Sundar and Subramanya, 2010; Parejo et al. 2019). Such group of waders may be considered as wetland bio-indicators for an accurate assessment of the health of a particular wetland. (Green, 1995).

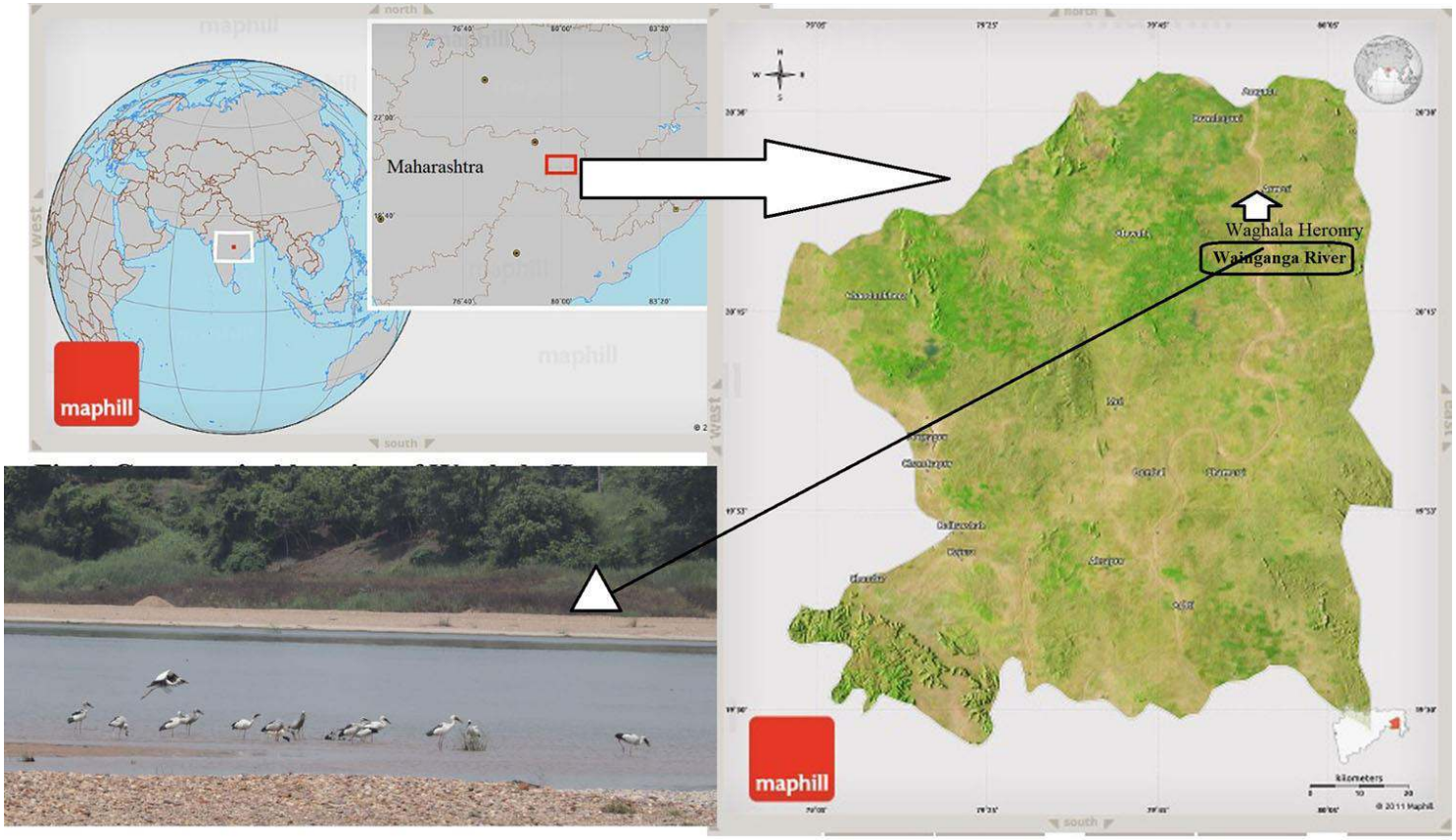


Fig. 1. Geographical location of study site, at Waghala **Inset shows bank of Wainganga river**

Fig.2. Habitat site of Waghala heronry. A. Nesting site of Openbill (Anastomus oscitans) alongwith other water birds on Tamarindus indicus tree. B. Openbill C. Large number of Indian carmorants basking in Wainganga river. D. Black Headed Ibis E. Painted Stork

