

Bird Diversity and Conservation at Kallar Kahar Lake with Special Reference to Water Birds

Muhammad Rais*, Maqsood Anwar, Tariq Mehmood and Iftikhar Hussain

Department of Wildlife Management, Faculty of Forestry, Range Management and Wildlife, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi

Abstract.- The study was conducted to document richness, density and relative abundance of avifauna, particularly the water birds of Kallar Kahar Lake, Chakwal. A total of 86 bird species belonging to 16 orders and 36 families were recorded. Among these, 61.62 % species were residents, 25.58% winter visitors, 8.13% summer breeding visitors and 4.65 % passage migrants. Water birds constituted 33.72% of the avifauna of lake. As many as 162±17.71 individuals of six species of ducks and 440±94.51 individuals of other 23 species of water birds were recorded with black coot (*Fulica atra*) and shoveler (*Anas clypeata*) as the most abundant species. The densities of water birds and ducks were estimated to be 3.29 and 2.56 birds per hectare, respectively. Presently around 31 % (42 ha) of the lake area has been invaded by *Phragmites* which provides breeding sites to night heron (*Nycticorax nycticorax*) and little egret (*Egretta garzetta*) having 25 and 13 nests per hectare, respectively. The lake as a whole depicts an alarmingly deplorable ecological condition which is evident from the 39.32 % reduction in the area of lake within a short span of seven years. Unregulated tourism, land encroachment, eutrophication and siltation are major threats to the lake. The lake may lose its resilience in the face of a changing environment due to loss in the species richness and homogenization of species composition with that of bird species of surrounding towns and cultivated lands.

Key words: Bird diversity, migratory ducks, salt range, wetland degradation, threats to water birds

INTRODUCTION

Kallar Kahar Lake along with other brackish lakes viz. Ucchali, Khabbeki, Jahlar and Nammal is located in semi-arid hill ranges in the north-central parts of Pakistan (Scot, 1986).

Avifauna – particularly water birds- of the lake has been documented to some extent. Ali and Akhter (2005) recorded thirty different bird species from the lake. Ali (2007) reported 25 water bird species whereas Azam *et al.* (2008, 2009) recorded 23 and 30 water bird species, respectively, from the lake. Surveys have been undertaken for *Oxyura leucocephala* (white-headed duck) at Kallar Kahar Lake, but no evidence was found (Ali and Akhter, 2005). Ali and Akhter (2006) concluded that the area of Kallar Kahar had reduced by 30 % from 1990-2003.

The bird fauna of the lake has been documented by earlier workers (Roberts, 1991, 1992; Ali and Akhter, 2005; Ali, 2007), but water

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birds including a globally endangered species viz. white-headed duck remained the main focus of research (Ali and Akhter, 2005, 2006; Ali *et al.*, 2007). Wintering migratory birds have been under study since 1972. Present study was undertaken to document the avifauna of Kallar Kahar Lake with special reference to the richness, abundance, occurrence and status of water birds.

MATERIALS AND METHODS

Study area

The Kallar (salt) Kahar (valley) Lake (Fig. 1) is located in District Chakwal, Punjab Province at a distance of 25 km north of Chakwal city. It is a Game Reserve. It covers an area of 133.5 hectares, and is located between 32 46 30.31 North latitude and 72 42 23.80 East longitude at an altitude of 554 meters above sea level. According to Ramsar Convention's wetland types, Kallar Kahar is an Inland permanent saline/brackish lake (Code Q). It is fed by numerous minor and three main freshwater springs at the base of hills. Runoff from catchment areas is also a source of water to the lake. Although,

* Corresponding author: sahil@uaar.edu.pk
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spring water is fresh but salt in the bedrock of the lake turns it into moderately brackish. The lake recharges aquifer and moderates the climate of the area.

