

# **Resident and Non-Resident Birds of Dal Lake and Anthropogenic Factors affecting them**



## **DISSERTATION**

**Submitted to the University of Kashmir in partial fulfillment of  
the requirements for the Award of the Degree of**

**Master of Philosophy (M.Phil.)  
in  
Zoology**

**By  
Syed Gousia Nisar**

**Under the Joint Supervision of**

**Supervisor**

**Prof. G. Mustafa Shah**  
Dean Biological Science &  
Prof. P. G. Department of Zoology  
University of Kashmir

**Co-Supervisor**

**Prof. Ulfat Jan**  
Prof. P. G. Department of Zoology  
University of Kashmir

**DEPARTMENT OF ZOOLOGY**

**Faculty of Biological Sciences  
University of Kashmir  
Srinagar-190006, Kashmir  
October 2012**



**POST GRADUATE DEPARTMENT OF ZOOLOGY**  
**Faculty of Biological Sciences**  
**UNIVERSITY OF KASHMIR**  
**Hazratbal, Srinagar – 190 006, Kashmir**

*No.:* \_\_\_\_\_

*Dated:* \_\_\_\_\_

## *Certificate*

Certified that the dissertation entitled “**Resident and Non-Resident Birds of Dal Lake and Anthropogenic Factors affecting them**” submitted by **Syed Gousia Nisar** for the award of **M.Phil.** Degree in Zoology, is based on original research work carried out by her under our supervision. This dissertation has not been submitted in part or in full, to any University/Institution for any degree. The candidate has fulfilled all the statutory requirements for the submission of the dissertation.

### **Supervisor**

**Prof. G. Mustafa Shah**

Dean Biological Science &  
Prof. P. G. Department of Zoology  
University of Kashmir

### **Co-Supervisor**

**Prof. Ulfat Jan**

Prof. P. G. Department of Zoology  
University of Kashmir

### **Prof. M. Nayyar Azim**

Professor & Head  
Department of Zoology  
University of Kashmir

# CONTENTS

Chapter No.		Page No.
	<b>Acknowledgement</b>	
<b>1</b>	<b>INTRODUCTION</b>	<b>1-3</b>
<b>2</b>	<b>REVIEW OF LITERATURE</b>	<b>4-12</b>
<b>3</b>	<b>STUDY AREA</b>	<b>13-14</b>
<b>4</b>	<b>MATERIALS AND METHODS</b>	<b>15-16</b>
<b>5</b>	<b>RESULTS</b>	<b>17-61</b>
	• Species composition	17
	• Habitat Use	59
<b>6</b>	<b>DISCUSSION AND CONCLUSION</b>	<b>62-67</b>
<b>7</b>	<b>MANAGEMENT AND CONSERVATION</b>	<b>68-71</b>
	<b>REFERENCES</b>	<b>72-82</b>

## LIST OF TABLES

Table No.	Title of the Table	Page No.
1	Combined monthly population of various bird species recorded from 4 sites of Dal lake	44
2	Diversity of bird species at different study sites	55
3	Check list of birds recorded from Dal lake	56



*Dedicated  
To  
My Parents*

## **ACKNOWLEDGEMENT**

*It gives me great pleasure to express my sincere and heartfelt thanks to all those who helped me during the period of my research. First and foremost, I feel great pride and pleasure in putting on record, a deep sense of gratitude to my supervisor, **Prof. G. Mustafa. Shah**, Dean Biological Science, and Ex-Head, Department of Zoology, University of Kashmir, Srinagar, under whose supervision I completed this research work. I pay my homage and sincere thanks to him for his invaluable suggestions. I always received enlightenment, inspiration, and encouragement throughout his guidance. Despite his over busy schedule, finding time for suggestions and concomitant track of events is commendable. I owe a lot to him.*

*I pay my sincere thanks to **Prof. Ulfat Jan**, P. G. Department of Zoology, University of Kashmir, Srinagar, for her co-supervision and help to boost my morale during the course of study. I express my sincere gratitude for her extremely valuable guidance, encouragement and untiring efforts to enable me to complete this work. I am highly thankful to her for her trust, the easy and straight forward cooperation and motivating and encouraging words.*

*It is my obligation to express my sincere thanks to **Prof. M. N. Azim**, Professor and Head, Department of Zoology, for providing requisite working facilities in the Department.*

*My sincere thanks are due to all teaching and non teaching staff of Department of Zoology for their kind help, support and cooperation. I extend my thanks to Dr. Fazili and Dr. Bilal Assistant Professors, P.G. Department of Zoology, University of Kashmir, for their valuable suggestions.*

*My friends and colleagues viz, Raashid, Umer, Aijaz, Muneera, Tanzeel, Jameela, Tahilla, Sunober and Rehana deserve special thanks for their cooperation and valuable suggestions*

*I owe everything to my parents. Their care, support, affection and right guidance is beyond the scope of words. This work definitely would not have evolved without their persistent help and guidance*

*My special thanks are due to my mother, who has always been a beacon of my life and stood like a rock to give me encouragement in my tough times.*

*Lastly, thanks are due to Virus Computers for composing this manuscript so neatly and beautifully.*

*There are so many others who have been helpful to me in one or the other way. I would like to thank them all. May Allah bless them.*

***Syed Gousia Nisar***

**K**ashmir is a beautiful Himalayan valley with breath taking mountain scenery, magnificent forests, fields, lakes, marshes, huge vegetation and wetlands. Kashmir valley measures about 130 km in length and over 40 km in width with a total area of 15120 sq.km (Majid, 1987) and situated in the middle of Himalayan range between latitude 33-35°N and longitude 73-76°E at an attitude of 5000 feet above sea level (Koul, 1913).

The valley of Kashmir is rich in bird fauna. A variety of habitats exist in the valley which inhabit different combination of bird species. The water birds of the valley are most famous and considerable amount of work has been conducted on them. (Shah 1984; Fazili 2002; Ahanger 2008).

Birds are often common denizens of ecosystems and they have been considered as an indicator species of inhabited areas (Blair, 1999). Studies showed that depressed abundance of various bird species in most parts of world today especially in urban areas are of particular concern as many cities are growing rapidly both in area and in population (Emlen, 1974; Donaldson *et al.*, 2007). Population of birds is a sensitive indicator of population in both terrestrial and aquatic ecosystem (Gaston, 1975). The estimation of local densities of avifauna helps to understand the abundances of various species of other organisms (Turner, 2003). One of the major priorities in conserving animals is monitoring their populations to find methods for their long term survival (Caughley, 1982).



Every year flock upon flock of honking squawking birds fly in the valley which migrate from Central Asia and Northern Europe after flying over some of the world's highest mountains, and find excellent feeding and resting grounds in numerous lakes, marshes and other wetland spread all over the valley which provide excellent habitat for birds both resident and passage migrants.

Wetlands and water birds are inseparable elements and support a rich array of water bird communities (Grimmett and Inskipp 2007). Water birds are an important component of most of the wetland ecosystem as they occupy several trophic levels in the food web of wetland nutrient cycles. Activities of water bodies are considered as indicator of quality of the wetland ecosystem and form the terminal links in mainly aquatic food chains and as a result they reflect changes originating in several different ecosystem components (Custer and Osborne, 1977 and Browder, 2000).

The impact of human activities on natural environment are profound. Vegetation change may result from urbanization (Ford *et al.*, 2001) which will not only affect the species richness but will also change the species composition (Williamson *et al.*, 1981). Such changes in species composition may cause future intra species and inter species competition for resources. It could also speed up the rate of transmitting diseases and parasites (Catterall *et al.*, 1998). Moreover increasing human pressure have resulted in drastic changes in the natural habitats of these birds which results in fluctuation of avifauna population. Negligence of authorities, excessive siltation and rampant encroachment have reduced these aquatic habitats to mere water holes, leaving no space for our guest birds. Our water reserves have shrunk to such an extent that these can't fully accommodate immigrant flocks. That is why some of the birds by pass the valley and others have stopped winter stays in Kashmir or have drastically declined in number and have been listed in various categories based on current status.

In the past, over 22 sp. of waterfowls were regularly coming to the valley in winter. Now the winter tally of species has declined to 12 (Shah *et al.*, 1984). Exotic birds like whooper swans, Curlews, Sand hill cranes, Bar headed geese have completely stopped migrating to Kashmir. The honking calls of Bar headed geese remain only a memory for Kashmiris, who watch members of species by pass their valley and fly to the remote Ladakh plateau.

The preservation and management of natural habitats of birds is only way to protect these unique creatures (Hughes *et al.*, 2000) and it was with this aim that present study on population dynamics, periodically and relative abundance was undertaken in one of the lakes of Kashmir Valley – Dal Lake. The information will be helpful in future for special specific work on avifauna of Dal lake and for launching conservation strategies.

In the field of ornithology Baker (1929) has done considerable work on the avifauna of British India and recorded vernacular names, description, nesting, distribution, nidification and habits of 2293 species of birds. This elaborate work was followed by Ali (1941-55): Jerdon (1964) and Ali and Ripley (1983). They recorded field characters, distribution, habits, food and nesting of 181, 1008 and 1200 sp. of birds respectively including those of water birds e.g. spoonbill, white ibis, black ibis, night heron, little egret.

Theobald (1854) made earliest studies on the birds of Kashmir.

Brooks (1871&1872) was a pioneer in conducting detailed investigations on the birds of Kashmir. The exhaustive and invaluable photography of birds and bird watching of this region during earlier years was successfully accomplished by Loke (1946, 1952). Bates and Lowther (1952) provided a detailed information on the behavior and breeding of birds in Kashmir.

Kluijver (1955) carried out a detailed study on breeding behavior of Great reed warbler and found that atmospheric temperature is the cause of delay in the arrival of breeding birds.

Ogilvie (1968) suggested that disturbance and drainage of the habitat were responsible for the diminishing importance of several sites as wintering grounds for waterfowl.

Gaunlett (1971) listed 100 species of birds from Durgapur barrage, which has been found to be a good wetland water bird habitat. In the later study

(1972) he made same observation on the birds of Kashmir and furnished a systematic list of 111 species of hill birds, which he compared with the data given in, "The Breeding Birds of Kashmir, by Bates and Lowther (1952).

Weller (1972) made ecological studied of Falkland islands waterfowl and showed there was little competition among eleven breeding species of waterfowl because of diversity of habitat niches that provided different sources of food.

Masatomi (1975) carried out some observations on birds of high attitude lake sides in Gossin Kanel, Nepal and briefly described the status of each species.

Sugden (1979) found coots to be generalists as they used all types of wetlands.

Wilson *et al.* (1980) observed the avifauna of habitat islands in Grand Camjon U.S.A and co-related the increase in number of bird species, breeding in habitat islands with the increase of islands size.

North (1984) studied the modelling annual number of birds territories on farm land plots.

Shah (1984) carried out studies on the feeding and breeding biology of some resident and non-resident birds of Hokersar. In addition he also carried out studies on the gut analysis of 12 species of waterfowl and the breeding biology of Indian moorhen.

Freemark and Merrian (1986) examined the relationship among area, habitat heterogeneity and bird assemblages in 21 forest fragment in agricultural landscape near Ottawa Canada. Number of species and pairs of birds at individual points within forests increased with greater height but not with larger size.

Hansson, Lennart (1986) studied the breeding bird communities in relation to distance from winter food supply and found that during breeding times birds fed at houses in winter but dependent only on the breeding habit in spring and remained more common in Conifer woods, adjacent to 500 m away from feeding area than in more adjacent woods.

Medin (1986) studied the grazing and passerine breeding birds in Great Basin (USA) and noted that important structural and compositional differences existed in vegetation of experimental pastures.

Nilson (1986) in his studies in oligotrophic Swedish lakes found that bird densities decreased with increasing biotype patch size.

Gaston, *et al.* (1987) studied the distribution of larger species of birds breeding on the coasts of Foxebasin and Northern Hudson Bay Canada and found that greatest number of birds were seen along the low lying coasts backed by wet low land tundra.

Rapheal *et al.* (1987) studied the breeding bird populations during 25 years of post fire succession in Sierra Nevada (USA). Total density of birds was nearly equal on two plots but species richness increased on burned plot.

Johnels and Thomas (1988) conducted a survey on the species composition and abundance of bird fauna in a distributed forests in Central Andes of Columbia and recorded forty species of birds belonging to 19 families and 23 additional species in the surrounding area.

Shah and Qadri (1988) carried studies on food of Mallard at Hokersar, Wetland Kashmir. They found that plant material of 37 species formed 95.46% of the diet. *Oryza sativa* was the principal food and formed of 47.01% of the diet.

Holmes and Parr (1989) gave a checklist of breeding birds of Haigam Rakh, Kashmir (India). Little bittern, Water Rail, Common kingfisher were observed to be the dominant amongst the different species.

Arnold and Weeldenburg (1990) studied the factors determining the number of species of birds in road verges in wheat belt of western Australia and noted that assemblage of birds and their relative abundance differed seasonally and in different vegetation types.

Rahmani (1991) found on three different occasions when little grebe were seen commensally feeding with Shovellar, Pintail and Wigeon ducks.

Blake *et al.* (1992) examined hourly variation in number of birds detected during morning line transect counts in North Wisconsin (USA) and upper Peninsula Michigan. They analysed hourly variation by month (May-Sept.) year (1986- 87) and state.

Probst *et al.* (1992) studied the breeding bird communities in regenerating and mature broad leaf forests in USA lake states. Bird species richness and total population were highest in mature stands and in regenerating stands.

Pandey (1993) made comparisons in the water bird diversity in the Pong Dam reservoir, H.P., with the diversity recorded in this areas before the construction of the dam. The results were compared with the data reported in Whistler (1926)'s list of birds of Kangra. The comparisons indicated that water bird diversity as well as abundance has increased considerably since Whistler's study. A total of 54 species were recorded at the reservoir between 1988 and 1992, of which 39 are now common, compared to 27 species seen by Whistler, of which only 8 were listed as common.

Johnsingh and Joshna (1994) carried out studies on avian diversity in three vegetation types of Mundanthurai plateau, South India. No relationship could be established between bird and tree species diversity.

Southernmost records of the Common pochard and Tufted ducks were made by Badri Narayanan, (1994).

Studies conducted by Lopez and Mundker (1997), revealed that more than three million water fowls migrate to land wetlands of India from Eurasia and across Himalayas during every winter (October – March).

Kumar (1998) conducted studies on water bird diversity of the Asan reservoir in Dehradun. He used remote sensing techniques, GIS and population dynamics of migratory waterfowl and created adequate technical information base for effective management of wetland.

Dar (1998) carried out a biological survey of Haigam wetland, Kashmir

Rahmani *et al.* (1998) carried out study on conservation of the avi- fauna of Dudwa national park, India and a total of 330 species were recorded , of which only 112 species breed in the area.

Tatu *et al.* (1998) developed the methodology for delineation, mapping, and inventorying waterbird population of inland wetland viz. Nal Sarovar (Gujarat). They noticed that water bird habitats in wetlands are deteriorating due to variety of human activities threatening the survival of waterfowl and suggested that sound management of such habitats is possible if information regarding them is available.

Hawkings and Nancy (1999) made surveys of cooperative roadside waterfowl breeding population in the southern Yukon Territory and found that total bird numbers declined 25% from 1998 values and indicated pairs were down 5% but these differences were not statistically significant.

Richard (1999) investigated the avian diversity of Kelabit highlands and surroundings shapes. He identified 12 species representing 29 families of birds.

Jayson *et al.* (2000) examined the seasonal changes of tropical forest birds in the south western Ghats and observed that highest population was found from December-April where as species richness of birds declined during monsoon. When compared, abundance and density of birds, observed in the

evergreen forests (929/km<sup>2</sup>) was more than in moist deciduous forests (747/km<sup>2</sup>).

Narang *et al.* (2000) worked on the avian species involved in pollination and seed dispersal of some forest plant species. He found 31 bird species interacting with 28 species of trees and shrubs. 10 bird species were involved in pollination alone, 8 species were involved in seed dispersal alone while as 10 species contributed to both these processes. The remaining three species were all Parakeets and were seed eaters, although two of these contributed to pollination alone.

Ahlund and Anderson (2001) studied brood parasitism in waterfowl and found that females can substantially increase their reproductive output by parasitizing conspecific nests.

Fazili (2002) carried out studies on the annual cycle of some birds of Wular lake, Kashmir and recorded breeding biology of Indian whiskered tern, Indian great reed warbler, Pheasant tailed jacana and Dabchick.

Mehta *et al.* (2002) observed 206 species of birds at Ropar wetland from January to June 2002. Their two fold status (residential as well as abundance) and habitat wise distribution have been worked out and presented. Even threatened species have been highlighted. Sixty nine species of waterbird including winter visitors have been emphasized through their ecological grouping.

Selmi *et al.* (2002) investigated the diversity of breeding bird communities in 53 Oases I southern Tunisia in relation to vegetation structure and geographic location and found that bird richness was related to Oasis size and to vegetation traits, namely to the diversity of trees and herbaceous plants.

