

**ORIGINAL ARTICLE**

## **Diversity of Waterbird in Wular lake Jammu and Kashmir, India**

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### **ABSTRACT**

*To know the status of waterbirds in Wular Lake a study was conducted during December, 2008-February, 2009 winter season. The study site was stratified visually into 4 distinguishable habitat categories. Sampling for each site was done by direct count. The observations revealed that the wetland provides habitat for 24 species of waterbirds belonging to 8 orders and 10 families, including 17 species are winter visitor and 7 species are widespread resident (R). The highest density was observed at site III followed by site IV, site I and site II. The species diversity index Shannon-Weiner and Simpson was highest at site III. Whereas, the species evenness was highest at site II followed by site I, site IV and site III. Order Anseriformes has the maximum species diversity followed by Charadriiformes, Coraciiform and so on. Based on the observation, few conservation measures were suggested.*

**Keywords:** Wular, wetland, birds, population, conservation, threats, lake, Kashmir

### **INTRODUCTION**

Wetlands provide home for a large diversity of wildlife including birds, mammals, fish, amphibians, insects and plants [1]. Wetlands in India cover an area of 58.2 million hectares [2]. Approximately 23% (310 of 1340) of the bird species found in India [3] are known to be dependent on wetlands [4]. The preparation of a list of species is basic to the study of avifauna of a site, because a list indicates basic species presence [5]. Past studies have documented the birds communities of different wetland habitats in India [6, 7, 8, 9, 10].

Eleven of 21 Important Bird Areas in the Jammu and Kashmir regions of India fulfill Ramsar criteria and four wetlands are designated as Ramsar sites [11]. The Kashmir-Himalayan valley, well known for its diversity of wetlands has also witnessed increased environmental deterioration due to anthropogenic activities. Overexploitation of resources (e.g., harvesting, fishing, and hunting) of several Kashmir wetlands has caused decline or the near disappearance of many plant and animals species [12]. The major threats to wetlands of Jammu and Kashmir include increased siltation, eutrophication due to run-off from catchments, agricultural conversion, receding open water areas as a result of expanding reed beds, construction of canals, weirs, levees and over-grazing [13]. Due to the importance of the lake a preliminary study was designed to document the distribution of avifauna of Wular Lake.

### **STUDY AREA**

The study was carried out in Wular Lake (34° 15' & 34° -28' N, 74°34' & 74°45' E) on District Bandipora in North Kashmir. The lake encompasses an area of 189 km<sup>2</sup>, and is located about 40 km north-west of Srinagar (Fig. 1). The maximum depth of the lake is 14 meters, the climate is cold and temperate, with temperature remaining below 0°C during winter (December –February) but rising during the rest of the year to 20°C – 25°C (May-June). Annual precipitation varies from 900 mm to 1000 mm annually and begins from June –July and continues till the end of August.

### **MATERIALS AND METHODS**

To assess the waterbird population, data was collected during winter (December- February 2008-2009) season. The study site was stratified visually into 4 distinguishable habitat categories. Sampling for each site was done by direct count. In order to avoid double counting or missing birds, a vantage point was used. Counting was done with the aid of a 10 x 80 field binoculars. Data was collected by recording the number of individuals of each species (species-wise count). Birds were identified to species level using available field guides [14]. Double counting was avoided by

recording the birds that flew into and out of the plots during the census. Counts were not made on days with rain, snowfall, and strong wind [15]. Simpson's (1-D) and Shannon- Wiener (H') indices is used to evaluate the bird species diversity.

## RESULTS

The observations revealed that the wetland provides habitat for 24 species of waterbirds belonging to 8 orders and 10 families, including 17 species are winter visitor and 7 species are widespread resident (R) (Table 1). Species diversity of the identified waterbird showed variation between sites. The highest density was observed at site III (22 species) followed by site IV (17), site I (14) and site II (13). The species diversity index Shannon-Weiner and Simpson was highest at site III (2.56 and 0.91). Whereas, the species evenness was highest at site II (0.70) followed by site I (0.66), site IV (0.61) and site III (0.58) (Table 2).