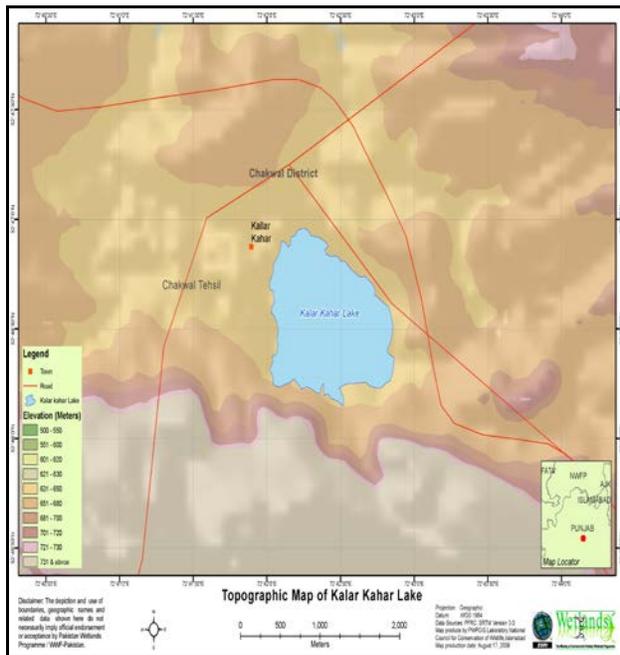


Fig. 1. Topographic map of Kallar Kahar Lake.

An area of 164 ha has been enclosed within a constructed bund. The volume of water, however, keeps on changing based on the seasons and amount of rainfall received, and may be reduced to even almost 50 ha, and may swell again after the rains especially in the monsoons.

The lake receives a fair number of visitors daily. Punjab Fisheries Department harvests Carp fish species from the lake as well. Shrines of two saints and historical structures such as Takhte-e-Babri are located near the lake. The lake falls under the jurisdiction of district government. The management authority of the lake is Tourism Development Corporation of Punjab (TDCP). The lake has been declared as Game Reserve by the Punjab Wildlife and Parks Department.

Numerous resorts and hotels have been built along the southern margin of the lake. TDCP Motel and Forest department' rest house being more prominent. A huge area in the south-west, south and south-east has been converted into recreational area

having many noisy ferry wheels. Orchards of loquat (*Eriobotrya japonica*) are located on south-west, south and south eastern sides of the lake. Cultivated lands are situated on the eastern side. TDCP offers boating facility to the tourists up to a certain distance over the lake. TDCP has recently constructed a park along the lake in front of its motel. Various sign boards with wildlife conservation oriented public- awareness messages can be seen in this area as well.

The lake is surrounded by mountains in the south, Kallar Kahar city in the west and motorway in the east. There is an abundant growth of aquatic vegetation mainly species of *Phragmites* and *Typha*. This infestation is very high in the south-east and eastern side (Table IV). The eastern side is marshy, characterised by shallow water, muddy bottom and emergent rushes. It is a perfect retreat for moorhens, egrets, herons, ducks and shorebird species.

Methodology

The lake was regularly visited monthly from October 2008 to August 2009. Observations were made during morning and evening for two hours each by a single observer using binoculars (10x50) and spotting scope (15x15-60). Birds were identified by using Field Guide to the Birds of Pakistan by Mirza (2007). Secondary data were obtained from published literature and local people.

Observations of water birds were made from a vantage point within each of the two selected sampling units viz. KK1 and KK2. KK1 (N 32 46 167, E 72 42 291) is a well-developed area in front of TDCP Resort with a newly constructed park, visitors' and boating area. KK2 (N 32 46 383, E 72 42 887) is in the eastern most corner of the lake, approximately 100 ha in area. It is a marshy area with shallow water and emergent rushes.

Number of individuals of the bird species counted three times and an average was calculated and recorded during each survey. Paddle boats were used to access *Phragmites* vegetation and number of eggs and individuals counted (Schemnitz, 1980; Sale and Berkmuller, 1988; Sutherland, 1996). Following measures of abundance were calculated using the following formulae;

Population density (PD)

PD = Number of individuals of a bird species/
Area of lake (133.50 ha).

Relative abundance (RA)

RA= Number of individuals of a water bird
species/number of individuals of all water bird
species X 100

RESULTS

A total of 86 bird species belonging to 16 orders and 36 families were recorded from Kallar Kahar Lake (Table I). The most abundant family was found to be Ardeidae (9.30 %). Of the total bird species, 61.62 % species were resident, 25.58% winter visitors, 8.13% summer breeding visitors and 4.65 % passage migrants. Water birds constituted 33.72% of avifauna of the lake.

Table I.- Birds of Kallar Kahar Lake recorded during 2008-09.

