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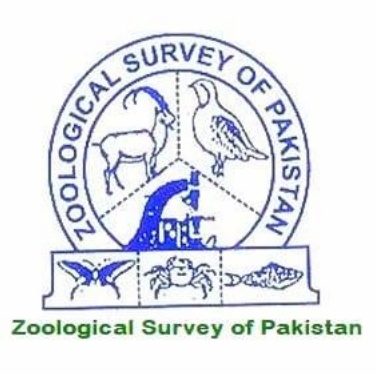

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Chaudhry M. Shafique PhD

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Fishes of Family Monacanthidae (Pisces) from Pakistan with comments on Fishery of *Aluterus Monoceros* (Linnaeus, 1758)

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KEYWORDS

Lalmohania velutina,
Acreichthys tomentosus,
A. scriptus and
Stephanolepis diaspros,
unusual increase,
unicorn leatherjacket filefish

ABSTRACT

Ten species of filefishes (Family Monacanthidae) belonging to six genera are reported from Pakistan. *Lalmohania velutina* which was previously known from Gulf of Mannar, India was reported for the first time from Pakistan coast. Four species i.e. *Acreichthys tomentosus*, *Aluterus monoceros*, *A. scriptus* and *Stephanolepis diaspros* are found commonly along Pakistan whereas other species are mainly reported rarely. The paper also gives an account of fishery of unicorn leatherjacket filefish (*A. monoceros*). Unusual increase in catches of this species was noticed since 2005 and now it is harvested and exported on commercial scale.

Introduction

Member of family Monacanthidae commonly known as filefishes are found in tropical and subtropical waters of Atlantic, Pacific and Indian Ocean. In their general shape the members of This family are deep and flattened sidewise, with small terminal mouths, projecting incisor teeth and having short gill openings. In many respect filefishes grossly resemble with triggerfishes (family Balistidae) but can be distinguished from them in having only one dorsal spine instead of three and their scales are so minute that the skin is velvety but very tough. With the exception of *Aluterus monoceros* (unicorn leatherjacket filefish), no species is edible and are commercially important.

Although many authors have reported triggerfishes from Pakistan, these records are mere repetition of the names from previously published lists of members of family Monacanthidae from the area. In the present paper a review of the published literature on the occurrence of filefishes in Pakistan as well as comments is made on identification and distribution of the known species from Pakistan. The paper will also include a narration on some aspects of fishery of *Aluterus monoceros* from Pakistan which has gained economic importance in past few years.

Material and Methods

Published scientific literature was examined for the record on occurrence of various species of filefishes of family Monacanthidae from Pakistan. The occurrence record was separated for two maritime provinces of Pakistan i.e. Sindh and Balochistan, A few unpublished records of recent occurrence of filefish from Pakistan were also included and comments on their status is made. Specimens of filefishes available in the collection of Marine Fisheries Department, Karachi, Pakistan were also examined.

Information about seasonal distribution and abundance of commercially important *Aluterus monoceros* was collected from 4 gillnet fishing boats on which WWF-Pakistan had deputed observers. These vessels operated between October, 2012 and May, 2014 except during June and July which is traditionally close season in Pakistan.The observers recorded the quantity of all filefishes caught on each haul of gillnet. Seasonal data presented in this paper is monthly average of four vessels.

Results

Filefishes are locally known as "kako" or "kookh" in the province of Sindh whereas it is known as "pokki", "khar" or"har" in the province of Balochistan. Commercially important *Aluterus* in local market is known as "chapal" or "sapna". Present study reports ten species from Pakistan which are alphabetically detailed in the paper.

Acreichthys tomentosus (Linnaeus, 1758)

Bristle-tail filefish was reported from Pakistan as Pervager tomentosus by Hoda (1985, 1988), Hussain (2003) and Jalil and Khalil (1972, 1981) without mentioning any specific location whereas Niazi (2001) reported it from Karachi. Murray (1880) reported this species from Sindh as Monocanthus tomentosus.

This species commonly known as bristle-tail filefish, is widely distributed in the Indo-West Pacific area extending between East Africa to Fiji, south to Australia (New South Wales) and north to the Ryukyu Islands (Froese and Pauly, 2014). Although no information about the habitat in which this species from Pakistan is known except Niazi (2001) has collected this species from the trawlable fishing grounds along Karachi coast. A few specimens of this species are also collected from bycatch of shrimp trawling landed at Karachi Fish Harbour.

This species can be distinguished from its congeners in having robust first dorsal-fin spine which may be relatively large prominent barbs. In addition, posterior margin of caudal fin is always convex in this species (posterior margin of caudal fin in other species may be convex, concave, truncate, or diamond-shaped). In Pakistan, this species is usually confused with Stephanolepis diaspros which usually have elongated anterior most ray in second dorsal fin with a filament and oblong patch of bristles on caudal peduncle. Long filament and patch of bristle is absent in *A. tomentosus*.

Aluterus monoceros(Linnaeus, 1758) – Figure 1

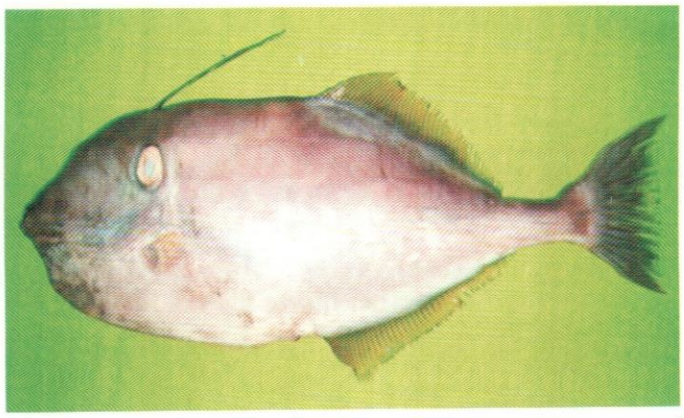


Figure 1. *Aluterus monoceros*- Specimen collected from offshore waters of Pakistan, 54 cm.

This species which is commonly known as unicorn leatherjacket is reported from Pakistan by Bianchi (1985), Hoda (1985, 1988), Hussain (2003), Hutchins (1984) and Jalil and Khalil (1972, 1981) without mentioning any specific location whereas Niazi (2001) reported it from Karachi. Zugmayer (1913) reported this species from Sindh as *Monocanthus monocerus* whereas Hussain and Kidwai (1994) reported its occurrence from offshore waters of Pakistan.

Genus *Aluterus* can be distinguished from all other filefishes in having more than 43 second dorsal and anal fins (other species have 39 or even lesser number of rays). It can be distinguished from *A. scriptus* in having longer than deep caudal peduncle (deeper than long in *A. scriptus*). It has relatively short caudal fin as compared to *A. scriptus.*

This species has circumtropical distribution in Atlantic Pacific and Indian Ocean (Froese and Pauly, 2014). Along the coast of Pakistan, this species is predominantly found in the offshore waters mainly along the continental margin. Although it is mainly caught by pelagic gillnetters operating in neritic and offshore waters, sometimes this species is caught in comparatively shallower waters along Balochistan coast.

Specimen Examined:

1 specimen collected from off Sonmiani (RV Firdows Cruise 1) in November 2009. Total length 54 cm

4 specimens collected from Karachi Fish Harbour on September 19, 2013, Total length 40, 44, 43, 48 cm

3 specimens collected from tuna gillnetter (Gul Muhammad in March 2013) in offshore waters of Pakistan (Specimens not retained). Total length 44,47, 49 cm.

Aluteruss criptus (Osbeck, 1765) – Figure 2

Figure 2. *Aluterus scriptus*- Specimen collected from offshore waters of Pakistan; 45 cm.

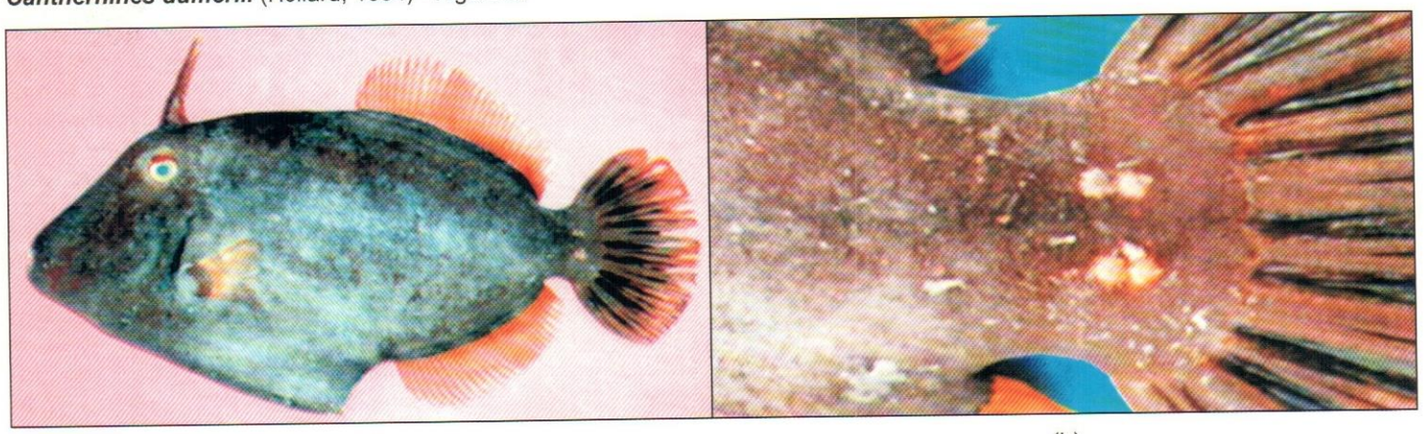
Scrawled leatherjacket filefish, as it is commonly known is reported as *Balistes laevis* from waters of Sindh by Murray (1880). This species has circumtropical distribution in Atlantic Pacific and Indian Ocean (Froese and Pauly, 2014). Along the coast of Pakistan, this species is predominantly found in the offshore waters along the continental margin. Although not rare in the offshore waters, it was previously recorded only by Murray (1880). A marked variation in colour pattern was noticed with specimens having almost drab colour to having distinct pattern with blue curves and lines (Fig. 2).

Specimen Examined:

1 specimen collected from Karachi Fish Harbour on April 29, 2013. Total length 46 cm

3 specimens collected from tuna gillnetter (Gul Muhammad in January 16, 2014) in offshore waters of Pakistan (samples not retained). Total length 40, 44, 45 cm.

Cantherhines dumerili (Hollard, 1854) - Figure 3.



(a) (b)

Figure 3. *Cantherhines dumerili*- (a) Specimen collected from Karachi Fish Harbour 24 cm; (b) caudal peduncle showing 2 pairs of spines.

It is commonly known as whitespotted filefish and reported from Pakistan by Hoda (1988) without mentioning any specific location. This species is widely distributed in the Indo-Pacific area extending between East Africa to French Polynesia, north to Japan and Hawaii. Its distribution is extended from Mexico to Colombia and Baja California in the Eastern Pacific (Froese and Pauly, 2014; Hutchins, 2001).

Specimen Examined:

1 specimens collected from commercial landings at Karachi Fish Harbour on June 16, 2015 measuring a total length of 24 cm.

Cantherhines fronticinctus (Günther, 1867)

Based on trawl sample, this species which is commonly known as spectacled filefish was reported in Karachi (Niazi, 2001).It is known from Indo-Pacific areas south to Durban, South Africa, east to Marshall Islands and Tonga (Froese and Pauly, 2014). No sample of this species was examined.

Lalmohania velutina Hutchins, 1994 – Figure 4-5

Figure 4. *Lalmohania velutina* collected from Karachi Fish Harbour

This species was originally described from Gulf of Mannar, India by Hutchins (1994). It was considered to be endemic to India. During present study a number of specimens of this species were collected from commercial fish landings at Karachi Fish Harbour. This species can be distinguished from its congeners in having rudiment pelvic fin, movably articulated with the pelvis. Scales on the anterior one-quarter of the body are very small, each possessing posteriorly curved spinules arranged in a transverse line. Scales on the posterior three-quarters are much larger, particularly those located midlaterally, each supporting a single, elongate spinule. Because of the spinules it has a velvety texture, thus, it will be appropriate to name it velvet filefish. It has moderately deep body with interdorsal space prominently concave in lateral profile.

Colour variable with ground colour brown with many dark brown closely packed spots; head and body also with darker blotches. There are several dark bands across breast. Lighter colour specimens which have faint blotches are also found. The specimens from Pakistan seem to have comparatively less concave than those reported from India (Fig. 4). It has moderately large pelvic fin rudiment (Fig. 5) with a prominent space ventrally between the encasing scales. Present paper extends the distribution of this species to further north in the Arabian Sea along the coast of Pakistan.

Specimen Examined:

2 specimens collected from commercial landings at Karachi Fish Harbour on April 24, 2014 measuring a total length of 17 cm.

1 specimen collected from commercial landings at Karachi Fish Harbour on December 11, 2010 measuring a total length of 15 cm.

Figure 5. *Lalmohania velutina* showing pelvic fin rudiment. *Paramonacanthus choirocephalus* (Bleeker, 1852)

Commonly known as pigface leatherjacket, this species was reported from Pakistan by Hoda (1985, 1988), Hussain (2003) and Jalil and Khalil (1972, 1981) without mentioning any specific location. This species is known from Thailand, Malaysia, northwestern Australia, Philippines, Indonesia, and New Guinea (Froese and Pauly, 2014). The reports from India (Kapoor et al., 2002) and Sri Lanka by Hutchins (1997) are considered doubtful and possibly based on misidentification (Froese and Pauly, 2014). No specimen of this species was examined during the present study. Further studies are required to verify their presence in Arabian Sea.

Paramonacanthus pusillus (Rüppell, 1829)- Figure 6

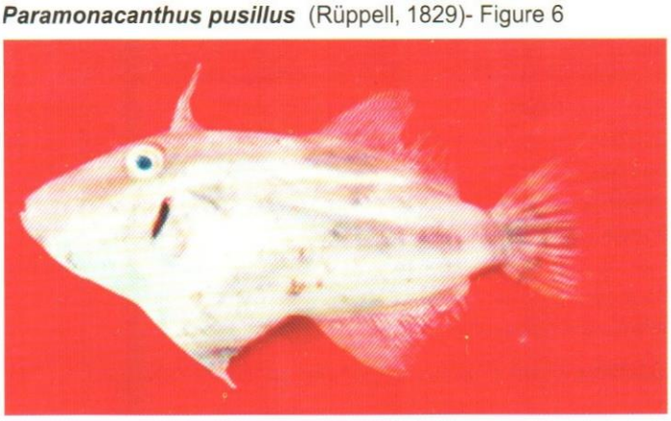


Figure 6. Paramonacanthus pusillus

Faintstripe filefish, as it is commonly known is reported from Pakistan as *Laputa cingalensis* by (Niazi, 2001). This species is known from Red Sea to South Africa and northern Australia (excluding the northeastern region), north to southern Japan

(Froese and Pauly, 2014). During the present study one specimen of this species was collected from offshore waters of Karachi.

pusillus, Monacanthus Rüppell [W. P. E. S.] 1829:34 [Atlas zu der Reise im nördlichen Africa. Fische des Rothen Meeres; ref. 3843] Massawa, Eritrea, Red Sea. Holotype (unique): SMF 3488.

Specimen Examined:

1 specimen collected from off Karachi photographed on February 5, 2016, 14 cm

Stephanolepis diaspros Fraser-Brunner, 1940 – Figure 7

Reticulated leatherjacket, as it is commonly known, was reported from Pakistan by Hoda (1985, 1988), Hussain (2003) and Jalil and Khalil (1972, 1981) without mentioning any specific location. This species is known from Persian Gulf to the Red Sea (Froese and Pauly, 2014). This species is considered to be one of the few lessepsian fish species that has immigrated via the Suez Canal to the Mediterranean Sea and now well distributed (Froese and Pauly, 2014; Por, 1978). This species is widely distributed along Pakistan coast. It was collected from Indus Creek areas and from Miani Hor lagoon which are mangrove laden habitat. In addition, a large number of specimens were collected from shallow coastal waters to the offshore areas. In the offshore waters, these were observed to be associating with flotsams. Second dorsal soft ray in adult males gets prolonged into a filament (Fig. 7a). In addition, adult males also have a patch of forward-curving bristles on side of caudal peduncle (Randall, 1995).

Specimen Examined:

1 specimen collected from off Ormara (RV Dr. Fridtjof Nansen Cruise 2) in December 2, 2010, 17 cm

2 specimens collected from Karachi Fish Harbour on April 21, 2012, 22, 19 cm

1 specimens collected from tuna gillnetter (Gul Muhammad in January 9, 2014) in offshore waters of Pakistan, 21 cm.

(a) (b)

Figure 7. *Stephanolepis diaspros* (a) specimen collected Miani Hor (b) Juvenile specimen photographed at offshore waters

Stephanolepis setifer (Bennett, 1831)

Pygmy filefish, as this species is commonly known is reported from Balochistan by Zugmayer (1913) as Monacanthus setifer. Although this species is known mainly from Atlantic Ocean including from Bermuda, North Carolina (USA), and northern Gulf of Mexico to northern South America (Froese and Pauly, 2014), there are a number of records of this species from Indo-Pacific area. Norman (1939) reported this species from Gulf of Aden. No specimen of this species was examined. The specimens collected during John Murray Expedition and listed by Norman (1939) are probably housed in Natural History Museum, London, U. K. Their re-examination will verify their presence in the area.

Commercial Fisheries of Aluterus monoceros

Aluterus monoceros used to be rarely found in the commercial catches in Pakistan and only on rare occasions a few specimens were caught in commercial trawling or gillnetting. Since 2005, unicorn leatherjacket filefish started appearing in commercial quantities and by 2009, export of this species to China started. In India, also A. monoceros appeared in commercial catches in 2004. Chavan et al., (2004) reported unusal increase in its catches in dol net at Bassein Koliwada Maharashtra and stressed the need for monitoring of its landings. Subsequently heavy landing of A. monoceros was reported from various other parts of Indian coast (Ghosh et al., 2011; Kanthan et al., 2011, Saleela, et al., 2011; Varghese et al., 2011). This species is now also commercially harvested and exported from India.

In Pakistan, a commercial fishery for this species is now established. It is mainly caught as bycatch of gillnets vessels being operated in neritic and offshore waters (Moazzam and Ayub, 2015). The data collected from October, 2012 to May 2014 from four tuna gillnet vessels being operated in offshore waters of Pakistan revealed that this species is found throughout the year with peak landings in May and November (Fig. 8). The data further revealed that March and August are months during which its landings decrease substantially. Information about their catches during June and July are not available because of traditional close season for fishing in the offshore waters.

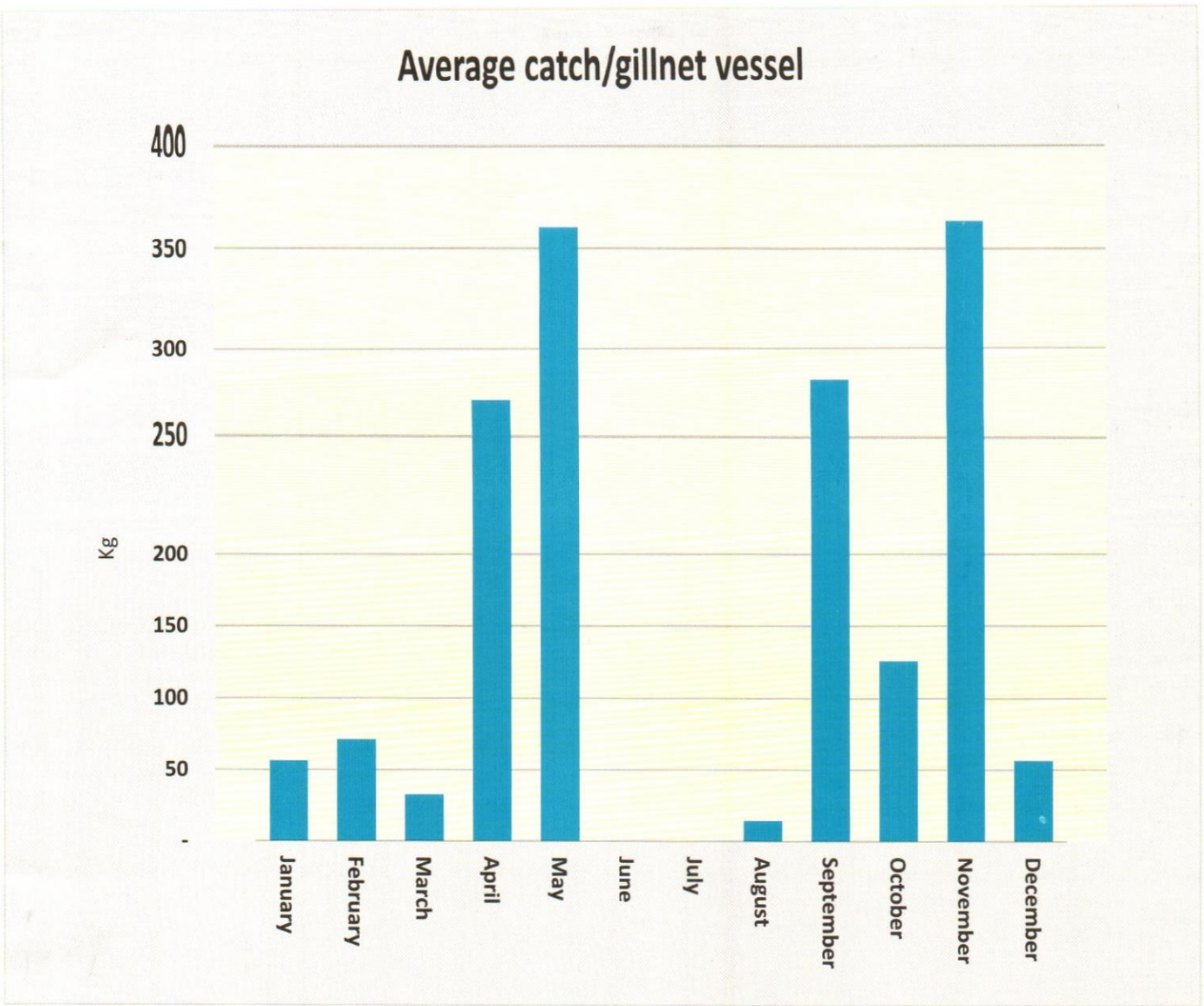


Figure 8. Average catches of 4 tuna gillnet vessels from offshore waters of Pakistan

Unicorn leatherjacket filefish is kept with ice and landed in chilled form by local boats. It is beheaded, eviscerated and skinned before export in frozen form. Main export market for this product is Mainland China, however, it is also exported to Vietnam and Hong Kong enroute to China. The prices being offered ranges between US $ 2.5 and 5.0 per kg depending upon size of the fish.

Acknowledgment

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Biodiversity, seasonal abundance and marketing chain of small indigenous species (SIS) in the Balikhola fish landing center, Kishoreganj, Bangladesh

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KEYWORDS

Biodiversity,
seasonal abundance,
marketing chain,
small indigenous
species

ABSTRACT

Kishoreganj district is well known for rich inland open water capture fisheries of Bangladesh particularly for small indigenous species (SIS) production. A 12-month study was conducted in order to assess the biodiversity status, seasonal abundance and marketing chain of SIS in the Balikhola Fish Landing Center, Kishoreganj. During the study period, 30 fish species that belonged to 7 orders and 15 families were found. The highest number of species which is 9 classified under the family Cyprinidae and *Puntius sophore* was found to be the most dominant species. It was observed that 19 species have normal abundance, 6 have moderate abundance and 5 have least abundance. The number of species was found to be highest in October and the lowest in February. The yield of SIS was found to be far up during the months of September to December whereas there was least availability in January to April. Among the studied species, 19 are considered as not threatened (NO), 2 as critically endangered (CR), 4 as endangered, 3 as vulnerable (VU) and 2 as data deficient (DD). *Nundas nundas, Chaca chaca, Eutropiicthys vacha* which were once available have now disappeared from the study area. Four levels of market or marketing systems have also been observed in the distribution channel of SIS trade.

Introduction

Bangladesh is blessed with tremendous water resources. Fish and fisheries have been an indispensible source of nutrition for the people of this region ever since the old time. It has a globally important wetland ecosystem and associated aquatic biodiversity ranked third in Asia, with approximately 260 indigenous fresh water species with 143 small indigenous species (Rahman, 2005). Around 10% of the people are directly or indirectly dependent on fisheries, 58% of the protein is obtained from fish for nutrition purposes, 2.7% goes for export earnings, and 3.74% of GDP comes from fish and fish products. Fisheries sector contributes 22.23% of the total agricultural production and small indigenous species (SIS) alone contribute 27% of total fish production of Bangladesh (DoF, 2011). From all these statistics, the importance of fisheries and SIS in a country like Bangladesh can easily be determined.

Kishoreganj is renowned for being very rich in inland open water capture fisheries especially for SIS production in Bangladesh. SIS contribute 50.4% of total fish production of Kishoreganj district (Nurullah et al., 2001). However, SIS biodiversity is gradually decreasing due to many reasons such as overfishing, aquaculture practice, introduction of exotic species, habitat loss, degradation, sedimentation, pollution, alterations to hydrology and dredging etc. IUCN Bangladesh (2000) has revealed 54 threatened freshwater fish species in Bangladesh, out of which 33 are SIS, 5 are critically endangered, 19 are endangered and 9 are vulnerable. In order to meet the immense protein demand of this country, preventive steps need to be done to avoid the loss of SIS biodiversity.

At present the SIS marketing system of Bangladesh is very important because mostly it is considered to be a limiting factor for fisheries development. Bhuiyan (1964) and Chowdhury (1996) reported that control over domestic markets by government officials is irregular. Various factors such as poor infrastructure of most of the landing center, markets, rough communications, inadequacy of storage and preservation facilities, inefficient transporting systems, market price, absence of a cooperative system and inadequate financing of the fishermen and fish traders have negatively affected the marketing system. Nuruzzaman (1993) found that the SIS market in this country has always remained in the control of influential persons of the surrounding area, depending on a wide range of socio-economic and political factors.

Very few studies have been conducted on biodiversity of SIS in Bangladesh, so sufficient data related to SIS is not available. In order to take proper management measures, it is necessary to have extensive background knowledge of present SIS biodiversity status. The important steps in the formulation of a management plan are conducting surveys, inventory and analysis of existing natural resources, composing relevant literature and data. Findings from this biodiversity study will help increase the knowledge regarding present biodiversity status of SIS in Balikhola Fish Landing Centre, Kishoreganj and it will also determine its future trend. Study about the seasonal availability of SIS will help to show the real picture of species abundance of this time period. Moreover the outputs from this study can be implemented in the development of national biodiversity strategies, conservation planning and integration of biodiversity information within the development and environmental planning process. Hence the main objectives of this study were to 1) to identify the present status of biodiversity of SIS in the study area, 2) to determine the seasonal abundance and variations of SIS in the selected fish landing center and 3) to determine the SIS marketing system.

Material & Methods

To assess the change in the state of biodiversity and seasonal abundance monitoring is required at the relevant scales of time and space. This study was a systematic regular field study. Assessment of any group of biodiversity requires knowledge of both qualitative & quantitative aspects of a taxon. Research activities used to study

the biodiversity of fishes of the selected area during this period were based on fish landing center visit, data collection, interviews of local people, sample collection and secondary data collection.

Study area

The study was carried out at Balikhola Fish Landing Center, Kishoreganj, Bangladesh, from December 2010 till November 2011. The study site (landing center) was selected on the basis that it gathers fish from a wide area of Dhanu River, Bara beel and Kalapanie beel as it is an area with enormous small indigenous species diversity.

Data collection

Primary and weekly data were collected from 10 local fishermen over phone. Relevant data such as local name, production, availability of the species were collected from the study sites by interviewing 7 arotdars, 10 fishermen & local people for 12 months from December 2010 to November 2011. The entire area of the beels and parts of Dhanu River were visited by boat and surrounding land areas were visited on foot. For justification of the collected data, cross check interviews were conducted by key informants, such as Upazila Fisheries Officer (UFO). Research papers on the fish fauna of Bangladesh were also consulted. The PRA technique (Focus Group Discussion) was used to collect baseline information about the landing site and beels, their resources, seasonal availability of SIS and related problems. Specific information on the subject of the abundance, fishing and marketing of SIS was also brought together during PRA session.

Collection, taxonomic study and identification of fish samples

Monthly fish samples were collected from the landing centre. The samples were brought to the laboratory in the Department of Fisheries & Marine Science, at Noakhali Science & Technology University, Noakhali and preserved with 10% formalin for further identification. From samples, catch rate and species composition were analyzed. Each of the species of SIS was separated carefully. Following separation, weight (g) of each species was measured and the percentage composition of each of the species was calculated. Morphometric & meristic characteristics of the collected species were analyzed and measurements for total length, standard length and height of body etc. were also taken for each species. The collected fish samples were identified by evaluating their morphometric & meristic characteristics through the taxonomic guide by Rahman (2005) & Siddique et al. (2007).

