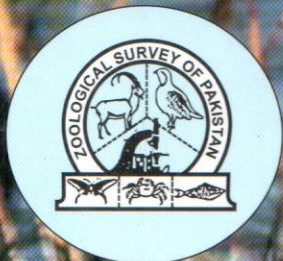


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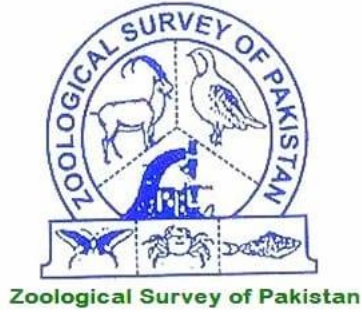
Zoological Survey of Pakistan

Volume-23

2017



Zoological Survey of Pakistan
Ministry of Climate Change, Islamabad - Pakistan



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Water Beetles in Fish Ponds at Punjab Fish Seed Hatchery Rawal Town, Islamabad

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KEYWORDS

Water beetles,
Fish Hatchery,
Species,
Diversity,
Ponds

ABSTRACT

The present study was carried out to investigate the water beetles in Punjab Fish Seed Hatchery and Training centre at Rawal Town, Islamabad. Total of 74 individuals of water beetles belonging to dytiscidae family, including 36 individuals of three species i.e., *Hydaticus spp* (4), *Hydaticus fabricus* (2), & *Eretes sticticus* (30) in earthen ponds; and 38 individuals in concrete pond belonging to 2 species *Hydaticus spp* (14) and *Eretes sticticus* (24) were recorded. Berger-Parker Index showed higher diversity (1.58) in concert pond as compared to (1.20) in the earthen ponds.

Introduction

Coleoptera is the largest order of insects including 2 sub orders having members of aquatic families (Jach & Balke, 2008). This order includes approximately 400,000 species and 170 families (Archangelsky *et al.*, 2009). Pakistan is one of the thirteen mega bio-diversity countries of the world. In total, 80% of the insects are endemic in Pakistan (Prerlman & Adelson, 1997).

Water beetles being one of the basic biotic components of any water body form a very diverse group of aquatic insects. (Bilton, 2009). Aquatic insects are those that spend some part of their life-cycle closely associated with water either skimming along on top of the water or living beneath the surface of water (Stanley & Bedick, 1997). They are good indicator of aquatic habitat age, naturalness and quality (Bilton, 2009). Habitat preference of aquatic beetles also vary between different stages like larva, pupa and adult (Jach & Balke, 2008).

Water beetles have been studied throughout the World. This is the most important group of insects in aquatic environment, which is studied due to its diversity abundance and its important role in nutrient dynamics and energy flow in the aquatic systems (Cobbaert *et al.*, 2010). At present, it is estimated that about 18,000 species of water beetles are present on the earth. Out of this about 12,600 (70%) of these species are already described but remaining number of species are undescribed (Jach & Balke, 2008).

Punjab Fish Seed Hatchery is a governmental research and training organization situated at Rawal Town, Islamabad which produces fish seed for the local natural water bodies and for the private fish farmers. Aquatic beetles are present in various types of fish ponds like nursery, rearing and stocking ponds which are considered to be harmful for fish and its larval stages such as spawn, fry and fingerlings. The objective of the present study is the population estimation of water beetles in fish ponds at Fish Seed Hatchery Rawal town, Islamabad.

Material and Methods

Study area:

The study area was Punjab Fish Seed Hatchery, Rawal Town,

Islamabad at 33° 43' (N), 73° 3' (E) located in the northern edge of the Potohar Plateau.

Study design:

Four ponds were selected as sampling sites for the collection of water beetles. Two concrete ponds and two earthen ponds having the size of 173 x 85 x 6 feet were chosen (Fig. 1 & 2). Each site was sampled twice a month for the time period of three months i.e. May, June and July 2013. The application of diesel and Mobil oil on the surface of pond water was used as sampling method. The mixture of diesel and Mobil oil having the ratio of 2:1 was applied on the surface of experimental ponds for creating suffocation in water for water beetles. After some time water beetles came on the surface of pond and they were collected by using scoop net and hand net. Collected water beetles were preserved in 10% formalin. After preservation the collected water beetles were brought to the Fisheries and Aquaculture Laboratory at Zoology Department, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi for identification. Collected insects were identified with the help of key book Freshwater Invertebrates (Robert, 2007).

Data analysis:

Data was analyzed by using Berger-Parker Index to check the final outcome of water beetle diversity in two different types of ponds at Punjab Fish Seed hatchery Islamabad.

Results

A total of 74 individuals of water beetles were collected belongs to a single family and five species. The individuals (36) captured from earthen ponds were belongs to 3 species *Hydaticus spp* (4), *Hydaticus fabricus* (2) and *Eretes sticticus* (30). Two species *Hydaticus spp* and *Eretes sticticus* containing 14 and 24 individuals respectively were found in concrete ponds. *Eretes sticticus* shows higher density as compared to the other two species (Table 1). Darilmaz *et al.* (2014) studied the fauna of water beetles in Sivas, Turkey and reported about 25 species of family Dytiscidae in Sivas province. Jaiswal (2012) studied the water beetles of Ameenpur Lake, Hyderabad India and reported 26 species of water beetles belongs to 4 families namely Dytiscidae, Gyrinidae, Hydrophilidae

and Haliplidae. Similarly, Attique and Kamaluddin (2005) studied the water beetles of Sindh, Thatta and Dadu, Pakistan.

In concrete pond the number of individuals belonging to the species *Eretes sticticus* (Fig. 3 & 4) recorded in the months of May, June and July were 4, 14 and 6 respectively while that of species *Hydaticus spp.* (Fig. 5 & 6) were 2 in May, 10 in June and 2 in the month of July (Table1). While in earthen pond the number of *Eretes sticticus* in the month of May, June and July were 5, 16 and 9 respectively. *Hydaticus spp* and *Hydaticus fabricus* were only observed in the month of June. Overall result of water beetles in both types of fish ponds shows that the density and diversity was higher in the month of June. In previous studies, Darilmaz and Ahmed (2009) recorded *Hydaticus leander* (Coleoptera, family Dytiscidae) for the first time in pools of Mirpur Khas, Sindh of Pakistan. Moreover, Abdullah (2009) reported the presence of 4

species of water beetles in the survey conducted at Teluk Bewah and Sungai Cicir in Kenyir water river catchment. The recorded species belongs to family Dytiscidae and Hydrophilide.

Most of the diversity and density of water beetles were found in the month of June which predicts that this month is highly productive for water beetles as compared to the other two months May and July, which can be due to the different ecological conditions and change in environment with reference to water temperature in the specific time period of research.

Total diversity of water beetles was calculated by Berger-Parker Index (Table 2). This Index shows that the concrete ponds have more diversity (1.58) as compared to the earthen ponds (1.20). This may be due to the more competition for food in earthen pond as compared to the concrete pond.

Table 1: Diversity and density of Water beetles present in two different fish ponds at study area

Sr.no	Pond type	Water beetle species	Month-wise No. of Individuals			Total
			May	June	July	
1	Concrete pond	<i>Hydaticus spp</i>	04	14	06	24
		<i>Eretes sticticus</i>	02	10	02	14
2	Earthen pond	<i>Hdyaticus fabricus</i>	05	16	09	30
		<i>Hydaticus spp.</i>	0	04	0	04
		<i>Eretes sticticus</i>	0	02	0	02

Table 2: Berger Parker Index for diversity of the water beetles in two different fish ponds

Sr.no	Pond type	Total no. of individuals (N)	Maximum abundant species (N max)	Berger-parker Index $d = N \max / N$	1/d
1	Concrete pond	38	24	0.63	1.58
2	Earthen pond	36	30	0.83	1.20



Fig.1. Concrete pond



Fig.2. Earthen pond



Fig.3. Dorsal view of *Eretes sticticus*



Fig.4. Ventral view of *Eretes sticticus*



Fig.5. Dorsal view of *Hydaticus* spp.



Fig.6. Ventral view of *Hydaticus* spp.

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Occurrence and Distribution of Leatherback Turtle (*Dermochelys coriacea*) in the Coastal and Offshore Waters of Pakistan

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KEYWORDS

Leatherback turtles,
Dermochelys coriacea,
Entanglement,
Safe release,
Gillnets.

ABSTRACT

Although leatherback turtle (*Dermochelys coriacea*) has previously been reported from Pakistan but these were based on stranding of 4 dead specimens on beaches of Sindh and Balochistan. Unconfirmed nesting were also reported from sandy beaches at islands of Indus estuary, Cape Monz, Mubbarak Village along Sindh Coast and Pushukan, Gwadar and Jiwani along Balochistan coast. Present paper reports confirmed occurrence of 8 specimens of leatherback turtles that were entangled in fishing gears. One specimen was found floating dead in Miani Hor which possible had a boat strike. All specimens entangled in gillnets were safely release except one entangled specimen which was found dead when heaved on the fishing boats. The records of leatherback turtles along Pakistan indicate that this species is widely distributed but have extremely rare occurrence. No marked seasonality of occurrence was noticed except that more sighting were made during winter months.

Introduction

Marine turtles of Pakistan have been studied since long. Murray (1884) was possibly the first to report marine turtles from Pakistan. He reported occurrence of olive ridley turtle (as *Caouana olivacea*) and green turtles (as *Chelonia virgata*) in Sindh. Shockley (1949) reported only green turtle (*Cheloniemydas*) from Jiwani, Balochistan. Minton (1966) reported five species of marine turtles from Pakistan coast including green turtle (*C. mydas*), logger head (*Caretta caretta*), hawksbill (as *Eretmochelys imbricate squamata*), leatherback (*Dermochelys coriacea*) and olive ridley (*Lepidochelys olivacea*).

Murray (1884) mentioned green turtle nesting at Clifton and Gizri at Karachi with great quantities of eggs brought for sale during breeding season. Shockley (1949) while reporting green turtle (*C. mydas*) from Jiwani, Balochistan pointed out major feeding and nesting area for this species. Because of their abundance, the local were reported to call a part of the Jiwani Peninsula as "turtle cliff" (presently Daran).

Minton (1966) included loggerhead (*C. caretta*) and hawksbill (as *E. imbricata squamata*) in the list of species of marine turtles of Pakistan but he has not examined any specimens of these species and only speculated their presence in Pakistan. Although there have been records of occurrence of leatherback turtle (*D. coriacea*) in Pakistan but these were based either on photograph, dead specimens or on hearsay, therefore, most of these records cannot be ascertained.

It was Minton (1966) who for the first time reported leatherback from Pakistan which was based on a photograph taken in June, 1958 of an adult specimen that was stranded on Hawksbay, Karachi. Mertens (1969) reported this species from Pakistan based on report of Minton (1969). It was mentioned in Minton (1966) that according to fishermen, leatherback turtles nest on the islands near the mouth of the River Indus. Extensive surveys for the sandy islands at the mouth of the River Indus between Bundal Island and Sir Creek were made during last 30 years but no such nesting was observed (Niaz-Rizvi, personal communication).

During a survey conducted along Makran coast between 19 and 22 January 1987, Groombridge (1987; 1989) contacted someone in

Ormara who said that leatherback turtles (which he identified from photograph) were occasionally caught in nets, however, this could not be independently verified. *D. coriacea* is included among five other species of marine turtles have been reported to occur in the territorial waters of Pakistan (Ghalib & Zaidi, 1976), but they have not mentioned any specific record or any nesting from anywhere in Pakistan.

Firdous (1989; 2000) reported a dead male leatherback turtle beached on Sandspit, Karachi on 5 September, 1998. She attributed the death of this 2.134 m long (carapace length) turtle to possible shark attack as there was a prominent cut on the ventral side of the left rear flipper. She also collected another dead specimen on 25 April 1989 from Paradise Point, Karachi. There was a very big hole on the proximal end of right front flipper. Both of the back flippers were also damaged indicating the attack of shark. However, according to the Editor, IOSEA Marine Turtle MoU (mentioned in Firdous, 2006) carcasses reported by Firdous (1989; 2006) were in poor condition when washed ashore and the injuries attributed to shark attack, could have occurred after these turtles have died. Therefore cause of death cannot be attributed to shark attack and possibility of anthropogenic factors cannot be ruled out. Another freshly dead leatherback turtle was reported from in Pushukan near Gwader in 2002 (Hasnain; personal communications).

Khan *et al.*, (2010) reported leatherback nesting at Mubarak Village, Pishukan, and Jiwani. They reported nesting at Mubbarak Village, Cape Monz near Karachi during June and July, at Pishukan during February and Jiwani during January and February. There was no evidence of juveniles or any adult specimen reported by Khan *et al.* (2010) and also no details of technique used for the identification of the nests was given. The information about their nesting in these area cannot be independently verified.

WWF-Pakistan has initiated a study to document presence of leatherback turtle in Pakistan in 2012 which reveals that this species is occasional found in Pakistan especially in the offshore waters. Present paper deals with the authentic records of leatherback turtles in Pakistan.

Material and Methods

Along the coast of Pakistan, a number of volunteers have been assigned to keep a vigil on record of any unusual animals including turtles and report it to WWF-Pakistan office located in Karachi. In addition, WWF-Pakistan has initiated a crew-based observers programme on board tuna gillnet vessels (Moazzam & Rab, 2017). These observers are record the instance of bycatch of megafauna including turtles. These observers are also trained to safely release any entangled turtles and other bycatch. These are two main sources of data on leatherback turtles which is presented in this paper.

Results

There are records of only four dead leatherback turtles over a period of more than 60 years. Present paper reports eight additional confirmed cases of occurrence of leatherback turtle from Pakistan. The details of all sightings, strandings or reports of occurrence/nesting of leatherback turtle from Pakistan are given in Table-I.

Table-I. Report of Occurrence of Leatherback turtle (*Dermochelys coriacea*) from Pakistan coast.

Date	Location	Status	Author	Remarks
June 1958	Hawksbay, Karachi	Stranded	Minton (1966)	Based on a photograph
19-20 January 1987	Ormara	Occasionally entangled in the net	Groombridge (1987, 1989)	Fishermen identified from Photograph
-	Territorial waters of Pakistan	Occurrence	Ghaliband Zaidi (1976)	Without any specific record
5 September 1988	Sandspit, Karachi	Dead stranding	Firdous (1989)	Male (2.13 m)
25 April, 1989	Paradise Point, Karachi	Dead Stranding	Firdous (1989; 2000)	1.25 m
2002	Pushukan, Gwadar	Dead Stranding	Hasnain Personal Communication	Reported by WWF
June and July	Mubbarak Village, Cape Monz, Sindh	Nesting	Khan <i>et al.</i> (2010)	Details of nesting not provided
February	Pushukan, Gwadar	Nesting	Khan <i>et al.</i> (2010)	Details of nesting not provided
January-February	Jiwani	Nesting	Khan <i>et al.</i> (2010)	Details of nesting not provided
16 April 2012	Sur Gwadar	Entangled in coastal monofilament net	Present Study	Male (1.6 m)
6 January 2015	4.5 n. miles from Gwadar (East Bay)	Entangled in coastal monofilament net	Present study	1.2 m. Safely released in the sea
17 February 2015	204 km southwest of Karachi (depth 1,285 m)	Entangled in the tuna gillnet	Present study	Slipped back in the sea while heaving (Iqrar Muhammad)
17 November, 2016	Miani Hor, Sonmiani	Dead floating in water	Present study	1.4 m. Signs of boat strikes visible.
30 December 2016	218 km southwest of Karachi (depth 1,354 m)	Entangled in the tuna gillnet	Present study	1.54 m. Dead, thrown back in the sea by fishermen (Muhammad Islam)
4 January 2017	Khori Great Bank about 70 km southwest of River Indus mouth (depth 64 m)	Entangled in the tuna gillnet	Present study	1.52 m. Safely released by fishermen (Saeed Badsha)
29 January 2017	122 km southwest of Karachi (depth 253 m)	Entangled in the tuna gillnet	Present study	Safely released by fishermen (Sher Zamin Khan) Not measured
21 April 2017	97 km from south of Malan, Balochistan (depth 2,975 m)	Entangled in the tuna gillnet	Present study	1.4 m. Safely released by fishermen (Muhabbat Khan)

Records of Leatherback turtle since 2012

Leatherback turtle enmeshed at Sur, Gwader in April 2012.

A large male leatherback turtle (Fig. 1) was caught in pelagic monofilament net along Sur (Gwadar coast) on April 16, 2012. The



Fig.1. Leatherback turtle entangled in monofilament gillnets at Sur, Gwadar in 2013

Leatherback turtle enmeshed at Gwader in January 2015.

On 6 January 2015, a group of fishermen operating a monofilament gillnet caught a 1.2 m large male leatherback turtle about 4.5 n. miles in the Gwadar East Bay (Fig. 3). This turtles got entangled in the net but could not be released at sea, therefore, brought to Gwadar Fish Harbour where it was freed from the net. The turtle was placed in the fishing boats and safely released at the site of its capture.