**Table 1. Birds identified in Wular Lake during December 2008 to February 2009**  
Status\* (LC= Least concern, R= resident, WM= winter migrant)

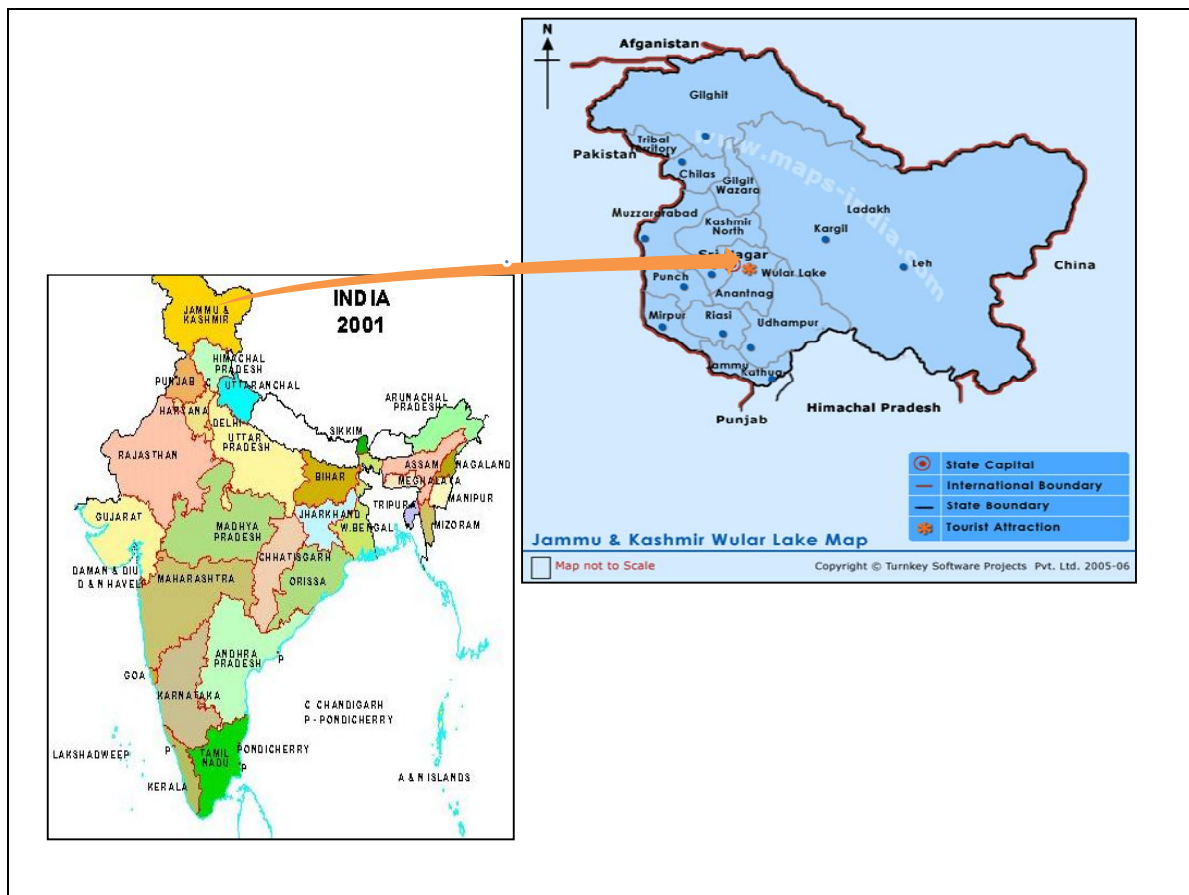
Order	Family	Common/ Scientific name	Status		
Charadriiformes	Recurvirostridae	Black-winged Stilt ( <i>Himantopus himantopus</i> )	LC (R)*		
	Scolopacidae	Common Sandpiper ( <i>Actitis hypoleucos</i> )	LC (WM)*		
		Common Snipe ( <i>Gallinago gallinago</i> )	LC (WM)*		
Anseriformes	Anatidae	Northern Pintail ( <i>Anas acuta</i> )	LC (WM)*		
		Northern Shoveler ( <i>Anas clypeata</i> )	LC (WM)*		
		Common Teal ( <i>Anas crecca</i> )	LC (WM)*		
		Eurasian Wigeon ( <i>Anas penelope</i> )	LC (WM)*		
		Common Mallard ( <i>Anas platyrhynchos</i> )	LC (WM)*		
		Gadwall ( <i>Anas strepera</i> )	LC (WM)*		
		Greylag Goose ( <i>Anser anser</i> )	LC (WM)*		
		Red-crested Pochard ( <i>Netta rufina</i> )	LC (WM)*		
		Common Teal ( <i>Anas crecca</i> )	LC (WM)*		
		Ruddy Shelduck ( <i>Tadorna ferruginea</i> )	LC (WM)*		
		Coraciiformes	Alcedinidae	Common Kingfisher ( <i>Alcedo atthis</i> )	LC (R)*
				Pied Kingfisher ( <i>Ceryle rudis</i> )	LC (R)*
			Halcyonidae	White-throated Kingfisher ( <i>Halcyon smyrnensis</i> )	LC (R)*
Falconiformes	Accipitridae	Eurasian Marsh Harrier ( <i>Circus aeruginosus</i> )	LC (WM)*		
Ciconiiformes	Ardeidae	Gray Heron ( <i>Ardea cinerea</i> )	LC (WM)*		
		Indian Pond-Heron ( <i>Ardeola grayii</i> )	LC (R)*		
		Little Egret ( <i>Egretta garzetta</i> )	LC (R)*		
Pelecaniformes	Phalacrocoracidae	Great Cormorant ( <i>Phalacrocorax carbo</i> )	LC (WM)*		
Podicipediformes	Podicipedidae	Little Grebe ( <i>Tachybaptus ruficollis</i> )	LC (WM)*		
Gruiformes	Rallidae	Common coot ( <i>Fulica atra</i> )	LC (WM)*		
		Indian moorhen ( <i>Gallinula chloropus</i> )	LC (R)*		