Results

SIS biodiversity

During the study period, only 30 species under 15 families were found. The maximum number of species (9) was found from the family Cyprinidae. Local name, scientific name, family name, species groups and abundance of SIS found in Balikhola fish landing centre are given in Table 1. Here it is revealed that 19 species have normal abundance, 6 species have moderate abundance and 5 species have least abundance.

Table 1: Local name, Scientific name, Family name, Species groups & Abundance of SIS found in Balikhola fish landing centre

Local name	Scientific name	Family	Species groups	Abundance
Kachki	*Corica soborna*	Clupeidae	River Shads	+++
Chapila	*Gudusia chapra*	Clupeidae	River Shads	+++
Kanpona	*Aplocheilus panchax*	Aplocheilidae	Minnows	++
Mola	*Amblypharyngodon mola*	Cyprinidae	Minnows	+++
Chapchela	*Chela cachius*	Cyprinidae	Minnows	+++
Darkina	*Esomus danricus*	Cyprinidae	Minnows	+++
Dhela	*Osteobrama cotio*	Cyprinidae	Minnows	+
Cholapunti	*Puntius chola*	Cyprinidae	Barbs	+++
Sarpunti	*Puntius sarana*	Cyprinidae	Minor carp	++
Jatpunti	*Puntius sophore*	Cyprinidae	Barbs	+++
Ttitpunti	*Puntius ticto*	Cyprinidae	Barbs	+
Leuzza darkina	*Rasbora rasbora*	Cyprinidae	Minnows	+
Rani	*Botia dario*	Cobitidae	Loaches	+
Gutum	*Lepidocephalus guntea*	Cobitidae	Loaches	+++
Gulsha tengra	*Mystus cavasius*	Bagridae	Catfish	++
Bujuri tengra	*Mystus tengara*	Bagridae	Catfish	+++
Tengra	*Mystus vittatus*	Bagridae	Catfish	+++
Madhu pabda	*Ompok pabda*	Siluridae	Catfish	+++
Kajoli	*Ailia coila*	Schilbeidae	Catfish	++
Garua bacha	*Clupisoma garua*	Schilbeidae	Catfish	+
Batasi	*Pseudeutropius atherinoides*	Schilbeidae	Catfish	+++
Koi	*Anabas testudineus*	Anabantidae	Perches	+++
Khalisha	*Colisa fsaciata*	Osphronemidae	Gouramies	+++
Chanda	*Chanda nama*	Ambassidae	Glassfish	+++
Kakila	*Xenentodon cancila*	Belonidae	Gars	+++
Taki	*Channa punctatus*	Channidae	Snakeheads	+++
Cheng	*Channa orientalis*	Channidae	Snakeheads	++
Magur	*Clarius batrachus*	Claridae	Catfish	+++
Shing	*Heteropneustess fossilis*	Heteropneustidae	Catfish	++
Bele	*Glossogobius giuris*	Gobitidae	Gobies	+++

+ least abundance, ++ moderate abundance, +++ normal abundance

Among the total number of species found during the study, 2 species were critically endangered (CR), 2 species were data deficient (DD), 3 were vulnerable (VU), 4 were endangered (EN) and 19 species were not threatened (NO) based on IUCN Bangladesh (2000) list of threatened fishes of Bangladesh. Among the observed SIS, the highest total length was observed in *Clarius batrachus* (25.3 cm) and lowest total length was found in *Corica soborna* (2.1 cm).

Seasonal abundance

In Bangladesh SIS harvesting is mostly seasonal. In the present study, most of fishes under study were more or less available throughout the year, but some of the species were not available in all seasons. The highest numbers of species (25) were found in October and the lowest number (3) was found in February. Monthly variations in SIS availability at Balikhola fish landing center is shown in Figure 1.

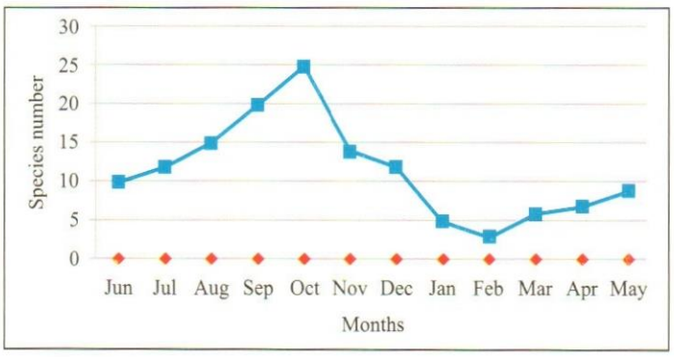


Figure 1: Monthly variation in species number at Balikhola fish landing centre during the study period

Yield of SIS was the highest (155900kg) during September to December in comparison to January to April (23350kg) and May to August (110100kg). Fishing effort was also observed to be highest in last monsoon period due to availability of more SIS. Figure 2 shows that catfishes contributed 39%, minor carp & minnows 22%, barbs 17%, perches 10%, snakeheads 5%, gouramies 2% and loaches, gars, glassfish, river shads contributed 1% individually in the total catch composition of the landing center.

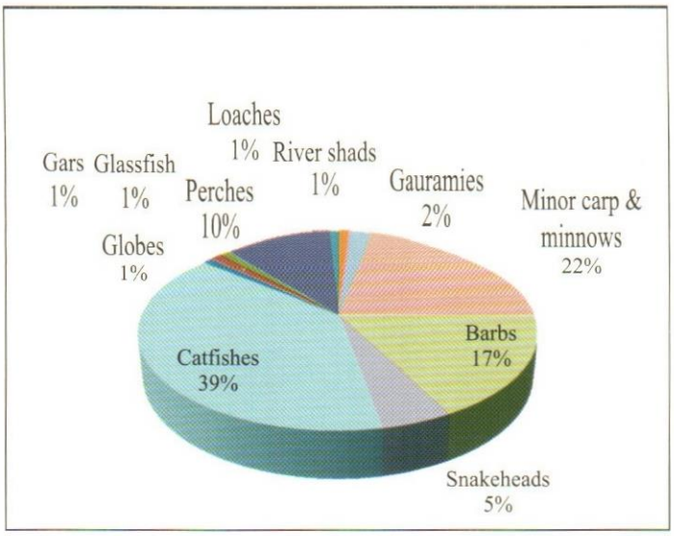


Figure 2: Percentage of species composition of SIS at Balikhola fish landing centre

Five highest and five lowest yielding SIS from the total yield are presented in Figure 3.

Marketing chain of SIS

Generally many retailers of Balikhola Fish Landing Centre collect fish by direct fishing from the river and beels or sometimes they

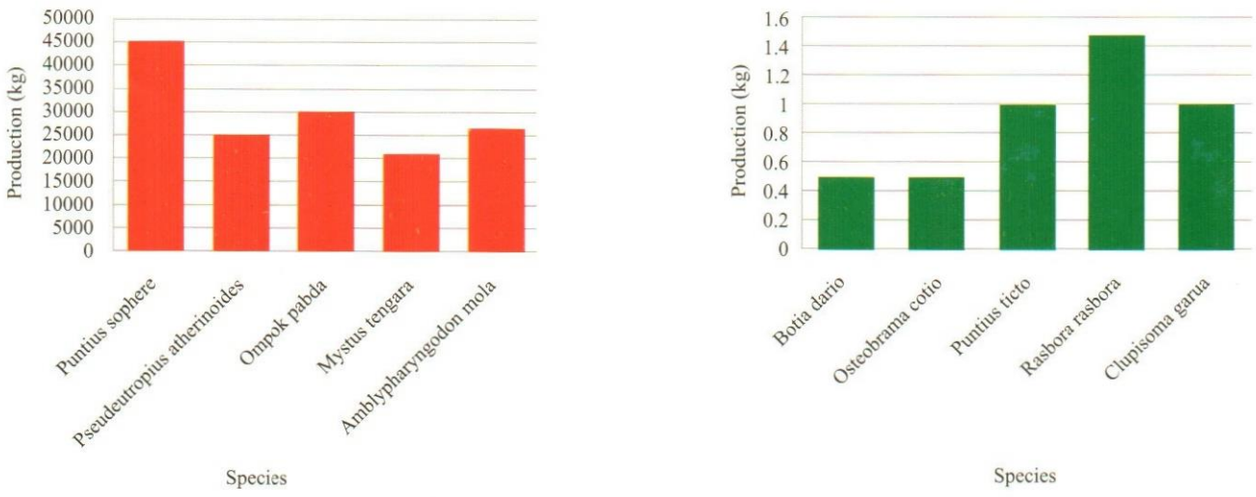


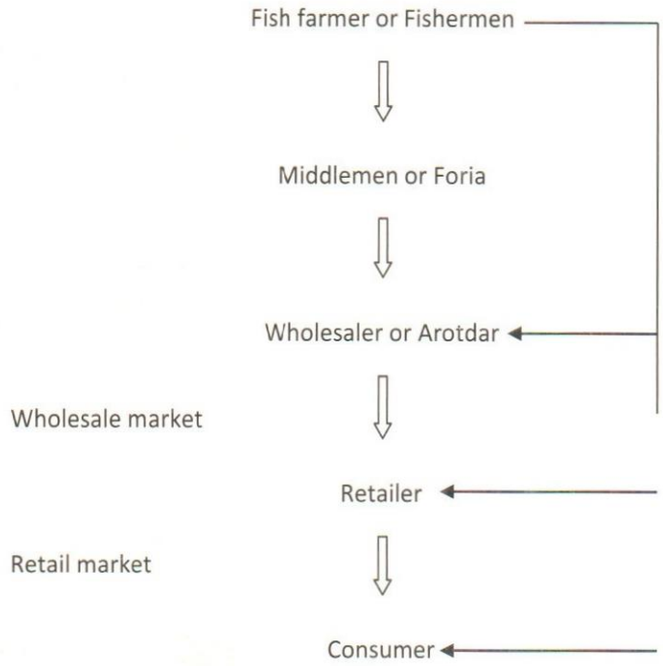
Figure 3: Yield of 5 highest (left) and 5 lowest (right) SIS of Balikhola fish landing centre

collect from the local fishermen too. There is no specific marketing chain for fish in the area. The length and component of marketing channel vary from season to season and place to place. Anybody can purchase fish from anybody and anybody can sell to anybody in this area. The general pattern to be followed in market is - after buying fish from fish farmer/fishermen; middlemen (locally known as Foria) bring to the wholesale market and sell to the wholesaler (Figure 4). The retailers buy fish from wholesaler through auction with the highest bid. The retailers then bring the fish to particular market where they usually sell the fish to the consumers.

In these marketing systems, there were a number of middlemen involved. The marketing chain from farmers to consumers consisted of a number of intermediaries like local fish traders, agents, wholesalers and retailers. The demand of SIS was high in markets but the supply was limited and developed a strong network

with brokers and traders intervening between farmers or fish catchers at one end and the consumers at the other end. With a few exceptions, farmers never directly communicated with consumers and normally market communication was carried out by middlemen.

It has been observed that local traders usually tend to sell fish to consumers in village market as well as to the wholesale market. Mainly the fish is usually sold to the village market first by the local traders and huge quantities are then further destined to market in which local prices are kept at the desirable level. Moreover local traders may have any informal agreements with wholesalers in markets obliging them to supply certain quantities in spite of the lower profit margins.



Discussion

The availability and abundance of the SIS were recorded during the entire study period. Attempts were made to measure SIS biodiversity by direct sampling in different arots in Balikhola fish landing center during the study period. The SIS populations were studied by observing fish from arots and catches from different fishing sites. Previous fish production data was collected through interviews of the fishermen and local people living around the sites. Data on catch per unit effort (CPUE) were taken directly from the field by observing the catches as well as by interviewing the fishermen. All species of fishes under study were almost available round the year. Ahmed (1997) observed that seasonal fluctuation in the fish species is a normal phenomenon. In the present study, the highest number of species was found in October and the lowest in February. Abundance of SIS was comparatively higher in September to December than the rest of the year. Thilsted (2003) also found maximum availability of SIS during October. Least availability of SIS were found during (Jan-Apr) agreeing with the findings of Thilsted (2003). Hossain (1996) studied various aspects of small indigenous species (SIS) of fishes in Bangladesh and found that the demand for fishes remain relatively throughout the year but a remarkable variation was observed in the production scale from month to month agreeing with the present findings.

Based on the result of catch composition of the 30 species recorded, catfishes were the dominant group comprising 39% species. Nurullah et al. (2001) reported that abundance of Punti, Mola, Tengra, Batashi, Pabda were higher than other SIS, Kholisha, Chanda, Chapila were moderately abundant and Dhela was least abundant in Kishoreganj district which is almost similar to the present finding.

Species under the Cyprinidae family were found to be in the highest number and Jatpunti (*P. sophore*) was dominating by production. Nurullah et al. (2001) also reported that Punti (*P. sophore*) was at top of the list in percent production in Kishoreganj. Catfishes were the highest by percentage composition at Balikhola fish landing center except in September-December, when minor carp and minnows and barbs were dominant.

Few decades ago, small fishes were used to be abundant in the rivers, beels, jheels, canals, streams, and ponds etc. of Bangladesh (Jhingran and Talwar, 1991; Shafi and Quddus, 1982 and Ahmed, 1984) however; recent trends have shown that, these species of fish are on verge of extinction despite their ability to reproduce naturally due to environmental degradation. Fish habitat destruction by roads, embankments, drainage and flood control, and natural siltation along with over-fishing have been commonly cited as causes of the deterioration of the country's resources (Hughes *et al.*, 1994; Ali, 1997). Principle causes behind the recent increase in the loss of fish biodiversity in Bangladesh include habitat alteration, fragmentation and simplification. According to Hussain and Mazid (2001), habitat degradation has recently become a great concern in most aquatic ecosystems of Bangladesh. Distinct changes have been observed in natural fish populations of many fish species because of unplanned environmental modifications and man-made interventions affecting the spawning and feeding grounds of fishes. Tsai and Ali (1987) recorded that the fish community in beels of the Sylhet-Mymensingh basin changed dramatically from 1967-1973 to 1984.

According to the villagers and fishermen, many SIS which were available in the past are vanished now like *Nundas nundas, Chaca chaca, Eutropiicthys vacha* due to destruction of nursery and breeding ground by dredging, pollution from the Chamraghat port and use of current Jal. According to IUCN Bangladesh (2000) report, these SIS are also reported as extinct species.

Of the 11 SIS whose abundance is declining and is under threat have been categorized, based on IUCN Bangladesh (2000) method as endangered and critically endangered. Bhuiya (2002) conducted a study on haor fisheries resources in Itna upazilla under Kishoreganj district for a period of one year and observed 9 barbs. In the current study, 4 barbs were found in the landing center indicating the alarming drop of barb species. Mazid and Kohinoor (2003) reviewed the research advancements on conservation aspects of SIS in Bangladesh and mentioned that most of the SIS is presently threatened in natural water bodies and a number of SIS are on the rim of extinction and immediate measures should be taken for the conservation of the species.

In Bangladesh, there is no licensing system of fish retailer and middlemen. Fish farmers/fishermen can sell fish directly to the wholesaler or even to the consumers. The value of fish increases monetarily at every stage by 20-40% in market. Thilsted (2003) also reported the same marketing chain of SIS in the country. Mia (1996) identified three marketing channels in Mymensingh district, the first

one was fish farmer- bapary- aratdar- retailer-consumer, the second one was fish farmer-bapary-retailer-consumer, and the third one was bapary-aratdar-retailer-consumer which was similar to the studied area. He also found that marketing intermediaries in Mymensingh faced a number of problems such as price fluctuation, political instability, lack of marketing facilities, inadequate storage and transportation facilities which were also common in the present study.

Conclusion

Fish is a very important source of protein to the population of the South and South East Asian countries. The contribution of fishery in the economy of Bangladesh and livelihood of her people is very important for creating job opportunities for unemployed people, earning foreign exchange, alleviating poverty and improving nutritional status. Many of the SIS which were once naturally abundant are now considerably reduced in the studied area. The highest number of species were found in October and lowest number in February. The length and component of marketing channel varied from one place to another. In the marketing systems, there were a number of middlemen involved. To conserve the rich biodiversity of the studied area as well as the whole country, government and related organizations should take immediate steps like declaration of fish sanctuary at the major points, inclusion of more SIS in aquaculture systems, ban on fishing of small undersized fishes, ban on fishing in their recruitment months, development of fish shelter and establishment of fish friendly structures.

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Propensity of using harmful gas controller and oxygen supplier on the basis of fish farmers' age, educational status and landownership of six upazilas in Noakhali district, Bangladesh

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KEYWORDS

Harmful gas controller,

oxygen supplier,

educational status,

land-ownership

ABSTRACT

The trend of using aquaculture is increasing day by day in Bangladesh. To meet the increasing demand new technologies are being used to enhance production. Recently the use of fish medicines in aquaculture is also seen among the farmers of our country. In the present study, the propensity of using harmful gas controller and oxygen supplier on the basis of farmers' age, educational status and land ownership were studied. The study was conducted in six upazilas of Noakhali district, Bangladesh. Data were collected through questionnaire survey of 77 fishermen by interviewing them and discussing it with upazila fisheries officer, retailers of fish medicines and representatives of pharmaceutical companies and market survey. The propensity of using harmful gas controller was higher than any other medicines used by farmers of all upazilas surveyed. In this case, around 36% of farmers were found to be inclined towards the use of harmful gas controller because of the problems related to the harmful gases in the ponds. In case of oxygen supplier 22% farmers used oxygen in their ponds. Most of the farmers' age ranged between 26-35 and 36-45 years who were more inclined to use both medicines in their ponds. It was also found that those farmers whose education level was above higher secondary school certificate (HSC) showed more likelihood of using medicines. Farmers who were rich having six and more than six acres of land showed increasing trends of using medicines in their ponds than poor and moderately rich farmers. The study clearly showed that there is a relationship between farmers' age, educational status, land ownership and the adoption of harmful gas controller and oxygen supplier.

Introduction

Bangladesh is one of the world's leading inland fisheries producer with a production of 2,381,916 mt, marine fish production of 517,282 mt and a total production from closed water body of 1,351,979 mt (DoF, 2011).

As fish cultivation has advanced, the use of medicine has also increased. The rationale of this study was to find out whether there is any correlation between increasing fish cultivation and harmful gas controller and oxygen supplier usage with age, educational status and land ownership of the farmers. As a model, district Noakhali was selected, which is famous for its vast area of watery resources located in the Chittagong division, Bangladesh with a land area of 3600.99 km^2. Studies have not been able to find out strong evidence to support the hypothesis that age of the farm operator has an impact on the adoption decision (Boz and Akbay, 2005; Daberkow and McBride, 2003). There are also large working bodies that document a strong, positive association between education and health measures however, little is known about the mechanisms by which education might affect the adoption of new technologies as well as chemical use. So, the specific objective of the experiment was to identify the propensities of using harmful gas controller and oxygen supplier in aquaculture activities by fish farmers on the basis of their age, educational status and land ownership.

Material and Methods

Research approach and technique

The quantitative data were collected by structured survey while qualitative information was explored by case studies as primary tools of data collection (Blaxter et al., 1996). Both types of researches were important and useful although they were not mutually exclusive.

Research design

The design of the survey for the present study involved some necessary steps, which are outlined in fig.1:

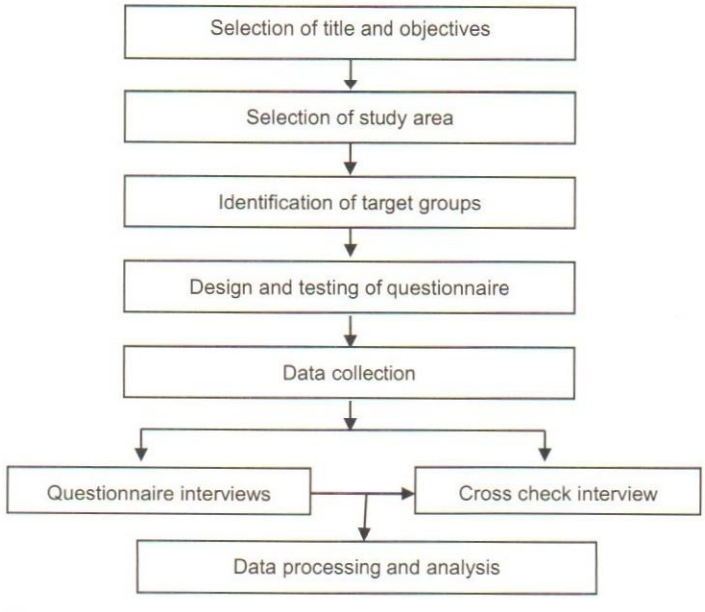

Figure 1: Flow chart of the research design

Study area selection

There are 9 upazilas in Noakhali district, Bangladesh. 6 upazilas among them were selected due to the convenience of communication from university campus (Noakhali Science and Technology University). The selected upazilas were Begumganj, Chatkhil, Companiganj, Kabirhat, Noakhali Sadar and Subarnachar.

Sampling and data collection

77 farmers were interviewed in 6 selected upazilas. The interview was taken from farmers when they were administering medicine in the pond, chatting with each other in different localities and purchasing medicine from fish medicine stores and different fish markets. Farmers' list was collected from upazila fisheries office and fish medicine companies. After that the farmers were classified in different age groups from 15 to 65 years.

Frequency distribution on the basis of upazila

Frequency of the farmers and their percentage distribution among 6 upazilas are shown in table 1.

Table 1: Distribution of the fish farmers according to the upazila

Upazila name	Frequency	Percentage
Begumganj	10	13.0
Chatkhil	12	15.6
Companiganj	12	15.6
Kabirhat	11	14.3
Noakhali Sadar	26	33.8
Subarnachar	6	7.8
Total	**77**	**100**

Categorization of farmers on the basis of age

According to 10 years interval the total farmers were classified into 5 categories (table 2).

Table 2: Distribution of fish farmers according to age

Age interval	No. of the interviewee	Percentage of the interviewee
16-25	14	18.2
26-35	24	31.2
36-45	24	31.2
46-55	9	11.7
56-65	6	7.8
Total	**77**	**100**

Categorization of farmers on the basis of farmers' educational status

Farmers were classified into 5 different categories according to their educational status (table 3).

Table 3: Distribution of fish farmers according to educational status

Educational Status	No. of interviewee	Percentage of the interviewee
No education	4	5.2
Primary	27	35.1
SSC	19	24.7
HSC	14	18.2
Above HSC	13	16.9
Total	77	100

Categorization of farmers on the basis of farmers land ownership

Farmers were classified into 3 groups according to the quantity of land they owned (table 4).

Table 4: Distribution of fish farmers according to the land ownership

Quantity of land owned (acre)	Categorization of farmers	Frequency	Percentage
1-2.9	Poor farmers	34	44.2
3-5.9 6+	Moderately rich farmers	19	24.7
	Rich farmers	24	31.2
	Total	**77**	**100.0**

Data analysis

The questions were post coded when needed, entered on the computer using Microsoft excel, checked after entry and analyzed using statistical software version (15.0) SPSS. Descriptive statistics was used for analysis and presentation of data.

Results

Use of harmful gas controller

Harmful gas controller is used to control the obnoxious gas present in the bottom of the pond, to develop the required environment of the pond and to save fish from the diseases. Some of the drugs used in Noakhali district were Zeolite, Gasonex, Aquamagic, Megazeo, Geotox etc.

(a) Use of harmful gas controller on the basis of upazila

From the study it was observed that 10% farmers of Begumganj upazila, 50% of Chatkhil upazila, 55% of Kabirhat upazila, 42% of Noakhali sadar upazila, and 67% of Subarnachar upazila used harmful gas controller. However, in Companiganj upazila no farmer was seen to use it (table 5).

Table 5: Distribution of harmful gas controller user on the basis of upazila

Upazila Name	Harmful Gas Controller				Total
	Non user	Percentage	User	Percentage	
Begumganj	9	90	1	10	10
Chatkhil	6	50	6	50	12
Companiganj	12	100	0	0	12
Kabirhat	5	45	6	55	11
Noakhali sadar	15	58	11	42	26
Subarnachar	2	33	4	67	6
Total	**49**	**64**	**28**	**36**	**77**

(b) Use of harmful gas controller on the basis of age

Farmers of early ages showed higher tendency to use harmful gas controller in their ponds. Thus the farmers of age range 16-25 used more fish medicines in comparison to others (table 6).

Table 6: Distribution of harmful gas controller user on the basis of age

Age Interval	Harmful Gas Controller				Total
	Non user	Percentage	User	Percentage	
16-25	8	57	6	43	14
26-35	15	62	9	38	24
36-45	15	62	9	38	24
46-55	6	67	3	33	9
56-65	5	83	1	17	6
Total	**49**	**64**	**28**	**36**	**77**

(c) Use of harmful gas controller on the basis of educational status

The farmers who were illiterate having no educational background, did not show any inclination towards the use of these medicines (table 7).

Table 7: Distribution of harmful gas controller user on the basis of educational status

Educational Status	Harmful Gas Controller				Total
	Non user	Percentage	User	Percentage	
No education	4	100	0	0	4
Primary	23	85	4	15	27
SSC	12	63	7	37	19
HSC	4	28	10	72	14
Above HSC	6	46	7	54	13
Total	**49**	**64**	**28**	**36**	**77**

(d) Use of harmful gas controller on the basis of land ownership

From the study it was found that 24% of farmers having 1-2.9 acre land, 37% having 3-5.9 acre land and 54% farmers having more than 6 acre land were more inclined towards harmful gas controller usage (table 8).

Table 8: Distribution of harmful gas controller user on the basis of land ownership

Land Ownership	Harmful Gas Controller				Total
	Non user	Percentage	User	Percentage	
Poor farmer	26	76	8	24	34
Moderately rich farmer	12	63	7	37	19
Rich farmer	11	46	13	54	24
Total	**49**	**64**	**28**	**36**	**77**

Use of oxygen supplier

Oxygen supplier is a medicine which supplies essential oxygen to the water body. The benefits of using this medicine are to regulate the growth of phytoplankton, to save the fish from parasites, and to maintain the nutrients of the water body.

(a) Use of oxygen supplier on the basis of upazila

It was found that no farmers used oxygen supplier in their pond in Kabirhat upazila, whereas 20% of farmers used it in Begumganj upazila, 25% in Chatkhil upazila, 8% in Companiganj upazila, 17% in Subarnachar upazila and 39% farmers in Noakhali sadar upazila (table 9).

Table 9: Distribution of Oxygen supplier user on the basis of upazila

Upazila Name	Oxygen Supplier				Total
	Non user	Percentage	User	Percentage	
Begumganj	8	80	2	20	10
Chatkhil	9	75	3	25	12
Companiganj	11	92	1	8	12
Kabirhat	11	100	0	0	11
Noakhali sadar	16	61	10	39	26
Subarnachar	5	83	1	17	6
Total	**60**	**78**	**17**	**22**	**77**

(b) Use of oxygen supplier on the basis of age

According to the study, middle aged farmers used more oxygen supplier in their ponds (table 10).

Table 10: Distribution of Oxygen supplier user on the basis of age

Age Interval	Oxygen Supplier				Total
	Non user	Percentage	User	Percentage	
16-25	13	93	1	7	14
26-35	18	75	6	25	24
36-45	18	75	6	25	24
46-55	6	67	3	33	9
56-65	5	83	1	17	6
Total	**60**	**78**	**17**	**22**	**77**

(c) Use of oxygen supplier on the basis of educational status

Some variations were observed in case of oxygen supplier usage among farmers. 25% of farmers with no education, 11% of primary educated farmers, 26% in case of SSC level, 14% in case of HSC level and 46% farmers with education level higher than HSC were found to be using oxygen supplier (table 11).

Table 11: Distribution of Oxygen supplier user on the basis of educational status

Educational Status	Oxygen Supplier				Total
	Non user	Percentage	User	Percentage	
No education	3	75	1	25	4
Primary	24	89	3	11	27
SSC	14	74	5	26	19
HSC	12	86	2	14	14
Above HSC	7	54	6	46	13
Total	60	78	17	22	77

(d) Use of oxygen supplier on the basis of land ownership

Poor farmers were less inclined towards the use of oxygen supplier while rich farmers were more involved in its usage (table 12).