Fig. 3. Leatherback turtle entangled at Gwadar (East Bay) after disentanglement from the net at Gwadar Fish Harbour in January 2015

Leatherback turtle Carcass at Miani Hor lagoon in November 2016.

A specimen of a leatherback turtle was found in Miani Hor lagoon near Sonmiani, Lasbela District, Balochistan on 17 November, 2016. The carcass was floating in the lagoon water which was photographed (Fig. 4). The turtle was measured to be about 1.4 m long and had peeled skin on its carapace which indicates that turtle might have died due to a boat strike, however, there may be other causes of the death.

turtle was about 1.6 m long. In order to free this turtle from their net, the fishermen beached it and the WWF-Pakistan staff helped released it back into the sea (Fig.2).



Fig.2. Leatherback turtle entangled at Sur, Gwadar was safely released



Fig. 4. Leatherback turtle carcass floating in Miani Hor lagoon near Sonmiani on 17 November, 2016

Muhammad Islam December 30, 2016 (23°26'N; 65°29'W)

A male leatherback turtle got entangled in the tuna gillnets on 30 December, 2016 about 218 km southwest of Karachi. The depth at the site of entanglement was about 1385 m. It was about 1.54 m long (Fig. 5-6). The specimen when hauled was already dead, therefore, after taking measurements, it was thrown overboard.

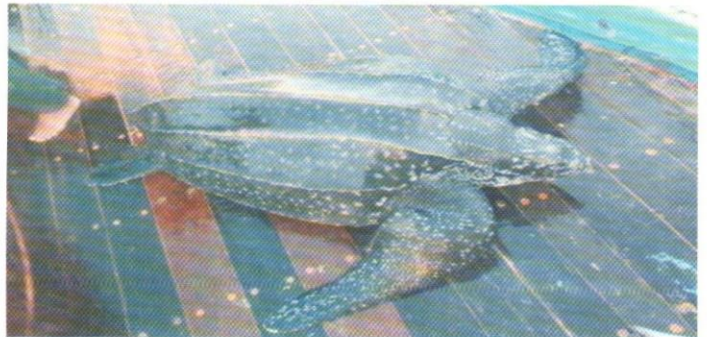


Fig. 5. Male Loggerhead caught southwest of Karachi on 30 December 2016 (Dorsal View)



Fig. 6. Male Loggerhead caught southwest of Karachi on 30 December 2016 (Ventral View)

Sher Zamin Khan, Off Tursian Creek December 2016

A large leatherback turtle got entangled in the tuna gillnets in December, 2016 off 12 km south Tursian Creek (Fig. 7). The depth at the site of entanglement was about 30 m. The specimen could not be measured but it was large about 1.5 m long. The specimen slipped from the net and swam away and could not be hauled overboard



Fig. 7. Leatherback turtle entangled in tuna gillnet and safely released off Turshian Creek in December 2016.

Leatherback turtle safely released at Khori Great Bank in January, 2017

A leatherback turtle was safely released by a fishermen in Khori Great Bank near Indus Canyon (Swatch) on January 4, 2017. This 1.52 m long turtle was found entangled in the gillnet laid down for catching tuna about 100 nautical miles from Karachi (Fig. 8). Captain of the tuna gillnet vessel noticed this giant turtle entangled in the gillnet. He maneuvered the net to get the turtle safely released. After a struggle of about 20 minutes the turtle was able to swim away safely from the net.



Fig. 8 Leatherback turtle entangled in the tuna gillnet Khori Great Bank near Indus Canyon on January 4, 2017.

Leatherback turtle entangled in gillnet on April 21, 2017 near Malan

While operating on 21 April, 2017 about 97 km from south of Malan (24° 27' N; 64° 52' E), a large leatherback turtle with a length of about 1.4 m got entangled in the tuna gillnet (Fig. 9). The depth at the location was about 2,975 m. The turtle was heaved on board and measured and released. The specimen was in healthy condition and was safely released. Sex of the turtle could not be determined.



Fig. 9. Leatherback turtle entangled in the gillnet off Malan on 21 April, 2017

Discussions

Presence of leatherback turtles is now well authenticated through a number of antecedent records as well as by the live specimens that interacted with fishing gears, as reported in present paper. In most cases the entangled leatherback turtles were safely released. The records further indicate that this species is predominantly found during the winter months between September through April except one record made by Minton (1966) in June 1958.

It was observed that leatherback turtle is widely distributed along the coast of Pakistan (Fig. 10) with the main reports are from four areas i.e. Gwadar Jiwani area including Surbundar (4 specimens); Malan Sonmiani area (3 specimens); Karachi (4 specimens) and Great Khori Bank- Indus Canyon offshore area (4 specimens), however, future reports may help in determining their spatial distribution pattern along the coast of Pakistan.

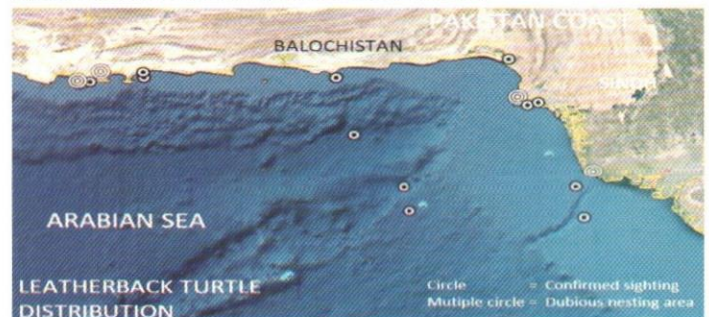


Fig. 10. Map showing distribution of leatherback turtle along Pakistan Coast.

Khan *et al.*, (2010) reported nesting of leatherback turtle during June and July at Karachi, February at Pushukan and Gwadar and during January and February at Jiwani, however, the procedure for identification of the nesting were not described. The authors have been visiting these beaches regularly for many years but neither any record of leatherback nesting, eggs or baby turtles was ever noticed from any of these beaches, nor coastal communities residing in these areas ever noticed leatherback turtles or their nesting.

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A Preliminary study of Migratory Water Birds at Chashma Barrage

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KEYWORDS

Migration,
Chashma Barrage,
Wildlife Sanctuary,
Waterfowl,
Species.

ABSTRACT

Chashma barrage is important wetland contributing to the avifaunal diversity. Every year during winters, a substantial concentration of passage migrants visit the wetland. Current study was conducted to explore the avifaunal diversity with challenging threats at Chashma Lake. Extensive field surveys were carried out to monitor the birds at the wetland and identification was carried out using the field guides. 50 bird species belonging to 11 families and 6 orders were recorded during the study. Family Anatidae (52%) with 11 bird species was most abundant and diversified. Second more abundant family was Phalacrocoracidae (34%) with 4 bird species. Families Phalacrocoracidae (7%) with only 2 bird species, Podicipedidae (3%) with 2 bird species, Ardeidae (2%) with 9 bird species were at third, fourth and fifth number in abundance respectively. The least abundant families recorded were Scolopacidae (0.8%) with 10 bird species, Laridae (0.7%) with 3 bird species, Charadriidae (0.2%) with 6 bird species, Recurvirostridae (0.13%) with 1 bird species, Sternidae (0.2%) with 1 bird species and Jacanidae (0.08%) with only 1 bird species.

Introduction

Bird migration has always fascinated humans. There is something enigmatic about how migratory birds return each year to the North in spring and then disappear before winter arrives (Newton, 2008). Of the known 9,856 bird species present on Earth, 1,855 are migratory. They take advantage of seasonal resources. Breed in one region and then, when food availability changes, spending the non-breeding months in other regions. There are 181 nomadic species, whose migrations do not follow regular directional and spatial patterns; 262 are marine and coastal birds, also known as seabirds, whose routes cross the oceans or go from coast to coast; and 343 are altitudinal migrants, moving seasonally between lower and higher elevations within the same region. The largest group is made up of 1,593 migratory land and water birds, representing 16% of the avian species which populate the Antarctic, Indo-malayan, Australasian, Nearctic, Neotropical, Afrotropical and Palearctic geographic realms (Kirby *et al.*, 2008; Bird Life International, 2008).

Wetlands are frequently used by a diverse number of migratory and resident bird species for foraging, nesting and roosting due to heterogeneity of microhabitats and available rich food resources (Mitsch & Gosselink, 2007; Zakaria *et al.*, 2009). Birds are an extremely diverse, conspicuous and significant component of freshwater wetland ecosystems, and they may fly to different areas to feed, mate and nest (Furness & Greenwood, 1993; Kushlan, 1993). The presence or absence of birds may indicate the ecological conditions of wetland habitats and form an important link between the food web and nutrient cycle. Moreover, birds may respond quickly to any change in habitat and climatic condition (Fuller *et al.*, 1995; Gregory & Baillie, 1998; Siriwardena *et al.*, 1998; Krebs *et al.*, 1999).

Wetlands in Pakistan cover an area of 780,000 hectares, comprising 9.7 percent of the total surface area of the country with 74% freshwater and 26% of coastal wetland areas (IUCN, 1989; Altaf *et al.*, 2014). A total of 225 wetlands in Pakistan including 19 Ramsar sites support unique assemblages of biodiversity including globally important habitats, species and genomes (Ali & Akhtar, 2006). Natural wetlands whether, permanent or seasonal, exists as peatland, rivers, streams, lakes, marshes, estuaries, mudflats and inter-tidal areas. Pakistan's natural wetlands occur in the coastal,

arid, semi-arid and alpine areas (PWP, 2008). They are the most productive sites as provide food source to almost all the water birds (Ali, 2005; Altaf *et al.*, 2013).

Pakistan lies at the crossroads of Asia's major Palaearctic bird migration routes. At different times in the annual cycle there are substantial concentrations of passage migrants, influxes of winter visitors from northern breeding grounds and summer breeding migrants from the Indus Plains or northern alpine regions. The Indus Flyway is one of the world's major migration routes, running from Siberia to various destinations in Pakistan over the Karakorum, Hindu Kush and Suleiman mountain ranges, along the Indus River and down to the delta (Ali & Akhtar, 2006). The convergence of three high mountain ranges gives rise to a great variety of landscapes and wetland habitats (glacial lakes, running streams, nullahs or dry watercourses). The unique canal system and combination of man-made and natural wetlands attract millions of birds in unique patterns and congregations at numerous sites throughout Pakistan (Sheikh & Kashif, 2006).

Pakistan has more than 670 species of birds, of which one third are water birds, with most of these being migratory species including geese, ducks, swans, waders and other water birds (Sheikh & Kashif, 2006). The avian diversity in Pakistan is facing substantial threats due to loss of natural habitat, illegal hunting and leasing of land for cultivation. These activities seriously degrade the natural habitat of wild birds (He & Hubbell, 2011; Umair, 2012; Altaf *et al.*, 2013). Eutrophication also leads to increased sedimentation and oxygen deficiency hence adversely affecting the diversity directly and indirectly. Threats like predation, dams, over fishing, pollution and water extraction are also present.

The study area, Chashma barrage was declared a Wildlife Sanctuary on January 31, 1974 for a period of five years under the provisions of the Punjab Wildlife Act, 1974. Since then it continuously existed as a Wildlife Sanctuary till now. It is a wetland of international importance and is also a RAMSAR Site. This wetland is very important staging and wintering area for a wide variety of waterfowl. Highest concentration of the waterfowl was reported in the past especially in winter it supports up to 2, 00,000 waterfowl. (Ahmad, 1994). The present study was therefore carried out to explore the avifaunal diversity with challenging threats at Chashma Lake.

Material and Methods

Study Area:

Chashma Barrage (32° 25'N, 71° 22' E) is located at Southwest of Mianwali to Dera Ismail Khan Road in the Punjab Province. Barrage covers an area of about 33,109 hectares and it is at an altitude of about 225m (Scott, 1989). The climate of the area is generally subtropical with hot summer and cool winters. The annual rain fall varies from 300-500 mm, and the relative humidity varies from 22-85 %. PH values of water ranges from 6.5 to 7.2. Maximum flooding occurs in spring. The average maximum temperature in June is 41° c and the average minimum in January is 4.5° c (Savage, 1992; Roberts, 1984; Ahmad, 1987).

The aquatic vegetation consists of *Hydrilla verticillata*, *Nelumbium speciosum*, *Nymphaea lotus*, *Typha angustata*, *Phragmites karka*, *Potamogeton pectinatus*, *Saccharum spontaneum*, *Vallisneria spiralis* and *Zannichelli apalustris*. The natural vegetation of the region is a mixture of subtropical semi-evergreen scrub and tropical thornforest with species. Most of the natural thorn forest on the plains to the east of the Indus has been cleared for agricultural land and for irrigated plantations of *Dalbergia sissoo* and other species.

The wetland was first declared as a Wildlife Sanctuary of 33,084 ha in 1974. The Sanctuary was re-notified in July 1984, and since then, the level of protection has greatly improved. The wetland is state owned (Irrigation Department, Government of the Punjab); adjacent areas are partly state owned and partly privately owned.

Survey Methodology:

Field survey was carried out in January 2017 to collect data on the distribution and status of water birds mainly during mid-winter waterfowl census. Different points were selected for direct count of birds. Survey was conducted on foot in morning from 7.00 to 10.00am and evening from 14.00 to 17.00pm and average of both timings were taken. GPS (Magellan SporTrack) was used to record coordinates and elevation above sea level. Spotting scope (15×45 Nikon) and a Binocular (16×40 Olympus) was used to observe, spot and identify the bird species. The birds were identified with the help of Water birds of Asia (Sonobe and Usui, 1993) and Birds of Pakistan (Mirza, 2007). Notes and onsite observations were also taken. Informal discussions and dialogues with the locals were also carried out to gather the information about the natural resources of the wetlands and their management.

The data was interpreted using Microsoft Excel 2010 to determine the relative abundance based on actual abundance. To measure the diversity of bird species Simpson's diversity index was applied as

Simpson's diversity index (D) = $\sum n(n-1)/N(N-1)$

Where n= number of specimens of a species and N = the total number of all the species. The value of D ranges between 0-1. With the index, 0 represents infinite diversity and 1, no diversity i.e., bigger the value of D, the lower the diversity.

Result and Discussion

Chashma barrage Wildlife Sanctuary is a complex of aquatic and terrestrial habitats; therefore, it accommodates a large variety of birds. More than 100 species of birds have been recorded here, with migratory birds found in abundance in summers and winters.

During present study, a total of 50 bird species belonging to 11 families and 6 orders were recorded as shown in Fig. 4.1. Among these 11 families, the family Anatidae (52%) with 11 bird species was most abundant and diversified. Second more abundant family was Phalacrocoracidae (34%) with 4 bird species. Families Phalacrocoracidae (7%) with only 2 bird species, Podicipedidae (3%) with 2 bird species, Ardeidae (2%) with 9 bird species were at third, fourth and fifth number in abundance respectively. The least abundant families recorded were Scolopacidae (0.8%) with 10 bird species, Laridae (0.7%) with 3 bird species, Charadriidae (0.2%) with 6 bird species, Recurvirostridae (0.13%) with 1 bird species, Sternidae (0.2%) with 1 bird species and Jacanidae (0.08%) with only 1 bird species.

In a similar study during 1996 – 2005 at Chashma Lake, Akber *et al.*, (2009) reported 46 water fowl species belonging to similar families. He had observed 13 species of family Anatidae (59.29%) as most abundant and family Recurvirostridae with 2 species and Jacanidae with 1 bird species as least abundant of total avian fauna of study area. In another study, Ali and Akhtar (2005) recorded 126 avifauna species from Chashma.

During this survey only, migratory waterfowls were recorded as Chashma Lake is the central enactment area for a large diversity of waterfowl. Some migratory bird species with number as *Fulica atra* (common coot) 14710, *Anas clypeata* (Northern Shovlor) 5727, *Anas crecca* (common Teal) 4610, *Anas strepera* (Gadwall) 3672, *Aythya Ferina* (Common Pochard) 2179 were recorded most abundant and common species. While, the least abundant species observed were *Ardea pupurea* (Purple Heron) 4, *Vanellus leucurus* (White-Tailed Plover) 4, *Calidris temminckii* (Temincks stint) 4 and *Ixobrychus minutes* (Little Bittern) 3. Similar field work is also reported by other researchers. M. M. Hussan *et al.*, (2011) reported 769535 *Fulica atra* (common coot) in a study during 1989 to 2008 at Chashma Barrage.

Relative abundance and Simpson's diversity index (D) for each bird species was calculated (table 4.1). The values of D = 0.157 shows a decaling trend in waterfowl population at Chashma. Our study revealed the IUCN status of only a single bird species i.e. Common Pochard as vulnerable and Indian River Tern as near threatened. Remaining all other species is least concern.