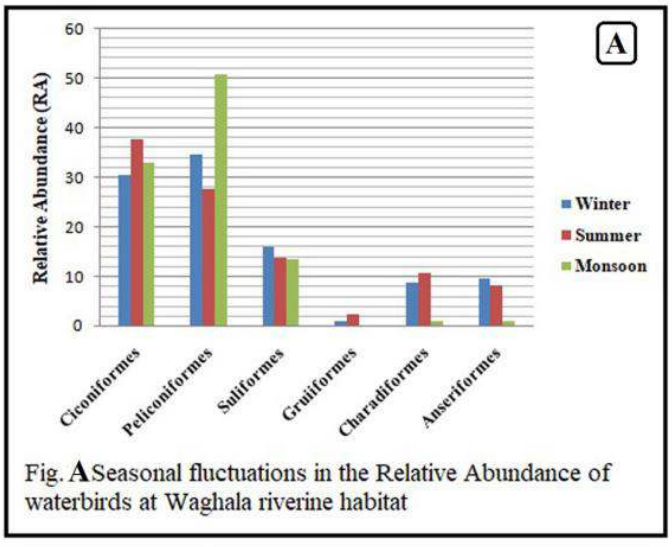
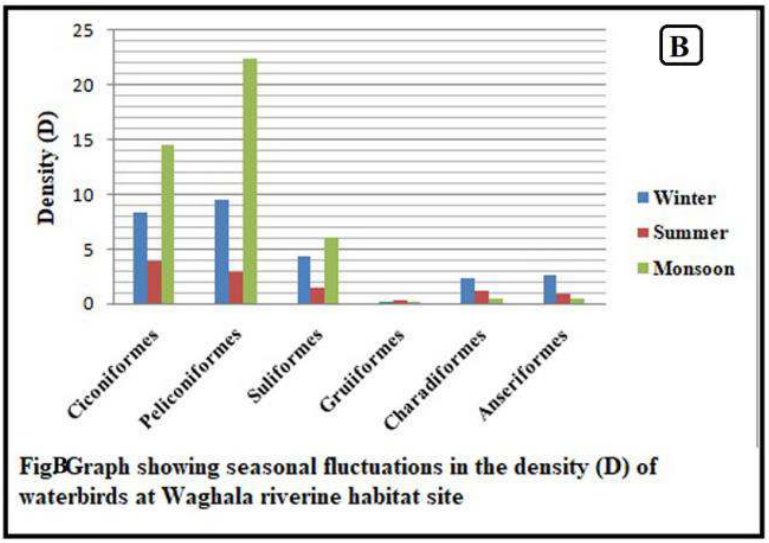


Fig. **A** Seasonal fluctuations in the Relative Abundance of waterbirds at Waghala riverine habitat



FigBGraph showing seasonal fluctuations in the density (D) of waterbirds at Waghala riverine habitat site

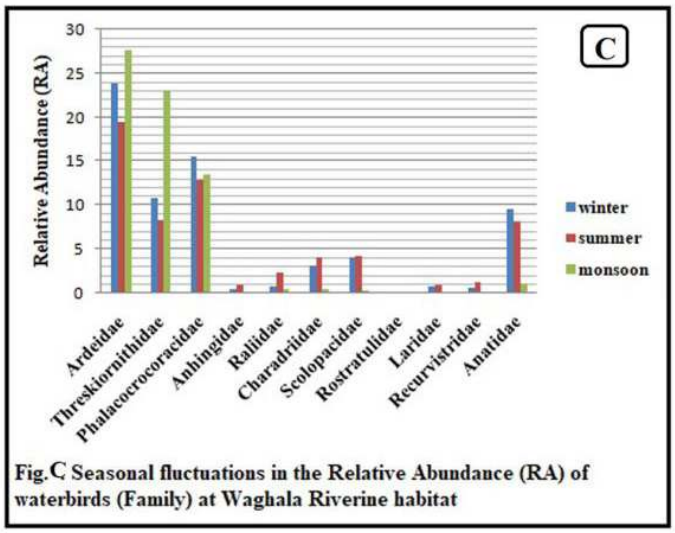


Fig.C Seasonal fluctuations in the Relative Abundance (RA) of waterbirds (Family) at Waghala Riverine habitat