Awan *et al.* (2004) conducted a preliminary study on distribution of avian fauna of Muzaffarabad, Pakistan and recorded total of 59 species



belonging to 9 orders and 31 families. Out of these 24 were resident, 14 were winter visitors, 11 were summer visitor and 10 were rare.

Urfi *et al.* (2005) examined the status of counting birds for various purposes in India and elaborated that usage of particular method depends upon the type of habitat, purpose of estimation, accuracy needed, behavior of the species and many other factors.

Donnelly and Marzuluff (2006) used 54 sq. km land scape in the Seattle Washington, U.S.A., metropolitan area to determine the relative importance of habitat quality, structure and species pattern of bird diversity and abundance. They found that conservation of native birds in reserves can be supplemented by managing the amount, composition, structure complexity and arrangement of vegetation in neighbour hoods.

Awan *et al.* (2007) examination altitudinal range and relative abundance of five species of Tits in Machiara National Park, Pakistan and observed that all the five species were found between the range of 1180-3080m and Great tit was found to be the most abundant species with a relative abundance of 37.7% among the five.

Gadhvi (2008) worked on the population dynamics of water fowls in Gaurishankar lake, Bhavnagar, Gujarat and found that lake provides excellent habitat to the thousands of waterfowls every year and a total of 102 sp. of waterfowl were enlisted from the lake.

Ahanger (2008) examined the bird diversity of different wetlands of Kashmir and reported species diversity of 92 from Wular lake, 81 from Shallabug, 90 from Hokersar and 83 from Haigam wetland.

Rathod *et al.* (2008) made a comparative study of avifauna of a sub-urban wetland and an irrigation reservoir of Savli Taluka, District Vadodara and observed that an urban pond supports more resident and terrestrial species

of birds, where as an undisturbed-irrigation dam is preferred by migratory species of birds.

Shah *et al.* (2008) observed egg laying, egg parameters and clutch size in Mallard (*Anas Platyrhynchos*) and found that egg laying season extended from early March to early June with April as the peak laying month.

Akbar *et al.* (2009) conducted survey on water fowl diversity at Chashma Barage and Marala Headworks, Pakistan and recorded 46 waterfowl species belonging to 26 genera from 11 families – representing 6 orders from Chashma barrage and 44 water fowl species belonging to 25 genera from 11 families representing 6 orders from Marala Headworks. A decreasing trend in waterfowl population both the wetland was observed.

Ishwara *et al.* (2009) studied the avifaunal diversity of Anekere Wetland, Karkala, Udupi district, Karnataka, India and found that wetland attracted 44 bird species, which are local and migratory including aquatic birds, Waders and others. Prominent residents were Moorehen, Jacanas, Herons and Cormorants.

Sandilyan *et al.* (2010) in their investigation on decline in species richness of water birds in Picha varam-Mangroove wetlands, showed that 40% of the water bird species no longer occur in the area due to anthropogenic impacts.

Thakur *et al.* (2010) in his investigation on bird diversity in Sarkaghat valley Mandi (H.P) India, revealed the presence of 102 species of birds belonging to 77 genera spread over 34 families and 14 orders. Further he noted that passerine birds dominated the diversity with 58 species as compared to non passerines (44 species).

Meshram (2010) made his investigation on diversity of fauna in national Chambal sanctuary in Madhya Pradesh, India and observed that sanctuary gives very good account of avi-fauna.

Mohan *et al.* (2010) carried out bird survey in Kothri valley of Lansdowne forest division, Uttarakhand state and recorded 150 species of birds out of which 75 showed confirmed and 34 probable evidence of breeding.

Verma (2011) made a preliminary survey on the avian community of Dalma Wildlife sanctuary, Jharkhand and a total of 71 species of birds grouped into 36 families were recorded and found that Sturnidae family shows highest species richness within the sanctuary.

Rajashekara *et al.*, (2011) made their observation on the occurrence, abundance, richness and diversity of water birds in 15 major lakes in Bangalore city and 35 species of aquatic birds were recorded and the number of aquatic bird species recorded at various lakes ranged from 23 to 35.

Bhatt *et al.* (2011) made their observation on bird assemblages in natural and urbanized habitats in Nainital district and results indicated that the forest had more complex bird community structure in terms of higher species richness, higher species diversity and more rare species as compared to urban habitat.

Datta (2011) studied the human interference and avifaunal diversity of two wetlands of Jalpaiguri, west Bengal, India and recorded a total of 80 bird species from one wetland and only 42 species from other.

Saikia *et al.* (2011) studied avian fauna at Jeypore reserve forest, Eastern Assam and revealed 270 species of avian fauna belonging to 56 families of which 14 were globally threatened species and other 14 were migratory rare species.

On the basis of the above scanned literature. The present endeavor thus signifies the worth ness for carrying out the study. Thus the present study exploring “The resident and non resident birds of Dal lake” were explored with some background on the possible anthropogenic impacts.

**D**al Lake is a Himalayan urban lake, located in the heart of Srinagar (34°18" N latitude and 74°91"E longitude) at an average altitude of 1583m. The lake covers an area of 11.56 sq. km with the average depth of 5.4m. The top crust of the lake has also been observed to freeze when the mercury falls to -11°C. Spring and early summer are the wet periods when maximum rainfall occurs and average annual rainfall recorded is 655 mm. It is in this season that the snow melts in the higher catchments results in maximum discharge in Dachigam and Dara Nallah which flows into the lake. Dal Lake is unique in having hundreds of houseboats, which afford an opportunity to tourists to reside on the lake in an atmosphere of peace and tranquility. Dal Lake comprises of five basins viz. Hazratbal, Bod-Dal, Gagribal, Nageen and Brari-Nambal. A perennial inflow channel known as Telbal Nallah enters the lake from the north and supplies 80 per cent of the water from a high altitude lake called Marsar Lake (Qadri, 1980). Within the lake basin itself there are number of springs (Kundangar *et al.*, 1995) which act as permanent water source to the lake.

The present study was carried at Dal Lake , and for studying and noting various bird species , the lake was divided into four study units in such a way that it includes every habitat type; open water areas with submerged vegetation, areas with floating, emergent vegetation and peripheral terrestrial zones.

**Site 1:** This site was located towards north western side of lake and supports thick vegetation, emergent and free floating vegetation comprised of *Phragmite* sp., *Typha* sp. etc

**Site 2 and Site 3:** These sites were located towards south eastern side. The macrophytic association comprised of *Ceratophyllum demersum*, *Potomageton* sp., *Hydrilla* sp., etc. It may be noted , there was less human pressure at site 2 as compared to site 3

**Site 4:** It was located towards north western side of lake and was represented by peripheral tree zone.

**F**or the purpose of present investigation population of birds were estimated fortnightly by visual counts and line transect census methods.

From November to march visual census (Shah, 1984) was conveniently employed. Each part of the study unit was scanned from suitable vantage points with the help of field binoculars and the number of bird species were counted.

From April to October line transect method (Watson, 1965: Gaston, 1975) was used, when emergent vegetation disrupts visual census. The method entailed moving along a pre determined route recording the birds on either side of the route.

The data was collected by using direct and indirect methods in order to study the presence, population status, local threats, distribution and diversity of avian fauna. For direct data collection, visits were conducted on morning and evening hours. Survey was conducted on foot and by boat. Marginal littoral areas (bundhs) were surveyed by walking on bundhs where as lake area was surveyed by using wooden boats.

For indirect data collection, local residents, farmers and other knowledgeable persons were interviewed about the present and past status of the birds, threats and effect of human population and urbanization on bird's diversity.

However counting nests in colonies (Thompson and Rothery, 1991) method, was used for bird like Indian whiskered tern which nest in colonies during breeding season. Number of breeding pairs was easily counted by counting the number of live nests.

The birds were identified by studying their characteristic features in accordance with the identification keys evolved by Bates and Lowther (1952), Whistler (1963) and Ali (1979).

Terms used in defining the abundance of each species are those used by Bull (1964), Mc Caskie (1970) and Shah (1984). The arbitrary scale thus used is as:

Very abundant (VA)	over 1000 individuals seen per day
Abundant (A)	201-1000 individuals seen per day
Very common (VC)	51-200 individuals seen per day
Common (C)	21-50 individuals seen per day
Fairly common (FC)	7-20 individuals seen per day
Uncommon (UC)	1-6 individuals seen per day
Rare (R)	1-6 individuals seen per season
Very rare (VR)	infrequent occurrence

---

---

## A. SPECIES COMPOSITION

### 1. Little grebe or Dabchick

*Podiceps ruficollis capensis* (Salvadori)

*Tachybaptus ruficollis* (Pallas)

**Local name: Pind**

It constituted an important and common group of resident birds of lake. Although it was recorded throughout the year but the greater population density was observed during July to September.

It is a shy small tailless duck, dark brown in colour. Bill short and pointed. These occurs in Pairs (breeding season) or small parties swimming in open water and often dives, as it can submerge for a considerable period (10-16 sec) and then suddenly emerges on the surface of water at different point.

Nests mostly build in open water, nest is in the form of pad of water reeds, eggs when laid are pure white and become dark chocolate brown from their contact with wet vegetable matter and are often covered over by the weedy vegetable matter during daytime, **Plate 2b**.

### 2. Indian large cormorant

*Phalacrocorax carbo sinensis* (Shaw)

**Local name: Mong**

It is also a winter visitor, uncommon migrant till December. In January, only 1 or 2 individuals could be seen but from February to ending April they were abundant and a population of 1100 and 1200 was built up respectively in March and February and in April only 600 birds were seen and started leaving the lake in last week of April and exodus was complete in May.

It is identified with its black plumage with metallic greenish shine; throat and front half of the face white, **Plate 2c**.



### 3. Little egret

#### *Egretta garzetta garzetta* (Linnaeus)

It a common resident bird, through out the study period its Number varies between 15-20. However in summer months they were very common when upto 150 individuals were found in the lake.

It is a lanky snow white marsh bird; has a slender dagger – like black bill, legs are black with yellow feet and a long drooping crest of two narrow plumes acquired in breeding season, **Plate 3a.**

### 4. Indian cattle egret

#### *Bulbulcus ibis coromandus* (Boddaert)

Although it is a resident bird but was uncommon and usually was found in close association with grazing animals. Distinguished from little egret by color of bill which is yellow not black, neck shorter and thicker. Buffy orange chest, breast and shoulders in breeding plumage; short legs are yellowish, **Plate 3b.**

### 5. Indian pond heron

#### *Ardeola grayii* (skykes)

#### **Local name: Broku**

It was conspicuous bird amongst the resident bird population of lake. An almost stable population of heron was always noticed sitting on floating gardens and edge of water bodies. Largest number of herons recorded at a time was 130 in July and 110 in June. At other periods of the year their number was mainly between 15-35.

The bird is earthy brown when at rest; with white wings in flight; acquires maroon hair like plumes on its back in breeding season. Bill is brownish yellow with black tip, **Plate 3c.**

## 6. Night heron

*Nycticorax nycticorax* (Linnaeus)

**Local name: Bor**

Resident and fairly common; that stay all through the year, not more than four birds were observed at any one time. It is nocturnal in habit and appears to be a shy bird; during day time it sleeps among upper foliage; becomes active at dark when they begin to hunt for fish. This bird is characterized by a heavy body; short thick neck and short legs; adult is dark backed and entirely white below; the bird has a stout deep bill, large head hunched between shoulders on a thick neck, **Plate 4a**.

## 7. Eastern grey heron

*Ardea cinerea rectirostris* (Gould)

**Local name: Brag**

Although resident but uncommon. A total of birds were recorded through out the course of study. The highest population however was observed in the months of July and August. Mostly seen standing on floating islands, edges of water. They were also seen on willow trees in the periphery of lake.

It is characterized by ash grey colour; with long slender S-shaped neck and a pointed dagger like bill; legs are long with elongated white feathers on the breast having some black streaks.

## (8) Little bittern

*Ixobrychus minutus minutus* (Linnaeus)

**Local name: Goi**

It is one among summer breeding birds that arrived the lake in the month of April, when only 5 birds were observed, which increased to 28 by the end of may and 30 in June. The dense growth of vegetation generally provides a

camouflage for these birds from their predators. They were often seen standing motionless on the outskirts of a reed bed and when approached especially during nesting the bird elongated its neck and thrust its beak upwards displaying itself in such a way that bird seemed part and parcel of reeds among which it was standing. Male bird is characterized by its blue black back and wings which in female are brown, **Plate 4b**.

### **(9) Grey Lag Goose**

*Anser anser* (Linnaeus)

**Local name: Anz.**

It is only goose that visits the valley during winter. During the entire course of study only 62 birds were recorded from September to April. In November and December only 6 individuals each months were recorded and in January, no bird was seen. However the birds were fairly common in February to April when 9 and 12 of them were noticed in February and March respectively. On 8<sup>th</sup> April a flock of about 20 birds took the aerial view of Dal Lake and returned back, probably didn't find suitable place for their feeding and resting. The bird can be identified with its long neck, grey rump and flesh pink bill.

### **(10) Mallard**

*Anas platyrhynchos* (Linnaeus)

**Local name: Niluj (Male): Thug (Female)**

Mallard formed important contributor to the total duck population. A population of 150 was noticed in September when they first arrived in the lake which built upto maximum of 1000 in November and 1500 in December .From December onwards the population decreased sharply through the month of January when the number was reduced to 100. The possible factor should be extreme cold conditions, competition for food and space. However in February

a sudden population build up was again noticed with a count of 1350 and thereafter it gradually decreased with their outward migration. However it is to be noted that small population stayed here for breeding purpose.

Male is identified with its white collar around the neck; glistening dark green head and neck; nicely turned up quiff of still feathers in the tail; female is drab mottled brown with orange legs and orange bill.

Nesting usually starts in February but in the year 2011 it was delayed because of torrential snowfall which continued from Mid February to late February and resulted in drop of temperature. Nests were found in the patches of tall and dense macrophytic vegetation which was dominated by *Phragmites communis*, *Typha angustata* and *Sparganium ramosum*. A nest with 8 eggs was found on 23-06-2011 towards south eastern side of lake, **Plate 4c**.

### **(11) Common teal**

*Anas crecca* (linnaeus)

**Local name: Keus**

The common teal was found to arrive in small flocks that varied from 500-1500, Common teal together with the Mallard were the first to arrive the lake generally in the first week of September. During their overall period of stay the population fluctuations followed more or less the same pattern as the Mallard. The inward migration continued till November when the first peak of population was attained being 1450. During the two months that followed the majority of the ducks migrated away from the lake and only a small population was left behind and second spurt of population was recorded in February and thereafter it gradually decreased with their outward migration.

It is smallest duck that visits Kashmir. Male is identified by its dark head with a broad metallic green band running backwards from eye to nape bordered above and below by whitish lines, where as female is mottled dark and light brown with pale under parts, **Plate 6b**.

---

---

## (12) Northern Pintail

*Anas acuta* (Linnaeus)

**Local name: Sukh pachan**

Pintail was found to be a regular and significant contribution to the duck population. Small flocks of the bird arrived in September which increased through the month of October, building up the maximum population in November being upto 450 which suddenly dropped to 30 in January on account of severe winter conditions. The population again picked up in February-March being 1450 in February and 1600 in March, before their bulk outward migration which was completed by the end of April.

Male is characterized by its sharp tail plumes; white under parts; dark head, pointed pin like feathers projecting well beyond the tail. However female is pale mottled brown with an elongated body; tail tapering without pins; speculum is metallic brown with a white rear border, **Plate 5b**.

## (13) Gadwall

*Anas strepera* (Linnaeus)

**Local name: Budun**

It is also a winter visitor and arrived in lake in September and established a small population of 35. The greater influx was in October when it reached a density of 200 building up a maximum of about 470 in November. Then there was sudden decrease of population in December which continued through January followed by an increase in February building upto 600. There after the duck started leaving the lake and this outward migration was completed till end of April. Male can be identified by its plain head, dark bill, grey body and dark tail coverts. While as female is dark brown mottled with buff; It is duller but slightly smaller edition of Mallard.

**(14) Northern shoveller***Anas clypeata* (Linnaeus)**Local name: Honk**

Like Gadwall the Shoveller formed a consistent visitor of the lake being present throughout the study period from September to April, however there was a month wise fluctuation in the total population. Only 12 Shovellers could be sighted in the lake during September and 15 in October, however during November the population was of the order of 400 and all of them flew away and weren't seen during December and January. The regrouping was seen in February building up a peak population of 1630 in March. The final outward migration of the duck started in March and was completed by the end of April.

Male has a glossy dark green head and neck; breast is white; rest of the under surface is chestnut. Female is mottled brown with bright orange bill,  
**Plate 5c.**

**(15) Wigeon***Anas penelope* (Linnaeus)**Local name: Shierene budun**

It is also a winter visitor and arrived in October and was uncommon during first four months. However in February and March there was a sudden influx and a population of 800 and 1000 was built in March and February respectively. Thereafter the bird starts its outward migration which was complete by the end of April.

Male is identified with a rusty head grey sides, creamy crown, brownish pink breast, black tail coverts and small narrow bill.

Duck is like female Gadwall but with a speculum of different pattern. It has a small blue bill.