Order Sub-order Family	Scientific name (Common name)	Occurrence *
1. Podicepidiformes i. Podicepididae	Little grebe (<i>Tachybaptus ruficollis</i>)	R
2. Pelecaniformes i. Phalacrocoracidae	Great cormorant (<i>Phalacrocorax carbo</i>)	W
	Little cormorant (<i>Phalacrocorax niger</i>)	R
3. Ciconiformes i. Ardeidae	Black-crowned night heron (<i>Nycticorax nycticorax</i>)	SB
	Indian pond heron (<i>Ardeola grayii</i>)	R
	Cattle egret (<i>Bubulcus ibis</i>)	R
	Little egret (<i>Egretta garzetta</i>)	R
	Intermediate egret (<i>Mesophox intermedia</i>)	W
	Great egret (<i>Casmerodius albus</i>)	W
	Grey heron (<i>Ardea cinerea</i>)	W
	Purple heron (<i>Ardea purpurea</i>)	W
4. Anseriformes i. Anatidae	Gadwall (<i>Anas strepera</i>)	W
	Common teal (<i>Anas crecca</i>)	W
	Mallard (<i>Anas platyrhynchos</i>)	W
	Northern pintail (<i>Anas acuta</i>)	W
	Northern Shoveler (<i>Anas clypeata</i>)	W

Common pochard (<i>Aythya ferina</i>)	W	
5. Accipitriformes i. Accipitridae	Black-winged kite (<i>Elanus caeruleus</i>)	R
	Black kite (<i>Milvus migrans</i>)	R
	Shikra (<i>Accipiter badius</i>)	R
6. Falconiformes i. Falconidae	Common kestrel (<i>Falco tinnunculus</i>)	R
	Red-headed merlin (<i>Falco chicquera</i>)	R
7. Galliformes i. Phasianidae	Black francolin (<i>Francolinus francolinus</i>)	R
	Grey francolin (<i>Francolinus pondicerianus</i>)	R
	Common quail (<i>Coturnix coturnix</i>)	R
	Indian peafowl (<i>Pavo cristatus</i>)	R
ii. Rallidae	Common moorhen (<i>Gallinula chloropus</i>)	R
	Purple swamphen (<i>Porphyrio porphyrio</i>)	R
	Black coot (<i>Fulica atra</i>)	W
8. Charadriiformes i. Recurvirostridae	Black-winged stilt (<i>Himantopus himantopus</i>)	SB
ii. Charadriidae	Kentish plover (<i>Charadrius alexandrinus</i>)	W
	Red-wattled lapwing (<i>Vanellus indicus</i>)	R
iii. Scolopacidae	Spotted redshank (<i>Tringa erythropus</i>)	W
	Common redshank (<i>Tringa totanus</i>)	W
	Common sandpiper (<i>Actitis hypoleucos</i>)	W
iv. Sternidae	Gull-billed tern (<i>Sterna nilotica</i>)	W
9. Columbiformes i. Columbidae	Rock pigeon (<i>Columba livia</i>)	R
	Eurasian collared dove (<i>Streptopelia decaocto</i>)	R
	Red-collared dove (<i>Streptopelia tranquebarica</i>)	R
10. Psittaciformes i. Psittacidae	Rose-ringed Parakeet (<i>Psittacula krameri</i>)	R
11. Cuculiformes i. Cuculidae	Pied-crested cuckoo (<i>Clamator jacobinus</i>)	SB
	Asian koel (<i>Eudynamis scolopacea</i>)	SB

