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DISTRIBUTION, FOOD AND HABITAT PREFERENCES OF SMALL MAMMALS IN MACHIARA NATIONAL PARK, DISTRICT MUZAFFARABAD, AZAD KASHMIR, PAKISTAN

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Abstract: First detailed study in Machiara National Park was conducted from April 2003 to August 2003 to determine distribution, food and habitat preferences of small mammals. During this study nineteen species of small mammals, representing five orders, eleven families and eighteen genera, were recorded. Among these six species (*Vulpes vulpes, Prionailurus bengalensis, Paguma larvata, Martes flavigula, Mustela erminea and Herpestes javanicus*) were carnivores, nine (*Hystrix indica, Petaurista petaurista, Hylopetes fimbriatus, Rattus rattus, Rattus turkestanicus, Apodemus rusiges, Mus musculus, Alticola roylei and Hyperacrius wynnei*) were rodents, and two (*Lepus capensis and Ochotona roylei*) were lagomorphs. House shrew (*Suncus murinus*) and Horseshoe bat (*Rhinolophus ferrumequinum*) represented the orders insectivora and chiroptera, respectively. The other species like *Martes flavigula, Suncus murinus, Rattus turkestanicus, Apodemus rusiges* and *Alticola roylei*, were uncommon. Similarly, *Paguma larvata, Hylopetes fimbriatus, Lepus capensis* and *Ochotona roylei* were considered as vulnerable species in this area. *Vulpes vulpes, Hystrix indica, Rattus rattus, Mus musculus, Hyperacrius wynnei* and *Rhinophus ferrumequinum* were common and widely distributed species. These mammals were studied and trapped from different major habitats including villages (houses and agriculture lands), mixed temperate forests, sub alpine scrub forests and alpine meadows and their food habit was also determined in different localities. Human related activities inside the Park area, were the major threats to the small mammals of study area.

Key words: Machiara National Park, small mammals, forests.

INTRODUCTION

The State of Azad Jammu and Kashmir is located in the lower hills of Himalayas. It lies between 73°-24′E to 73°-75′E longitude and 33°-36′N to 35°-07′N latitude in the Sub-continent. The territory of the State is encircled from the north by Northern Areas, from the west by North West Frontier Province (NWFP), from the south by the Punjab and from the east by the Line of Control (Anonymous, 1996). It covers an area of 5,134 sq. miles (13,297sq.kilometers; 1,229,729 hectares). Elevation

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from sea level ranges from 902 feet in the south (Manawar) to 20750 feet in the north (Shonter top) (Anonymous, 2002).

Woods and Kilpatrick (1997) and other authors have described the biodiversity of small mammals in the mountain ranges of Pakistan. They have discussed the distribution of these animals in the Northern Areas which are similar (in climatic conditions, vegetations and topography) to the Muzaffarabad, Azad Jammu and Kashmir. They include Murree Hills, Kaghan Valley and adjacent area.

Red Fox *(Vulpes vulpes griffithi)* occurs throughout the Northern hemisphere (Ables, 1975), in Himalayas, Africa, northern and western areas of Pakistan including mountains and intermountainous valleys of Bluchistan, North West Frontier Province (NWFP) and Himalayas (Woods *et al.,* 1997; Roberts, 1997; Farooq and Ghalib, 1979), usually found in close association with human population (Roberts, 1997). Leopard Cat *(Prionailurus bengalensis)* is a globally endangered species and is distributed all over the Southern and Central Asia (Prater, 1965), some parts of Pakistan and Northern Areas including Azad Kashmir (Roberts, 1997 and Farooq and Ghalib, 1979), inhabiting Himalayan moist temperate forests (Roberts, 1997). Yellow Throated Marten *(Martes flavigula)* is found in India, Nepal, Bangladesh, Bhutan, Burma, South China, Malaysia, Taiwan, Korea and Eastern Siberia (Pocock, 1941; Prater, 1965). In Pakistan its distribution is confined to Murree Hills, Margalla Hills, Attock Distt., Hazara, Dir, Swat, Chitral districts ,Gilgit, Chilas districts and Neelum Valley of Azad Kashmir (Roberts, 1997; Woods and Kilpatrick, 1997 and Qurashi, 2000).