---

---

**(16) Garganey (Blue winged teal)***Anas querquedula* (Linnaeus)**Local name: Noer**

Like other ducks it is also a winter visitor and arrived in the lake towards the end of September, till November their number was very small and didn't exceed 400. During the months of December and January they were completely absent and abruptly arrived in February when their greatest number was recorded being upto 1350. This was followed by a gradual decrease in March and finally they left the lake completely by the end of April.

Male is identified by its pink brown white speckled head with conspicuous broad white eyebrows and bluish grey on wing and shoulders.

Female closely resembles the teal but it is paler; it has a pure white throat, **Plate 7a**.

**(17) Common pochard***Aythya ferina* (Linnaeus)**Local name: Thauther**

It arrived in October and wasn't common. Its population increased from 8 in October to 12 in December falling to 3 in January. In February a population of 40 was build up. They started leaving the valley in early April and the exodus was complete by the end of April.

The bird is characterized by a bill which has black base and tip and middle part is palish; male with ruddy head and neck; upper back and breast are black; rump and tail covets are black ventrally; sides are grayish white. Female is brownish on head, neck, upper back and breast; remaining parts are greyish brown.

---

---

**(18) Red crested pochard*****Rhodonessa rufina* (Pallas)****Local name: Tsarow**

It was a regular visitor of lake but forms a small contribution to the total duck population. It arrived in October when only 10 birds were recorded which increased to 13 in November and none in December and January. The regrouping was seen in February building up a population of 20 in March. The final outward migration of the duck started in March and was completed by the end of April.

Male has distinct orange red head; bright crimson bill; upper parts light brown; white patches on shoulders; lower plumage black and flanks white. Female has a brown head with whitish sides; dark brown crown and whitish speculum, **Plate 6c**.

**(19) White eyed pochard*****Aythya nyroca* (Guldenstadt)****Local name: Harwat**

A rare to fairly common late winter visitor. During the entire course of study only 20 birds were recorded from November to April. Only 4 birds were noticed in November and December each and none in January. However the birds were fairly common in February when 12 of them were noticed. In March only 2 birds were recorded and from early April they started outward migration which was complete by the end of April.

The general aspect of the body is brownish, a whitish wing bar is conspicuous – in flight; abdomen seen as an oval white patch during the flight. Iris is white in male and brown in female. Female is duller colored.



---

---

**(20) Brahminy duck*****Tadorna ferruginea* (Pallas)****Local name: Tsakaow**

Brahminy duck forms a small contributor to the duck population and its occurrence was more or less persistent in the lake from October through April. The maximum population noticed at one time in the lake was 20 in February and at other periods, it fluctuated between 2-6.

Orange brown duck with paler head and neck, wings white, black and glistening green; tail is black. Male has a thin black collar; female lacks black collar, **Plate 6a**.

**(21) Common Merganser*****Mergus merganser* (Linnaeus)**

A small number of common merganser was sighted in November when it stayed for a week. Thereafter the species was again noticed in April and left by the end of same month. The population density of the species during the entire course of study was quite insignificant.

It is characterized by its saw shaped toothed bill; male with a white body; black neck and head and narrow red bill.

The female has a grayish body; a reddish head; chin and throat, secondaries and underparts are white.

**(22) Common periah kite*****Milvus migrans govinda* (Sykes)****Local name: Gaunt**

A fairly common resident bird found throughout the year. Often seen sitting on trees; besides flying over the wetlands. It is characterized by its

---

---

brown upper plumage with black outer flight feathers, tail deeply forked with whitish brown chin and throat, **Plate 7c**.

**(23) Indian purple coot**

*Porphyrio porphyrio* (Linnaeus)

**Local name: Wan tech.**

A rare winter visitor. It was observed only for the three months of December, January and February. It is characterized by its purplish blue color, with red legs and toes and conspicuous red bill and forehead, **Plate 8a**.

**(24) Indian moorehen**

*Gallinula chloropus indicus* (Blyth)

**Local name: Tech.**

Although it is a resident bird, however in the month of March, some more waterhen migrate to valley and stay here for breeding purpose and made addition to population structure.

It is a black duck like bird with yellow tipped red bill, having red shield on the forehead and white patch bordering the closed wings. These spend most of their time while swimming in water but also observed to walk on seed patches, **Plate 8b**.

**(25) Coot**

*Fulica atra atra* (Linnaeus)

**Local name: Kollur**

Like ducks and geese, coot is a winter visitor and was seen from September to May. In September and October the coot was abundant but became very abundant from November to April with a maximum population of about 3000 in February. It is characterized by plumage which is blackish grey, head and neck are somewhat darker, under parts are greyer; bill is white.

They collect in droves of hundred to cruise about open water, dive freely to obtain food, and have no love of flight, but when disturbed they fly well, **Plate 8c.**

## **(26) Pheasant - tailed Jacana**

*Hydrophasianus chirugus* (Scopoli)

**Local name: Gund Kaw or Gair kaw**

Summer migrant and were first noticed in the first week of April, when only 4 individuals were seen flying in the lake, thereafter the number of incoming birds gradually increased with a maximum of 50 in July and started leaving the valley from early September.

It is characterized by white and chocolate brown plumage and pheasant like tail; in flight the abnormally long toes trail behind. It was mostly seen on lotus leaves and weed covered shallows, **Plate 9a.**

## **27. European little ringed plover**

*Charadrius dubius* (Scopoli)

**Local name: Kola Katij**

Summer migrant but fairly common and only 10 and 15 birds were recorded each in the month of June and July respectively.

It is characterized by its large head with black collar around white neck. Eye rim and legs are yellowish in color, **Plate 9b.**

## **28. Fantail Snipe/Common Snipe**

*Gallinago gallinago* (Linnaeus)

**Local name: Chah**

It is also summer migrant but uncommon. A total of 21 birds were seen during its 4 months of stay. It is identifiable by its very long straight bill and a brown body heavily streaked and lined with black.

## **29. Commons sand piper**

*Actitis hypoleucos* (Linnaeus)

**Local name : Kola Kavin**

Summer migrant that was fairly common from April to August near floating islands. The bird is identifiable by its grey above, sullied white below coloration and a long straight bill; a whitish band bordering the trailing edge of the wing is very prominent in flight.

## **30. Black winged stilt**

*Himantopus himantopus* (Linnaeus)

**Local name: Longzeyat**

It is also a summer migrant that arrives in Dal in early April for a brief stay till end of July. They were fairly common in April and May, very common in June and July usually seen wading in clear water and the most striking feature about Black winged stilt is the inordinate length of its thin red legs with slender body and black wings, **Plate 9c**.

## **31. Indian whiskered tern:**

*Chlidonias hybrida indica* (Stephens)

**Local name: Krind**

Indian whiskered tern, another summer migrant arrived the lake from the first week of April, when only 20 birds were observed and number increased to 60 in May. As these birds reached the lake they were observed enjoying feeding and flying over reeds and open waters with occasional aquatic plants that reached the surface. It is characterized by light grey color; top of head and abdomen are black, bill and feet are red, **Plate 10a**.

### **32. Hume's blue rock pigeon**

*Columba livia neglecta* (Hume)

**Local name: Jungli Kotur**

Common through out the study period, usually seen in flocks and have a habit of coming out in mornings to feed on grains. The bird is characterized by a bluish grey back; rump is pale grey; wings have dark bars with black bill.

Male exhibit various courtship display which includes, following the female from one place to another; males also swells up their body, produces sounds and makes several circles around the female, **Plate 10b**.

### **33. Indian ring dove**

*Streptopelia decaocto* (Frivaldsky)

**Local name: Kukil**

Summer migrant, fairly common to common from April - September. The bird started coming to the valley from the month of April and a maximum population was built in June and July. From early September, they started leaving Kashmir and the exodus was complete by the end of September. It is light grey bird with a circular black ring around the back of neck **Plate 10c**.

### **34. Oriented turtle dove**

*Streptopelia Orientalis* (Latham)

**Local name: Wan Kukil**

Summery migrant, and made their appearance in the month of April and were fairly common, they progress easily on the land as if they peck about in search of grains. It is identifiable by scaly pattern and reddish brown and graduated tail, **Plate 11a**.

### **35. Himalayan slaty - headed parakeet**

*Psittacula himalayan* (Lesson)

**Local name: Shoga**

Summer visitor, fairly common from mid April and was occasionally seen until the middle of October. Mostly seen on populus and Chinar trees. It is bright green bird with slaty head and yellow tip to long and blue narrow tail; male has red shoulder patches with red and yellow deep forked bill, **Plate 11b**.

### **36. Rose ringed parakeet**

*Psittacula krameri* (Scopoli)

**Local name: Tota**

It is local altitudinal migrant and uncommon from October to march. They were usually seen in pairs moving from one tree to another. It is grass green color with a typical short deeply hooked red bill and rose collar around the neck female lacks this collar, **Plate 11c**.

### **37. Asiatic Cuckoo**

*Cuculus canorus* (Linnaeus)

**Local name: Hor Kuk**

Summer visitor and fairly common in June and July which came to valley in the month of April. They stay to breed here and outward migration begins from middle of August. The bird has dark ash grey color above; with whitish lower parts barred with blackish: tail long and graduated, narrowly tipped with white.

### **38. Central Asian Kingfisher**

*Alcedo atthis* (Reichenbach)

**Local name: Kola Tonch**

Resident and common through out the study period. Often seen sitting on branches keenly looking towards to catch the prey. It is small kingfisher with upper plumage bright blue and white on each side of neck and under parts are chestnut. Bill large with large head, **Plate 12a.**

### **39. White breasted Kingfisher**

*Halcyon Smyrnensis* (Linnaeus)

**Local name: Bud Kola Tonch**

Although resident but uncommon in winter and fairly common in summer. A blue coloured bird with deep chocolate brown head; neck and under parts; chin, throat and breast however are white. Bill heavy red. Usually seen in and around the aquatic habitats looking for its prey and when found; it dives into water grabbing it in its bill and flying back to some shady place to devour it, **Plate 12b.**

### **40. Indian Pied Kingfisher**

*Ceryle rudis* (Reichenbach)

**Local name: Hor Kola Tounch**

Resident, fairly common to common through out the year. The bird is boldly patterned in black and white. There is a broad collar on the breast; in males, there is another in definite one just below it. The feathers on the crown of large head are slightly elongated to form a crest. Bill and legs are black. Usually occurs in pairs and loves to sit on some shaded branch over the water waiting for prey to appear below it. It captures fish by plunging into water, first hovering in mid air with its heavy pointed bill directed down wards, **Plate 12c.**

#### **41. Kashmir roller**

*Coracias garrulous (Linnaeus)*

**Local name: Nilakrash**

Summer migrant and was found to be uncommon to fairly common from mid April to September. It is identifiable by its large head with stout bill which is black.

#### **42. European Hoopoe**

*Upupa epops (Linnaeus)*

**Local name: Satut, Hudhud.**

Summer migrant, fairly common and started arriving to valley from the middle of April and stay to breed here and outward migration begins from the middle of August which was complete by the end of September. It is identified by its long curved bill and fan like crest, **Plate 13a.**

#### **43. Brown fronted wood pecker**

*Dryobates brunifrons (Gould)*

Rare, local altitudinal winter migrant and made its appearance from December to April and no sighting was made from May until November, **Plate 13b.**

#### **44. Grey headed woodpecker**

*Picus canus*

Rare, local altitudinal winter migrant. It has green upperparts, pale grey under parts and a yellow rump. It has grey head and male has a red crown, it has shorter neck. Slimmer bill and slightly rounder head.



## **45. Common swallow**

*Hirundo rustica* (Linnaeus)

**Local name – Katij**

The bird is summer visitor to the valley. They start arriving to the Kashmir right from the March and maximum population builds in June. They breed in Kashmir. The outward migration starts in early September and by the end of September most of the birds had already left Kashmir. These were often seen gregariously in small loose parties and are characterized by upper deep blue plumage, with reddish- brown forehead; chin and throat reddish brown; under parts are pale rufous; tail is deeply forked with pointed wings, **Plate 13c**.

## **46. Grey drongo**

*Dicrurus leucophaeus* (Vieillot)

**Local name: Gunkots**

Uncommon to fairly common summer visitor from April to September, singly or in pairs among the thick grown of willows and chinar trees. It is characterized by deep blue black upper plumage and deeply forked tail.

## **47. Eurasian golden oriole**

*Oriolus oriolus* (Linnaeus)

**Local name: Poshnul**

Uncommon summer visitor and these birds arrive to the valley in April, stay to breed here and start leaving Kashmir from first week of September. It is golden yellow bird with black in wings and tail and a conspicuous black streak through the eye, **Plate 14a**.

**48. Long tailed shrike***Lanius schach* (vigors)**Local name: Harvatij**

It is also summer migrant, fairly common to common from April to September. Usually found either singly or in pairs, with grey head; and black forehead, and a black band runs through eyes; lower back and rump are bright rufous, **Plate 14b.**

**49. Common myna***Acridotheres tristis tristis* (Linnaeus)**Local name: Hor**

Resident, common to very common in and around the lake; usually found in pairs in breeding season and in parties of five or six birds during rest of the year, **Plate 14c.**

**50. Himalayan starling***Sturnus vulgaris* (Brooks)**Local name: Tsinihangur**

Common early summer migrant that started arriving to valley from April. These were often seen in pairs or in small groups feeding on grounds. The bird is a glossy black with a pale whitish tip to each feather; tail short with yellow bill; legs and feet are reddish-brown, **Plate 15a.**

**51. House crow***Corvus splendens* (Laubmann)**Local name: Kav.**

Resident, common through out the study period , often seen in flocks on banks of Dal lake feeding particularly on Spilt grains of cooked rice; a piece of

dry, insects, fruits; prays upon eggs and chicks of other birds in lake. It is identifiable by its broad color around the neck which is dusky grey; appearing white in some lights; fore head, crown, chin, throat and upper plumage excluding the neck and upper back are glossy black; lower plumage below the upper breast dull blackish; legs and bill are black, **Plate 15b**.

## **52. Himalayan jungle crow**

*corvus macrorhynchos* (Adams)

**Local name: Diva Kav, Pantsol Kav**

Although it is resident but in winter it becomes common even venturing into gardens. Generally seen singly or in pairs or in small parties of 5-6 birds. Entirely black bird with considerable gloss. Legs are black. Bill is heavy and black.

## **53. Eastern jackdaw**

*Corvus monedula* (Fisher)

**Local name: Kavin**

Resident, common to very common around the Dal lake. Smaller than house crow; has a stumpy body and distinct white iris; bill is short and nearly straight, **Plate 15c**.

## **54. White cheeked bulbul**

*Pycnonotus leucogenys* (Gray)

**Local name: Bil-bi -Chur**

Resident, fairly common to common, often seen in pairs or small parties flying from one branch of tree to another; often descends to ground to pick up insects. It has crest curving right over the bill; cheeks are white; under parts are dark olive green; yellow patch under the tail; chin and throat black; legs and bill are also black, **Plate 16a**.

**55. White caped redstart***Chaimarrhornis leucocephalus***Local name: Chets tal**

Resident, fairly common but in winter they were uncommon. It has glistening white cap and black fore parts and fiery back and tail, terminated by a black band. It always remain near to the water bodies and cliffs in search of food but sooner or later it return to its mountain torrent to flit from stone to stone, **Plate 16b**.

**56. Plumbeous redstart***Rhyacornis fuliginosa* (Vigors)**Local name: Kola Tiriv**

Resident, fairly common and were often seen along the banks of a Dal lake or climbing laboriously over the rocks and boulders of a mountain torrent and perch indiscriminately on the low boughs of trees near water. The male is dark leaden-grey with short tail of dull chestnut; the female much lights in tone having a white tail with a dark brown wedge running into it, **Plate 16c**.

**57. Ruby throat***Luscinia pectoralis* (Gould)**Local name : Yaquat Hot**

This also was a winter visitor but otherwise local altitudinal migrant, 3-5 bird being found only during the months of Dec-Mar, male is brownish slaty above with a white forehead. Wings are brown; tail is blackish – brown with white base and tips. Chin and throat are scarlet. Female is grey brown with eye ring. Tail is blackish brown with white tips. Breast is smoky grey. Abdomen with white down feathers.

### **58. Tree pipit**

*Anthus trivialis*

It is also rare winter visitor to the valley of Kashmir. It is streaked brown above with black markings on a white belly and buff breast below, slenderer bill and longer tail.

### **59. Himalayan whistling thrush**

*Myiophoneus caruleus* (Vigors)

**Local name: Hazar dastan**

Local altitudinal migrant, fairly common to common from October to April, probably when the mountains remain covered with snow. It is characterized by deep blue black colour with silver tips of feathers about head and shoulders are visible only at close range; bill is yellow. Often seen hopping; and is cheerful and energetic bird with strong and swift flight. Feeds on insects earth worms etc., **Plate 17a.**

### **60. Simla Streaked laughing thrush**

*Trochalopteron lineatum* (Hartert)

**Local name : Sheen- a -pi - pin**

Local altitudinal migrant, its arrival was noticed from first week of November on approach of winter and then move back in the month of April. While a few remain for breeding purpose. It is shy warm brown bird with black or white shaft on body feathers; creeps the under growth in a rat like fashion; with tail being flicked alternatively to opposite sides, **Plate 17b.**

### **61. Himalayan paradise flycatcher**

*Terpsiphone paradisi* (Swainson)

**Local name: Ranga Bulbul**

A uncommon to fairly common summer visitor from April to September; often seen singly and in pairs among the thick growth of willows and chinar trees. The male has a glossy blue black head, neck and throat; rest of the plumage is white; two central tail feathers are greatly elongated. Female is chestnut above, grayish white below; head and crest are black; central tail feathers only slightly elongated, **Plate 17c**.

