

Diversity and conservation status of water birds at Upper lake, Bhopal – A Ramsar site in central India

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ABSTRACT:

Wetlands support considerable biodiversity including water birds. In central India, the Upper lake of Bhopal is designated as a Ramsar site and IBA status concerning to its diverse avifauna. At present, a detailed study regarding avian diversity of entire Upper lake is lacking. Considering the increasing population pressure leading to land use changes in immediate catchment of Upper lake and affecting the lake ecology, such monitoring is essential. The present work has been carried out from June 2010 to June 2012. Monthly observations of birds were made with the aim to identify and enlist various species of water birds of Upper lake. Total 68 species of water birds belonging to 14 families are reported with Anatidae as the most dominating family with 16 species. Of these, 43 species were migratory and 25 species were residents. Also, 11 important species in terms of their conservation status are reported. Of these, eight species of Near Threatened status, two species of Vulnerable status and one species of Endangered status are reported. The presence of internationally important birds, migratory, local migratory and resident species of birds in this area indicates the importance of Upper Lake as a year round habitat for water birds. The increasing human population in the area is placing strain on this valuable inland freshwater resource and the related avifauna and thus more conservation efforts are desperately needed.

Keywords:

Upper Lake, wetland, water birds, diversity, conservation status

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INTRODUCTION

Wetlands are shallow water areas which act as transitional zones between terrestrial and aquatic systems (Cowardin *et al.*, 1979; Mitsch and Gosselink, 1986) and support considerable biodiversity of organisms (Dudgeon *et al.*, 2006). Wetlands hold immense ecological significance by providing suitable habitat to a vast variety of faunal diversity. Water birds generally occupy the position of top level consumers in aquatic food chain and thus any changes in the habitat and food availability directly affects them. Water birds are thus considered as indicators of wetland habitat conditions (Kushlan, 1978). Among the several kinds of wetlands such as marshes, lagoons, bogs, fens, mangroves and other open water bodies etc., urban lakes are at a large risk of habitat degradation due to the prevailing anthropogenic pressure in the surroundings which in turn affects the avian diversity supported by them.

India possesses wide-ranging wetland habitats that support numerous water birds, many of which are migratory visiting the subcontinent from their breeding

grounds in the northern regions. In central India, the Upper lake of Bhopal is an important water bird abode for resident species as well as an equally prominent staging and wintering site for numerous migratory species. It is designated as a Ramsar site and IBA status in concern to the fact that it supports a distinct and ample population of water birds around the year. A variety of water birds like cormorants, egrets and herons, storks and ibises, crane, ducks, jacanas, lapwings, stilts, sandpipers, gulls and terns, kingfishers etc. find refuge in this lake (Vyas, 1992) emphasizing the overall importance of this water body. The avian species richness supported by Upper lake is largely due to the presence of high food availability which attracts avifauna to settle here (Vyas *et al.*, 2010). At present, a detailed study regarding avian diversity of entire area of Upper lake is lacking which is essential considering the increasing population pressure leading to changes in the landuse of immediate catchment of Upper lake and affecting the lake ecology. Thus, the present work has been carried out with the aim to identify and enlist