Table 12: Distribution of Oxygen supplier user on the basis of land ownership

Land Ownership	Oxygen supplier				Total
	Non user	Percentage	User	Percentage	
Poor farmer	28	82	6	18	34
Moderately rich farmer	15	79	4	21	19
Rich farmer	17	7	7	29	24
Total	**60**	**78**	**17**	**22**	**77**

Discussion

Aquaculture in Bangladesh is expanding rapidly with diversification, intensification and technological improvements. Around 60% of animal protein is supplied by the commercially important fisheries organisms which are also considered as the cheapest and richest source of animal protein (DoF, 2011). The major goal of aquaculture is to increase the production, which is environmentally viable. The aquaculture activities in Bangladesh are also influenced by a number of chemicals. As a result, different types of chemicals are used frequently in this sector. The present study has identified a range of chemicals that are being used in fresh water aquaculture activities in Noakhali district. For pond preparation and water quality management, farmers used lime, zeolite, fish toxin, insecticides and different fertilizers. Lime is very effective in different purposes such as pH, water color and turbidity maintenance, it increases the rate of decomposition and it is also used to treat different fish diseases. Most of the farmers use lime because of its low price, effectiveness in water quality management and because of the fact that it also acts against different diseases. Lime is being used as an effective and widely used chemical in aquaculture in Bangladesh (Sultana, 2004).

It was found that the farmers in Noakhali Sadar upazila were more keen to use oxygen supplier than any other upazilas surveyed. Due to the availability of fish medicine store, medical representatives, convenience of communication and for the expert of upazila fisheries office, the farmers who use fish medicines are higher in this region. However, in case of harmful gas controller usage farmers were seen comparatively higher in newly formed Subarnachar upazila, though the total number of farmers in Subarnachar upazila is less than any other upazilas surveyed. There are some hatcheries and fish farms which use these fish medicines for commercial purpose. These fish farms may have influenced the farmers in Subarnachar upazila to use these medicines. A very little number of farmers in Companiganj upazila were found to use the harmful gas controller and oxygen supplier. In accordance with Companiganj upazila, the farmers in Begumganj and Kabirhat upazila showed no or little trend of using fish medicines.

It has been observed that age had a negative and significant relationship with adoption level. It might be because the aged persons were less prone to change and are reluctant to adopt new technologies in their farms. In a recent study, it was found that the younger the farmer, the more likely he/she is to adopt innovations early in his/her respective life cycle and older farmers may have a shorter time horizon and are less likely to invest in novel technologies (Rogers, 1995). Present study reveals that, average rate of aged farmers were seen to use harmful gas controller and oxygen supplier. As it is obvious that 'educated people make good innovators' and that 'education is especially important to those functions requiring adaptation to change' (Nelson and Phelps, 1966). Therefore educated farmers use fish medicines more than those of illiterate and less educated farmers. This study also reveals the same pattern.

The rate of adoption rates also increase with the size of the farm operation (Fernandez-Cornejo et al., 2002). From the results of this study, it was found that the rich farmers who have more than 6 acres land use more medicine in their farm than poor and moderately rich farmers for commercial purposes.

Conclusion

Aquaculture in Noakhali region has increased remarkably in the past few years and consequently the use of chemicals in aquaculture is increasing as well. If aquaculture is done in larger densities to enhance the production, the proper use of chemicals in aquaculture must be maintained. However, some aquaculture chemicals appear to be relatively hazardous and on this basis their use should be reduced. In this case, denying regulatory approval of the chemicals can be unnecessarily restrictive for the aquaculture industry but education, awareness about harmful effect of hazardous chemicals and enforcement of effluent quality limits are the possible approaches to ensure the safe use of these chemicals.

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Highaltitude herpetofaunal species occurring at Ayubia National Park district Abbotabad, province Khyber Pakhtoonkhwa, Pakistan

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KEYWORDS

Reptiles,

amphibians,

herpetofauna,

biodiversity,

Westen Himalayan Region

ABSTRACT

This paper provides information on the herpetofaunal species occurring in Ayubia National Park (ANP) district Abbotabad, province Khyber Pakhtoonkhwa (KP). This mountainous region is western extremity of Himalayan Region varying huge altitudinal and environmental gradients, and is the hotspot focused for biodiversity conservation in the region. However, the amphibians and reptiles in this area occurs with low diversity in species and remain poorly known. We observed only six species of amphibians and reptiles: the Kashmir Rock Agama, *Laudakia tuburculata* Indian Garden Lizard, *Calotes versicolor* Striped Grass Skink, *Mabuya dissimilis* Himalayan Pit Viper, *Agkistrodon himalayanus* Asian Garden Toad *Bufo melanosticus* and Murree Hill Frog *Rana vicina*. The iformation describes the habitat and distribution of herps and amphibians species studied during the periodic suveys over the years to perform a preliminary analysis of ecological aspects. Even among widespread species with high reproductive potentials and significant dispersal abilities, the populations were extremely low for the amphibians while lizards species were dominating in their favourable habitats.

Introduction

Pakistan supports a highly unique and diverse herpeto-fauna due to its immense ecological history and biogeographical regions, broad latitudinal span and huge altitudinal range with zoogeographic patterns increase many provisions in species richness and diversity, and therefore the efforts are in focus to conserve this value in this part of the world. The present effort was used to investigate the amphibians and reptilians of the Ayubia National Park, district Abbotabad. The study area is well-known for its natural scenic beauty and a famous historical hill-station including areas of the Changla Gali, Kuza Gali, Ghora Dhaka, Khanspur, Dunga Gali and Nathia Gali. Khanspur used as Military Cantonement during the British Rule. The site can easily be approached by Islamabad-Kohala-Murree Highway some 50 km in the north-east of Islamabad - the Capital Territory. Being located in the western Himalayan moist-temperate region the climate is moist-moderate which is affected heavily by monsoon rains, therefore, the summers are pleasant with heavy moisture content in the air and winters are severe with dry winds and snowfall.

The terrain is hilly semi-rugged enclosing open fertile small valleys. Generally the formulations are of thin limestone, alluvial deposits and sand-stones aging of tertiary period. Fertile reddish-brown soils with a high content of minerals are capable of absorbing good quantity of water thus plants grow such lands. Highlands of the site are fairly forested with evergreen coniferous and broad-leave plants while undergrowth is dominated with a large variety of shrubs, herbs and grasses. Many small seasonal tributaries join the main streams which drain out to River Jhelum in the east while the streams falling in the west drain out to river Daur.

Material and Methods

The investigation techniques used to explore the species were stone turning and searching at and through bushes. Bush flora is so important around the rocks or big stones that it provides necessary food requirement that includes particularly insects. For snakes, lizards, and amphibians especially for toad, the stone turning technique helps a lot for the location and estimation of population of different species to the observer or biologist. This technique is specially used in the mountainous or sub-montane areas where scattered stones or big rocks are found. It is not easy to remove or turn large and heavy stones or rocks but small and loose stones can be turned to see the hiding reptiles and amphibians specially toads. Snakes, lizards and toads always hide and take rest under the stones. These should be placed at the same position and at the same place like natural setting so that the natural habitat and ecology may not be disturbed. To record the species of frogs the fresh water pools or ponds (water bodies) were important which formed in the way of fresh water streams or by rains because during summers they spend most of their time in the water or in the grassy flanks of the streams or fresh water ponds.

For agama species (lizards) the big rocks or stones along the boulders of the running streams or dry beds of seasonal streams were best places. In mountainous area agama species are found abundantly. They usually come just after sunrise from under the huge rocks. When the rocks become slightly warm, agama species come out of the cracks or crevices and enjoy sunshine on the top and sides of the rocks.

For nocturnal species spotlighting was used particularly for snakes, because snakes mostly come out at night in search of food specially rodents that includes mice, moles and rats or amphibians which consisted of frog and toad. The best timing for diurnal species (amphibians and lizards) is between dawn and mid-morning or shortly before sunset (Minton, 1966). In general the best season to record the species like lizards and snakes is soon after the monsoon rains and for amphibians during the summer rains. To record the species of amphibians and reptilians occurring in the Park periodic surveys were conducted over the years but recently the area was visited in July 2013.

Results and Discussion

The present study deals with the distribution and status of reptiles and amphibians occurring in the Ayubia National Park, district

Abbotabad. We could record only 6 species of herps including one species each of the toad, frog and skink. Six species of herps belonging to 5 families of 3 orders include the two amphibians and 4 reptiles. Of which a single species of poisonous snake, the Himalayan Pit Viper of family Viperidae, 2 species of lizards belonging to the family Agamidae and single species of Striped Grass Skink of the family Scincidae were more commonly observed while the two amphibians the Asian Garden Toad and Skittering Frog grouped under the order Anura are distributed each in different families as the Bufo in Bufonidae and the Frog in Ranidae. Amphibians were found very rare in the Park.

Amphibians

Two amphibian were recorded from the Park including one species each of the frog and toad.

Skittering Frog or Daddoo *Euphlyctis cyanophlyctis* Schneider

Description

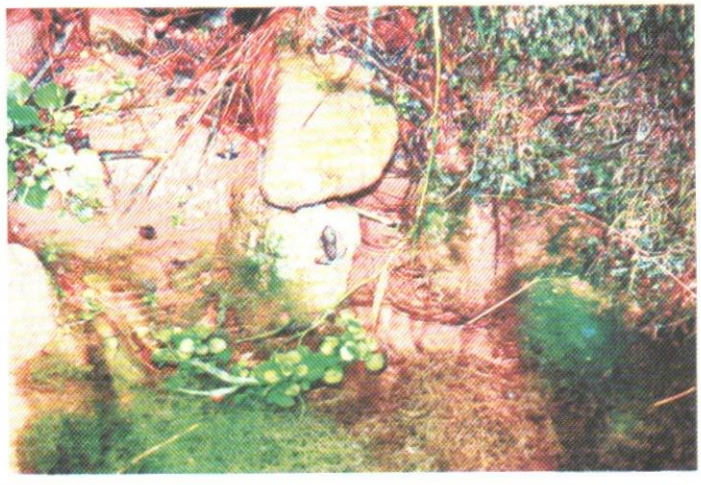
The Skittering frog or Daddoo *Euphlyctis cyanophlyctis* belongs to the broad-mouth frogs group; the dorsum surface is light grey. Thighs posteriorly dark with one or two yellow or white irregular longitudinal stripes but regular vertical stripes have been clearly observed in tadpoles. Ventrum is white without spots or with dark markings. Tadpoles are dark-grey with oval body, broadest at mid, ventrum greyish extremely soft and flat. The eyes are large, tail is long muscular with wider dorsal and narrower at ventral fins, and tail tip is thick and broad. Total length of the tadpole 42-46 mm, tail 23-24 mm. Large tadpole remains solitary, minors in small groups, stay most of the time at the bottom, if alarmed they hide themselves in the debris (observations). They feed mostly on debris. Examination has proved that usually there no fresh vegetation is detected in its digestive tract. It also feeds on dead tadpoles, drowned animals like earthworms or other decayed materials (Khan and Tasnim, 1989).

Euphlyctis cyanophlyctis (Schneider, 1799) Skittering Frog or Daddoo; (tadpoles and immature form just after tadpole, remains solitary and showing clearly vertical dark stripes on the thighs and legs).

Euphlyctis c. cyanophlyctis is a common frog everywhere they exist and their tadpoles are most common in water bodies throughout the plains of Punjab and Sindh from late February to mid-September. We collected five tadpoles during this study. This frog has a spectacular unique habit of skittering over the water surface, therefore it is named conceiving from this habit.

Euphlyctis c. cyanophlyctis is a voracious feeder, feeding mostly on aquatic insects, beetles, tadpoles, dragonflies, grasshoppers, etc. It is pest exterminator, feeds voraciously on different insects and their larvae. The frog is known to come out of the water during the night and goes to foraging in the surrounding grasses, returning to the pond at dawn (Khan and Tasnim, 1989).

Habitat, Distribution and Status:



An ideal breeding habitat of *Euphlyctis cyanophlyctis* (Schneider, 1799) Skittering Frog or Daddoo: the bottom of the pond is representing excellent place for hiding tadpoles under the stones, many species of aquatic vegetation providing food stuff to the new borns.

Euphlyctis c. cyanophlyctis is observed as a common aquatic and littoral species. It remains permanently resident in different types of habitats with pooled water in the plains and sub-mountainous parts of Pakistan. The frog is remarkably capable of adjusting itself to the uncertain aquatic conditions in temperate arid parts of Pakistan (Minton, 1966). The common skittering frog is one of the most widely distributed Oriental species. It extends from Thailand to Nepal, throughout India, Sri Lanka, almost throughout Pakistan below 1800m (Khan, 1997). It extends westwards to Iran and Afghanistan. Recently Khan (1997) described a spinulate race *E. c. microspinulata* of this species from northwestern plateau of Hindukush and Balochistan. In the present site it occurs less commonly below 1800m elevation.

At low altitude valleys, the frog was confined to small water bodies with dense cover of grass layer. During a previous survey in April, the frog was observed breeding even in small pooled water nearly of 4 feet in diameter formed along the water channel . We observed its breeding stages in the pooled water at two places. The frog was adapted to subtropical features in open valleys of the site, it avoided the temperate or dense forest and high altitude areas. It prefferd the fresh water pool in stream beds with dense cover of grass. Tadpoles fed in the debris collected at bottom, it was important in reproduction of the frog (photographs).

Breeding Forms (tadpoles and immature) Euphlyctis cyanophlyctis (Schneider, 1799) Skittering Frog

Asian Garden Toad or Hazara Toad Bufo melanosticus hazarensis (Duttaphrynus melanostictus hazarensis) (Schneider, 1799).

Description

This largest toad subspecies has not been enlisted in Mintons (1966) Herpetology of Pakistan, however he described the form of this species occurring in Thatta and Jhangshahi, Sindh. Khan (2001) has identified the existing populations of this toad in mountainous areas of Pakistan as a new subspecies *Bufo melanostictus hazarensis* on the basis of kidney shaped parotid glands, double subarticular tubercles under penultimate phalanx of all fingers, rostral ridge absent from head, temporal ridge present with light brown dorsum (Khan, 2001).

Bufo melanosticus hazarensis Asian garden Toad, photographed at 2450m elevation in Ayubia National Park during monsoon, the toad was captured wandering in a grassy mountain slope, in search of a party to join .

It is the largest toad mostly found in temperate region relatively at high elevation than the other toads existing in Pakistan, females are significantly larger than males that exceeds 15cm in snout-vent length and are equaled in size by the closely allied Himalayan Toad *Bufo himalayanus*. Colour of the dorsum is uniform gray of various shades, mostly brown or reddish buff with dark spots, ventrum uniform dirty white or creamy, speckled with light brown on chin and throat (photograph). They wanders out of their hideouts during the monsoon to join parties and suitable breeding sites.

Habitat, Distribution and Status

The toad (*Bufo melanostictus*) has been reported to be as the common toad due to widely distributed in Indo-Pakistan subcontinent. Nevertheless, the toad at present is not common in Pakistan, this toad is confined to District Hazara, Northwestern Frontier Province, Alpine Punjab and Azad Kashmir (Mertens, 1969a; Khan, 1972a). The toad is known to occur from the sea level to 2000m (Daniel, 2004). During this study the toad was collected in the day hopping at a grassy mountain slope at 2450m elevation in the Ayubia Nationa Park, district Abbot abad.

A rare toad in Pakistan mostly confined to the temperate and moist region of low northern hill ranges of Khyber Pukhtoonkhwa, upper Punjab and Azad Kashmir. Mostly Nocturnal, appears soon after sunset; during day hides under stones, logs, piles of vegetation, holes and crevices among stones and in ground. It was caught in the broad day light during the monsoon season (July) at open grassy slope with scattered bushes of *Viburnum nervosum* and *Sorbaria tomentosa* at a mountain ridge. The toad is slow moving animal with deliberate hops from place to place in search of food on which it feeds but it is active during the breeding season when it searches most of the time to join parties.

In temperate environs of western Himalayas, the breeding is initiated by the monsoon rains, from July to August and the male toads gather in shallow side-pools along torrents and ponds. It breeds in suitable places containing some water from first showers of monsoon rains. (Khan, 1982b).

Globally the toad is found in Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Hong Kong, India, Indonesia, Lao People's Democratic Republic, Malaysia, Maldives, Myanmar, Nepal, Pakistan, Singapore, Sri Lanka, Taiwan, Thailand, Viet Nam, Peninsular Malaysia, Sabah, Sarawak.

Reptilians

The accounts of lizards has been gradually increasing from Minton's (1966) record 65, Mertens (1969) accounted 82 while Khan M. (1980b) listed 88 and Khan M (2002) finalized with 101 species and sub species from 35 genera.

Blue Rock Agama or Neela Kirla *Laudakia tuberculata* [*Agama tuberculata*] Hardwicke & Gray

Description:

Head pale yellow or grey, sometimes speckled on the sides black bar between eye and tympanum; in juveniles reticulated; chest and belly pale yellow but may be speckled with age, males with blue or grey wash; body colour highly variable, when the specimen itself lack any pattern on the body, the tail is also devoid of it .

It is most active diurnal species found in and surrounding areas of the Park. They are most plentiful in the rocks along the water channels but otherwise may be found almost everywhere, forests logs, stream-banks, tree logs etc. They mainly feed on insects but during unfavourable conditions may eat buds twigs of plants. The species otherwise is widely distributed in the Himalayas starting from Afghanistan and goes to Tibbet.

This is one of the most common species of the Park and is widely distributed in the rocky areas , especially along the water course. It was found plentiful in rocky bush habitat.

Body is not robust but lightly built and the tail is heavier and relatively shorter as compared to other agamids comprising 163-194 percent of snout-vent length. Colour slightly varies with its distribution in different eco-regions. In adults it is brownish to bluish or greenish, ventral surface of males deeply marbled with dark blue. Females are lighter in colour and shine creamy, young looks similar to adults but on dorsal, markings are more conspicuous (Minton 1966). According to Khan (2009) the adults were paler at head, throat and chest bluish and the ventral side whitish.

Kashmir Rock Agama (*Laudakia tuburculata*) searching for prey insects in the bushes.

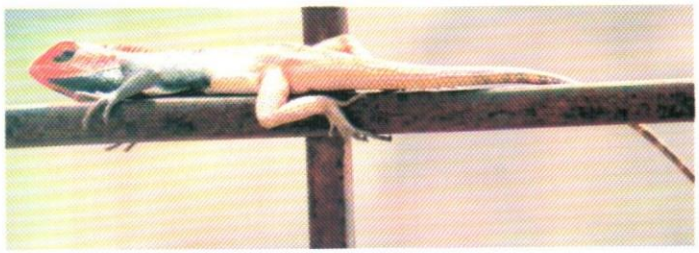
Description

Kashmir Rock Agama *Laudakia tuburculata* is a common species occurring in northern Pakistan and Kashmir. It does not occur above 2500m altitude (Khan, 1999b) and lower than 1250m (Minton, 1966). In a recent study (Khan, 2009) the species has been collected at 4000m in Khunjerab National Park, northern Pakistan. The species is mostly herbivore but also feeds on insects if available in its domain and reach (observations). During the present study particularly juveniles and sub-adults were observed preferring insects which included ants, termites and beetles while an adult was observed picking soft sprouting buds and leaves from the herbs grown adjacent to its nesting rocks. *Atemesia spp* was also observed as favouable feed. It inhabits big rocks of running or dry beds of streams in the study site. Surrounding major habitat is dominated by Blue Pine, *Pinus wallichiana* and Sumbal *Berberis lyciumn*. The macrohabitat includes a number of herbaceous flora. It is common in the study site as well as throughout its wide distribution in northern Pakistan at elevations of 1500-2500m; extralimitally eastern Afghanistan, and Kashmir up to Nepal.

Kashmir Rock Agama *(Laudakia tuburculata)* basking on a rock edge and actively scouting for any threat nearby.

Asian Garden Lizard *Calotes versicolor* Jerdon

This widespread beautiful lizard is native to Indian subcontinent can easily be found in tropical forests, parks and gardens where it feeds on insects and other prey. The lizard was flushed during the survey carried out in the month of June. External features and apparent colors of the body distinguish it a breeding male as identified by Jerdon and Blyth. Though its colour ranges from brownish-buff to greyish, and in the breeding season the throat of the male becomes red and black. The species is identified by the short crest above the neck, the presence of small spines above the tympanum and by the lack of a shoulder fold. The male has swollen cheeks clearly observed. Commonly found amongst low shrubs and bushes, it will also scamper up to wooden structures found with its habitat and/or tree trunks to avoid being detected from predators. Like many agamids the lizard lays its eggs in a hole in the ground.

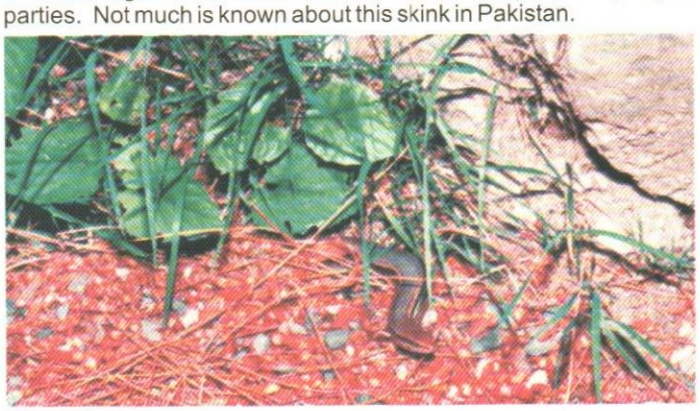


Asian Garden Lizard (male) *Calotes versicolor* Jerdon

The ground-colour is generally a light brownish olive, but the lizard can change it to bright red, to black, and to a mixture of both (photograph). This change is sometimes confined to the head, at other times diffused over the whole body and tail. A common state in which it may be seen is, seated on a hedge or bush, with the tail and limbs black, head and neck yellow picked out with red, and the rest of the body yellowish-red. Jerdon and Blyth agree that these bright changeable colours are peculiar to the male during the breeding-season, which falls in the months of May and June. The species is widely distributed, it ranges from Iran to India, and from southern China down to Thailand.

Striped Grass Mabuya or Striped Grass Skink *Eutropis dissimilis* Hallowell

Striped Grass Skink is a species of skink found in South Asia. In Pakistan, it is distributed in temperate regipon of northern Pakistan and western Himalayas. In Ayubia National Park, the skink was recorded at elevations up to 2500m in rock crevices, under leaf litter or under logs. It was observed in the broad day light enjoing in parties. Not much is known about this skink in Pakistan.



Striped Grass Mabuya (*Eutropis dissimilis*), also called striped grass skink, adapted to moist-temperate forest environment at a height of 2500m and below in Ayubia National Park.

Description

They are medium-sized beautiful lizards with cylindrical bodies, tails of small to medium length, and well-developed arms and legs; each feet and forelimbs have 5 toes. Snout moderate, obtuse. Lower eyelid with an undivided semi-transparent disk. Nostril behind the vertical of the suture between the rostral and the first labial; no postnasal; anteriolabial in contact with the first labial; supranasals in contact behind the rostral; frontonasal broader than long; prefrontals forming a median suture; frontal in contact with the second supraocular only (exceptionally with the first as well). Ear-opening oval, larger than a lateral scale, smaller than the eye-opening, with 3 or 4 short pointed lobules anteriorly. Toes short; subdigital lamellae smooth. Tail about 2.6 times long of head and body. Olive or brownish above, black-spotted, and with 3 more or less distinct light longitudinal streaks, flanks white-spotted; a short horizontal white streak below the eye; lower surfaces whitish.

The skink prefers to moist and shaddy places, hides itself under stones and grasses. In the daytime they come out of their hides and rest in parties in places facing sunlight.

It occurs in Plains of Northern India, from Pakistan to Bengal, also in the "Western Himalayas".

Himalayan Pit Viper *Agkistrodon himalayanus* Gunther

This is a mountain snake occurs most commonly between 1500-5300m elevations but the range may stretch from 800–4877m. It lives in rocky wooded mountain sides, in shady places with more or less closed canopies.

Description

Head moderate sized, distinctly wider than neck, snout blunt slightly turned up at the end, but only in large adults; dorsal scales keeled, in 21: 21: 17 rows; ventrals 147-175; subcaudals 42-53 in males and 36-48 in females; terminal spine of tail sharply pointed; subcaudals divided with few exceptions.

The pattern of the body usually consists of a series of dark cross bands, only slightly distinguishable from the ground color except for their dark margins, irregular ventrolateral spots appear on the lower two or three scale rows and the edges of the ventrals. It also exhibits black band from eye to beyond the angle of mouth and continues on the sides of the neck.

Himalayan Pit Viper *Agkistrodon himalanus* occurs in Ayubia National Park, district Abbotabad.

It is common in the temperate forests of Western Himalayas including the forest of Machiara National Park, AJK and Galliat forest, district Abbotabad and Kaghan-Shogran forests of district Mansehra in Khyber Pakhtunkhwa. This species otherwise is known from the southern face of the Himalayas in the northern Pakistan, Kashmir, northern India and Nepal.

The species was collected from Ghora Dhaka and Dunga Gali area but reported from all over the park at higher elevations. It is still common anywhere occurs in the Park.

Himalayan Pit Viper *Agkistrodon himalayanus.* The species prefers moist-temperate environs, hides itself in the grasses and bushes or under the loose stones.

Discussion

The wild life of this area is varied due to its transitional situation between the Palaearctic and Oriental region. The wildlife fauna has never been systematically evaluated although some survey work has been completed and partial picture exists. The forest of the Ayubia National Park provides the richest habitats for the wild life of Pakistan. Information on the reptiles and amphibians occurring in these mountains is incomplete and very little in-depth research has been done or is under way. Rafaqat (2011) presented an annotated complete list of amphibians and reptiles of Marghalla Hills National Park unfolding 9 species of amphibians and 32 species of reptiles from the area situated between 400-1000m elevation. The present study was conducted at high altitude area lying between 1500-2600m elevation, therefore the area is representative of only few species of reptiles and amphibian occurring at high altitude.

A total of 6 species of Herps belonging to 3 orders and 5 families were recorded. A single species of snake commonly called Himalayan pit-viper, Agkistrodon himalayanus Gunther was observed. It is highly poisonous but rare and less oftenly observed during our travels in the park. This snake is much active only in summer and very successfully camouflaged in the bushy rocks. The snake remains concealed during the low temperature and only seen during clear sunny weather but never observed during nights probably because the temperature of the area sometimes falls to below zero °C even during summer. The snake hibernate for long period during winter when temperature may drops upto -10 °C particularly in the months of January and February (Shafique, 2012).

Among the lizards, 2 species belonging to Agamidae of order Squamata, were abundantly observed during the present study. These species include Kashmir Rock Agama, *L. tuburculata* Hardwick and Gray and the Indian garden lizard, *Calotes versicolor* Jerdon. All species of lizards were more commonly observed during summer and autumn and less abundantly observed during spring and rarely been in winter.

Only one species of the striped grass skink, *Mabuya dissimilis* Hallowell of family Scincidae of order Squamata was more abundantly seen in summer during the present study. As with the case of other reptiles, this species was more common during summer, however they were commonly observed during spring and relatively less common during autumn and become hibernate during winter.

Amphibians were very rare in the Park and the present study has seen the Skittering Frog only during summers. Only one species of Asian Garden Toad, *Bufo melanosticus hazarensis* of family Bufonidae and order Anura was recorded from the Park. The toad is very rare.

Conclusion and Suggestions

All the herps recorded in the Park were strictly confined to arid and open valleys situated on the eastern and southern aspects due to their preference for warmer places. Considerable population variation in the same seasons of different years have been noted because of the little change in the environmental variables. Observations showed that these creatures are so efficient siphoning warmth from their environs that they can raise their body temperatures by sun bathing. At many instances the author observed the Kashmir Rock Agama *L. tubureulata*, Indian Garden Lizard, *Calotes versicolor* going through this process.

Winters are particularly too harsh in the Park normally they fall into deep sleep (hibernation); in some cases as long as 4-5 months (Nov., Dec., Jan., Feb. and March), especially the body temperatures of amphibians become so low that their all body activities slowed down and they become sluggish. In this condition they cannot live above the ground so they pars invents by digging down and rest. They do not eat food but to keep up their vital activities they consume the reserve food stored in the form of fat-bodies. Similarly in summer, due to high temperature, they once again go under ground to sleep particularly in the extreme hotter places. The underground stay is called as summer sleep or aestivation.

Unfortunately, so far no systematic research has been conducted there to explore the herpeto-fauna of the study site. The information described in this paper will be determined by short period of study which was limited to explore all high altitude area ranging from 1500-2900m. Seasonal surveys are suggested to be undertaken at suitable times if we are serious to know the definite record of all herpeto-faunal species occurring in the Park.

Our surveys suggest that the richness of herpetofauna communities in the high altitude areas of Pakistan is quite low, particularly compared to the high richness of southern Pakistan. For example, we never found more than one species of amphibian in each surveyed area. The study area is one of the highest altitude areas situated at the western flanks of the western Himalayas. In these high elevation regions, species richness decreases because of the unfavourable climatic conditions.

Limiting Factors (Threats) to Populations

Human wastes, tetrapacks, wrappers, plastic bags and bottles, tin cans etc. from all habitations, hotels and shops are thrown on hillsides which immediately float to the nearby riparian zone and ultimately to the water bodies. These include the biodegradable materials which contaminate the water and detrimental for the creatures that live in the water.