### **62. Indian great reed warbler**

*Acrocephalus Stentoreus* (Hemprich and Ehrenberg)

**Local name: Korkat**

Summer migrant, common to very common from mid April to the end of September. The bird starts arriving from late March and stay to breed here before they start leaving by the end of August. They established their territories amongst the thick growth of reeds and willow plantation. It is a bird of light olive-brown bird; darkest on the wings and tail; lightest on the rump; chin is pure white, bill is dark brown.

### **63. Witherby's paddy field warbler**

*Acrocephalus concinens* (wither by)

Uncommon to fairly common summer migrant, they start arriving from early April, stay until the mid of August when outward migration begins which was complete by the end of August. It is a sober olive brown bird with well defined eye stripe which extends farther back. The lower plumage is buff. It is smaller than Indian great reed warbler.

#### **64. Western spotted fork tail**

*Enicurus maculates* (vigors)

**Local name: Shakhel lot**

Summer visitor, uncommon to fairly common from mid March to September mostly seen on the willow trees and on the banks of Dal lake. It is a bird of contrasting black and white plumage with upper parts spotted and barred; lower parts are pure white. Tail is long and forked drooping slightly at the end; two parts of the tail are often spread wide apart; legs and feet are white: forehead is white with erectile feathers.

#### **65. Little fork tail**

*Microcichla Scouleri* (Vigors)

A rare local altitudinal migrant found from December to March, not as energetic as spotted forktail, remain almost motionless on ground for quite sometimes, Patterned in black and white like spotted fork tail.

#### **66. Kashmir greytit**

*Parus major* (Hartert)

**Local name: Ranga Tsar**

Resident, fairly common to common through out the year. Usually seen singly, in pairs or small parties mobbing from one branch of tree to the other. It is grey colored sparrow like bird; cheeks and wing bars are white; throat and head are black; there is a broad black line all the way from breast to abdomen. Bill is black and legs are slaty grey

#### **67. Spot winged tit**

*Parus melanolophus*

Uncommon to fairly common winter visitor and were mostly found in the areas with a thick emergent vegetation.

It is small stocky bird with short, stout bill that inhabit woodlands; with white nape spot on its black head.

### **68. Green backed tit**

*Parus monticolus.*

Winter visitor, fairly common and were mostly found in thick vegetation of willow trees on south eastern side of lake.

It is a very small, active bird with a black head, neck and bib extending as a line down the centre of its breast and a conspicuous white cheek. Its sides are bright lemon yellow washed with gray, its back is light yellowish green and its tail is bluish gray.

### **69. Kashmir wren**

*Troglodytes troglodytes* (Brooks)

It is local altitudinal migrant and was uncommon to fairly common during winter months. It is identified by its small size with small tail and dark brown barrings on the belly. It is energetic bird always on move, seen flitting from branch to branch of trees.

### **70. Tree creeper**

*Certhia himalayana* (Meinertzhagen)

**Local name: Koel dider**

Uncommon to fairly common local altitudinal migrant which migrate from high attitudes during the months of October and November and stay until the end of March after which they again became invisible. It is identified by upper mottled dark brown plumage; tail with narrow blackish bars; bill is long and curved; it often climbs up the trees in a mouse like manner using tail as a support, **Plate 18a.**



## 71. Wall creeper

### *Tichodroma Muraria* (Linnaeus)

It is rare winter visitor to the valley of Kashmir. The bird is characterized by the bright crimson patches and white spots of wings against its otherwise grey plumage. Bill is narrow, long and slightly curved. Wings are rounded.

## 72. Yellow magpie

### *Urocissa flavirostris*

Uncommon to fairly common summer migrant from May to August. It is large bird having a yellow bill and yellow streak around the eye and a long tail which make it easy to identify.

## 73. Hodgson's pied wagtail

### *Motacilla alba* (Hodgson)

#### **Local name: Dobbai**

Spring and summer visitor that were very common during spring and early summer and become common towards late summer. By the end of August, the bird started backward migration which was completed by the end of September. Adult is identified by its black cap, bib and central tail feathers. Face, wing white. The bird constantly wags its tail up and down. Bill as well as legs are black, **Plate 18b**.

## 74. Eastern grey wagtail

### *Motacilla cinerea* (Pallas)

#### **Local name: Khak Dobbai**

Summer visitor, fairly common to common from March to September beyond that they start their outward migration. It is slender blue grey bird with pale yellow under parts. Male is identified by black chin, throat and breast;

under parts are pale yellow; long and narrow tail is continuously waged up and down.

### **75. Hodgson's yellow headed wagtail**

*Motacilla citreola* (Hodgson)

**Local name: Ledar Debbai**

Summer visitor fairly common to common from April to September. They start arriving in early April and stay here till the end of August when the outward migration begins which was completed by the end of September. A bright yellow and black slender bird . Male; head and under parts are bright, lemon yellow contrasting strongly with deep black of the nape and back. Female; whole underside yellowish.

### **76. Kashmir house sparrow**

*Passer domesticus* (Sharpe)

**Local name: Male, Kantur, Female Tsar**

Resident, common to very common throughout the year. Male is recognized by its black bib and bill; cheeks are white; top of the head and upper back is grey , female is having upper plumage light brown streaked with black and rufous on the upper back; tail dark brown with pale edges; a pale rufous streak over the eye. Lower plumage grayish white, **Plate 18c**.

**Table 1: Combined monthly population of various bird species recorded from 4 sites of Dal lake**

<b>1</b>	<b>Dabchick</b>	<b>Jan.</b>	<b>Feb.</b>	<b>Mar.</b>	<b>Apr.</b>	<b>May.</b>	<b>Jun.</b>	<b>Jul.</b>	<b>Aug.</b>	<b>Sep.</b>	<b>Oct.</b>	<b>Nov.</b>	<b>Dec.</b>
	Site I:	24	18	20	24	22	26	27	18	21	16	16	17
	Site II:	6	4	9	6	10	12	13	12	09	08	06	05
	Site III:	-	-	-	02	06	04	05	02	-	-	-	-
	Site IV:	-	-	-	02	02	-	-	-	-	-	-	-
<b>2</b>	<b>Indian Large Cormorant</b>												
	Site I:	-	20	30	10	05	-	-	-	-	-	-	-
	Site II:	1	1110	980	540	40	-	-	-	-	-	-	-
	Site III:	-	70	90	50	05	-	-	-	-	-	-	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>3</b>	<b>Little Egret</b>												
	Site I:	4	3	8	7	6	80	85	60	13	5	07	05
	Site II:	5	6	7	8	6	40	42	30	5	6	03	04
	Site III:	-	2	2	1	-	10	13	-	-	03	-	-
	Site IV:	4	3	3	3	4	20	20	20	02	1	02	01
<b>4</b>	<b>Cattle Egret</b>												
	Site I:	01	-	-	-	01	-	03	04	-	-	-	-
	Site II:	-	-	-	-	-	-	-	-	-	-	-	-
	Site III:	-	-	-	-	-	-	-	-	-	-	-	-
	Site IV:	01	01	-	-	02	-	03	03	-	-	-	-
<b>5</b>	<b>Pond heron</b>												
	Site I:	11	14	16	18	40	70	90	30	15	17	12	11
	Site II:	08	05	08	10	15	30	30	40	9	07	04	06
	Site III:	04	05	04	05	15	05	06	15	03	05	02	02
	Site IV:	02	06	05	02	09	05	04	05	01	01	02	-
<b>6</b>	<b>Night heron</b>												
	Site I:	02	04	07	10	11	11	10	12	12	08	06	08
	Site II:	01	03	03	03	03	06	03	05	01	02	02	03
	Site III:	-	-	02	03	05	03	06	03	02	-	01	01
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-

<b>7</b>	<b>Grey heron</b>												
	Site I:	01	01	02	02	03	06	05	05	01	01	01	02
	Site II:	01	-	02	01	01	02	03	02	-	-	-	-
	Site III:	-	-	-	01	01	01	03	04	01	-	01	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>8</b>	<b>Little bittern</b>												
	Site I:	-	-	-	04	26	29	33	28	05	-	-	-
	Site II:	-	-	-	-	-	-	-	-	-	-	-	-
	Site III:	-	-	-	-	-	-	-	-	-	-	-	-
	Site IV:	-	-	-	01	02	01	02	02	-	-	-	-
<b>9</b>	<b>Grey lag goose</b>												
	Site I:	-	01	-	02	-	-	-	-	01	-	-	-
	Site II:	-	07	10	16	-	-	-	-	01	05	04	04
	Site III:	-	01	02	02	-	-	-	-	-	01	02	02
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>10</b>	<b>Mallard</b>												
	Site I:	04	08	12	15	08	03	01	-	07	09	10	12
	Site II:	90	1282	1108	525	45	25	23	-	100	136	880	1408
	Site III:	06	06	80	60	25	02	01	-	43	25	110	80
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>11</b>	<b>Common teal</b>												
	Site I:	02	06	07	04	-	-	-	-	02	01	09	06
	Site II:	88	1304	1351	38	-	-	-	-	08	11	1406	125
	Site III:	10	40	42	08	-	-	-	-	-	03	35	19
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>12</b>	<b>Northern pintail</b>												
	Site I:	-	08	08	06	-	-	-	-	02	03	15	06
	Site II:	28	1372	1318	33	-	-	-	-	17	19	376	358
	Site III:	02	70	74	11	-	-	-	-	01	08	59	36
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>13</b>	<b>Gadwall</b>												
	Site I:	-	09	03	-	-	-	-	-	-	02	06	02
	Site II:	18	460	86	05	-	-	-	-	03	180	445	32
	Site III:	02	131	11	-	-	-	-	-	-	18	19	06

	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>14</b>	<b>Northern shoveller</b>												
	Site I:	-	-	06	03	-	-	-	-	-	02	03	06
	Site II:	-	1420	1584	21	-	-	-	-	-	08	10	382
	Site III:	-	80	40	6	-	-	-	-	-	02	02	12
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>15</b>	<b>Wigeon</b>												
	Site I:	-	09	03	01	-	-	-	-	-	-	-	01
	Site II:	04	820	728	08	-	-	-	-	-	10	45	27
	Site III:	01	171	69	01	-	-	-	-	-	03	05	02
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>16</b>	<b>Garganey</b>												
	Site I:	-	09	06	02	-	-	-	-	-	-	-	06
	Site II:	-	1305	760	26	-	-	-	-	-	08	41	376
	Site III:	-	36	34	12	-	-	-	-	-	02	09	08
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>17</b>	<b>Pochard</b>												
	Site I:	-	-	01	-	-	-	-	-	-	01	02	-
	Site II:	06	36	07	-	-	-	-	-	-	06	06	10
	Site III:	01	04	02	-	-	-	-	-	-	01	01	02
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>18</b>	<b>Red crested pochard</b>												
	Site I:	-	02	01	01	-	-	-	-	-	-	02	02
	Site II:	-	16	10	02	-	-	-	-	-	-	06	10
	Site III:		02	03	01	-	-	-	-	-	-	02	03
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>19</b>	<b>White eyed pochard</b>												
	Site I:	-	02	-	-	-	-	-	-	-	-	-	-
	Site II:	-	08	02	-	-	-	-	-	-	-	03	03
	Site III:	-	02	-	-	-	-	-	-	-	-	01	01
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>20</b>	<b>Brahminy Duck</b>												
	Site I:	-	06	02	-	-	-	-	-	-	01	02	02
	Site II:	02	11	02	-	-	-	-	-	-	03	04	-

	Site III:	-	3	-	-	-	-	-	-	-	-	-	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>21</b>	<b>Common merganser</b>												
	Site I:	-	06	08	05	-	-	-	-	01	06	12	-
	Site II:	-	1308	876	37	-	-	-	-	07	70	335	-
	Site III:	-	36	16	8	-	-	-	-	2	24	23	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>22</b>	<b>Common periah kite</b>												
	Site I:	02	04	04	03	02	04	04	02	02	01	01	02
	Site II:	-	02	02	04	04	04	06	07	05	02	02	04
	Site III:	02	01	01	02	04	02	02	04	03	02	01	01
	Site IV:	02	02	02	02	02	04	04	04	01	03	02	01
<b>23</b>	<b>Indian purple coot</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	04	02	-	-	-	-	-	-	-	-	-	02
	Site III:	02	02	-	-	-	-	-	-	-	-	-	01
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>24</b>	<b>Indian moore hen</b>												
	Site I:	18	23	41	45	47	54	54	55	38	24	18	18
	Site II:	-	-	-	-	-	-	-	-	-	-	-	-
	Site III:	-	-	-	-	-	-	-	-	-	-	-	-
	Site IV:	06	07	09	11	13	14	14	13	11	06	07	05
<b>25</b>	<b>Coot</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	300	500	400	100	-	-	-	-	50	100	200	300
	Site III:	1200	2500	1500	300	-	-	-	-	150	200	1500	2200
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>26</b>	<b>Pheasant tailed jacana</b>												
	Site I:	-	-	-	01	12	14	13	11	04	-	-	-
	Site II:	-	-	-	03	14	16	33	32	8	-	-	-
	Site III:	-	-	-	-	04	03	04	02	01	-	-	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>27</b>	<b>European little ringed plover</b>												
	Site I:	-	-	-	-	-	08	09	-	-	-	-	-

	Site II:	-	-	-	-	-	02	03	-	-	-	-	-
	Site III:	-	-	-	-	-	-	03	-	-	-	-	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>28</b>	<b>Common snipe</b>												
	Site I:	-	-	-	-	04	05	04	02	-	-	-	-
	Site II:	-	-	-	-	01	01	02	02	-	-	-	-
	Site III:	-	-	-	-	-	-	-	-	-	-	-	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>29</b>	<b>Common sand piper</b>												
	Site I:	-	-	-	08	11	15	17	15	-	-	-	-
	Site II:	-	-	-	02	03	04	03	02	-	-	-	-
	Site III:	-	-	-	-	-	-	-	-	-	-	-	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>30</b>	<b>Black winged stilt</b>												
	Site I:	-	-	-	08	14	127	161	-	-	-	-	-
	Site II:	-	-	-	04	05	23	29	-	-	-	-	-
	Site III:	-	-	-	-	-	-	-	-	-	-	-	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>31</b>	<b>Indian whiskered tern</b>												
	Site I:	-	-	-	06	15	35	52	29	13	-	-	
	Site II:	-	-	-	12	45	155	198	101	27	-	-	
	Site III:	-	-	-	-	-	-	-	-	-	-	-	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>32</b>	<b>Hume's blue rock pigeon</b>												
	Site I:	07	07	06	09	08	11	06	06	07	05	03	04
	Site II:	03	10	08	08	12	09	08	06	06	06	04	06
	Site III:	02	04	03	05	04	06	02	02	02	03	02	03
	Site IV:	05	04	04	06	09	10	04	02	04	03	03	02
<b>33</b>	<b>Indian ring dove</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	-	-	-	03	05	04	03	02	02	-	-	-
	Site III:	-	-	-	06	07	08	07	06	04	-	-	-
	Site IV:	-	-	-	02	06	04	05	03	-	-	-	-

<b>34 Oriental turtle dove</b>													
Site I:	-	-	-	-	-	-	-	-	-	-	-	-	-
Site II:	-	-	-	04	05	05	06	04	02	-	-	-	-
Site III:	-	-	-	06	08	09	09	08	06	-	-	-	-
Site IV:	-	-	-	04	04	04	07	07	02	-	-	-	-
<b>35 Himalayan slaty headed parakeet</b>													
Site I:	-	-	-	01	02	02	03	03	-	01	-	-	-
Site II:	-	-	-	02	01	02	10	02	-	03	-	-	-
Site III:	-	-	-	03	05	05	06	06	04	02	-	-	-
Site IV:	-	-	-	02	03	03	03	03	-	02	-	-	-
<b>36 Rose ringed parakeet</b>													
Site I:	-	-	-	-	-	-	-	-	-	-	-	-	-
Site II:	-	-	-	-	-	-	-	-	-	-	-	-	-
Site III:	02	02	01	-	-	-	-	-	-	02	02	03	-
Site IV:	01	02	-	-	-	-	-	-	-	01	02	02	-
<b>37 Asiatic cuckoo</b>													
Site I:	-	-	-	04	06	04	04	03	-	-	-	-	-
Site II:	-	-	-	02	03	03	02	01	-	-	-	-	-
Site III:	-	-	-	04	06	04	06	02	-	-	-	-	-
Site IV:	-	-	-	05	07	05	06	06	-	-	-	-	-
<b>38 Central Asian kingfisher</b>													
Site I:	12	11	13	12	14	21	11	10	9	10	13	12	-
Site II:	06	07	06	04	06	07	06	06	07	07	07	07	-
Site III:	04	05	04	03	04	05	04	02	02	03	04	04	-
Site IV:	09	07	06	04	06	07	05	03	03	03	05	05	-
<b>39 White breasted kingfisher</b>													
Site I:	03	03	02	06	05	06	08	08	06	04	02	02	-
Site II:	-	01	01	02	02	03	02	03	02	01	-	-	-
Site III:	-	-	-	01	01	01	02	02	03	01	02	-	-
Site IV:	01	01	-	01	02	02	03	03	02	01	01	01	-
<b>40 Indian pied kingfisher</b>													
Site I:	07	09	13	15	18	16	15	15	13	14	9	5	-
Site II:	01	02	02	03	03	04	05	04	03	03	02	01	-
Site III:	-	01	03	04	05	06	05	06	04	06	04	01	-



