



## Avifaunal occurrence and distribution of wetland birds in Sakhya Sagar and Madhav Lakes in Madhav National Park, Shivpuri, India

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### Publication Info

Paper received:  
23 October 2012

Revised received:  
24 March 2013

Accepted:  
19 August 2013

### Abstract

The present study on wetland birds was carried out at Madhav National Park, Shivpuri, M.P., India. This Park comprises of two lakes namely Sakhya Sagar and Madhav Lakes, which support fascinating wildlife. These lakes are winter resorts for variety of migratory birds for shelter, breeding, nesting and provide a suitable habitat for several resident and local migratory wetland bird species. This paper assesses the occurrence of 73 wetland birds (18 families and 8 orders) with their distribution in different locations and habitats. The present study provides a comprehensive checklist of wetland birds of Sakhya Sagar and Madhav Lakes by covering 15 locations and 10 habitats utilized by migratory, resident migratory and resident wetland bird species during different seasons of year and at various sighting frequencies.

### Key words

Distribution, Madhav Lake, Sakhya Sagar, Wetland birds

### Introduction

Wetland birds play a significant role in wetland ecosystem. Wetland birds are an important component of wildlife and their occurrence and distribution are an important phenomenon to understand the overall picture of wetland habitat. Birds are one of the best indicators of environmental changes. The population of birds in any kind of ecosystem shows the environmental quality of the area, pollution level, security and availability of food and habitat. According to Rathore and Sharma (2000), birds present in or near lake are affected by several factors such as pollution, disturbance by human activities and lack of maintenance of water bodies. Most of the birds have specific habitat requirements from season to season, a loss of which may lead to their extinction (Chauhan *et al.*, 2008). Of 1340 bird species found in India (Ali and Ripley, 1987; Manakandan and Pittie, 2001), around 310 species are known to be dependent on wetlands (Kumar *et al.*, 2005). Fulfilling the habitat requirements of water birds is one of the most important functions performed by wetlands. Loss of anthropogenic habitat more closely related to habitat loss than to any other aspect of human

activity such as use of agricultural pesticides, poaching and hunting, or human population density. Hence, this study was taken up to assess the occurrence and distribution of wetland birds in two water bodies. As a wetland ecosystem, this area is large, protected and premier roosting and nesting ground for many wetland birds and include some globally near threatened birds and several other taxa of fauna and flora.

### Materials and Methods

**Study area :** Madhav National Park, Shivpuri is one of the 9 National Parks of Madhya Pradesh. It is situated on Agra-Bombay highway (NH-3), 115 km., south of Gwalior. The park is situated northern part of Madhya Pradesh and represents northern tropical dry deciduous mixed forest type. The park lies between 77° 38' to 77° 57' E longitude and 25° 20' to 25° 38' N latitude at an altitude of 380 to 480 m amsl. Sakhya Sagar and Madhav Lakes are located in the central zone of the park. Both the lakes are jewels in the dry deciduous landscape of Madhav National Park and life-line of plants and animals of the park. Sakhya Sagar Lake and Madhav Lake are spread in an area of 309.01 ha and 49 ha,

respectively. Sakhya Sagar Lake (Chandpatha Lake) lies between 77° 43' E longitude and 25° 26' N latitude and Madhav Lake lies between 77° 44' E longitude and 25° 26' N latitude. They are man-made lakes and about 25 sq. km. of forest is spread around these lakes. These lakes attract number of wetland bird species for nesting, feeding, breeding and wintering grounds, utilized by different species of both resident as well as migratory birds. These lakes add to the natural beauty of the area and also provide a permanent source of water to the wildlife, and a fine wetland habitat to the wetland birds. Sakhya Sagar Lake is most valuable wetland recognized by International Union for Conservation of Nature and Natural Resources (IUCN, 1989) and is also considered as one of the most important wetlands of Asia. Recently, Sakhya Sagar Lake is listed as important wetlands under National Wetland Conservation Programme (NWCP, 2009).

The study was carried out from October, 2006 to February, 2008. Regular surveys were done in and around Sakhya Sagar and Madhav Lakes to enlist the species of wetland birds throughout the survey period. The survey was conducted from 7 to 10 a.m. and from 3 to 7 p.m. using binocular (Olympus, 7×50), for direct visual count. Birds seen were recorded along with their status, seasonal visits, frequency of sighting, locations and habitat types. Standard guides such as Ali and Ripley (1987) Grimmet *et al.*, (1999) and Ali (2002) were referred for identification, taxonomic position and nomenclature of wetland birds. Sub-specific identification was not made because all the observations were visual and no birds were caught for identification in hand.