Population of frog is very common in every type of small or large water bodies but today a great deal of pollutants in water largely affect the numbers of frog and toad especially. In this situation, mortality rate is increased and the population migrates for its sustenance to new ponds, however, their eggs or tadpoles are perished. Adaptation immediate to new places, howevever, is critical matter to limiting populations.

the toad is a species of mountains exterminates insect pests and other insects. General habitat alteration or logging related activities threatens the populations. In Pakistan the Hazara toad is a highland form, it does not extend in the lower Indus Valleys and therefor, the distribution area of the species is limited.

The requirement of wood and fodder, livestock's grazing and browsing, eating or trampling prevented the growth of regenerated shoots of the herbs and shrubs.

The increasing human pressure on the temperate region has badly affected the habitats and the environment putting severe pressure especially on those areas adjoining to the villages. The local population thinning the forest has declined the quality of habitat.

Recreation, relaxation take a number of forms. The increasing density of habitat treks, tracks and passes through the Park, the chair lift related activities and unmanaged tourism has altered the natural habitat and causes massive erosion altering hill-sides scarred and denuded of vegetation.

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Avian diversity and abundance in and around the Khuiratta city, district Kotli, Azad Jammu and Kashmir, Pakistan

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ABSTRACT

A total of twelve study surveys were conducted from March, 2008 to October, 2008 to assess avian diversity in and around the Khuiratta city of District Kotli Azad Kashmir. The study area is at an elevation of about 74°0′35.6 E to 74°7′46.46″E above sea level. During the study survey a total of 50 bird species, belonging to 11 orders and 32 families were observed. Results showed that Passeriformes were the most abundant species (62.00%), followed by Columbiformes (6.00%), Psittaciformes (5.68%), Accipitriformes (5.00%), Apodiformes (4.26%), Coraciiformes (4.00%), Cuculiformes (2.00%), Charadriiformes (1.00%), Strigiformes (0.71%), Galliformes (0.70%), and Caprimulgiformes (0.28%). Diversity indices were recorded highest (3.48) in summer season followed by autumn (3.37) and spring (2.96). The most common birds at Khuiratta city and its surroundings included House sparrow, Black kite, Common myna, House crow, Red vented bulbul, White cheeked bulbul, Spotted dove, Jungle babbler, Koel and rose ringed parakeets.

Introduction

Azad Jammu and Kashmir is situated at foothills of Himalayas. It lies between longitude 73° -75° and latitude of 33°-36° and comprised of an area of 13, 297 square kilometer (Planning and Development Department, Muzaffarabad, 2007). Fauna of Azad Kashmir consists of both Palearctic and Oriental elements (Roberts, 1991).

Many bird species migrate locally or over long distances due to climatic conditions and also in search of food (Awan and Saleem, 2007).

Himalayan Tree Creeper *(Certhia himalayana)* is common and resident bird in Muzaffarabad (Awan et al., 2004). Hoopoe (*Upupa epops)* feeds on ground often found around houses or cultivated areas (Woodcock, 1980 and Ward, 1994). Hoopoe has a resident population in Lahore cantonment and also migrant breeding population found probably in winters in East Africa (Roberts, 1991).

Golden Oriole (*Oriolus oriolus*) is distributed in Pakistan, mainly in the northern part of the country; it is a common visitor and nests around the Murree hills, Abbotabad and Muzaffarabad (Roberts, 1992). Golden Oriole is a common summer visitor in Muzaffarabad but scarce in number (Awan et al., 2004).

Indian Tree Pie (*Dendrocitta vagabunda*) is a wide-spread oriental species, adapted to plains and foothill areas, depending fairly upon good bush cover, as it is arboreal in habits. It occurs all over India, Assam and Burma (Goodwin, 1976). It is also found in Murree hills (Roberts, 1992). Indian tree pie was recorded as resident in Muzaffarabad during the survey but scarce in number (Awan et al., 2004).

Spotted Dove (*Streptopelia chinensis*) widely distributed in Southern Asia, is familiar around villages and gardens (Woodcock, 1980). It is summer visitor to Pakistan, often associated with villages and farm settlements, perching readily upon buildings and nesting in orchards. They are quite tame in the presence of humans but when disturbed burst upwards with noisy clapping flight (Roberts, 1991).

Blue-Throated Barbet (*Megalaima asiatica*) is the common bird of wooded country in the Himalayas, N.E. India and Bangladesh. It has a distinctive rolling three-note call, very familiar around hill villages, although bird itself often remains concealed near the top of a tree (Woodcock, 1980). It is a resident of wooded areas (Kazmierczak, 2000).

Study Area

Khuiratta city the study area lies in district Kotli of Azad Jammu and Kashmir and it is among the most popular cities of district Kotli, which is linked with Islamabad/ Rawalpindi by a distance of 141km and from Kotli 27km road leads to Khuiratta. Climatic conditions of Khuiratta vary during the whole year.

Topographically, study area is semi-mountainous and vegetated with valleys and stretches of plains. The area has various types of landforms and small plateau. Study area was divided into four different study sites according to topographic conditions and vegetation namely Darghooti, Diar, Khagroot and Barooth. Darghooti was the first study site at an elevation of 2576m, and 8km from Khuiratta towards West, having sub-tropical biome. Diar was the second study site mainly vegetated and having plain topography at an elevation of about 2766m, and 1km from Khuiratta towards East. Barooth was the third study site mainly vegetated and plain area at an elevation of about 3715m, and 2km from Khuiratta towards North. Khagroot was the fourth study site mainly plain area at an elevation of about 2706m. This area lies at the end of Khuiratta city, towards west.

Material and Methods

The study surveys were conducted from March 2008 to October 2008, to explore the avian diversity in and around the Khuiratta city. For data collection direct as well as indirect methods were used. For direct data collection fixed point count method was used where-in birds were observed in the area of about 1 km around a fixed point by standing for 30 minutes at different predetermined points in each site of the study area. Birds were identified by using field guides of Woodcock (1980). Binocular and digital camera were used for observation. For birds counting data sheets were used.

Data was analyzed for relative abundance, species richness and diversity indices by using following formula.

Relative abundance = Pi = ni/Ni

Relative abundance = No. of individuals of one specie / Total no. of all species

Shannon- Wiener Index $=H`= -\sum_{i-1}^{s}$ Pi log ePi

Analysis of variance (ANOVA) was done to test the significant difference between different seasons and between different study zones of the area.

Results and Discussions

Study area Khuiratta is the part of district Kotli of Azad Jammu and Kashmir. Its climatic conditions, diverse vegetation and topography provide an ideal habitat to wild life.

A total of 12 monthly visits were made to determine distribution, species richness, abundance and habitat preference of avian fauna in the study area. During present study a total of 50 species belonging to 11 orders and 32 families were identified. The highest numbers of species were found in the family Turdidae of order Passeriformes. Overall relative abundance was recorded highest for Common Myna and lowest for Blue Rock Pigeon, Little Night Jar, Kashmir Roller, Common Sand Piper and Red–wattled Lapwing. Species richness was recorded highest (n =45) in summer followed by autumn (n = 41) and spring (n = 28). Seasonal Shannon – Weiner Index of these species were recorded highest (3.48) in summer season followed by autumn (3.37) and spring (2.96). Out of total 50 species 62.00%, belong to order Passeriformes followed by Columbiformes (6.00%), Psittaciformes (5.68 %), Accipitriformes (5.00 %), Apodiformes (4.26 %), Coraciformes (4.00 %), Cuculiformes (2.00 %), Charadriiformes (1.00 %), Strigiformes (0.71 %), Galliformes (0.70%), and Caprimulgiformes (0.28%).

Test of analysis of variance was also applied between seasons and study sites, which showed significant effect. Calculated value of F_1 (8.55) was greater than tabulated value (5.14) at degree of freedom $F_{0.05}$ (2,6) and the calculated value of F_2 (9.89) was greater than tabulated value (4.76) at degree of freedom $F_{0.05}$ (3,6). So the null hypothesis was rejected, it was concluded that the means of each season and study sites were significantly different.

Common Myna (*Acridotheres tristis)* was very common in the study area. The bird was recorded in spring, summer and autumn. The overall relative abundance is 0.085 (Table 1). It is very abundant in cultivated areas and around human habitation (Woodcock, 1980).

Golden Oriole (*Oriolus oriolus)* was recorded more often in spring season than summer and autumn. Overall relative abundance was recorded to be 0.017 (Table 1), usually seen in trees. It is a common bird in Kashmir, also breeds across northern India, wintering in South and Sri Lanka (Woodcock, 1980). Golden Oriole is a common summer migratory bird in Muzaffarabad but scarce in number (Awan et al., 2004). It prefers cultivated tracts and gardens (Awan and Saleem, 2007).

Jungle babbler (*Turdoides caudatum)* was common in the study area and was recorded several times during summer and autumn. Overall relative abundance was recorded to be 0.042 (Table 1), usually recorded feeding on ground and perching on trees. It is found through-out the area except Srilanka and east of Bangladesh (Roberts, 1991), mostly found in open and dry countries in South Asia (Coller et al., 2007).This bird is omnivorous and feeds on nectar, flower buds, berries, insects, molluscs and seeds (Woodcock,1980).

White Wagtail *(Motacilla alba)* was recorded several times during the survey with overall relative abundance of 0.011 (Table 1). The bird is distributed in Himalayas and Srilanka (Woodcock, 1980), occurs throughout the Indus basin including areas away from water, along roads in cultivated areas and around the margins of ponds and lakes (Roberts, 1992). White Wagtail is recorded as winter visitor in Pattika Recreational Park, Muzaffarabad (Awan and Saleem, 2007).

Large Pied Wagtail (Motacilla *moderospatensis*) was seen many times in summer at different zones. Overall relative abundance was recorded to be 0.011. These birds were mostly recorded walking on grassy ground. This bird is resident throughout the area in well watered countryside, absent in Srilanka. It is more partial to the actual water side by pond or stream than other wagtails, which are content with marshy field (Woodcock, 1980). The large pied wagtail is a sedentary wagtail and a truly Oriental species which is endemic to the Sub-continent; it occurs in the Southern Punjab and lower streams of the Indus in the KPK (Roberts, 1992). The Large-pied Wagtail was recorded for only one time in Chellah, Muzaffarabad along with White Wagtail (Awan et al., 2004). Large pied wagtail was recorded as winter visitor in Pattika Recreational Park, Muzaffarabad (Awan and Saleem, 2007).

House Crow (*Corvus splendens*) was found during the whole survey in the study area, and was observed during spring, summer and autumn in the months of April to August at different study sites. Overall relative abundance of this species was 0.030 (n=28) (Table 1). Woodcock (1980) reported it as widely distributed from treeless steeps of high Himalayas throughout India and Srilanka. It feeds largely on human scraps, small reptiles, insects and other small invertebrates, eggs, nestlings, grain and fruits (Bird Life International, 2007).

Jungle Crow (*Corvus macrorhynchos)* was found throughout the study area during the months of April to August. The bird was mostly recorded sitting on trees and flying. Overall relative abundance recorded is 0.068 (n = 48) (Table 3.1). It inhabits forest, rural habitation and in small number in towns and cities (Grewal, 1993). Mathews (1941) reported that in summer they occur in higher mountains slopes, scrub bushes and juniper forest up to 3600 meters.

Indian Tree Pie (*Dendorcitta vagabunda)* was very common in the study area. The bird was recorded during spring, summer and autumn. Overall relative abundance recorded was 0.028 (n = 20) (Table 1). The bird was mostly seen on tall trees, flying from one tree to other. Kazimierczak (2000) reported it as the most common

and wide-spread bird present in well wooded areas, open forests and parks. Indian Tree Pie is scarce in number and was recorded as resident in Muzaffarabad (Awan et al., 2004).

Himalayan Tree Creeper (*Certhia himalayana*) was recorded during spring season in the months of March and April. Overall relative abundance recorded was 0.004 (n = 3) (Table 1). Whistler (1949) has also reported this species in Kashmir. The bird was always recorded in trees in Pattika Recreational Park, Muzaffarabad and seemed to prefer areas covered with trees and forest (Awan and Saleem, 2007).

White-cheeked Bulbul (*Pycnonotus leucogenys*) was mostly seen during spring, summer and autumn season with overall relative abundance of 0.021 (n = 4) (Table 1). This bird was mostly recorded sitting on trees in the form of pairs. The bird is distributed in Himalayas, also ranges over most of Pakistan and North-West India (Woodcock, 1980). It is wide-spread in the Indus plains and on cultivated areas, especially adapt to drier habitat (Grimmett and Inskip, 2001). It is recorded as resident and abundant (Awan et al., 2004).

Indian Robin (*Saxicoloides fulicata*) was recorded in the study area during the month of autumn sitting on rocks. Overall relative abundance recorded was 0.004 (Table 1). It occurs in open country, cultivation, gardens and searching for insect life on the ground, holding the tail cocked lip as it hops about (Woodcock, 1980). It is found in the low rocky hill out crops of the Punjab Salt Range, Sindh, Kohistan, Khyber-Pakhtoonkhwa extending westwards into Lasbella and the Makran, but it is absent from the interior of Balochistan (Roberts, 1992).

Common Swallow (*Hirundo rustica*) was recorded during spring and summer season with overall relative abundance 0.042 (Table 1). It is common winter visitor that rises in large flocks found over marshes and open countries (Bird Life International, 2004). It breeds in the Himalayas and Assam, dispersing in winter in huge flocks across India to Srilanka, mostly feed on insects (Woodcock, 1980).

Black Drongo (*Dicrurus macrocerus*) was recorded several times during the survey period, in spring, summer and autumn. Bird was mostly recorded on electric wires and sometimes on trees. Overall relative abundance was calculated to be 0.042 (n = 30) (Table 1). It prefers cultivated areas and gardens. The bird is found all over the Indian Subcontinent, Bangladesh, Myanmar, Srilanka and Pakistan (Bird Life International, 2005).

Ashy Drongo (*Dicrurus adsimilis*) was recorded during the spring and summer, mostly recorded perching on electric wires. Overall relative abundance was calculated to be 0.014 (Table 1). The Ashy drongo is present in the hills of tropical Southern Asia from Eastern Afghanistan to China (IUCN, 2006). This is an aggressive, fearless bird found in hill forests and winter in similar well-wooded habitats (Pereira and Alan, 2005). Many populations are migratory (Bird Life International, 2004). The Ashy drongo is insectivorous (Grimmet et al., 2000).

Paradise Flycatcher (*Terpsiphone paradise*) was recorded during spring and summer with an overall relative abundance (0.008) (Table 1). The bird was mostly recorded perching on trees and flying. According to Ali and Ripley (1987) it is a common summer visitor to Punjab. The bird is distributed in Himalaya's foothills, North India, absent in a broad belt across gengetic plains, wide-spread in peninsular India. It inhabits light forests, gardens and open country (Grewal, 1993). Paradise Flycatcher is common summer visitor in Muzaffarabad (Awan et al., 2004). The bird was mostly recorded in Pattika Recreational Park, Muzaffarabad, perching in trees and flying vertically, preferring villages and forests (Awan and Saleem, 2007).

Rofous-backed Shrike (*Lanius schah*) was recorded during summer and autumn with relative abundance of 0.015 (n= 5), 0.026 (n = 5) respectively. This bird was mostly seen on top of the trees. According to Woodcock (1980) this species occurs throughout the area in several races, one being black-headed form, breeding in the central and eastern Himalayas and wintering in the north east.

Grey Tit (*Parus major*) was recorded several times during the study area, with overall relative abundance 0.028 (Table 1). The bird was mostly recorded perching on bushes or small trees and flying down. The bird occurs throughout the lower valleys of Gilgit and Baltistan and in AJK.

It is plentiful below about 2400m (8000f) in horse chestnut forest (Roberts, 1992). It is found in Pattika Recreational Park with a percentage of about 1.74 (Awan and Saleem, 2007). It is found in almost all the parts of Machiara National Park (Awan and Awan, 2007). It is a common winter visitor in the city area of Muzaffarabad (Awan et al., 2004).

Spotted Munia (*Lonchura punctulata*) was recorded during the months of June, July and August, mostly recorded on trees. Overall relative abundance recorded was 0.014 (Table 1). Commonly found in flocks in areas of open scrub and cultivation, interspersed with grassland or gardens. It occurs throughout the plains and hills except in the drier parts of the north-west (Woodcock, 1980).

Blue-throated Barbet (*Megalaima asiatica*) was recorded during summer and autumn with relative abundance 0.006 (n=2), and 0.015 (n=3) respectively. The bird was recorded sitting on wires. Blue-throated Barbet is the common bird of wooded country in the Himalayas, N.E. India and Bangladesh. It has a distinctive rolling three-note call, very familiar around hill villages, although bird itself often remains concealed near the top of a tree (Woodcock, 1980). It is resident found in wooded areas (Kazmierczak, 2000).

Rose-ringed Parakeet (*Psittacula krameri*) was noted several times at different localities with overall relative abundance 0.042 (Table 1). The bird was mostly recorded on pear's plant. In the wild, Rose-ringed Parakeets usually feed on buds, fruits, vegetables, nuts, berries, and seeds (Birdlife International, 2004). According to Grewal (1993) it is found in all India, south of Himalayas foot hills and inhabits light orchards forest and villages. Among residential species Rose-ringed Parakeets were common in Muzaffarabad (Awan et al., 2004).

Pied Crested Cuckoo (*Clamator jacobinus*) was recorded during summer and autumn. Overall relative abundance recorded was 0.009 (Table: 1). According to Ali and Ripley (1987) Pied-crested Cuckoo are brood parasites.

Blue-cheeked Bee Eater (*Merops orientalis*) was recorded only during the autumn with relative abundance of 0.020 (n=4). The bird was mostly recorded sitting on electric wires and trees. It is Oriental in origin occurring widely in S.E. Asia, migrates from India, S.E. China and Indo-China, wintering in the Philippines and Celebes, and is summer visitor to Punjab and NW Pakistan (Ali and Ripley, 1987).

Table 1: Overall relative abundance habit and habitat of birds species recorded at and around the Khuiratta during the year, 2008.

Order	Family	Common Name	Scientific Name	Locality	Abundance	Relative Abundance	Habit/Activity	Habitat	Dominant Vegetation
Passeriformes	Sturnidae	Common Myna	*Acridotheres tristis*	Khagroot , Bahroot, Diar, Darghooti	60	0.085	Birds were mostly walking on ground and sometime flying in air	Hilly, Sloppy and Vegetated area	*Dalbergia sissoo Acacia nilotica*
	Oriolidae	Golden Oriole	*Oriolus oriolus*	Bahroot, Diar	12	0.017	Birds were sitting on trees	Hilly and Vegetated area	*Dalbergia sissoo Olea ferruginea royle*
	Timaliidae	Jungle Babbler	*Turdoides striatus*	Bahroot, Diar	30	0.042	Birds were mostly sitting on ground trees	Hilly and Vegetated area	*Dalbergia sissoo Olea ferruginea royle Cedrela toona*
	Motacilidae	White Wagtail	*Motacilla alba*	Bahroot, Khagroot	6	0.008	Birds were mostly walking on grounds	Vegetated area Hilly	*Dalbergia sissoo Morus nigra*
		Large Pied Wagtail	*Motacilla maderaspatensis*	Bahroot Diar	8	0.011	Birds were walking on ground	Hilly and Vegetated area	*Grewia villosa Dalbergia sissoo*
		Yellow Wagtail	*Motacilla flava*	Bahroot Khagroot	4	0.005	Birds were walking on ground	Vegetated and Hilly area	*Dalbergia sissoo Morus nigra*
	Zoosteropidae	Indian White Eye	*Zosterops pelpebrosa*	Bahroot	12	0.017	Birds were sitting on tree	Vegetated area	*Eucalyptus citriodora*
	Corvidae	House crow	*Corvus splendens*	Bahroot, Khagroot , Diar	28	0.03	Birds were seen on flying in air	Hilly and Vegetated area	*Morus nigra Melia azedarach*
		Jungle Crow	*Corvus macrorhynchos*	Bahroot, Khagroot , Diar, Durghooti	48	0.068	Birds were seen on flying in air	Slopy, Hilly and Vegetated area	*Morus nigra Grewia villosa*
		Indian Tree Pie	*Dendrocitta vagabounda*	Bahroot, Diar	20	0.028	Birds were seen on tall trees and flying from one tree to other	Vegetated area	*Dalbergia sissoo Morus nigra*
	Nactarriniidal	Purple Sun Bird	*Nectarinia asiatica*	Bahroot	10	0.014	Birds were sitting on bottle brush	Vegetated area	Bottle brush
Passeriformes	Passeridae	House Sparrow	*Passer domesticus*	Bahroot, Khagroot , Diar	20	0.028	Birds were sitting on trees in group	Hilly and vegetated area	*Melia azedarach Grewia villosa*
	Certhidae	Himalayan Tree Creeper	*Certhia himalayana*	Bahroot	3	0.004	Birds were sitting on trees making holes on the bark of tree	Vegetated area	*Olea ferruginea royle*
	Pycnonotidae	White-checked Bulbul	*Pycnonotus leucogenys*	Bahroot, Diar, Darghooti, Khagroot	33	0.046	Birds were sitting on trees	Vegetated, Hilly and Sloppy area	*Dalbergia sissoo*
		Red-vented Bulbul	*Pycnonotus cafer*	Bahroot, Diar, Khagroot Darghooti	20	0.028	Birds were sitting on tree	Vegetated, Hilly and Slopy area	*Morus nigra Dalbergia sissoo Grewia villosa*

Order	Family	Common Name	Scientific Name	Locality	Abundance	Relative Abundance	Habit/Activity	Habitat	Dominant Vegetation
	Turdidae	Indian Robin	*Saxicoloides fulicata*	Bahroot, Diar	3	0.004	Birds were sitting on rocks	Vegetated area	*Dalbergia sissoo* *Acacia nilotica* *Cedrela toona*
		Whistling Thrush	*Myiophoneus caeruleus*	Khagroot , Diar, Darghooti	5	0.007	Birds were sitting on wire	Plain and vegetated area	*Ziziphus mauritiana,*
		Magpie Robin	*Copsychus saularis*	Bahroot	15	0.021	Birds were sitting on ground	Vegetated area	*Morus nigra* *Dalbergia sissoo*
		Brown Rock Chat	*Cercomela fusca*	Bahroot, Diar	8	0.011	Birds were sitting on wire	Hilly and Vegetated area	*Acacia nilotica* *Dalbergia sissoo*
		Pied Bush Chat	*Saxicola caprata*	Bahroot Khagroot , Diar	7	0.009	Birds were sitting on tree.	Hilly and Vegetated area	*Morus nigra* *Dalbergia sissoo*
Passeriformes	Hirundinidae	Common Swallow	*Hirundo rustica*	Khagroot	30	0.042	Birds were perching on electric wire and flying	Hilly area	*Morus nigra* *Dalbergia sissoo*
	Dicruridae	Black Drongo	*Dicrurus adsimilis*	Bahroot, Khagroot , Diar, Darghooti	30	0.042	Birds were perching on electric wire and flying	Sloppy Hilly, Vegetated area	*Melia azedarach* *Grewia villosa*
		Ashy Drongo	*Dicrurus leucophaeus*	Bahroot	10	0.014	Birds were perching on electric wire and flying	Vegetated area	*Dalbergia sissoo* *Morus nigra*
	Muscicapidae	Paradise Fly Catcher	*Terpsiphone paradise*	Bahroot Diar	6	0.008	Birds were sitting on trees	Hilly and Vegetated area	*Dalbergia sissoo* *Morus nigra*
	Laniidae	Rufous- backed Shrike	*Lanius schach*	Bahroot, Diar	10	0.042	Birds were sitting on the top of the trees	Hilly and vegetated area	*Grewia villosa* *Morus nigra*
Passeriformes	Laniidae	Indian Grey Shrike	*Lanius excubitor*	Bahroot, Diar	8	0.011	Birds were sitting on the top of the trees	Hilly and vegetated area	*Grewia villosa* *Zanthoxylum alatum*
	Estrildidae	Spotted Munia	*Lanchura punctulata*	Bahroot, Diar	10	0.014	Birds were sitting on the tree	Hilly and vegetated area	*Acacia nilotica* *Olea ferruginea*
	Paridae	Grey Tit	*Parus major*	Bahroot, Diar	20	0.028	Birds were sitting on the tree	Hilly and vegetated area	*Acacia nilotica* *Dalbergia sissoo*
		Red-headed Tit	*Aegithalos concinnus*	Bahroot, Diar	10	0.014	Birds were sitting on the tree	Hilly and vegetated area	*Dalbergia sissoo* *Acacia nilotica*
		House Martin	*Delichon urbica*	Bahroot, Diar	5	0.007	Observed on electric wire and trees	Hilly and vegetated area	*Morus nigra* *Dalbergia sissoo*
Columbiformes	Columbidae	Blue Rock Pigeon	*Columba livia*	Diar	2	0.002	Birds were flying in air	Vegetated and hilly area	*Morus nigra* *Acacia nilotica*
		Spotted Dove	*Streptopelia chinenisis*	Bahroot, Diar	20	0.028	Birds were observed on electric wire and pairs of birds sitting on trees	Hilly, vegetated area	*Morus nigra* *Acacia nilotica*
		Collard Dove	*Psittacula decaocto*	Khagroot , Darghooti	20	0.028	Birds were observed on electric wire and pairs of birds sitting on trees	Slopy, Hilly and vegetated area	*Ziziphus mauritiana* *Morus nigra*

Order	Family	Common Name	Scientific Name	Locality	Abundance	Relative Abundance	Habit/Activity	Habitat	Dominant Vegetatio
Psittaciformes	Psittacidae	Rose-ringed Parakeet	*Psittacula krameri*	Bahroot, Diar	30	0.042	Birds were sitting on trees of pear	Hilly and vegetated area	*Debergia sissoo* *Acacia nilotica*
		Alexandrine Parakeet	*Psittacula eupatria*	Bahroot, Diar	10	0.014	Birds were sitting on trees, of pear and apple.	Hilly and vegetated area	*Dalbergia sissoo* *Acacia nilotica*
Cuculiformes	Cuculidae	Common Koel	*Eudynamys scolopacea*	Bahroot, Diar	7	0.009	Birds were singing song	Vegetated and Hilly area	*Dalbergia sissoo* *Acacia nilotica*
		Pied Crested Cuckoo	*Clamator jacobinus*	Bahroot	7	0.009	Birds were sitting on trees	Vegetated area	*Morus nigra* *Dalbergia sissoo*
Coraciiformes	Upupidae	Hoopoe	*Upupa epops*	Bahroot, Diar	10	0.014	Birds were sitting on maize field	Vegetated and Hilly area	*Cedrela toona* *Morus nigra*
Coraciiformes	Coraciidae	Kashmir Roller	*Coracias garrulus*	Khagroot	2	0.002	Birds were observed on electric wire	Hilly area	*Morus nigra* *Dalbergia sissoo*
	Alcedinidae	White- breasted King Fisher	*Halcyon smyrnensis*	Khagroot , Bahroot, Diar	10	0.014	Birds were sitting on electric wire	Hilly, vegetated area	*Morus nigra* *Dalbergia sissoo*
	Alcedinidae	Pied King Fisher	*Ceryle rudis*	Diar	6	0.008	Birds were sitting on electric wire	Vegetated and Hilly area	*Dalbergia sissoo* *Morus nigra* *Acacia nilotica*
	Meropidae	Blue-cheeked Bee Eater	*Merops orientalis*	Bahroot	4	0.005	Birds were sitting on a wire	Vegetated area	*Dalbergia sissoo* *Morus nigra* *Grewia villosa*
Apodiformes	Apodidae	Little House Swift	*Apus affinis*	Khagroot	30	0.042	Birds were flying in air	Hilly area	*Dalbergia sissoo* *Morus nigra*
Caprimulgiformes	Caprimulgidae	Little Night Jar	*Caprimulgus asiaticus*	Bahroot	2	0.002	Birds were sitting on a tree	Vegetated area	*Dalbergia sissoo* *Acacia nilotica* *Morus nigra*
Accipitriformes	Accipitridae	Black Kite	*Milvus migrans*	Khagroot , Diar, Darghooti, Bahroot	35	0.049	Birds were flying in air	Sloppy, Hilly and vegetated area	*Dalbergia sissoo* *Morus nigra*
Strigiformes	Strigidae	Spotted Owlet	*Athene brama*	Diar	5	0.007	Bird were sitting on a trees	Hilly and vegetated area	*Morus nigra* *Dalbergia sissoo*
Charadriiformes	Scolopacidae	Common Sand Piper	*Tringa hypoleucos*	Khagroot	2	0.002	Birds were sitting on the rock	Hilly area	*Dalbergia sissoo* *Morus nigra*
Passeriformes	Capitonidae	Blue-throated Barbet	*Megalaima asiatica*	Bahroot	5	0.007	Birds were sitting on trees	Vegetated area	*Dalbergia sissoo*
Galliformes	Phasianidae	Common Quail	*Coturnix coturnix*	Diar	3	0.004	Birds were sitting on trees	Hilly and vegetated area	*Morus nigra*
	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	Khagroot	2	0.002	Birds were recorded on rocks	Hilly area	*Dalbergia sissoo*

Black Kite *(Milvus migrans)* was recorded frequently during the survey. The bird was mostly recorded flying in air. Overall relative abundance recorded was 0.049 (n = 35) (Table 1). Black Kite is well adapted to living in cities and is found even in densely populated areas (Pierre and Alan, 2005).