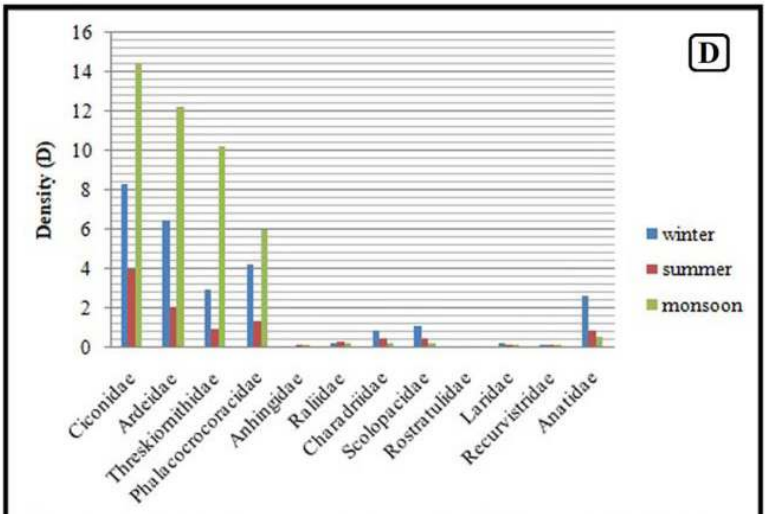


Fig.D. Graph showing seasonal fluctuations in the density (D) of waterbirds at Waghala riverine habitat site

Fig. 3. Graphs showing seasonal fluctuations during study period at Waghala riverine habitat

Appendix

Table 1

Sr. N.	Common Name	Zoological Name	Total Count Winter	Total Count Summer	Total Count Monsoon	RA Winter	RA Summer	RA Monsoon	Density (D) Winter	Density (D) Summer	Density (D) Monsoon	I UCN	Abundance
Order - Ciconiformes													
Family - Ciconidae													
1	Painted Stork	*Mycteria leucocephala*	58	0	493	1.088	0.000	5.720	0.297	0.000	2.520	LC	RA
2	Asian Openbill stork	*Anastomus oscitans*	1563	769	2342	29.325	37.696	27.173	7.990	3.931	11.973	LC	VCom
Order - Peliconiformes													
Family - Ardeidae													
3	Purple Heron	Ardea pupurea	12	3	6	0.225	0.147	0.070	0.061	0.015	0.031	LC	Com
4	Grey Heron	*Ardea cinerea*	15	6	7	0.281	0.294	0.081	0.077	0.031	0.036	LC	Com
5	Indian Pond Heron	*Ardea grayii*	21	19	27	0.394	0.931	0.313	0.107	0.097	0.138	LC	Vcom
6	Intermediate Egret	*Ardea intermedia*	165	34	365	3.096	1.667	4.235	0.844	0.174	1.866	LC	com
7	Catle Egret	*Bubulcus ibis*	367	168	532	6.886	8.235	6.172	1.876	0.859	2.720	LC	Vcom
8	Little Egret	*Egretta garxetta*	623	134	1236	11.68	6.569	14.340	3.185	0.685	6.319	LC	Vcom
9	Large Egret	*Casmerodius albus*	67	32	214	1.257	1.569	2.483	0.343	0.164	1.094	LC	Vcom
Family - Threskiornithidae													
10	Black Headed Ibis	*Threskiornis melanocephalus*	523	156	1952	9.812	7.647	22.648	2.674	0.798	9.979	NT	Com
11	Eurasian Spoonbill	*Platalea leucorodia*	3	0	0	0.056	0.000	0.000	0.015	0.000	0.000	LC	VRa
12	Red Naped Ibis	*Pseudibis papilosa*	49	14	43	0.919	0.686	0.499	0.250	0.072	0.220	LC	Vcom
Order - Suliformes													
Family - Phalacocrocoracidae													
13	Little Cormorant	*Phalacrocorax niger*	426	231	693	7.992	11.324	8.040	2.178	1.181	3.543	LC	Vcom
14	Great Cormorant	*Phalacrocorax carbo*	79	21	0	1.482	1.029	0.000	0.404	0.107	0.000	LC	UnCom
15	Indian Cormorant	*Phalacrocorax fuscicollis*	321	9	467	6.023	0.441	5.418	1.641	0.046	2.387	LC	UnCom
Family - Anhingidae													
16	Darter	*Anhinga melanogaster*	22	17	16	0.413	0.833	0.186	0.112	0.087	0.082	NT	Com
Order - Gruiiformes													
Family - Raliidae													
17	White breasted Waterhen	*Amaurornis phoenicurus*	3	11	13	0.056	0.539	0.151	0.015	0.056	0.066	LC	Vcom
18	Eurasian Coot	*Fulica atra*	28	13	0	0.525	0.637	0.000	0.143	0.066	0.000	LC	UnCom
19	Grey Headed Swamphen	*Porphyrio poliocephalus*	11	24	27	0.206	1.176	0.313	0.056	0.123	0.138	LC	Vcom
Order - Charadiiformes													
Family - Charadriidae													
20	Little Ringed Plover	*Charadrius dubios*	98	46	16	1.839	2.255	0.186	0.501	0.235	0.082	LC	Vcom