In an attempt to investigate the wetland birds observed in the study area, they were categorized according to their occurrence throughout the study period. Wetland birds recorded in the present study are listed in Table 1, with their status, seasonal visit and sight frequency. The status of bird species was divided in to three types respectively as migrants, resident migrants and resident. Seasonal visit of these birds was categorized as winter visitors, vagrant and every season. Similarly, the sight frequency was divided in to four types as common, fairly common, uncommon and rarely seen species.

**Key for occurrence :** The occurrences of wetland birds in the study area were established upon the following criteria:

**Status :** Migratory (M), the birds that visit lakes annually during specific season and which are not resident of study area are termed as migratory. Resident Migratory (RM), the birds which although reside in India during rest of the period but arrive the study area for some time and breeding in surrounding areas are termed as resident migratory. Resident (R), the birds indigenous and residing in the area throughout the year and which breed in the study area itself are termed as local or resident. **Seasonal visitors-** Winter Visitors (WV), birds visiting lakes from winter

season (October to February) are termed as winter visitors. Vagrant (V), birds that are seen in one part of the study area in one season and move to other parts within the same season or different season is categorized as vagrant species. The local movements of birds highly depends on availability of resources of the study area. Every Season (ES), birds which sighted in all the visits throughout the year.

**Sight frequency :** (Kumar and Gupta, 2009), Common (C), recorded 9 - 10 times out of 10 visits. Fairly Common (FC), recorded 6 - 8 times out of 10 visits. Uncommon (U), recorded 3 - 5 times out of 10 visits. Rare- (Rr), recorded 0 - 2 times out of 10 visits.

**Key for distribution :** The distribution of wetland birds on the basis of locations and habitats are as follow :

**Locations :** Near Bhadaiya Kund- (BK), Landing No.-1 (L-1), Landing No.-2 (L-2), Landing No.-3 (L-3), Landing No.-4 (L-4), Landing No.-5 (L-5), Landing No.-6 (L-6), Landing No.-7 (L-7), Landing No.-8 (L-8), Landing No.-9 (L-9), Landing No.-10 (L-10), Near Saling Club- (SC), Near Pump House- (PH), Mound Area in Water- (MAW), Northern bank of Lake- (NB) Fig.1.

**Habitat types :** Submerged vegetation (H-1), Emergent vegetation (H-2), Floating vegetation (H-3), Open water (H-4), Muddy shoreline (H-5), Shallow marshy area (H-6), Rocky area near water (H-7), Tree and bushes standing near water (H-8), Reeds and grasslands near water (H-9) and Fly over and around water bodies (H-10).

## Results and Discussion

The present survey revealed the presence of 73 species of wetland birds belonging to 18 families and 8 orders. The family wise proportion of species richness of wetland birds varied from 24.66% to 1.37%. Family Anatidae with 18 species (24.66%), followed by Charadriidae 10 (13.7%), Ardeidae 9 (12.33%), Ciconiidae 6 (8.22%), Phalacrocoracidae, Rallidae and Laridae with 4 species each (5.47%), Threskiornithidae and Alcedinidae with 3 species each (4.11%), Accipitridae, Gruidae and Jacanidae with 2 species each (2.74%) and Podicipitidae, Pelecanidae, Rostratulidae, Recurvirostridae, Burhinidae and Glareolidae by single species each (1.37%). Individuals of the families Ardeidae, Podicipitidae, Rallidae, Jacanidae, Rostratulidae, Recurvirostridae, Burhinidae and Alcedinidae, were observed to be dominant throughout the survey period.

Out of 73 species of birds found in Sakhya Sagar and Madhav Lakes, 25 species were residents, 29 resident migrants and 19 migrants. 38 winter visitors, 23 vagrant and 12 species were seen in every season. 26 were common, 22 fairly common, 20 uncommon and 5 species were rarely seen. The distribution of wetland birds is based on availability of food at various locations, where different bird species were recorded frequently. A total of 12

location sites in Sakhya Sagar Lake and 03 sites in Madhav Lake were recorded. In Sakhya Sagar Lake, the landing No. 5 had 64 wetland bird species, which was highest in number, 41 at Landing No. 3, 29 species near Bhadaiya Kund, 28 species at Landing No. 4, 24 species at Landing No. 10, 22 species at near Sailing Club, 13 species at Landing No. 1, 12 species at Landing No. 2, 08 species at Landing No. 9, 3 species at Landing No. 6 and Landing No. 8 and only 2 species were observed at Landing No. 7. In Madhav Lake, the highest number of wetland species was 28 at Mound area, 19 species were counted near Pump House and 09 species were recorded at Northern Bank of the lake.