Little Night Jar (*Caprimulgus asiaticus*) was recorded only during the summer with relative abundance of 0.006 (n=2). The bird was recorded sitting on a tree. The bird was also recorded in Nagarparker, district Tharparkar, Sindh (Azam and Shafique, 2005). Usually seen at dusk flitting over a garden or forest glade. Found throughout the area in open, bushy or lightly wooded country (Woodcock, 1980).

Present study reveals that the area is rich in avian fauna. In order to maintain and enhance this fauna it is imperative to take steps for the betterment of habitat of the study area. This can be done by increasing the plantation of the area as these trees provide the habitat, food, nesting sites and other requirements for the bird species.

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Vertebrate diversity of West Coast of Pakistan

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KEYWORDS

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ABSTRACT

Coastal areas are important ecologically and economically for a country. The present study was conducted to determine the vertebrate diversity as well as threats to vertebrate at three localities namely Ormara, Pasni/Astola and Gawadar/Jiwani of Makran coast of Pakistan. The population was estimated by both direct and indirect methods. During study, 149 species of birds belong to 43 families and 17 orders, 13 species of mammals comprising of 5 families and 3 orders, 16 species of reptiles from 8 families and 4 orders, single species of toad from single family and single order and 34 species of fish belong to 12 families were recorded. The serious Threats to vertebrate diversity including: Poaching, killing, capturing animals alive, domestication of animals, and remains of nylon fishing nets are also discussed in detail.

Introduction

Pakistan has 1046 km long coastline, stretching from Sir Creek on the southeast adjacent to Indian border to Jiwani on the west near Iranian border (IUCN 2005). The major portion of Pakistan's coastline almost 770 km lies in Balochistan while the rest 270 km lies in Sindh. The Balochistan Coast extends from Lasbela near Karachi to Jiwani at the Iranian borders and has several indentions (UNESCO 1994). These indentions are shelters to the small fishing craft from high waves. The area receives very low precipitation, 150 mm/per annum and the soils are highly saline. Due to hyper saline condition and low precipitation, the coast is entirely deserted. Four small urban centers, Ormara, Pasni, Gawadar and Jiwani (Figure1) account for more than half of the coastal population estimated at 400,000.

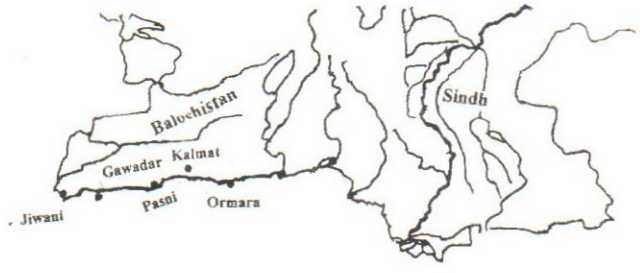

Figure 1: Map of study area- Ormara, Kalmat, Pasni, Gawadar, Jiwani

The coast is drained by the seasonal rivers of Hingol, Basol, Shadi Kaur and Dhasht. The mountains are composed of bare rocky limestone or conglomerate and except in some upper highlands, have no vegetation. The coastline is subject to wave attack during south west monsoons, when near seashore wave height is over 3.5 meters. The coastline faces considerable erosion. On the coastal Balochistan water erosion is several times higher than wind erosion. Owing to the shortage of promontories and sheltered areas, most of the littoral material is lost to the sea. Some 25 km south of Pasni is the Astola Island with an area of 5000 hectares. The major portion of the Island comprises of small mountains which are about 200 meters above the sea level (Khurshid et al 1995). Hard and soft coral communities have been reported in the area.

There are only three small pockets of mangroves along the whole Balochistan coastline covering a total area of only 18,350 acres (Saifullah and Rasool 2002). But along Makran coast, mangrove thickets are restricted to two geographical locations, namely Kalmat Khor and Gawadar Bay. At present the dominant species in most areas is *Avicennia marina*. The mangrove thickets are excellent habitats for birds, fishes, marine mammals and marine snakes (Hasan 1994 and Ahmad et al 1997) and birds utilize mangrove thickets in several ways (Hasan 1996). In the mangrove ecosystem several species of fishes pass early stages of life cycle (Ahmad and Hasan 1997).

Large numbers of green turtles are known to visit the beaches of the study area for nesting. Olive ridley turtles also visit this coast, although their numbers are lower to green turtles. The most important turtle beaches are at Ormara (Taak), Astola (off Pasni) and Jiwani (Daran). Marine turtles nest throughout the year along the Makran Coast, with peak activity in the months of October to December for green turtles and July to August for Olive ridley turtles. The present study was conducted in three localities of Makran coast namely Ormara, Pasni/Astola and Gawadar/Jiwani.

Material and Methods

Direct count is one of the most widely used methods for determining species diversity and abundance. This is done by taking randomly selected points and recording number of each species. During the survey, birds were identified in the field by professional skills and confirmed with the help of field guides (Roberts 1991-92). Binoculars and spotting scope was used to count the number of birds precisely. In order to estimate bird species diversity, richness and abundance, surveys of hot spots (identified by locals) were carried out in all the three localities of Makran Coastal Wetlands Complex. This was done by taking random points at different places within hot spots.

Small mammals were sampled using small locally made aluminum box traps. Traps of this type are suitable to capture small rodents and other mammals of similar size; they were baited with

combination of rolled oats, peanut butter and honey. Twenty traps were set within cover or shaded locations at each sampled site and then left overnight for early morning examination. The species of small mammals were identified (Roberts 1997) and number of individual animals of each species counted before releasing them.

Surveys were carried out in hilly and sandy areas with xerophytic plantation and at harbours. Reptiles and amphibian were identified after Khan (2006). Fishes of the study area were identified at harbours/Jetties during public sale. Fishes were identified after Fischer and Bianchi (1984) and Bianchi (1985). Photographs of fishes were also taken for further identification.

Results and Discussions:

Birds:

The coastal areas of Makran provide excellent breeding, feeding and roosting grounds for a variety of migratory and resident birds (Hasan and Khan 2005). The coastline provide refuge for a variety of globally threatened species of waterfowl, desert birds, eagles falcons, pelicans, variety of ducks, sand grouses and bustards. Marine Biological Research Laboratory, Karachi has recorded 149 species of birds comprising of 43 families and 17 orders. The complete list of birds along with their status is given in Appendix I.

Appendix I

List of birds recorded from Makran coast. Abbreviations: Resident (R), Winter visitor (WV), Partly winter visitor/partly resident (WV/R), Passage migrant (PM), partly resident/partly winter visitor (R/WV), Migratory/passage migrant (M/PM), Rare winter visitor (WV/r), summer breeding visitor/passage migrant (SBV/WV/PM), summer visitor (SV), summer breeding visitor/passage migrant (SBV/PM)

Order	Family	Scientific Name	Common Name	Status
		Tachybaptus ruficollis	Little grebe	R/common
		Podiceps nigricollis	Blacknecked grebe	WV/Scarce
Podicipediformes	Podicipedidae	*Podiceps cristatus*	Great crested grebe	WV/Scarce
		Pelecanus onocrotalus	White pelican	WV/common
	Pelecanidae	*Pelecanus crispus*	Dalmatian pelican	WV/rare
	Sulidae	*Sula dactylatra*	Bluefaced bobby	WV/rare
Pelecaniformes	Phalacrocora-cidae	*Phalacrocorax carbo*	Large cormorant	WV/common
		Ardea cinerea	Grey heron	WV/common
		Ardeola grayii	Indian pond heron	R/common
Ciconiiformes	Ardeidae	*Egretta alba*	Large egret	WV/common
		E. garzetta	Little egret	R/comm
		E. gularis	Indian reef heron	R/common
	Threskiorni-thidae	*Platalea leucorodia*	White spoonbill	WV/frequent
Phoenicopteri-formes	Phoenicopte-ridae	*Phoenicopterus ruber*	Greater flamingo	WV/common
		Tadorna tadorna	Common shelduck	WV/common
		Anas crecca crecca	Common teal	WV/common
		Anas Platyrhynchos	Mallard	WV/common
		Anas acuta	Nothern pintal	WV/common
		Anas strepera	Gadwall	WV/common
		Anas penelope	Wigeon	WV/common
		A. querquedula	Garganey or blue-winged teal	PM/common
		A. clypeata	Common shoveller	WV/common
		Aythya ferina	pochard	WV/common European
		Aythya fuligula	Tufted duck	WV/frequent
Anseriformes	Anatidae	*Netta rufinia*	Red creasted pochard	WV/rare
		Mergus serrator	Red breasted merganser	WV/rare
		Mergus merganser	Common merganser	WV/scarce
		Milvus migrans	Black pariah kite	R/common
		Accipiter badius	Sparrow hawk	R/frequent
		Buteo rufinus	Longlegged buzzard	R/common
		Buteo buteo	Common buzzard	WV/frequent
		Butastur tessa	White eyed buzzard	R/common
		Aquila heliaca	Imperial eagle	WV/scarce
		A. rapax	Tawany eagle	R/frequent
		Aquila nipalensis	Steppe Eagle	WV/frequent
		A. clanga	Greater spotted eagle	WV/frequent
Accipitriformes	Accipitridae	*Neophron percnopterus*	Egyptian vulture	R/common
		Circus aeruginosus	Marsh harrier	WV/frequent
		Circus macrourus	Pallid harrier	WV/scarce
		Haliaeetus leucoryphus	Palla's ringed tailed fish eagle	WV/scarce
	Pandionidae	*Pandion haliaetus*	Osprey	WV/common

Falconiformes	**Falconidae**	*Falco cherrug*	Saker falcon	WV/rare
		F. tinnunculus	Kestrel	WV/common
		F. naumanni	Lesser kestrel	WV/rare
		Falco concolo	Sooty falcon	R/rare
		Falco polegrinoides	Red napped shaheen	WV/rare
Galliformes	**Phasianidae**	*Ammoperdix griseogularis*	See see partridge	R/rare
		Cotumix cotumix	Common quail	M/PM
Gruiformes	**Rallidae**	*Gallinus chloropus*	Indian moorhen	R/common
		Fulica atra	Common coot	WV/common
Charadriiformes	**Haematopodidae**	*Haemantopus ostralegus*	Oystercatcher or sea-pie	WV/common
	Dromadidae	*Dormas ardeola*	Crab plover	M/rare
	Recurvirostridae	*Himantopus himantopus*	Blackwinged stilt	R/common
	Burhinidae	*Esacus recurvirostris*	Great thicknee or stone plover	R/rare
		Cursorius cursor	Cream coloured courser	WV/scarce
	Charadriidae	*Vanellus indicus*	Redwattled lapwing	R/common
		Chettusia levicurus	White tailed lapwing plover	WV/rare
		Pluvialis squatarola	Grey plover	WV/frequent
		P. apricaria	Golden plover	WV/rare
		Charadrius dubius	Little ringed plover	R/common
		C. alexandriunus	Kentish plover	SBV/WV/PM
		C. leschenaultii	Great sand plover	WV/common
		C. mongolus	Mongolian sand plover	WV/common
	Scolopacidae	*Limosa limosa*	Blacktailed godwit	WV/scarce
		L. lapponica	Bartailed godwit	WV/scarce
		Numenius phaeopus	Whimbrel	PM/rare
		N. arquata	Curlew	WV/common
		Tringa erythropus	Dusky redshank	WV/common
		Tringa stagnatilis	Marsh sandpiper	WV/common
		T. nebularia	Greenshank	WV/frequent
		T. ocropus	Green sandpiper	WV/frequent
		Xenus cinereus	Terek sandpiper	WV/common
		Tringa totanus	Common redshank	WV/common
		Actitis hypoleucos	Common sandpiper	WV/common
		Gallinago gallinago	Common fantail snipe	WV/scarce
		Calidris tenuirostris	Great knot	WV/common
		C. alba	Sanderling	WV/common
		C. minuta	Sanderling	WV/common
		C.alpina	Dunlin	WV/common
		C. furruginea	Curlew sand piper	WV/common
		Limicola falcinellus	Broadbilled sandpiper	WV/rare
		Phliomachus pugnax	Ruff	WV/common
	Laridae	*Larus hemprichii*	Sooty gull	SV/scarce
		L. argentatus	Herring gull	WV/common
		L. fuscus	Lesser blackbacked gull	WV/common
		L. ichthyaetus	Great blackheaded gull	WV/common
		L. ridibundus	Blackheaded gull	WV/common
		L. genei	Slender-billed gull	R/common
		Gelochelidon nilotica	Gull-billed tern	WV/common
		Sterna caspia	Caspian tern	WV/common
		Sterna albifrons	Little tern	R/common
		S. hirundo	Common tern	R/common
		Sterna sandvicensis	Sandwich tern	M/common
		Sterna bergii	Large crested tern	Irregular year round/common
		Anous stolidus	Common noddy	S/rare

	Pteroclididae	*Pterocles orientalis*	Black bellied sandgrouse	WV /scarce
	Columbidae	*Columba livia*	Blue rock pigeon	R/common
		Streptopelia decaocto	Indian collared dove	R/common
Columbiformes		*S. senegalensis*	Indian laughing dove	R/common
Strigiformes	Strigidae	*Asio flammeus*	Short-eared owl	WV/frequent
Caprimulgi-formes	Caprimulgidae	*Caprimulgus mahrattensis*	Sykes nightjar	R/frequent
Cuculiformes	Cuculidae	*Eudynamys scolopacea*	Indian koel	R/common
Apodiformes	Apodidae	*Apus pallidus*	Pale brown swift	WV/scarce
	Alecedinidae	*Alcedo attis*	Indian common blue kingfisher	R/common
		Halcyon smyrensis	Whitebreasted kingfisher	R/common
	Meropidae	*Merops superciliosus*	Bluecheeked bee eater	SBV/PM
		Merops orientalis	Sind little green bee-eater	R/common
Coraciiformes	Coraciidae	*Coracias benghalensis*	Indian roller	R/common
	Alaudidae	*Alaemon alaudipes*	Desert finch-lark	R/frequent
		Alaemon alaudipes	Hoopoe lark	R/common
		Calandrella acutirostris	Hume's Short-toed lark	WV/common
		Ammomanes cincturus	Bar-tailed lark	WV/common
		Galeria cristata	Indian crested lark	R/common
		Alauda gulgula	Small sky lark	R/common
	Hirundinidae	*Riparia paludicola*	Indian sand martin	R/common
		Ptyonoprogne fuligul	Plae crag martin	R/common
		Hirundo rustica	Common swallow	R/common
	Motacillidae	*Motacilla flava*	Yellow wagtail	PM/scarce
		M. alba	Indian pied wagtail	WV/common
		Anthus campestris	Tawny pipit	WV/common
		A. similis	Longbilled pipit or brown rock pipit	R/common
	Pycnonotidae	*Pycnonotus leucogenys*	White cheeked bulbul	R/common
	Laniidae	*Lanius vittatus*	Bay-backed shrike	PM/common
		Lanius excubitor	Indian great grey shrike	R/common
		L. isabellinus	Isabelline shrike	R/common
	Turdidae	*Phoenicurus ochruros*	Black redstart or Indian redstart	WV/scarce
		Erithacus svecicus	Bluethroat	WV/scarce
		Sexicola caprata	Pied bush-chat	R/common
		Oenanthe isabellina	Isabelline wheatear	WV/common
		O. picta	Pied wheatear	WV/scarce
		Oenanthe deserti	Desert wheatear	WV/common
		O. monacha	Hooded wheatear	R/common
		O. xanthoprymna	Red tailed wheatear	WV/scarce
	Timaliidae	*Turdoides caudatus*	Common babbler	R/common
	Sylviidae	*Prina gracilis*	Graceful prinia	R/common
		Prinia buchanani	Wren prina	WV/common
		Sylvia nana	Desert warbler	WV/common
Passeriformes		*Sylvia curruca*	Lesser white throat	WV/common
		Cettia cetti	Cetti's warbler	WV/scarce
		Aacrocephalus dumetorum	Blyth's reed warbler	WV/frequent
		Phylloscopus collybita	Chiffchaff	WV/common
	Nectariniidae	*Nectarinia asiatica*	Puple sunbird	R/common
	Emberizidae	*Emporia etiolate*	House bunting	R/common
	Ploceidae	*Passer domesticus*	House Sparrow	R/common
		Ploceus philippinus	House Sparrow	R/common
	Sturnidae	*Acridotheres tristis*	Indian common mynah	R/common
	Dicruridae	*Dicrurus macrocercus*	Black drongo	R/common
	Corvidae	*Corvus splendens*	House crow	R/common
		C. ruficollis	Brown-necked raven	R/common

Mammals

During the survey of three localities of Makran coast, 13 species of mammals belong to seven families and three orders were recorded (Appendix II) and confirmed by Roberts (1997). Out of 13 recorded species, 10 species of mammals were observed from land while 3 species of marine mammals were reported from the study area. Among the terrestrial species, seven species of rodents and three species of carnivores were observed from Makran Coast (Appendix II).

Marine Mammals

Three species of marine mammals were recorded from the study area. A total of 18 humpbacked dolphins (*Sousa chinensis*) were sighted at Pasni and Gawadar/Jiwani areas of Makran in three sightings. The first sighting was at Pasni on the way to Astola Island where 10 Humpback dolphins were recorded at Khoi Ku (Pasni). The other two sightings were at Gawadar on the way to Jiwani. The first sighting was near Matka Post where two dolphins were observed from beach while during second sighting six dolphins were observed near Peshukan (Gawadar). In the other sightings more than 10 spinner dolphins (*Stenella longirostris*) were recorded near Astola. A dead beached specimen of black finless porpoise (*Neophocaena phocaenoides*) was observed at Gawadar.

Terrestrial Mammals

During the survey of three localities of Balochistan Coast, 10 species of terrestrial mammals were recorded from the study area. Out of 10 species, seven species belong to order Rodentia and three species come under order Carnivora (appendix II).

Appendix II

List of mammals observed from Makran Coast ("+" indicates the presence of species)

Order	Family	Name	Common name	Ormara	Pasni	Gawadar/ Jiwani
Carnivora	Canidae	*Canus aureus*	Asiatic Jackal			+
		Vulpus vulpus	Common Red Fox			+
	Herpestidae	*Herpestes edwardsi*	Indian Grey Mongoose			+
Rodentia	Sciuridae	*Funambulus pennanti*	Northern palm squirrel	+		
	Hystricidae	*Hystrix cristatus*	Indian crested porcupine		+	+
	Muridae	*Rattus rattus*	Roof rat	+		
		Mus musculus	House mouse	+		
		Gerbillus nanus	Balochistan gerbil	+	+	+
		Tatera indica	Indian gerbil	+	+	+
		Meriones hurrianae	Indian desert gird			+
Cetacea	Delphinidae	*Sousa chinensis*	Humpback dolphin		+	+
		Stenella longirostris	Spinner dolphin		+	
	Phocoenidae	*Neophocaena phocaenoides*	Finless porpoise			+

Reptiles

From the Makran coast 16 species of reptiles from 8 families, 4 orders (Appendix III) were reported and confirmed after Khan (2006). Sixteen species of reptiles include one species of marine turtle, one species of Crocodile, four species of Agama, two species of Lacerta, two species of Gecko, one species of Sand swimmer, five species of snakes (including one sub-species).

Aquatic Reptiles

Marine turtles

During present surveys of Makran coast, only one species of marine turtle i.e *Chelonia mydas* was sighted. The intensity of nesting at Astola Island in the month of November was recorded very high where more than 25 female of Pacific green sea turtle (*Chelonia mydas) and their nests* were counted on a ½ kilometer stretch. The other two sites, Ormara and Jiwani where surveys were conducted in October and December are equally important sites for *Chelonia mydas* nesting.

Marine Snakes

Out of 14 species of marine snakes reported by Rehman et al 1988 from Pakistan, three species were sighted at Ormara Jetty during current surveys. The species were: annulated sea snake (*Hydrophis cyanocinctus*), yellow sea snake (*Hydrophis spiralis*), and pelagic sea snake (*Pelamis platurus*).

Crocodiles

One species of Marsh crocodile (*Crocodylus palustris)* was recorded from two visited reservoirs at Dhast River (Gawadar) and one at Basol River Reservoir (Ormara). Sighting of footprints of several crocodiles at both the localities were recorded along muddy banks. According to local peoples, the following are some of the ponds in Dhast river which have quite good number of Marsh

Crocodiles: Bashir-e Guerm (12), Lodi-e-Ab (21), Culmeri Sunt (17), Shum-e-Ab (05), Regathani Bat (07), Rahi-e-Bat/Bogy-e-Bat (08 – 10) and Chati Gadop (02).

Terrestrial Reptiles:

From the study area 11 species of terrestrial reptiles were recorded (appendix III). Out of 11 species of reptiles, four species of Agama include: Yellow speckled toad agama (*Phrynacephalus luteoguttatus*) observed from Gawadar area, Common tree lizard (*Calotes versicolor*) observed from Awaran (Pasni) and Jiwani Hor area. *Agama agilis* (*Trapelus agilis pakistanensis*) observed from Basol and Dabban areas of Ormara and Ocellate ground agama (*Trapelus megalonyx*) observed from Dabban area of Pasni. Two species of geckos, Yellow tail sand gecko (*Crossobamon orientalis*) and Kachh-spotted ground gecko (*Cyrtopodion kachhense kachhense*) were observed from two different localities of Pasni. Kachh-spotted ground gecko was observed from Astola while Yellow tailed sand gecko was observed from Awaran. Two species of lizards, Blue- tail sand lizard (*Acanthodactylus cantoris*) and Rugnose spectacled lacerta (*Ophisops jerdonii*) and Blue tail sand lizard was observed in all the three localities of Makran while Rugnose spectackled lacerta was observed from Dabban (Pasni) and Gawadar area. One species of viper snake, Saw- scale viper (*Achis carinatus carinatus*) and its sub-species Astola saw-scaled viper or Dark-blotched saw-scale viper (*Achis carinatus astolae*) was also recorded from the study area. Saw-scaled viper was observed from Thalkar (Ormara) and Juddi (Pasni), while Dark-bloched saw-scaled viper was confirmed from Astola Island.

Appendix III

List of reptiles recorded from Makran Coast ("+" indicates the presence of species)

Orders	Family	Name	Common name	Ormara	Pasni	Gawadar/Jiwani
Testudine	Chelonilidae	*Chelonia mydas*	Green turtle	+	+	+
Crocodilia	Crocodylidae	*Crocodylus palustris*	Marsh crocodile Or Magar mach	+		+
Squamata	Agamidae	*Phrynocephalus luteoguttatus*	Yellow speckled toed agama			+
		Calotes versicolor	Common tree lizard		+	+
		Trapelus agilis pakistanensis	Trapelus agilis	+		
		Trapelus megalonyx	Ground agama	+		
	Scincidae	*Ophiomorus tridactylus*	3-toed Sand-Swimmer		+	+
	Gekkonidae	*Crossobamon orientalis*	Yellow tail sand gecko		+	
		Cyrtopodion kachhense kachhense	Kachh-Spotted ground gecko		+	
	Lacertidae	*Acanthodactylus cantoris*	Blue tail sand lizard	+	+	+
		Ophisops jerdonii	Rugose Specktacled Lacerta	+		+
Ophidia	Viperidae	*Achis carinatus carinatus*	Saw-scale viper	+	+	
		Achis carinatus astolae	Dark-blotched saw-scale viper		+	
	Hydrophilidae	*Hydrophis cyanocinctus*	Annulated sea snake	+		
		Hydophis spiralis	Yellow sea snake	+		
		Pelamis platurus	Pelagic sea snake	+		

Amphibian

Only one species of toad, Indus valley toad (*Bufo stomaticus*) belongs to family bufonidae and order anura was observed from Thalkar (Ormara) and Jiwani Hor. At Thalkar (Ormara), 8 specimens were observed while at Jiwani Hor only single specimen was observed.

Fishes

From the study section, 34 species of fish comprising of 12 families were recorded (Appendix IV). At Pasni Harbour, *barracuda* was the major landing group. Two species of barracuda were identified as *Cherron barracuda* and *Pickhandle barracuda* (Fischer and Bianchi, 1984).

At Gawadar Harbour, croakers (scianids) were the major landing group, while the other important groups were hairtails and white pomfrets. On the west coast of Gawadar there were bulk landings of sardines. The species was identified as *Sardinella longiceps*.

Appendix IV

List of fishes recorded from Makran Coast ("+" indicates the presence of species)

Family	Scientific Name	English Name	Local Name	Ormara	Pasni	Gawadar/ Jiwani
Clupeidae	*Sardinella longiceps*	Indian Oil Sardine	Luger (Bal.)			+
	Tenualosa ilisha	Hilsa Shad	Palwar			+
	Tenualosa toil	Toli Shad	Palwar			+
Muraenesocidae	*Muraenesox cinereus*	Dagger tooth pike conger	Bam, Saang		+	
	Arius thalassinus	Giant cat fish	Kanparo	+	+	+
	Epinephelus diacanthus	Thorny cheek grouper	Chancho		+	
	Epinephelus malabaricus	Malabar grouper	Nambo		+	+
Carangidae	*Carangoides fordan*	Blue trevally	Pattar		+	
	Carangoides malabaricus	Malabar trevally	Pattar		+	+
	Gnathanodon speciosus	Golden trevally	Gishron		+	
	Parastromateus niger	Black pomfret	Kala pithoo		+	
	Scomberoides tol	Needle scaled queen fish	Saram kainchan		+	+
Pomadasyide	*Pomadasys argenteus*	Silver grunt	Kimpo		+	+
	Pomadasys multimaculatum	Cock grunter	Kimpo		+	+
Lethrinidae	*Lethrinus nebulosus*	Spangled emperor	Gadeer			+
Sciaenidae	*Protonibea diacanthus*	Spotted croaker	Kir		+	+
	Otolithes rubber	Tiger tooth croaker	Musko	+	+	+
	Otolithes cuvieri	Tiger tooth croaker	Musko		+	+
Scatophagide	*Scatophagus argus*	Spotted scat	Dateera		+	
Mugilidae	*Mugil cephalus*	Flathead mullet	Tagan	+	+	+
	Liza vaiginesis	Square tail mullet	Murbo	+	+	+
Sphyraenidae	*Sphyraena putnamiae*	Cherron barracuda	Kund		+	+
	Sphyraena jello	Pickhandle barracuda	Kund		+	+
Scombridae	*Euthynnus affinis*	Kawakawa	Ahore		+	+
	Katsuwonus pelamis	Skipjaek tuna	Ahore		+	+
	Rastrelliger kanagurta	Indian Mackerel	Bangon	+	+	+
	Scomberomorus commerson	Narrow-barred Spanish	Mackerel Gore		+	+
	Scomberomorus lineolatus	Streaked seer fish	Kulgun		+	+
	Scomberomorus guttatus	Indopacific king mackerel	Kulgun		+	+
	Thunnus albacares	Yellowfin tuna	Gidder		+	+
Trichiuridae	*Trichiurus lepturus*	Large head hair tail	Chundi	+	+	+
	Lepturacanthus savala	Savalal hair tail	Chundi	+	+	+
Stromateidae	*Pampus argenteus*	Silver pomfret	Pitho	+	+	+
	Pampus chinnensis	Chinese silver pomfret	Wanag	+	+	+

Threats to vertebrate diversity

1. It was observed during survey at Ormara that illegal hunters captured the birds like quails by net traps (Fig.2). In this way hundreds of live birds are trapped and sold.

Figure 2: Common quail at Ormara

2. Falcons are trapped at Ormara by totally different technique. A poacher remains hidden in a small hideout for hours and tries to attract falcons by using a bait usually European kestrel or dove as a bait fixed with the rope connect by a small net. The net opens with the pulling of rope. In normal condition, net remains closed (Fig.3). The net opens and the prey and predator both are trapped in it. There are some confirmed reports that several expensive falcons are captured every year for smuggling.

Figure 3: A trap set for Falcons at Ormara

3. Some residents of Ormara capture Pelecans, Flamingoes and other important birds for domestication (Fig.4). The purpose for domestication seems aesthetic. The survey team observed some of the birds at streets of Ormara. The birds were not shy at all with humans or vehicles.

