



Abundant Distribution of Little Indian Field Mouse, *Mus booduga*, in the Wetlands of Salt Range, Punjab, Pakistan

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ABSTRACT

We studied the abundance and population structure of Little Indian field mouse, *Mus booduga*, at five lakes in the Salt Range, Punjab, Pakistan. The trapping data of 375 trap nights indicated highest abundance of *Mus booduga* (no = 132), out of 141 small mammals trapped. Majority of the *Mus booduga* specimens were adults (56.06%) while the juvenile/sub-adults were 43.94% of the total specimens trapped. The highest trap success of *Mus booduga* of 74% was achieved at Namal Lake, followed by Khabeki (38.67%), Uchali (30.67%), Kallar Kahar (16%) and the lowest at Jahlar Lake (12%). The results of the present study indicated that distribution of *Mus booduga* was abundant in thorn-scrub habitat around five lakes in the Salt Range.

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Authors' Contributions

AAK conceived and designed the study, and wrote the manuscript. AAK, WAK and WAK participated in the field work. NHK provided field support and logistics.

Key words

Small mammals, Thorn-scrub habitat, Wetlands of salt range.

INTRODUCTION

The diversity of small mammals, particularly the rodent species of Muridae family, is remarkable in Pakistan (Akhtar, 1958-60; Ellerman, 1961; Siddiqi, 1961, 1969; Taber *et al.*, 1967; Ahmad and Ghalib, 1979; Roberts, 1997; Woods and Kilpartick, 1997). Rodents occupy a wide range of crop lands, natural habitats, including deserts, range lands and forests. They often represent a significant amount of the animal biomass in scrub forests and other natural habitats and provide ecosystem services. The high diversity of rodent species in any ecosystem provides an opportunity to identify them and study their populations. These activities may indicate whether the ecosystem is in poor condition (degraded landscape) or in good shape (sustainable productivity). Rodent species which indicate such conditions are known as indicator species. Therefore, rodents particularly belonging to *Mus* spp. are to be considered as better indicators of environmental health at a local to ecozone level.

In Pakistan, the current level of information reflects the uneven knowledge of small rodent mammals in different ecological zones of the country. The majority of rodent

species are considered as pests of agricultural crops, range lands and forests (Khan, 2012) and not as being considered worthy of conservation except few species of Jarbos (*Salpingotus michaelis* and *Allactaga elator*) and crestless Himalayan porcupine, *Hystrix hodgsoni*. Very little knowledge is available on small rodent mammals inhabiting thorn scrub vegetation, natural forests, intermountainous ecozones, range and desert lands of Pakistan (Roberts, 1997; Mirza, 1969). Woods and Kilpatrick (1997) provided a comprehensive account of small mammals of northern mountains of Pakistan. Recently, Awan and Akbar (2012) documented animal and vegetation diversity of Salt Range.

Species of the genus *Mus* have been studied by Hussain *et al.* (1975), Rana and Beg (1976) and Khokhar (1983). Research based studies in croplands have provided an excellent account on small rodent mammals (Mann, 1969; Khokhar, 1981; Fulk *et al.*, 1981; Rana and Beg, 1976; Beg and Khan, 1984; Hussain *et al.*, 1992, 2002, 2003). Rana (1991) studied the biology and taxonomic status of little Indian field mouse, *Mus booduga*, in four districts of Punjab, covering both croplands and con-crop areas. *M. booduga* have not been recorded from alkaline tracts, farm houses and from the natural vegetation belts (Rana, 1991). Prakash (1975) recorded this species from the ruderal habitat as well as from the crop fields. In this study, data on its abundance and population structure were

