International Journal of Forest Sciences (2021). 1(1):1-11

Research Paper **Open Access**

Diversity and density of mammals in Chinji National Park, district Chakwal, Punjab, Pakistan

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SUMMARY

Pakistan characterized by a unique blend of bloomy and faunal variety of mammals. The main objectives of study is to know the diversity and density of mammalian species in the vicinity of Chinji National Park, district Chakwal, Punjab, Pakistan. The data were collected through "direct count method" and "indirect count method". Total of 22 species of mammals were recorded from Chinji National Park. From data analysis Shannon-Weiner diversity Index recorded was 0.91, Evenness 0.77 and Margalef Index was 5.31. It was found that dessert hare (*Lepus nigricollis*) and Asiatic jackal (*Canis aureus*) were the dominating species of the study area. During study, it was noted that mammalian species are continuously declining due to human interruption.

Keywords: Jackal, Evenness, Mammals, Hare

Citation: Kanwal, R., and S. Ashraf. 2021. Diversity and density of mammals in Chinji National Park, district Chakwal, Punjab, Pakistan. International Journal of Forest Sciences 1: 1-11.

INTRODUCTION

Pakistan has wide variety of flora and fauna, some parts of this country situated in three bio-geographic realms i.e. "Palearctic", "Oriental" and "Ethiopian". Large part of Pakistan is hilly and immediate changes in elevation provoke changes in biodiversity within small areas. Pakistan consists of 18 major geographical zones i.e. Alpine meadows, Balochistan Desert Scrub, Indus Plains, Sand dunes, Dry temperate coniferous forest, Himalayan moist temperate forest, Inundation Zones, Less, pronounced Monsoon influenced, Monsoon-influenced arid subtropical, Permanent snowfield and cold desert, Riverine tract Steppic forest in the intermediate latitude, in the Northern latitude, in the Southern latitude, Sub-alpine, scrub and birch forest, Tropical deciduous forest, littoral zone and Sub-tropical pine forest (Roberts, 1997).

Till now, more than 4763 species of mammals are documented in whole world (Molur, 2003). Out of total, more than 195 mammalian species are recorded in Pakistan (Roberts, 2005b, a). World has 18 mammalian orders. Pakistan is represented by the 10 out of total orders. The natural resources such as national parks, protected areas, natural forests and wetlands are good source to provide ecological balances as well as a source of earning for local people. On the other hand, national park is the protected area which is properly managed specially designed for the conservation and protection of wildlife (Haq, 2016). The major function of national

park is to conserve the wildlife. They provide shelter to various abandoned wildlife, conserve the threatened wildlife in their natural habitats. They provide environmental stability to an ecosystem (Alemu, 2016). Main of study is to know the diversity and density of mammalian species in the vicinity of Chinji National Park (CNP), district Chakwal, Punjab, Pakistan.

MATERIALS AND METHODS

This study was conducted in October 2017–July 2018 in surroundings areas of Chinji National Park, Chakwal. It is situated in salt range approximately 130 km from Islamabad. Total area of national Park is 6076 hectares and altitude is 680 meters (Figure 1).