	Greater coucal (<i>Centropus sinensis</i>)	R		Indian robin (<i>Saxicoloides fulicata</i>)	R
12. Strigiformes			vi. Sylviidae	Plain prinia (<i>Prinia inornata</i>)	R
i. Strigidae	Spotted owlet (<i>Athene brama</i>)	R		Tailor bird (<i>Orthotomus sutorius</i>)	R
13. Apodiformes			vii. Timaliidae	Common babbler (<i>Turdoides caudatus</i>)	R
i. Apodidae	House swift (<i>Apus affinis</i>)	R		Striated babbler (<i>Turdoides earlei</i>)	R
14. Coraciformes				Jungle babbler (<i>Turdoides striatus</i>)	R
i. Alcedinidae	White-throated kingfisher (<i>Halcyon smyrnensis</i>)	R	viii. Nectarinidae	Purple sunbird (<i>Nectarinia asiatica</i>)	SB
	Pied kingfisher (<i>Ceryle rudis</i>)	R	ix. Laniidae	Bay-backed shrike (<i>Lanius vittatus</i>)	R
ii. Meropidae	Little green bee-eater (<i>Merops orientalis</i>)	R		Rufous-backed shrike (<i>Lanius schach</i>)	R
	Little green bee-eater (<i>Merops orientalis</i>)	SB		Grey-backed shrike (<i>Lanius excubitor</i>)	SB
iii. Coraciidae	Madagascar bee-eater (<i>Merops superciliosus</i>)	SB	x. Dicruridae	Black drongo (<i>Dicrurus macrocercus</i>)	R
	Indian roller (<i>Coracias benghalensis</i>)	R	xi. Corvidae	Indian tree pie (<i>Dendrocitta vagabunda</i>)	R
iv. Upupidae	Hoopoe (<i>Upupa epops</i>)	R		House crow (<i>Corvus splendens</i>)	R
15. Piciformes			xii. Sturnidae	Common myna (<i>Acridotheres tristis</i>)	R
i. Picidae	Black-rumped flameback (<i>Dinopium benghalense</i>)	R		Bank myna (<i>Acridotheres ginginianus</i>)	R
	Yellow-fronted woodpecker (<i>Dendrocopos mahrattensis</i>)	R	xiii. Passeridae	House sparrow (<i>Passer domesticus</i>)	R
16. Passeriformes			xiv. Estrildidae	White-throated munia × (<i>Lonchura malabarica</i>)	R
i. Alaudidae	Crested lark (<i>Galerida cristata</i>)	R		Spotted munia (<i>Lonchura puntulata</i>)	R
ii. Hirundinidae	Plain sand martin (<i>Riparia paludicola</i>)	R			
	Bank swallow (<i>Riparia riparia</i>)	W			
	Barn swallow (<i>Hirundo rustica</i>)	W			
iii. Motacillidae	Australasian pipit (<i>Anthus novaeseelandiae</i>)	R			
	Blue-headed wagtail (<i>Motacilla flava beema</i>)	PM			
	Black-headed wagtail (<i>Motacilla flava melanogrisea</i>)	PM			
	Indian white wagtail (<i>Motacilla alba dukhensis</i>)	W			
	Large pied wagtail (<i>Motacilla maderaspatensis</i>)	R			
	Grey wagtail (<i>Motacilla cinerea</i>)	W			
iv. Campenahagidae	Himalyan bulbul (<i>Pycnonotus leucogenys</i>)	R			
	Red-vented bulbul (<i>Pycnonotus cafer</i>)	R			
v. Turdidae	Indian magpie robin (<i>Copsychus saularis</i>)	PM			
	Stonechat (<i>Saxicola torquata</i>)	PM			
	Pied bushchat (<i>Saxicola caprata</i>)	R			

*R, Resident; SB, Summer breeder; W, Winter Visitor; PM, Passage migrant

As many as 440.18±94.51 (mean±SE) individuals of 23 species of water birds (excluding ducks because male and female individuals of ducks were counted separately, therefore, separate calculations were made) were recorded from the lake (Tables II, III). The most abundant water bird species recorded at the lake was black coot (*Fulica atra*) with a density of 1.47 coots per hectare of the lake.

As many as 162.1±17.71 individuals of six species of ducks were recorded from the lake during the study. The most abundant duck species was found to be shoveler (*Anas clypeata*) with 0.81 shovelers per hectare (Table III). The densities of water birds and ducks were estimated to be 3.29 and 2.56 per hectare, respectively. Bird categories (%age) such as water birds, birds of prey and passerine birds, etc. (Fig. 2) and order-wise

distribution of birds at Kallar Kahar Lake (Fig. 3) were also determined.