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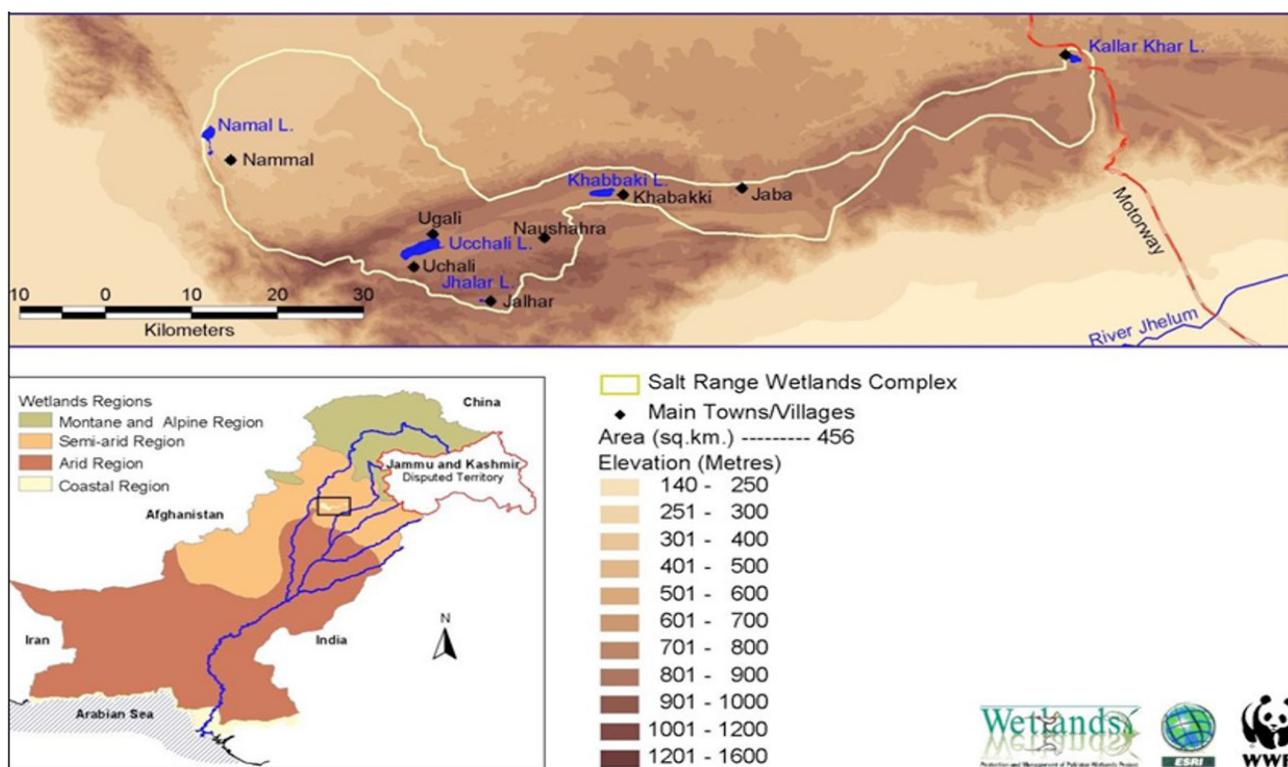


Fig. 1. Locations of five lakes in the Salt Range, Punjab.

gathered. The results of the present study on *M. booduga*, conducted in the five wetlands of Salt Range will add further knowledge on small rodent mammals of Pakistan.

MATERIALS AND METHODS

Study sites

Five lakes, Kallar Kahar, Khabeki, Uchali, Jhalhar and Namal (Fig. 1) were sampled from June 03 to 12, 2011 to assess small rodent mammal's populations, abundance and richness of species in the Salt Range. Salt Range is the last out-riders and the first uplifts of the Himalayas, commonly known as Siwaliks.

Uchali Wetland Complex is famous for having a group of three lakes (Khabeki, Uchali and Jhalhar) and are 700-980 m above sea level. The complex is located in the Soan Valley, district Khushab, in the middle of the Salt Range between Indus and Jhelum rivers at 32° 29' to 32° 37' N latitude and 72° to 72° 15' E longitude. The total water surface area of the complex is about 1,243 hectares. The three lakes have been declared as wildlife sanctuaries and designated as a Ramsar site of international importance. These lakes provide habitat to a wide variety of wintering waterfowls including species of concern such as white-headed duck (*Oxyura leucocephala*), ferruginous duck

(*Aythya nyroca*), greylag goose (*Anser anser*) and greater flamingo (*Phoenicopterus ruber*).

The Soan Valley, the home of these lakes is an arid, sub-tropical zone, characterized by rocky and hilly areas and covered with thorn scrub vegetation. The natural vegetation of the area mainly consists of Phulai (*Acacia modesta*), Kareer (*Capparis aphylla*) and Kahu (*Olea ferruginea*). Another dominating species is *Gymnosporia royleana*, commonly known as Pataki. In addition to the tree and shrubs of *Ziziphus nummularia* (Jharber) and *Z. mauritiana* (Ber) are common species of the Salt Range. *Cymbopogon jwarancusa* (Khavi grass), *Cynodon dactylon* (Dub), *Desmostachya bipinnata* (Kusa), *Typha elephantine* (Elephant grass) and *Echinochloa colona* (Sanwak) are common grasses found in the area. The cultivated flora in the agriculture lands include *A. nilotica* (Kikar), *Eucalyptus* spp. (Red gum), *Melia azaderach* (Bakain), *Dalbergia sissoo* (Shisham) and *Morus alba* (Shahtut).