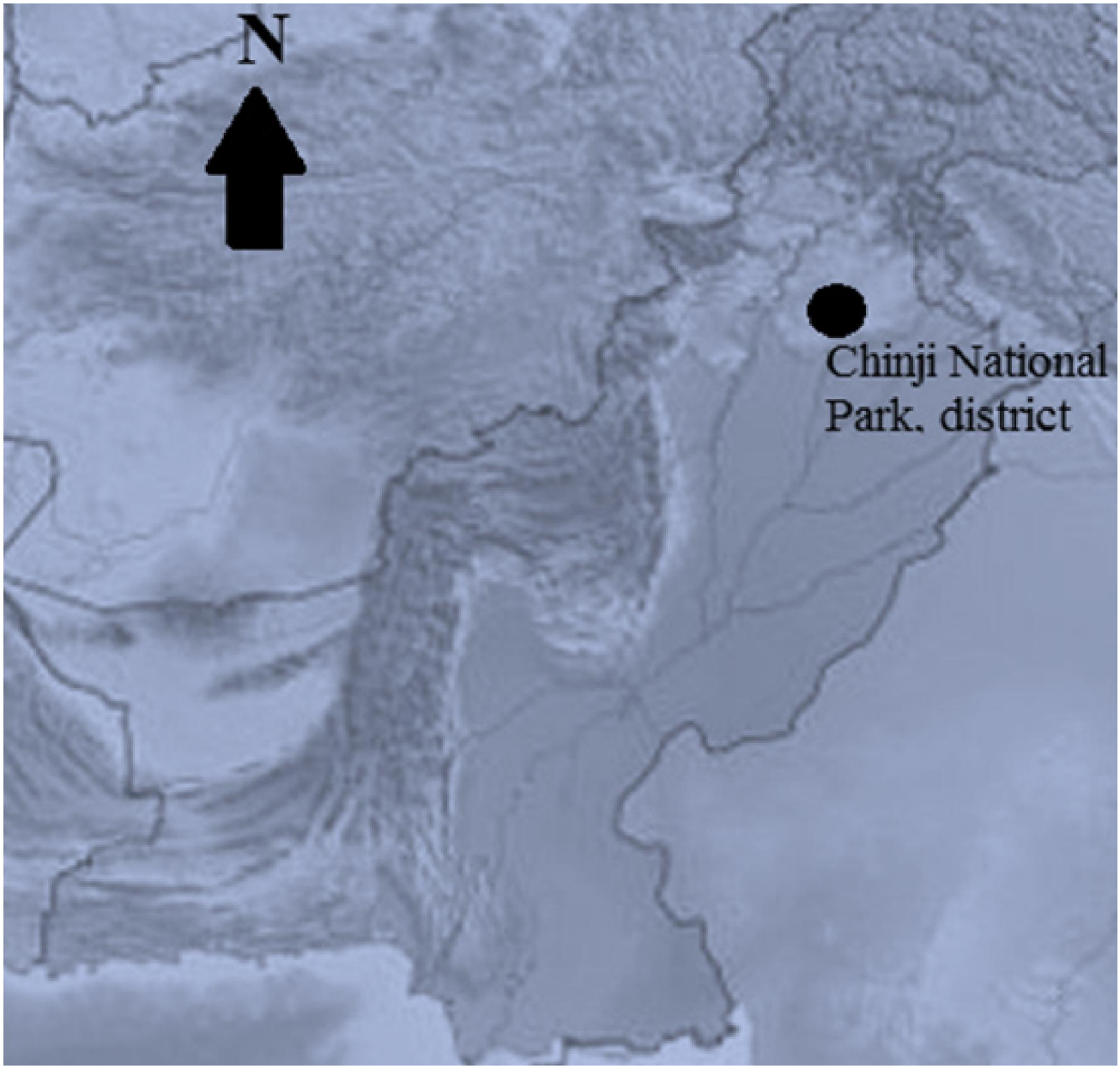

Figure 1: Map of study area.

Several villages are present in the vicinity of Chinji National Park like Chinji, Kotehra, Jhatla. People of this area are Punjabi, Pashtoon and Tribes. They earn their livelihood by Farming, Livestock farming, and Merchant.
In study area, average annual rain fall is 537, while the average minimum in January is 22^{o}C and average maximum temperature in the area is 27^{o}C in June. It is comprising of igneous, and sandstone rocks (Naeem *et al.,* 2000).

METHODOLOGY

The linear count method applied and mammalian diversity was assessed through direct and indirect counts. The "direct count method" viz. physical presence and voices while "indirect count method" viz. presence of nests, foot-prints, pug marks, fecal pellets, hair mounting and group questionnaire survey (Altaf, 2016; Haider and Altaf, 2018). Book (i.e. Mammals of Pakistan) is used for identification of mammalian species (Roberts, 2005b, a).

