

DIVERSITY OF WILD MAMMALIAN FAUNA OF CHENAB RIVERINE FOREST, PUNJAB, PAKISTAN

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ABSTRACT

Present study was conducted at head Marala (SA1), head Khanki (SA2) and head Qadirabad (SA3) which are important wetland sites of River Chenab to find out the diversity of the mammalian fauna. SA1 comprises 2816 ha wetland area, SA2 occupies an area of 1200 ha while SA3 spreads over 1620 ha. Linear count method was applied to estimate the populations of various mammalian species and diversity was measured through Shannon-Wiener index. A total of 15 species (11 large mammals and 4 small mammals) belonging to 6 orders, 10 families and 14 genera were recorded from the study area. Shannon-Wiener diversity index for SA1, SA2 and SA3 was 0.860, 0.972 and 0.975, respectively while the census index/ density was 0.0414 at head Marala, 0.0508 at head Khanki and 0.0231 at head Qadirabad. Indian wild boar (*Sus scrofa*) and small Indian mongoose (*Herpestes javanicus*) were dominating species of study area.

Key words: Mammals, Density, Richness, Evenness, Riverine forests, River Chenab.

INTRODUCTION

Biodiversity is facing substantial threats from anthropogenic hazards like habitat fragmentation and loss of habitat and deserves better management to maintain the number of species (Dwyer, 1983; McPhee, 1988; Rubin *et al.*, 1998; Li and Mundkur, 2003). Diversity of species comprises two basic components; one is richness i.e. number of species in a given area and the other is evenness i.e. relative abundance or biomass distributed among species (Magurran, 2004). Both of these components are combined in diversity indices (Smith and Wilson, 1996). According to IUCN (2002), out of 4763 mammalian species of the world, 1137 are threatened. Mammalian fauna of Pakistan is represented by 195 species belonging to 10 orders (Roberts, 2005a, b). Out of 195 mammal species, 5 are endemic to Pakistan, 12 are Critically Endangered (1 endemic), 12 Endangered (3 endemic), 20 Vulnerable, 32 Near Threatened (1 endemic), 71 Least Concern, 38 Data Deficient, 8 Regionally Extinct and 2 are Not Evaluated (IUCN, 2003).

Diversity of Pakistan is unique as the country harbors three bio-geographic realms i.e. Palearctic, Oriental and Ethopion. Roughly two-thirds of the country is mountainous and abrupt changes in altitude provoke changes in diversity within short distances. Pakistan encompasses wide array of terrestrial ecosystems within 18 major geographical zones i.e. Permanent snowfield and cold desert, Alpine meadows, Sub-alpine scrub and birch forest, Dry temperate coniferous forest, Himalayan

moist temperate forest, Sub-tropical pine forest, Tropical deciduous forest, Steppic forest in the Northern latitude, Steppic forest in the intermediate latitude, Steppic forest in the Southern latitude, Monsoon-influenced arid sub-tropical, Less pronounced Monsoon influenced, Balochistan Desert Scrub, Indus Plains, Sand dunes, Inundation (Seepage and Swamp) Zones, Riverine tract and littoral (Inter-tidal) zone. In addition, a number of distinct agro-ecosystems have been created through the conversion of natural habitats for agricultural use (Roberts, 1997). Roberts (1997) explored mammalian fauna of Pakistan, Chaudhry *et al.* (1997) documented diversity of Salt Range and Cholistan desert while Singh and Banyal (2012) recorded mammalian diversity from river Ravi near India-Pakistan border.

Wetlands provide habitat to a large number of terrestrial and aquatic organisms and therefore are considered important places for evolution and genetic diversity. Wetlands are classified on the basis of their origin, chemical composition, age, depth as well as size of the wetland (Gorham and Janssens, 1992). Pakistan possesses 225 important wetland areas out of which 19 are Ramsar sites (IUCN, 1989). River Chenab starts from the Kangra and Kulu districts of Himachal Pradesh, provinces of India and enters in Pakistan near Diawara village, district Sialkot. Total length (In Pakistan and India) of river Chenab is 960 km and it occupies an area of 41656 km. Annual water flow is 26.44 billion cubic meters. Head Marala, head Qadirabad, head Khanki and head Trimmu are the important water reservoirs of the river (Siddiqi and Tahir-Kheli, 2004; Dawn, 2014).

The present study concentrates specifically three sub-regions (i.e. head Marala, Head Khanki and head Qadirabad) of the Chenab River to explore the mammalian fauna diversity of the area which was still unexplored.