The Kallar Kahar Lake is a small brackish water body, with an area of 85 ha. The lake is located in Chakwal district at a distance of 25 km north of Chakwal city; 135 km from Rawalpindi via Chakwal road where as 100 km from Islamabad by Motorway. It is located between 32° 46' to 30° 31' N latitude and 72° 42' to 73° 00' E longitude

at an altitude of 554 m above sea level. Khabeki lake is a shallow brackish lake of approximately 283 ha situated 10 km northeast of Naushera town and 38 km northwest of Khushab city between 32° 37' N latitude and 72° 14' E longitude. Jhalar lake is a small brackish to saline lake of 17 ha, situated 10 km southeast of Uchali lake and 10 km southwest of Naushera town, between 32° 29' N latitude and 72° 07' E longitude. The Uchali is brackish to saline lake and the largest lake (943 ha) and almost entirely surrounded by agricultural lands. It is situated 13 km west of Naushera town and 42 km northwest of Khushab city, between 32° 33' N latitude and 72° 01' E longitude. The Namal Lake (32° 41' N latitude and 71° 49' E longitude) is a special type of wetland in the Salt Range. It is a shallow brackish lake, partly impounded by a dam in one corner. It lies at an approximately distance of 30 km north-east of Mianwali city. Its total surface area is 486 ha and lies at an altitude of 532 m above sea level.

Traps and trapping

H.B. Sherman collapsible rat and mouse traps were used to capture live animals. In majority of the cases trap lines were selected 200-300 m away from the water line of the lakes. At each lake 2-3 trap lines were operated. Between the trap lines a distance of 150-200 m was kept. On each trap line 25 traps were set about 10 m apart. The traps were set one hour before sunset and trapped animals were collected next morning (0530-0600 h). Altogether, 15 trap lines were established at five lakes. Before the placement of traps, a piece of sweet melon was used as fresh bait in each trap. The collected live specimens were transferred in a transparent polythene bag for identification and recording weight nearest to 0.1 g. After recording necessary data, the captured animals were set free in the

same habitat from where they were trapped. After every two trap nights, the traps were washed before using again.

Raw trap success (no. of rats/trap nights) x 100, was adjusted using equation of [Caughley \(1977\)](#) as follows:

$$\text{Adjusted Trap Success (ATS)} = \ln \frac{1 - \text{Animal caught}}{\text{Number of traps}} \times (-100)$$

RESULT AND DISCUSSION

The trapping data of five lakes are presented in [Table I](#) which indicated high abundance of little Indian field mouse (*M. booduga*), followed by house or musk shrew (*Suncus murinus*), house mice (*Mus musculus*) and house rat (*Rattus rattus*). Altogether, three species of small rodent mammals and one insectivore were captured. Out of 141 small mammals trapped 49.14% were males and 51% females, while 57.45% were adults and 42.55% were juvenile/sub-adults. Juvenile population contained 38.33% males and 61.67% females. Among the adult population 56.79 % were males and 43.20% females. The trapping data also indicated that females were frequently trapped than males. The maximum (40%) males were trapped from Namal lake area, while maximum females were captured from the surroundings of Khabeki Lake. Among the trapped animals (no=141), *M. booduga* ranked highest in number (no=132), followed by *S. murinus* (no = 05), *M. musculus* (no = 03) and *R. rattus* (no = 01). Majority of the *M. booduga* specimens were adults (56.06%) while juvenile/sub adults were 43.94%. Females comprised 50.76% while males were 49.24% of the total specimens trapped. In the present study the proportion of juvenile/sub-adults of *M. booduga* was the highest so far record of the species in any eco-zone of the country and elsewhere

Table I.- Population structure of trapped small rodent mammals including shrews.

Location	Species	Adult Males	Adult Females	Sub-adult/ Juvenile Males	Sub-adult/ Juvenile Females	Male/ Female Ratio	Total
Khabeki	<i>Mus booduga</i>	14	16	10	18	0.41:0.59	58
Khabeki	<i>Suncus murinus</i>	1	2	--	--	0.33:0.67	03
Uchali	<i>M. booduga</i>	7	3	7	6	0.62:0.38	23
Uchali	<i>Mus musculus</i>	1	--	1	1	0.67:0.33	03
Jhalar	<i>M. booduga</i>	1	--	1	4	0.33:0.67	06
Namal	<i>M. booduga</i>	16	10	4	7	0.54:0.46	37
Kallar kahar	<i>M. booduga</i>	5	2	--	1	0.63:0.37	08
	<i>S. murinus</i>	1	1	--	--	1:1	02
	<i>Rattus rattus</i>	--	1	--	--	--	01
Total of 05 Lakes	04 Species	46	35	23	37	--	141

in India. In the crop and non-crop lands of central Punjab, Rana (1991) recorded proportion of young *M. booduga* which varied from 8 to 12%.