STATISTICAL ANALYSIS

"Shannon-Weiner diversity index" was used to know the mammalian diversity of CNP through the formula given below following (Shannon and Weaver, 1949). "Shannon-Weiner diversity index" is denoted by H'.

$$"H' = -[\Sigma Pi \ In \ Pi]"$$

Richness was calculated with given formula (Margalef, 1958).

$$"R= S-1/LogN"$$

Evenness was analyzed with formula given below (Pielou, 1966).

$$"E= H'/ln \ (S)"$$

Where, Pi = Proportion of the mammalian species "I" relative to the whole number of mammalian species, "InPi" = Natural logarithm of this proportion, "S"= Total number of mammalian species, "N" = Total number of individuals
Density is find out with following formula

$$D = T/A$$

"T" = Total number of individuals of specific species while "A"= total area.

RESULTS AND DISCUSSION

In study area, total 22 species belonging to 15 families (i.e. Erinaceidae, Soricidae, Muridae, Leporidae, Sciuridae, Hystricidae, Muridae, Mustelidae, Herpestidae, Manidae, Canidae, Felidae, Suidae, Bovidae and Viverridae) (Figure 2) and 6 orders (i.e. Eulipotyphyla, Rodentia, Carnivora, Pholidota, Artiodactyla and Lagomorpha) (Figure 3) were documented. Shannon Wiener Diversity Index for mammalian species in the vicinity of Chinji National Park was as 0.91 and species richness was 5.31 and Evenness index was as 0.77 in study area (Table 2).

During present study, dessert hare (*Lepus nigricollis*) was found as the most abundant species (R.A = 0.1536071) from Chinji National Park (Table 1). This species was previously reported Punjab (i.e. Dera Ghazi Khan, Multan, river Chenab, Jhelum, Indus), Sindh and Khyber Pakhtunkhwa (i.e. Mahban and Malka valley) (Roberts, 1997; Altaf *et al.,* 2014; Khan *et al.,* 2015; Akhtar *et al.,* 2018).

Brandt's hedgehog (*Hemiechinus hypomelas*) is documented form the study area with the relative abundance of 0.0132459 (Table 1). This species is only reported from Punjab, Sindh, Balochistan, and Khyber Pakhtunkhwa (Roberts, 1997; Ghalib *et al.,* 2007).