Of the total identified birds Common Mallard (*Anas platyrhynchos*) were counted highest at site III (674) and IV (122) followed by Indian Pond-Heron (*Ardeola grayii*) at site I (208) and Little Grebe (*Tachybaptus ruficollis*) at site II (202) (Fig.2). The order-wise proportion of species richness of waterbirds varied from 42% to 4 % as follows: order: Anseriformes with 10 species (42%) followed by Charadriiformes, Coraciiform and Ciconiiformes with 3 species each (13 %), Gruiformes 2 species (8%) and Falconiformes, Pelecaniformes, Podicipediformes by a single species each (4%) (Fig.3).

**Table 2. Species diversity of birds in Wular Lake**

Sites	Species	Individuals	D	H'	1-D	H/S
Ningli (I)	14	744	0.14	2.22	0.86	0.66
Watlab (II)	13	692	0.15	2.21	0.85	0.70
Shahgund (III)	22	4816	0.09	2.56	0.91	0.59
Zalwan (IV)	17	496	0.13	2.28	0.87	0.62

D= Diversity Index; H' = Shannon-Wiener Index; 1-D= Simpson Index; H'/S= Evenness



**Figure1.** Map of India indicating the location of Wular Lake

**DISCUSSION**

[16] recorded 853 birds from Shallabug wetland, Kashmir. [17] Conducted bird surveys in 9 Kashmir wetlands and reported 11 species were most abundant in February and lowest in March. Our results indicated a similar pattern, where maximum congregation of winter visitor species occurred in January. Species diversity and evenness revealed that site III had the highest diversity and site I had the highest evenness. In these sites (site III and I) more area is covered by water and aquatic microphyte as compared to site II and IV. In the present study, floating vegetation revealed highest congregations of waterbirds. This was attributed to availability of large food resources in these habitats. The maximum individuals of Mallard, Pond Heron and Little Grebe in the study site shows these species preferred water depths of less than 1 metre (3.3 ft), and avoiding areas more than a few metres deep. They are attracted to bodies of water with aquatic vegetation [16]. Previous

study on waterbird population of Hokersar wetland found shallowness of areas in the wetland as positively correlated to waterfowl abundance [12].