MATERIALS AND METHODS

Study area: Study was conducted from May 2009 through April 2010 in riverine forests around three reservoirs at River Chenab i.e. head Qadirabad, head Khanki and head Marala. Head Qadirabad (Sub Area 1, SA1) is comprises of wetland area of 2816 ha, located at 32° 20'06 N, 073° 41'36 E, and 206 m elevation. SA2 i.e. head Khanki is located at 32° 24'07 N, 073° 58'39 E, and 219 m elevation and head Marala (SA3) at 32° 39'59 N, 74° 28'05 E, elevation of 244 m, and comprises of wetland area of 1200 ha (Figure 1). Head Marala is situated near Pak-Indian border, water enters from India, moves to head Khanki and then to head Qadirabad. Distance between head Marala to head Khanki is 73.7 km while distance between head Khanki to head Qadirabad is 39.8 km.

Climate of the area is tropical to sub-tropical and is comprised of four seasons i.e. summer, spring, winter and autumn. Annual average temperature ranges from 5°C during winter to 45°C during summer. The pH of river water is alkaline and averages 7.9 to 8.1 (Irrigation and Power Department Punjab, 2007).

Head Qadirabad, head Khanki and head Marala forest falls under Tropical thorn forest (Siddiqui, 1997; Roberts, 1997). Large area of the forest has been converted into agriculture land some of which lies in river basin and island type dry areas are prominent. Prominent aquatic vegetation of the study area includes lyngbye's sedge (*Carex fedia*), hydrilla (*Hydrilla verticillata*), water lily (*Nymphaea lotus*), horned pondweed (*Zannichellia palustris*), reed (*Phragmites karka*), Indian lotus (*Nelumbo nucifera*), curly-leaf pondweed (*Potamogeton crispus*), lesser Indian reed mace (*Typha angustata*), eel grass (*Vallisneria spiralis*) and muskgrass (*Chara sp.*). Important natural vegetation of the surrounding plains includes jand (*Prosopis cineraria*), athel (*Tamarix aphylla*), Indian plum (*Zizyphus mauritiana*), goose grass (*Eleusine compressa*), kans grass (*Saccharum spontaneum*), shisham (*Dalbergia sissoo*) and kikar or thorn-tree (*Acacia nilotica*) by Savage, 1968; Roberts, 1984; IUCN, 1987. Most common weed species of the study area include burra gokharu (*Tribulus terrestris L.*), common cockle-bur (*Xanthium strumarium*), Indian doab (*Cynodon dactylon*), devil's horsewhip (*Achyranthes aspera*), slender amaranth (*Amaranthus viridis*), white-top weed (*Parthenium hysterophorus*), prostrate spurge (*Euphorbia prostrata L.*) and marijuana (*Cannabis sativa*). Rice (*Oryza sativa*), wheat (*Triticum aestivum*) and pea plants (*Pisum*

sativum) are amongst the prominent crop species of the study area (Umair, 2012).

Methodology: Linear count survey method was used for population estimation of mammalian fauna of the study area. Both, direct (total/physical count and calls or voices) and indirect (nests, fecal pellets, marks on trees, group questionnaire Survey and foot-prints) methods were applied to find out mammalian diversity of the area (Maan and Chaudhry, 2001). Binoculars (32x50) were used to observe the animals and field guides were consulted to correctly identify the species (Roberts, 2005 a, b).

Statistical Analysis: Shannon-Weiner index was used to find out the abundance of various mammalian species of the study area through the equation given below following Shannon and Weaver (1963).

Shannon-Weiner Diversity Index is denoted by H'

$$H' = -\sum P \ln P$$

Species richness was measured by Index of richness (R) given by Margalef (1958).

$$R = S - 1 / \ln N$$

Species evenness was measured with evenness index (denoted by E) given by Hill (1973).

$$E = H' / \ln S$$

Where, P = Proportion of the species i relative to the total number of species

In P = Natural logarithm of this proportion

S = Total no. of species

N = Total no. of individual

Higher values of H' indicates heterogeneity in the community whereas the lesser values point to the homogeneity in the community.