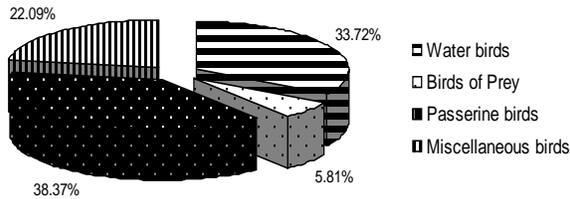


Fig. 2 Categories (percentage) of bird species of Kallar Kahar Lake

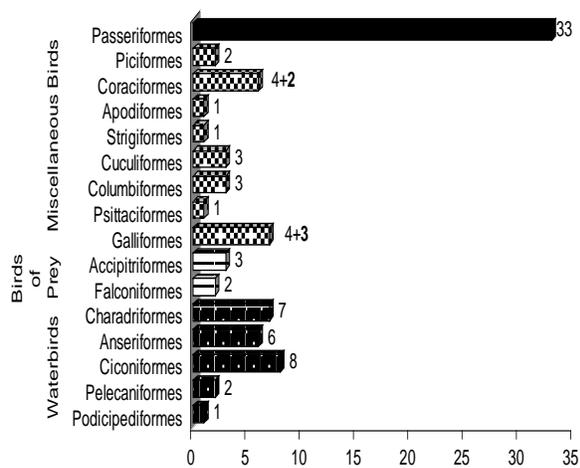


Fig. 3. Order-wise distribution of bird species of Kallar Kahar Lake

*Numbers in bolds represent water birds within miscellaneous bird category

It was estimated that around 31 % of the area of the lake has been invaded by *Phragmites* (42 ha). It provided breeding sites to night heron (*Nycticorax nycticorax*) and little egret (*Egretta garzetta*). The *Phragmites* area had 12 night herons and 7 little egrets per hectare with 25 and 13 nests per hectare respectively (Table IV).

DISCUSSION

Of 86 bird species 29 were water birds (including six duck species and 23 other water bird species) from Kallar Kahar Lake while Ali and Akhter (2005) recorded 30 bird species from the Lake during January-February, 2003. Ali and Akhter (2005) did not get any evidence of the white-headed duck from the lake. No evidence of the presence of whit-headed duck was obtained during

the present study as well. Ali and Akhter (2005) did not record even a single black coot during their study while the present study recorded this species with a population density of 1.47 birds per hectare. Likewise, they did not find any duck species at the lake. However, the present study revealed that all the six recorded duck species arrived at Kallar Kahar Lake during December and stayed as late as April (Table III).

A comparison of richness and abundance of water bird species among present study and past available records (Ali, 2007; Azam *et al.*, 2008, 2009) of Kallar Kahar Lake is given in Table V. The highest similarity was found with Azam *et al.* (2009), however, variations in the population statistics might be due to different timings and duration of surveys, use of different sampling units and observers' ability to identify bird species. Some species reported in the previous literature (Ali, 2007; Azam *et al.*, 2008, 2009) such as great crested grebe (*Podiceps cristatus*), black-necked grebe (*Podiceps nigricollis*), wigeon (*Anas penelope*), tufted duck (*Aythya fuligula*), black-headed gull (*Larus ridibundus*) and grey river tern (*Sterna aurantia*) were not found during present study. On the contrary, few other species such as black-crowned night heron (*Nycticorax nycticorax*), purple heron (*Ardea purpurea*), kentish plover (*Charadrius alexandrinus*), common sandpiper (*Actitis hypoleucos*) and gull-billed tern (*Sterna nilotica*) recorded during present study were not reported previously by Ali (2007).

Threats to lake and water birds

Pollution (nitrogen, phosphorous, etc.) and invasive alien species very rapidly had very high impact on wetlands over the last century across the world while overexploitation had a moderate impact which is continuing (MEA, 2005a). Biological invasions are a major environmental concern due to their negative impacts on biodiversity and economics. Invasive bird species such as house crow (*Corvus splendens*) and common myna (*Acridotheres tristis*) are associated with different aspects of human-modified environment (Lim *et al.*, 2003). Kallar Kahar was found to be affected by invasive species (such as crows and myna) and overexploitation in terms of unregulated tourism.

Nutrient loading in the lakes causes creation of hypoxic zones, acidification, formation of algal blooms and eutrophication (MEA, 2005a). Adverse effects of eutrophication such as deterioration in water quality, enormous growth of hydrophytes, reduction in the surface area of lake and fish mortality, etc. were evident at Kallar Kahar Lake. The lake area was 220 ha in 2003 (Ali and Akhter, 2006) but reduced to 133.50 ha during 2009. This could be due to siltation and excessive growth of certain hydrophytes such as *Phragmites*. An estimated cover of *Phragmites* was found to be 42 hectares which accounted for 31 % of the lake. Likewise, most of the catchment area of the lake is now deprived of vegetation. Consequently, runoff from this area carries an enormous amount of silt and nutrients. The former is reducing the depth of the lake while the latter is contributing to the phenomenon of eutrophication, hence, synergistically reducing the area of the lake.