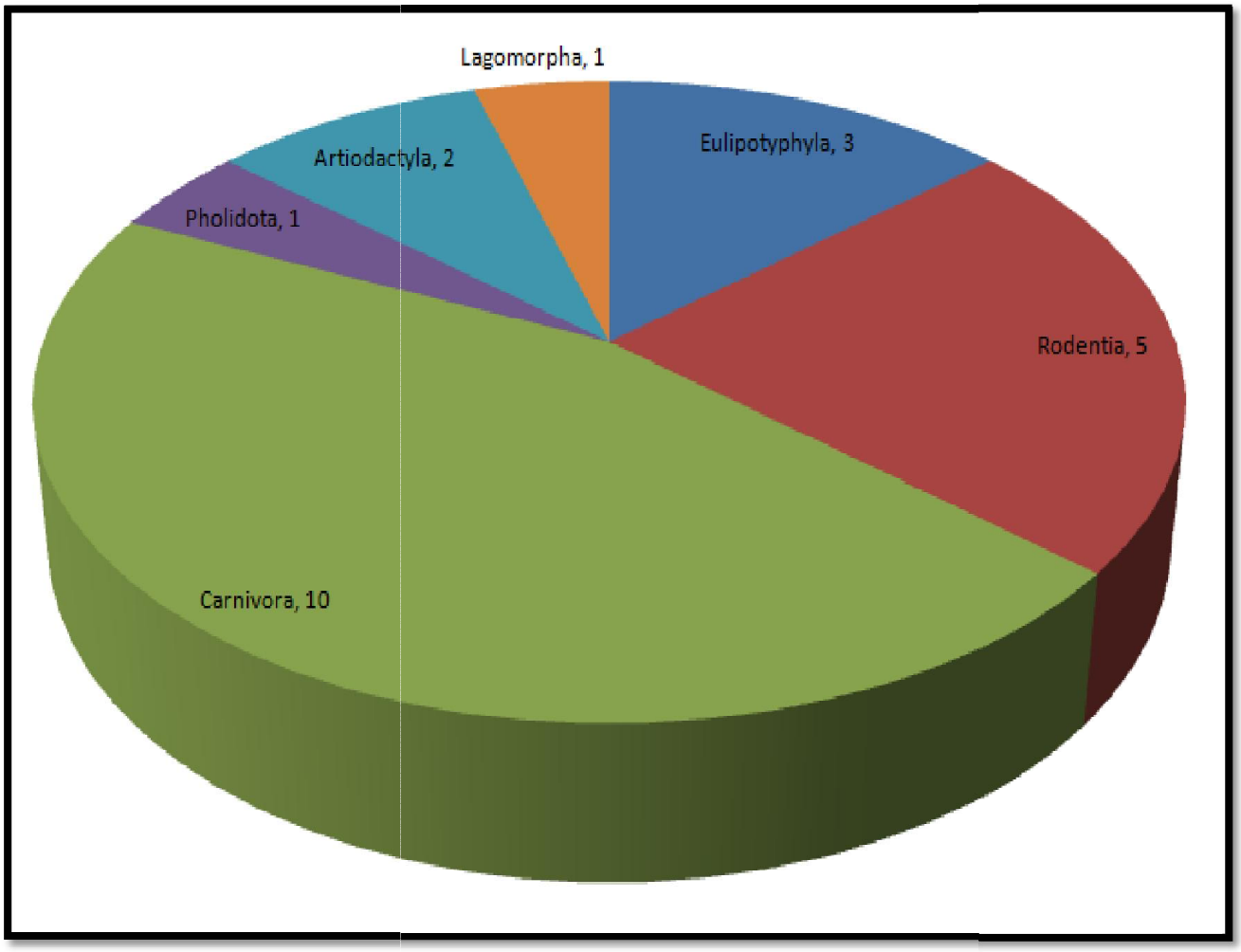

Figure 2: Orders of mammalians species of study area.

House shrew (*Suncus murinus*) is observed (relative abundance 0.0142047) from Chinji National Park (Table 1), this species is reported from Punjab, Sindh, Khyber Pakhtunkhwa (Roberts, 1997; Awan *et al.,* 2004; Rais *et al.,* 2011; Altaf *et al.,* 2014; Khan *et al.,* 2015).

Indian bush rat (*Golunda ellioti*) is seen in Chinji National Park and relative abundance (abbreviated as RA) is 0.0057676 (Table 1). This species is reported from Punjab, Sindh, Balochistan, and Khyber Pakhtunkhwa (Roberts, 1997).

Northern palm squirrel (*Funambulus pennanti*) is present in the study area with relative abundance of 0.0671825 (Table 1). This species is previously reported from Punjab, Sindh, Balochistan, and Khyber Pakhtunkhwa (Roberts, 1997; Rais *et al.,* 2011; Altaf *et al.,* 2012; Altaf *et al.,* 2014; Khan *et al.,* 2015).