Figure 4: A domesticated white Pelican on the street at Ormara

4. Some bird hunting incidents were also witnessed by the members of survey team. The survey team found used cartriges at Ormara Jetti and Baldra River. The local people confirmed that illegal shooting at some of the hot spots take place every year.
5. Taak, an important turtle beach was found unsaved for turtle hatchlings and gravid females. There are some reports (personal communications) of attacking of dogs on turtle hatchling and gravid females. The survey team observed dogs very potential at the site of Taak turtle beach.
6. The survey team also visited one of the reservoirs at Basol River. The local people of the area pointed out that sometimes crocodiles attack their domestic animals (e.g. sheep and goats) and produce negative impact. Therefore, the locals try to kill them to save their domestic animals.
7. The introduction of domestic cats in mid-sixties on the Astola Island by some fishermen for the control of small rodents created threat to the wildlife. The cats decreased the population of rodents on which birds depend. The disappearance of breeding from the vicinity of Island might be the cause of this artificial attempt to control rodents.
8. During surveys, it was noticed that some fishermen with good diving skills break live coral pieces to sell out in market for decoration. This attempt may disturb the ecosystem.
9. There were several dead hatchlings entangled in the pieces of nylon nets, spread all over the beach on Astola Island. The nylon nets also offer resistance during the nesting season for female turtles. The survey team rescued a female nesting turtle which was entangled in a net during her pet formation. In this way, nylon nets are posing a severe threat to green turtles.
10. There were some reports of poaching of green turtles because the quacks use blood of turtles for the treatment of paralysis.

Figure 5: Entangled hatchlings of Green Turtle at Astola Island

11. Daran Conservation Society, a community based organization (CBO) is running a small project for the protection and conservation of marine turtles at Daran (Jiwani) turtle beach. At present, CBO is badly facing the problem of funding for proper conservation and management. This grave situation, if continues, may produce severe threat to turtle eggs and their hatchlings. These beaches like other turtles beaches of Makran Coast need proper attention against predators (stray dogs, gulls and terns).

12. The area of Jiwani was found to be highly affected by hunting of birds by the people, which is a very serious threat to wildlife.

13. On the beaches of Gawadar and Jiwani, carcasses of marine turtles, dolphins and porpoises are usually found. The team confirmed that these precious animals died due to entangling in fishermen's nets.

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Manchar: The Deteriorated Great Lake of Pakistan

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KEYWORDS

Manchar Lake,
Asia's largest lake,
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ABSTRACT

The present study was conducted to assess the threats to biological diversity Manchar Lake in Sindh province. The main threat found was saline water flow from the Main Nara Valley Drain (MNV Drain) from upper Sindh and has severely affected its biodiversity. It has also contaminated water of the lake resulting in water born diseases in the area. The fish production of the lake dwindled with the passage of time and the people who depended on Manchar Lake for their livelihood have either migrated to other wetlands or shifted to other businesses. This great lake is in need of conservation by the Government and other stakeholders.

Introduction

Asia is the largest continent of the world which comprises approximately 14% of land surface. It is estimated that at least 120 million hectares of wetlands of International importance are located in South and South East Asia (Ghandhiv et al., 2007). The high human population density of this region, 56% of the world, has led to a long historical dependence of the people on wetland resources. Due to high population pressure on wetland resources in South Asia (93%) and South East Asia (94%) compared to East Asia (66%), the wetlands of this area are more vulnerable and fragile. The threats to wetlands include agriculture, urbanization and industrialization, which result in destruction of natural vegetation, nutrient and toxin loading, sedimentation, turbidity, and altered low regimes. All these threats are direct consequence of anthropogenic activities (Ghandhiv et al., 2007).

Pakistan has many wetlands of international importance which support a number of migratory birds and are sources of livelihood for thousands of people. Most of such wetlands are located in Sindh province (Scott and Poole, 1989). The Manchar Lake is also one of the largest wetlands of Asian sub-continent (http://www.tourism.gov.pk/manchar_lake_sindh.htm). The Lake was home to variety of local water birds and a number of migratory bird species and also a source of livelihood for thousands of people around the lake. But carelessness of Government, concerned departments and lack of awareness among local communities has led to deterioration of the lake and it has turned into saline water body. Thus a great loss has incurred both to biological diversity of lake and to the people who used the wetland resources.

Quite a few scientific studies of Manchar Lake have been conducted during the last few years. Some of these include; studies on water chemistry and fish production of Manchar Lake (Mahar, et al., 2000); studies on algal flora of MNV Drain entering Manchar Lake (Mahar, et al., 2005); and Studies on fish yield production of Manchar Lake (Jafri, et al., 2006), and also few studies on the avifauna like Brohi (2010) recorded 59 species of birds while, Hasan (1964) who recorded 43 species of water birds. Hume (1873) in his contribution to the avifauna of Sindh recorded a number of birds from Manchar Lake. Becher (1886) gave a brief account of game and few other birds and recorded 25 species. Twenty out of 25 of the birds were new to the Hume's list. Ali (1928) while describing other aspects of the lake also recorded 33 species of birds. According to Hume (1873), Coot (*Fulica atra)* was very common species and no part of the world had seen such incredible multitudes of coots as were met within Sindh in Manchar Lake. But no studies have ever been undertaken on the effects of water pollution on the biodiversity of the lake.

The present paper deals with causes of degradation of the lake and also suggests some measures for the conservation and management of the lake.

Material and Methods

Study Area

Manchar Lake is one of the largest fresh water lakes of Asian sub-continent located at a distance of about 18 km from Sehwan town of district Jamshoro, Sindh (longitude 67 -34' to 67 -43' E and latitude 26 -23' to 26 -28' N). The lake covers an area of approximately 200 km^2, spreads over district Jamshoro and district Dadu. During Monsoon season (July-September) water from Indus River and other seasonal streams originating from Kirthar range i.e., Nai Gaj, Nai Baran and Nai Angai fall in lake and may spread over an area up to 300 km^2. The surrounding area of the lake is classified as arid

subtropical, with very hot summers and cold winters (Scot and Poole, 1989).

A series of surveys of the lake were carried out in 2008 (January, March, June, September, October and December), a total of 30 days were spent in the field area. The survey method includes; on site observation and discussions/dialogue with local communities in and around the lake, and the farmers who use the lake water for irrigation purposes. Information about the different aspects of the lake was also gathered from libraries, internet and news-papers.

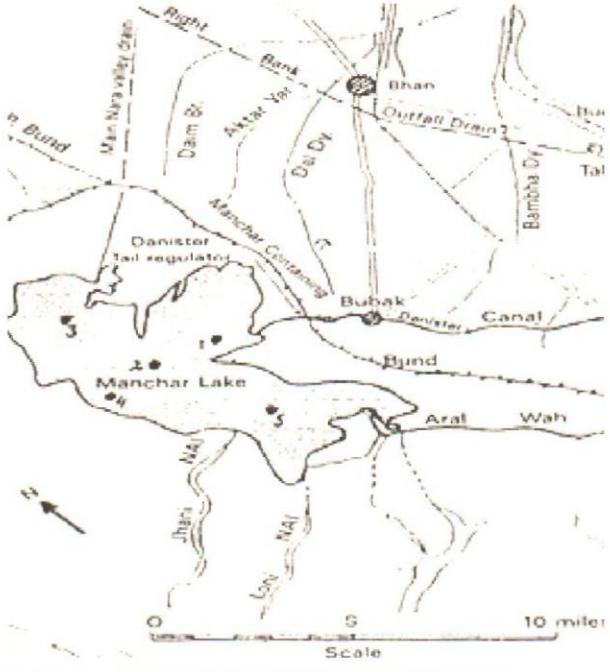

Figure 1: Map of Manchar Lake (Adopted from Mahar, 2000)

Results and Discussion

Manchar the great Lake in Sindh Pakistan (Fig. 1) is the largest natural lake in Southeast Asia. However its importance arises not just from its size but the lake has played a central role in the history and culture of the people of the area. It continues to play an important role as a source of livelihood for thousands of people by providing wetland resources like fish, bird sport and is a source of irrigation for thousands of acres of land around the lake.

This largest lake of Pakistan has always been ignored both by Government and conservation organizations. The lake was primarily home for millions of migratory water birds (Ali, 1928), while thousands of tons of fish were annually caught from the lake (Mahar, et al., 2000; Jafri, et al., 2006).

Currently the water of the lake has turned saline and thus the vegetation has disappeared from the lake creating gaps in ecological web leading to decrease in fish production and negatively impacting the bird fauna in and around the lake. Scarcity of wetland resources has caused the people especially the fisher folk community to migrate to Chashma, Taunsa and other water bodies of the Punjab. The water from the lake also irrigated thousands of acres of land but the salinity has affected the land use practices in the area. The farmers who used the lake water for irrigation purposes have also shifted to other businesses in order to meet their livelihood.

Some of the major factors responsible for degradation of the lake are discussed below.

Water Quality Parameters

The productivity of wetland depends on the water quality including salinity, conductivity, hardness and dissolved solid particles. These parameters for the water of Manchar Lake vary from 1.7-6.4 g/l, 2.35-11.34 ms/cm 710-994 mg/l, and 890-6200 mg/l, respectively (Mahar et al., 2005). Whereas recent studies of physico-chemical parameters of the lake (Arain et al., 2008; Mastoi et. al.,2008: Burdi, 2010) suggest that the ratio of dissolved solid particles are higher than permit able limits of World Health Organizations (WHO) guidelines for safe drinking water.

Threats to Manchar Lake and its biodiversity

There are multiple threats to Manchar Lake and its biodiversity. Ecological changes in aquatic life depend upon the physico-chemical characteristics of water bodies (Mahar et al., 2000). Manchar is basically a fresh water lake and its degradation has been occurring for a long time but the effects have been felt recently. Due to diversion of water from the upstream Indus and decreased runoff from the Kirthar Mountains there has been a diminished fresh water supply which is further upset by saline water from the Main Nara Valley Drain (MNV Drain).The Main Nara Valley Drain (MNV Drain) is pouring Saline water into the lake, which contains agricultural wastes like fertilizers, pesticides and many other effluents. The polluted water of the MNV Drain is drastically degrading the water quality of Manchar Lake along with the biotic components (Mahar et al., 2005). Thus the main threat to this water body is from MNV Drain. Basically the MNV Drain is an old natural distributary of river Indus called Eastern Nara. It was an inundation canal on the right bank of the river. Before the construction of Sukkur Barrage its overflow used to find its way towards Manchar Lake. Later it was modified into a regular canal named as Main Nara Valley Drain. At the time of construction of Sukkur Barrage in 1932, taking this old path of natural flow of water into consideration, two permanent canals namely Rice and Dadu canal were constructed to supply water to the cultivable lands of Dadu and Larkana Districts. Later on Nara Valley Drain was also used to carry surplus water of Rice canal and spillage of Hammal Lake to Manchar Lake. Afterwards a project namely Right Bank Outfall Drain or (RBOD) was initiated on the Main Nara Valley Drain in 1970. Since then, various drains are pouring their effluents, agricultural runoff which contains many pesticides and other chemicals including domestic sewage into Manchar Lake. These agricultural wastes have brought drastic impacts on the water quality resulting in the deterioration of the flora and fauna of the Lake.

Many species of plants of economical value have disappeared from the lake, like Lotus (*Nymphaea lotus),* Beh *(Nelumbium spociosum),* lorh *(Nymphea slallata),* Typha (*Typha angustata*) which provided nesting and roosting grounds for migratory birds, food for fish and also served as livelihood for local fishermen. Due to salinity of the water the fish production of the lake has also declined in recent years and only few tons of fish was caught each year (919 metric ton in 1960 and 500 metric ton in 1998; Mahar, et al., 2000). Currently (2011) according to local fish contractors only few mounds of fish are caught from the lake which includes mostly Talapia (*Talapia mosambicus*) which is a tasteless fish and used in poultry feed.

In order to meet their livelihood the local people now also catch migratory birds and sell them in local markets. On the one hand, the habitat loss due to pollution has a direct impact on the fisheries and water birds while on the other hand; loss of livelihood of the fishermen has dwindled making them beggars in near-by towns and villages. The water pollution has threatened the unique culture and exposed the population living in and around the lake to poverty and health issues. Malnutrition can also be observed in most people, especially women and children. This leads to varied diseases like Hepatitis B&C, skin and eye infections, TB, night blindness and infant and maternal mortality. In addition to all these problems each family has to now spend Rs 80 to 90 ($1 =Rs: 90 approx.) a day to buy water (Zehra,2010).

The recent floods of 2010 have brought a little bit improvement in the water quality of the lake and a few species of water plants can be observed in and around the lake, but when the extra water from the lake drained back into River Indus the standing water of the lake becomes saline and unfit for human consumption (personal observation). According to Burdi (2010) at least five more such floods are required to reestablish fauna and flora of the lake and to wash away heavy metals embedded in the soil of the lake.

Recommendations

- It is a welcome initiative of the Government to divert the polluted water of MNV Drain through RBOD channel, though the sink, Arabian Sea is also not a better option. The RBOD needs a prompt completion to save the fauna and flora of the lake.
- Regular studies on water quality and vegetation as well as changes in the community structure and population dynamics of the key species, fish, birds and plants may be carried out.
- Sindh irrigation Department should provide fresh water to the lake in times of drought.
- Provincial Fisheries Department should take measures to increase the fish production of the lake so that the fisherfolk community can utilize the wetland resources.
- Ministry of Climate Change in coordination with NGOs may initiate awareness raising among the local fishermen communities for wise use of wetland resources especially in context of fisheries and water birds through community managed concept of natural resources.
- The Manchar Lake has potential for bird watching, fish angling and water sports. Ecotourism as an alternate source of income for the local communities can be developed to protect the fauna and flora of the lake and create jobs for local communities.
- Manchar Lake being the largest fresh water lake of Pakistan which also fulfils the requirements of a wetland of International importance. For its better management and conservation of its flora and fauna, the Government should make efforts to declare it as a Ramsar Site.

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Catalogue on the museum specimens of mammal species collected a century ago from the Indian subcontinent

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KEYWORDS

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ABSTRACT

In Bio-Sciences, an animal or part of an animal preserved for scientific use is called a specimen. The specimen preserved is referred to verify the identity of a species, mammal study skins, and skeletal material for various purposes. The data associated with specimens is the place and date of collection, attached to the specimen by a label. Additional information is the name of the collector and the habitat. Tissue from specimens may be saved for genetic studies (molecular data, DNA). A voucher is a representative specimen of the animal used in a study, such as a specimen collected as part of an ecological survey or a specimen which was the source of DNA for a molecular study. This paper presents information on the historic collection of Mammal's species containing on 639 specimens present in Pakistan Museum Natural History Islamabad is a part of biodiversity representing data on species taxonomic and ecological perspective. This collection containing on 639 specimens of mammal species is representative of 8 orders of the total 10 currently recognized mammalian orders in Pakistan. The specimens are distributed in 96 genera and 30 families. Rodents and bats are especially well-represented, with large series of individuals for multiple taxa. Geographic coverage includes parts of Indian subcontinent, with special emphasis on identification, taxonomy, geography and location of the species it collected.

Introduction:

A museum is a place that exhibits a vast range of specimens from various groups of Natural History. In life sciences, an animal or part of an animal preserved for scientific use is called a specimen. If we don't have the specimens, then we can't obtain the data that we actually need to conserve the species. Traditionally, collecting what scientists call a voucher specimen is considered the gold standard for documenting the presence of a species. It's the ultimate evidence that we have found something, we have the whole animal. For this value, the present mammalian collection containing on huge series of species including the ungulate trophies is the largest mammalian collection in Pakistan such collection representative of Pakistan Museum Natural History (PMNH), Islamabad. It contained over 639 skinned and stuffed specimens of mammals except those preserved in fluid. It also contained skins of carnivores and stuffed ungulate trophies including the antelopes, cervids and bovids. The collection also includes type specimens, making it unique and historical being the oldest collection in Pakistan collected a century ago but still in excellent form for reference use. The museum (PMNH) is particularly famous for its exhibition of Blue Whale skeleton and ornate architecture exemplified by the largest surviving mammal on the planet. The oldest specimens include in the collection were collected by G.C. Shortridge, Cann, Crump, Mayor and Macmillan during the second decade of the twentieth century from 1911-1914.

Blue Whale, *Balaenoptera musculus* is the largest ever surviving animal on the earth.

This skeleton of Blue Whale was caught from Pasni (Baluchistan) in 1967 and preserved in the museum of Zoological Survey of Pakistan based at Karachi. Recently, in 2011 this Blue Whale skeleton shifted to Pakistan Museum of Natural History Islamabad and mounted it in front of the museum building. Blue Whale is a mammal and the largest animal ever surviving on the earth. It has maximum size of 35 meters (105 feet) and weighs up to 200 tones. The heart of the Blue Whale weighs upto 600 kg and is as big as small sized automobile, the tongue alone can weigh as much as an elephant, weight of the newly born calve is about 3 tones having a length of 25 feet. It drinks upto 570 liters of milk in a day and gains about 90 kg weight per day. It is a long lived animal with an average life span of 90 years. It is considered one of the most endangered animals.

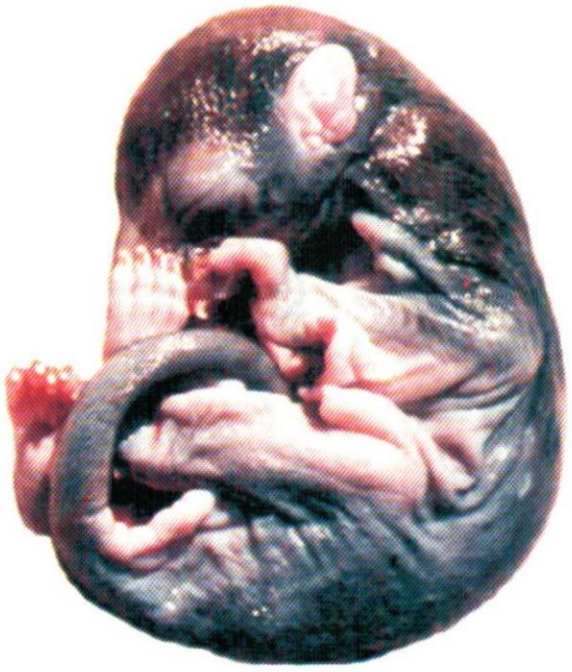
Head Trophy: Indian buffalo *Bos gorus* present in PMNH, Islamabad. (A historic trophy shifted from India to Pakistan in 1948.

Brief Description of the Indian Sub-continent

Biogeographically and ecologically, the Indian sub-continent is one of the most enthralling regions in the world. The subcontinent of India extends from Baluchistan, and parts of Eastern Afghanistan in the north-west, Indus plains in Sindh and Punjab through Gilgit,

Laddakh, Kashmir, Nepal, Sikkim, Bhutan to the Burma border, including the entire Pakistan, India, Bangladesh and Ceylon. Defining this at the region stretches from 60°E to 100°E longitude and 6°N to 38°N latitude. Biogeographically the Indian sub-continent may be divided into two broad regions: the first one is known as Cis Gangetic Region covering most of the Peninsula and the second represents Trans Gangetic Region of Himalaya and Assam, the Cis-Gangetic region itself comprising of the sub regions including major geographical regions of Pakistan.

The Western Ghats tract has rich fauna, remarkable for the fact that some species occur only in the Ghats, and nowhere else in the peninsula and for the fact that related groups occur only in the Himalayas and the Western Ghats. The present varied and interesting composition of the mammalian fauna of Indian subcontinent is largely due to its geographical location. Species belonging to the Palearctic realm occur largely in the Himalayan and Baluchistan uplands; those belonging to the Indo-Malayan realm occur primarily in the Indus plains including the Thar Desert and Himalayan foothills. In addition, species with affinities to the Ethiopian region occur in the dry southwest and along the Makran Coast and the Thar Desert. North-western region has some of the most astonishing geography on the planet. The biome is defined as northwestern Himalayan alpine shrub and meadows. Western region most of which is included in Balochistan, has a complex geography. In mountainous highlands, habitat varies from conifer forests of deodar in Waziristan and juniper in Ziarat. Vast deserts are also present, showing xeric shrubland vegetation in the region. Date-palms and Ephedra are common flora varieties in the desert. The Himalayan foothills and the Potohar Plateau including the Salt Range and Kala Chitta Range are covered with scrub forests which now have been degraded to strewn growth in most areas where still occur most important wildlife species.



A museum specimen: developing fetus of Red Himalayan Giant Flying Squirrel, *Petaurista petaurista albiventer* preserved in solution (photograph by the author)

Exploration of Mammals in the Indian Subcontinent

During the nineteenth century, extensive exploration of mammalian species of the Indian subcontinent was made by Flower (1891). Some other remarkable contributions in this field were those compiled by Lydekker (1891) and Trouessart (1897-1905). Jerdon as early as 1847 was the first who described the "mammals of India". He provided consolidated account of Indian mammals for the first time (1867) dealt with morphology, habits and distribution. Sterndale (1884) published his work on Indian mammals. Later, Blanford (1888-1891) published his fauna of Mammalia in British India, in which he referred species to habitat areas now are part of Pakistan. He brought out systematic account of the mammalian fauna of the Indian subcontinent with taxonomic revision. In connection with the catalogues of the mammals of Indian Museum, substantial information on the mammalian species was provided by Anderson (1881) and Sclater (1891).

Head Trophy: Addax *Addax nasomaculatus* present in PMNH, Islamabad.

Significant contribution on the regional mammalian fauna of India were made by Robinson (1913), Ward (1924-28), Cabrera (1914), Ognev (1928-48), Kuroda (1938), Osgood (1932), Phillips (1935), Allen (1938-40), Pocock (1917, 1939), Chasen (1940) and Bobrinskii et al. (1944). During the first three quarters of the

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Table 1:

Taxonomic and geographic information of the mammalian species collected a century ago from the Indian Subcontinent present in Pakistan Museum of Natural History (PMNH) Islamabad