	Site IV:	06	06	08	07	08	06	06	05	06	04	03	04
<b>41</b>	<b>Kashmir roller</b>												
	Site I:	-	-	-	-	01	01	02	01	-	-	-	-
	Site II:	-	-	-	-	02	03	02	-	-	-	-	-
	Site III:	-	-	-	03	09	09	06	07	03	-	-	-
	Site IV:	-	-	-	02	01	03	02	02	-	-	-	-
<b>42</b>	<b>European hoopoe</b>												
	Site I:	-	-	-	-	02	01	01	-	-	-	-	-
	Site II:	-	-	-	-	02	01	01	-	-	-	-	-
	Site III:	-	-	-	02	06	09	07	03	-	-	-	-
	Site IV:	-	-	-	03	03	05	01	-	-	-	-	-
<b>43</b>	<b>Brown fronted wood pecker</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	-	-	-	-	-	-	-	-	-	-	-	-
	Site III:	02	03	02	-	-	-	-	-	-	-	-	03
	Site IV:	01	-	-	-	-	-	-	-	-	-	-	02
<b>44</b>	<b>Grey headed wood pecker</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	-	-	-	-	-	-	-	-	-	-	-	-
	Site III:	02	02	01	-	-	-	-	-	-	-	-	01
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>45</b>	<b>Common swallow</b>												
	Site I:	-	-	04	06	07	15	17	21	04	-	-	-
	Site II:	-	-	11	12	13	22	23	24	04	-	-	-
	Site III:	-	-	13	15	16	106	109	122	06	-	-	-
	Site IV:	-	-	09	7	13	26	32	33	06	-	-	-
<b>46</b>	<b>Grey drongo</b>												
	Site I:	-	-	-	01	01	-	-	-	-	-	-	-
	Site II:	-	-	-	01	01	-	-	01	-	-	-	-
	Site III:	-	-	-	04	05	10	08	04	-	-	-	-
	Site IV:	-	-	-	04	04	09	04	03	-	-	-	-
<b>47</b>	<b>Golden oriole</b>												
	Site I:	-	-	-	02	03	03	01	-	-	-	-	-
	Site II:	-	-	-	-	-	03	03	-	-	-	-	-

	Site III:	-	-	-	06	06	09	10	11	03	-	-	-
	Site IV:	-	-	-	02	04	05	02	03	01	-	-	-
<b>48</b>	<b>Long tailed shrike</b>												
	Site I:	-	-	-	01	03	02	01	02	-	-	-	-
	Site II:	-	-	-	02	04	06	05	03	-	-	-	-
	Site III:	-	-	-	09	16	16	12	06	04	-	-	-
	Site IV:	-	-	-	08	06	02	02	02	-	-	-	-
<b>49</b>	<b>Common myna</b>												
	Site I:	09	11	12	05	9	9	11	14	16	18	18	16
	Site II:	16	15	06	7	08	11	09	13	15	17	17	13
	Site III:	13	16	08	09	04	08	07	17	17	19	16	12
	Site IV:	11	15	11	07	09	12	10	16	17	17	19	14
<b>50</b>	<b>Himalayan starling</b>												
	Site I:	-	-	-	02	04	04	05	06	04	-	-	-
	Site II:	-	-	-	05	11	14	14	13	07	-	-	-
	Site III:	-	-	-	09	13	15	16	15	08	-	-	-
	Site IV:	-	-	-	02	06	06	09	11	05	-	-	-
<b>51</b>	<b>House crow</b>												
	Site I:	06	05	06	07	04	09	06	07	06	05	08	06
	Site II:	09	08	08	08	05	11	09	08	07	06	04	04
	Site III:	10	08	07	09	05	9	16	12	05	04	06	05
	Site IV:	08	09	06	13	06	10	14	13	06	04	09	06
<b>52</b>	<b>Jungle crow</b>												
	Site I:	03	04	03	-	-	-	-	-	03	03	04	05
	Site II:	04	05	03	03	-	-	-	-	-	06	04	05
	Site III:	06	07	04	03	04	-	-	-	04	06	07	07
	Site IV:	04	06	03	-	-	-	-	-	05	04	05	05
<b>53</b>	<b>Eastern jackdaw</b>												
	Site I:	12	13	06	12	14	23	12	15	13	14	15	16
	Site II:	22	20	12	15	16	24	13	21	22	21	12	19
	Site III:	23	15	09	23	16	12	17	29	28	17	20	13
	Site IV:	20	16	07	21	17	13	12	26	26	18	17	12
<b>54</b>	<b>White cheeked bulbul</b>												
	Site I:	07	03	06	09	04	06	06	09	08	06	05	06

	Site II:	8	04	04	08	03	05	08	07	08	09	06	04
	Site III:	05	2	03	07	05	02	06	08	09	10	06	05
	Site IV:	06	2	03	05	03	04	05	05	05	09	04	05
<b>55</b>	<b>White caped redstart</b>												
	Site I:	-	-	02	03	03	02	02	02	01	02	-	-
	Site II:	-	02	03	02	02	03	03	02	03	02	-	-
	Site III:	02	04	02	04	05	06	07	06	06	05	05	02
	Site IV:	01	01	02	02	02	01	04	01	01	-	02	-
<b>56</b>	<b>Plumbeous water red start</b>												
	Site I:	-	-	02	03	03	02	03	04	02	-	-	-
	Site II:	01	02	01	01	-	03	03	03	01	01	01	-
	Site III:	03	03	05	06	06	05	06	07	06	06	07	03
	Site IV:	-	01	02	-	01	02	04	03	02	01	-	02
<b>57</b>	<b>Ruby throat</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	-	-	-	-	-	-	-	-	-	-	-	-
	Site III:	02	02	02	-	-	-	-	-	-	-	-	03
	Site IV:	02	01	01	-	-	-	-	-	-	-	-	02
<b>58</b>	<b>Tree pipit</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	-	-	-	-	-	-	-	-	-	-	-	-
	Site III:	03	03	04	-	-	-	-	-	-	02	02	01
	Site IV:	02	03	03	-	-	-	-	-	-	-	01	-
<b>59</b>	<b>Himalayan whistling thrush</b>												
	Site I:	7	06	09	03	-	-	-	-	-	03	03	04
	Site II:	08	06	08	-	-	-	-	-	-	-	04	09
	Site III:	09	09	11	06	-	-	-	-	-	07	06	07
	Site IV:	09	03	09	03	-	-	-	-	-	05	07	08
<b>60</b>	<b>Simla streaked laughing thrush</b>												
	Site I:	04	02	02	-	-	-	-	-	-	-	01	02
	Site II:	02	-	-	-	-	-	-	-	-	-	-	02

	Site III:	07	08	09	-	-	-	-	-	-	-	03	09
	Site IV:	06	04	04	-	-	-	-	-	-	-	01	04
<b>61 Himalayan paradise fly catcher</b>													
	Site I:	-	-	-	-	02	03	03	-	-	-	-	-
	Site II:	-	-	-	-	-	-	03	03	-	-	-	-
	Site III:	-	-	-	03	09	09	11	08	06	-	-	-
	Site IV:	-	-	-	02	04	05	04	03	-	-	-	-
<b>62 Indian great reed warbler</b>													
	Site I:	-	-	-	30	45	86	56	43	12	-	-	-
	Site II:	-	-	-	-	03	02	06	-	-	-	-	-
	Site III:	-	-	-	3	5	6	11	5	2	-	-	-
	Site IV:	-	-	-	04	08	07	13	07	03	-	-	-
<b>63 Witherby's paddy field warbler</b>													
	Site I:	-	-	-	05	11	15	19	12	-	-	-	-
	Site II:	-	-	-	-	-	-	-	-	-	-	-	-
	Site III:	-	-	-	02	03	02	02	02	-	-	-	-
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	-
<b>64 Western spotted fork-tail</b>													
	Site I:	-	-	-	-	01	01	-	-	-	-	-	-
	Site II:	-	-	-	-	02	02	01	01	-	-	-	-
	Site III:	-	-	02	03	05	06	05	03	03	-	-	-
	Site IV:	-	-	-	02	03	03	02	-	-	-	-	-
<b>65 Little fork-tail</b>													
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	-	-	-	-	-	-	-	-	-	-	-	-
	Site III:	04	01	01	-	-	-	-	-	-	-	-	03
	Site IV:	-	01	-	-	-	-	-	-	-	-	-	-
<b>66 Kashmir grey tit</b>													
	Site I:	-	01	02	-	-	-	-	-	-	-	03	02
	Site II:	-	-	03	-	-	-	-	-	-	-	03	03
	Site III:	04	05	11	12	-	-	-	05	03	03	07	13
	Site IV:	03	-	05	05	-	-	-	01	-	-	04	04

<b>67</b>	<b>Spot winged tit</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	01	-
	Site II:	-	-	01	02	-	-	-	-	-	-	01	02
	Site III:	04	05	06	07	-	-	-	-	02	03	09	09
	Site IV:	02	01	02	02	-	-	-	-	-	-	02	04
<b>68</b>	<b>Green backed tit</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	-	-	-	02	-	-	-	-	-	-	02	02
	Site III:	3	04	06	07	-	-	-	-	02	06	09	10
	Site IV:	02	-	-	-	-	-	-	-	-	-	02	03
<b>69</b>	<b>Kashmir wren</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	02	-	-	-	-	-	-	-	-	-	-	05
	Site III:	11	13	02	-	-	-	-	-	-	-	08	09
	Site IV:	04	01	02	-	-	-	-	-	-	-	03	04
<b>70</b>	<b>Tree creeper</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	04	-	-	-	-	-	-	-	-	-	-	01
	Site III:	13	11	05	-	-	-	-	-	-	-	04	09
	Site IV:	07	04	-	-	-	-	-	-	-	-	02	03
<b>71</b>	<b>Wall creeper</b>												
	Site I:	-	-	-	-	-	-	-	-	-	-	-	-
	Site II:	-	-	-	-	-	-	-	-	-	-	-	-
	Site III:	-	-	03	-	-	-	-	-	-	-	01	02
	Site IV:	-	-	-	-	-	-	-	-	-	-	-	02
<b>72</b>	<b>Yellow bellied magpie</b>												
	Site I:	-	-	-	-	02	01	02	01	-	-	-	-
	Site II:	-	-	-	-	01	02	01	01	-	-	-	-
	Site III:	-	-	-	-	03	06	07	04	-	-	-	-
	Site IV:	-	-	-	-	-	02	03	01	-	-	-	-
<b>73</b>	<b>Hodgson's pied wagtail</b>												
	Site I:	-	-	5	11	12	13	18	17	17	-	-	-
	Site II:	-	-	04	05	06	08	07	04	-	-	-	-
	Site III:	-	-	-	06	02	04	05	05	04	-	-	-
	Site IV:	-	-	04	04	05	05	09	08	03	-	-	-

<b>74 White wagtail</b>													
Site I:	-	-	05	09	11	12	13	11	05	-	-	-	-
Site II:	-	-	02	03	05	04	03	03	-	-	-	-	-
Site III:	-	-	-	03	03	-	04	-	-	-	-	-	-
Site IV:	-	-	01	02	04	03	-	02	02	-	-	-	-
<b>75 Hodgson's yellow headed wagtail</b>													
Site I:	-	-	04	09	12	12	09	08	06	-	-	-	-
Site II:	-	-	-	04	06	07	06	02	-	-	-	-	-
Site III:	-	-	-	06	05	05	04	04	-	-	-	-	-
Site IV:	-	-	-	05	07	06	06	02	03	-	-	-	-
<b>76 House sparrow</b>													
Site I:	13	08	08	11	11	06	08	10	09	09	09	09	07
Site II:	11	07	09	09	12	07	04	06	08	11	11	11	04
Site III:	14	06	07	11	10	06	07	09	07	09	09	09	06
Site IV:	13	09	05	10	11	04	06	09	09	08	09	09	04

**Table 2. Diversity of bird species at different study sites**

<b>Site</b>	<b>Diversity (Shanon Wiener index)</b>
I	3.485
II	2.605
III	1.778
IV	2.920

**Table 3: Check list of birds recorded from Dal lake**

S.No.	Common name	Scientific name	Status
<b>Family: Podicipedidae</b>			
1	Dabchick	<i>Podiceps ruficollis capensis</i>	R
<b>Family: Phalacrocoridae</b>			
2	Indian large cormorant	<i>Phalacrocorax carbo sinensis</i>	WM
<b>Family: Ardeidae</b>			
3	Little egret	<i>Egretta garzetta garzetta</i>	R
4	Cattle egret	<i>Bubulcus ibis coromandus</i>	R
5	Pond heron	<i>Ardeola grayii</i>	R
6	Night heron	<i>Nycticorax nycticorax</i>	R
7	Grey heron	<i>Ardea cinerea rectirostris</i>	R
8	Little Bittern	<i>Ixobrychus minutus minutus</i>	SM
<b>Family: Anatidae</b>			
9	Grey lag goose	<i>Anser anser</i>	WM
10	Mallard	<i>Anas platyrhynchos</i>	WM
11	Common teal	<i>Anas creaca</i>	WM
12	Northern pintail	<i>Anas acuta</i>	WM
13	Gad wall	<i>Anas strepera</i>	WM
14	Northern shoveller	<i>Anas clypeata</i>	WM
15	Wigeon	<i>Anas penelope</i>	WM
16	Garganey	<i>Anas querquedula</i>	WM
17	Common pochard	<i>Aythya ferina</i>	WM
18	Red crested pochard	<i>Aythya rufina</i>	WM
19	White eyed pochard	<i>Aythya nyroca</i>	WM
20	Brahminy duck	<i>Tadorna ferruginea</i>	WM
21	Common merganser	<i>Mergus merganser</i>	WM
<b>Family: Accipitridae</b>			
22	Common peria kite	<i>Milvus migrans</i>	R
<b>Family: Rallidae</b>			
23	Indian purple coot	<i>Porphyrio poliocephalus</i>	WM
24	Indian moore hen	<i>Gallinule chloropus indicus</i>	R
25	Coot	<i>Fulica atra atra</i>	WM
<b>Family: Jacanidae</b>			
26	Pheasant tailed Jacana	<i>Hydrophasianus chirugus</i>	SM
<b>Family: Charadriidae</b>			
27	European little ringed plover	<i>Charadrius dubius curonicus</i>	SM
<b>Family: Scolopacidae</b>			
28	Common snipe	<i>Gallinago gallinago</i>	SM
29	Common sand piper	<i>Actitis hypoleucos</i>	SM
<b>Family: Recurvirostridae</b>			
30	Black winged stilt	<i>Himantopus himantopus</i>	SM
<b>Family: Laridae</b>			
31	Indian whiskered tern	<i>Chlidonias hybrida indica</i>	SM
<b>Family: Columbidae</b>			
32	Hume's Blue rock pigeon	<i>Columba livia neglecta</i>	R
33	Indian ring dove	<i>Streptopelia decaota</i>	SM
34	Oriental turtle dove	<i>Streptopelia chinensis</i>	SM
<b>Family: Psittacidae</b>			
35	Himalayan slaty headed	<i>Psittacula himalayana</i>	SM

	parakeet		
36	Rose ringed parakeet	<i>Psittacula krameri</i>	LAM
	<b>Family: Cuculidae</b>		
37	Asiatie cuckoo	<i>Cuculus canorus telephonus</i>	SM
	<b>Family: Alcedinidae</b>		
38	Central Asian kingfisher	<i>Alcedo atthis pallasii</i>	R
39	White breasted kingfisher	<i>Halcyon smyrnensis smyrnensis</i>	R
40	Indian pied kingfisher	<i>Ceryle rudis leucomelanura</i>	R
	<b>Family: Coraciidae</b>		
41	Kashmir roller	<i>Coracias garrula semenowi</i>	SM
	<b>Family: Upupidae</b>		
42	European hoopoe	<i>Upupa epops epops</i>	SM
	<b>Family: Picidae</b>		
43	Brown fronted wood pecker	<i>Dendrocopos auriceps</i>	LAM
44	Grey headed wood pecker	<i>Picus canus</i>	LAM
	<b>Family: Hirundinidae</b>		
45	Common swallow	<i>Hirundo rustica rustica</i>	SM
	<b>Family: Dicruridae</b>		
46	Grey drongo	<i>Dicrurus leucophaeus</i>	SM
	<b>Family: Oriolidae</b>		
47	Golden oriole	<i>Oriolus oriolus</i>	SM
	<b>Family: Lanidae</b>		
48	Long tailed shrike	<i>Lanius schach erythronotus</i>	SM
	<b>Family: Sturnidae</b>		
49	Common Myna	<i>Acridotheres tristis tristis</i>	R
50	Himalayan starling	<i>Sturnus vulgaris humii</i>	SM
	<b>Family: Corvidae</b>		
51	House crow	<i>Corvus splendens</i>	R
52	Jungle crow	<i>Corvus macrorhynchos</i>	R
53	Eastern jackdaw	<i>Corvus monedula</i>	R
	<b>Family: Pycnonotidae</b>		
54	White checked Bulbul	<i>Molpastes leucogenys leucogenys</i>	R
	<b>Family: Muscicapidae</b>		
55	White caped redstart	<i>Chaimarrhornis leucocephalus</i>	R
56	Plumbeous water red start	<i>Rhyacornis fulginosus</i>	R
57	Ruby throat	<i>Calliope pectoralis pectoralis</i>	LAM
58	Himalayan whistling thrush	<i>Myiophoneus caeruleus temminckii</i>	LAM
59	Simla streaked laughing thrush	<i>Trochalopteron lineatum</i>	LAM
60	Himalayan paradise fly catcher	<i>Tersiphone paradise</i>	SM
61	Indian great reed warbler	<i>Acrocephalus stentoreus</i>	SM
62	Witherby's paddy field warbler	<i>Acrocephalus concinens</i>	SM
63	Western spotted fork-tail	<i>Enicurus maculatus</i>	SM
64	Little fork-tail	<i>Microcichla scouleri</i>	LAM
	<b>Family: Passeridae</b>		
65	Tree pipit	<i>Anthus trivalis</i>	WM
	<b>Family: Paridae</b>		
66	Kashmir grey tit	<i>Parus major</i>	R