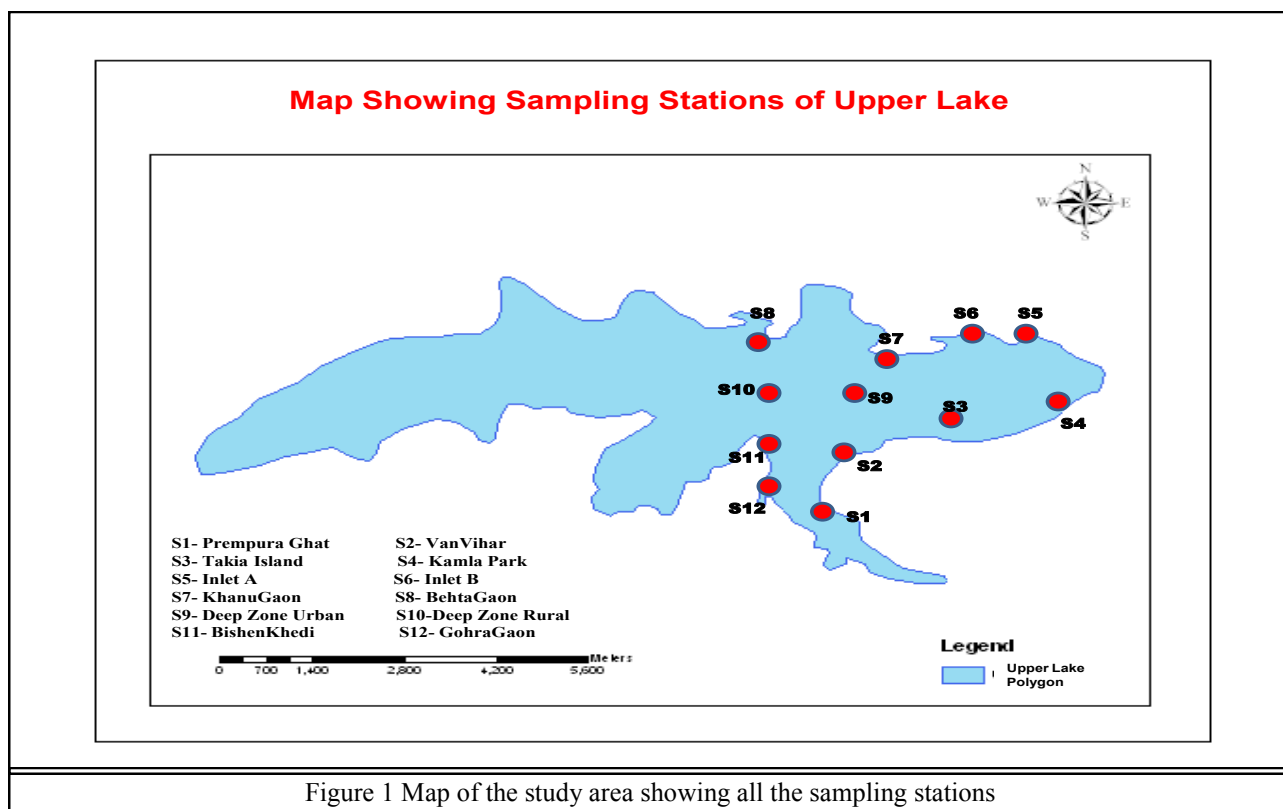




Figure 2 Upper Lake of Bhopal

various species of water birds visiting and residing in the Upper lake which may provide a baseline for the future management of avian fauna in the area.

MATERIALS AND METHODS

The Upper lake is an east-westerly elongated urban lake which receives water from the river Kolans and from the direct rains, both during rainfall months which is the main source of drinking water for the residents of Bhopal. This lake was formed by constructing an earthen dam across the Kolans river in the 11th century by Raja Bhoj of Dhar. The catchment area of the lake is 361 sq. km and the water spread area is 30.72 km at FTL, its mean depth is 3.16 m while maximum depth is 11.64 m. The excess water from Upper lake flows into Kaliasot River which further meets Betwa River and finally gets drained into the Yamuna river. The altitude of Upper lake is about 503 m above mean sea level and it is situated at 23°16' N latitude and 77°25' E longitude. It is an east westerly elongated shallow lake bordered by human settlements on the eastern and northern boundaries while its western margins are intensively used for agriculture, on the southern margin lies Van Vihar National Park. It has irregular margins that support dense growth of macrophytes and sustains well diversified aquatic flora and fauna.

The study was conducted from June 2010 to June 2012 at the Upper Lake of Bhopal (Figure 1 and 2). The

sampling points, total 12 in number, were identified carefully keeping in mind the subject of habitat features and avifaunal occurrence and also such limitations as approachability (Figure 1). Study was conducted with special reference to diversity of birds. Monthly observations of birds were made during the study where birds were observed within 300 m transect using Nikon Binoculars of 10×50 magnification. Identification of the water birds was done using standard taxonomic keys (Ali and Ripley, 1988; Ali, 2002) and the checklist was prepared as per Manakadan and Pittie (2001). On foot surveys were done by walking across selected tracks along the lake margins and the lake area was covered using boats. Information from the local community and on site observations were recorded on every visit and accumulated at the end of the study. The status of the birds is categorized as Resident (R), Migratory (M) and Resident Migratory (RM) after Ali (2002) and the threatened status is taken according to the Bird Life International, (2014).