Table 4.1: Water fowl species; showing number, relative abundance, Simpson's diversity index and status at Chashma Barrage

Birds Classification	Common Name	Total number	R.A*	D**	Status	
Order Anseriformes: Family Anatidae						
1	<i>Anas clypeata</i>	Northern Shovler	5727	0.129	0.01687	LC***
2	<i>Anas crecca</i>	Common Teal	4610	0.105	0.01093	LC
3	<i>Anas strepera</i>	Gadwall	3672	0.083	0.00693	LC
4	<i>Aythya ferina</i>	Common Pochard	2179	0.049	0.00244	VU****
5	<i>Anas penelope</i>	Eurasian Wigeon	1829	0.041	0.00172	LC
6	<i>Anas platyrhynchos</i>	Mallard	1820	0.041	0.0017	LC
7	<i>Anas acuta</i>	Northern Pintail	1322	0.029	0.0009	LC
8	<i>Aythya fuligula</i>	Tufted Duck	1237	0.028	0.00079	LC
9	<i>Tadorna ferruginea</i>	Ruddy Shelduck	216	0.005	0.00002	LC
10	<i>Nettion erythrorhynchos</i>	Red-crested Pochard	173	0.004	0.00002	LC
11	<i>Aythya nyroca</i>	White-eyed Pochard	89	0.002	0.00	LC
Order Ciconiiformes: Family Ardeidae						
12	<i>Egretta garzetta</i>	Little Egret	728	0.017	0.00027	LC
13	<i>Ardeacineria</i>	Gray Heron	139	0.003	0.00001	LC
14	<i>Ardeola grayii</i>	Indian Pond Heron	77	0.002	0.00	LC
15	<i>Bubulcus ibis</i>	Cattle Egret	62	0.001	0.00	LC
16	<i>Egretta alba</i>	Large Egret	38	0.0008	0.00	LC
17	<i>Egretta intermedia</i>	Intermediate Egret	17	0.0003	0.00	LC
18	<i>Nycticorax nycticorax</i>	Night Heron	12	0.0002	0.00	LC
19	<i>Ardea purpurea</i>	Purple Heron	4	9.071	0.00	LC
20	<i>Ixobrychus exilis</i>	Little Bittern	3	6.803	0.00	LC
Order Charadriiformes: Family Scolopacidae						
21	<i>Limosa limosa</i>	Black-tailed Godwit	149	0.003	0.00001	LC
22	<i>Calidris minutilla</i>	Little Stint	72	0.001	0.00	LC
23	<i>Tringa totanus</i>	Redshank	39	0.0008	0.00	LC
24	<i>Tringa erythropus</i>	Spotted Redshank	25	0.0005	0.00	LC
25	<i>Gallinago gallinago</i>	Common Snipe	21	0.0004	0.00	LC
26	<i>Actitis hypoleucos</i>	Common Sandpiper	13	0.0002	0.00	LC
27	<i>Tringa nebularia</i>	Greenshank	12	0.0002	0.00	LC
28	<i>Tringa ochropus</i>	Green Sandpiper	10	0.0002	0.00	LC
29	<i>Tringa glareola</i>	Wood Sandpiper	9	0.0002	0.00	LC
30	<i>Calidris temminckii</i>	Temincks stint	4	9.0713	0.00	LC
Family Charadriidae						
31	<i>Charadrius alexandrinus</i>	Kentish Plover	28	0.0006	0.00	LC
32	<i>Charadrius dubius</i>	Little ringed Plover	25	0.0005	0.00	LC
33	<i>Holoopus indicus</i>	Red-wattled Lapwing	17	0.0003	0.00	LC
34	<i>Charadrius hiaticula</i>	Ringed Plover	12	0.0002	0.00	LC
35	<i>Vanellus vanellus</i>	Northern Lapwing	5	0.0001	0.00	LC
36	<i>Vanellus leucurus</i>	White-Tailed Plover	4	9.071	0.00	LC
Family Recurvirostridae						
37	<i>Himantopus himantopus</i>	Black Winged Stilt	61	0.001	0.00	LC
Family Jacanidae						
38	<i>Hydrophasianus chirurgus</i>	Pheasant-tailed Jacana	39	0.0008	0.00	LC
Family Sternidae						
39	<i>Sterna aurantia</i>	Indian River Tern	172	0.004	0.00	NT*****
Family Laridae						
40	<i>Larus ridibundus</i>	Black headed gull	264	0.006	0.00	LC
41	<i>Larus ichthyaetus</i>	Great black-headed Gull	40	0.0009	0.00	LC
42	<i>Larus argentatus</i>	Herring Gull	26	0.0006	0.00	LC
Order Gruiformes: Family Rallidae						
43	<i>Fulica atra</i>	Common Coot	14710	0.34	0.11128	LC
44	<i>Porphyrio porphyrio</i>	Purple Moorhen	209	0.005	0.00	LC
45	<i>Gallinula chloropus</i>	Indian Moorhen	124	0.003	0.00	LC
46	<i>Amaurornis phaeopus</i>	White-Breasted Water Hen	10	0.0002	0.00	LC
Order Podicipediformes: Family Podicipedidae						
47	<i>Tachybaptus</i>	Little Grebe	1261	0.029	0.00	LC
48	<i>Pediceps cristatus</i>	Great Crested Grebe	23	0.0005	0.00	LC
Order Pelecaniformes: Family Phalacrocoracidae						
49	<i>Phalacrocorax carbo</i>	Large Cormorant	1732	0.040	0.00154	LC
50	<i>Phalacrocorax niger</i>	Little Cormorant	1025	0.024	0.000539	LC
Total			44095		0.157	

R.A * Relative Abundance, D** Simpson Diversity Index LC*** Least Concerned VU**** Vulnerable NT***** Near Threatened

Waterfowl survey is conducted annually by different agencies involved in research. Scott (1989) reported that over 114,000 birds were present in January 1975 and more than 100,000 in January 1987 and 1988 at Chasma barrage. In another study, Ali and Akhtar, (2006) reported that about 122,950 birds in 1993 and 710,08 birds in 2003 were present at Chashma lake. While during present survey only 44095 birds were recorded at this lake.

Conclusion:

Our data indicate a great reduction in bird's population which is due to number of threats affecting migratory birds as habitat degradation, illegal hunting and netting of waterfowl, fishing practice, chemical toxins, water pollution, and shortage of water. It was reported that more than 90% of globally threatened birds and 86% of other birds' species are facing a serious threat primarily due to habitat destruction (Kideghesho *et al.*, 2006; Sandilyan, 2014). Therefore, very strict actions should be taken to overcome these threats and conservation of waterfowl population in their natural environment.

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ANNOTATED CHECKLIST OF BIRDS OF ZOO-CUM-BOTANICAL GARDEN BANI GALA ISLAMABAD

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Introduction

Zoo Cum Botanical Garden (ZCBG) is located in Islamabad occupying an area of 725 acres. It comprises of a long ridge stretching between Simly Dam Road and Banni Gala Hills Islamabad. The altitude of the area varies between 530 and 800m with latitude 33-5 and longitude 30-6 and 73-8 east. Its elevation ranges between 950 and 2000 ft. (m.s.l) The idea of development of ZCBG was incorporated in the master plan of Islamabad in 1968. In January 1989 physical possession of the reserved forest land was handed over to Zoological Survey of Pakistan by Capital Development Authority for the development of ZCBG. (Ejaz & Anwer, 2012).

In Pakistan, It is one of the largest ZOO-Cum Botanical Garden. The topography of the area is steep to very steep, surrounded by villages. Soil cover is very thin and rate of erosion is very high. Mean average annual rainfall is about 1000 mm about 70% of which is received during monsoon. Weather conditions are extreme with hot summer and cold winter. Coldest months are January and December while June and July are hottest months (Ahmad *et al.*, 1989). Main vegetation type is scrub forest with *Acacia modesta* (phulai) and *Dodonia viscosa* (sanatha) as dominant plant species. A few trees of *Olea ferruginea* (kau) and other broad-leaved trees are also present. *Acacia nilotica* (kikar) and *Carissa opaca* (garanda) are associated plant species. (Ejaz & Anwer, 2012).

Reportedly, ZCBG houses a variety of wildlife mammal species including jackals, wild boars, porcupines, cape hares, shrews and other rodents. In reptiles various species of lizards and snakes are inhibited here. A large number of bird species also inhabit the area. With availability of adequate food resources such as insects, nectars, fruits etc, this area is a suitable nesting and breeding site for avifauna. Resident and common bird species found in the area are *Frencolinus frencolinus* (Black Partridge), *Frencolinus pondicerianus* (Grey Partridge), *Vanelus indicus* (Red wettled Lapwing), *Merops orientalis* (Small bee eater), *Pycnonotus cafer* (Red vented Bulbul), *Pycnonotus leucotus* (White checked Bulbul), *Milvus migrans* (Black Kite), *Streptopelia senegalensis* (Little brown Dove) and *Saxicoloides fulvicata* (Indian Robin).

Bird species plays a vital role to enhance the beauty of ZCBG. Perching voice of passerines sounds in the fields of reserved site. A good population of passerines found in the area. These include Bulbuls, Babblers, Wagtails, Mynas, Crows, and Sparrow etc. Diversity of bird species highlights the importance of ZCBG and its conservation

In future ZCBG will offer great opportunity for recreation, entertainment, conservation, research and education. The purposed ZCBG will be a great place where birds are kept in an environment that is close to their natural habitat. Besides, entertainment it will also play an important role in research and conservation of wildlife. Therefore, the present study was designed to document the avifauna of ZCBG.

Material and Methods

The present study was conducted in ZCBG for the period of three months during 2017. The total area was regularly visited twice a week during the study period. Birds were observed at or flying condition over the water body during the period of high bird activity i.e. 6.00 am to 10.00 am and then 4.30 pm to 7.00 pm. A binocular (Olympus 8-16 X 40, DPS I) was used for observation and identification of birds. For the identification of birds, Salim Ali (2002), Roberts (1991) was referred. Data of bird species collected weekly and then computed instantly after viewing.

Checklist of Birds of ZCBG

Order: Galliformes

Family: Phasianidae

1. *Frencolinus frencolinus* (Black Partridge)

Description:

Common year-round resident breeder in ground covers. Nests in scrub jungles. Avoid open places and bare hills. Present in irrigated and riverine forests of Punjab and Sindh. There is a good population in Margalla hills to the north of Islamabad (Pyhala, 2001). The bird sound can be heard regularly in the Park area year around and it is estimated that 10 to 12 pairs of Black Partridge are present in Park.

2. *Frencolinus pondicerianus*. (Grey Partridge)

Description:

Common year round resident-breeder. Well adapted to arid conditions. Evenly distributed throughout Indus plains penetrating into desert tracts as well as arid broken foothills to the west of Indus. Share their habitat with black partridge in plantations and outer slopes of Margalla hills (Roberts, 1991). Flock of up to 10 individuals have been recorded in the Park area and it is estimated that 50 to 60 individual birds regularly occur in Park area.

3. *Turnix sylvatica* (Small button quail)

Description:

Rare bird. A resident species in grassy plains of subcontinent which enters in Pakistan as erratic summer breeding visitor during and right after monsoon. Likely to be encountered in north east corner of Punjab and south east corner of Sindh and up to Rawalpindi District (Roberts, 1991). This small quail also occurs in Park area but few in numbers. The author has also recorded its chicks near the Department of Zoological Survey of Pakistan.

Order: Columbiformes
Family: Columbidae

4. *Streptopelia senegalensis* (Little brown Dove)

Description:

It is common breeding dove throughout Indus plains of Sindh and Punjab. Present abundantly in hot arid stony hills and gullies of KPK and Baluchistan along the west bank of Indus river. In Murree foothills found at an elevation of 914 meters. Pairs and loose flocks of little brown dove are seen throughout the year in the fields of ZCBG. It is very abundant and resident bird species in the park area.

5. *Streptopelia chinensis* (Spotted dove)

Description

It is abundant and resident bird. Encountered in sub tropical pine zone and outer foothills of Himalayas and Murree. There is noticeable influx of birds in early may around Islamabad and Murree hills. This dove species is uncommon in the Park area and rarely visits the Park area.

Order: Acciptriformes
Family: Accipitridae

6. *Milvus migrans* (Black Kite)

Description:

Common, resident bird often seen flying in the field throughout the year. Confined near towns and villages where food access is easy. It is still very common with flock of 150 to 160 birds wheeling in wide circle over Rawalpindi city. This bird is commonly found hovering over the Park area.

7. *Elanus caeruleus* (Black shouldered kite)

Description:

It is common and resident raptor in Pakistan. Present in Indus plains from Potohar and Salt range down to Karachi. Avoids mountainous regions and prefer open lightly wooded areas. This bird commonly visits the Park area and can be found on electrical poles around the Park.

8. *Aquila rapax* (Tawany eagle)

Description:

Common and resident scavenging raptor. On Potohar plain outside Rawalpindi there is a traditional roosting site of this eagle where up to 38 birds have been counted at a time (Roberts 1991). This bird species visit the area regularly and can be found on top cliffs of Park area.

9. *Accipiter badius* (Shikra)

Description:

This species of raptors is quite common at Margalla hills and probably resident breeder and can be seen throughout year in the field snatching small birds (Pyhala, 2001). This species can also be found in the Park area while devouring on small birds.

Order: Charadriiformes
Family: Rostratulidae

10. *Rostratula benghalensis* (Greater Painted snipe)

Description:

Rare bird. Roberts considers the Islamabad area resident territory. Adapted to swampy borrow pits and reed fringed ponds. This species is very rare and was only once observed near stream inside Park area.

Family: Charadriidae

11. *Vanellus indicus* (Red wattled lapwing)

Description:

Abundant resident breeder in agricultural land and often seen along nullahs. This species is resident in the Park area and also eggs and chicks of Red-wattled Lapwing can be observed in the Park during breeding season i.e. May to June.

Order: Psittaciformes
Family: Psittacidae

12. *Psittacula krameri* (Rose Ringed Parakeet)

Description

Abundant resident breeder throughout Islamabad up to an elevation of 800 meter in Margalla hills (Roberts 1991 and Brohi 2014). The species can be observed in the South of Park area where forests are still intact. Flocks can be observed flying over the Park area regularly.

Order: Gruiformes
Family: Rallidae

13. *Amaurornis akool* (Brown crane)

Description:

Rare bird and resident breeder. It seems that brown crane is becoming more frequent in Pakistan as indicated by numerous records from shahpur dam (Roberts 1991). This species also breeds in the Park and can be found in fewer number at the small streams around the Park area.

14. *Galinula chloropus* (Common moorhen)

Description:

Common resident breeder. Its often seen in winter months as well as occasionally in summers. The specie also breeds in the Park area and chicks can be observed during breeding season i.e; April to May. This species is uncommon in the park area.

Order: Coraciformes
Family: Meropidae

15. *Merops orientalis* (Small Bee eater)

Description:

Migratory usually seen in the form of pair or sometime flying in the form of flocks. Abundant and summer breeder in various biotopes in Islamabad area. This bird can be observed while, playing on the ground in flocks of up to 11 birds during migratory season.

16. *Merops superciliosus* (Blue Checked Bee-eater)

This is a very scarce summer visitor Bee-eater species and randomly found in the Park area. The authors had only once recorded the species from Park area and that was a single bird in the month of August.

Family: Upapidae

17. *Upupa epops* (Common hoopoe)

Description:

Common resident breeder in Islamabad and surrounding areas. Prefers gardens and open fields but can also be found in woodlands. One or a single pair can be observed in the Park area.

Order: Cuculiformes

Family: Cuculidae

18. *Clamator jacobinus* (Pied crested cuckoo)

Description:

It is common summer breeder in Islamabad. This bird can be seen in woodlands below Margallas. The species frequently visits the Park area in the month of August. But we have never observed the nesting of this species in Park area.

19. *Cuculus canorus* (Common cuckoo)

Description

According to Roberts (1991) this species is occasional double passage migrant in Islamabad area. Often found calling in woodlands and ridges below the Margallas. We observed this species near streams and frequently in the Park area while, singing during morning hours. Our findings suggest that the species is resident in Park area and found all year around.

20. *Phaenicophaeus leschenaultii* (Sirkees malkoha)

Description:

According to Robert (1991) this bird species is resident in Islamabad and surrounding areas. This is a very shy bird and randomly found in open. In Park area can be found perching on Phulai trees and never been observed in pairs.

Family: Ardeidae

21. *Bubulcus ibis* (Cattle egret)

Description

Common resident species in Islamabad area. Encountered near cattle. They breed at north of Rawal lake. In winters they migrate towards south (Pyhala, 2001). In park area the Cattle Egret can be observed near streams and sometimes near grazing herds of buffaloes in Park area.

Order: Strigiformes

Family: Caprimulgidae

22. *Caprimulgus indicus* (Nightjar)

Description:

Vagrant species common in Murree hills (Roberts, 1991). It is oriental species however is not present in plains of Pakistan. It is

essentially a bird of sub-tropical, deciduous or evergreen forest. A nest with single hatchling was observed in Park area.