67	Spot winged tit	<i>Parus melanolophus</i>	WM
68	Green backed tit	<i>Parus monticolus</i>	WM
	<b>Family: Troglodytidae</b>		
69	Kashmir wren	<i>Troglodytes troglodytes</i>	LAM
	<b>Family: Sittidae</b>		
70	Wall creeper	<i>Tichodroma muraria</i>	WM
	<b>Family: Certhidae</b>		
71	Tree creeper	<i>Certhia himalayana limes</i>	LAM
	<b>Family: Corvidae</b>		
72	Yellow bellied magpie	<i>Urocissa flavirostris</i>	SM
	<b>Family: Motacillidae</b>		
73	Hodgson's pied wagtail	<i>Motacilla alba alboides</i>	SM
74	White wagtail	<i>Motacilla cinerea melanope</i>	SM
75	Hodgson's yellow headed wagtail	<i>Motacilla citreola calcarata</i>	SM
	<b>Family: Fringillidae</b>		
76	House sparrow	<i>Passer domesticus griseigularis</i>	R

## B. HABITAT USE

The importance of habitat structure and complexity to avian ecology has been widely documented (MacArthur 1961; MacArthur *et al.* 1962; Cody, 1981, 1985), and positive correlations between habitat cover, habitat area, species richness and local abundance have been found (MacArthur 1961; Venier and Fahrig 1996). The relationship between habitat structure and wetland bird assemblages is centered on habitat extension effects on the community structure (Froneman *et al.* 2001; Riffell *et al.* 2001). Species richness, bird abundance and species build have been positively correlated with wetland area and water surface area (Babbitt 2000). Some habitat characteristics may change over time (e.g., water depth level, vegetation cover, among others) and bird selection criteria might also change in response to these habitat changes (Riffel *et al.* 2001). Also, bird habitat requirements change seasonally due to nest or food utilization in breeding and non-breeding seasons (DuBowy 1988; Froneman *et al.* 2001).

Dal lake was found to be the most diverse in respect of vegetational characteristics and habitat types and provides a thick cover to the avifauna for resting and nesting. However during the period of winter months, lake is more or less completely devastated but other periods of year, it is characterized by luxuriant growth of seasonal emergent both tall and short. Among the tall emergents the most dominant are *Phragmites australes*, *Typha angustata*, *Sparganium ramosum* and *Epilobium sp.* and short emergent's include *Cyperus sp.*; *Polygonum sp.*, *Sagittaria saggitifolia*, *Myriophyllum verticellatum*, *Juncus articulatus*, *Hippurus vulgaris*, *Alisma platigo aquatica*, were seen distributed more or less in between the tall emergents.

The north western zone of lake was characterized by presence of emergents, subemergents and floating vegetation. The dominant emergents in the zone were *Phragmites australes*, *Sparganium ramosum*, *Sagittaria saggitifolia*, *Juncus articulatus*, *Cyperus deformis*. Among short and low

emergent *Hippurus vulgaris* and *myriophyllum verticellatum*, were most dominant and form thick and conspicuous strand. In addition to these macrophytes *Typha angustata*, *Epilobium hirsutum*, *Polygonum hypdropiper* were also present in this zone. The floating vegetation found in this region includes *Nymphoides peltatum*, *Potomegaton natans*, *Nymphaea alba*, *Myriophyllum aquaticum*, *Trapa natans*. The submerged vegetation comprises of *ceratophyllum demersum*, *Hydrilla verticillata*,

Some trees like *Salix alba* have grown in this habitat which serve as watching spots for predators like kites and resting sites for egrets, crows. During spring and summer months these were also used by tree warblers.

In this habitat the emergent macrophytic vegetation like *phragmites australes*, *Typha angustata*, *sparganium romasum*, were used for nesting by the birds like little bittern, indian great reed warblers, moorehen, wagtails, while as floating vegetation like *Trapa natans*, *Nymphoide sp.* were used for nesting by dabchick, whiskered tern and pheasant tailed jacana.

The south eastern was mostly characterized by the presence of floating species. The chief floating vegetation comprised of *Nymphoides peltatum*, *Nymphaea alba*, *Nelumbo nucifera*, *Nymphaea mexicana*, *Trapa natans*, *Lemna gibba*, *Lemna trisulca*, *potomogeton lucens*, *P. crispus*, *P.natans*. The other type of vegetation found in this area includes *Scirpus triqueter*, *Eichhornia crassipes*, *Cyperus deformis*, *Carex sp.*, *Polygonum amphibium*, *Polygonum hypdropiper*, *Myriophyllum verticellatum*, *M. spicatum*, *Hippuris vulgaris*, *Lycopus europus*, *Alisma plantago*, *Sium latijugum*, *Azolla pinnata* , *Salvinia natans*, *Hydrilla verticellatum*. This habitat was found to be successfully exploited by waterfowls and has forest areas in its vicinity and some forest birds may occasionally stray towards the lake.

### Habitat preference of different bird species in relation to vegetation

<b>North Western habitat</b>	
Moorehen, Indian great reed warblers, Little Bittern, Wagtails	<i>Phragmites australes, Typha angustata, Sparganium romosum, .</i>
Whiskered tern, Dabchick, Pheasant tailed Jacana	<i>Trapa natans, Nymphoides peltatum, Nymphaea alba, Potomagaton natans.</i>
<b>South Eastern Habitat</b>	
Mallard, Pintail, common teal, shoveller, Grey lag goose, Wigeon, Gadwall, Pochard, coot.	<i>Nelumbo nucifera, Nymphae alba, Nymphoides peltatum, scirpus triqueter, Cyperus deformis, carex sp, polygonum amphibium, Myriophyllum verticellatum, M. spicatum, Sium latijugum, Polygonum hydropper, Alisma plantigo, Lycopus europus, Trapa natans, Azolla pinnata, Salvinia natans. Hippuris vulgaris.</i>
Whiskered tern, Dabchick, Pheasant tailed Jacana	<i>Nymphoide sp., lemna gibba lemna trisulca.</i>

Study revealed that no species restricted itself to only one habitat and only maximum density was found in that habitat. Diverse habitat preferences were observed among some species of ducks which apparently seemed to be related with adequate habitat factors. In order to obtain food, ducks performed different ways which seemed to be directly related with nature of habitat.



(a)



(b)



(c)

**Plate 1:** a. Air gun  
b. Pellets used for air gun  
c. Poached birds



(a)



(b)



(c)

**Plate 2:** a. Man destroying macrophytic vegetation containing nests  
b. Dabchick  
c. Indian large cormorant





(a)



(b)



(c)

**Plate 3:** a. Little egret  
b. Cattle egret  
c. Pond heron



(a)



(b)



(c)

**Plate 4:** a. Night heron  
b. Little bittern  
c. Mallard (Female along with ducklings).





(a)



(b)



(c)

**Plate 5:** a. Mallard (Male)  
b. Pintail (Male and Female)  
c. Shoveller



(a)



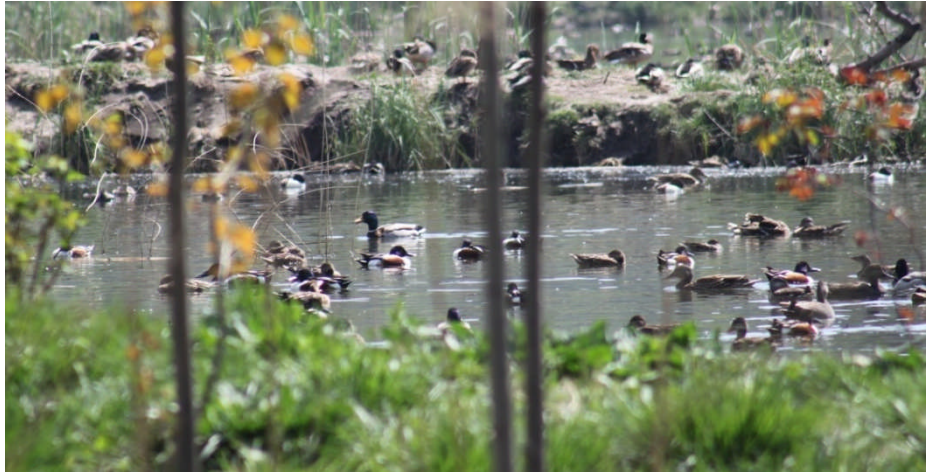
(b)



(c)

**Plate 6:** a. Brahminy duck  
b. Common teal  
c. Red crested Pochard





(a)



(b)



(c)

**Plate 7:** a. Garganey  
b. Waterfowls  
c. Kite



(a)



(b)



(c)

**Plate 8:** a. Indian purple coot  
b. Indian moorehen  
c. Coot





(a)



(b)



(c)

**Plate 9:** a. Pheasant tailed Jacana  
b. European little ringed plover  
c. Black winged stilt



(a)



(b)



(c)

**Plate 10:** a. Whiskered tern  
b. Pigeon  
c. Indian ring dove



(a)



(b)



(c)

**Plate 11:** a. Oriental turtle dove.  
b. H. Slaty headed parakeet  
c. Rose ringed parakeet



(a)



(b)



(c)

**Plate 12:** a. Central Asian kingfisher  
b. White breasted kingfisher  
c. Indian Pied kingfisher





(a)



(b)



(c)

**Plate 13:** a. European hoopoe  
b. Brown fronted wood pecker  
c. Common swallow



(a)



(b)



(c)

**Plate 14:** a. Golden oriole  
b. Long tailed shrike  
c. Common myna



(a)



(b)

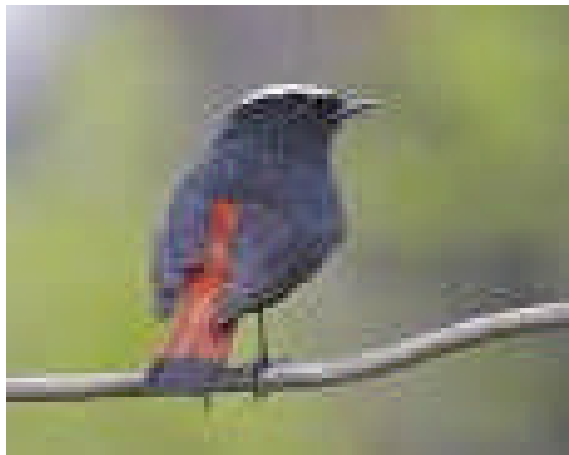


(c)

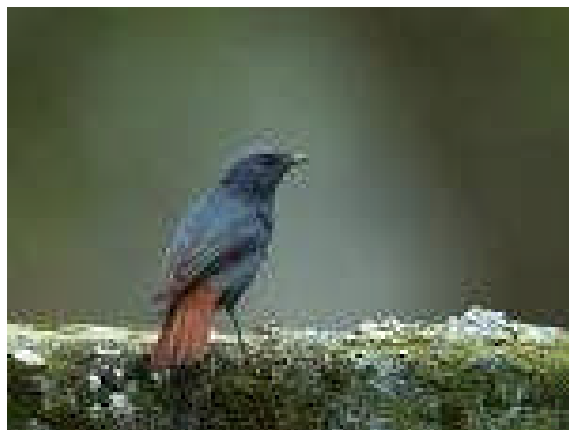
**Plate 15:** a. Starling  
b. House crow  
c. Jack daw



(a)



(b)



(c)

**Plate 16:** a. Bulbul  
b. White caped red start  
c. Plumbeous water redstart





(a)



(b)



(c)

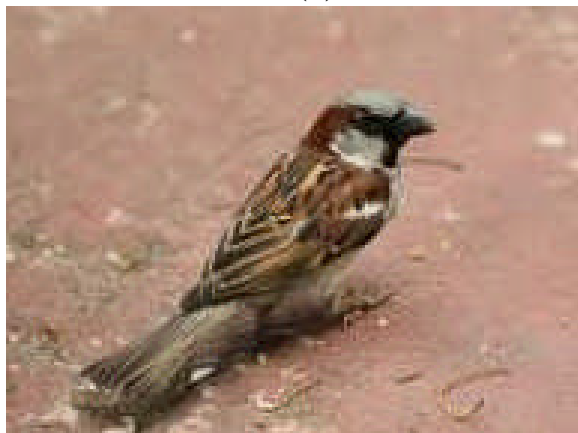
**Plate 17:** a. H. Whistling Thrush  
b. Simla streaked laughing thrush  
c. H. Paradise flycatcher



(a)



(b)



(c)

**Plate 18:** a. Tree creeper  
b. White wagtail  
c. House sparrow



(a)



(b)



(c)

**Plate 19:** a. Nest of whiskered tern  
b. Covered nest of dabchick  
c. Nest of bulbul





(a)



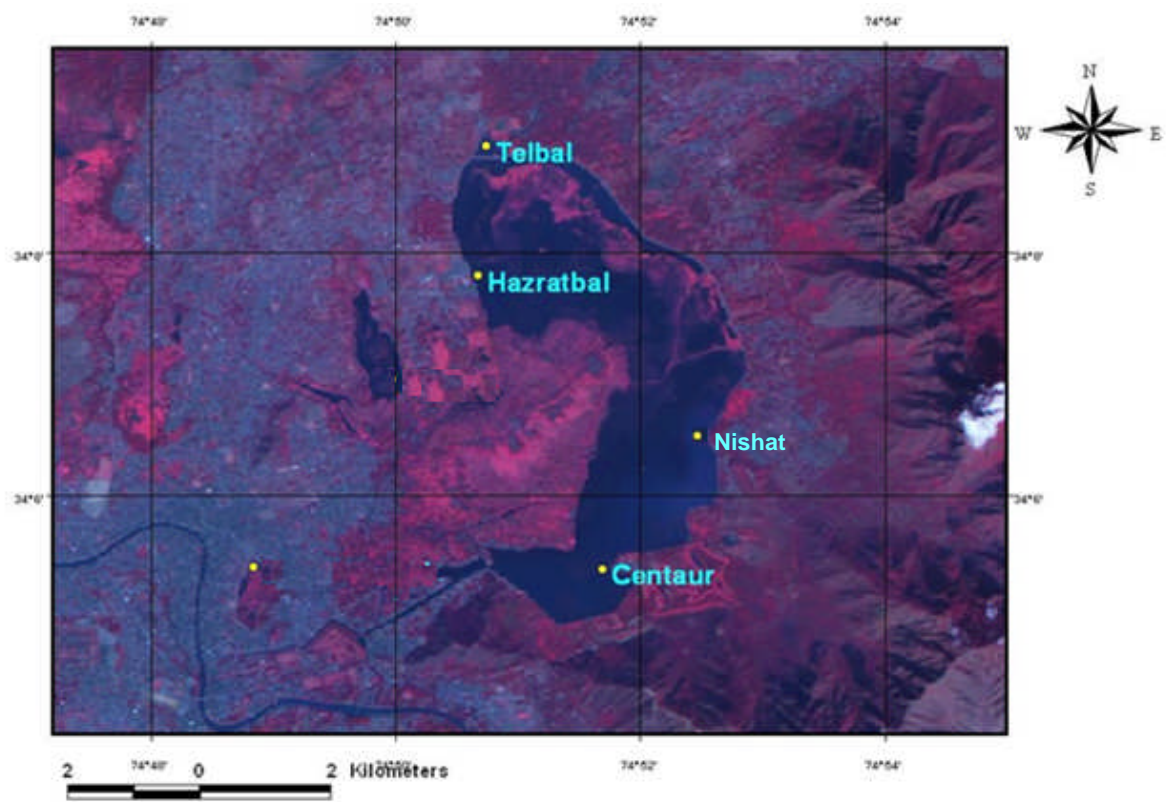
(b)



(c)

**Plate 20:** a. Young of moorehen  
b. Young of dabchick  
c. Newly hatchling of bulbul





**Satellite Imagery of Dal Lake showing different study sites**



**Site 1: Located towards Hazratbal**



**Site 2: Located towards Nishat**





**Site 3: Located towards Centaur**



**Site 4: Located towards Telbal**

## DISCUSSION

A total of 300 bird species have been recorded from Jammu and Kashmir, which includes both resident and non resident ones (Ali and Ripley, 1983). Of these Bates and Lowther (1952) have listed 167 species of breeding birds of Kashmir in their book "Breeding Birds of Kashmir". Shah (1984) recorded 90 species of both resident and non resident from Hokarsar wetland and 92 species have been listed by Holmes and Parr (1988) from Haigam wetland.