RESULTS AND DISCUSSION

A total of 15 mammalian species (11 small and 4 large), belonging to 14 genera, 10 families and 6 orders were recorded from the study area (Table 1). Out of these, 11 were common to all the three sub areas while two species were recorded only from head Marala, one species was common at head Qadirabad and head Khanki and 1 at head Khanki and head Marala (Table 1). Roberts (1997) recorded 23 mammalian species (15 small and 8 large mammalian species) from river Chenab belonging to 20 genera, 11 families, and 6 orders. Singh and Banyal (2012) observed mammalian diversity of riparian wetland of river Ravi and documented 16 species belonging to 14 genera, 12 families and 6 orders.

Shannon-Wiener diversity index for mammal species of head Marala, Khanki and head Qadirabad was 0.860, 0.972 and 0.975, respectively while the census index/ density was 0.0414 at head Marala, 0.0508 at head Khanki and 0.0231 at head Qadirabad. A total of 67 individuals were observed at head Marala, 65 at Qadirabad and 61 at head Khanki. Species evenness at

head Qadirabad was 0.38026, at head Khanki was 0.39097 and at head Marala was 0.20446, while species richness at head Qadirabad was 6.619, at Khanki was 6.161 and at head Marala was 7.119 (Table 2).

During present study, indian wild boar was found as most abundant species of the study area with relative abundance of 21.5 at head Qadirabad, 16.4 at head Khanki and 11.9 at head Marala. The species is present up to 900 m elevation in Pakistan and is one of the abundant mammalian species of Punjab and Sindh provinces (Shafi and Khokhar, 1986).

Asiatic jackals (relative abundance (RA) = 0.046 at head Qadirabad, RA = 0.0333 at head Khanki and RA = 0.06 at head Marala) and indian fox (RA = 0.031 at head Qadirabad, RA = 0.0333 at head Khanki and RA = 0.015 at head Marala) were often seen in the dense area of the forest and many dead bodies of Asiatic jackal were observed at road due to road accidents from GT road near river Chenab area during present survey. The species is abundant and widely distributed in irrigated areas of Pakistan (Roberts, 1997). Indian Fox is abundant in North east of the Punjab, some parts of Sindh and Balochistan. The species is also common in India (Roberts, 1997).

Among rodents' species, indian gerbil (*Tatera indica*) was abundant (RA = 0.046 at head Qadirabad, RA = 0.030 at head Marala) while it was not recorded from head Khanki and most widely distributed in agricultural lands at river Chenab of the study area. It is found throughout the irrigated as well as rural areas of the Punjab (Roberts, 1997).

Present census revealed that palm squirrel (*Funnambulus pennantii*) was the most abundant species of river Chenab (RA= 0.185 at head Qadirabad, RA = 0.197 at head Khanki and RA= 0.060 at head Marala). This species is also most abundant in Hingol National Park, Balochistan (Mehrban and Shamim, 2006). *F. pennantii* is common in semi-desert areas, villages and cities; it is abundant and widely distributed in Pakistan (Roberts, 1997).

House shrew (*Suncus murinus*) (relative abundance was 0.045) and soft-furred field rat (*Millardia meltada*) (relative abundance was 0.015) are recorded only from head Marala and could not be traced at other study areas. House Shrew is an oriented species which is recorded from Faisalabad, Chhanga Manga (Taber *et al.*, 1967), Karachi, Sialkot, Lahore and Rawalpindi (Roberts, 1997).

Soft-Furred field rat only recorded (relative abundance, 0.015) from head Marala during present survey, Taber *et al.* (1967) was reported from northern Punjab and lower Sindh (Roberts, 1997).

Short tailed mole rate (*Nesokia indica*) was sighted at head Qadirabad (relative abundance, 0.015) and Khanki (relative abundance, 0.033) during present study. It is widely distributed near wetland areas of the Punjab (Schilitter and Setzer, 1973) and Balochistan (Roberts, 1997).

Small Indian mongoose (*Herpestes javanicus*) was observed at head Khanki (relative abundance, 0.066) and head Marala (relative abundance, 0.030) during present study. The species is common in Jhelum, Lahore, Kasur and Sialkot districts (Roberts, 1997).

It was observed during present survey that ecological equilibrium is subject to disturbances from developments and human interventions. With the passage of time water has decreased from the wetland areas and urbanization and crops cultivation is adversely affecting the forest area, as a result many mammalian species have left their natural habitat and/or forced to live near or around human populations. These findings are inline with the results of Southwick and Siddiqi (1994) Singh and Banyal (2012).