Order: Passeriformes

Family: Passeridae

23. *Anthus similis* (Brown rock pipit)

Description:

Frequent winter visitor and summer breeder. Widespread breeding bird in lower hilly ranges of Pakistan with some local migrations into the Indus plains in winter. The bird can be observed near streams and grassy areas in and around the Park area.

24. *Passer domesticus* (House sparrow)

Common resident breeder all over Islamabad. Large flocks can be observed throughout the Park in evening time.

25. *Lonchura malabarica* (White throated Monia)

Description

Common and resident bird. Better adapted to semi-arid tracts and low rocky biotopes with cane grass. This species is very common in the Park area and can be observed in flocks of dozens of birds. White-throated Monia is a frequent visitor to Park area. This bird species can be observed while collecting nest building material from bushes in the Park area. This trend indicates that the species breeds in the Park area.

Family: Sturnidae

26. *Myiophonus caeruleus* (Blue Whistling Thrush)

Description:

Common winter visitor, this bird makes a loud call and can be observed during winter season in the Park area. The authors recorded the species many times in the Park area. It was observed that the bird is solitary and never observed in pair.

27. *Acridotheres tristis* (Common Myna)

Description:

Abundant and resident breeder bird in Islamabad. Particularly absent from thick forests and Margalla hills. Present year around. The nests of this bird can be observed in the Park area.

Family: Paridae

28. *Parus major* (Great tit)

Description:

Common winter visitor. Present all over the wooded areas and Margalla hills in Islamabad where it mixes with other birds to relish feeding party. This bird can be observed in Park area.

Family: Corvidae

29. *Corvus splendens* (House crow)

Description:

Common and abundantly present all over Islamabad throughout the year. It has been seen fostering the immature koels, acting as a host for brood parasites. Common Crow can be observed in park

area in day time. This bird nests in large old trees but due to lack of large trees in Park area it can only be found in day time foraging on eggs of small birds.

30. *Dicrurus macrocercus* (Black Drongo)

Description:

Common summer breeder all over Islamabad and can be found up to an altitude of 1000 meters. Common Drongo is very common in the Park area and can be observed on woodlands and electrical poles passing from park area.

31. *Dendrocitta vagabunda* (Indian Tree Pie)

Description:

Common year round visitor. Most occasionally encountered in months of September to April. Present in and around city gardens of Islamabad, woodlands and lakes. Seen in pairs however sometimes can be found in groups consisting of up to 6 birds. Indian Tree pie is common in park area and can be found in pairs all year around.

Family: Lanidae

32. *Lanius schach* (Rufous backed shrike)

Description:

Abundant resident breeder all over Islamabad. Encountered near open lands in gardens and parks (Pyhala, 2001). This species can be found in Park area throughout the year.

Family: Muscipidae

33. *Copsychus saularis* (Oriental magpie robin)

Description:

Winter visitor. This bird is recently becoming abundant resident breeder in gardens and woodlands below margallas. It was assigned as local and scarce before by Roberts. This bird species can be found in Park area.

34. *Saxicola caprata* (Pied bush chat)

Description :

Common winter visitor. Breeds from mid level at margalla hills to lakes and agricultural lands of Islamabad. Mainly present from February to October. This bird species prefers bush type of vegetation and can be found through out the park area.

35. *Myiophonus caeruleus* (Blue whistling thrush)

Description:

Common winter visitor. Often seen around Margallas, rawal lake, city gardens and surrounding country sides in Islamabad. Its alarm call and songs are among the characteristic sounds of Islamabad. This bird can be found in Park area.

36 *Turdoides earlei* (Striated babbler)

Description

Abundant and resident bird species. Flocks of half dozen or more on the ground or in low bushes are often seen. Due to favorable habitat this bird is very common throughout Park and can be found in large numbers while, making noisy calls.

37. *Saxicoloides fulicata* (Indian robin)

Description:

Resident breeder. Common all over Islamabad throughout year. A nest of Indian robin was found along with its nestlings during summer season. Mostly found in pairs. Indian Robin is common in the Park area and its eggs and hatchlings can be observed in the Park area in summer months.

Family : Sylviidae

38. *Prinia subflava* (Tawny prinae)

Description :

This small bird species is resident in the Park area. And can be observed all year around.

Family: Hirundinidae

39. *Hirundo rustica* (Common swallow)

Description:

Common in Islamabad. Usually seen flying in the form of groups with the largest flocks consisting up to 10,000 birds. Present throughout the year. Flocks of Common Swallow can be observed while sitting on electrical poles in the park area.

40. *Hirundo simithii* (Wire-tailed Swallow)

Description:

Wire-tailed Swallow is a locally migratory swallow species and summer visitor to Islamabad and near by areas. This bird species can be observed in the Park area during the migratory season i.e. Summer.

Family: Sturnidae

41. *Sturnus contra* (Asian pied starling)

Description:

Occasional bird having oriental origin occurring in lowland areas of Punjab. Inhabitant of open country with cultivation having patches of damp grass and rice fields. This bird species can be observed in few numbers in the Park area.

Family: Nectaridae

42. *Nectarinia asiatica* (Purple sun bird)

Description:

Common summer visitor. Appear on the scrub of *Acacia modesta* and *Lantana camera* during summer season, usually seen in the form of pairs. It is the only representative of this family in Pakistan ranging from Karachi up to murree hills. Purple Sun bird frequently visit the park area and can be observed while, roaming around lantana flowers in the search of nectar.

Family: Pycnonotidae

43. *Pycnonotus cafer* (Red vented bulbul)

Description:

One of the most common resident bird species in Islamabad. April is the starting season for young ones. It can form hybrids with white cheeked bulbul. This species is very common in the Park area and can be found in flocks.

44. *Pycnonotus leucotis* (White checked bulbul)

Description:

Common resident breeder. Abundantly present all over Islamabad throughout the year. Mostly encountered while sitting on *Lantana* bushes in and outside the garden. White-cheeked Bulbul is very common in the Park area and can be found in the flocks of up to 20 birds. The park is also a breeding site for this species. Nest of this species along with chicks is a common site at the Park.

45. *Hypsipetes mdagascariensis* (Black bulbul)

Rare breeding bird confined to outer foothill zone of Himalayas and

murree hills. Frequently descends to margalla hills and lakes of Islamabad in winter. Black Bulbul can be observed in Park area from December to March.

Family : Motacillidae

46. *Motacilla alba* (White wagtail)

Description:

Occasional winter visitor to Islamabad. Seen at lakes, gardens and fields in flocks of up to 40-60. This species of wagtail is common in Park area and can be observed near water streams.



Fig 1: Purple sun bird



Fig 2: Great tit



Fig 3: White checked Bulbul



Fig 4: Grey Partridge



Fig 5: Common Hoopoe



Fig 6: Pied Crested Cockoo



Fig 7: Small Monia



Fig 8: Indian tree pie

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Population Estimates of Indian Peafowl (*Pavo cristatus*) in District Tharparker, Sindh, Pakistan

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KEYWORDS

Indian Peafowl,
Population,
Tharparker,
New Castle Disease,
Muskat,
Deforestation,
Threats.

ABSTRACT

The present study was carried out in response to a news article in Daily "The Dawn" of September, 2012 in which it was reported that hundreds of peacock had died in district Tharparker in the province of Sindh, Pakistan. After eight days of thorough surveys in four of the Tehsils of district Tharparker, the researchers found that the numbers mentioned by the reporters were exaggerated. The present survey was confined to four Tehsils of district Tharparker, Sindh to assess the status of the species, its habitat and conservation. Line transect and point count methods were used for estimation of number of the bird while general observation and interviews with local community members were tools for habitat scanning and threats determination. In all a total of 1,086 peafowl were physically seen throughout district Tharparker (1.7 birds per sq km). Highest number of birds were present in Nangarparkar Tahsil i.e. 2.09 birds per sq km. It was observed that, Newcastle or Rani Kath, disease, has not much affected the peafowl population in the area. The possible reason for mortality may be late onset of monsoon rains in the District. The threats which the peafowl face are the selling of eggs, chicks and feathers by Bheel community of lower caste Hindus, the other Hindu communities regard them sacred. Other possible threat noted is the multidirectional growth of an invasive alien plant species, the Muskat or Devi. As an aesthetically important and religiously sacred bird, beside its ecological significance, the government should take stern action against the wildlife poachers. Proper feeding during drought period, especially before the monsoon season, may be arranged for the birds in coordination with the local communities. Spread of muskat in the habitat of the peafowl may be scientifically controlled.

Introduction

Indian Peafowl (*Pavo cristatus*) commonly known as peacock (Family Phasianidae; Order Galliformes) originated in India and is inhabitant of Indian Subcontinent (Del Hoyo *et al.*, 1994; Madge & McGowan 2002). Its range extends from Pakistan through Nepal and India, South of Himalayas down to Sri Lanka. It is rarely found in Bhutan while extinct in Bangladesh (Ramesh and McGowan, 2009). Peafowls are also raised as ornamental birds and for centuries these birds have had close association with man (Clayton *et al.*, 2010; Titilincu *et al.*, 2009). These beautiful birds were later introduced to Europe, via Greece and Italy in VII-VIII century B.C.

The species is found in forest edges, grasslands, and in lightly wooded forests. It is said to also inhabit undergrowth in deciduous forests near water (Grimmett *et al.*, 1998), and *Zizyphus* species thorn bushes (Fleming *et al.*, 1976). The species is gregarious and roosts in tall trees (Grimmett *et al.*, 1998). Indian Peafowl is shy, immediately escaping into bushes or flying away upon the slightest hint of danger (Pandey, 1984). Peafowl are omnivorous. It feeds on seeds, grain, lentils, ground nuts, tender shoots of crops, flower-buds, berries, drupes, wild figs, centipedes, scorpions, lizards, small snakes, insects, worms, and grubs (Ali & Ripley, 1987).

In Pakistan, major portion of peafowl population is now found only in extreme south-eastern region of Sindh province around Tharparker. However, small populations are also found in north-eastern border areas of the Punjab (Roberts, 1991), including border belt in district Narowal, northern Punjab (Akbar *et al.*, 2005), where it moves between Pakistan (for feeding during the day) and Indian Territory (for roosting at night). It was earlier reported to be thinly but widely distributed in areas of Vatala and Deva in Azad Jammu & Kashmir (Azam *et al.*, 2007). The Thar Desert region of Sindh province in Pakistan is estimated to habitat 65,000 to 70,000 blue and green wild Indian peafowls (*Paw cristatus*). They are essential part of animal biodiversity of the desert region (Kalhoro and Dhanani, 2013)

There are numerous threats to its existing populations including; habitat loss and degradation, human population pressure, illegal poaching, intensive agricultural practices and use of pesticides, retaliatory killing, collection of eggs for consumption and killing for medicinal purposes. In Pakistan, peafowl has been extirpated from many parts of its former range due to trapping and illegal poaching of this beautiful bird. This peacock is prized as a pet bird and its colorful feathers are also used in a variety of decorative items. Indian peafowl has been listed as Least Concern globally (IUCN, 2015).

This species has an extremely large range, and hence does not approach the thresholds for Vulnerable under the range size criterion (Extent of Occurrence <20,000 km² combined with a declining or fluctuating range size, habitat extent/quality, or population size and a small number of locations or severe fragmentation). The population trend appears to be stable, and hence the species does not approach the thresholds for Vulnerable under the population trend criterion (>30% decline over ten years or three generations). The population size has not been quantified, but it is not believed to approach the thresholds for Vulnerable under the population size criterion (<10,000 mature individuals with a continuing decline estimated to be >10% in ten years or three generations, or with a specified population structure). For these reasons the species is evaluated as Least Concern (Birdlife International and IUCN, 2016).

The current survey of Indian Peafowl (*Pavo cristatus*) was carried out in the wake of disease in the bird the New Castle Disease (locally known as Rani Keith) which killed more than 300 peacocks throughout Tharparker District (Daily Dawn, 2012). The primary purpose of this survey was to access the population of peacocks after the outbreak of disease and also threats to peacocks in its habitat. No specific surveys have been carried out for peacocks before this in District Tharparker.

Material and Methods

Study Area

District Tharparkar (24° 44' 24"N 69° 48' 00"E) is in South-Eastern corner of Sindh and is one of the largest districts of Sindh spread over an area of 19,638 km² (7,582 sq mile) bordering India. The district Tharparkar is divided in to four sub-divisions, Mithi, Nangarparkar, Chachro, and Diplo. These consist of Great Thar Desert and the Karon-Jhar hills. The Parkar area has been formed by the alluvial deposits of river Indus while Thar mostly consists of barren tracts of sand dunes covered with thorny bushes. The main vegetation of the area consists of *Acacia Senegal* (locally Koonbhat), *Salvadora indica* (locally jar), *Prosopis juliflora* (locally Devi), *Prosopis cineria* (locally kandi), *Capparis decidua* (locally kurr), *Ziziphus nummularia* (locally ber), *Acacia nilotica* (locally babul), and *Nelia azadractta* (locally neem). The only hills of the district, named Karon-Jhar, are in the extreme south-east corner of Nagar Parkar Taluka, a part of Thar. The Karoonjar hill is spread over about 20 kilometers in length and attains a height of 300 meters. Covered with sparse jungle and pasturage, they give rise to two perennial springs as well as seasonal streams flow after rains. The Thar area has a tropical desert climate. The months of April, May and June are the hottest ones during the day. The average maximum and minimum temperatures during this period remain 41°C to 24°C, respectively while December, January and February are the comparatively coldest months with average maximum and minimum temperatures 28 centigrade to 9 centigrade respectively. Rainfall varies from year to year. Most of the rain falls in the monsoon months between June and September whereas the winter rains are insignificant. The people of District Tharparkar depend on livestock, labor and farming provided there are rains and also Government services.

Survey Methodology

The field surveys were undertaken in all the four Sub Divisions (Tehsils) of District Tharparkar i.e. Tehsils, Mithi, Nangarparkar, Chachro and Diplo Tehsils, at least 15 villages were visited in each taluka. Surveys were carried out by using 4x4 wheel vehicles and at least 8 days were spent in the field and two days in each sub-division (Tehsil). Line transect method was applied to estimate the population of peafowl in the area. Transects of 1km x 400m (200 meters on either sides) were taken after every 5 km in the areas of occurrence of peacocks. The Peacocks within 200 meter width on each sides of transect were counted. The population of peacocks of the total survey area was estimated by the following formula

$$P = \frac{AZ}{2XY}$$

Where

P = Population

A = Total Area of Study

Z = Number flushed

Y = Average flushing distance

X = Length of strip

To cross check the population status, point count method was used in and around each village because due to drought like conditions in the area the peacocks generally roam around the villages in search of food. In this method a certain village was selected where maximum number of peacocks could be observed in a specific time. Binoculars (Olympus 8-16x40, DPS-I) were used for identification and determination of sex. GPS points of the study sites were also marked. Surveys proforma was used, which

contained different questions like status, distribution, breeding biology, conservation status and threats to Peacocks. The surveys were carried out in the month of September 2012. The data was then computed and population estimation formula was applied on the total area of each tehsil of district to determine the population abundance in the selected tehsil of the district Tharparkar.

Results and Discussion

The primary purpose of this survey was to access the population of peacocks after the outbreak of disease and also study threats to peacocks in its habitat. No specific surveys have been reported on peacocks in District Tharparkar. The present survey was carried out from 8th to 15th of September 2012 after monsoon rains in the area. This season is considered one of the best for Peacocks because of availability of abundant food like grass and insects (Roberts, 1992). In Tehsil Diplo, 15 points were surveyed and the number of peacocks observed was 227. Among them 76 male and 151 female were recorded. The male to female ratio in this tehsil was calculated to be 1:1.98. In Tehsil Mithi, a total of 232 peacocks were observed from 15 survey sites. It included 79 males and 153 females. The male and female ratio in this district was calculated to be 1:1.94. The number of peacocks observed in Tehsil Chachro was 234 and it included 71 males and 162 females from 15 survey points. The male female sex ratio in this Tehsil was 1:2.28. The number of peacocks observed in Tehsil Nangar Parkar was 393 from 15 survey points. Among them 114 male and 279 female were recorded. The male to female ratio in this tehsil was calculated to be 1:2.25 (Table 1).

During the current survey a total of 1,086 peacocks were physically observed in the field area throughout the District (1.7 birds per sq km). Highest number of birds was observed in Nangarparkar Tehsil i.e. 2.09 birds per sq km. It was observed that after the rainy season the peacocks relish on fresh leaves of the newly grown grass, plowed seeds of bajree (*Pennisetum glaucum*), thir, (*Sesamum indicum*), guar (*Cyamopsis glaucum*), moong (*Vigna radiata*) and johar (*Sorghum vulgare*). The fruits of jar (*Salvadora indica*) locally known as peru was found to be one of the most favorable food of peacocks and besides this they also eat berries of *Ziziphus nummularia* locally known as ber. It was also observed that the current disease has not affected the population of peacocks much (pers. observation). Rare cases of bird disease were recorded in the district and it was observed that the disease could be due to late monsoon rains in the area because in the search of food and water the bird visit and live in the vicinity of human settlements and mixes with domestic hens (pers. observation).