Wetlands of valley have been used as suitable habitat for migratory, passage and resident birds since long, including the winter visiting ducks and geese from Siberia, Central Asia and parts of Northern Europe on their flyway routes to plains of India (Ali, 1979)

Bates and Lowther (1972) reported impressive assemblage of wintering waterfowl and an abundance of breeding Mallards, Pochards and Coots in the wetlands of Kashmir.

During the present study a total of 76 bird species belonging to 34 families were recorded. Out of total diversity 34.2% (26 species) were summer visitors, 26.31% (20 species) were winter visitors, 27.63% (21 species) were residents, 11.84% (9 species) were local altitudinal migrant.

Maximum number of species belonged to Anatidae (13 species) followed by Muscicapidae (10 species); Ardeidae (6 species), Rallidae, Columbidae, Alcedinidae, Corvidae, Patidae and Motacillidae (3 species each), Scolopacidae, Psittacidae, Picidae, Sturnidae (2 species each), Podicipedae, Phalacrocoridae, Accipitridae, Jacanidae, Charadriidae, Recurvirostridae, Laridae, Cuculidae, Coraciidae, Upupidae, Hirundinidae, Dicruridae, Oriolidae, Lanidae, Pycnonotidae, Passeridae, Troglodytidae, Sittidae, Certhidae, Corvidae and Fringillidae (1 species each).

The maximum diversity of 3.4952 was observed at site I and least was recorded at site III. From site IV site and site II, 2.92 and 2.605 diversities were recorded respectively. The highest diversity at site 1 can be attributed to its emergent and floating vegetation; as dense vegetation benefit the nest building of birds and enhance their breeding success (Froneman *et al.*, 2001) and also provides shelter and because of little human disturbance ( Hattori and Mae, 2001)

During winter months large congregations of waterfowl accumulated in the lake and showed their appearance from September. The number of each species increased through October and maximum population was noticed in late November and early December. This number showed a marked decline in overall population in January due to rapid changes in environmental conditions such as severe cold, freezing of water and formation of snow cover. The extreme cold also affected the food availability. Swanson *et al.*, (1974), Shah (1984), Shah and Qadri (1988) also reported great variation in the population of waterfowl due to climatic changes than any other factors. Krapu (1979), have suggested that low availability of fauna and other surface food during extreme cold of winter as a factor limiting the population of waterfowl. Bennet and Bole (1978) also showed that severe weather condition especially low temperature of January and food shortage are known to cause stress and affect the distribution and movement of waterfowl. With the improvement of conditions in February the waterfowl population reformed again. So difference in the diet reflect the difference in the availability and possibly differing abundance of foods in the different periods as also suggested by Olney (1967) and Thomas (1982). Wintering waterfowl generally loose weight and are in their poorest physical condition during the periods of cold stress (Palus, 1980). Therefore the movements may be a behavioral response to lessen the effects of harsh weather.

The lake was found to consist of open water areas, areas with submerged and floating vegetation, area with emergent macrophytic vegetation and peripheral wooded areas. The areas with floating vegetation like *Trapa natans*, *Nymphaeoides* sp, *Potamogeton* sp. were used for nesting by birds like Dabchick, Whiskered tern and Pheasant tailed jacana. The emergent macrophytic vegetation like *Phragmites communis*, *Typha angustate*, *Sparganium ramosum* were used for nesting by birds like Moorehen, Little bittern, Indian great reed warblers and Wagtails, while as peripheral trees served as the resting sites for the number of upland species like Herons, Rollers, Doves, Golden oriole, Long tailed shrike,. Similar findings have been reported by Bates and Lowther (1952), Ali (2002), Shah (1984) and Ahanger (2008). Many studies have also indicated that species richness and abundance of water birds increase with increasing emergent vegetation in wetlands, especially when water birds are less mobile and are more sensitive to disturbance (Owen and Black, 1990)

Anthropogenic interference was severe at lake and was present in the form of illegal hunting, macrophytic harvesting, boating. These activities disturbed the water bird and forced them to remain always on their wings. Dozens of poachers along with their rifles were seen in lake during winter and early spring shooting upon large populations of waterfowls which forces the birds to leave the lake habitat and choose better and safe places. This results in the declining of population of waterbirds. Similar findings for the declining trend in various waterfowl species in many regions of world were observed by Nudds and Cole (1991), Phillips (2008), Houdkova (2003), Horn *et al.* (2008), Martarano and Yparraguirre (2008)

Some of the waterfowl during day hours remained confined to protected premises of lake and during night waterfowl come out for feeding. Ma zhijun *et al.*, (1998) also reported that ducks and geese were forced to shift their habitat to those places which were free from anthropogenic activities.

## CONCLUSION

Wetlands and lakes in the valley of Kashmir represent the principle wintering habitats of many waterfowl species in Northern India. Climatic instability and natural differences in the capacity to retain water and other conditions including man induced cause drastic annual and seasonal variation in aquatic habitats which in turn are reflected in variation in their use by waterfowl. In spite of decline of area of aquatic habitats, these are still continued to be preferred habitats by waterfowls.

The present study was carried out at Dal lake which provide an excellent feeding and resting grounds to a wide variety of avi-fauna, both resident and non resident. To determine the avian diversity, four study sites were selected in such a way that each habitat type viz., open water area and area with submerged and floating vegetation, and peripheral terrestrial zone were studied.

A total of 76 species of birds belonging to 34 families were recorded from Dal lake. These comprised of:

Summer visitors	26 species
Winter visitors	20 species
Residents	21 species
Local altitudinal migrants	9 species

Among residents, Little grebe, Moorehen, Pond heron, Blue rock pigeon, House crow, Jackdaw, White breasted kingfisher were dominant. Summer visitors include Little bittern, Pheasant tailed jacana, Indian great reed warbler, Whiskered tern, Common swallow, Wagtails, Indian ring dove, Himalyan starling, Paradise flycatcher etc.

Winter visitors included 13 species of waterfowls viz., Grey lag goose, Mallard, N.pintail, White eyed pochard, Brahminy duck, Garganey, Wigeon, Common mergeanser, Gadwall, Common teal, and N. shoveller. Brahminy

duck, Pochard, White eyed pochard and Red crested pochard contributed little to water fowl population.

The waterfowl arrived to in September–October and stayed here for winter. Backward migration was completed by the end of May. Local altitudinal migrants are those species which are resident to the valley and for most of the year occur in forest areas and higher altitudes but are forced by the severe cold and snowfall to descend to lower reaches during winter. The local altitudinal migrants that came across during study period include Simla streaked laughing thrush, Himalayan laughing thrush, Kashmir wren, Tree creeper etc.

The highest diversity of 3.485 was recorded from site I the lowest diversity from site III being 1.778. While as 2.605 and 2.92 diversity were recorded from site II and site IV.

Dal lake was characterized by different types of habitats viz. open water area mostly with submerged vegetation, areas with floating and emergent vegetation and peripheral water zone. Open water areas formed an important habitat component for waterfowl which prefer travel by swimming and it provided excellent resting places for them. The areas with emergent and floating vegetation provided breeding grounds to the birds like- Little bittern, Great reed warbler, Moorehen, Wagtails, Dabchick, Pheasant tailed jacana etc. The peripheral tree zones provided shelter to a number of upland species

Further anthropogenic interference was severe at lake and was present in the form of illegal hunting, boating, macrophytic harvesting. These activities disturbed the waterbirds and forced them to remain always on their wings

Above all, Dal lake is moving towards its definite end. The conservation efforts, being ecologically inefficient and insound, have proved to be a total failure. Official apathy and non seriousness of managing authorities have deteriorated the overall condition of lake. There is a need to formulate proper



ecologically sound management plan for the lake encompassing all the environmental components of the lake ecosystem and thus help to conserve the lake in real ecological sense and indirectly making way to our guests (waterfowl).

Over 50% of wetlands in the world have been lost in the past century, and the remaining wetlands have been degraded to different degrees because of the adverse influences of human activities (Fraser and Keddy, 2005). The loss and degradation of wetlands has negatively affected water birds, which depend on wetland habitats. How to provide high quality habitats for water birds through effective management is a critical issue in water bird conservation (Erwin 2002; Taft *et al.*, 2002). Many studies have indicated that effective management plays a critical role in enhancing habitat quality of wetlands for water birds (Balcombe *et al.*, 2005).

Habitat destruction is manifested in three different forms viz.; degradation, fragmentation and outright loss (Hunter and Gibbs, 2007). In recent years habitat loss has attained a paramount importance for being the most severe threat to wildlife across the globe (Brooks *et al.*, 2002 and Smith and Smith, 2003). Over 90% of globally threatened birds and over 86 % of the other bird species are threatened mainly due to degradation and habitat loss which is attributed to the destruction of huge areas of natural habitats such as wetlands. Human activities such as over-grazing, deforestation, bush fires, mining, and urbanization are amongst the principle causes of habitat destruction (Kauzeni and Kiwasila, 1994; Kideghesho *et al.*, 2006 and Mwalyosi, 1992).

During the present study the major threat to the Dal lake are from continued heavy siltation due to direct discharge of feeding channels. Large areas of the lake have got filled up and transformed into permanent land masses due to heavy siltation. Some of these areas are regularly used for cultivation of

food during summer months and construction of new houses, even though it is legally banned.

Moreover Telbal nallah after leaving from Dachigam, meandering through large number of villages , brings along with it not only heavy loads of nutrients but excessive quantities of silt which get deposited in lake directly and cause its shallowness. It has been estimated that about 80,000 tonnes of silt has been deposited by Telbal nallah in a single year and 14.8 tonnes of phosphorus and 322.1 tonnes of nitrogen enter the lake each year.

It is therefore recommended, the encroachment to the extent possible, be removed, the areas silted or reclaimed be dredged and converted to water expanse, increased siltation in the lake should be discouraged in order to avoid dwindling of the area and to enhance growth of food plant species, and to avoid the flow of siltation into lake there should be arrangement of silt traps or slit basin and sluice gate before it enters the lake.

Dal lake provides main source of fodder and is being exploited for their macrophytes. The harvesting of macrophytes is done either by local people and by contractors. The large scale harvesting poses a serious problem. Moreover harvesting is not selective and some of the areas are completely cleared of both floating and emergent vegetation. In doing so the breeding habitats including nest made by the birds are completely destroyed. It is therefore necessary that selective harvesting be ensured to remove only the excessive macrophytes without causing damage to the breeding places and the nests contained there in,

**Plate 2a.**

Hunting pressure is intense in the lake. The main hunting methods involve a combination of shooting (either with air guns or sling shots). The main species caught by shooting are winter migrants like Greylag goose, Common teal, Pin tail, Shoveller, Wigeon, Coot etc. Dozens of poachers along with their rifles were seen in lake in wee hours of winter, shooting upon large

population of waterfowl. It was estimated that hundreds of ducks being shot dead by these poachers every day, **Plate, 1a,b.**

The main cause of the large scale poaching is that Dal lake is not under the control of department of wildlife and thus doesn't keep vigil on the lake. So it is necessary that the lake should come under the jurisdiction of Dept. of Wildlife Protection. Further, awareness programme should be launched by Govt. to educate the people, about the importance of biodiversity and wildlife, who are mainly responsible for hunting birds. Wildlife conservation and management laws must be implemented strictly and people who earn their livelihood by hunting water fowl illegally should be provided with alternative source of livelihood, **Plate 1c.**

House boats discharge effluents and wastes directly into the lake. This activity has drastically affected nesting habitats of the breeding birds. To avoid such activity, houseboats should be provided with solid-waste disposals, which otherwise make direct way into the lake.

Many studies have indicated that species richness and abundance of water birds increase with increasing emergent vegetation cover in wetlands, especially during breeding periods when water birds are less mobile and more sensitive to disturbance (Froneman *et al.*, 2001). It is therefore suggested that large emergents stand of *Typha sp.* and *Phragmites sp.* be grown along the fringes of lake.

Although the feeding habits of various dabbling and diving ducks varies greatly, the seeds, fruits, succulent and other vegetative parts of various macrophytes especially *Typha sp.*, *Polygonum sp.*, *Cyperus sp.*, *Trapa sp.*, etc provide the wide food spectrum for ducks and geese. Their optimum growth and introduction as regarded therefore need to be ensured and taken care of an availability of food (*Trapa natans*) and more open water areas in the lake are the main force of attraction for winter migrants (Nilson, 1972). So maximum availability of these two factors could be used to attract waterfowl. In order to

increase the availability of food,, removal of macrophytes is needed to be banned completely and permitted only when the vegetational density becomes nuisance.

In Dal Lake, fishing is done in random manner. Although fish is not the major component of food of most of the birds, still mere presence of fishermen in the lake disturbs the breeding summer migrants. Therefore it will be wise not to allow fishing especially during the breeding period of resident and summer migratory birds.

Studies have indicated that wetland size influences species richness and abundance of water birds (Sanchez – Zapata *et al.*, 2005). Because water birds have different preferences with respect to habitat configuration, the larger wetlands which are more likely than smaller wetlands to have high habitat heterogeneity, can support a greater diversity of water birds than smaller ones (Colwell and Taft, 2000). During entire course of study, Dal lake accommodate and support less species density when compared with previous record. This may be because of the reason that its areas has reduced from 22km<sup>2</sup> to 11.56 km<sup>2</sup> only and larger area has got converting into floating gardens. As per the information furnished by Dal Dweller's Zaminder Union, vegetables worth Rs 35 crores are cultivated and supplied from the lake every year. The area of lake available for the vegetable cultivation is 450 ha.

Water depth and level are important variable affecting the use of wetland habitats by water birds (Isola *et al.*, 2002). Breeding attempts are abandoned when water rises submerge nests and water drops make birds more vulnerable to mammalian predators after nesting. Moreover brood densities of water birds are greater on wetlands with stable water levels than on seasonally flooded wetlands because stable water level benefits the breeding of water birds by providing suitable nest sites (Cannor & Gabor, 2006). Therefore proper water level is advisable so that it may not pose any threat during breeding period of water birds.

- Adams, L. W. 1994. *Urban wildlife habitats*. University of Minnesota Press. Minneapolis.
- Ahanger, F. A. 2008. Studies on avian diversity and breeding biology of mallard. Ph. D. Thesis submitted to Department of Zoology.
- Ahlund, M. and Anderson, M. 2001. Brood parasitism- female ducks can double their reproduction. *Nature*, 414: 600-601.
- Akbar M., Mushtaq-ul-Hassan M., and Hassan, M. 2009. Water fowl diversity at chashma Barrage (Wildlife Sanctuary Mianwali) and Marala Headworks (game Reserve Sialkot), Pakistan during 1996-2005. *Int. J. Agric. Biol.* 11: 188-192.
- Ali, S. 1941-55. The book of Indian Birds. *Bom. Nat. Hist. Soc. Bombay*.
- Ali, S. and Ripley, S.D. (1983). Handbook of birds of India and Pakistan, Compact edition, *Oxford University press*. Delhi. pp.737
- Ali, S. and Ripley, S.D. 1968-75. The Handbook of Birds of India and Pakistan; 10 vols. *Oxford Univ. Press*. Bombay.
- Ali. S. and Ripley. S. D. 1983. Handbook of birds of India and Pakistan. Compact edition. *Oxford Univ. Press*. Delhi.
- Arnold, G.W. and Weeldenburg, J.R. 1990. Factors determining the number and species of birds in road verges in wheat belt of W. Australia. *Biol Conserv.*
- Awan , N . M., Awan, M. S and Ahmad , K. B. 2004. A preliminary study on distribution of Avian fauna of Muzaffarabad, Pakistan. *Int. J. Agri. Biol* .6(2): 300-302.
- Awan, N . M., Awan, M. S. 2007. Altitudinal range and relative abundance of five species of Tits in Machiara national park, Muzaffarabad, Pakistan.