RESULTS AND DISCUSSION

The lake ecology of Upper Lake is under constant threat due to various on going developmental activities in the immediate catchment. In the urban surroundings, a vast increase in developmental activities and related waste dumping is observed whereas in the rural areas, major changes in cropping patterns, including extensive use of chemical fertilizers and pesticides has

Table 1 The residence and conservation status of bird diversity of Upper lake

S.No	Family	Scientific Name	Common Name	Status	
				Residence	Conservation
	Podicipitidae				
1		<i>Tachybaptus ruficollis</i>	Little Grebe	R	LC
	Phalacrocoracidae				
2		<i>Phalacrocorax carbo</i>	Great Cormorant	RM	LC
3		<i>Phalacrocorax fuscicollis</i>	Indian Shag	RM	LC
4		<i>Phalacrocorax niger</i>	Little Cormorant	RM	LC
5		<i>Anhinga melanogaster</i>	Darter	RM	NT
	Ardeidae				
6		<i>Casmerodius albus</i>	Large Egret	RM	LC
7		<i>Egretta garzetta</i>	Little Egret	R	LC
8		<i>Mesophoyx intermedia</i>	Median Egret	RM	LC
9		<i>Bubulcus ibis</i>	Cattle Egret	RM	LC
10		<i>Ardea cinerea</i>	Grey Heron	RM	LC
11		<i>Ardea purpurea</i>	Purple Heron	RM	LC
12		<i>Butorides striatus</i>	Little Green Heron	R	LC
13		<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	R	LC
14		<i>Ardeola grayii</i>	Indian Pond-Heron	R	LC
15		<i>Ixobrychus cinnamomeus</i>	Chestnut Bittern	RM	LC
	Ciconiidae				
16		<i>Mycteria leucocephala</i>	Painted Stork	RM	NT
17		<i>Anastomus oscitans</i>	Asian Openbill-Stork	R	LC
18		<i>Ciconia episcopus</i>	White-Necked Stork	R	V
19		<i>Ciconia ciconia</i>	European White Stork	M	LC
20		<i>Ciconia nigra</i>	Black Stork	M	LC
21		<i>Ephippiorhynchus asiaticus</i>	Black-Necked Stork	R	NT
	Threskiornithidae				
22		<i>Threskiornis melanocephalus</i>	Oriental White Ibis	R	NT
23		<i>Pseudibis papillosa</i>	Black Ibis	R	LC
24		<i>Plegadis falcinellus</i>	Glossy Ibis	RM	LC
25		<i>Platalea leucorodia</i>	Eurasian Spoonbill	RM	LC
	Anatidae				
26		<i>Anser indicus</i>	Bar-headed Goose	RM	LC
27		<i>Tadorna ferruginea</i>	Brahminy Shelduck	RM	LC
28		<i>Sarkidiornis melanotos</i>	Comb Duck	R	LC
29		<i>Dendrocygna javanica</i>	Lesser Whistling-Duck	R	LC
30		<i>Anas acuta</i>	Northern Pintail	M	LC
31		<i>Anas crecca</i>	Common Teal	M	LC
32		<i>Anas poecilorhyncha</i>	Spot-billed Duck	RM	LC
33		<i>Anas platyrhynchos</i>	Mallard	RM	LC
34		<i>Anas strepera</i>	Gadwall	M	LC

become a common practice. The entry of pesticides from the rural margins and untreated sewage from both urban