Masked Palm Civet *(Paguma larvata)* is distributed throughout the Himalayas to Assam Hills (Roberts, 1997). It has been reported in different forest areas of Pakistan including Murree and Neelum Valley of Azad Kashmir (Farooq and Ghalib, 1979; Woods and Kilpatrick, 1997 and Roberts, 1997), usually lives in forests and bushy lands (Roberts, 1997). Stout or Ermine *(Mustela erminea)* is found in Europe, Russia, North America, Canada (Jone et al., 1988; Baker and Rollin, 1983) Pakistan, including Northern Areas, Chitral, Kaghan, Kohistan and Azad Kashmir (Woods and Kilpatrick, 1997; Roberts, 1997). It prefers underground burrows and rocks of woodlands and open areas of alpine meadows (Wilson and Reeder, 1993). Small Indian mongoose (*Herpestes javanicus*) is distributed in South East Asia, from Pakistan to south coast of China, Malaysia, Java, Iran, Afghanistan, India, Assam, Burma and Thailand. (Nellis and Everad, 1983; Turtkovic and Krystufek 1990; Ogura *et al.*, 1998 and Roberts, 1997). Porcupine *(Hystrix indica)* is distributed throughout Southern and Central Asia, Middle East, India, South Asia (Prater, 1965; Ellerman, 1961; Gurung and Singh, 1996). In Pakistan it is found in desert areas and Himalayan moist temperate deciduous forests including Northern Areas and Azad Kashmir (Roberts 1997; Woods and Kilpatrick, 1997; Mian *et al.*, 1988 and Farooq and Ghalib, 1979).

Indian Giant Red Flying Squirrel *(Petaurista petaurista)* ranges from the eastern border regions of Afghanistan to Java including Kashmir, Taiwan, Southern China to Srilanka and in northern forest regions of Pakistan (Parker, 1990; Nowak, 1991 and Roberts, 1997). Its distribution is restricted in Murree Hills, Margala Hills, Hazara, Donga gali, Shogran, Naran and Neelum Valley of Azad Jammu and Kashmir (Roberts, 1997; Farooq and Ghalib, 1979). Small Kashmir Flying Squirrel *(Hylopetes fimbriatus)* is distributed in Afghanistan, Northern India and Pakistan

(Nowak, 1991). It is distributed in Chitral, Dir, Swat, Murree Hills, Hazara, Shogran, Kaghan, Naran valleys, Gilgit and throughout Azad Jammu and Kashmir (Farooq and Ghalib, 1979; Roberts, 1997).

Roof Rat or House Rat *(Rattus rattus)* is distributed throughout Pakistan except in the upper Northern Areas where it is replaced by Turkistan Rat *(Rattus turkestanicus)*. It is generally found in close association with human population, mainly in houses, farmhouses and their roofs (Roberts, 1997; Hassan *et al.*, 1997, 1998). Turkistan Rat *(Rattus turkestanicus)* is distributed in the higher mountainous regions of Afghanistan, Russian Turkistan, Xinjiang of China and Iran (Nowak, 1991 and Roberts, 1997). In Pakistan it is present in Murree Hills, Chitral, Dir, Swat, Kohistan, Northern Areas (Woods and Kilpatrick, 1997; Roberts, 1997 and Farooq and Ghalib, 1979).

Himalayan Wood Mouse or Field Mouse *(Apodemus rusiges)* is distributed in Southwestern Asia, Northwestern Africa and Europe (Nowak, 1991). In Pakistan it is mostly distributed in northern hilly areas including Murree Hills, Swat, Chitral, Hazara Distt. and Northern Areas (Wood and Kilpatrick, 1997; Roberts, 1997 and Farooq and Ghalib, 1979) and live in burrows and usually found in Himalayan mixed temperate coniferous forests (Parker, 1990; Nowak, 1991 and Roberts, 1997). House Mouse *(Mus musculus)* is found throughout the world (Hassan *et al.*, 1998 and Roberts, 1997), lives in houses, cultivated fields and may be found in woodlands (Nowak, 1991; Naz *et al.*, 1997).

Royle's High Mountain Vole *(Alticola roylei)* is distributed in Central Asia from Mongolia to the Western Himalayas. In Pakistan it occurs in high mountainous regions and has been reported throughout the Northern Areas (Farooq and Ghalib, 1979 and Roberts, 1997). Murree Vole *(Hyperacrius wynnei)* is one of the uniquely endemic species of Pakistan and is restricted in Murree Hills, Shogran, Kaghan and lower Swat (Roberts, 1997; Woods and Kilpatrick, 1997; Farooq and Ghalib, 1979). Murree Vole is highly fossoreal and excavates complicated food tunnels in forests and alpine pastures (Roberts, 1997).

Royle's Pika or Indian Pika *(Ochotona roylei)* ranges mainly in Nepal, Tibet, Szechuan, Western China and Northern Burma (Nowak, 1991; Orr, 1977 and Smith, 1981). In Pakistan it is reported around Gilgit, Skardu, Baltistan, Chitral, Swat, Kohistan and Naran (Farooq and Ghalib, 1979). Royle's Pika prefers rocky areas and usually nests in stone heaps (Smith, 1981). Cape Hare *(Lepus capensis)* is found in Africa, Middle East and Central Asia (Nowak, 1991), widely distributed in Pakistan, generally associated with agriculture fields, alpine meadows and tropical pine forests (Roberts, 1997).