From the interviews of local villagers and the questionnaire filled in, the following facts came in the knowledge of survey team. The number of peahens is higher than peacock with the ratio of 60-40. The clutch size was noted 3 to 6 and survival rate was 60 to 80%. According to local villagers there is no threat to Peacock except natural one like, eating of eggs by Monitor lizard, killing of hatchlings by birds of prey and sometimes jungle cat and fox.

Threats to Peacocks

No particular threats to peacocks were found in the area except that the Bheel community one of the lower Hindu cast community, collects the eggs, catches the young birds and sells them in the nearby cities. The tail of adult peacock (for decoration purpose) is also sold by the same community in nearby towns and the authors also observed such a case while a little young boy was standing on the main Nangar Parkar to Mithi road with the tail feathers of peacocks in his hands for selling. Besides this, electric poles were also found to be one of the main threats to peacocks. The other

also found to be one of the main threats to peacocks. The other threats which were recorded during the current study were natural, monitor lizards prey on the eggs of peacocks, and the birds of prey also hunt newly hatched young birds. It was also observed that in the areas of Bheel community less number of peacocks was found due to the hunting of bird by the Bheels. Another possible threat observed by the survey team may be the rapid and uncontrolled spread of an invasive alien plant, Muskat (*Prosopis juliflora*) also called Devi.

The peacock is considered as the beauty of Tharparkar. Local Hindu communities give the bird full protection due to their religious point of view and killing a peacock is regarded as sin. It was also observed that people arrange food for peacocks and especially throw bhajra, wheat, rice and other food stuff for the bird in the vicinity of their homes. The people of Thakur community have established special feeding places in their villages for peacocks, where the peacocks visit early in the morning or at sunset for food and water. The Muslim communities of Tharparkar district also regard the peacock the beauty of Thar so they also play an important role in the conservation of the bird.

Table1. Population Estimates of Peacocks in District Tharparkar (Sindh)

S. NO.	Area / Site	No. of Peacock Observed	Surveyed Area (Km ²)	Density per Km ²	Total Area of Habitat (Km ²)
1	Tehsil Mithi	232	146	1.58	4048
2	Tehsil Nangarparkar	393	188	2.09	4185
3	Tehsil Diplo	227	140	1.62	3914
4	Tehsil Chachro	234	142	1.64	7247
	Total	1086			

Recommendations

During the drought period, there should be provision of bhajra and other food for peacocks and feeding stations should be separated from domesticated birds to control the spread of any disease.

Illegal hunting of the bird should be checked and Provincial Wildlife Department should take strict action against the people involved in illegal business of peacock. The widely and rapidly spreading invasive alien species of muskat plant may be scientifically controlled. As the peacock builds its nest and resides in large trees so the illegal cutting of the trees may stopped to save the habitat of peacock.

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Nesting and Breeding Biology of Black francolin (*Francolinus francolinus*) and Grey francolin (*Francolinus pondicerianus*) in Nara, District Khairpur Mir's, Sindh, Pakistan.

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KEYWORDS

Nest,
Population,
Species,
Breeding,
Eggs,
Incubation,
Habitat.

ABSTRACT

The present study is carried out in Nara, the largest Taluka and deserted area of Khairpur Mir's, Sindh, Pakistan, during 2017. Non invasive census method was used to avoid any disturbance to the nesting pairs. The nesting pairs progressively increased from March to May 2017. Both the nesting and non nesting population of francolin species grew from March to December 2017, in study area. In spite of increasing in young population size of francolin species, the bushy, wild and natural habitat occupied by them is decreased and cultivated for the agriculture purpose, causing inverse effect on their food, feeding, nesting and breeding. The black and grey francolin females started their nest building and egg laying between the mid March and early of the April. Onset of egg laying was estimated on 35 nest samples between 05 April to 25 June, about 95% of those pairs were incubating their eggs between 6 to 28 May 2017. After 18 July there was no more nest sample with incubating francolin species. This data allowed us to estimate that the average length of incubation period is 20.6 days, and the mean number of hatched eggs is 6.8 ± 2.96 per nest.

Introduction

The Grey and Black francolins are important game and delicious table birds and used as cage and fighting birds. The Grey and Black francolins are considered as "farmer friends" due to consuming variety of invertebrate pest, including eggs, larvae, pupae and adult insects, therefore act as bio controlling operators (Beg & Qureshi, 1972; Qureshi, 1972; Khan, 1989; Mian, 1995). They prefer to the open fields, grassy land having dominancy of trees, shrubs and herbs. On the basis of calls they are locally called "Teeter".

Use of pesticides, habitat degradation, excessive hunting, predation and intensification for agriculture purpose are the main reasons of their rapid decline of the bird species. Nesting of black and grey francolin is reported from 23 different sites in Nara. Generally francolin nests on grassy covered ground and laid their eggs from March to early of May (Cramp, 1980, Bull & Farrand 2000), though some low level of egg laying continued till June. Their breeding population progressively increased from March to April and decreased from May to September. In this paper we present some data on breeding biology, nesting success, early chick survivorship and population trend of the grey and black francolin in Nara, District Khairpur Mir's Sindh.

Material and Methods

The present study was conducted in Tehsil Nara, District Khairpur Mir's, Sindh, about 35 km south of Chundiko town. Area is basically hot (average temperature: winter 5.5°C, summer 45.°C and above) and arid, (Rao *et al.*, 1989). The main road from Chundiko to Sanghar serves as a boundary of study area in the East, the Western edge is at the Nara canal, while the South and North boundaries of study area are closed by the link road of RD No: 463 bridge and Hussain Shah Bridge respectively. The study area consists of wetlands, crop lands and pure wild habitat. The census method performance of nesting francolins was observed in three times through primate counts during the breeding season, (March, April, May, June and July). Four groups of two observers were placed in main sighting places and starting two hours before sunset. The perched francolins were counted before the incoming

and out coming birds. The counting was stopped after the half an hour of sunset. The result of algebraic sum of incoming and out coming birds was added to the initial count the average of results obtained by four groups of observers represented the total population of the francolin species. The perimeter count is a relatively less precise technique for censusing birds, but it allowed us to avoid any disturbance of the francolin pairs.

As the thickness of the bushy and grassy land don't allow a nest count from outside the colony, at the end of breeding season we counted all the nests of the colony walking inside the study area. Each tree, herb and shrub was marked and the number of nests per plant was recorded. The nests of the francolin species were easily recognizable for their dimension and their number was confirmed by the number of pairs censused in June 2017. At the end of September careful survey of study area was conducted, neither old nest nor remains of the old nests on the grassy ground under the previously marked plants in the study area were find out. During the breeding season (March, April, May, June and July) study area was monitored regularly on the samples of 23 francolins nests, watching them for three hours from vantage points, high enough to observe the highest nests. The nests were recognized by using reference points, taking photos and marking the trail where the observation points were placed. During the observation period some sample nests were lost (due to their destruction by predators and covering by bushes), therefore the sample was reduced to 20 for March, 18 for April, 19 for May, 12 for June, 7 for July. The following parameters were recorded: nesting phase, number of chick per nest, mortality, predation, number of fledged young's and eggs per nest. The average incubation period was estimated calculation the difference between the median time values of the nests with eggs and the nests with chick distribution. All the observation was made with 10×50 binoculars.

Results

The population of each francolin species (nesting and non nesting) and the number of nests found in the study area increased gradually from March to May 2017. The active nesting area was

almost stable, covering 33km, while the number of plants sheltering the nests increased from March to May 2017. The nest building begun from the first week of March.

Figure no.1 summarizes the breeding season of francolin species recorded in 2017. From the observed data it is estimated that the Black and Grey francolins egg laying started in March, while a

major peak of incubating activity was mainly recorded between 4th and 28th May and hatching started between 8th and 26th May. At the end of July all the new born Chicks were fledged. The breeding parameters found in this study are summarised in Tab.2, in comparison with data reported in literature. As we observed the sample nests from outside the study area, we were not able to see and count the eggs in all the sample nests. Therefore we could not

Table .1: Number of francolin species in Nara, Khairpur, from January to December, 2017.

Francolin	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Nesting black francolin	–	–	8	10	13	01	–	–	01	–	–	–
Non nesting black francolin	70	52	10	13	17	25	30	45	50	55	58	69
Chick black francolin	–	–	33	38	27	20	15	13	7	–	–	–
Nesting grey francolin	–	–	12	19	17	03	–	01	–	–	–	–
Non nesting grey francolin	65	63	16	25	28	38	49	58	60	60	58	62
Chick grey francolin	–	–	35	108	145	95	63	40	23	–	–	–

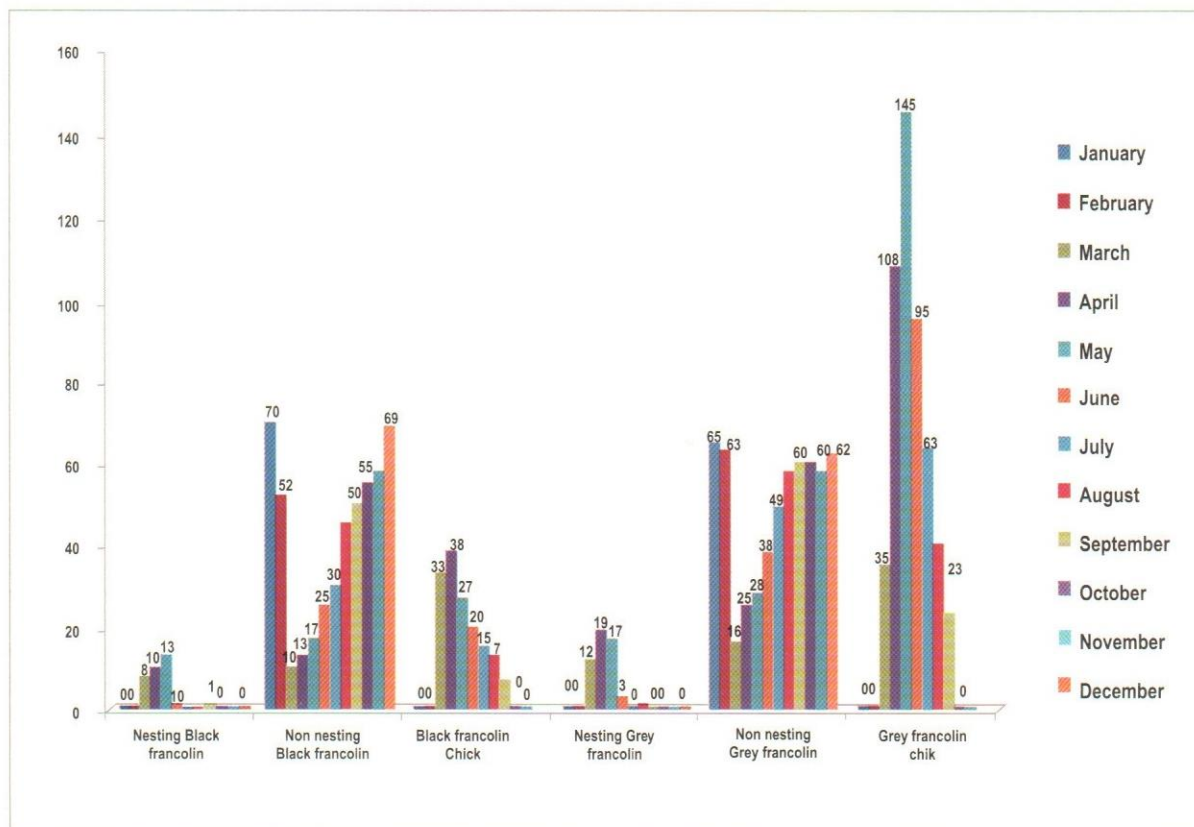


Fig.1. Number of Black francolin and Grey francolin censused in Nara, Khairpur, from January to December 2018.

Table 2. Francolin nest building, censused in Nara, District Khairpur Mir's, Sindh, Pakistan, from January to December 2017.

Nest type	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Nest with eggs	–	–	8	13	10	3	2	1	1	–	–	–
Nest with eggs & chicks	–	–	5	9	13	2	1	–	–	–	–	–
Old nest remains	–	–	–	–	–	–	5	7	3	2	–	–

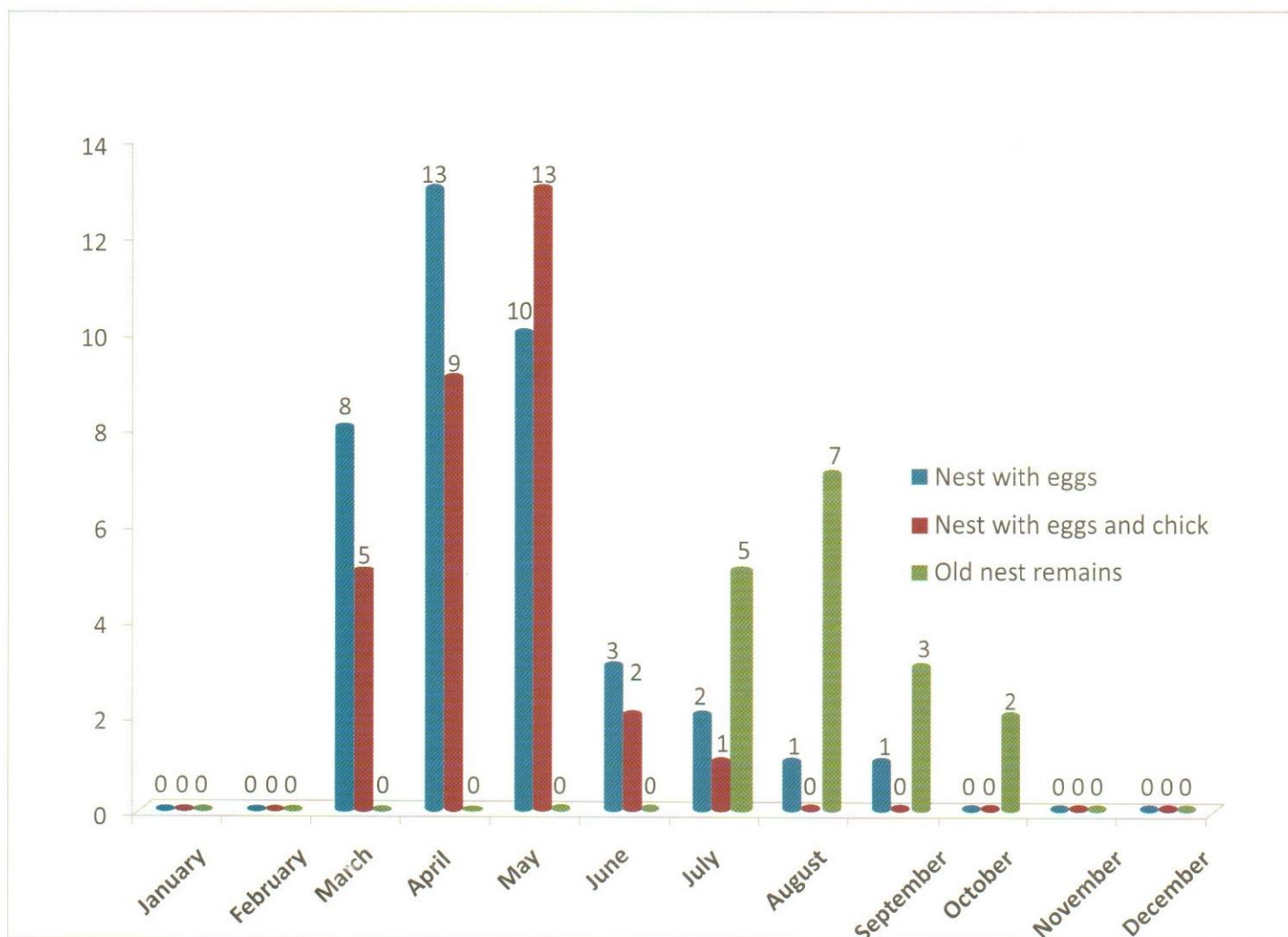


Fig. 2. Francolin nest building, censused in Nara, District Khairpur Mir's, Sindh Pakistan from January to December 2017

calculate the average clutch size; however we were able to see one sample nest with only one egg hatched and another nest with five chicks plus one egg not hatched. Since the number of chicks per nest was never higher than 5, we could reasonably estimate that the clutch size ranged from 1 to 6 eggs. The median date of nest with eggs and nest with chicks distributions were 15 May – 8 June 2017. The results are similar to the results of Mann and Chaudhry,

(2000). The difference yields respectively for the incubation period of 25.4 and 24 days. The average of two values is 23.8 days very close to all other average data available in literature ranging from 22 to 24 days (Hilaluddin, 2003). During the observation period various predators were found in the study area, including Eagles, Snakes, Wild cats, Jackals, Dogs and other wild animals which destroy the nests and eggs of francolin species.