- Babbitt, K. 2000. Use of temporary wetlands by anurans in a hydrologically modified landscape. *Wetlands* 20: 313-322.
- Badri Narayanan, T. 1994. *Journal of the Bombay natural history society*. 9(3): 452.
- Baker, E.C.S. 1929. The fauna of British India-*Birds* (2<sup>nd</sup>. Ed) Vol. VI. *Taylor and Francis*, London.
- Baker, E.C.S. 1922-1930. Fauna of British India: *Birds* 2<sup>nd</sup> Ed; 8 Vol. *Taylor and Francis*, London.
- Balcombe, C.K, Anderson, J.T, 2005. Aquatic macroinvertebrate assemblages in mitigated and natural wetlands. *Hydrobiologia*, 541: 175-188.
- Bates, R.S. P. and Lowther, E.H.N. 1952. The breeding birds of Kashmir. *Oxford University press*. London
- Bates, R.S.P. and Lowther, E.H.N. 1952. Breeding birds of Kashmir. *Oxford Univ. press*, London. pp. 367.
- Blair, R. B. 1999. Birds and butterflies along an urban gradient. Surrogate taxa for assessing biodiversity. *Ecol. Appl.*, 9, 164-170
- Blake, J. J., Hanowski, G. J., Nienni and Patrick T. C., 1992. Hourly variations in transect counts of birds. *Ornis Fenn.* 68(4): 139.
- Brooks, T. M., Mittermeir, R. A. Mittermeir, C. G. Fonseca, G. A. Rylands, B. Konstant, A. B. W. Flick, R. P. Pilgrim, S. Oldfield, G. Magin, and Hilton-Taylor C. 2002. Habitat loss and extinction in the hotspots of biodiversity. *Conservation Biology*. 16(40): 909-923.
- Brooks, W.E. 1872. Notes on the ornithology of Kashmir. *J. Asiatic Soc. Bengal Ind.* 12: 73-86.

- Browder, S. F., Johnson, D. H. and Ball, I. J. 2002. Assemblages of breeding birds as indicators of grassland condition. *Ecological Indicators*, 2: 257-270.
- Catterall, C. P., Kingston, M. B. Park, K. and Sewell, S. 1998. Deforestation, urbanisation and seasonality: interacting effects on a regional bird assemblage. *Biological Conservation*, 84: 65-81
- Caughley, G. 1982. Analysis of Vertebrate populations. John Wiley, New York
- Cody, M. L. (Ed.). 1985. Habitat Selection in Birds. Academic Press. Orlando, FL.
- Cody, M. L. 1981. Habitat selection in birds: The roles of vegetation structure, competitors, and productivity. *Bio. Science*, 31: 107-113
- Colweel, M.A. Taft, O. W. (2000). Water bird communities in managed wetlands of varying water depth. *waterbirds*, 23: 45-55.
- Conner, K.J., Gabor, S., (2006). Breeding waterbird wetland habitat availability and response to water level management in Saint John River floodplain wetlands. *Hydrobiologia*- 567:169-181.
- Crowder, A. A., and Bristow, J. M. 1988. The future of waterfowl habitats in the Canadian lower Great Lakes wetlands. *Journal of Great Lakes Research* 14: 115-127.
- Custer, T. W. 1977. Osborne: Wading birds as biological indicators. Long survey, U.S. Fish and Wildlife service Washington, DC.
- Dar, S. A. 1998. A biological survey of Haigam wetland. Ph.D. Thesis submitted to Univ. of Kashmir.
- Dhananjai, M. and Raman K. 2010. Breeding birds of Kothri valley, Eastern Garhwal Himalayan Foothills, India. *Forktail* 26: 75-81.



- Donald, P. F., Fuller, R. J. Evans, A. D. and Gough. S. J. 1998. Effects of forest management and grazing on breeding bird communities in plantations of broadleaved and coniferous trees in western England. *Biological Conservation* 85: 183-197.
- Donaldson, M.R., Henein K.M. and Runtz, M.W. 2007. Assessing the effect of developed habitat on water bird behavior in an urban riparian system in ottawa, Canada..*Urban ecosystem*, 10: 139-151 .
- Donnelly, R. and Marzuluff, J. M. 2006. Relative importance of habitat quality, structure and species pattern to birds in urbanizing environments. *Urban ecosyst.:* 99 – 117
- DuBow, P. 1988. Waterfowl communities and seasonal environments: temporal variability in interspecific competition. *Ecology* 69: 1439-1453
- Emlen, J. T. 1974. An urban bird community in Tuscon, Arizona: Derivation, Structue, regulation, *The condor*, 76; 184-197
- Erwin, R.M., 2002. Integrated management of water birds: beyond the conventional. *Waterbirds*, 25(Suppl. 2): 5-12.
- Fazili, M.F. 2002. Studies on Annual cycle of some birds of Wular lake, Kashmir. Ph.D. Thesis submitted to Univ. of Kashmir.
- Ford, H. A., Barrett, G. W. Saunders, D. A. and Recher, H. F. 2001. Why have birds in the woodlands of Southern Australia declined? *Biological Conservation* 97: 71-88.
- Ford, H. A., Barrett, G. W. Saunders, D. A. and Recher, H. F. 2001. Why have birds in the woodlands of Southern Australia declined? *Biological Conservation* 97: 71-88.
- Fraser, L.H., Keddy. P.A. (2005). The word's largest wetlands: Ecology and conservation. *Cambridge University Press*, Cambridge.

- Freemark, K. and Merriam, H.G. 1986. Importance of area and habitat heterogeneity to bird assemblages in temperate forest fragments. *Biol. Conserv.* 36(2): 115-142.
- Froneman, A., Mangnall, M. J., Little, R. M. 2001. Waterbird assemblages and associated habitat characteristics of farm ponds in the western cape, South Africa. *Biodiversity and conservation*, 10: 251-270.
- Gadhvi, I. R. 2008. Population dynamics of waterfowls in Gaurishankar lake, Bhavnagar, Gujarat. *The 12th World Lake conference*: 116-123.
- Gaston, A. J. 1975. Methods for estimating bird populations. *J. Bombay Nat. Hist. Soc.*, 72, 271-283.
- Gaston, A. J., Decker, R. F. Cooch G. and Reed, A. 1987. The distribution of large species of birds breeding on coasts of forebasin and Northern handson Bay Canada. *Arctic*, 39(39): 285-296.
- Gaunlett, F.M. 1972. Notes on some Kashmiri birds. *J. Bom. Hist. Soc.* 69(3): 591-615.
- Grimmett, R. and Inskipp T. 2007. Birds of southern India. Om books international, New Delhi, India.
- Hansson, Lennart. 1986. Breeding bird communities in relation to distance from winter food supply. *ORNIS FENN*, 63(2): 47-49.
- Hawkings, J. and Nancy, H. 1999. Cooperative roadside waterfowl breeding population survey in the southern Yukon territory. 1999 report, Canadian Wildlife service, 91782. Alaska high way white house Yukon, YIA' 5B7.
- Holmes, P.R. and Parr, A.J. 1989. A checklist of birds of Haigam Rakh, Kashmir (India). *J. Bomb. Nat. Hist. Soc.* 85(3): 465-473.

- Horn, K.V., Benton K. and Gatti., 2008. Waterfowl Breeding Population Survey for Wisconsin, 1973-2007.
- Houndkova, B., 2003. Trends in numbers of coot (*Fulica atra*) in Czech republic in 1998-2000. *Ornis Hungarica*, 12-13: 283-288.
- Hughes, J.B. and Daily, G.C., 2002. Conservation of tropical forest birds in country side habitats. *Ecology letters* 5: 121-129
- Hunter, M. L. 1999. Maintaining biodiversity in forest ecosystems. Cambridge University Press, Cambridge
- Hunter, M. L. and Gibbs, J. 2007. Fundamentals of conservation biology. (3rd eds.) *Wiley-Blackwell*. p. 497.
- Ishwara, B. P., Cristopher S.S. and Hosetti, B.B. 2008. Avifaunal diversity of Anekere Wetland, Karkala, Udupi district, Karnataka, India. *Journal of environmental Biology*, 30(6): 1059-1062.
- Isola, C. R. Colwell, M.A. 2002. Interspecific differences in habitat use of shore birds and waterfowl foreging in manged wetlands of californi' s valley. *Waterbirds* 25(suppl. 2): 196-203.
- Jagruti, R. and Geeta, S. P. 2008. A comparative study of Avifauna of a suburban wetland and an irrigation reservoir of Savli Taluka, District Vedodara. *The 12<sup>th</sup> world lake conference*: 527-541.
- Jerdon, T. C. 1964. The birds of India. Vol. IIIrd. 441-875: pp. *George Wymanand Co*. Calcutta.
- Jhakur, M.L. Mattu, V.K. Mattu, N. Sharma, V.N. Bhardwaj R. and Jhakur, V. 2010. Bird diversity in Sarkaghat valley, Mandi (Himachal Pradsh), India. *Asian J. Exp. Biol. Sci.* 1(4): 940-950.

- John Singh, A.J.T. and Joshna J., 1994. Avifauna in three vegetation types on Mundanthurai platcan, south India. "*Journal of Tropical Ecology*". pp. 323-335.
- Johnels, S. A. and Thomas. C. C. 1988. Species composition and abundance of bird fauna in disturbed forest in central Andes of Columbia. *Hornero*.12(4): 235-241.
- Kauzeni, A. S. and Kiwasila H. L. 1994. Serengeti Regional Conservation Strategy: A Socioeconomic Study. Dares Salaam, Tanzania: Institute of Resource Assessment, University of Dar Es Salaam.
- Kideghesho, J. R., Nyahongo, J. W. Hassan S. M., Tarimo T. C., and Mbije N. E. 2006. Factors and ecological impacts of wildlife habitat destruction in the Serengeti ecosystem in Northern Tanzania. *Aajeam-Ragee*. 11:917-932
- Kluijver, H.N. 1955. The population ecology of the great tit, *Parus major*, *L. Ardea*, 39: 1-135.
- Koul, A. 1913. Geography of Jammu and Kashmir state. Light and life publishers – N.D.J. Rohtak.
- Kumar, A. 1998. Habitat evaluation of migratory waterfowls using remote sensing technique. Project report. Zoological survey of India. Dehradun
- Kundankar, M. R., Sarwar, D., S. G. and Shah, M. A.1995. Limnological characteristics of Hazratbal basin of Dal Lake 1992-93. Technical Report – submitted to Government of Jammu and Kashmir.
- Lack, D. 1947-48. The significance of clutch size. *Ibis* 89: 302-352; 90: 25-45.
- Lopez, A. and Mundker, T. 1997. The Asian water fowl census 1994-96, *wetlands International*, 1: 118.

- MacArthur, R. H., MacArthur, J. and Preer, J. 1962. On bird species diversity II. Prediction of bird census from measurements. *American Naturalist* 96: 167- 174.
- Majid, H. 1987. Geography of Jammu and Kashmir state. *Rajesh Publications*, New Dehli: 108 pp.
- Martarano, S. and Yparraguirre, D. 2008. DFG completes 2008. Waterfowl Breeding population survey; Twelve percent Decrease in Population seen among Duck species.
- Medin, D. A. 1986. Grazing and passerine breeding birds in Great Basin (U.S.A), *NAT* 46(3): 567-572.
- Mehta, H.S. Jhakur, M.L. Paliwal, R. and Tak, P.C. (2002). Avian diversity of Ropar wetland, Punjab, India. *Annals of forestry*. 10(2): 307.
- Michev, T. M. Nickolai., P. Dilchec and Simeon D. Simeonov. 1986. Dynamics of numbers and nest biology of white stork. (*Ciconia ciconia*) within the region of Sofia (Bulgaria). *Ekologia (Sofia)*. 6(17): 49-55.
- Mustafa, G. S., Ulfat, J. Fayaz, A. A., Bilal, A. B. and Fazili, M.F. 2008. Egg Laying, egg parameters and clutch size in Mallard. *Anas platyrhynchos*. *India Birds*. 4(3): 106-108.
- Mwalyosi, R. B. B (1992). Land-use changes and resource degradation in South-West.
- Narang, M. L, Rana R.S. and Prabhakar. M. 2000. Avian species involved in pollination and seed dispersal of some forestry species in Himachal Pradesh. *J. Bom. Nat. Hist. Soc.* 97: pp. 215-222.
- Nilson (1972). Habitat selection, food choice and feeding habits of diving ducks in coastal waters of south Sweden during non breeding season. *Ornis Scandinavica* 3: 55-78.

- North, P.M. 1984. Modelling annual number of birds territories on form land-plots *BIOM*, 25(5): 431-41.
- Nudds, T. D. and Cole, R.W. 1991. Changes in populations and breeding success of Boreal forest ducks. *J, Wildlife manag.*, 55: 569-673.
- Pandey, S. 1993. Changes in water bird diversity due to the construction of pong dam reservoir, Himachal Pradesh, India, *Biological Conservation*. 66(2): 125.
- Parsons, H., French, K. and Major. R. E. 2003. The influence of remnant bushland on the composition of suburban bird assemblages in Australia. *Landscape and Urban Planning*, 66:43-56.
- Philips, J.H., 2008. Decline of the Pintail part II, MadDuk. The conscience of waterfowl conservation.
- Probst, J. R. Dons. S. R. and David. J. R. 1992. Breeding bird communities in regenerating mature broad leaf forest in USA lake. *States for Ecol manage*; 49(1-2): 43-60.
- Qadri, M.Y., 1980. Limnological studies on Lake Malpur Sar 1. *The Biotope Geobios* pp 117-119.
- Rahmani, A. R. 1991. Feeding association of the little grebe with ducks. *Journal of the Bombay Natural History society*. 88(2): 279.
- Rajashekara, S. and Venkatesha, M. G. (2011). Community composition of aquatic birds in lakes of Bangalore, India. *Journal of environmental Biology*, 32 (1): 77-83.
- Raphael, M. 1987. Breeding bird population during 25 years of postfire succession in Sirra Nevada (U.S.A.). *Conoor*. 89(3): 614-626.

- Riffel, S. K., Keas B. E. and Burton, T. M. 2001. Area and habitat relationships of birds in great lakes coastal wet meadows. *Wetlands* 21: 492-507.
- Robertson, H. A., and Hackwell, K. R. 1995. Habitat preferences of birds in seral kahikatea *Dacrycarpus dacrydioides* (podocarpaceae) forest of South Westland, New Zealand. *Biological Conservation* 71: 275-280.
- Sanchez-Zapata, J.A. (2005). Breeding water birds in relation to artificial pond attributed: Implication for the design of irrigation facilities. *Biodiversity and conservation* 14: 1627-1639.
- Shah and Qadri (1988). Feeding ecology of Mallard, *Anas platyrhynchos* at Hokersar wetland. Kashmir. *J. Bombay Nat. Hist. Soc.* 85(2): 325-331.
- Shah, M. G., Qadri M.Y. and Ulfat J., 2000. Species composition and population dynamics of birds of Hokersar wetland Kashmir. *Environ, Biodiver, Conserve. M.A. Khan (ed.)* 2000. A.P.H. Publ. Corp. new Delhi.
- Shah, G.M. 1984. Birds of Hokersar: Food feeding and breeding biology of some resident and non resident birds.
- Smith, R. L. and Smith, T. M. (2003). Elements of ecology. San Fransisco, California, Benjamin Cumming.
- Taft, O.W., Colwell. M.A., Isola, C.R. Safran., R.J. (2002). Water bird responses to experimental drawdown: Implication for multispecies management of wetland mosaics. *Journal of Applied Ecology*: 39: 987-1001.
- Tatu, K., Kimothi, M. M. and Parihar, J.S. 1998. Methodology for remote sensing of water bird habitats in an inland wetland *Indian forester*. 124(10): 841.

- Terborgh, J., 1999. *Requiem for nature*. Island Press, Washington DC.
- Theobald, H. 1854. Indian Ecology: notes on the nidification of some common birds of salt Range, with few additions from Kashmir. *J. Asiatic Soc. Bengal Ind.* 23: 589-603.
- Turner, W. R. 2003. City wide biological monitoring as a tool for ecology and conservation in urban landscapes: The case of the Tucson bird count. *Landscape and Urban Planning*, 65, 149-166
- Urfi, A. J., Sen, M., Kalam, A. and Meganathan, T. (2005). Counting birds in India: Methodologies and trends. *Current science*, Vol. (89): 12- 25.
- Venier, L. and L. Fahrig, 1996. Habitat availability causes the species-abundance-distribution relationship. *Oikos* 76: 564-570.
- Wagner, M. 2004. Managing riparian habitats for wildlife. Report No PWD BR W7000-306, Texas Parks and Wildlife Department, Austin.
- Weller, S. 1965. The relationship between nesting and vegetation.
- Weller, M .W. 1972. Ecological studies of Falkland Islands waterfowls. *Wildfowl*, 23: 25 - 44
- Williamson, R. D., and DeGraaf, R. M. 1981. Habitat associations of ten bird species in Washington, DC. *Urban Ecology* 5: 125-136.
- Wilson, Mary. F. and Steven, W. Carothers. 1980. Avifauna of habitat Islands in Grand Canyon, USA. *South West. Nat.* 24(4): 563-576.