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TREND IN THE DIVERSITY OF MIGRATORY DUCKS AT RAWAL LAKE, ISLAMABAD

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Abstract. Rawal Lake is a part of the Margalla Hills National Park, Islamabad Capital Territory, Pakistan. Present study was conducted to determine the trend in the richness and abundance of migratory duck species at Rawal Lake. Observations were made at three sampling units twice a month from November, 2008 to July 2009 during the morning and evening hours. Seven migratory duck species (*Anas acuta, A. crecca, A. platyrhynchos*, *A. strepera, A. clypeata, Aythya ferina, A. fuligula*) were recorded. Data on average count, relative abundance and density calculated are given. Results of the present study were compared with the available past records of migratory ducks of Rawal Lake. It was observed that duck species diversity of Rawal Lake has decreased over the past 26 years. Around 75% decrease from 2,312 individuals of ducks in 1983 to 585 individuals during the present study was recorded (2.9% decrease per year). This trend was more obvious after recent development activities around the lake which included conversion of a part of the Lake area into park, construction of huts and increased tourism and its associated activities like boating.

Key words: Pakistan, wintering, number, richness, abundance, decline, conservation.

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Изменения разнообразия мигрирующих уток на озере Равал, Исламабад. - С. Билал, М. Раис, М. Анвар, Т. Махмуд, И. Хусаин, М.С. Надим. - Беркут. 20 (1-2). 2011. - Озеро Равал находится на территории национального парка Маргала Хиллс на окраине Исламабада (Пакистан). Учеты уток проводились на трех пробных участках дважды в месяц с ноября 2008 г. до июля 2009 г. в утренние и вечерние часы. Было зарегистрировано 7 видов перелетных уток (*Anas acuta, A. crecca, A. platyrhynchos*, *A. strepera, A. clypeata, Aythya ferina, A. fuligula*). Приводятся данные по численности, относительному обилию и плотности. По сравнению с данными за 1983 г. общая численность уток уменьшилась с 2312 до 585 особей. Эти изменения связаны с активной хозяйственной деятельностью в районе озера.

INTRODUCTION

Pakistan has more than 225 important wetlands covering an estimated area of 780,000 ha. These freshwater and marine wetlands, including 19 Ramsar Sites, support unique assemblages of biodiversity including globally important habitats, species and genera (Ali, Akhtar, 2006). Wetlands of Pakistan host a significant number of migratory birds every year. They use International Migratory Birds Route Number 4 or Green Route, commonly known as Indus Flyway to reach Pakistan (Rais, 2009). The flyway is used by a large number of birds including globally threatened species such as White-headed Duck (*Oxyura leucocephala*), Houbara Bustard (*Chlamydotis undulata*) and Siberian Crane (*Grus leucogeranus*) (Ali, Akhtar, 2006).

Pakistan's wetlands and their rich biological resources are threatened due to over-exploitation, habitat destruction and environmental pollution. Habitat destruction is mainly due to ineffective management, poor stakeholder's participation and lake of coordination for management strategies (Sheikh, Kashif, 2006). Human activities such as hunting, water pollution, encroachment of wetlands, etc have threatened many migratory bird species. Communication towers and masts, windows and tall buildings, wind turbines, power lines and light pollution are reported to be the major barrier in the routes of the migration of birds. A number of detrimental stressors like hunting, reduction in the areas of wetlands and pollution are severely affecting the migratory pattern and the populations of birds in Pakistan (Rais, 2009). Habitat destruction by land use changes is, however, the biggest threat and shallow wetlands which are stopover and wintering sites for migratory birds are particularly threatened by draining

and reclamation for human use (Rybak et al., 1973).

Roberts (1991) reported 34 species of order Anseriformes and 28 duck species from Pakistan of which 17 are winter visitors in the Salt Range. Mirza (2007) reported 32 species of order Anseriforms and 27 ducks from Pakistan of which 14 occur in Salt Range during winter months. Rawal Lake is located at the northern edge of Pothwar region of which Salt Range is a part. Zafar-Uddin et al. (1983) counted as many as 2,312 individuals of four duck species at Rawal Lake while Amin et al. (1984) recorded 2,038 individuals of nine duck species at this lake. Almost after two decades, Ali and Akhtar (2005) reported 942 individuals of eight duck species at Rawal Lake, showing a decreasing trend in duck population.

Table 1

Number of duck species at Rawal Lake during 2008–2009
Численность уток на оз. Равал в 2008–2009 гг.