S. #	SCIENTIFIC NAME	ORDER	FAM/ SUB FAM.	ZSP Code	ZSI Code	MEASUREMENTS				SEX	LOCALITY	COLLECTOR	DATE
						H & B	TL	HF	EAR				
1	*Petaurista philippensis*	Rodentia	Sciuridae Petaurinae	M. 199/307	-	-	-	-	-	♂	Benhope, Nilgris	JR O' Brien	27.04.1921
	Petaurista petaurista philippensis Common Giant Flying Squirrel (Eliot 1839) *Pteromys phillippensis* 1839 Eliot - Madras J. LiH & Sa. 10:217 near Madras India.												
2	*Petaurista cinnereaceus*	Rodentia	Sciuridae	M. 200	-	-	-	-	-	♀	Burma	G. C. Shortridge	13.09.1927
	Petaurista petaurista cineraceus Common Giant Flying Squirrel (Blyth 1847) *Pteromys petaurista var. cinneraceus* 1847 Blyth, J.Asiat.Soc.Bengal 16:865 Arakan Burma, Range Burma (Pegudistrict, Toungoo etc) Tennaserim part.												
3	*Petaurista candidulus*	Rodentia	Sciuridae	M. 201/310	-	-	-	-	-		Burma	M. D. Mackenzie	25.12.1914
	Petaurista alborufus candidulus Javan Lesser Flying Squirrel (wroughton 1911). 1911 *Petaurista candidulus* Wroughton J.Bombay N.H.Soc. 20, 4:1014-1022 Kindat, Western Burma.												
4	*Pteromys belone*	Rodentia	Sciuridae	M. 202/312	4971	90	78	22	12.5	♂	Tennaserim Town	G. C. Shortridge	18.03.1914
	Hylopetes sagitta belone (Thomas, 1908). 1908 *Sciuropterus (Hylopetes) belone* Thomas Ann. Mag. N.H. 2:305												
5	*Hylopetes phayeri*	Rodentia	Sciuridae	M. 203/313	3657	163	147	33	24	♀	Popa U. Burma	G. C. Shortridge	18.03.1914
	Hylopetes phayrei phayrei Phayre's Flying Squirrel (Blyth, 1859). 1859. *Sciuropterus phayeri* Blyth, J. Asiat. Soc. Bengal, 28:278 Rangoon, Burma.												
6	*Callosciurus erythraeus erythraeus*	Rodentia	Sciuridae	M. 204/315	1174	-	-	-	-	♀	Rajapora S.Kamrup	H. W. Wells	-
	Callosciurus erythraeus erythraeus Pallas's Squirrel (Pallas, 1779). 1779. *Sciurus erythraeus* Pallas Nov.Sp.Quad.Glir.Ord. 337. Locality unknow, but may be assumed to be some part of Assam.												
7	*Callosciurus erythraeus nagarum*	Rodentia	Sciuridae	M. 205/316	42	-	-	-	-	♀	Digboi, Lakhimpor, Assam	H. W. Wells	11.10.1919
	Callosciurus erythraeus erythrogaster Pallas's Squirrel (Blyth, 1842). 1842. *Sciurus erythrogaster* Blyth, J.Asiat.Soc.Bengal 11:970 Manipur. 1916. *Callosciurus erythraeus nagarum* Thomas & wroughton, J.Bom.N.H.Soc. 24, 2:228. Sadiya Assam.												
8	*Callosciurus erythraeus nagarum*	Rodentia	Sciuridae	M. 206/317	448	227	210	51	21	♂	Chin Hills, 50 miles W.Kindat, Burma	Mackenzie	16.05.1915
	Callosciurus erythraeus erythrogaster Pallas's Squirrel (Blyth, 1842). 1842. *Sciurus erythrogaster* Blyth, J. Asiat. Soc. Bengal 11:970 Manipur. 1916. *Callosciurus erythraeus nagarum* Thomas & Wroughton, J.Bom.N.H.Soc. 24. 2:228. Sadiya Assam.												
9	*Callosciurus erythraeus aquila*	Rodentia	Sciuridae	M.207/318	90	230	210	45	20	♂	Dilbong R.Saduja	H.W. Wells	30.11.1919
	Erythraeus intermedius Pallas's Squirrel (Anderson, 1879). 1921. *C. castaneoventris aquilo* Wroughton J.Bom.N.H.Soc. 27:601 Dibong River, Sadiya, 600 ft. Assam. Range: includes Mishmi, Northern Burma and Szechuan.												
10	*Callosciurus erythraeus aquila*	Rodentia	Sciuridae	M. 208/319	1825	223	-	52	22	♀	Dening, Mishmi Hills	H. W. Wells	29.04.1921
	Callosciurus castaneoventris aquilo Wroughton. J. Bombay Nat. Hist. Soc. 27:601. Dibong River, Sadiya, 600ft, Assam. Range includes Mishmi, Northern Burma and Szechuan.												
11	*Callosciurus erythraeus crotalius*	Rodentia	Sciuridae	M. 234/345	5872	240	151	55.5	22		Hkamti Upper Chindwin, Burma	G. C. Shortridge	29.07.1921
	Callosciurus erythraeus crotalius Pallas's Squirrel (Thomas & Wroughton, 1916). 1916. *Callosciurus erythraeus crotalius* Thomas & Wroughton. J.Bom.N.H.Soc. 24, 2:229 Hkamti, West bank Chindwin River, Burma. Range:Hkamti and South of Hukong Valley Western Burma.												
12	*Callosciurus erythraeus crotalius*	Rodentia	Sciuridae	M. 241/253	6013	242	237	58	21.5	♂	Hkamti Upper Chindwin, Burma	G. C.Shortridge	10.08.1914
	Callosciurus erythraeus crotalius Pallas's Squirrel (Thomas & Wroughton, 1916). 1916. *Callosciurus erythraeus crotalius* Thomas & Wroughton. J.Bom.N.H.Soc. 24, 2:229 Hkamti, West bank Chindwin River Burma. Range:Hkamti and South of Hukong Valley Western Burma.												
13	*Callosciurus erythraeus kinneari*	Rodentia	Sciuridae	M. 235/346	139	219	202	52.5	19.5	♀	6 mls. S. Kindat, West Bank of River Chindwin, Burma	-	11.10.1919
	Callosciurus erythraeus kinneari Pallas's Squirrel (Thomas & Wroughton, 1916). 1916. *C. erythraeus kinneari* Thomas & Wroughton J. Bom. N. H.Soc. 24, 2:229 Tatkon, West Bank Chindwin River, Burma. Range:40 miles West of Kindat Nanthalet & Tatkon Western Burma.												
14	*Callosciurus pygerythrus lokroides*	Rodentia	Sciuridae	M. 209/320	6517	193	191	45	20	♂	Sivok, Bengal	C. A. Crump	21.03.1915
	C. pygerythrus lokroides (Hodgson 1836) 1836 *Sciurus lokroides* Hodgson, J. Asiat. Soc. Bengal, 5:232 Nepal (Type in B.M)												
15	*Callosciurus sladeni sladeni*	Rodentia	Sciuridae	M. 220/351	5561	240	271	58	-	♂	U. Chindwin, Burma	G. C. Shortridge & S. A. Macmillan	29.06.1914
	C. flavimanus sladeni Yellow Banded Squirrel (Anderson, 1871). 1871. *Sciurus sladeni* Anderson, P.Z.S. 139 Thizyain, upper Burma.												
16	*Callosciurus sladeni sladeni*	Rodentia	Sciuridae	M. 221/332	5612	232	166	55	21	♀	S. Kindat, U.Chindwin, Burma	G. C. Shortridge & S. A. Macmillan	03.07.1914
	C. flavimanus sladeni Yellow Banded Squirrel (Anderson, 1871). 1871. *Sciurus sladeni* Anderson, P.Z.S. 139 Thizyain, upper Burma.												
17	*Callosciurus sladeni harlingtoni*	Rodentia	Sciuridae	M. 222/333	5675	254	272	60	23	♀	Hamolin, Upper Chindwin, Burma	G. C. Shortridge & S. A. Macmillan	14.07.1914
	C. flavimanus haringtoni Yellow Banded Squirrel (Thomas, 1905). 1905. *Sciurus haringtoni* Thomas Ann. Mag. N. H. 16:314 Moungkan, Upper Chindwin, Burma.												
18	*Callosciurus sladeni harlingtoni*	Rodentia	Sciuridae	M. 223/334	6101	242	255	59.5	22	♂	U. Chindwin Burma	G. C.Shortridge & S. A. Macmillan	29.08.1914
	C. flavimanus haringtoni Yellow Banded Squirrel (Thomas, 1905). 1905. *Sciurus haringtoni* Thomas Ann. Mag. N. H. 16:314 Moungkan, Upper Chindwin, Burma.												
19	*Callosciurus sladeni rubex*	Rodentia	Sciuridae	M. 228/339	5349	215	226	55	22	♂	Yin-Lower Chindwin, Burma	G. C.Shortridge	10.06.1914
	C. flavimanus haringtoni Yellow Banded Squirrel (Thomas, 1914). 1914. *Sciurus sladeni rubex* Thomas J. Bom. N. H. Soc. 23, 2:198. Yin Lower Chindwin, Burma. (The locality in the description, Lonkin, Myitkyina district, is opparently an error, as the animal does not occur there) A specimen also examined from Youngbintha, left bank Irrawaddy River.												
20	*Callosciurus sladeni rubex*	Rodentia	Sciuridae	M. 229/340	5421	224	221	54	21	♀	Lower Chindwin, Burma	G.C.Shortridge	16.06.1914
	C. flavimanus haringtoni Yellow Banded Squirrel (Thomas, 1914). 1914. *Sciurus sladeni rubex* Thomas J. Bom. N. H. Soc. 23, 2:198. Yin Lower Chindwin, Burma. (The locality in the description, Lonkin, Myitkyina district, is opparently an error, as the animal does not occur there) A specimen also examined from Youngbintha, left bank Irrawaddy River.												
21	*Callosciurus sladeni shortridgei*	Rodentia	Sciuridae	M. 230/341	5755	221	69	56.5	22.25	♀	Hkamti, Upper Chindwin, Burma	G.C.Shortridge	24.07.1914
	C. flavimanus shortridgei Yellow Banded Squirrel (Thomas & Wroughton, 1916). 1916. *Callosciurus sladeni shortridgei* Thomas & Wroughton, J.Bom.N.H.Soc. 24, 2:232 pl. fig 1. Hkamti, upper Chindwin, Burma.												
22	*Callosciurus sladeni shortridgei*	Rodentia	Sciuridae	M. 231/342	5907	213	264	58.25	22.25	♂	Hkamti, Upper Chindwin, Burma	G.C.Shortridge	01.08.1914
	C. flavimanus shortridgei Yellow Banded Squirrel (Thomas & Wroughton, 1916). 1916. *Callosciurus sladeni shortridgei* Thomas & Wroughton, J.Bom.N.H.Soc. 24, 2:232 pl. fig 1. Hkamti, upper Chindwin, Burma.												
23	*Callosciurus atrodorsalis shanicus*	Rodentia	Sciuridae	M. 232/343	2711	201	188	48	21	♂	Maymyo, U. Burma	G.C.Shortridge	14.04.1913
	Callosciurus caniceps shanicus Golden-backed Squirrel (Ryley, 1914). 1914. *Sciurus atrodorsalis shanicus* Ryley, J.Bom.Natural History Soc. 22:663 Gokteik 2, 133 ft. Northern Shan States, Burma. Range:Shan States, Tennaserim (Part) and Siam (Part) apparently.												
24	*Callosciurus atrodorsalis shanicus*	Rodentia	Sciuridae	M. 233/344	2799	200	212	49	20	♀	Gokteik N.Shan States, Burma	G.C.Shortridge	26.04.1913
	Callosciurus caniceps shanicus Golden-backed Squirrel (Ryley, 1914). 1914. *Sciurus atrodorsalis shanicus* Ryley, J. Bom. Natural History Soc. 22:663 Gokteik 2, 133 ft. Northern Shan States, Burma. Range:Shan States, Tennaserim (Part) and Siam (Part) apparently.												
25	*Callosciurus atrodorsalis shanicus*	Rodentia	Sciuridae	M. 239/251	2814	205	185	49	22	♂	Paunggaung N.Shan States, Burma	G.C.Shortridge	30.04.1913
	Callosciurus caniceps shanicus Golden-backed Squirrel (Ryley, 1914). 1914. *Sciurus atrodorsalis shanicus* Ryley, J. Bom. Natural History Soc. 22:663 Gokteik 2, 133 ft. Northern Shan States, Burma. Range:Shan States, Tennaserim (Part) and Siam (Part) apparently.												
26	*Callosciurus atrodorsalis shanicus*	Rodentia	Sciuridae	M. 240/252	1495	165	180	46	18	♀	Kalaw, Burma	Mackenzie	02.10.1928
	Callosciurus caniceps shanicus Golden-backed Squirrel (Ryley, 1914). 1914. *Sciurus atrodorsalis shanicus* Ryley, J.Bom.Natural History Soc. 22:663 Gokteik 2, 133 ft. Northern Shan States, Burma. Range:Shan States, Tennaserim (Part) and Siam (Part) apparently.												
27	*Callosciurus atrodorsalis shanicus*	Rodentia	Sciuridae	M. 242/254	2814	-	-	-	-	♂	Paunggaung N.Shan States, Burma	G. C. Shortridge	30.04.1913
	Callosciurus caniceps shanicus Golden-backed Squirrel (Ryley, 1914). 1914. *Sciurus atrodorsalis shanicus* Ryley, J.Bom.Natural History Soc. 22:663 Gokteik 2, 133 ft. Northern Shan States, Burma. Range:Shan States, Tennaserim (Part) and Siam (Part) apparently.												
28	*Callosciurus epomophorus davisoni*	Rodentia	Sciuridae	M. 238/349	4346	219	225	51	20.5	♀	Victoria Point, S.Tennaserim	G. C.Shortridge	28.11.1913
	C. caniceps davisoni Golden-backed Squirrel (Bonhote, 1901). 1901. *Sciurus epomophorus davisoni* Bonhote, Ann.Mag.N.H. 7:273 Bankason Tennaserim.												
29	*Callosciurus epomophorus davisoni*	Rodentia	Sciuridae	M. 239/350	4824	209	240	52	21.5	♂	Tennaserim Town	G. C. Shortridge	03.03.1914
	C. caniceps davisoni Golden-backed Squirrel (Bonhote, 1901). 1901. *Sciurus epomophorus davisoni* Bonhote, Ann. Mag. N. H. 7:273 Bankason Tennaserim.												
30	*Callosciurus ferrugineus*	Rodentia	Sciuridae	M. 236/347	648	231	234	51	20	♀	S. Zamayi Res. 40 miles North of River Chindwin	Mackenzie	10.05.1916
	C. finlaysoni ferrugineus Finlayson's Squirrel (F. Cuvier, 1829). 1829. *Sciurus ferrugineus* F.Cuvier, H. N. Mamm. 3:pl. 238 Pegu Lower Burma.												

Taxonomic and geographic information of the mammalian species collected a century ago from the Indian Subcontinent present in Pakistan Museum of Natural History (PMNH) Islamabad

S. #	SCIENTIFIC NAME	ORDER	FAM/ SUB FAM.	ZSP Code	ZSI Code	MEASUREMENTS				SEX	LOCALITY	COLLECTOR	DATE
						H & B	TL	HF	EAR				
31	*Callosciurus ferrugineus*	Rodentia	Sciuridae	M. 237/348	1430	226	244	55	22	♂	40 miles NW of Taungoo West Burma	Mackenzie	14.01.1928
	C. finlaysoni ferrugineus Finlayson's Squirrel (F. Cuvier, 1829). 1829. *Sciurus ferrugineus* F.Cuvier, H. N. Mamm. 3:pl. 238 Pegu Lower Burma.												
32	*Dremomys lokriah lokriah*	Rodentia	Sciuridae	M. 266/384	6388	173	135	43	21	♂	Sulia pokr Darjeeling	C.A. Crump	23.02.1915
	Dremomys lokriah lokriah Orange-bellied Himalayan Squirrel (Hodgson, 1836). 1836. *Scirus lokriah* Hodgson, J. Asiat. Soc. Bengal 5:232 Nepal.												
33	*Dremomys lokriah macmillani*	Rodentia	Sciuridae	M. 267/385	512	142	100	39	15	♀	Lait kynsao, Khasi Hills	H.W.Wells	26.04.1920
	Dremomys lokriah macmillani Orange-bellied Hmalayan Squirrel (Thomas, 1916). 1916. *Dremomys macmillani* Thomas, J. Bom. N. H. Soc. 28, 2:430 Tura Garo Hills, Assam. Range: Assam many localities and Western Burma.												
34	*Dremomys rufigenis adamsoni*	Rodentia	Sciuridae	M. 268/386	1479	183	119	47	20	♀	Taungoo, Burma	Mackenzie	03.04.1928
	Dremomys rufigenis adamsoni Red Cheeked Squirrel (Thomas, 1914). 1914. *Dremomys rufigenis adamsoni* Thomas, J. Bom. N. H. Soc. 23, 1:25 Maymyo, Burma. Range: east side Chindwin River (Kindat0 and Shan States, Burma.												
35	*Dremomys rufigenis adamsoni*	Rodentia	Sciuridae	M. 269/387	3031	207	155	45	21.5	♂	Pyaunggaung, Northern Shan State, Burma	G.C.Shortridge	11.05.1913
	Dremomys rufigenis adamsoni Red Cheeked Squirrel (Thomas, 1914). 1914. *Dremomys rufigenis adamsoni* Thomas, J. Bom. N. H. Soc. 23, 1:25 Maymyo, Burma. Range: east side Chindwin River (Kindat0 and Shan States, Burma.												
36	*Funumbulus palmarum*	Rodentia	Sciuridae	M. 254/371	1907	163	152	39	15.5	♀	Kalar Town, East Mysor	G.C.Shortridge	09.10.1912
	Funumbulus palmarum palmarum Indian Palm Squirrel (Linnaeus, 1766). 1766. *Sciurus palmarum* Linn. Syst. Nat. 12th ed. 1:86 Madras India.												
37	*Funumbulus palmarum*	Rodentia	Sciuridae	M. 254/A	10778	127	155	36	17	♀	Balapalli Range	N.A.Baptista	30.08.1929
	Funumbulus palmarum palmarum Indian Palm Squirrel (Linnaeus, 1766). 1766. *Sciurus palmarum* Linn. Syst. Nat. 12th ed. 1:86 Madras, India.												
38	*Funumbulus palmarum brodie*	Rodentia	Sciuridae	M. 250/367	642	155	168	38.5	18	♂	Manar, N.P.Ceylon	Major E. W. Mayor	29.10.1913
	Funumbulus palmarum brodie Indian Palm Squirrel (Blyth, 1849). 1849. *Sciurus brodie* Blyth, J. Asiat. Soc. Bengal 18:602 Point Pedro.												
39	*Funumbulus palmarum brodie*	Rodentia	Sciuridae	M. 251/368	749	152	141	37	16	♀	Cheddi Kulam, N.P.Ceylon	Major E.W.Mayor	09.12.1913
	Funumbulus palmarum brodie Indian Palm Squirrel (Blyth, 1849). 1849. *Sciurus brodie* Blyth, J. Asiat. Soc. Bengal 18:602 Point Pedro.												
40	*Funumbulus palmarum favonicus*	Rodentia	Sciuridae	M. 252/369	14	140	131	33	15	♀	Kohawa S. P. Ceylon	Major E. W. Mayor	11.04.1913
	Funumbulus palmarum kelaarti Indian Palm Scuirrel (Layard, 1851). 1915. *Funumbulus palmarum favonicus* Thomas & Wroughton, J. Bom. N. H. Soc. 24: 1:39 Udugama Southern Province, Ceylon.												
41	*Funumbulus palmarum bellaricus*	Rodentia	Sciuridae	M. 253/370	105	161	145	38	15	♂	Pharwar S. Mahratta	G. C. Shortridge	14.11.1911
	Funumbulus palmarum bellaricus Indian Palm Squirrel (Wroughton, 1916). 1916. *Funumbus palmarum bellaricus* Wroughton, J. Bom. N. H. Soc. 24:674 Vijayanagar, Bellary India. Range: Bellary, Dharwar and Mysore districts, Peninsular India.												
42	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 279/398	533	140	152	33	16	♀	Kashmore U.Sind	S.H.Prater	07.03.1915
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
43	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 280/399	713	138	132	35	18	♂	Sehwan, Sind	S. H. Prater	31.03.1915
	Funumbulus pennanti Northern Palm Squirrel ;Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
44	*Funumbulus penanti argentescens*	Rodentia	Sciuridae	M. 281/400	148	133	143	35	18	♂	Gharo, Sind	-	04.10.1922
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
45	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 282/401	168	125	138	34	15	♀	Mirpur Sakro Sind	-	09.10.1922
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J.Bom.N.H.Soc. 16, 3:413 Rawalpindi Northern Punjab.												
46	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 283/402	206	-	-	-	-	♀	Gohan, Sind	-	17.10.1922
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
47	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 284/403	248	128	160	35	15	♂	Thatta, Sind	C.M.Cann	22.10.1922
	Funumbulus penanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H.Soc. 16, 3:413 Rawalpindi Northern Punjab.												
48	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 285/404	245	-	-	-	-	♂	Benhope, Nilgris	-	11.07.1921
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, 16, 3:413 Rawalpindi Northern Punjab.												
49	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 286/405	99	135	150	36	16	♂	Nagacoil	R. Smillay	28.09.1915
	Funumbulus penanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
50	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 270/388	3358	130	142	36	17	♂	Pathankot, Punjab	H. W. Wells	04.02.1923
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H.Soc. 16, 3:413 Rawalpindi Northern Punjab.												
51	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 271/389	3386	145	150	36	18	♀	Ara, Salt Range Punjab	H. W. Wells	26.03.1923
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
52	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 272/390	3650	124	131	38	17	♀	Ara, Salt Range Punjab	H.W.Wells	26.03.1923
	Funumbulus pennanti Northern Palm Squirre (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
53	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 272/391	3766	132	143	38	16	♂	Kalar Kahar, Salt Range, Punjab	H. W. Wells	24.04.1923
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
54	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 273/392	25	127	134	36	17	♀	Chaklala, Rawalpindi	Maj. C. H. Stockley	12.07.1921
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
55	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 274/393	47	136	160	38	20	♂	Rawal, NW Punjab	Maj. C. H. Stockley	24.07.1921
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
56	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 275/394	96	-	-	-	-	♀	Toupi NW Punjab	Maj. C. H. Stockley	14.08.1921
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
57	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 276/395	283	130	-	38	19	♂	Turbat Baluchistan	J.E.B.H.	26.02.1918
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
58	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 277/396	445	-	-	-	-	♂	Baluchistan	J.E.B.H.	06.01.1916
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
59	*Funumbulus pennanti argentescens*	Rodentia	Sciuridae	M. 278/397	442	129	87	35	15	♂	Jacobabad Sind	S. H. Prater	22.02.1915
	Funumbulus pennanti Northern Palm Squirrel (Wroughton, 1905). 1905. *Funumbulus pennanti argentescens* Wroughton, J. Bom. N. H. Soc. 16, 3:413 Rawalpindi Northern Punjab.												
60	*Funumbulus tristriatus numarius*	Rodentia	Sciuridae	M. 257/374	41	111	143	28	15	♂	Helwak, Satara Distt. India	S. H. Prater	09.12,1914
	Funumbulus tristriatus tristriatus Jungle Striped Squirrel 1916. *Funumbulus tristriatus numarius* Wroughton, J. Bom. N. H. Soc. 24:646 Helwak, Satara district, India.												
61	*Funumbulus sublineatus*	Rodentia	Sciuridae	M. 261/378	17	110	119	22	12	♀	Shamhagaur	-	17.02.1923
	Funumbulus sublineatus sublineatus Dusky Striped Squirrel (Waterhouse, 1838). 1838. *Sciurus sublineatus* Waterhouse, P.Z.S. 19 Nilgiri Hills, Southern India.												
62	*Funumbulus bengalensis*	Rodentia	Sciuridae	M. 248/365	607	142	154	41	18	♂	Bahgowne, Darbbanga Distt.	S. H. Prater	02.09.1922
	Funumbulus palmarum palmarum Indian Palm Squirrel (Linnaeus, 1766). 1916. *Funumbulus bengalensis* Wroughton, J. Bom. N. H. Soc. 24:648 Hazaribagh, Bihar, India. 1766. *Sciurus palmarum* Linnaeus, Syst. Nat. 12th ed. 1:86 Madras, India.												
63	*Funumbulus bengalensis*	Rodentia	Sciuridae	M. 249/266	5135	145	150	36	16	♀	Pareohmath, Hazaribagh, Bhar Orissa	C.A. Crump	15.06.1914
	Funumbulus palmarum palmarum Indian Palm Squirrel (Linnaeus, 1766). 1916. *Funumbulus bengalensis* Wroughton, J.Bom.N.H.Soc. 24:648 Hazaribagh, Bihar, India. 1766. *Sciurus palmarum* Linnaeus, Syst.Nat. 12th ed. 1:86 Madras, India.												
64	*Funumbulus robertsoni*	Rodentia	Sciuridae	M. 256/373	986	144	120	38	16	♀	Pachmarhi, Hoshangabad	C. M. Crump	12.03.1912
	Funumbulus palmarum robertsoni Indian Palm Squirrel (Wroughton, 1916). 1916. *Funumbulus robertsoni* Wroughton 1916, J. Bom, N. H. Soc. 24:647 Pachmarhi, Hoshangabad, Central Provinces, India.												
65	*Funumbulus robertsoni*	Rodentia	Sciuridae	M. 255/372	159	115	142	38	18	♂	Chikalala, Berar C. P.	B.N.H.S.	19.05.1911
	Funumbulus palmarum robertsoni Indian Palm Squirrel (Wroughton, 1916). 1916. *Funumbulus robertsoni* Wroughton 1916, J. Bom, N. H. Soc. 24:647 Pachmarhi, Hoshangabad, Central Provinces, India.												

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						H & B	TL	HF	EAR				
66	*Funumbulus thomasi*	Rodentia	Sciuridae	M. 258/375	-	130	163	35	17	♀	Thatkopar, Bombay	S. H. Prater	27.04.1919
	Funumbulus tristriatus Jungle Striped Squirrel 1916. *Funumbulus thomasi* Wroughton & Davidson, J. Bom. N. H. Soc. 26, 3:729 Khandala, Bombay Presidency, 2000 ft. India.												
67	*Funumbulus wroghtoni*	Rodentia	Sciuridae	M. 259/376	131	-	-	-	-	♀	Cotengady Estate Cochn	I. R. O'Brien	26.05.1921
	Funumbulus tristriatus wroughtoni Jungle Striped Squirrel (Ryley, 1913). 1913. Ryley, J. Bom. N. H. Soc. 22:437 Srimangala, Coorg 2,782 ft. India (Type in B.M.). Range: Coorg also Shemelly, Cochin and Kotengady Estate, Travancore, India.												
68	*Funumbulus wroghtoni*	Rodentia	Sciuridae	M. 260/377	2188	194	119	45	16.5	♂	Halery Estate N. Coorg	G. C. Shortridge	21.10.1921
	Funumbulus tristriatus wroughtoni Jungle Striped Squirrel (Ryley, 1913). 1913. Ryley, J. Bom. N. H. Soc. 22:437 Srimangala, Coorg 2,782 ft. India (Type in B.M.). Range: Coorg also Shemelly, Cochin and Kotengady Estate, Travancore, India.												
69	*Funumbulus Kathleenae*	Rodentia	Sciuridae	M. 262/379	1094	113	115	31	14.5	♀	Umbawala, Uwa Ceylon	Maj. E. W. Mayor	03.04.1914
	Funumbulus sublineatus obscurus Dusky Striped Squirrel (Pelzeln & Kohl, 1885). Verh. Zool. Bot. Ges. Wien. 35:525. 1915. *Funumbulus kathleenae* Thomas & Wroughton, J. Bom. N. H. Soc. 24, 1:38 Kohawa, Southern Province Ceylon.												
70	*Ratufa macroura*	Rodentia	Sciuridae	M. 247	-	-	-	-	-		-	B.N.H.S.	04.09.1930
	Ratufa macroura macroura Grizzled Indian (Giant) Squirrel (Pennant, 1769). 1769. *Sciurus macrourus* Pennat, Ind.Zool. 1:Pl.1.Highlands of Ceylon.												
71	*Ratufa macroura dandolena*	Rodentia	Sciuridae	M. 245	-	-	-	-	-		-	N. A. Baptista	04.09.1930
	Ratufa macroura dandolena Grizzled Indian (Giant) Squirrel (Thomas & Wroughton, 1915). 1915. *Ratufa macroura dandolena* Thomas & Wroughton, J. Bom. N. H.Soc. 24, 1:36 Wellawaya, Uwa, Ceylon.												
72	*Ratufa macroura dandolena*	Rodentia	Sciuridae	M. 246/263	-	-	-	-	-		N. Salem	N. A. Baptista	28.08.1930
	Ratufa macroura dandolena Grizzled Indian (Giant) Squirrel (Thomas & Wroughton, 1915). 1915. *Ratufa macroura dandolena* Thomas & Wroughton, J.Bom.N.H.Soc. 24, 1:36 Wellawaya, Uwa, Ceylon.												
73	*Ratufa maxima*	Rodentia	Sciuridae	M. 243/356	-	-	-	-	-	♂	Modura Distt.	S. H. Prater	14.05.1917
	Ratufa indica maxima Indian Giant Squirrel or Malabar Squirrel (Schreber 1784) 1784. *Sciurus maximus* Sahreber Saugeth. 4:784, Pl21713 Malabar India Range: Nilgiris Hills, Cochin, Palni Hills, Travancore, Malabar, etc. in Southern India.												
74	*Ratufa indica*	Rodentia	Sciuridae	M. 244/357	-	-	-	-	-	♀	Cochin	JR. O' Brien	07.04.1921
	Ratufa indica indica Indian Giant Squirrel or Malabar Squirrel (Erxleben, 1777). 1777. *Sciurus indicus* Erxlebon, Syst. Regn. An 420 Bomb. Presidency, India.												
75	*Menetes berdmorei*	Rodentia	Sciuridae	M. 263/380	781	149	144	43	19	♀	35 mis. SE. of Prome, Burma	Mackenzie	15.01.1917
	Menetes berdmorei berdmorei Berdmore's Squirrel (Blyth, 1849). 1849, *Sciturus berdmorei* Blyth, J. Asiat. Soc. Bengal, 18:603 Thoungyeen district, Lower Burma												
76	*Menetes berdmorei decoratus*	Rodentia	Sciuridae	M. 264/382	3766	171	157	42	20	♂	Int. Popa U. Burma	G. C. Shortridge	14.09.1913
	Menctes berdmorei decoratus Berdmore's Squirrel (Thomas, 1914). 1914. *Menetes berdmorei decoratus* Thomas, 1914 J. Bomb. N. H. Soc. 23, 1:24, Mt. Popa, Burma. Only known from the type locality, upto about 4,000 ft.												
77	*Menetes berdmorei decoratus*	Rodentia	Sciuridae	M. 265/383	3867	170	161	42.5	20	♀	Int. Popa U. Burma	G.C.Shortridge	23.09.1913
	Menctes berdmorei decoratus Berdmore's Squirrel (Thomas, 1914). 1914. B169 *Menetes berdmorei decoratus* Thomas, 1914 J. Bomb. N. H. Soc. 23, 1:24. Mt. Popa, Burma Only known from the type locality, upto about 4,000 ft.												
78	*Menetes berdmorei jew*	Rodentia	Sciuridae	M. 381	1106	94	66	29	10	♂	10 mis. North of Taungoo (E) Byen	Mackenzie	22.04.1927
	Menetes berdmorei berdmorei Berdmore's Squirrel (Blyth, 1849). 1849. *Sciturus berdmorei* Blyth J. Asiat.Soc.Bengal 18:603 Thoungyeen district, Lower Burma.												
79	*Tameutes blythi*	Rodentia	Sciuridae	M. 210/321	5489	159	183	44	18		Totkon, West Kindat, Chindwin River.	G. C. Shortridge & S. A. Macmillan	26.06.1914
	Callosciurus pygerythrus blythi Irrawaddy Squirrel (Tytler 1854). 1854. *Sciurus blythii* Tytler, Ann. Mag. N. H. 14:172. Dacca, Eastern Bengal.												
80	*Tameutes blythi*	Rodentia	Sciuridae	M. 211/322	1062	179	180	43	19	♀	Rajpara S. Kamrup	H. W. Wells	12.11.1920
	Callosciurus pygerythrus blythi Irrawaddy Squirrel (Tytler 1854). 1854. *Sciurus blythii* Tytler, Ann. Mag. N. H. 14:172. Dacca, Eastern Bengal.												
81	*Tomeutes phayrei*	Rodentia	Sciuridae	M. 224/335	915	205	238	50	19.5	♂	7 miles east of Toungoo, Burma	Mackenzie	29.12.1926
	Callosciurus flavimanus phayrei Yellow Banded Squirrel (Blyth 1855). 1855. *Sciurus phayrei* Blyth. J. Asiat. Soc. Bengal, 24:472, 476 Martaban Burma, Range: approximaately Tennaserim, Northwards to Shan, States.												
82	*Tomeutes phayrei phayrei*	Rodentia	Sciuridae	M. 225/336	1481	26	233	47	21	♀	Toungoo (E) Thandaung Burma	Mackenzie	03.04.1928
	Callosciurus flavimanus phayrei Yellow Banded Squirrel (Blyth 1855). 1855. *Sciurus phayrei* Blyth. J. Asiat. Soc. Bengal, 24:472, 476 Martaban Burma Range: approximaately, Tennaserim, Northwards to Shan. States.												
83	*Tomeutes phayrei blanfordi*	Rodentia	Sciuridae	M. 226/337	2785	243	250	55.5	22	♀	Goktick, N. Shan States Burma	G. C. Shortridge	24.04.1913
	Callosciurus flavimanus blanfordi Yellow Banded Squirrel Blyth 1862). 1862. *Sciurus blanfordi* Blyth. J. Asiat. Soc. Bengal, 31:333 Ava Upper Burma.												
84	*Tomeutes phayrei blanfordi*	Rodentia	Sciuridae	M. 227/338	3411	217	195	49	21	♂	Ngapyimen, Oirwaddy, Burma	G. C. Shortridge	02.08.1913
	Callosciurus flavimanus blanfordi Yellow Banded Squirrel Blyth 1862). 1862. *Sciurus blanfordi* Blyth. J. Asiat. Soc. Bengal, 31:333 Ava Upper Burma.												
85	*Tomeutes pygerythrus*	Rodentia	Sciuridae	M. 212/323	720	189	154	44	16.5	♂	Pegu, Burma	Mackenzie	19.07.1916
	Tomeutes pygerythrus pygerythrus Irrawaddy Squirrel (Geoffroy, 1831). 1831. *Sciurus pygerythrus* Geoffroy, in Belanger, Voy Indes Orient. 1: 145, Atlas pl.7 Pegu Burma.												
86	*Tomeutes pygerythrus*	Rodentia	Sciuridae	M. 213/324	1416	167	175	40	18	♀	20 mis. N. of Taungoo (W) Burma	Mackenzie	04.01.1928
	Tomeutes pygerythrus pygerythrus Irrawaddy Squirrel (Geoffroy, 1831). 1831. *Sciurus pygerythrus* Geoffroy, in Belanger, Voy Indes Orient. 1: 145, Atlas pl.7 Pegu Burma.												
87	*Tomeutes pygerythrus janetta*	Rodentia	Sciuridae	M. 214/325	3155	181	177	44.5	20.5	♀	Mandalay, Burma	G. C. Shortridge	30.06.1913
	Callosciurus pygerythrus janetta Irrawaddy Squirrel (Thomas, 1914). 1914. *Sciurus pygerythrus janetta* Thomas J. Bomb. N. H.Soc. 23, 2:203 Mandalay, 200 ft. Burma Range:Various localities in Burma from Mt.Popa to east side Chindwin River etc.												
88	*Tomeutes pygerythrus janetta* thos	Rodentia	Sciuridae	M. 215/326	5448	183	185	45	21	♂	Lower Chindwin, Burma	G. C. Shortridge & S. A. Macmillan	18.06.1914
	Callosciurus pygerythrus janetta Irrawaddy Squirrel (Thomas, 1914). 1914. *Sciurus pygerythrus janetta* Thomas J. Bomb. N. H. Soc. 23, 2:203 Mandalay, 200 ft. Burma Range:Various localities in Burma from Mt.Popa to east side Chindwin River etc.												
89	*Tamiops macclellandi*	Rodentia	Sciuridae	M. 217/328	5	90	82	25	11	♂	Naga Hills, Assam	H.W.Wells	21.10.1919
	Callosciurus macclellandi macclellandi Himalayan Striped Squirrel (Horsfield 1839). 1839. *Sciurus macclellandi* Horsefield, P.Z.S. 152. Assam.												
90	*Tamiops macclellandi manipurensis*	Rodentia	Sciuridae	M. 216/327	423	112	97	28	13	♂	Chin Hills, Bom. W. Kindat, Burma	Mackenzie	06.06.1915
	1900. *Sciurus macclellandi manipurensis* Himalayan Striped Squirrel Bonhote, Ann. Mag. N.It. 5:51 Aimole, Manipur.												
91	*Tamiops macclellandi barbei*	Rodentia	Sciuridae	M. 218/329	1328	108	124	29	13	♀	6 mis. east of Taungoo (E) Burma	Mackenzie	06.09.1927
	Callosciurus macclellandi barbei Himalayan Striped Squirrel (Blyth 1847). 1847. *Sciurus barbei Blyth, J. Asiat.Soc.Bengal, 16:875 Ye Tennaserim.*												
92	*Tamiops macclellandi barbei*	Rodentia	Sciuridae	M. 219/330	4932	116	84	29	13	♂	Tennasserin Town	G. C. Shortridge	13.03.1913
	Callosciurus macclellandi barbei Himalayan Striped Squirrel (Blyth 1847). 1847. *Sciurus barbei* Blyth, J. Asiat.Soc.Bengal, 16:875 Ye Tennaserim.												
93	*Platacanthomys lasiurus*	Rodentia	Muscardinidae Platacanthomyinae	M. 187/295	2377	135	103	25	24	♀	Virajpet, South Coorg.	G. C. Shortridge	24.01.1913
	Platacanthomys lasiurus Malabar Spiny Dormouse (Blyth, 1859). 1859. *Platacanthomys lasiurus* Blyth, J. Asiat. Soc. Bengal 28:289 Alipi, Malabar, India.												
94	*Platacanthomys lasiurus*	Rodentia	Muscardinidae Platacanthomyinae	M. 188/295	2378	115	85	25	24	♀	Virajpet, South Coorg.	G. C. Shortridge	24.01.1913
	Platacanthomys lasiurus Malabar Spiny Dormouse (Blyth, 1859). 1859. *Platacanthomys lasiurus* Blyth, J. Asiat. Soc. Bengal 28:289 Alipi, Malabar, India.												
95	*Rhizomys pruinosus*	Rodentia	Rhizomyidae	M. 170/278	488	230	81	41.5	18	♀	Cherrapungi, Assam	H. W. Wells	21.04.1920
	Rhizomys pruinosus pruinosus Hoary Bamboo Rat (Blyth 1851). 1851. *Rhyzomys pruinosus* Blyth, J.Asiat.Soc.Bengal, 20:519 Cherrapunji, Khasi Hills, Assam.												
96	*Nyctocleptes cinereus*	Rodentia	Rhizomyidae	M. 189/396	3018	222	98	44	18.5	♂	Pyaunggaung, Northern Shan States, Burma	G. C. Shortridge	09.05.1913
	Rhizomys sumatrensis cinereus Large Bamboo Rat (M'Clelland, 1942). 1842. *Rhizomys cinereus* M'clelland, 1842, Calcutta J. B. N. H. 2:456 Moulmein, Tennaserim.												
97	*Cannomys badius*	Rodentia	Rhizomyidae	M. 190/297	679	162	57	28	9	♀	Hot spring, Jaintia Hills	H. W. Wells	17.07.1920
	Cannomys badius badius Bay Bamboo Rat - Lesser Bamboo Rat (Hodgson, 1842). 1842. *Rhizomys badius* Hodgson, Calcutta J. N. H. 2:60, 410 (for April, 1841) Nepal. Range: Nepal, Darjeeling district, Bhutan Duars, Manipur, Assam, where it is common, to Western Burma.												
98	*Cannomys badius*	Rodentia	Rhizomyidae	M. 191/298	680	187	54	28	9	♂	Hot spring, Jaintia Hills	H. W. Wells	17.07.1920
	Cannomys badius badius Bay Bamboo Rat - Lesser Bamboo Rat (Hodgson, 1842). 1842. *Rhizomys badius* Hodgson, Calcutta J. N. H. 2:60, 410 (for April, 1841) Nepal. Range: Nepal, Darjeeling district, Bhutan Duars, Manipur, Assam, where it is common, to Western Burma.												
99	*Cannomys badius*	Rodentia	Rhizomyidae	M. 192/299	155	-	-	-	-	♀	Kindat 20 mis. SW Chin Hills	Mackenzie	18.01.1915
	Cannomys badius badius Bay Bamboo Rat - Lesser Bamboo Rat (Hodgson, 1842). 1842. *Rhizomys badius* Hodgson, Calcutta J. N. H. 2:60, 410 (for April, 1841) Nepal. Range: Nepal, Darjeeling district, Bhutan Duars, Manipur, Assam, where it is common, to Western Burma.												