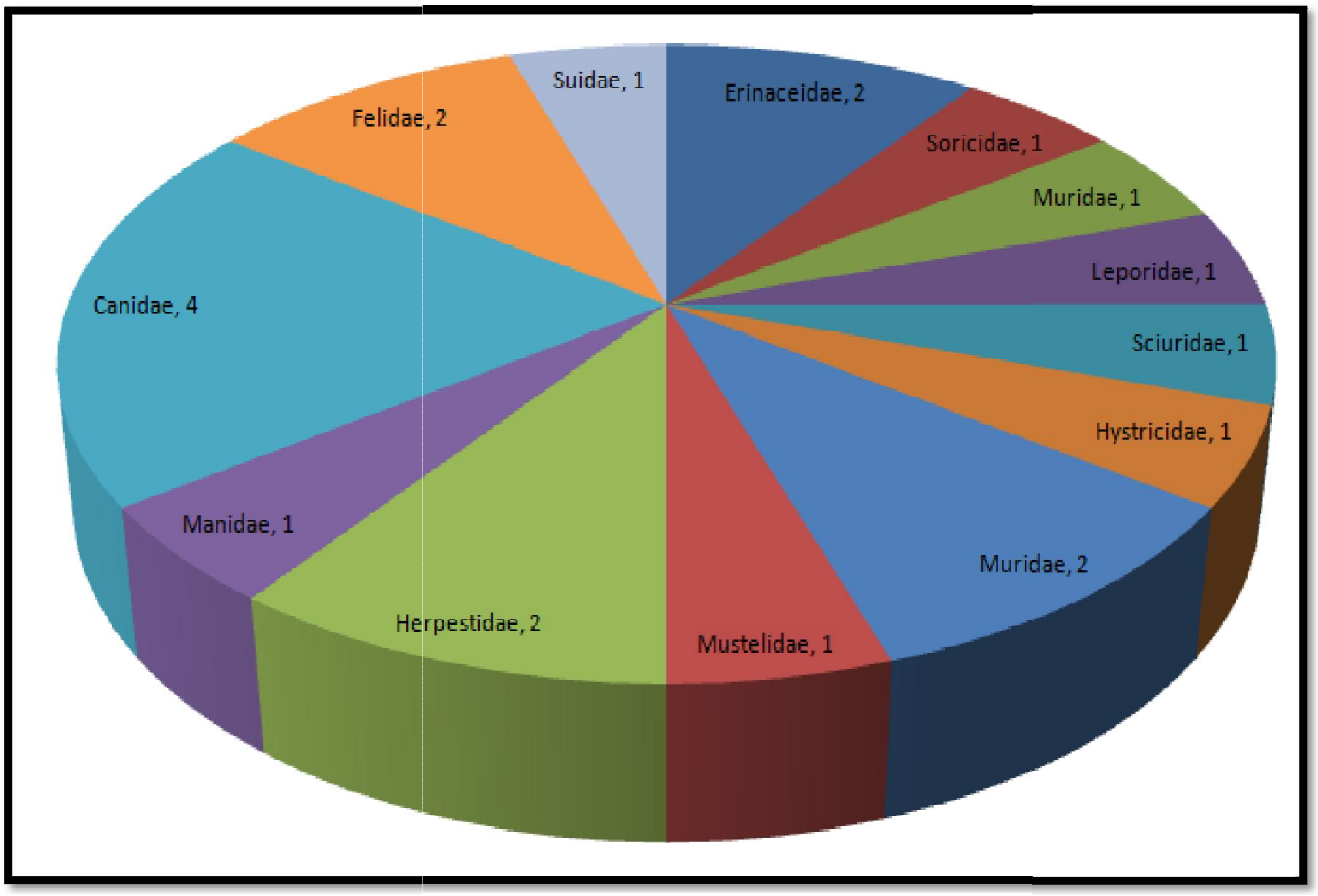

Figure 3: Families of mammalians species of study area.

Yellow throated marten (*Martis flavigula*) is present in the study area and relative abundance is 0.0032096 (Table 1). This species is previously reported from Punjab, Sindh, Gilgit Baltistan and Azad Jammu and Kashmir (Roberts, 1997).

Presence of Indian pangolin (*Manis crassicaudata*) is also noted from the study area with relative abundance of 0.0132459 (Table 1). This species is previously reported in Punjab, Sindh and Azad Jammu and Kashmir (Roberts, 1997; Khan *et al.,* 2015; Iftkhar *et al.,* 2018).

Indian fox (*Vulpes bengalensis*) is also noted from the study area with the relative abundance of 0.0122657 (Table 1). This species is previously reported from Punjab and Sindh (Roberts, 1997; Altaf, 2016).

Red fox (*Vulpes vulpes*) and Indian wolf (Canis lupus) are also reported from the study area. The relative abundance of both species are same i.e. 0.0032096 (Table 1). Red fox is previously documented from Punjab, Sindh, Balochistan, and Khyber Pakhtunkhwa (Roberts, 1997; Akhtar *et al.,* 2018; Azad *et al.,* 2018) and Indian wolf is previously documented from Punjab, Sindh, Balochistan, KPK and AJK (Roberts, 1997).