In the present study, 10 categories of habitats were observed. Wetland birds were found to utilize different habitats extensively for foraging, nesting and roosting on the emergent and fringed vegetation. Some water birds require a cluster of platforms within the water bodies in order to sit for basking during winters. On the basis of observation, 44 wetland bird species were recorded utilizing shallow marshy areas, 43 species used muddy shoreline habitat, 29 species used areas with submerged vegetation, 21 species were found in open water, 18 species in

reeds and grasslands, 17 species in rocky area near water, 16 species in emergent vegetation, 11 species in floating vegetation, 08 species were found in trees and bushes standing near water bodies and 08 species were recorded flying over and around water bodies. It was also noted that many species used two or more locations and habitats.

Out of 73 species of wetland birds, 69.88 % birds are highly dependent on water bodies of the Park. Chandra and Nema (2006) provided a complete checklist of birds, including terrestrial and arboreal birds (239 species, 58 families) from Madhav National Park. Kumar *et al.*, (2006) assessed the status of 310 Indian wetland birds. Gupta *et al.* (2011) surveyed various wetlands of Tamil Nadu which are the premier roosting and nesting grounds for many wetland birds including some globally threatened and near threatened species. Bhat *et al.* (2009) recorded avifaunal diversity of Anekere wetland, Karnataka and recorded the seasonal change in density and diversity of 44 bird species. Seasonal fluctuations of birds occur due to change in weather conditions or fluctuation in food productivity and habitat quality (Norris and Marra, 2007). Many



Fig. 1 : Map of Sakhya Sagar Lake and Madhav Lake showing different location sites



wetland birds are locally displaced in different seasons. Stay of any migratory birds at one place during visiting period depends on temperature, security, food availability and water level. Maximum migratory birds began to arrive in mid of October or starting of November and all of them leave by end of March or mid of April. Winter migratory birds that arrived in Madhav National Park were 14% in October, 33% in November, 46% in December and 07% in mid of January. The departure began from February and was completed by April. The percentage of species that departed from Madhav National Park was 17% in February, 49% in March and 34% in April. The migratory birds prefer muddy or stony habitat with well-developed weed infestation. According to Sahu and Rout (2005), submerged vegetation attracts more number of migratory birds. Water birds were found to utilize different wetland habitats extensively for foraging, nesting and roosting on the emergent and fringed vegetation (Kumar and

Gupta, 2009). Sakhya Sagar Lake has rocky and sloppy treeless banks on some landing areas and so during winters hundreds of migratory and other water birds come there for wintering. This may be due to fewer disturbances, long marshy shoreline; availability of abundant food and more aquatic vegetation are easily found in this lake. Madhav Lake has steep rocky bank and is surrounded very closely by tree growth so the number of migratory birds visiting this lake is less, but there are some mound area inside water, trees and bushes; and different aquatic vegetation are well developed in this area which inhabits many resident wetland birds. Most of wetland birds depend on aquatic vegetation for different purposes like feeding and habitat, as breeding and nesting ground. Sakhya Sagar Lake has large muddy and marshy habitat and shoreline between L. No. 2 to 5 and L. No. 8 to 10 are fully secured and inhabits important aquatic vegetation like *Hydrilla verticillata*, *Vallisneria spiralis*, *Chara*,

**Table 1** : List of wetland birds with their occurrence and distribution in Sakhya Sagar and Madhav Lakes of Madhav National Park, Shivpuri