Well-being of the people living near wetlands and health of wetlands are inter-connected, thereby, people may suffer due to wetland degradation and loss (MEA, 2005a). The phenomenon of reduction in the area of Kallar Kahar lake is not likely to be stopped and it is expected that a gradual reduction with eventual loss in the wetland would deprive the local people of wetland services such as ground water recharge and regulation of local climate. Intense climatic conditions do not prevail or are less pronounced in areas with wetlands. Globally, around 1.5 to 3 billion people are dependent on groundwater charged through wetlands (MEA, 2005a). Kallar Kahar Lake is one of the few sources for such a recharge in this arid terrain of Pakistan.

Wetlands are generally converted into agriculture lands or developed for tourism. However, converted wetlands have far less economic value than of unconverted and unaltered ones (MEA, 2005b). Loss of wetland due to conversion of land surrounding the Kallar Kahar Lake into residential areas, hotels and restaurants might result in the loss of significance of the lake as a tourist spot, thereby, affecting the economy of the area.

Some invasive species such as house crows and common mynas were observed in very high abundance and were observed to be affecting other

species such as little egret, night heron by predation and competition. This has led to the homogenization of species diversity of lake ecosystem and surrounding cities and town. The lake may lose its resilience in the face of a changing environment due to loss in the species richness and species homogenization.

Suggested measures for conservation

The ecological health of the lake and habitat quality for birds can be improved by zonation of the lake (wildlife and tourist's zone etc.), construction of check-dams to minimize the influx of silt and nutrients from catchment areas, initiation of vegetation control program, strict check on land encroachment, regulated tourism practices, regular wildlife research and monitoring programs and formulation of species recovery plan for threatened species of the area such as white-headed duck.

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Table II.- Count of water birds (excluding ducks) at Kallar Kahar Lake during 2008-09.

Scientific name (Common name)	2008			2009								Total	Mean±SE	Relative abundance	Population density (PD) (birds/hectare)
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug				
1. Little grebe (<i>Tachybaptus ruficollis</i>)	18	23	20	17	15	22	26	29	16	19	18	223	20.27±1.30	4.60	0.15
2. Great cormorant (<i>Phalacrocorax carbo</i>)	00	02	05	07	10	04	00	00	00	00	00	28	2.54±1.05	0.57	0.01
3. Little cormorant (<i>Phalacrocorax niger</i>)	29	38	46	43	35	38	41	36	31	34	30	401	36.45±1.63	8.28	0.27
4. Night heron (<i>Nycticorax nycticorax</i>)	00	00	00	06	08	91	22	00	00	00	00	127	11.54±8.20	2.62	0.08
5. Indian pond heron (<i>Ardeola grayii</i>)	08	08	05	06	04	03	06	02	02	04	04	52	4.72±0.63	1.07	0.03
6. Cattle egret (<i>Bubulcus ibis</i>)	10	13	11	12	10	16	18	24	21	26	25	186	16.90±1.87	3.84	0.12
7. Little egret (<i>Egretta garzetta</i>)	21	26	31	41	80	100	70	60	47	39	46	561	51.00±7.31	11.58	0.38
8. Intermediate egret (<i>Egretta intermedia</i>)	00	05	09	18	22	29	16	30	21	26	28	204	18.54±3.05	4.21	0.13
9. Great white egret (<i>Egretta alba</i>)	00	00	05	08	16	19	03	00	00	00	00	51	4.63±2.08	1.05	0.03
10. Grey heron (<i>Ardea cinerea</i>)	00	08	10	13	04	05	02	01	01	00	00	44	4.00±1.36	0.90	0.02
11. Purple heron (<i>Ardea purpurea</i>)	00	00	00	06	03	04	03	00	00	00	00	16	1.45±0.65	0.33	0.01
12. Common moorhen (<i>Gallinula chloropus</i>)	18	25	31	33	28	20	28	30	11	10	13	247	22.45±2.54	5.10	0.16
13. Purple moorhen (<i>Porphyrio porphyrio</i>)	22	20	30	47	52	80	43	36	20	15	19	384	34.90±5.89	7.93	0.26
14. Black coot (<i>Fulica atra</i>)	00	160	320	550	680	382	80	00	00	00	00	2172	197.45±74.85	44.85	1.47
15. Black-winged stilt (<i>Himantopus himantopus</i>)	00	00	00	12	08	16	10	06	00	00	00	52	4.72±1.79	1.07	0.03
16. Kentish plover (<i>Charadrius alexandrinus</i>)	00	00	00	02	00	00	00	00	00	00	00	2	0.18±0.18	0.04	0.001
17. Red-wattled lapwing (<i>Vanellus indicus</i>)	00	06	09	07	10	06	05	00	00	00	00	43	3.90±1.20	0.88	0.02
18. Spotted redshank (<i>Tringa erythropus</i>)	00	00	00	00	01	00	00	00	00	00	00	1	0.09±0.09	0.02	0.0006
19. Common redshank (<i>Tringa totanus</i>)	00	00	00	03	00	00	00	00	00	00	00	3	0.27±0.27	0.06	0.002
20. Common sandpiper (<i>Actitis hypoleucos</i>)	00	00	00	04	00	02	00	00	00	00	00	6	0.54±0.38	0.12	0.004
21. Gull-billed tern (<i>Sterna nilotica</i>)	00	00	00	00	02	01	00	00	00	00	00	3	0.27±0.19	0.06	0.002
22. White-breasted kingfisher (<i>Halcyon smyrnensis</i>)	03	01	04	01	02	03	02	04	02	01	03	26	2.36±0.33	0.53	0.0177
23. Pied kingfisher (<i>Ceryle rudis</i>)	01	00	00	02	02	00	00	03	02	00	00	10	0.90±0.34	0.20	0.0068
												Total	4842	440.18±94.51	