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Population Estimates and Threats to Indian Pangolin (*Manis crassicaudata*) in Potohar Region of Punjab and Margallah Hills National Park, Pakistan

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KEYWORDS

Indian Pangolin,
Potohar Region,
Distribution,
Threats,
Illegal hunting

ABSTRACT

Field surveys were conducted to study the population status and threats to Indian pangolin in the selected sites of Potohar region and Margallah Hills National Park. Extensive field surveys of potential scaly ant-eater's habitat were carried out during October 2014 to July 2015. Night surveys aided by powerful electric chargeable were also carried out and at least four to five hours were spent in the field. Information regarding the illegal capture of species in study region was collected via interviews with locals including shepherds, nomads, farmers and others. A total of 26 fresh living burrows, 68 old burrows, 47 feeding burrows and 2 direct sightings of species were recorded from 11 selected sites of District Chakwal. There is a record of 8 fresh living burrows, 31 old burrows and 24 feeding burrows from District Jhelum with maximum population density in Sohawa. In District Attock a total of 14 km² area was surveyed. 15 fresh living burrows, 32 old burrows and 27 feeding burrows were observed in the six studied sites. Indian Pangolin has high population density in ChumbiSurla Wildlife Sanctuary i.e. 0.008/hectare. As compared to Potohar Region, a sufficient population of Indian Pangolin was observed in Margallah Hills National Park (0.016/hectare). A total of 11 fresh burrows, 27 old burrows and 15 feeding burrows were recorded from an estimated area of 7 km of the Park. Information revealed that the animal is highly prized for its scales and is under tremendous hunting pressure and much of its population has vanished. If present trend of declining population continues, it is no doubt that the species will face high risk of extinction in near future. There is a dire need to address the conservation issues of Indian Pangolin. Concrete measures need to be taken to control the illegal trade of the species on the part of Federal and Provincial Wildlife Departments along with imparting education and awareness to the masses for the conservation of biological capital.

Introduction

Scaly ant eater or Indian pangolin (*Manis crassicaudata*) is member of mammalian order *Pholidota*, family *Manidae* (Wilson & Reeder, 2005). Globally, eight pangolin species are on record and Indian Pangolin is the sole species to inhabit Pakistan (Roberts, 1997). Indian Pangolin has is widely distributed throughout Pakistan, India, Sri Lanka and Bangladesh (Prater, 2005, Mishra & Panda 2012).

The toothless mammal has long protrusible tongue and 11-13 rows of overlapping keratinized scales. It is a characteristic feature of the species. They possess hump-backed body and a thick tapering tail (Pocock, 1924, Heath, 1995, Robert, 1997). Pangolins exhibit the phenomenon of sexual dimorphism: both sexes differ in their weight. Pangolins vary in size from about 1.6 kgs to a maximum of about 33kg where males are almost 90 percent heavier than females (Heath, 1995). Pangolins inhabit a variety of habitats and occur in areas inhabited by ants and termites. Deep pangolin burrows both for sleeping and nesting contain big enough circular chambers for a human to crawl inside and stand. The solitary mammal is nocturnal and highly secretive, making it hard to study it in its natural habitat (Anonymous, 2014). Pangolins are ecologically important. Pangolin's burrowing activity helps in aeration and mixing of soil, creates additional wildlife shelter and ants and termites diet make them a natural pest control. It is estimated that a single adult pangolin can consume up to 70 million insects in a year (Soewu & Adekanola, 2011)

Information regarding population statistics of pangolins is scarce as these are secretive, solitary, and nocturnal mammals (WCMC *et al.* 1999; CITES, 2000). Indian pangolin is considered rather uncommon in Pakistan. It is generally found in barren hilly and

desert regions (Roberts, 1997). Pangolins can also adapt to modified habitats i.e. forested, cultivated and grassy regions with abundant termite food (Prater, 2005; Zoological Survey of India, 1994).

In Pakistan, distribution range of Indian Pangolin extends from North-west of Punjab (District Jhelum, Gujrat and Sialkot) across Salt Range to Mardan, Kohat and Peshawar up to Galiat in KPK. In Sindh Province, it can be found from right bank of Indus in the hilly regions of District Larkana, Dadu upto Malir Karachi and it also has been recorded from Hyderabad, Sanghar, Umardot Districts of Sindh up to Run of Kuch. In Balochistan it has been recorded from Makran and Lasbela (Roberts, 1997). It also occurs in Azad Jammu and Kashmir. Although, Indian Pangolin has ecologically beneficial but have not received much attention by biologists. Previously no scientific studies had been conducted on ecology, behavior, status and distribution of Indian Pangolin in Pakistan (Roberts 1997). Reports of its mass killing of the species with declining population were highlighted in the media from District Chakwal in Punjab Province (Mahmood *et al.*, 2012). Keeping in view the ecological importance of the species and tremendous hunting pressure, attempts are being given to study this valued species. Moreover, considering the generalized hypothesis that the species is declining day by day and facing conservation problems, the present study has been designed.

Material and Methods

Study Area:

Selected sites of Potohar region (Table 1) i.e. District Chakwal, Jhelum, Margalla hills and area of Fateh Jang of District Attock were surveyed for the animal.

Table 1: Study sites and area surveyed in selected Districts of Potohar and Margallah Hills National Park

	Study Locations	GPS points	Surveyed Area (Sq. Km)	
1	District Chakwal	Bhalla village	32 49'42.7 N, 072 53'41.2 E	2
		ChambiSurla	32 48'01.4 N, 072 49'46.7 E	6
		Shams Abad	32 49'09.3 N, 072 47'22.2E	4
		KundChinji	32 40'50.0 N, 072 23'17.0E	6
		DhokJandawali	32 41'52.8N, 072 25'55.3 E	3
		Murat Goranwali	32 55'11.7 N, 072 29'02.2 E	4
		Nika Kahut	32 56'14.8 N, 072 28'12.9 E	6
		Nakata Kahut	32 58'03.6 N, 072 29'42.4 E	3
		Mureed	32 58'03.6 N, 072 29'42.4 E	4
		DhokSiyal	32 58'03.6 N, 072 29'42.4 E	2
		Chaki Rangpur	32 47'22.3 N, 072 36'45.0 E	2
2	District Jhelum	TokBagh	33 04'40.6 N, 073 28 13.1 E	4
		Amral	33 05'26.6 N, 073 28 49.9 E	3
		Ratiyal	33 02'40.7 N, 073 31 22.6 E	2
		Domeli	33 03'25.5 N, 073 25 52.6 E	2
		Sohawa	33 08'16.1 N, 073 23 29.5 E	2
3	District Attock	Motiwala	33 12'48.1 N, 072 16 46.5 E	3
		Dhok Bhatti	33 29'58.2 N, 072 21 54.8 E	3
		Naseerabad	33 10'16.9 N, 072 16 46.5 E	2
		Fateh Jang	33 12'48.1 N, 072 16 46.5 E	2
		TakhtiwalaBadh	33 35'30.5 N, 072 35 55.3 E	2
		DarbarwaliGadh	33 36 10.7 N, 072 36 933 E	2
4	Margallah Hills National Park	Compartment 2	33 45'39.6 N, 73 01 49.7 E	1
		Jabbi village	33 45'21.1 N, 73 01 59.8 E	1
		Compartment 10	33 46'25.9 N, 73 08 22.1 E	1.5
		Shah Allah Ditta	33 42'26.8 N, 72 56 40.5 E	1.5
		Shahdara	33 47'46.3 N, 73 11 21.0 E	1
		TalharGali	33 46'08.1 N, 73 01 48.1 E	1

Survey Methodology:

Standard ecological methods (line transects, field sightings and records of signs) were employed. Extensive surveys of the open wild areas were conducted by walking certain distances to collect information about occurrence of species, living or fresh burrows, old burrows, feeding burrows and direct sightings. As the species is nocturnal in nature, night surveys were also conducted by using powerful electric chargeable Torches and at least four to five hours were spent in field. Secondary data was collected by interviews

with local people, shepherds and hunters. Information regarding current and past status of the species, extent of hunting and type of people involved in poaching of the species in the area was asked. The hunters were also interviewed for extent of hunting, capturing techniques, usage of body parts or all of species, trade routes and other information. GPS points of the study sites were also recorded. The data was then computed and population estimation formula was applied on the surveyed site of each district to determine the population abundance in the Potohar region.

Results and Discussion

Population Distribution and Estimation:

Along with two direct sighting, 26 fresh living burrows, 68 old burrows and 47 feeding burrows recorded from 11 selected sites of the District Chakwal. Population estimates for the district as calculated are 0.055/h. ChumbiSurla Wildlife Sanctuary has high population density (0.8/sq Km) of the species with direct sightings of the species as well. Poaching in Mureed and Siyal of District Chakwal is at its peak. 5 recently excavated burrows, with animal recently captured were observed from the area. Mahmood et al. (2012) calculated the population estimates to be 0.063/ha in District Chakwal but our results show a significant decrease i.e. 0.055/h, almost 8% decrease in population in the area within a year and half. District Jhelum had a 0.033/h population density of Indian pangolin. 8 fresh living burrows, 31 old burrows and 24 feeding burrows were recorded from the selected study sites in Jhelum. Sohawa had the maximum population density i.e. 0.015/h while 12 old burrows were recorded in a small area of 4 km² of Tok Bagh. With a population estimates of 0.023/h, 15 fresh living burrows, 32 old burrows and 27 feeding burrows were recorded from study sites in District Attock. A sufficient population of Indian Pangolin still exists in Margalla Hills National Park. A total of 11 fresh burrows, 27 old burrows and 15 feeding burrows were recorded from an estimated area of 7 km of Park with an estimated population of 0.093/h. Hunting is most common in all the areas of Jhelum, Attock and in Margalla Hills. Although Margalla Hills National Park is a

protected area but illegal hunting of the species was observed common in and around the Park area.

Threats to Indian Pangolin:

The species is faced with multiple threats and poaching being the most imminent. According to the Red data Book, Indian pangolin is listed as "Endangered" in Appendix-1 (Lagrada et al., 2014). It is being protected under north-west frontier province wildlife act 1975 and Islamabad wildlife ordinance 1979. Yet mass hunting and ruthless killing of this species continues. Secondary data revealed that poachers from Faisalabad, Sargodha, Abbottabad and other areas come and hunt the species with the help of local people. Scales trade is a luxurious business. These scales are used in traditional Chinese medicine (Baillie et al., 2014). Pangolins are one of the most-poached mammals recently and according to London Zoological Society, more than one million pangolins have been poached over the past 10 years. The animal is being ruthlessly hunted throughout its range resulting in a serious population decline and make it a conservation priority. This fact is already in agreement to the latest IUCN Red List of Threatened Animals (2014). Species has been hunted at such a large scale that it has been almost wiped out from the Potohar Region. Phenyl, fire or digging are usually involved in excavation of burrows and to suffocate the animals to come out. A more ruthless technique of using dogs for hunting pangolin is also being used. Captured animals are treated in boiled water to remove their scales and later on animal is thrown for rotting (Figure 1).

Table 2. Population Estimates of Indian Pangolin in Potohar Region of Punjab and Margallah Hills National Park, Pakistan.

S. No.	Study Districts	Area Surveyed in Sq. Km	Direct Sighting	Living Burrows	Old Burrows	Feeding Burrows	H*
1	District Chakwal	42	2	26	68	47	0.06
2	District Jhelum	13	0	8	31	24	0.03
3	District Attock	14	0	15	32	27	0.012
4	Margallah Hill National Park	7	0	11	27	15	0.016

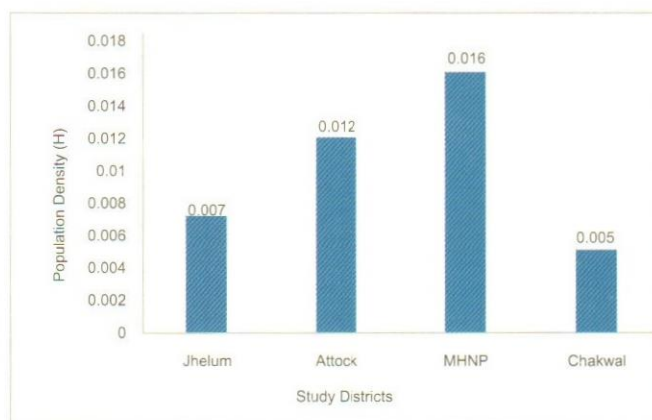


Fig. 1. Population Estimates of Indian Pangolin in Potohar Region of Punjab and Margallah Hills National Park, Pakistan.



Fig. 2. Scaly anteater after scales are removed is thrown for rotting. It was discovered at Tehsil Talagang



Figure 2: Scaly anteater after scales are removed is thrown for rotting. It was discovered at Tehsil Talagang

Habitat fragmentation, as well as destruction, is an important driver of population decline. Pangolin is facing the problem of habitat loss in Potohar region. Local folks believe that the scales of the Pangolin have some super natural powers which can save their cattle from evil and disease. The local villagers after killing the animal, remove its scales and thus a single piece of scale is tied in the neck of animal (Cow, goat, sheep etc.). During the current study, scales of pangolin were observed tied in the necklaces fastened to goats and cows.

Conclusion: Current study suggests that the population of the animal is on a serious decline and if serious conservation efforts are not taken, it may go locally extinct. To minimize the poaching and trade, existing mechanisms to impose fines and other penalties should be improved and made effective. The wildlife staff may be trained in accordance with current trends in wildlife management and conservation so that they can implement wildlife rules and stop illegal trade. Public awareness is an important tool in conservation. Public awareness and education regarding the importance and conservation of biodiversity is the key to protect the wildlife resources of country. Further, community based protection and management of species should be practiced. Protected areas system is vital to the conservation of biological diversity. For the conservation of species rehabilitation, release and monitoring programs may also be initiated.

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Floristic Composition and Ecological Characteristics of Grasses Growing in the University of Peshawar Botanical Garden, Khyber Pakhtunkhwa, Pakistan

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KEYWORDS

Grasses,
Floristic composition,
Ecological characters,
Life form,
Botanical garden.

ABSTRACT

The present study was initiated to investigate the diversity and ecological status of grasses present in the Botanical Garden, Azakhel, which floristic composition of grasses has been lacking. Therefore a floristic survey of these grasses were carried out during July 2013 to December 2014. A total 37 grass species belonging to 31 genera, 11 tribes, and 4 subfamilies were identified from different sites of the research area. The tribe Paniceae was the most dominant with 11 (30.56%) species followed by Andropogoneae with 7 (19.44%) species. *Setaria* and *Brachiaria* were the most dominant genera each with 3 species. The habit of the grasses shows that 31(83.78%) species were erect while 6 (16.21%) were prostrate. The life cycle classes show that 22(58.33%) species are annual and 15 (41.67%) species are perennial. Oosting Scale of abundance status shows that 11 (30.56%) species were rare, 9 (25.00%) were very abundant, 7 (19.44%) were infrequent, 6 (16.67%) were abundant, and 3 (8.33%) species were very rare. Life form spectra shows 24 (64.86%) therophytes, 8 (21.62%) hemicryptophytes 2 (5.41%) geophytes, 2 chamaephytes (5.41%) and 1 (2.70%) nanophanerophytes. This was observed that most of the grass species occurs as weeds and the flowering period varies from species to species mostly from June to November. The results show that the Botanical Garden has a diversity of grasses.

Introduction

The grasses are the most abundant in number and most widely distributed among the flowering plants on the earth. Grass family (Poaceae) comprises 832 genera and 12,096 species throughout the world, while in Pakistan the family is represented by 158 genera and 492 species (Cope, 1982). It is one of the largest among angiosperms families and ranks 1st in abundance, 3rd in number of genera after Asteraceae and Orchidaceae and 5th in number of species after Asteraceae, Orchidaceae, Leguminosae and Rubiaceae (Ahmad, 2011). The grasses are found in every habitat due their adaptability and occur in marshes, swamps, wetlands, river beds, and mountains, terrestrial and aquatic ecosystems. The grasses are well adapted to warm, humid and tropical climate but also established to Polar Regions (Ahmad *et al.*, 2009). Grasses are valuable to human and animals due to the production of food and occupy about 23% of the forest area of the world, while altogether grasses cover > 20% of the earth's land surface (Shantz, 1954). The grasses (Poaceae) have been considered a natural group, which is characterized by the presence of glumes, paleas, lemmas, and caryopses, and several molecular synapomorphies, including characteristic structural rearrangements of the chloroplast genome [Grass Phylogeny Working Group (GPWG) 2001]. The grass family is the most important both economically and ecologically, accounts about 25% of global gross primary productivity and produces about 23% of global grain and rank among the world's most important crops, weed plants, and potential biofuels such as corn, sugarcane, and sorghum (Sage, 2004; Monfreda *et al.*, 2008; Edwards *et al.*, 2010). Only the three cereal crops maize, wheat and rice two-third of the calories and half of the proteins for which most of the world's population depends for its 80-85% of the annual global food (FAO 1999). Wildlife is also dependent upon grass and grassland habitats for food, shelter and normal completion of their life cycle (Gould, 1969). The allelochemicals present in the grasses can be useful for a very interesting goal is biological control of weeds, pests, fungi,

bacteria, algae and aphids (Brecke & Shilling, 1996; Cheema & Khaliq, 2000). The grasses has the ability to compete with other plants species occur as destructive weeds in many agriculture lands and cropping systems of the world (Khalida, S, 2004).