Small Indian civet (*Viverricula indica*) is present in the study area with 0.0069473 RA (Table 1). This species is reported from Punjab, Sindh and Azad Jammu and Kashmir (Roberts, 1997; Altaf, 2017).

Present survey revealed that long eared dessert hedgehog *Hemiechinus collaris* is reported from the study area with relative abundance was as 0.0169692 (Table 1). This species is previously reported from Punjab, Sindh, Khyber Pakhtunkhwa and Azad Jammu and Kashmir (Roberts, 1997; Altaf *et al.,* 2017).

Hystrix indica is also noted from the study area with the relative abundance of 0.0716413 (Table 1). This species was previously reported from Punjab, Sindh, Balochistan, Khyber Pakhtunkhwa and Azad Jammu and Kashmir (Roberts, 1997; Maan and Chaudhry, 2001; Rais *et al.,* 2011; Altaf *et al.,* 2014; Khan *et al.,* 2015; Iqbal *et al.,* 2018; Safeer *et al.,* 2018; Rasheed *et al.,* 2020).

House rat (*Rattus rattus*) is present in the study area with 0.0290516 RA (Table 1). This species is reported from Punjab, Sindh, Balochistan, Khyber Pakhtunkhwa (Roberts, 1997; Altaf *et al.,* 2012; Altaf *et al.,* 2014; Iqbal *et al.,* 2018).

House mouse (*Mus musculus*) is present in the study area with relative abundance of 0.0297811 (Table 1). This species is previously reported from whole Pakistan (Roberts, 1997; Rais *et al.,* 2011; Altaf *et al.,* 2012; Altaf *et al.,* 2014; Iqbal *et al.,* 2018; Manzoor *et al.,* 2018).

Indian grey mongoose and small Indian mongoose are present in present study area with relative abundance of 0.0312176 and 0.1379383 respectively (Table 1). Indian grey mongoose is previously reported from (Roberts, 1997; Ghalib *et al.,* 2007; Rais *et al.,* 2011; Khan *et al.,* 2015; Iqbal *et al.,* 2018) and small Indian mongoose is previously reported from (Roberts, 1997; Ghalib *et al.,* 2007; Altaf *et al.,* 2012; Altaf *et al.,* 2014; Khan *et al.,* 2015; Altaf *et al.,* 2018).

Asiatic jackal (*Canis aureus*), jungle cat (*Felis chaus*), Indian dessert cat (*Felis silvestris ornate*) and Indian wild boar (*Sus scrofa*) are present in the study area with relative abundance of 0.1443558, 0.0102321, 0.0229081 and 0.1067732 respectively (Table 1). Asiatic jackal is previously reported in whole Pakistan (Roberts, 1997; Ghalib *et al.,* 2007; Rais *et al.,* 2011; Altaf *et al.,* 2014; Khan *et al.,* 2015; Iqbal *et al.,* 2018; Younus *et al.,* 2018; Rasheed *et al.,* 2020). Jungle cat is previously reported from Punjab, Sindh, Khyber Pakhtunkhwa and Balochistan (Roberts, 1997; Rais *et al.,* 2011; Khan *et al.,* 2015). Indian dessert cat is previously reported from Punjab (i.e. salt range, river Ravi) and Sindh (i.e. Tharparkar, Dadu and Larkana) (Roberts, 1997; Rais *et al.,* 2011; Khan *et al.,* 2015). Indian wild boar is previously reported from Punjab, Sindh, Khyber Pakhtunkhwa and Azad Jammu and Kashmir (Roberts, 1997; Rais *et al.,* 2011; Altaf *et al.,* 2014; Chughtai *et al.,* 2018; Rasheed *et al.,* 2020).

Punjab Urial (*Ovis vignei punjabensis*) is present in the study area with relative abundance of 0.0091727 (Table 1). This species is previously reported from Punjab (Roberts, 1997; Maan and Chaudhry, 2001; Ghalib *et al.,* 2007).

CONCLUSION

The mammalian species are facing threat from anthropogenic impacts viz. intense urban, agriculture and industrial development. Likewise, folklore medicinal uses of mammalian species, illegal hunting, and led many species to extinction.