Table III.- Count of duck species of Kallar Kahar Lake during 2008-09.

Duck Species	Dec 2008		Jan 2009		Feb 2009		Mar 2009		Apr 2009		Total	Mean±SE	Sex Ratio		Relative Abundance	Population density (PD) (ducks/hectare)
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀			♂	♀		
1. Gadwall (<i>Anas strepera</i>)	03	02	04	05	02	02	00	00	00	00	18	1.8±0.57	50	50	1.11	0.02
2. Common teal (<i>Anas crecca</i>)	05	06	13	15	11	10	20	20	05	04	109	10.9±1.91	49.54	50.45	6.72	0.16
3. Mallard (<i>Anas platyrhynchos</i>)	03	03	05	04	16	19	30	30	20	20	150	15±3.37	49.33	50.66	9.25	0.22
4. Northern pintail (<i>Anas acuta</i>)	26	28	50	47	61	60	40	38	14	11	375	37.5±5.56	50.93	49.06	23.13	0.56
5. Shoveler (<i>Anas clypeata</i>)	39	46	79	84	71	76	50	52	23	26	546	54.6±6.95	47.98	52.01	33.68	0.81
6. Common pochard (<i>Aythya ferina</i>)	22	22	42	43	55	56	61	58	34	30	423	42.3±4.70	50.59	49.40	26.09	0.63
											Total	1621	162.1±17.71			

Table IV.- Estimated number of individuals and nests of two Ciconiforms (night heron and little egret) at Kallar Kahar Lake.

	<i>Phragmites</i> cover on eastern side (of the boating area): L=0.5 km X W=0.6 = 0.3 sq.km or 30 ha.				<i>Phragmites</i> cover on western side (of the boating area): L=0.4 km X W=0.3 = 0.12 sq.km or 12 ha.				
	Total <i>Phragmites</i> cover 42 hectares i.e. 31 % of the total area of Kallar Kahar Lake								
	1	2	3	4	5				
Radius (m)	50	60	50	70	50				
Area (m ²)	7850	11304	7850	15386	7850				
Species	NH	LE	NH	LE	NH	LE	NH	LE	LE
No. of individuals	21	11	14	08	12	06	16	09	02
No. of nests	50	20	30	13	20	09	21	16	03
	Total cover of <i>Phragmites</i> sampled= 50240m ² or 5 ha.								
	Number of nests				Number of individuals				
	per 5 ha.		per ha.		per 5 ha.		per ha.		
Night heron (NH)	126		25.2		66		12.2		
Little egret (LE)	61		13.2		36		7.2		