Order/Families	Occurrence			Distribution		
	Name of species	Status	Seasonal visitors	Sight frequency	Locations	Habitat types
<b>Podicipediformes / Podicipitidae</b>						
Little Grebe	R	V	FC	L-1, 4, 5, 6, MAW	H-1, 3, 4, 6	
<b>Pelecaniformes / Pelecanidae</b>						
Great White Pelican	RM	WV	U	L-3, 4	H-4, 5	
<b>Phalacrocoracidae</b>						
Little Cormorant	RM	V	FC	BK, L-1, 2, 4, 5, 10, SC, NB	H-4, 6, 7, 8	
Great Cormorant	RM	WV	C	L-2, 3, 5	H-4, 5	
Indian Shag	RM	WV	FC	L-2, 3, 5, MAW	H-4, 5	
Darter or Snake Bird	RM	V	C	L-1, 3, 4, 5, SC, MAW	H-4, 6, 7, 8, 9	
<b>Ciconiiformes / Ardeidae</b>						
Indian Pond-Heron	R	ES	C	BK, L-1, 2, 5, SC, PH, MAW	H-1, 3, 5, 6, 9	
Grey Heron	RM	V	FC	BK, L-4, 10, SC, MAW	H-1, 2	
Purple Heron	RM	WV	U	BK, L-1, 5, 9, PH, MAW	H-3, 6, 7	
Little Green Heron	R	V	FC	BK, L-1, SC, MAW	H-5, 6, 9	
Night Heron	R	V	U	BK, L-3, 5, MAW	H-1, 5, 9	
Cattle Egret	RM	ES	C	BK, L-1, 2, 5, 6, 8, SC, PH, MAW	H-1, 5, 6, 9	
Large Egret	RM	ES	C	BK, L-2, 4, 5, SC, MAW, NB	H-1, 6, 9	
Median Egret	RM	V	FC	BK, L-2, 5, SC, MAW	H-1, 2, 5, 6, 9	
Little Egret	R	V	FC	BK, L-1, 2, 5, SC, PH, MAW	H-1, 3, 5, 6, 9	
<b>Ciconiidae</b>						
Painted Stork	RM	V	C	L-3, 4, 5, SC, MAW	H-1, 6, 8	
Asian open bill stork	R	V	C	L-3, 4, 5, MAW	H-5, 6	
European White Stork	M	WV	U	L-3, 4, 5	H-5, 6	
White-necked Stork	RM	WV	FC	BK, L-4, 5, MAW	H-5, 6	
Lesser Adjutant Stork	RM	WV	FC	L-3, 5, 10	H-5, 6	
Black-necked Stork	R	V	FC	L-3, 4, 5, MAW	H-5, 6	
<b>Threskiornithidae</b>						
Oriental White Ibis	R	V	U	L-3, 5, 9	H-4, 5	
Black Ibis	R	V	U	L-3, 5, 9	H-1, 5, 6	
Eurasian Spoonbill	RM	WV	C	L-3, 4, 5, MAW	H-1, 2, 5, 6	
<b>Anseriformes / Anatidae</b>						
Grey-leg Goose	M	WV	C	L-2, 3, 5	H-4, 5, 6	
Bar-headed Goose	RM	WV	C	L-2, 3, 5	H-4, 5, 6	
Brahminy Shelduck	RM	WV	C	L-1, 2, 3, 5, 10, MAW	H-1, 2, 4, 6	
Comb-duck	RM	WV	C	L-3, 4, 5	H-1, 2, 6	