House Shrew or Musk Shrew *(Suncus murinus)* is distributed throughout the oriental region, reported from Afghanistan, China, Iran, Saudi Arabia, Egypt, Eastern Africa, Southern Japan, Madagascar and other islands of Indian Ocean (Anonymous, 1995). In Pakistan it has been reported from Punjab, Southern Sind, NWFP and foothills of the Himalayas including Azad Kashmir (Saddiqui, 1971; Beg *et al.*, 1986; Farooq and Ghalib, 1979 and Roberts, 1997). Greater Horseshoe Bats *(Rhinolophus ferrumequinum)* are present in India, Afghanistan, Iran, Japan, Korea, Europe (Roberts, 1997) and Pakistan ((Farooq and Ghalib, 1979 and Roberts, 1997).

Study Area

The study area, Machiara National Park is situated in the foot Hills of Himalayas at about 32 km north to Muzaffarabad, on the west bank of the Neelum River, facing slopes of Ganja mountain ranges on south. It lies on latitude 34°-31N and longitude 73°-37E, covering an area of about 13537 ha (33437acres) and elevation between 1300 m and 4733 m. Villages Bheri, Machiara, Konkan and Jhing are linked to Muzaffarabad city by metalled roads via Pattika, which is about 20 km north to Muzaffarabad city. The Park has excellent scenic beauty, panoramic views, towering hills and evergreen forests.

Machiara National Park comprises, Himalayan mixed temperate forests, including Himalayan moist and dry temperate coniferous forests, Sub alpine scrub forests and Alpine pastures/meadows. Dominant plant species include *Cedrus deodara, Pinus wallichiana, Abies pindrow, Picea smithiana, Aesculus indica, Jaglans regia, Prunus padus, Vibernum foetens and V.erubeseens, Pinus roxberghii, Prunus cornuta, Betula utilus, Salix alba, Salix tetrasperma, Jumiperus communis, J. squamata, Lonicera* spp., *Rhodendron lepidotum, Polygonum amplexicaule* and *Bergenia* spp. *Caprex* spp, *Artimisia* spp. and *Medicago* spp etc.

Machiara National Park is situated at the junction of Palearctic and Oriental regions (Saharia, 1982), comprising elements of both the regions. The animal fauna includes Black Bear, Himalayan Ibex, Snow leopard, Hunting leopard, Himalayan Grey goral, Asiatic jackal, House mouse, Himalayan Wood mouse, Horseshoe bat, Leopard cat, Musk shrew (Anonymous, 1991). Murree vole (*Hyperacrius wynnei*) is the only species that is endemic to Pakistan (Roberts, 1997).

In Azad Jammu and Kashmir, so for no detailed study has been conducted on small mammals. The present work in Machiara National Park is preliminary study in Azad Kashmir and is aimed to explore the current distribution, food and habitat preference.

MATERIALS AND METHODS

The present study was conducted from April 2003 to December 2003 in order to determine the current distribution and habitat preference of small mammals in Machiara National Park. For this purpose, the study area was divided into five major localities (Table 1) on the basis of topography and climatic conditions. Each locality was further subdivided into four sub-localities i.e. villages (houses and agriculture lands), mixed temperate forests, sub alpine scrub forests and alpine meadows.

The different methods were adopted to study these animals. Most of the small mammals were nocturnal and shy, so the direct observations and physical trapping of comparatively larger animals was not possible under the available conditions. Thus the indirect evidences, such as footprints, fecal droppings, caves, burrows, beds, runways, fresh ground scratching, signs of predations and other related information were collected to locate and confirm the animal's presence. The useful information about these mammals was obtained from local residents, shepherds, hunters and game watchers of the area. Other small mammals e.g. weasels, pikas, high mountain voles, cape hares and small Indian mongooses were directly observed by using binocular (8X40) during the study

period. Most of the small mammals, like rodents were trapped by using steel snap traps (17X9.5cm) and cage traps (28X16 cm), baited with different objects in different habitats. For this purpose 30-50 traps were set in the randomly selected area of each sub-locality.

Baited traps were set and tied with unmovable objects by using rope of diameter 3mm. The traps were set in the evening and collected in the morning and vice versa. In each selected area trapping was done for two consecutive days and nights (Mian *et al.*, 1988; Knudsen, 1972). After removing the dead and live animals, photographs were taken. The morphometric measurements, geographic locality, date, elevation, soil type, stage (adult, male, female or immature) and dominant vegetations within 20X20 m were collected and identified and preserved by the method describe by Knudsen (1972). Bats were collected with the help of net and preserved in 10% formalin solution. After preservation, each specimen was tagged with a field number. The specimens were identified and classified by using photographs, literature and keys. For this purpose Roberts (1997) was followed.