Throughout the study period livestock grazing was observed in and around forest area. The practice is a source of income for nearby communities and plays a role for general socio-economic development of the area but has adverse impacts on biodiversity. Non degradable products from hotels, shepherds, local people and tourists are adversely affecting the water quality of the river water and scenic beauty of the forest area. These non degradable products are also a major hurdle in renewal of forest and obstruct aforesation thus directly depleting plant and indirectly, animal diversity. Nearby communities rely on the Riverine water for fishing and agriculture and forest area for hunting, livestock production and crop cultivation.

Threats: During present study, the large number of threats were identified which are depleting the forest and wetland area at an unprecedented rate which include increased level of toxic chemicals from fertilizers and pesticides in agriculture area, shortage of water or decreased water level gradually, road accidents, excessive hunting (trophy hunting and illegal hunting), natural as well as human disturbance of forest area, human-wildlife conflict and species dislike.

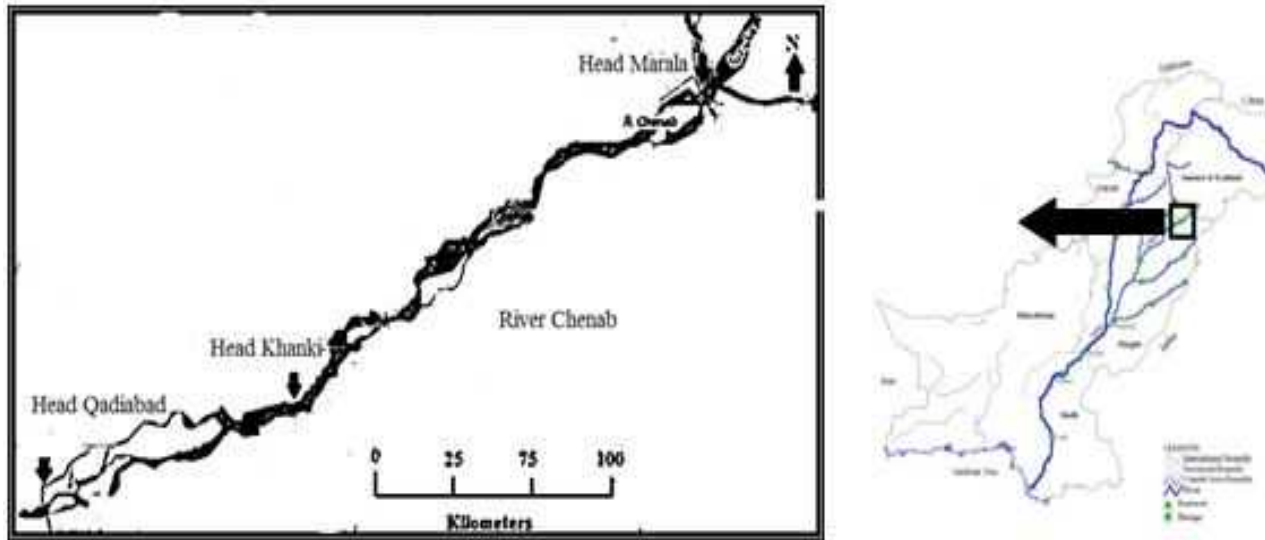


Figure: 1. Map of River Chenab

Table 1. Mammalian diversity of the study area

No.	Common Name	Scientific Name	Family	Order	Relative Abundance	Census Index	PilogPi
Head Qadirabad							
1	House shrew	<i>Suncus murinus</i>	Soricidae	Insectivora	0.123	0.0028	-0.11
2	Mediterranean pygmy shrew	<i>Suncus etruscus</i>	Soricidae	Insectivora	0.046	0.0011	-0.06
3	Desert hare	<i>Lepus migricollis dayanus</i>	Leporidae	Lagomorpha	0.046	0.0011	-0.06
4	Northern palm squirrel	<i>Funnambulus pennantii</i>	Sciuridae	Rodentia	0.185	0.0043	-0.14
5	Indian crested porcupine	<i>Hystrix cristatus</i>	Hystricidae	Rodentia	0.015	0.0004	-0.03
6	House rat	<i>Rattus rattus</i>	Muridae	Rodentia	0.092	0.0021	-0.10
7	House mouse	<i>Mus musculus</i>	Muridae	Rodentia	0.123	0.0028	-0.11
8	Short tailed mole rate	<i>Nesokia indica</i>	Muridae	Rodentia	0.015	0.0004	-0.03
9	Indian gerbil	<i>Tatera indica</i>	Muridae	Rodentia	0.046	0.0011	-0.06
10	Long eared desert hedgehog	<i>Hemiechinus collaris</i>	Erinaceidae	Erinaceidomorpha	0.01.5	0.0004	-0.03
11	Asiatic jackal	<i>Canus aureus</i>	Canidae	Carnivora	0.046	0.0011	-0.06
12	Indian/Bengal fox	<i>Vulpes bengalensis</i>	Canidae	Carnivora	0.031	0.0007	-0.05
13	Indian wild boar	<i>Sus scrofa</i>	Suidae	Artiodactyla	0.215	0.0050	-0.14
					1.00	0.0231	-0.975
Head Khanki							