ACKNOWLEDGEMENT

Authors are thankful for the cooperation of local community.

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Table 1: Diversity of the Mammals of Chinji National Park, district Chakwal, Pakistan.

Sr.	Scientific Name Common Name Order Family	Relative Abundance	Density	Reported Area	Reference
1	*Hemiechinus collaris* (Gray, 1830) Long eared dessert hedgehog Eulipotyphyla Erinaceidae	0.0169692	0.0025	Punjab, Sindh, Khyber Pakhtunkhwa and Azad Jammu and Kashmir	(Roberts, 1997; Altaf *et al.,* 2017)
2	*Hemiechinus hypomelas* (Brandt, 1836) Brand's hedgehog Jha, Kandella Eulipotyphyla Erinaceidae	0.0132459	0.0018	Punjab, Sindh, Balochistan, and Khyber Pakhtunkhwa	(Roberts, 1997; Ghalib *et al.,* 2007)
3	*Suncus murinus* (Linnaeus, 1758)	0.0142047	0.0020	Punjab, Sindh, Khyber	(Roberts, 1997; Awan *et al.,* 2004;

	House shrew Eulipotyphyla Soricidae			Pakhtunkhwa	Rais *et al.,* 2011; Altaf *et al.,* 2014; Khan *et al.,* 2015)
4	*Golunda ellioti* (Gray, 1837) Indian bush rat Rodentia Muridae	0.0057676	0.0007	Punjab, Sindh, Balochistan, and Khyber Pakhtunkhwa	(Roberts, 1997)
5	*Lepus nigricollis* (Cuvier, 1832) Desert Hare Lagomorpha Leporidae	0.1536071	0.0823	Punjab (i.e. Dera Ghazi Khan, Multan, river Chenab, Jhelum, Indus), Sindh and Khyber Pakhtunkhwa (i.e. Mahban and Malka valley)	(Roberts, 1997; Altaf *et al.,* 2014; Khan *et al.,* 2015; Akhtar *et al.,* 2018)
6	*Funambulus pennanti* (Wroughton, 1905) Northern palm squirrel Rodentia Sciuridae	0.0671825	0.0160	Punjab, Sindh, Balochistan, and Khyber Pakhtunkhwa	(Roberts, 1997; Rais *et al.,* 2011; Altaf *et al.,* 2012; Altaf *et al.,* 2014; Khan *et al.,* 2015)
7	*Hystrix indica* (Kerr, 1792) Indian crested porcupine Rodentia Hystricidae	0.0716413	0.0176	Punjab, Sindh, Balochistan, Khyber Pakhtunkhwa and Azad Jammu and Kashmir	(Roberts, 1997; Maan and Chaudhry, 2001; Rais *et al.,* 2011; Altaf *et al.,* 2014; Khan *et al.,* 2015; Iqbal *et al.,* 2018; Safeer *et al.,* 2018; Rasheed *et al.,* 2020)
8	*Rattus rattus* (Linnaeus, 1758) House rat Rodentia Muridae	0.0290516	0.0049	Punjab, Sindh, Balochistan, Khyber Pakhtunkhwa	(Roberts, 1997; Altaf *et al.,* 2012; Altaf *et al.,* 2014; Iqbal *et al.,* 2018)
9	*Mus musculus* (Linnaeus,1758) House mouse Rodentia Muridae	0.0297811	0.0051	All Pakistan	(Roberts, 1997; Rais *et al.,* 2011; Altaf *et al.,* 2012; Altaf *et al.,* 2014; Iqbal *et al.,* 2018; Manzoor *et al.,* 2018)
10	*Martis flavigula* (Boddaert, 1785)	0.0032096	0.0003	Punjab, Sindh, Gilgit Baltistan	(Roberts, 1997)