RESULTS

During this study current distribution, food and habitat preferences of nineteen species of small mammals belonging to five orders, twelve families and eighteen genera were recorded (Table1), which are described below.

Red Fox *(Vulpes vulpes griffithi)* was a larger animal having grayish brown colored hair on the dorsal and somewhat rusty-orange hairs on the ventral sides. it was commonly distributed through out the National Park from elevation1500 m to 3300 m (Table 1), reported to kill poultry near Basri, Gali Khatter and Chathian, where a male Fox was observed producing characteristic voices at evening and another young male was trapped. It has also been reported from Danna, Machiara, Chathian Mohri, Koli, Punjal Gali, Konkan, Panjnand, Serli Sacha, Jing and Balgiran (Table 1). Red Fox prefers deciduous forests around villages, in close association with the human population, resting in burrows and caves and avoiding dense forests. One such burrow was observed under the bushes near Chathian. Its feces were observed containing the hairs of Royle's Pika. wing remains of beetles. It also destroys the chicks and eggs of some valuable game birds e.g. pheasants.

Leopard Cat *(Prionailurus bengalensis)* was rare and endangered, found in all localities of the study area between 2500 m and 4000 m. It was reported around Bheri, Seri, Basri, Gali Khatter, Machiara (around Mohri, Danna), Serli Sacha and Jhugian (Table 1). It prefers Himalayan moist temperate coniferous forests usually around the villages resting between rocks and holes of the trees (Table 1). It mainly preys on rodents, small birds, eggs and chicks of Monal and Koklas pheasant and reported to be hunted for its densely spotted fur.

Palm Civet *(Paguma larvata)* was present through out the study area ranging between 1500 m and 3200 m (Table 1). Feces of palm civet were observed near Bheri (1500 m), Seri (1600 m), Doba (2000 m). This animal was also reported from Chathian,

Gali Khatter, Danna (2700 m), Gahatian, Machiara, Serli Sacha and Jing areas (Table 1). It generally prefered deciduous and moist temperate coniferous forests, resting in dens and holes of trees like *Aesculus indica* and *Juglans regia*. Undigested seeds of *Prunus* spp, *Diospyrus lotus*, *Ficus palmate*, *Pyrus pashia* and *Viburnum* spp were observed in its feces.

Yellow Throated Marten *(Martes flavigula)*, was rare species, found at the elevation range of 2500 m to 4000 m (Table 1). The feces of this animal were observed at Thellan near Basri. Two individuals were seen walking on snow under the dense trees of *Pinus wallichiana* near Chathian at elevation of 2900 m during daytime and it was also reported around Machiara and Serli Sacha. The footprints were observed near Kuthiali at elevation 3500 m. (Table 1). It is usually found in the Himalayan moist temperate coniferous and sub alpine scrub forests and was observed taking rest in the dens and holes of *Aesculus Indica* and *Taxus wallichiana* (Table 1). Its diet mainly consists of small mammals (rodents), fruits, occasionally honey and was also reported to prey on Musk deer, young of Grey goral and squirrels, usually attack bigger animals in pairs.

Stout or Ermine *(Mustela erminea)* was commonly seen in different localities of the study area between the elevation of 2000 and 4500 m (Table 1). It was observed near Choki, Gali Khatter and Ganja (4100m), where five young specimens were seen and one of them trapped. It was also found around Machiara and Serli Sacha and Konkan, where an individual was observed in the stone walls along the road. It is found in deciduous, moist temperate coniferous, sub alpine scrub forests and alpine meadows and also common in villages, usually lives in burrows between rocks, rocky walls of huts and cultivated fields (Table 1). It was reported to prey on *Mus musculus*, *Rattus rattus*, *Hyperacrius wynne*, pikas, snakes, frogs, small birds and their eggs.

Small Indian Mongoose (*Herpestes javanicus*) was observed around Pattika, (1200 m), Sadka, (1300 m), Choki (1600 m), Gali Khatter (2500 m), Batdara, Madar and Konkan. (Table 1). This animal prefered lower dry areas of Machiara National Park, not above 2500m elevations and common around cultivated fields of Pattika, Madar and Batdara, observed in crevices and burrows. It consumed rodents (*Rattus rattus and Mus musculus*), Snakes, lizards, small birds, their eggs and domestic poultry.

Indian Porcupine (*Hystrix indica*) was commonly distributed in study area up to 3200 m elevation. This animal was physically seen at night, in maize crops near Gali Khatter (Table 1). This animal generally preferd to live near the cultivated fields in villages, usually avoiding dense forests. Its burrow was observed at about 2 km away from the human population, near Gali Khatter, where its fecal pellets were also observed. The animal was observed utilizing fruits of *Pranus* spp, *Lupha* spp and *Pyrus malus*, fallen on the ground and potatoes were preferably consumed. In winter it was observed eating the tubers of *Arisaema Jacquemontii*, roots of *Convolvulus arvensis*.