1	Mediterranean pygmy shrew	<i>Suncus etruscus</i>	Soricidae	Insectivora	0.033	0.0017	-0.049
2	Desert hare	<i>Lepus migricollis dayanus</i>	Leporidae	Lagomorpha	0.082	0.0042	-0.089
3	Northern palm squirrel	<i>Funnambulus pennantii</i>	Sciuridae	Rodentia	0.197	0.0100	-0.139
4	Indian crested porcupine	<i>Hystrix cristatus</i>	Hystricidae	Rodentia	0.033	0.0017	-0.049
5	House rat	<i>Rattus rattus</i>	Muridae	Rodentia	0.148	0.0075	-0.123
6	House mouse	<i>Mus musculus</i>	Muridae	Rodentia	10.48	0.0075	-0.123
7	Short tailed mole rate	<i>Nesokia indica</i>	Muridae	Rodentia	0.033	0.0017	-0.049
8	Long eared desert hedgehog	<i>Hemiechinus collaris</i>	Erinaceidae	Erinaceidomorpha	0.033	0.0017	-0.049
9	Asiatic jackal	<i>Canus aureus</i>	Canidae	Carnivora	0.033	0.0017	-0.049
10	Indian/Bengal fox	<i>Vulpes bengalensis</i>	Canidae	Carnivora	0.033	0.0017	-0.049
11	Small Indian mongoose	<i>Herpestes javanicus</i>	Herpestidae	Carnivora	0.066	0.0033	-0.078
12	Indian wild boar	<i>Sus scrofa</i>	Suidae	Artiodactyla	0.164	0.0083	-0.129
					1.00	0.0508	-0.972
Head Marala							
1	House shrew	<i>Suncus murinus</i>	Soricidae	Insectivora	0.045	0.0019	-0.060
2	Mediterranean pygmy shrew	<i>Suncus etruscus</i>	Soricidae	Insectivora	0.030	0.0012	-0.046
3	Desert hare	<i>Lepus migricollis dayanus</i>	Leporidae	Lagomorpha	0.060	0.0025	-0.073
4	Northern palm squirrel	<i>Funnambulus pennantii</i>	Sciuridae	Rodentia	0.463	0.0191	-0.155
5	Indian crested porcupine	<i>Hystrix cristatus</i>	Hystricidae	Rodentia	0.030	0.0012	-0.046
6	Soft-furred field rat	<i>Millardia meltada</i>	Muridae	Rodentia	0.015	0.0006	-0.027

7	House rat	<i>Rattus rattus</i>	Muridae	Rodentia	0.045	0.0019	-0.060
8	House mouse	<i>Mus musculus</i>	Muridae	Rodentia	0.030	0.0012	-0.046
9	Indian gerbil	<i>Tatera indica</i>	Muridae	Rodentia	0.030	0.0012	-0.046
10	Long eared desert hedgehog	<i>Hemiechinus collaris</i>	Erinaceidae	Erinaceidomorpha	0.030	0.0012	-0.046
11	Asiatic jackal	<i>Canus aureus</i>	Canidae	Carnivora	0.060	0.0025	-0.073
12	Indian/Bengal fox	<i>Vulpes bengalensis</i>	Canidae	Carnivora	0.015	0.0006	-0.027
13	Small Indian mongoose	<i>Herpestes javanicus</i>	Herpestidae	Carnivora	0.030	0.0012	-0.046
14	Indian wild boar	<i>Sus scrofa</i>	Suidae	Artiodactyla	0.119	0.0049	-0.110
					1.00	0.0414	-0.860

Table 2. Diversity, Richness, Evenness and Density of mammals of study area

Study area	Diversity	Richness	Evenness	Density
Head Marala	0.860	0.860	0.20446	0.0414
Head Khanki	0.972	0.972	0.39097	0.0508
Head Qadirabad	0.975	6.619	0.38026	0.0231

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