Species	Average Count, ind.	Relative Abundance, %	Population Density (ind./ha.)
Anas acuta	30	5.1	0.016
A. crecca	99	16.9	0.052
A. platyrhynchos	239	40.9	0.126
A. strepera	2	0.3	0.001
A. clypeata	39	6.7	0.021
Aythya ferina	151	25.8	0.079
A. fuligula	25	4.3	0.013
Total:	**585**	**100**	

Past two decades have witnessed enormous alterations in the landscape and ecology of Rawal Lake. Construction of residential areas around the lake, disturbance due to visitors, motorboats, fishing practices, livestock grazing around the lake and water contamination altogether have greatly modified the conditions of this wetland (Hussain et al., 2002; Riaz, 2004). The present study documents the impact of developments around the Rawal Lake on the richness and abundance of migratory duck species at the lake.

MATERIAL AND METHODS

Study area

Rawal Lake is a part of the Margalla Hills National Park, and is situated in the south east of Islamabad city. It is the main source of drinking water supply for Rawalpindi city in addition to irrigation of some surrounding areas. Rawal dam has been constructed on Kurrang River, main source of water to Rawal Lake, having the catchment area of 106 sq miles with a total storage capacity of 47,500 acre-feet (PEPA, 2004). Total area of the lake is 1902 hectares with a buffer zone of 2 km (Hussain et al., 2002). Annual rainfall is 1000 mm and temperature ranges from 1–15°C in winter and 20–40°C in summer (Farooq, Ghalib, 1986). The lake is significant from recreational point of view, buffering against flood, and as a source of irrigation for local farms.

Lake was divided into three sampling units to record the data on ducks. The lake was visited twice a month from November 2008 to July 2009 during the morning and evening hours. Birds were observed by using binoculars (10×50) and spotting scope (15–60) and identified by using field guide by Mirza (2007).

Total count of the bird species was undertaken from a vantage point within selected units of study site. Observations were taken early in the morning before sun rise and in the evening before sun set. Number of individuals (n) of the birds was counted thrice and then their average was calculated and recorded during each survey. The results were compared with the available published literature. Notes were taken on the recent developments and changes around the lake, and data regarding the development of new tourists parks were taken from Capital Development Authority.

Table 2

Month-wise count of duck species from November, 2008 to July, 2009 at Rawal Lake
Ежемесячные учеты уток с ноября 2008 г. до июля 2009 г. на оз. Равал

Species	2008				2009												Average ± SE
	Nov.		Dec.		Jan.		Feb.		Mar.		Apr.		May		Jun.		Jul.		
	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	
Anas acuta	–	–	–	–	–	45[b]	40	32	18	16[a]	–	–	–	–	–	–	–	–	30.2 ± 5.8
A. crecca	–	–	–	–	125	195[b]	86	68	20[a]	–	–	–	–	–	–	–	–	–	98.8 ± 29.4
A. platyrhynchos	–	–	–	–	329	358[b]	230	216	168	133[a]	–	–	–	–	–	–	–	–	239.0 ± 36.1
A. strepera	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	2
A. clypeata	–	–	–	–	–	60[b]	39	47	25	22[a]	–	–	–	–	–	–	–	–	38.6 ± 7.0
Aythya ferina	–	–	–	–	199	222[b]	173	161	81	70[a]	–	–	–	–	–	–	–	–	151.0 ± 25.4
A. fuligula	–	–	–	–	–	–	–	–	28	22[a]	–	–	–	–	–	–	–	–	25.0
Total	**–**	**–**	**–**	**–**	**653**	**880**	**568**	**524**	**342**	**263**	**–**	**–**	**–**	**–**	**–**	**–**	**–**		

W1– week 1, W2 – week 2; a – minimum count, b – maximum count.

We calculated Shannon-Wiener Diversity Index (DI), Population Density (PD), Relative Abundance (RA) and Sorensen Similarity Index (SI).

RESULTS

As many as 585 individuals of seven species of migratory ducks (Anseriformes, Anatidae) were recorded at Rawal Lake from November 2008 to July 2009 (Table 1). Maximum number of ducks (n = 880) was recorded in the second week of January while minimum number (n = 263) was recorded in the second week of March (Table 2). Mallard (*Anas platyrhynchos*) (Average Count = 239, RA = 40.9, PD = 0.126) was recorded as the most abundant duck species while Gadwall (*A. strepera*) (Average count = 2, RA = 0.3, PD = 0.001) was the least abundant duck. Other duck species included Northern Pintail (*A. acuta*), Common Teal (*A. crecca*), Northern Shoveler (*A. clypeata*), Common Pochard (*Aythya ferina*) and Tufted Duck (*A. fuligula*) (Table 1). The duck species started arriving at the Rawal Lake during January and left the lake in April.