Himalayan Giant Red Flying Squirrel (*Petaurista petaurista albiventer*) was rare and endangered, confined to deep forest areas between 2600 m to 3800 m (Table 1). Its nests were observed near Chobsar at 2800 m and also reported around Besri and adjacent areas. An adult female was trapped from a nest near Chathian at elevation of 2600 m and a young male trapped from Gali Khatter. Inactive nests, partially eaten cones

and shoots were also observed in both villages. Indirect evidences and reports indicated its presence in the forest areas around Machiara, Serli Sacha and in locality D and E (Table 1). It prefered forests having dominent tree species of *Pinus wallichiana, Abies pindrow, Aesculus indica Picea smithiana, Cedous deodara, Juglans regia* and *Prunus cornuta* and did not penetrate into villages. Its nests were observed in the branches of *Abies pindrow, Pinus wallichiana* and *Quercus incana* near Gali Khatter. It was observed feeding on young cones and seeds, young shoots and nuts. The skin crusts of *Aesculus indica* were observed from the esophagus and stomach of a freshly killed specimen.

Small Kashmir Flying Squirrel (*Hylopetes fimbriatus*) was commonly distributed in all localities of the study area, usually preferred deciduous and Himalayan moist temperate coniferous forests, near villages at elevation range of 1500 m to 3200 m (Table 1). This species mainly inhabited the trees of *Juglans regia, Aesculus indica, Prunus cornuta* and made nests on the branches of *Pinus wallichiana* and *Pinus roxburghii*. During summer, it mostly ate the young nodes, buds, shoots and nuts of *Aesculus indica, Pinus roxburghii, Pinus wallichiana* and *Abies pindrow*. In autumn, it was noted to migrate to villages and ate the fruits, specially walnuts and frequently hunted by the local peoples. It is preyed upon by eagle, as was observed near Gali Khatter.

Roof Rat (*Rattus rattus*) was commonly found in all villages of the study area up to elevation of 3500 m. These rats were trapped from Bheri, Chathian, Gali Khatter, Machiara and Konkan (Table 1). This species usually occupied houses and cultivated fields and made burrows in roofs of houses, stores and godowns of grains and subsisted on seeds, grains and nuts etc.

Turkistan Rat (*Rattus turkestanicus*) was rare and could not be trapped except one specimen from a summerhouse in Loon Gali at 3500 m elevation. It was also reported around Jhugian (2800 m) (Table 1). It lived in the roofs of houses like *Rattus rattus* but prefered high elevation (Table 1), probably eats grains, nuts, seeds and fruits.

Himalayan Wood Mouse (*Apodemus rusiges*) was rare and unfamiliar to local people and little information was available about its distribution. Only three specimens were trapped, one from Babayan near Basri at elevation of 3600 m and other two from Lone Gali (3600 m) and Mohri near Gali Khatter. It usually prefered moist temperate coniferous forest but was also found in cultivated crops and even in houses near these forests (Table 1), making tunnels (burrows) in clay soils and ate mostly grains, seeds, roots, nuts and grasses. Pieces of grasses and maize plants were found from cheeks and esophagus of trapped specimens.

House Mouse (*Mus musculus*) was the most commonly distributed species among the small mammals, trapped form all localities of the study area (Table 1). Twenty-one specimens were trapped from Bheri, Sadka, Gali Khatter, Machiara, Konkan, and Serli Sacha. It was found extra-limitedly during the autumn season, when crops become ready for harvesting, generally found in close association with man. It usually made nest in burrows and piles of dry grasses, Maize plants and house roofs. It ate seeds, grains, walnuts and any human food that is accessible and was the greatest agricultural pests in the study area.

Royle's High Mountain Vole (*Alticola roylei*) was rare animal in the study area, present at elevations of 2800 m to 4700 m (Table 1). Two specimens were observed, one near Makkra (4300 m) and other in Kuthiali, three specimen were trapped, one from Moosa Gali (4000 m) and two from Ganja Mountains (4300 m). This species occupied the same rocky habitat as Royle's Pikas and was confined to sub alpine scrub forests and alpine meadows (Table 1). It was observed eating stems and leaves of wild herbaceous plants such as *Artimisia* spp. *Polygomum anplexicaule*, and *Thymnus serpyllum*.