	Yellow throated Marten Carnivora Mustelidae			and Azad Jammu and Kashmir	
11	*Herpestes edwardsii* (É. Geoffroy Saint-Hilaire, 1818) Indian grey mongoose Carnivora Herpestidae	0.0312176	0.0054	Punjab, Sindh, Balochistan, and Khyber Pakhtunkhwa	(Roberts, 1997; Ghalib *et al.,* 2007; Rais *et al.,* 2011; Khan *et al.,* 2015; Iqbal *et al.,* 2018)
12	*Herpestes javanicus* (Hodgson, 1836) Small Indian mongoose Carnivora Herpestidae	0.1379383	0.0588	Punjab, Sindh, Balochistan and Azad Jammu and Kashmir	(Roberts, 1997; Ghalib *et al.,* 2007; Altaf *et al.,* 2012; Altaf *et al.,* 2014; Khan *et al.,* 2015; Altaf *et al.,* 2018)
13	*Manis crassicaudata* (Linnaeus, 1803) Indian pangolin Salla Pholidota Manidae	0.0132459	0.0018	Punjab, Sindh and Azad Jammu and Kashmir	(Roberts, 1997; Khan *et al.,* 2015; Iftkhar *et al.,* 2018)
14	*Canis aureus* (Linnaeus, 1758) Asiatic jackal Carnivora Canidae	0.1443558	0.0665	All Pakistan	(Roberts, 1997; Ghalib *et al.,* 2007; Rais *et al.,* 2011; Altaf *et al.,* 2014; Khan *et al.,* 2015; Iqbal *et al.,* 2018; Younus *et al.,* 2018; Rasheed *et al.,* 2020)
15	*Vulpes bengalensis* (Shaw,1800) Indian fox Carnivora Canidae	0.0122657	0.0016	Punjab and Sindh	(Roberts, 1997; Altaf, 2016)
16	*Vulpes vulpes* (Linnaeus, 1758) Red fox Carnivora Canidae	0.0032096	0.0003	Punjab, Sindh, Balochistan, and Khyber Pakhtunkhwa	(Roberts, 1997; Akhtar *et al.,* 2018; Azad *et al.,* 2018)
17	*Canis lupus* (Linnaeus, 1758) Indian wolf Carnivora	0.0032096	0.0003	Punjab, Sindh, Balochistan, Khyber Pakhtunkhwa and	(Roberts, 1997)

	Canidae			Azad Jammu and Kashmir	
18	*Felis chaus* (Schreber, 1777) Jungle cat Carnivora Felidae	0.0102321	0.0013	Punjab, Sindh, Khyber Pakhtunkhwa and Balochistan	(Roberts, 1997; Rais *et al.,* 2011; Khan *et al.,* 2015)
19	*Felis silvestris ornate* (Schreber, 1777) Indian dessert cat Carnivora Felidae	0.0229081	0.0036	Punjab (i.e. salt range, river Ravi) and Sindh (i.e. Tharparkar, Dadu and Larkana)	(Roberts, 1997; Rais *et al.,* 2011; Khan *et al.,* 2015)
20	*Sus scrofa* (Linnaeus, 1758) Indian wild boar Artiodactyla Suidae	0.1067732	0.0342	Punjab, Sindh, Khyber Pakhtunkhwa and Azad Jammu and Kashmir	(Roberts, 1997; Rais *et al.,* 2011; Altaf *et al.,* 2014; Chughtai *et al.,* 2018; Rasheed *et al.,* 2020)
21	*Ovis vignei punjabensis* (Lydekker, 1913), Punjab Urial Artiodactyla Bovidae	0.0091727	0.0012	Punjab	(Roberts, 1997; Maan and Chaudhry, 2001; Ghalib *et al.,* 2007)
22	*Viverricula indica* (E. Geoffroy,1803) Small Indian civet Carnivora Viverridae	0.0069473	0.0008	Punjab, Sindh and Azad Jammu and Kashmir	(Roberts, 1997; Altaf, 2017)

Table 2: Diversity indices for mammalian diversity of study area.

Diversity Indices	**Values**
Shannon-Wiener Diversity Index (H´) = -[ΣPi In Pi]"	0.91
Evenness = H'/ Logn S	0.77
Richness = (R)/logn N	5.31
Density (D) = Number species species/total area	0.31