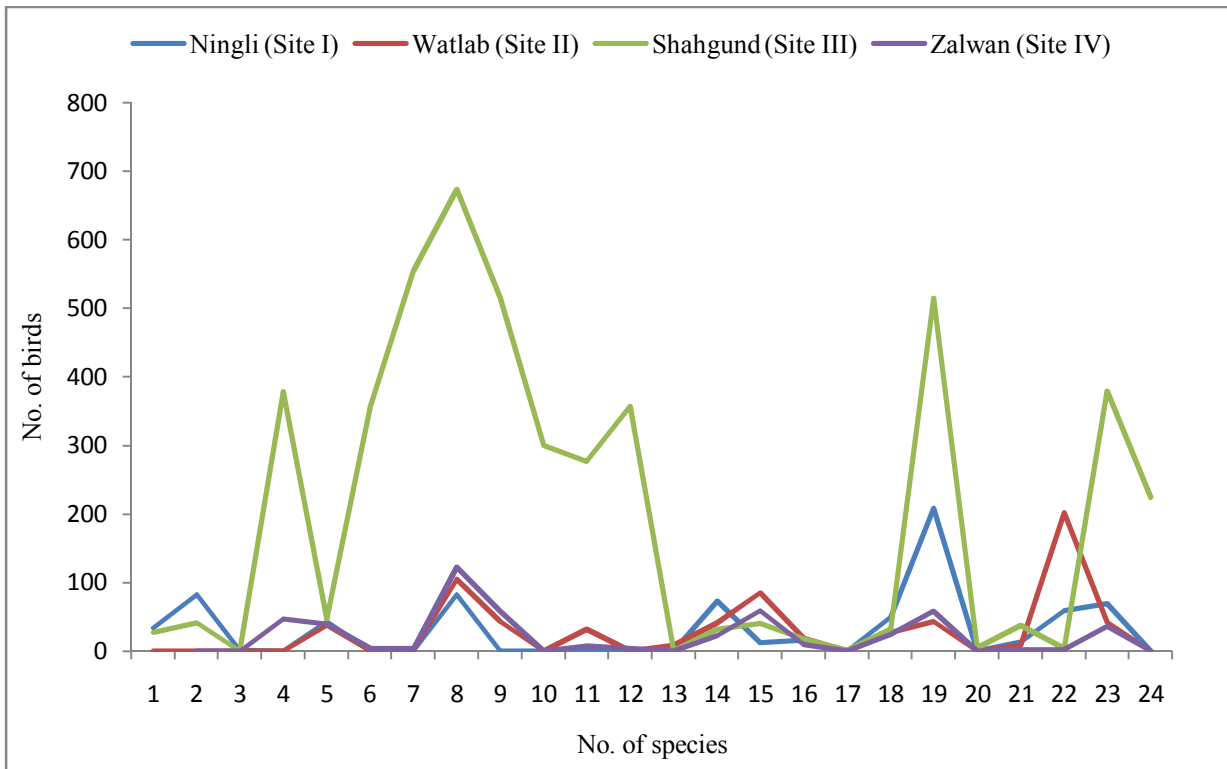


Figure 2. Birds of different species counted in four different location of Wular Lake