Murree Vole (*Hyperacrius wynnei*) was a densely populated species in study area. It was abundantly distributed in all localities of the study area above 2600 m elevation. It was found around Ban, Chabsar, Makkara (4500m) and Banda (3900m) (Table 1). It was trapped from Mohri near Gali Khatter (2600 m) and was also present throughout Ganja Mountains range, densely populated around Kuthiali, Lambi Digi,Charal, Tahair, around Ranja. Sokar Kasi, Sar Sangarh Gali, Barhi Baik and Dana (Table 1) rarely found below 2600 m elevation. The most preferred habitat was alpine meadows, sub alpine scrub forests and agriculture fields above 2800 m elevation (Table 1), usually avoid dense forests but was found in open places. Its burrows were also present between the roots of *Vibernum* spp and *Salix alba* in sub alpine areas. It excavated extensive network of shallow tunnels (about 3 inches deep) and dump their fecal pellets in a separate tunnel that was branched from main tunnel ending at about 1.5 feet away. Food depots were also observed in some burrows. It generally did not come on the ground surface and were captured by setting traps under the ground. It usually ate the roots, stems and leaves of herbaceous plants.

Royle's Pika *(Ochotona roylei)* was common and generally associated with high altitudinal areas ranging between 3000 m to above 4800 m (Table 1). Animal was present in the mountain areas of all localities including Makkra (4300 m), Kala Jabra (3600 m) and Ban (3700 m). Four specimens were trapped; two near Banda (3700 m), one from Moosa Gali (4000 m) and other one from Ganja (4400 m). It was commonly distributed in the rocky areas of Ganja, Kuthiali, Rveri, Alia Baik and Charal (Table 1). Its nests were found in stone heaps and cavities, formed by the loose accumulations of sliding rocks. It ate a variety of wild herbaceous plants like *Artimisia* spp. *polygonum amplexicuale, Senecio chrysanthemoides, Nepeta connata* and grasses.

Cape Hare (*Lepus capensis*) was confined to the lower cultivated fields above Pattika. Cape hares were absent from other localities of the study area and was common in winter season, lived in burrows (Table 1) and subsisted on wheat plants and other grasses.

House Shrew (*Suncus murinus*) was rarely found between 1300 m and 2500 m (Table 1). Among four specimens, two were trapped from Bheri (1800 m) and other two from Gali Khatter. They were trapped from godown, shops, and houses and were also reported from agriculture fields, resting in burrows (Table 1). Animal was mainly insectivorous but was also observed eating vegetable, bread and apple pieces.

Larger Horseshoe Bat (*Rhinolophus ferrumequinum*) was commonly present in lower areas and rare above 2000 m elevation, around Bheri, Daba, Basri Chathian and Gali Khatter. One specimen was seen flying around the electric lamp in a house lawn. Two specimens were trapped from Gali Khatter at about 2300 m elevation. It was also

present in locality C up to about 3000m elevations (Table 1). One specimen was observed in an old mosque near summer residence in Gali Khatter. Pieces of moths and mosquitoes were also detected from the esophagus of freshly killed bat from Gali Khatter.

Table 1: **Distribution and habitat preferences of small mammals in Machiara National Park during the year 2003.**

Species name	Elevation range (meters)	Forest type and Preferred Habitat	Distribution in study sites and source of information				
			A	B	C	D	E
Vulpes vulpes griffithi	1500-3300	Deciduous and moist temperate coniferous forests. Lives in burrow and caves in rocks.	4	1	2	4	4
Prionailurus bengalensis	2500-4000	Himalayan moist temperate coniferous forests mostly between rocks or holes in trees.	4	3	4	4	4
Paguma larvata	1500-3200	Tropical deciduous and moist temperate coniferous forest. Arboreal, lives in dens in trees.	3	3	3	3	4
Martes flavigula	2500-4000	Himalayan moist temperate coniferous and sub alpine scrub forests. Lives in dens in trees.	3	2	3	4	4
Mustela erminea	2000-4500	Coniferous forests and alpine meadows, lives in holes between rocks and burrows, rocky wall of human huts and cultivated fields.	2	1	2	2	?
Herpestes javanicus	1300-2500	Forests and alpine pastures, lives between rocks	2	2	2	2	?
Suncus murinus	1500-2000	Houses, rice field. Lives in burrows.	1	1	?	?	?
Lepus capensis	1300-1500	Cultivated fields (wheat fields), lives in burrows in soil.	4	0	0	0	0
Ochotona roylei	3000-4800	Moist temperate forests, subalpine scrubes and alpine pastures. Lives in between loose rocks.	1	1	2	2	4