36		<i>Anas clypeata</i>	Northern Shoveller	M	LC
37		<i>Anas querquedula</i>	Garganey	M	LC
38		<i>Rhodonessa rufina</i>	Red-crested Pochard	M	LC
39		<i>Aythya ferina</i>	Common Pochard	M	LC
40		<i>Aythya nyroca</i>	Ferruginous Pochard	RM	NT
41		<i>Nettapus coromandelianus</i>	Cotton Teal	R	LC
	Gruidae				
42		<i>Grus antigone</i>	Sarus Crane	R	V
	Rallidae				
43		<i>Amaurornis phoenicurus</i>	White-breasted Waterhen	R	LC
44		<i>Gallinula chloropus</i>	Common Moorhen	RM	LC
45		<i>Porphyrio porphyrio</i>	Purple Moorhen	R	LC
46		<i>Fulica atra</i>	Common Coot	RM	LC
	Jacanidae				
47		<i>Metopidius indicus</i>	Bronze-winged Jacana	R	LC
48		<i>Hydrophasianus chirurgus</i>	Pheasant-tailed Jacana	R	LC
	Charadriidae				
49		<i>Vanellus indicus</i>	Red-wattled Lapwing	R	LC
50		<i>Charadrius dubius</i>	Little Ringed Plover	RM	LC
51		<i>Charadrius alexandrinus</i>	Kentish Plover	RM	LC
52		<i>Tringa totanus</i>	Common Redshank	RM	LC
53		<i>Tringa nebularia</i>	Common Greenshank	M	LC
54		<i>Actitis hypoleucos</i>	Common Sandpiper	RM	LC
55		<i>Tringa stagnatilis</i>	Marsh Sandpiper	M	LC
56		<i>Tringa glareola</i>	Wood Sandpiper	M	LC
57		<i>Calidris temminckii</i>	Temminck's Stint	M	LC
58		<i>Numenius arquata</i>	Eurasian Curlew	M	NT
59		<i>Limosa limosa</i>	Black-tailed Godwit	M	NT
	Rostratulidae				
60		<i>Rostratula benghalensis</i>	Greater Painted-Snipe	R	LC
61		<i>Gallinago gallinago</i>	Common Snipe	RM	LC
	Recurvirostridae				
62		<i>Himantopus himantopus</i>	Black-winged Stilt	R	LC
	Laridae				
63		<i>Sterna aurantia</i>	River Tern	R	NT
64		<i>Sterna acuticauda</i>	Black-bellied Tern	R	E
65		<i>Larus brunnicephalus</i>	Brown-headed Gull	RM	LC
	Alcedinidae				
66		<i>Ceryle rudis</i>	Lesser Pied Kingfisher	R	LC
67		<i>Alcedo atthis</i>	Small Blue Kingfisher	RM	LC
68		<i>Halcyon smyrnensis</i>	White breasted Kingfisher	R	LC

Residenoncern; NT – Near Threatened; V – Vulnerable; E – Endangeredce Status :R – Resident; RM – Resident Migratory; M – MigratoryConservation Status : LC – Least

and rural surroundings is severely affecting water quality of the lake (Nandi, 2003). As a result, this water bird habitat is under immense pressure, which if not managed and conserved properly, may deteriorate to a level where its suitability to water birds may decline irreversibly. The Upper lake supports many ecosystem services on which many taxa depend. Thus changes in its wetland structure will undoubtedly also affect the related biodiversity especially the associated avifauna. The major threats to avifauna in the area are (i) intense agriculture in the

surrounding villages which is seriously degrading the natural water quality and thus habitat of water birds (ii) uninterrupted effluent discharge leading to high nutrient levels which may lead to increased eutrophication (iii) sedimentation leading to reduced water storage that may influence the open water area required by waterfowl (iv) livestock grazing that disturbs the water birds (v) unmanaged tourism and religious activities also adversely affect bird population.

A list of birds recorded from Upper lake along

with their common names, residence and conservation status is reported in Table 1. In the present study, 68 species of water birds belonging to 7 orders and 14 families are reported at Upper lake. Among these, the most dominating family with 16 species is Anatidae as also observed by Vyas (1992; Vyas *et al.*, 2010) in Upper lake and Balapure *et al.* (2012) in Barna reservoir of M.P. The second dominant family in the present study was Charadriidae with eleven species, Ardeidae with ten species, Ciconiidae with six species, Phalacrocoracidae, Threskiornithidae and Rallidae each with four species, Laridae and Alcedinidae each with three species, Jacanidae and Rostratulidae each with two species while Podicipitidae, Gruidae and Recurvirostridae were all represented by a single species each. Kumar and Gupta (2009; 2013) have also noted that family Anatidae dominated the wetland bird community at Kurukshetra and Chhilchhila Wildlife Sanctuary, Haryana respectively. Verma (2009) reported 68 waterbird species Bharatpur, Bundh Baretha Reservoir where Anatidae, Scolopacidae, and Ardeidae were recorded as the dominant families. Total 39 water bird species belonging to 16 families were reported by Das and Saikia (2011) from Deeporbeel of Assam. Twenty eight species of water birds were reported in three lakes viz. Rajura, Godada and Dhanora lakes of Buldhana district in Maharashtra, India by Joshi (2012).