Human activities at the lake have continuously increased during the past years. The existing picnic areas around Rawalpindi and Islamabad have now become overcrowded and insufficient due to increase in human population of twin cities. Keeping in view the extreme load of visitors at existing picnic spots, the Capital Development Authority, Islamabad (Rawal Lake's management authority) developed an additional recreational facility, the Lake View Park by converting previously undisturbed part of the lake. An amount of Rs. 357.00 million was ear marked for the development of an area of 35 acres and Rs.1183.671 million for an area of 100 acres around the lake to develop the facilities includ-

Table 3

Comparison of populations of duck species at Rawal Lake from 1983 to 2009
Сравнение численности уток на оз. Равал с 1983 по 2009 гг.

Species	Zafar-Uddin et al. (1983)	Amin et al. (1984)	Riaz (2004)	Ali, Akhtar (2005)	Present study (2009)
Tadorna ferruginea	2	–	–	14	–
Anas acuta	496	569	8	80	30
A. crecca	468	100	–	15	99
A. platyrhynchos	1346	790	113	65	239
A. strepera	–	–	–	–	2
A. penelope	–	89	–	26	–
A. querquedula	–	250	–	–	–
A. clypeata	–	57	–	250	39
Netta rufina	–	128	25	–	–
Aythya ferina	–	–	4	500	151
A. fuligula	–	53	1	6	25
A. marila	–	2	–	–	–
Total:	**2312**	**2038**	**151**	**942**	**585**

ing hotels, restaurants, huts, and a bridge and observation tower. Similarly, the Banni Gala Picnic Spot of the lake was renovated at a cost of Rs.60 million. Thus development of these areas into tourist spots has increased tourist input, and the tourism related activities like crowding, noise and boating were observed to be the main factors in affecting the duck species of the lake.

DISCUSSION

Diversity of duck species (richness and abundance) at the Rawal Lake has decreased during recent years. This reduction trend has been recorded particularly after recent developments which included conversion of part of lake area into park, construction of huts and picnic sites, increased tourism and its associated activities like boating.

The present study did not record the species such as Ruddy Shelduck (*Tadorna ferruginea*), Wigeon (*Anas penelope*), Garganey (*A. querquedula*), Red-crested Pochard (*Netta rufina*) and Scaup (*Aythya marila*) which were recorded in earlier studies (Zafar-Uddin et al., 1983; Amin et al., 1984; Riaz et al., 2004; Ali, Akhtar, 2005). Zafar-Uddin et al. (1983) counted 2312 individuals of four duck species while the present study counted 585 individuals of seven duck species (Table 3). Hence, 75% decease in the abundance of ducks since 1983 with 2.9% decrease per year was recorded. During the present study, 82.2% decrease in the number of Mallard since 1983 (3.2% per year) was recorded. Similarly, the population of Common Teal and Northern Pintail decreased by 94.0% (3.2%) and 78.8% (3.0%).

Amin et al. (1984) counted as many as 2038 individuals of nine duck species (Table 3). It showed a decrease of 71.3% (2.9% per year) in the population of ducks since 1984 at the lake. During the present study 94.7% decrease in the number of Northern Pintail (3.8%), 1% decrease in the number of Common Teal (0.04%), 69.7% decrease in the number of Mallard (2.8%), 31.6% decrease in the number of Shoveler (1.3%), and 52.8% decrease in the number of Tufted Duck (2.1%). Four duck species observed by Amin et al., (1984) were not recorded during the present study.

Ali and Akhtar (2005) recorded 942 individuals of eight duck species (Table 3). A 37.9% decrease was observed in the abundance of ducks since 2005 (9.5% per year). During the present study 62.5% decrease in the number of Northern Pintail (15.6%), 84.4% decrease in Shoveler (21.1%), 69.8% decrease in Common Pochard (17.5%) was recorded.

Several studies have revealed that disturbances arising from human activities severely affect population of birds particularly of ducks. The boating season caused 75% of total disturbances affecting the population development of moulting ducks (*Somateria mollissima* and *Tadorna tadorna*) in Wadden Sea of Schleswig-Holstein (Thiel et al., 1992). Most disturbance to birds on Esquimalt Lagoon resulted from human activities (Retfalvi, 1986) of which boating accounted 63% of the total human-initiated disturbance to birds resulting in the decline in the number of birds (Clowater, 2008). Disturbance has an energetic cost to wintering birds (Frid, Dill, 2002). When disturbance increased birds may become more vulnerable to predation (Mikola et al., 1994). Results of present study also showed decreasing trend in the richness and abundance of ducks at Rawal Lake due to human activities associated with development and tourism. It is suggested that the immediate steps should be taken to minimize the impacts of tourism activities on waterfowl particularly the migratory ducks such as ban on motor boating or replacing motor boats with paddle boats. The boating area should be restricted out of the core habitat of ducks in the Lake. Some marshy areas around the Lake should be maintained to provide habitat to waterfowl and access to these areas be contained.

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