Petaurista petaurista	2600-3800	Himalayan moist temperate coniferous forest, in dens of trees.	3	1	3	4	4
Hylopetes fimbriatus	1500-3200	Himalayan moist temperate forest with mixture of deciduous trees.	2	2	2	3	3
Hystrix indica	1300-3200	Deciduous and coniferous forest and cultivated fields. Lives in caves and burrows between rocks and soil.	3	2	3	3	3
Rattus rattus	1300-3500	Houses, cultivated field, roofs of houses and in burrows.	1	1	1	1	1
Rattus turkestanicus	2500-3800	Houses and moist temperate forests. In burrows and roofs of houses	?	1	?	?	4
Apodemus rusiges	2700-3800	Moist temperate coniferous forests, cultivated fields and houses. Live in burrows in usually clay soil.	1	1	?	?	?
Mus musculus	1300-3500	Cultivated field and houses. Live in burrows in sandy and clay soil.	1	1	1	1	1
Alticola roylei	2800-4700	Subalpine scrubs and alpine meadows, mostly between rocks.	2	1	2	3	?
Hyperacrius wynnei	2600-4700	Cultivated field, forests, subalpine scrubs and alpine meadows in burrows in clay soil.	1	1	1	3	3
Rhinolophus ferrumequi-num	2000-3000	Deciduous and moist temperate coniferous forests. Lives in darker natural caves and old houses.	2	1	1	4	?

Key:

0: Absent
1: Trapped
2: Physically seen
3: Confirmed (by indirect evidences)
4: Reported (from local community)
?: Informations not available,

Site A: Nala Kalas, Bheri, Doba, Basri
Site B: Chathian, Gali Khatter
Site C: Gahatian, Machiara, Panjnand, Konkan.
Site D: Panjur Gali, SerliSacha, Jhing
Site E: Balgiran, Jhugian, Chakrian

Threats

Machiara National Park is endowed with a rich and diverse fauna. Unfortunately, the human population and their livestock, present in the adjoining villages, are degrading its biodiversity. Poverty, illiteracy and environmental unawareness force people to use natural resources. They and their livestock depend entirely on the park resources. The main threats to wildlife of Machiara National Park include habitat destruction through natural and human related activities. The natural factors include snow, avalanches, land sliding and thunderstorms. The human related activities cause the habitat destruction through fuel wood extraction, timber, looping, commercial logging, grazing, grass cutting, extraction of medicinal plants, encroachment, hunting and poaching. In spite of these serious problems Machiara National Park has still diverse and unique fauna making it prominent among National Parks of country.

DISCUSSION

The present study was conducted from April 2003 to August 2003 to determine distribution, food and habitat preferences of small mammalian species in Machiara National Park.

Among the animals inhabiting village areas, *Vulpes vulpes, Hylopetes flmbriatus, Hystrix indica, Rattus rattus* and *Mus musculus* are dominant. They are followed by *Herpestes javanicus, Paguma larvata, Rhinolophus ferrumequinum, Suncus murinus* and *Lepus capensis*. Similarly *Prionailurus bengalensis, Petaurista petaurista, Mertes flavigula* and *Apodemus rusiges* are the inhabitants of deep coniferous forests. *Hyperacrius wynnei, Ochotona roylei* and *Alticola roylei* were mainly found in sub alpine scrubs and alpine meadows.

During this study very low population of Leopard cat, Giant red flying squirrel, Turkistan rat, Wood mouse, High mountain vole and House shrew were recorded. Most of the small mammals were rodents, belonging to three families e.g. Pteromyidae, Hystricidae and Muridae. Similarly six species of carnivores were related to Canidae, Felidae, Viverridae and Mustelidae. Two families (Leporidae and Ochotonidae) were of Lagomorphs and two other (Soricidae and Rhinolophidae) belonged to order insectivora and chiroptera respectively. Among these small mammals, nine species were noted as the agricultural pests in the study area. They cause significant damage to commercially exploitable crops including Maize, Potatoes, Tomatoes and Wheat.

Red Fox *(Vulpes vulpes griffithi)* is commonly distributed in all Villages of the study area in close association with human population. This sub-species, with same habits and habitat has already been described by Roberts (1997) and Ahmed (1997) in Azad Kashmir. Similarly Leopard cat has also been reported by Roberts (1997). During the present study, the population of this cat was estimated very low and similar status has already been described by Roberts (1997). It has become endangered in this area due to frequently hunting by the locals and outsiders for its highly priced skin.

Palm civet (*Paguma larvata*) was present in the deciduous and moist temperate coniferous forests of the study area (Table 1). It has been reported by Roberts (1997) in Neelum Valley in the same habitat. Like wise Yellow Throated Marten (Martes *flavigula*) occurs in the study area up to 4000 m in coniferous and sub alpine scrub forests (Table 1). Roberts (1997) has described this species associated with *Abies pindrow* and *Pinus wallichiana* in Himalayas including Azad Kashmir. Roberts (1997) and Qurashi (2000) also described it as the predator of Musk deer in the Neelum Valley of Azad Kashmir.