Table II.- Trap success of little Indian field mouse, *Mus booduga*, trapped from the surroundings of five lakes of salt range.

Location / Lake	No. of traps	No. of trap nights	No. trapped	Trap success(%)	ATS* (%)
Khabeki	50	150	58	38.67	48.94
Uchali	25	75	23	30.67	36.67
Jhalar	50	50	06	12.00	12.78
Namal	50	50	37	74.00	134.71
Kallar Kahar	50	50	08	16.00	17.43

*Adjusted trap success.

Trap success data of little Indian field mouse, *M. booduga*, at five lakes are summarized in Table II. This is a cumulative data of 15 traplines and 375 trap nights. The highest trap success of 74% was achieved at Namal Lake followed by Khabeki (38.67%), Uchali (30.67%), Kallar Kahar (16.0%) and the lowest at Jahlar (12.0%). Abundance of *M. booduga* at Namal Lake was the highest while it was lowest at Jahlar. Based upon over 1130 trap nights, Hussain *et al.* (1975) record trap success of 2.37% for *M. booduga* in winter and 4.57 % in summer in the croplands of district Faisalabad. This study indicated that *M. booduga* was less plentiful in croplands than that of the results of the present study conducted in scrub lands of Salt Range. The trap success of any animal species in a specific habitat is the most important indicator of abundance of particular species. Generally, trap success of 10% or more indicate high rodent population of any species. However, relative estimates of abundance through trap success do not give absolute value for population size at any location or between time periods. In such cases, every time an animal is caught, there is one trap fewer available to make more capture. Therefore, the raw trap success was adjusted (Caughley, 1976) to reflect a simple frequency-density relationship of both sexes of *M. booduga*. The age classes by weight were determined as: 6-10 g (juvenile/sub-adults); 11-15 g (adult) and 16-20 g (matured/old). Only one male weighing 5 g was trapped. Age classes of *M. booduga* specimen are presented in Figure 2. In all age classes the mean weight of individuals did not differ significantly. The maximum weight of an individual of both sexes was 20.0 g. Only two specimens (one ♂ and one ♀) were captured having this weight class. The mean weight of old/matured males was 16.57 ± 1.55 g, while for

females it averaged 17.2 ± 1.69 g. The mean weights of both sexes of juvenile/sub-adults and adults were 7.94 ± 1.39 g and 12.85 ± 1.36 g, respectively. Male-female sex ratio of *M. booduga* varied from 0.33:0.67 to 0.67:0.33. In the study of Rana (1991) the sex ratio varied from 1:1.38 to 1:0.45. The population structure and age classes recorded in this study indicated that *M. booduga* breeds throughout the year in the Salt Range. This confirmed the findings of Roberts (1997) and Rana (1991).

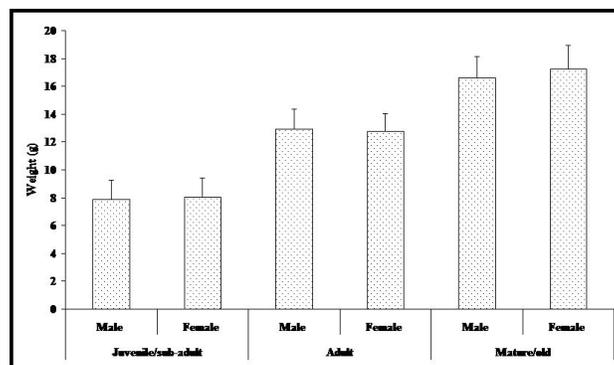


Fig. 2. Age classes of *Mus booduga* individuals by weight (n = 132)

CONCLUSION

The diversity of small rodent mammal species was remarkable in Salt Range wetlands. Among the trapped specimens, *M. booduga* was the most abundant and its population was almost evenly distributed in the five lakes area except Jahlar. Previous reports from Pakistan and India show that this species is found in irrigated croplands as compared to habitats with natural vegetation. This is for the first time that *M. booduga* has been recorded in abundance from the thorn-scrub lands of Salt Range. This species does not depend on human habitation like *M. musculus*. It prefers to live in patches of tropical thorn-scrub and also on the edges of the cultivated fields. In this study, all specimens of *M. booduga* were trapped from such habitats. The most important feature of the present study was the recording of high density population of *M. booduga* in the Salt Range with 74% trap success in Namal Lake area.

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Statement of conflicts of interest

Authors claim no conflicts of interest for this research.

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