The University of Peshawar Botanical Garden is situated in District Nowshera and lies between 71° 43' E to 71° 44' E longitudes and 34° 15' N to 34° 31' N latitudes, at an altitude of 290 msl. It is bounded on the South by Cherat hills behind Azakhel village, on North by GT Road, on East by Pirpai and on the West by Pabbi town. The total area occupied by the Botanical Garden is 83 acres. Botanical Garden is situated in semi-arid climatic region (hot during summer and cold during winter).

Research has been carried out on various aspects of grasses throughout the world by different scientists. Barbhuiya *et al.*, (2013) reported 98 grass species belonging to 49 genera in which Panicoideae (52 species) had the highest number of species followed by Bambusoideae (25 species along with the details of life form of southern part of Assam (Barak valley) India. Similarly Chaudhary and Sheikh (1968) during the study of halophytic flora of West Pakistan reported different grasses included *Cenchrusbiflorus*, *C. ciliaris*, *Dichanthiumannulatum*, *Eleusineflagellifera*, *Panicumantidotale*, *Sporobolusarabicus* and *Sporobolusmarginatus* as halophytic species. Ahmad *et al.*, (2009) also during taxonomic studies salt range area of Pakistan, reported 62 grass species of 11 tribes along with their indigenous uses and found that the area had a rich diversity of grasses, *Arundodonax*, *Aristidaadscensionis*, *Cymbopogonjwarancusa*, *Dactylocteniumaegyptium*, *Dichanthiumannulatum*, *Cenchrusciliaris* and *Setariaitalicawere* the common species. Some work has been done on the floristic composition of Botanical Garden. 7 grassy weed species from rice fields and 15 grassy weeds from wheat fields, have been reported by Hadi *et al.*, (2009) and Hussain *et al.*, (2009).

Materials and Methods

The present study was conducted during 2013-2014 to explore grasses diversity present in the University of Peshawar Botanical Garden, Azakhel. Several visits were in various sides of the research area were made in from time to time and different seasons for the collection of grass species. The grass species were collected in flowering period. The collected specimens were photographed in the field in their natural habitats by using digital camera. The geographical position of the grass species were noted by using Garmin Etrex GPS (Made in USA). The grass specimens were collected in triplicate and voucher number was allotted to the grass species. Abundance status and flowering period for all species was also noted on the spot. The grass specimens were identified, pressed, documented, dried and mounted on standard herbarium sheets. The identification was carried out with the help of available literature i.e. (Ahmad, 1954; Jafri, 1966; Stewart, 1972; Cope, 1982). The voucher specimens were deposited in the Herbarium of Centre of Plant Biodiversity and Botanical Garden, University of Peshawar (UPBG). Life form classification was carried out as per standard classes of Raunkiaer (1934) as follows:

Therophytes: Annual seed bearing plants which complete their life cycle in one year and overwinter; the unfavorable season by means of seeds or spores.

Geophytes: Perennating buds located below the surface of soil including plants with deep rhizomes, bulbs, tubers and corms, etc.

Hydrophytes: Submerged hydrophytes are those rooted in the muddy substratum. The above ground or upper parts die at the end of growing season.

Hemicryptophytes: Herbaceous perennial in which aerial portion of plant dies at the end of growing season, leaving a perennating bud at or just beneath the ground surface.

Chamaephytes: Perennating buds located close to the ground surface (below the height of 25 cm). They include herbaceous, low woody trailing, low stem succulents and cushion plants.

Phanerophytes: They are shrubby and tree species whose perennating buds are borne on aerial shoot reaching a height of at least 25 cm or more above the ground surface.

After having assigned life form to all the plants, Raunkiaerian spectra was calculated as follows:

$$\text{Biological spectra} = A/B \times 100$$

Where A = Number of species falling in a particular life form classes; B = Total number of all the species for that community/stand. (Rafay *et al.*, 2013).

Grass species distribution

The distribution of specimens was calculated by using Oosting (1956) scale.

Table 1. Oosting (1956) Scale

S.No.	Class	Rarity
1.	Class I	Very Rare
2.	Class II	Rare
3.	Class III	Infrequent
4.	Class IV	Abundant
5.	Class V	Very abundant

Results and Discussion

The floristic studies of grasses of the Botanical Garden, Azakhel were lacking. Floristic studies of a specific area are often the only source for botanical information, which may also provide a suitable starting point for more comprehensive studies (Keith, 1988). The listing of species and conciseness of plant species of an area makes it easy to handle and less time consuming, which helps in the identification and correct naming of species that are important resources for biogeographical studies and biodiversity estimates (Saima *et al.*, 2010). This quantitative study was conducted for the first time to investigate the diversity of grasses growing in the University of Peshawar Botanical Garden, Azakhel. The grasses of University of Peshawar Botanical Garden, Azakhel were collected, identified and classified into subfamilies, tribes wise consisting of voucher number, altitude, common names, flowering period and other diagnostic characters. The grasses are found in every habitat including deserts, marshes, mountains and streams. They are well adapted to warm, humid, polar and tropical climates and inhibits the greatest abundance than any other group of plants (Ahmad *et al.*, 2009). A total 37 grass species belonging to 4 subfamilies, 11 tribes and 31 genera were reported from different sites of the research area. The tribe Paniceae was the most dominant with 11 (30.56%) species followed by Andropogoneae with 7 (19.44%) species. The habit of the grasses showed that 83.78% (31) species were erect while 16.22% (6) were prostrate. The life cycle classes show that 22(59.56%) species are annual and 15 (40.54%) species are perennial. Oosting Scale of abundance status shows that 11 (29.73%) species were rare, 9 (24.32%) were very abundant, 7 (18.92%) were infrequent, 7 (18.92%) were abundant, and 3 (8.11%) species were very rare. Life form spectra showed. The results show that the Botanical Garden has a diversity of grasses. Life form of plant species was recorded and plants were divided into different life form classes. There were 24 (64.86%) therophytes, 8 (21.62%) hemicryptophytes 2 (5.41%) geophytes, 2 chamaephytes (5.41%) and 1 (2.70%) nanophanerophytes. Most the grasses were therophytes and found to weedy in nature occurring in lawns, nurseries and orchards. Shah *et al.*, (2008); Hussain *et al.*, (2009) and Inayat *et al.*, (2014), also observed that most the weeds are therophytes are weedy with small leaves and occurs in cultivated habitats. The flowering period of these grass species varies from January to December in different species. This study will provide the basis for further studies in explore the flora of Botanical Garden, University of Peshawar.

Conclusion

The studies reveal that the Botanical Garden, University of Peshawar has a great diversity of grasses. Further studies and proper labelling are needed to explore different aspects of these grasses and to provide information to the visitors.

Table2. Checklist and Biological spectra of grass species found in Botanical Garden, Azakhel, University of Peshawar, KP, Pakistan.

S. NO	Species name	English name	Habitat	Life-form	Flowering Period	Life cycle	Habit	Oosting Scale of Abundance	Vouch. No
A Arundinoideae									
I. Tribe Arundineae									
	<i>Arundodonax</i> L.	Giant reed	Cultivated, irrigation channels	G	June-Dec	P	Erect	II	R-12 (UPBG)
	<i>Phragmites karka</i> (Retz.) Trin. ex Steud	Common reed	Wild halophytic weed, play ground	G	May-Nov	P	Erect	V	R-13 (UPBG)
B Bambusoideae									
II. Tribe Bambuseae									
	<i>Dendrocalamus strictus</i> (Roxb.) Nees	Male bamboo	Cultivated in fields	NP	Nov-April	P	Erect	I	R-36 (UPBG)
C Chloridoideae									
III. Tribe Chlorideae									
	<i>Cynodondactylon</i> (L.) Pers.	Bermuda grass	Wild weed, lawns	H	Jan-Dec	P	Prostrate	V	R-03 (UPBG)
IV. Tribe Eragrostideae									
	<i>Dactyloctenium aegyptium</i> (Linn.) Willd	Egyptian finger grass	Wild weed, lawns	T	July-Oct	A	Prostrate	III	R-15 (UPBG)
	<i>Desmostachya bipinnata</i> (L.) Stapf	Salt reed-grass	Wild weed, sides of lawns, play ground	H	July-Nov	P	Erect	V	R-16 (UPBG)
	<i>Eleusine indica</i> (L.) Gaertn.	Goose grass	Wild weed, lawns	T	April-Aug	A	Prostrate	II	R-37 (UPBG)
	<i>Eragrostis cilianensis</i> (All.) Lut. Ex F.T. Hubbard	Stink grass	Wild weed, lawns	T	May-Oct	A	Erect	II	R-17 (UPBG)
	<i>Leptochloa panacea</i> (Retz.) Ohwi	Thread sprangletop	Wild weed, lawns	T	Aug-Nov	A	Erect	III	R-18 (UPBG)
V. Tribe Sporoboleae									
	<i>Sporobolus arabicus</i> Boiss.	-----	Wild weed, in fields	T	March-Oct	P	Erect	III	R-09 (UPBG)
D PANICEOIDEAE									
VI. Tribe Andropogoneae									
	<i>Apludamutica</i> Linn.	Mauritian grass	Wild sides of water channels	T	Aug-Nov	P	Erect	I	R-10 (UPBG)
	<i>Cymbopogon jwarancusa</i> (Jones.)Schult	Oil grass	Cultivated as ornamental and medicinal plant	H	Oct-Jan	P	Erect	I	R-11 (UPBG)
	<i>Dichanthium annulatum</i> (Forssk.)Stapf	Marvel grass	Wild weed, sides of lawns, play ground	H	April-Oct	P	Erect	V	R-01 (UPBG)
	<i>Imperata cylindrica</i> (L.) Raeush	Cogon grass,	Wild weed, sides of lawns	H	March-Oct	P	Erect	V	R-02 (UPBG)
	<i>Saccharum bengalense</i> Retz.	Bengal cane	Wild weed, sides of fields	H	Oct-Jun	P	Erect	III	R-14 (UPBG)
	<i>Saccharum spontaneum</i> Linn.	Kans grass	Wild weed, sides of fields	C	July-Sept	P	Erect	II	R-04 (UPBG)
	<i>Sorghum halepense</i> (L.) Pers.	Johnson grass	Wild weed, sides of lawns	H	May-Oct	P	Erect	IV	R-05 (UPBG)
VII. Tribe Paniceae									
	<i>Brachiaria eruciformis</i> (J.E.Sm.) Stapf	Sweat signal grass	Wild weed, sides of lawns, in fields	T	July-Sept	A	Prostrate	V	R-07 (UPBG)
	<i>Brachiaria ramosa</i> (Linn.) Stapf	Brown top millet	Wild weed, sides of lawns, in fields	T	June-Oct	A	Prostrate	III	R-08 (UPBG)
	<i>Brachiaria reptans</i> (Linn.) Gardner & Hubbard	Running grass	Wild weed, sides of lawns, in fields	T	June-Oct	A	Prostrate	III	R-19 (UPBG)
	<i>Cenchrus ciliaris</i> Linn.	Buffel grass	Wild weed, sides of lawns, in fields	H	March-May	P	Erect	III	R-20 (UPBG)
	<i>Digitaria ciliaris</i> (Retz.) Koeler	summer grass	Wild weed, lawns, in fields	T	July-Oct	A	Erect	IV	R-21 (UPBG)
	<i>Echinochloa colona</i> (Linn.) Link	Jungle rice	Wild weed, lawns, in fields	T	May-Oct	A	Erect	IV	R-22 (UPBG)
	<i>Echinochloa crus-galli</i> (L.) Beauv	Barnyard grass	Wild weed, lawns, in fields	T	June-Oct	A	Erect	IV	R-23 (UPBG)
	<i>Paspalum paspaloides</i> (Michx.) Scribn	Knot grass	Wild, in ponds, water channels	C	April-Sept	P	Erect	V	R-24 (UPBG)
	<i>Setaria pumila</i> Linn.	yellow bristle grass	Wild weed, lawns, in fields	T	June-Oct	A	Erect	V	R-34 (UPBG)
	<i>Setaria verticillata</i> (Linn.) P. Beauv.	Bristly foxtail	Wild weed, lawns, in fields	T	April-Oct	A	Erect	IV	R-35 (UPBG)
	<i>Setaria viridis</i> (Linn.) P. Beauv.	Green bristle grass	Wild weed, lawns, in fields	T	June-Sept	A	Erect	IV	R-32 (UPBG)

S. NO	Species name	English name	Habitat	Life-form	Flowering Period	Life cycle	Habit	Oosting Scale of Abundance	Vouch. No
E									
POOIDEAE									
VIII. Tribe Aveneae									
	<i>Alopecurus myosuroides</i> Huds.	Slender Fox-tail	Wild weed, in fields	T	March-April	A	Erect	II	R-27 (UPBG)
	<i>Avena sativa</i> L.	Common oats	Wild weed, in fields	T	March-Aug	A	Erect	II	R-28 (UPBG)
	<i>Phalaris minor</i> Retz.	Little seed canary grass	Wild weed, in fields	T	March-May	A	Erect	II	R-29 (UPBG)
	<i>Polypogon monspeliensis</i> (Linn.) Desf.	Beard grass	Wild weed, in fields	T	March-July	A	Erect	IV	R-30 (UPBG)
IX. Tribe Bromaeae									
	<i>Bromus gracillimus</i> Bunge.	Brome grass	Wild weed, in fields	T	April- July	A	Erect	II	R-31 (UPBG)
X. Tribe Poeae									
	<i>Dactylis glomerata</i> Linn.	Cock's-foot	Wild weed, in fields	T	July-Aug		Erect	II	
	<i>Poa annualis</i> Linn.	Annual meadow	Wild weed, lawns, in fields	T	Jan-Dec	A	Erect	V	R-33 (UPBG)
XI. Tribe Triticeae									
	<i>Aegilopstauschii</i> Cosson.	Tausch's goat grass	Wild weed, in fields	T	May-July	A	Erect	II	R-25 (UPBG)
	<i>Hordeum murinum</i> L.	false barley	Wild weed, in fields	T	April- July	A	Erect	II	R-26 (UPBG)

Keys: Life Form: 1. Th: Therophytes, 2. G: Geophytes, 3. H: Hemicryptophytes.

Leaf cycle: 1. A: Annual, 2. P: Perennial.

Habit: 1. E: Erect 2. P: Prostrate.

Table 3. Summary of Life-form, Habit, Leaf cycle and abundance of Grasses in Botanical Garden Azakhel, University of Peshawar.