21	Kentish Plover	*Charadrius alexandrinus*	13	3	0	0.244	0.147	0.000	0.066	0.015	0.000	LC	VRa
22	Red Wattled Lapwing	*Vanellius indicus*	37	25	21	0.694	1.225	0.244	0.189	0.128	0.107	LC	Vcom
23	River Lapwing	*Vanellus duvaucelii*	9	3	2	0.169	0.147	0.023	0.046	0.015	0.010	NT	UnCom
24	Yellow Wattled Lapwing	*Vanellius malabaricus*	13	6	0	0.244	0.294	0.000	0.066	0.031	0.000	LC	Ra
Family - Scolopacidae													
25	Temminck's Stint	*Calidris temminckii*	42	19	0	0.788	0.931	0.000	0.215	0.097	0.000	LC	Com
26	Little Stint	*Calidris minuta*	32	9	0	0.600	0.441	0.000	0.164	0.046	0.000	LC	Com
27	Common Snipe	*Gallinago gallinago*	18	10	8	0.338	0.490	0.093	0.092	0.051	0.041	LC	Vcom
28	Pintailed Snipe	*Gallinago sternura*	8	7	0	0.150	0.343	0.000	0.041	0.036	0.000	LC	Com
29	Spotted Redshank	*Tringa erythropus*	36	9	0	0.675	0.441	0.000	0.184	0.046	0.000	LC	Com
30	Common Greenshank	*Tringa nebularia*	26	3	0	0.488	0.147	0.000	0.133	0.015	0.000	LC	UnCom
31	Green Sandpiper	*Tringa ochropus*	17	4	0	0.319	0.196	0.000	0.087	0.020	0.000	LC	UnCom
32	Wood Sandpiper	*Tringa glareola*	22	17	13	0.413	0.833	0.151	0.112	0.087	0.066	LC	Vcom
33	Common Sandpiper	*Actius hypoleucos*	15	9	7	0.281	0.441	0.081	0.077	0.046	0.036	LC	Com
Family - Rostratulidae													
34	Greater Painted Snipe	*Rostratula benghalensis*	0	2	2	0.000	0.098	0.023	0.000	0.010	0.010	LC	Com
Family - Laridae													
35	River Tern	*Sterna aurantia*	43	19	13	0.807	0.931	0.151	0.220	0.097	0.066	Vu	Vcom
Family - Recurvirostridae													
36	Black Winged Stilt	*Himantopus himantopus*	34	23	12	0.638	1.127	0.139	0.174	0.118	0.061	LC	Vcom
Order - Anseriformes													
Family - Anatidae													
37	Lesser Whissling duck	*Dedrocigna javanica*	76	45	38	1.426	2.206	0.441	0.389	0.230	0.194	LC	Vcom
38	Indian spot billed duck	*Anas poecillorhyncha*	36	13	17	0.675	0.637	0.197	0.184	0.066	0.087	LC	Vcom
39	Northern pintail	*Anas acuta*	155	36	0	2.908	1.765	0.000	0.792	0.184	0.000	LC	Com
40	Common Teal	*Anas crecca*	67	20	0	1.257	0.980	0.000	0.343	0.102	0.000	LC	UnCom
41	Bar-headed goose	*Anser indicus*	56	5	0	1.051	0.245	0.000	0.286	0.026	0.000	LC	Ra
42	Brahmany Rudy Shelduck	*Tadorna ferruginea*	43	0	0	0.807	0.000	0.000	0.220	0.000	0.000	LC	Ra
43	Cotton Pygmy Goose	*Nettapus coromandlianus*	78	46	37	1.463	2.255	0.429	0.399	0.235	0.189	LC	Vcom
Total			5330	2040	8619	100	100	100	27.248	10.429	44.062		

Conclusion

The dominant waterbird species in other water reservoirs are the representative of particular foraging guild, the changes in the factors due to the change in season makes conditions favourable for their survival and breeding. Data on Waterbird community observed seasonal fluctuations as it is revealed by the fact that, order- Pelicaniformes shows domination during both winter and monsoon season. Data on Waterbird community observed seasonal fluctuations as it is revealed by the fact that, order- Pelicaniformes shows domination during both winter and monsoon season. It was followed by order – Ciconiformes and order - Anseriformes in winter season, and in monsoon season, order – Ciconiformes and Order –Suliiformes. The sudden rise of overall density of waterbirds during monsoon season, especially that belongs to Orders, Ciconiformes and Pelicaniformes attributed to approximation of habitat in the vicinity of Waghala nesting colony.

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