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Lesser-Whistling Duck	R	V	FC	L-3, 5, 6, 10, MAW, NB	H-5, 6, 7
Large Whistling Duck	RM	WV	FC	L-3, 5, L-10, SC	H-5, 6, 7
Northern-Pintail	M	WV	FC	L-3, 5	H-1, 2, 4, 6
Gadwall	M	WV	U	L-3, 4, 5	H-1, 2, 4
Shoveller	M	WV	C	L-3, 4, 5	H-1, 2, 4
Common Teal	M	WV	C	L-3, 4, 5, NB	H-1, 2, 4
Red-Crested Pochard	M	WV	Rr	L-3, 4, 5	H-5, 6
Ferruginous Pochard	RM	WV	Rr	L-3, 4, 5	H-4, 6
Common Pochard	M	WV	FC	L-3, 4, 5	H-4, 6
Tufted Pochard	M	WV	U	L-3, 4, 5	H-1, 4, 6
Mallard	RM	WV	U	L-3, 4, 5	H-1, 2, 4
Eurasian Wigeon	M	WV	FC	L-3, 4, 5	H-1, 4, 6
Garganey	M	WV	FC	L-3, 4, 5	H-1, 2, 6
Cotton teal	R	ES	C	L-2, 3, 4, 5, MAW, NB	H-2, 4, 6
<b>Falconiformes / Accipitridae</b>					
Marsh Harrier	M	WV	U	BK, L-8, MAW	H-8, 9, 10
Osprey	RM	WV	U	BK, L-8, MAW	H-8, 9, 10
<b>Gruiformes / Gruidae</b>					
Common Crane	M	WV	Rr	L-5, 10	H-5, 6
Sarus Crane	RM	V	Rr	L-5, 10	H-5, 6
<b>Rallidae</b>					
White-Breasted Waterhen	R	V	C	BK, L-4, 9, MAW	H-1, 2, 3, 9
Common Moorhen	RM	WV	C	BK, L-4, MAW	H-1, 2, 3, 9
Purple Moorhen	R	V	FC	L-4, 5, 9, MAW	H-1, 2, 3, 9
Common Coot	RM	WV	C	BK, L-5, 9, PH, MAW	H-1, 2, 3, 4
<b>Charadriiformes / Jacanidae</b>					
Pheasant-tailed Jacana	R	V	FC	L-4, 5, 8, MAW	H-1, 3, 9
Bronze-Winged Jacana	R	ES	C	L-4, 5, 8, MAW	H-1, 3, 9
<b>Charadriidae</b>					
Red-wattled Lapwing	R	ES	C	BK, L-1, 5, 10, SC, PH, NB	H-5, 7, 9, 10
Little ringed plover	RM	WV	C	L-3, 5, 10	H-5, 6
Golden Plover	M	WV	U	L-5, 10, SC, PH	H-5, 7, 9
Spotted Redshank	M	WV	U	L-3, 5, 10, PH	H-5, 6
Common Redshank	RM	WV	FC	BK, L-3, 5, 9, PH, NB	H-5, 6
Marsh Sandpiper	M	WV	FC	BK, L-3, 5, PH	H-1, 5, 6
Common Sandpiper	RM	WV	U	BK, L-3, 5, 9, PH	H-5, 6
Jack Snipe	M	WV	U	L-3, 5	H-5, 6
Little Stint	M	WV	FC	L-3, 5, 10	H-5, 6
Ruff	M	WV	U	L-3, 5	H-5, 6
<b>Rostratulidae</b>					
Painted Snipe	R	V	U	BK, L-3, 5 SC, PH	H-5, 6, 7
<b>Recurvirostridae</b>					
Black winged Stilt	R	ES	C	BK, L-1, 5, 10, SC, PH	H-1, 3, 5, 6, 9
<b>Burhinidae</b>					
Stone-Curlew	R	ES	C	BK, L-5, 10, SC, PH	H-5, 7
<b>Glareolidae</b>					
Indian Courser	R	ES	U	L-1, 3, 10, PH	H-5, 7
<b>Laridae</b>					
River Turn	RM	V	U	BK, L-5, 10, SC	H-5, 7, 10
Little Turn	R	V	FC	BK, L-5, 10, SC, PH	H-5, 7, 10
Brown headed Gull	RM	V	Rr	BK, L-5, 10, SC	H-5, 7, 10
Indian Skimmer	R	V	U	L-5, 10	H-5, 7, 10
<b>Coraciiformes / Alcedinidae</b>					
Lesser Pied Kingfisher	R	ES	C	BK, L-5, 10, SC, PH	H-7, 8, 10
Small Blue Kingfisher	R	ES	C	BK, L-10, SC, PH, NB	H-7, 8
White-breasted Kingfisher	R	ES	C	BK, L-1, 5, 10, SC, PH, NB	H-5, 7, 8

(M) = Migrant, (RM) = Resident Migrant, (R) = Resident, (WV) = Winter Visitors, (V) = Vagrant, (ES) = Every Season, (C) = Common, (FC) = Fairly Common, (U) = Uncommon, (Rr) = Rarely seen;\* Many species of these wetland birds used two or more locations and habitats in the study area

*Potamogeton* (Submerged), *Scirpus*, *Typha*, *Phragmites* (Emergent) and *Nymphaea nuchalis*, *Nymphaoides* (Floating) are well developed and well spread in the lakes. Water hyacinth though assuming weed proportion, serves as a good habitat and nesting site to wetland birds. Many wetland bird species are generally heterogenous in their feeding habits. Available fauna viz., crabs, snails, calms, worms, insects larvae and pupae in the surrounding area of water body may constitute their feed. Abundance of fish species also provided food securities for wetland birds in both lakes. This shows that the habitat conservation of water bodies is most important for sustaining the population of migratory and other wetland birds. The shallow open water and marshy area supports a variety of aquatic and semi aquatic vegetation that provides an adequate food spectrum and good habitation for living of these wetland birds.

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