S. No.	Parameters	No. of species	Percentage
A. Life-form classes			
1.	Therophytes	24	64.86%
2.	Hemicryptophytes	8	21.62%
3.	Geophytes	2	5.41%
4.	Chamaephytes	2	5.41%
5.	Nanophanerophytes	1	2.70%
Total		37	100
B. Habit Classes			
1.	Erect	31	83.78%
2.	Prostrate	6	16.21%
Total		37	100
C. Leaf cycle classes			
1.	Annual	22	59.56%
2.	Perennial	15	40.54%
Total		37	100
D. Abundance Classes (Oosting Scale)			
1.	Very abundant	9	24.32%
2.	Abundant	7	18.92%
3.	Infrequent	7	18.92%
4.	Rare	11	29.73%
5.	Very rare	3	8.11%
Total		37	100

FIGURES 1-5

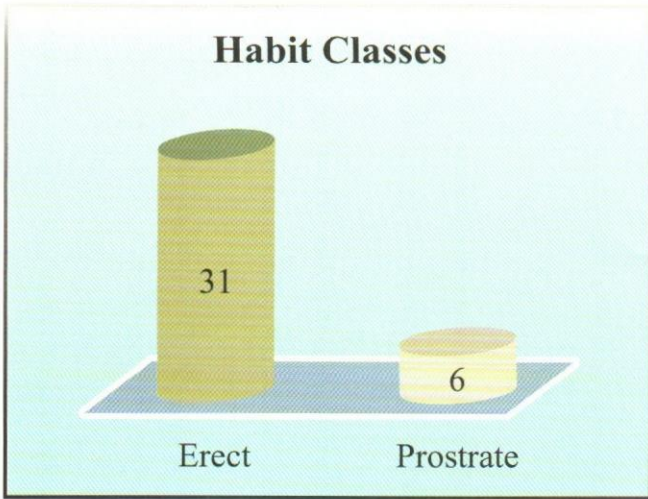


Fig. 1. Showing Habit of species

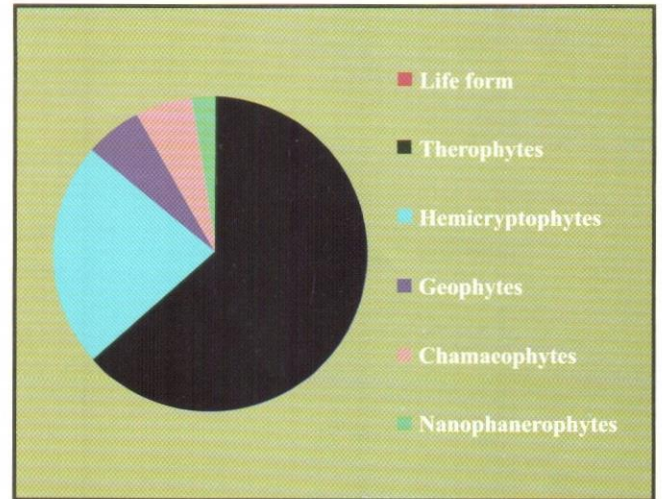


Fig. 2. Indicating Life form

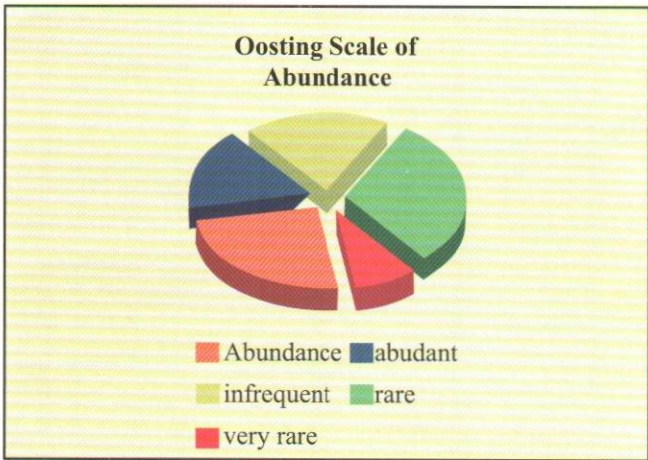


Fig. 3. Shows the abundance status

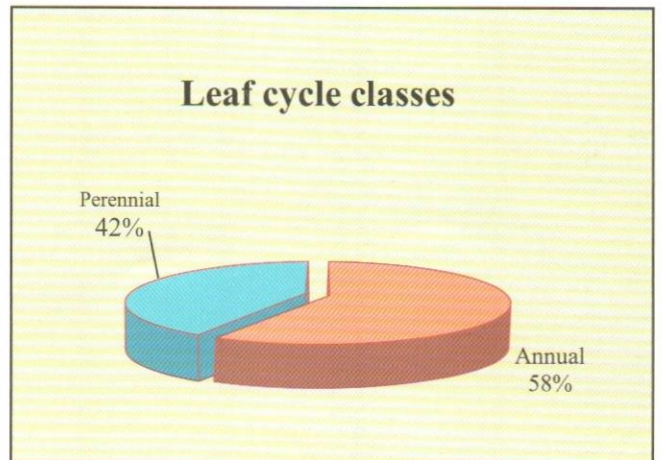


Fig. 4. Show percentage of Life cycle

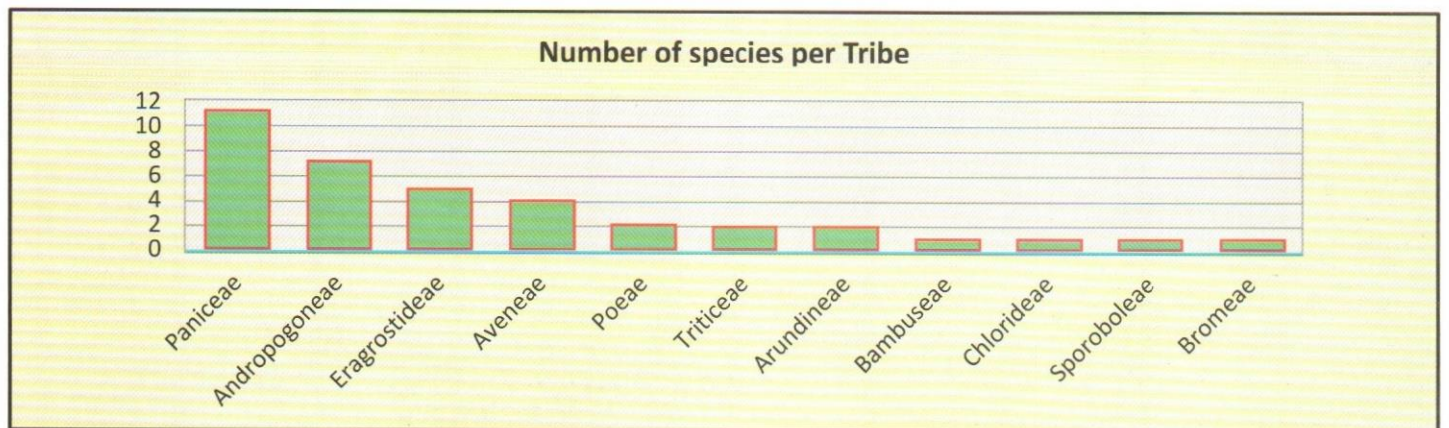


Fig. 5. Representing number of species per Tribe



1. *Saccharum spontaneum* L.



2. *Setaria viridis* (L.) P. Beauv.



3. *Desmostachya bipinnata* (L.) Stapf.



4. *Phragmites karka* (Retz.) Trin. ex Steud.



5. *Cymbopogon jwarancusa* (Jones.) Schult.



6. *Imperata cylindrica* (L.) Raeush

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Short Communication

Assessment of Birds in Jinnah Barrage Mianwali, Pakistan

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Introduction

Jinnah Barrage is situated (32° 55'N, 71° 31'E) about 50 Km northwest of Mianwali city (Figure 1). It has a voluminous watershed in the main downstream (river Indus). Few small ponds

are also located at the adjacent peripheries. The wetland has light submerged vegetation. The Barrage is unique in having good concentration of anatids both at upstream and downstream of the Barrage and also supports a variety of water birds.



Fig. 1. Downstream of Jinnah Barrage.

Materials and Methods

The Jinnah Barrage was surveyed for two years during the month of July for waterfowl census in 2016 and 2017. Different sites of Jinnah Barrage was visited at least three times during the survey period and counts were made. The birds were directly observed, identified and counted with the help of binoculars (Olympus 8-16 X 40, DPS I) and spotting scopes (Nikon w/ 15-45 X). The GPS receiver (Magellan SporTrack) was also used to record the coordinates of each wetland. For the identification of water birds, Sonobe and Usui (1993) were referred. We paid great attention to

the identification of each species of migratory water birds. Identifying as many species in each flock as possible, and then applying the observed ratios to unidentified members of the flocks to estimate total numbers of each species. The total number of the birds was determined by direct counts by selecting plots at each site of the Jinnah Barrage and counting the number of species and birds in each plot and then multiplying each plot with total area of the wetland to determine the number of birds present at the total area of wetland. The data collected and then computed to find out the total population estimates of migratory water birds at Jinnah Barrage.

Results and Discussions

During the current waterfowl census we identified 31 species of water birds (both migratory and resident) from Jinnah Barrage. Eighteen species were recorded in 2016, while 26 species were recorded in 2017. Five species that were recorded in 2016 (*Calidris minuta*, *Calidris alpina*, *Calidris temminckii*, *Gallinago gallinago* and *Vanellus vanellus*) were not recorded in 2017. In 2017, fourteen new birds species (*Larus argentatus*, *Larus ichthyaetus*, *Larus ridibundus*, *Sterna aurantia*, *Tringa ochronus*, *Actitis hypoleucos*, *Vanellus vanellus*, *Galinula chloropus*, *Porphyrio porphyrio*, *Fulica atra*, *Anas acuta*, *Anas clypeata*, *Aythya ferin* and *Egretta alba*) were recorded which were absent in

2016 survey. The largest population of migratory water birds was observed of *Anas platyrhyncho* (592) *Anas streptera* (513) in 2017 as their number increased very much from 2106 (Figure 2). If we compare current results with previous year's census, a significant change can be noticed at both surveyed years. The number of some birds species also decreased from 2016 (Table 1) but the overall conservation position is improved and that might be the result of conservation efforts of national and international conservation institutions. The reason of decrease in the population number of some birds is either increased commercial fishing activity or agricultural chemicals i.e. nitrogen, phosphorus and pesticides (Scott & Poole 1989; Azam, 1994; Javed, 2012). More conservatory efforts are needed to conserve the low bird population species.

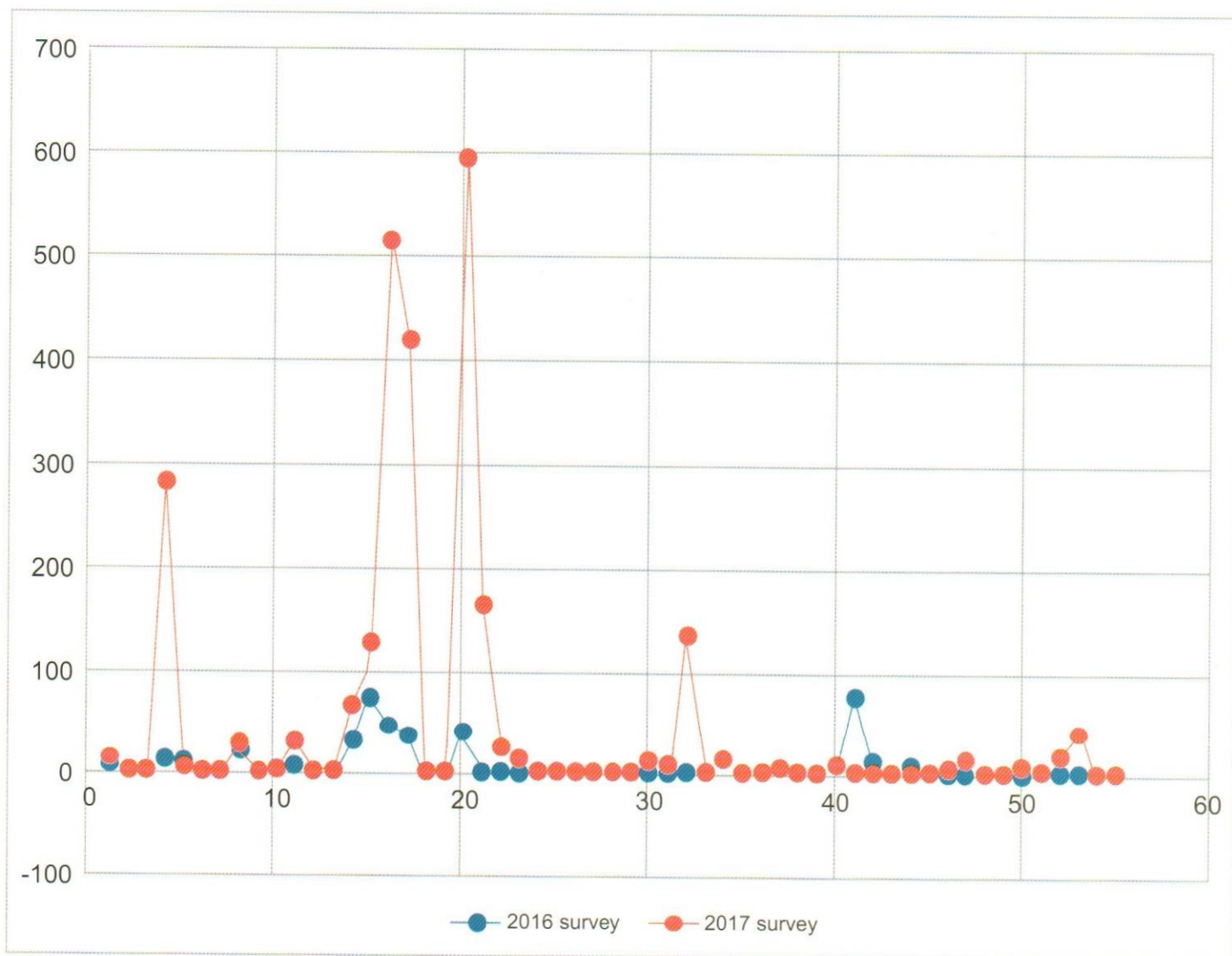


Fig. 2. Comparative analysis of birds in 2016 and 2017 in Jinnah Barrage.

Table 1. List of birds and their comparative number in June 2016 and 2017.

S#	Scientific Name	Common Name	June 2016	June 2017
1	<i>Tachy baptus</i>	Little Grebe	7	13
2	<i>Pediceps cristatus</i>	Great Crested Grebe	0	0
3	<i>Phalacrocorax carbo</i>	Large Cormorant	0	0
4	<i>Phalacrocorax niger</i>	Little Cormorant	12	280
5	<i>Ardeola grayii</i>	Indian Pond Heron	9	4
6	<i>Ixobrychus minutus</i>	Little Bittern	0	0
7	<i>Bubulcus ibis</i>	Cattle Egret	0	0
8	<i>Egretta garzetta</i>	Little Egret	21	27
9	<i>Egretta intermedia</i>	Intermediate Egret	0	0
10	<i>Egretta alba</i>	Large Egret	0	2
11	<i>Ardea cineria</i>	Gray Heron	6	28
12	<i>Anser anser</i>	Grey lag Goose	0	0
13	<i>Tadorna tadorna</i>	Common Shelduck	0	0
14	<i>Tadorna ferruginea</i>	Ruddy Shelduck	29	65
15	<i>Anas penelope</i>	Eurasian Wigeon	72	126
16	<i>Anas streptera</i>	Gadwall	45	513
17	<i>Anas crecca</i>	Common Teal	35	418
18	<i>Anas querquedula</i>	Garganey	0	0
19	<i>Anas poecilorhynca</i>	Spot-bill Duck	0	0
20	<i>Anas platyrhynchos</i>	Mallard	39	592
21	<i>Anas acuta</i>	Northern Pintail	0	163
22	<i>Anas clypeata</i>	Shovler	0	25
23	<i>Aythya ferina</i>	Common Pochard	0	13
24	<i>Nettarufina</i>	Red-crested Pochard	0	0
25	<i>Aythya nyroca</i>	White-eyed Pochard	0	0
26	<i>Aythya fuligula</i>	Tufted Duck	0	0
27	<i>Bucephala clangula</i>	Common Goldeneye	0	0
28	<i>Grus grus</i>	Common Crane	0	0
29	<i>Amaurornis phoenicurus</i>	White-Breasted Water Hen	0	0
30	<i>Galinula chloropus</i>	Indian Moorhen	0	12
31	<i>Porphyrio porphyrio</i>	Purple Moorhen	0	7
32	<i>Fulica atra</i>	Common Coot	0	132
33	<i>Hydrophasianus chirurgus</i>	Pheasant-Tailed Jacana	0	0
34	<i>Himantopus himantopus</i>	Black-winged Stilt	12	13
35	<i>Recurvirostra avosetta</i>	Pied Avocet	0	0
36	<i>Vanellus vanellus</i>	Northern Lapwing	2	0
37	<i>Charadrius alexandrinus</i>	Kentish Plover	6	4
38	<i>Vanellus leucurus</i>	White-Tailed Plover	0	0
39	<i>Charadrius hiaticula</i>	Ringed Plover	0	0
40	<i>Holopterus indicus</i>	Red-wattled Lapwing	9	7
41	<i>Calidris minuta</i>	Little Stint	74	0
42	<i>Calidris alpina</i>	Dunlin	12	0
43	<i>Calidris temminckii</i>	Temminck's Stint	2	0
44	<i>Gallinago gallinago</i>	Common Snipe	6	0
45	<i>Tringa erythropus</i>	Spotted Redshank	0	0
46	<i>Tringa ochronus</i>	Green Sandpiper	0	4
47	<i>Actitis hypoleucos</i>	Common Sandpiper	0	13
48	<i>Tringa glareola</i>	Wood Sandpiper	0	0
49	<i>Limosa limosa</i>	Black-tailed Godwit	0	0
50	<i>Larus argentatus</i>	Herring Gull	0	5
51	<i>Larus ichthyæetus</i>	Great black-headed Gull	0	2
52	<i>Larus ridibundus</i>	Black headed gull	0	17
53	<i>Sterna aurantia</i>	Indian River Tern	0	39
54	<i>Phoenicopterus ruber</i>	Greater Flamingo	0	0
55	<i>Ardea purperia</i>	Purple Heron	0	0

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PRINTING CORPORATION OF PAKISTAN PRESS
ISLAMABAD