The waterbird diversity was observed to be



Figure 3 SARUS CRANE at Upper lake of Bhopal

higher during post monsoon and winter months. Deshkar *et al.* (2010) have reported similar observations on seasonal variations in species richness of birds. The high diversity during winter is due to arrival of migratory birds during this season and minimum during summer as during this season all the migratory birds leave the area and return to their home ground. Least number of avian species was recorded in summer and monsoon which may be due to departure of winter visitors, local migration of resident birds, drying of sites making habitats unsuitable for birds in summer season and the commencement of heavy rains in monsoon season. Such behaviour is also reported by Surana *et al.* (2007) in Chimdilake of Nepal. Out of the total 68 species of waterbirds, 43 species (63.24 %) were migratory birds while 25 species (36.76 %) were resident birds. Of all the 43 migratory birds, 27 species (62.79 %) were local migrants and 16 species (37.21 %) were long distance migrants. Chinchkhede and Kedar (2012) reported 54 residents, 9 local migrants and 13 winter migrants among total observed 76 water bird species in and around the Koradi lake of Nagpur. Among all the 68 water bird species using Upper Lake, 11 important species in terms of their conservation status are reported (IUCN, 2014). Of these 11 species, 8 species of Near Threatened status, 2 species of Vulnerable status and 1 species of Endangered status are reported in this study. These Near-threatened species are: Black-Necked Stork (*Ephippiorhynchus asiaticus*), Black-headed Ibis (*Threskiornis melanocephalus*) and River Tern (*Sterna aurantia*) which are all resident water birds; Darter (*Anhinga melanogaster*) (Figure 4), Painted Stork (*Mycteria leucocephala*) and Ferruginous Pochard (*Aythya nyroca*) which are resident migratory water birds; Black tailed Godwit (*Limosa limosa*) and Eurasian Curlew (*Numenius arquata*) which are migrant species of water birds. Among the vulnerable species were 2 water birds - White necked Stork (*Ciconia episcopus*) and Sarus Crane (*Grus antigone*) (Figure 3) which are both

resident birds. One water bird species reported in the endangered category is the Black-bellied Tern (*Sterna acuticauda*) which is a resident bird. Asian Openbill Stork (*Anastomus oscitans*) (Figure 5) is a resident water bird of least concern.

Presence of such important birds as regular visitors as well as some residents in this lake highlights the importance of this area as a bird haven. Water birds like Black-necked Stork and White necked Stork were found along the shoreline areas of the lake with moderate tree canopy which allowed these birds proper roosting sites as well as protection from direct human disturbance. Maheswaran and Rahmani (2001) have reported that higher water level (> 60 cm) is not suitable for wading birds, including the Black-necked Stork even though the patch has more prey species. Sarus Crane and Black-headed Ibis preferred marshy borders of the wetland with more affinity towards surrounding agricultural fields. Thus, these species demonstrated a tendency to endure human presence up to some level. Darter and Painted storks were found preferring areas with dense surrounding vegetation but with least disturbance and moderate water depth. The conversion of wetlands into agricultural fields is altering the preferred habitats of birds and thus negatively impacting their distribution (Del Hoyo et al., 1996; Bird Life International, 2014). The terns were mostly observed at deep water zones of

lake with proper perching sites where the birds could assemble to consume their prey which were for the most part small fishes.

CONCLUSION

Upper lake is an ideal residence for innumerable water birds with different needs. The presence of migratory birds, local migratory and resident species of birds equally utilizing this area as their abode for continuing various lifecycle activities indicates the importance of Upper Lake as a year round habitat for water birds.

However, identification of this lake as a Ramsar site and IBA is alone not sufficient to conserve the entire biodiversity. In the present state of ecologically unmanaged development, full protection to all the existing habitats should be given with special attention during the migratory period. Since the lake is a shared resource, a common property to all the occupants including animals and human being alike, it is imperative to protect or conserve the entire ecosystem. For this, the most notorious component of this arrangement and the principal stakeholder involved in the deterioration process i.e. the human community must be educated about the importance of conserving the lake. With an increasing human population placing strain on the valuable inland freshwater resources and the related



Figure 4 DARTER at Upper lake of Bhopal



Figure 5 OPENBILL-STORK at Upper lake, Bhopal

avifauna due to rapid conversion of rural areas to urban lands, by creating awareness in local people through dispersion of fortifying environmental education concerning disturbance effects on ecosystem especially wildlife could aid in further conservation efforts.

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