Ermines (*Mustela erminea)* were found in villages, sub alpine and alpine meadows at elevation of 4500 m (Table 1). Roberts (1997) has collected this species at 4000 m elevation in Kaghan Valley and in study area they were sympatric with Alpine weasel (*Mustela altiaca).* Small Asian Mongoose (*Herpestes javanicus)* was distributed in lower cultivated areas (up to 2000 m) of the Park ((Table 1). It inhabited natural and man-made culverts and crevice in the cultivated fields and buildings. Roberts (1997) has described this species in lower Plain areas of Sind and Punjab. He has not recorded this animal in the mountainous areas of Himalayas. So, the present description of the species in the mountainous areas (study area) is a worthy of consideration. Similarly, House shrew (*Suncus murinus)* is also an inhabitant of plain area and low elevations but it has also been trapped by Roberts (1997) at 3600 m near Kaghan Valley. During present study, it was not observed above 2500 m elevations (Table 1).

Cape hare (*Lepus capensis*) was found in a small cultivated area between the elevation of 1300 m and 1500 m (Table 1). It has been described by Mirza (1998) and Roberts (1997), near Muzaffarabad and Murree Hills at 600 m and 900 m elevations respectively. Royle's Pikas (*Ochotona roylei*) were generally associated with the high elevation and rocky areas of the Machiara National Park (Table 1). Their preferred habitat was alpine and sub alpine scrubs at about 3000 m to 4800 m elevation in Machiara (Table 1). Roberts (1997) has recorded it at an elevation range of 2400 m to 3600 m. He has described it in association with *Cedrus deodara* and *Picea smithiana*. But during the present study it was noted that pikas generally avoid these forests, probably due to the presence of more predators in forests than the alpine and sub alpine areas (Table 1).

Giant red flying squirrel (*Petaurista petaurista*) was recorded at an elevation range of 2600 m to 3800 m in deep moist temperate coniferous forests of the study area (Table 1). It has also been recorded by Roberts (1997) and Mirza (1998) in Neelum Valley of Azad Kashmir at elevation of 1350 m to 3050 m. Porcupine (Hystrix *indica*) was widely distributed animal in Machiara National Park at an elevation of 1300 m to 3200 m (Table 1). Roberts (1997) has given its distribution in Blochistan, Punjab and Northern regions e.g. Hazara, Murree, Chitral and Kurram Valley up to 2750 m. Prater (1965) and Gurung and Singh (1996) have also described this animal throughout the Himalayas up to 2400 m.

Roof Rat (*Rattus rattus*) was densely populated species of the National Park. It was an agricultural pest in this area (up to 3500 m elevation) (Table 1). Roberts (1997), Hussain *et al.* (2002), Parker (1990), Nowak (1991) and Hassan *et al.* (1995) have described it as agriculture pest but were not trapped from cultivated fields during the present study and similar results were recorded by Taber *et al.* (1967). Turkistan Rat

(Rattus turkestanicus) inhabits the same habitat as Roof Rat in the study area. Its Morphology is similar (with little variations) to Roof Rat. In the study area it was trapped up to 3800 m (Table 1). In contrast, Roberts (1997) has reported it up to 3100 m. House Mouse *(Mus musculus)* was trapped from agriculture fields and village houses up to 3500 m (Table 1). Contrary to Roof Rat House Mouse and house shrew occur both indoor as well as out door (Hussain *et al.*, 1975).

High mountain vole (*Alticola roylei*) and Murree vole (*Hyperacrius wynnei*) were two other rodents present in alpine and sub alpine scrubs forests of the study area (Table 1). Roberts (1997) has recorded *Alticola* in Northern Areas up to 5300 m elevation. During present study, they were observed at 4500 m (Table 1). Like wise Murree vole has been reported by Roberts at an elevation range of 1850 m to 3050 m, but in present study they were trapped and observed up to 4600 m. Murree voles are mole like in habits and this information has already been given by Roberts (1997), Nowak (1991) and Phillips and Carleton (1969).

Afghan Vole *(Hyperacrius fertilis)* is found in Kaghan Valley but it is replaced by Murree Vole *(H. wynnei)* in Machiara National Park. Similarly Royle's Pika *(Ochotona roylei)*, High Mountain Vole *(Alticola roylei)* and Stout *(Mustela ermenea)* are absent from Murree Hills (Roberts, 1997) but they were observed in study area. Beech or Stone Marten (*Martes foina)*, Chinese Birch Mouse *(Sicista concolor)*, *Woolsly* Flying Squirrel *(Eupetaurus cinereus)*, Long Tailed or Kashmin Marmot *(Marmota caudate)*, Asiatic Pygmy Shrew *(Sorax thibetanus)* and Asiatic White-toothed Shrew *(Crocidura pullata)* are present around Murree and Kaghan Valley (Roberts, 1997) but absent in study area.

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