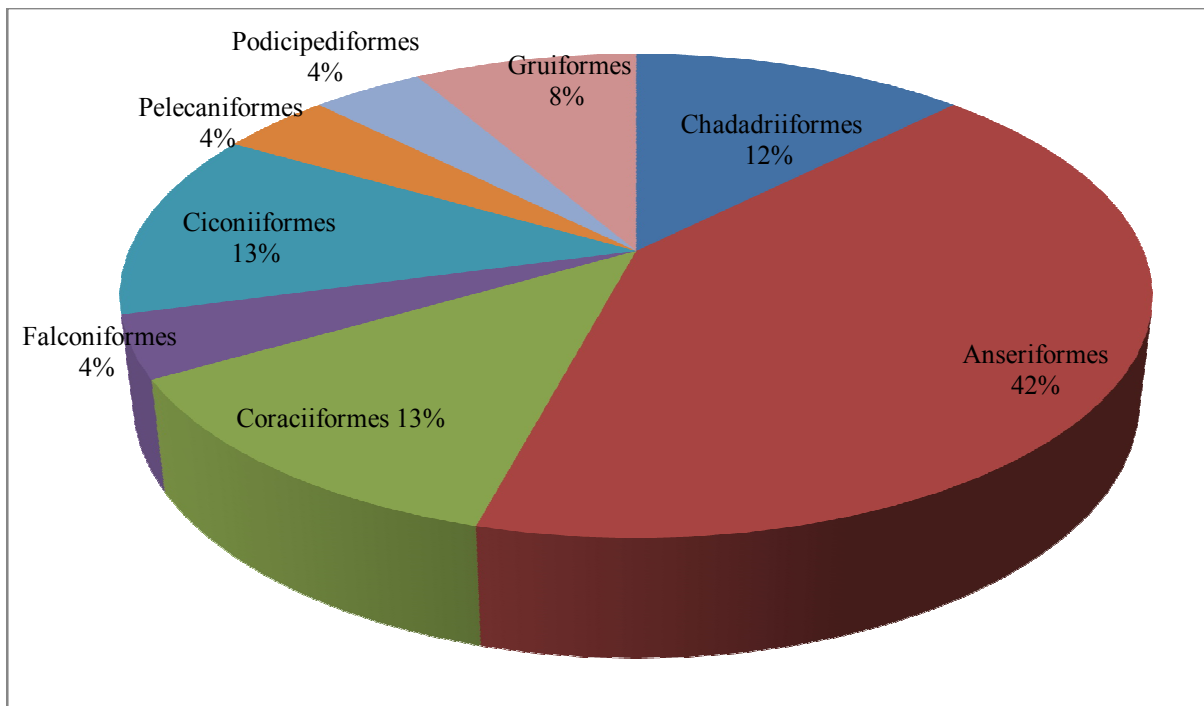


Figure 3. Proportion of order as represented by species richness of waterbirds in Wular Lake

Waterfowl mainly dabbling ducks ecologically prefer areas with low water depth to dabble or sieve seeds and invertebrates from shallow water [17]. Moreover, large areas of site I and III were inaccessible to people, this may contribute to favorable conditions for feeding and roosting of

water birds. In natural habitats where human intervention was less, avian species diversity and evenness was higher than disturbed sites where intensive farming was carried out [18]. Anatids existed as dominant groups and contributed maximum to water bird population in the Wular Lake. This indicates structure of water bird community as related to diversity in habitats of wetlands. The results clearly revealed diversity of habitats as the main factor which contributed to diverse populations of water bird communities.

Wetlands of Kashmir valley provide wintering resort to millions of migratory birds particularly the waterfowl (ducks, geese and swans) and conducive breeding grounds to a segment of resident and non-resident summer migrants [17]. At the close of the 19<sup>th</sup> century the area of Wular Lake was about 225 km<sup>2</sup> but during the last century its size has been reduced by more than 66% mainly due to human disturbance in the basin as well as in its catchments area [19]. The major problem in the Wular Lake is the increasing rate of siltation, which has caused a noticeable deterioration in wetland quality in recent years. Other threats include encroachment as more land is converted to rice paddy, and heavy grazing damages in some parts of the marsh (personal observation). Similar loss of wetland habitat was also observed in the Hokersar and Hygam wetlands [17, 20]. Unless appropriate conservation measure is taken, remaining wetland habitats may be lost in the near future.

## CONCLUSION

The occurrence of an average population of 24 waterbird species during the study period is, perhaps, an indication of the fact that in near future the Wular Lake becomes a favorable habitat for waterbirds. In spite of its importance, both ecological and socio-economic, the Wular Lake has received little attention. We recommend initiating a detail study on population status of waterbirds with periodic monitoring in Wular Lake for its future conservation and management.

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