Taxonomic and geographic information of the mammalian species collected a century ago from the Indian Subcontinent present in Pakistan Museum of Natural History (PMNH) Islamabad

S. #	SCIENTIFIC NAME	ORDER	FAM/ SUB FAM.	ZSP Code	ZSI Code	MEASUREMENTS				SEX	LOCALITY	COLLECTOR	DATE
						H & B	TL	HF	EAR				
164	*Rattus rattus wroughtoni*	Rodentia	Muridae Microtinae	M. 165/259	1335	162	-	-	-	♂	Kardebetta Shimoga Distt. Mysore	G. C. Shortridge	25.06.1912
	Rattus rattus wroughtoni House Rat, Black Rat (Hinton, 1919). 1919. *Rattus rattus wroughtoni* Hinton, J. Bom. N. H. Soc. 26:384 Coonoor, 6000 ft. Nilgiri Hills, India. Range: Southern Peninsular India.												
165	*Rattus rattus wroughtoni*	Rodentia	Muridae Microtinae	M. 154/A	102	181	230	35	25	♂	Silver Caseeds	Mackenzie	25.04.1922
	Rattus rattus wroughtoni House Rat, Black Rat (Hinton, 1919). 1919. *Rattus rattus wroughtoni* Hinton, J. Bom. N. H. Soc. 26:384 Coonoor, 6000 ft. Nilgiri Hills, India. Range: Southern Peninsular India.												
166	*Rattus rattus wroughtoni*	Rodentia	Muridae Microtinae	152/A	262	78	8	16		♀	Estate Cochin	J. R. O'Brien	19.04.1921
	Rattus rattus wroughtoni House Rat, Black Rat (Hinton, 1919). 1919. *Rattus rattus wroughtoni* Hinton, J. Bom. N. H. Soc. 26:384 Coonoor, 6000 ft. Nilgiri Hills, India. Range: Southern Peninsular India.												
167	*Rattus rattus gangutrianus*	Rodentia	Muridae Microtinae	M. 546/Z	2164	162	183	30	24	♀	Gopalpur Kangra Valley	H. W. Wells	03.03.1922
	Rattus rattus gangtrianus House Rat, Black Rat (Hinton, 1919). 1919. *Rattus rattus gangtrianus* Hintom J. Bomb. N. H. Soc. 26:389 Ranibagh Naini Tal Kumaon, 2500 ft. India Range: to Punjab.												
168	*Rattus rattus brunnaeus*	Rodentia	Muridae Microtinae	M. 198/B	64	143	183	36	12	♂	Patibhajan, Nepal	-	29.09.1920
	Rattus rattus brunnaeus House Rat, Black Rat (Hodgson, 1845). 1845. *Mus brunneus* Hodgson, Ann.Mag.N.H. 15:266. Nepal. A large form, apparently commensal.												
169	*Rattus rattus brunnaeus*	Rodentia	Muridae Microtinae	M. 153/246	238	169	220	38	28	♀	Chalua Khel Nepal	N. A. Baptista	05.05.1921
	Rattus rattus brunnaeus House Rat, Black Rat (Hodgson, 1845). *1845. Mus brunneus* Hodgson, Ann. Mag. N. H. 15:266. Nepal. A large form, apparently commensal.												
170	*Rattus rattus khyensis*	Rodentia	Muridae Microtinae	M. 167/A / 265	1318	152	186	32	22	♂	36 m. North of Taungoo (W)	Mackenzie	24.08.1927
	Rattus rattus khyensis House Rat, Black Rat (Hinton 1919). 1919. *Rattus rattus khyensis* Hinton - J.Bom.N.H.Soc. 26:398 Twenty five miles West of Kindat, 600 ft. Chin Hills Western Burma.												
171	*Rattus rattus khyensis*	Rodentia	Muridae Microtinae	M. 546/P	3460	147	186	30	20	♀	Popa U. Burma	G. C. Sohrtridge	30.03.1913
	Rattus rattus khyensis House Rat, Black Rat (Hinton 1919). 1919. *Rattus rattus khyensis* Hinton - J. Bom. N. H. Soc. 26:398 Twenty five miles West of Kindat, 600 ft. Chin Hills Western Burma.												
172	*Rattus rattus tikos*	Rodentia	Muridae Microtinae	M. 166/A	139	-	-	-	-	♂	Kings Island	C. Primrose	19.09.1921
	Rattus rattus tikos House Rat, Black Rat (Hinton 1919). 1919. *Rattus rattus tikos* Hinton, J. Bom. N. H. Soc. 26:400 Tennaserim Town, Tennaserim. Range : Includes Malcolm Island, King Island, Sullivan Islands all Mergui Archipelago and lower Siam.												
173	*Rattus rattus tikos*	Rodentia	Muridae Microtinae	M. 167/269	4269	-	-	-	-	♂	Victoria Point, S.Tennaserim	G. C.Shortridge	27.11.1913
	Rattus rattus tikos House Rat, Black Rat (Hinton 1919). 1919. *Rattus rattus tikos* Hinton, J. Bom. N. H. Soc. 26:400 Tennaserim Town, Tennaserim. Range : Includes Malcolm Island, King Island, Sullivan Islands all Mergui Archipelago and lower Siam.												
174	*Rattus rattus tikos*	Rodentia	Muridae Microtinae	M. 198/A	289	205	205	38	22	♀	Sir John Hayes Island	C. Primrose	06.12.1921
	Rattus rattus tikos House Rat, Black Rat (Hinton 1919). 1919. *Rattus rattus tikos* Hinton, J. Bom. N. H. Soc. 26:400 Tennaserim Town, Tennaserim. Range : Includes Malcolm Island, King Island, Sullivan Islands all Mergui Archipelago and lower Siam.												
175	*Rattus rattus tikos*	Rodentia	Muridae Microtinae	M. 546/W	475	171	180	33	25	♀	Malcolm Island	C. Primrose	22.02.1922
	Rattus rattus tikos House Rat, Black Rat (Hinton 1919). 1919. *Rattus rattus tikos* Hinton, J.Bom.N.H.Soc. 26:400 Tennaserim Town, Tennaserim. Range : Includes Malcolm Island, King Island, Sullivan Islands all Mergui Archipelago and lower Siam.												
176	*Rattus nitidus*	Rodentia	Muridae Microtinae	M. 135/225	1652	176	175	33	22.5	♂	Dening, Mishmi Hills	H. W. Wells	06.04.1921
	Rattus nitidus nitidus House Rat, Black Rat (Hodgson 1845). 1845. *Mus nitidus* Hodgson, Ann.Mag.N.H. 15:267 Nepal (Type in B.M.)												
177	*Rattus nitidus*	Rodentia	Muridae Microtinae	M. 134	682	117	117	28	20	♀	Hot spring, Jaintia Hills	H. W. Wells	17.07.1920
	Rattus nitidus nitidus House Rat, Black Rat (Hodgson 1845). 1845. *Mus nitidus* Hodgson, Ann.Mag.N.H. 15:267 Nepal (Type in B.M.)												
178	*Rattus ratoides*	Rodentia	Muridae Microtinae	M. 124/A / 195	540	-	-	-	-	♀	Ladha, S. Waziristan	Captain C.M.	30.09.1921
	Rattus rattoides rattoides Turkestan Rat (Hodgson 1845). 1845. *Mus rattoides* Hodgson, Ann. Mag. N. H. 15:267 Nepal Range: Kumaon, Nepal, Sikkim (It is just possible that this is a semi commensal variety.												
179	*Rattus ratoides*	Rodentia	Muridae Microtinae	M. 165/A	6001	151	175	34	24	♀	Chuntang, Sikkim	C. A. Crump	20.12.1914
	Rattus rattoides rattoides Turkestan Rat (Hodgson 1845). 1845. *Mus rattoides* Hodgson, Ann. Mag. N. H. 15:267 Nepal Range: Kumaon, Nepal, Sikkim (It is just possible that this is a semi commensal variety.												
180	*Rattus mackenzie*	Rodentia	Muridae Microtinae	M. 139/229	302	145	200	31	20	♀	Chin Hills 50 miles W. Kindat Burma	Mackenzie	24.04.1915
	Rattus bowersi mackenzie Bower's Rat (Thomas, 1916). 1916. *Epimys mackenzie* Thomas, J. Bom. N. H. Soc. 24, 3:410 Haingyan, 50 miles west of Kindat, Chin Hills, Burma.												
181	*Rattus concolor*	Rodentia	Muridae Microtinae	M. 136/226	4234	122	151	25	16.25	♂	Victoria Point, S. Tennaserim	G. C. Shortridge	25.11.1912
	Rattus exulans concolor Little Rat (Blyth, 1859). 1859. *Mus concolor* Blyth J. Asiat. Soc. Bengal 28:295 Schwegyin, Burma Range:Burma Northwards to Bhamo & Upper Chindwin : Tennaserim, Siam, Indo-China, Malay Peninsula & various small adjascent Islands.												
182	*Rattus concolor*	Rodentia	Muridae Microtinae	M. 137/227	5992	108	109	22	16	♀	Hnamti, Upper Chindwin Burma	G. C. Shortridge & S. A. Macmillan	10.09.1914
	Rattus exulans concolor Little Rat (Blyth, 1859). 1859. *Mus concolor* Blyth J. Asiat. Soc. Bengal 28:295 Schwegyin, Burma Range:Burma Northwards to Bhamo & Upper Chindwin : Tennaserim, Siam, Indo-China, Malay Peninsula & Various small adjascent Islands.												
183	*Rattus concolor*	Rodentia	Muridae Microtinae	M. 138/228	972	100	127	23	15.5	♂	Taungoo, Burma	Mackenzie	05.02.1927
	Rattus exulans concolor Little Rat (Blyth, 1859). 1859. *Mus concolor* Blyth J. Asiat. Soc. Bengal 28:295 Schwegyin, Burma Range:Burma Northwards to Bhamo & Upper Chindwin : Tennaserim, Siam, Indo-China, Malay Peninsula & Various small adjascent Islands.												
184	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 123/A	3760	158	185	35	24	♂	Dhakuri, Raman U.P.	C. A. Crump	18.09.1913
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann. Mus. St. Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												
185	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 153/A	4114	160	210	34	25	♂	Lahtrar, Murree Punjab	H. W. Wells	21.06.1923
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann. Mus. St. Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												
186	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 165/B	4234	157	201	33	23	♂	Murree, Punjab	H. W. Wells	21.07.1923
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann.Mus.St.Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												
187	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 196	3700	139	187	315	25	♂	Ghandhala, Salt Range	H. W. Wells	05.04.1923
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann. Mus. St. Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												
188	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 546/L	4235	136	187	32	23	♀	Murree, Punjab	H. W. Wells	21.07.1923
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann. Mus. St. Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												
189	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 546/F 201	67	125	173	31	21	♂	Jalala, Rawalpindi	G. C. Shortridge	29.07.1921
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann. Mus .St. Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												
190	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 546/G	3292	-	-	-	-	♂	Deolah, Tikri	H. W. Wells	08.01.1923
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann.Mus.St.Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann.Mag.N.H. 11:473 Simla Northern India May 1903.												
191	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 546/H	3686	158	-	31	25	♀	Choan, Salt Range, Punjab	H. W. Wells	02.04.1923
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann.Mus.St.Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												
192	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 546/O	4073	175	210	33	24	♂	Charehan, Murree	H. W. Wells	12.06.1923
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann. Mus. St. Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												

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S. #	SCIENTIFIC NAME	ORDER	FAM/ SUB FAM.	ZSP Code	ZSI Code	MEASUREMENTS				SEX	LOCALITY	COLLECTOR	DATE
						H & B	TL	HF	EAR				
193	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 546/Q	3881	157	-	31	24	♀	Salesar, Salt Range	H. W. Wells	15.05.1923
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann. Mus. St. Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												
194	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 546/X	3391	150	-	31	22	♀	Rohtas, Salt Range	H. W. Wells	21.02.1923
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann. Mus. St. Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												
195	*Rattus vicerex*	Rodentia	Muridae Microtinae	M. 546/A	3881	157	-	31	24	♀	Sakesar Salt Range	H. W. Wells	15.05.1923
	Rattus rattoides turkestanicus Turkestan Rat (Satunin 1903). 1903. *Mus turkestanicus* Satunin, Ann. Mus. St. Petersb. 7:588 Assam-bob, Ferghana, Russian Turkestan (April, 1903). 1903. *Mus vicerex* Bonhote, Ann. Mag. N. H. 11:473 Simla Northern India May 1903.												
196	*Rattus niviventer*	Rodentia	Muridae Microtinae	M. 546/Z	3110	125	165	28	20	♀	Tikri, Chamba State	H. W. Wells	04.12.1923
	Rattus niviventer niviventer White-bellied Rat (Hodgson, 1836). 1836. *Mus (Rattus) niviventer* Hodgson J. Asiatic. Soc. Bengal 5:234 Katmando, Nepal.												
197	*Rattus niviventer*	Rodentia	Muridae Microtinae	M. 204	3292	138	187	31	21	♂	Deolah Tikri Chamba	H. W. Wells	08.01.1923
	Rattus niviventer niviventer White-bellied Rat (Hodgson, 1836). 1836. *Mus (Rattus) niviventer* Hodgson J.Asiatic.Soc.Bengal 5:234 Katmando, Nepal.												
198	*Rattus mentosus*	Rodentia	Muridae Microtinae	M. 125/A	5814	149	192	31.5	23	♀	Hkamti Upper Chindwin, Burma	S. A. Macmillan	25.07.1914
	Rattus nivventer mentosus White-bellied Rat (Thomas 1916). 1916. *Rattus mentosus* Thomas, J. Bom. N. H. Soc. 24, 4:643 Hkamti, 500 ft. Upper Chindwin, Burma Range:Assam, Mishmi, Northern Burma (in part).												
199	*Rattus mentosus*	Rodentia	Muridae Microtinae	M. 546/Y	5957	140	173	31	22	♂	V. Chindwn, R. Burma	Mackenzie	07.08.1914
	Rattus niviventer mentosus White-bellied Rat (Thomas 1916). 1916. *Rattus mentosus* Thomas, J. Bom. N. H. Soc. 24, 4:643 H kamti, 500 ft. Upper Chindwin, Burma Range:Assam, Mishmi, Northern Burma (in part).												
200	*Rattus lepcha*	Rodentia	Muridae Microtinae	M. 126/A	6104	118	158	28	21	♀	Lachen, Sikkim	C. A. Crump	29.12.1914
	Rattus nivventor lepcha White-bellied Rat (Wroughton, 1916). 1916. *Epimys lepcha* Wroughton, J. Bom. N. H. Soc. 24:429 Chuntang, 5,350 ft. Sikkim. Range:Chuntang & Lachen, Sikkim, India.												
201	*Rattus fulvescens*	Rodentia	Muridae Microtinae	M. 546/K	638	105	158	28	19	♂	Poshak, Darjeeling	N. A. Baptista	20.08.1915
	Rattus fulvescens fulvescens Chestnut Rat (Gray, 1847). 1847. *Mus fulvescens* Gray, Cat. Hodgson Ann. Mag. N. H. 3:203 Nepal, (Published 9 January 1847 Sherborn).												
202	*Rattus fulvescens*	Rodentia	Muridae Microtinae	M. 546/M	291	150	208	29	21	♂	Tura, Gharo Hills	H. W. Wells	26.02.1920
	Rattus fulvescens fulvescens Chestnut Rat (Gray, 1847). 1847. *Mus fulvescens* Gray, Cat. Hodgson Ann. Mag. N. H. 3:203 Nepal, (Published 9 January 1847 Sherborn).												
203	*Rattus fulvescens*	Rodentia	Muridae Microtinae	M. 546/N	6020	128	190	25	20	♀	Lachen, Sikkim	C. A. Crump	22.12.1914
	Rattus fulvescens fulvescens Chestnut Rat (Gray, 1847). 1847. *Mus fulvescens* Gray, Cat. Hodgson Ann. Mag. N. H. 3:203 Nepal, (Published 9 January 1847 Sherborn).												
204	*Rattus fulvescens*	Rodentia	Muridae Microtinae	M. 546/R	573	134	192	27	20	♀	Shillong, Khasi Hills Assam	H. W. Wells	21.05.1920
	Rattus fulvescens fulvescens Chestnut Rat (Gray, 1847). 1847. *Mus fulvescens* Gray, Cat. Hodgson Ann. Mag. N. H. 3:203 Nepal, (Published 9 January 1847 Sherborn).												
205	*Rattus fulvescens*	Rodentia	Muridae Microtinae	M. 124/211	500	136	187	28	23	♀	Lait kynsao, Khasi Hills	H. W. Wells	26.04.1920
	Rattus fulvescens fulvescens Chestnut Rat (Gray, 1847). 1847. Mus fulvescens Gray, Cat. Hodgson Ann. Mag. N. H. 3:203 Nepal, (Published 9 January 1847 Sherborn).												
206	*Rattus eha*	Rodentia	Muridae Microtinae	M. 146/235	6048	100	163	25	19	♂	Lachen, Sikkim	C. A. Crump	25.12.1914
	Rattus eha eha Smoke-bellied Rat, Little Himalayan Rat (Wroughton, 1916). 1916. *Epimys eha* Wroughton, J. Bom. N. H. Soc. 24:428 Lachen, Sikkim, 8800 ft. India. Range:Nepal, Sikkim.												
207	*Rattus manipulus*	Rodentia	Muridae Microtinae	M. 145/234	248	166	189	35	25	♀	Golaghat, Assam	H. W. Wells	08.02.1920
	Rattus manipulus manipulus Manipur Rat (Thomas, 1916). 1916. *Epimys manipulus* Thomas, J. Bom. N. H. Soc. 24, 3:413 Kampat, Kabaw, Valley, 20 miles West of Kindat, 600 ft. Western Burma.												
208	*Rattus manipulus*	Rodentia	Muridae Microtinae	M. 170/A	224	148	161	36.5	24	♂	6 m. W. Kindat, Burma	Mackenzie	25.02.1915
	Rattus manipulus manipulus Manipur Rat (Thomas, 1916). 1916. *Epimys manipulus* Thomas, J. Bom. N. H. Soc. 24, 3:413 Kampat, Kabaw, Valley, 20 miles West of Kindat, 600 ft. Western Burma.												
209	*Rattus surifer*	Rodentia	Muridae Microtinae	M. 140/280	4239	173	197	40	22	♀	Victoria Point, S. Tennaserim	G. C. Shortridge	26.11.1913
	Rattus rajah surifer Ohiya Rat (Miller 1900). 1900. *Mus surifer* Miller, Proc. Biol. Soc. Washington, 13:148 Trang 3000 ft. Lower siam. Range: to Tennaserim, Hastings Islands, Hayes Island, King Island, Kisseraing Island, Malcolm Island Ross Island Sullivan Island, Tavoy Island. All Mergui, Agrchipelago. Also Penang, Malay States, Sumatra in Part.												
210	*Rattus surifer*	Rodentia	Muridae Microtinae	M. 141/231	387	164	148	39	23	♂	Sir John Malcolm Island	C. Primrose	26.01.1922
	Rattus rajah surifer Ohiya Rat (Miller 1900). 1900. *Mus surifer* Miller, Proc.Biol.Soc. Washington, 13:148 Trang 3000 ft. Lower siam. Range: to Tennaserim, Hastings Islands, Hayes Island, King Island, Kisseraing Island, Malcolm Island Ross Island Sullivan Island, Tavoy Island. All Mergui, Agrchipelago. Also Penang, Malay States, Sumatra in Part.												
211	*Rattus vociferans*	Rodentia	Muridae Microtinae	M. 143/233	348	233	355	43	26	♀	50 ft. Kisseraing Island	C. Primrose	07.01.1922
	Rattus sabanus vociferans Noisy Rat (Miller, 1900). 1900. *Mus vociferans* Miller, Proc.Biol.Soc.Washington 13:138 Trang 1,000 ft. Lower Siam Range: Malay States, Sumatra (parl) North to Tennaserim; King Island Kisseraing Island, Ross Island, Tavoy Island, Mergui Archipelago.												
212	*Rattus vociferans*	Rodentia	Muridae Microtinae	M. 144/234	72	223	305	45	25	♂	King, Island	C. Primrose	01.10.1921
	Rattus sabanus vociferans Noisy Rat (Miller, 1900). 1900. *Mus vociferans* Miller, Proc. Biol. Soc. Washington 13:138 Trang 1,000 ft. Lower Siam Range: Malay States, Sumatra (parl) North to Tennaserim. King Island Kisseraing Island, Ross Island, Tavoy Island, Mergui Archipelago.												
213	*Mus musculus*	Rodentia	Muridae Microtinae	M. 70	936	70	82	17	12	♀	Shangpong, Jaintia Hills	H. W. Wells	10.08.1920
	Mus musculus musculus House Mouse (Linnaeus 1758). 1758. *Mus musculus* Linnaeus Syst. Nat. 10th ed. 1:62 Upsala Sweden.												
214	*Mus gerbillinus*	Rodentia	Muridae Microtinae	M. 80/151	3408	80	80	19	16	♂	Rohtas Salt Range, Punjab.	H. W. Wells	25.02.1923
	Mus musculus bactrianus House Mouse (Blyth 1846). 1846. *Mus bactrianus* Blyth, J. Asiat. Soc. Bengal, 15:140 Kandahar, Afghanistan. 1853. *Mus gerbillinus* Blyth, J. Asiat, Soc. Bengal 22:410 Punjab.												
215	*Mus gerbillinus*	Rodentia	Muridae Microtinae	M. 81/152	3438	71	73	16	13	♀	Mogli, Salt Range, Punjab	H. W. Wells	02.03.1923
	Mus musculus bactrianus House Mouse (Blyth 1846). 1846. *Mus bactrianus* Blyth, J. Asiat. Soc. Bengal, 15:140 Kandahar, Afghanistan. 1853. *Mus gerbillinus* Blyth, J. Asiat, Soc. Bengal 22:410 Punjab.												
216	*Mus gerbillinus*	Rodentia	Muridae Microtinae	M. 82/153	3480	73	82	18	15	♂	Chakri, Salt Range, Punjab	H. W. Wells	09.03.1923
	Mus musculus bactrianus House Mouse (Blyth 1846). 1846. *Mus bactrianus* Blyth, J. Asiat. Soc. Bengal, 15:140 Kandahar, Afghanistan. 1853. *Mus gerbillinus* Blyth, J. Asiat. Soc. Bengal 22:410 Punjab.												
217	*Mus gerbillinus*	Rodentia	Muridae Microtinae	M. 83/154	3576	70	78	17	13	♀	Ara, Salt Range, Punjab	H. W. Wells	19.03.1923
	Mus musculus bactrianus House Mouse (Blyth 1846). 1846. *Mus bactrianus* Blyth, J. Asiat. Soc. Bengal, 15:140 Kandahar, Afghanistan. 1853. *Mus gerbillinus* Blyth, J. Asiat. Soc. Bengal 22:410 Punjab.												
218	*Mus gerbillinus*	Rodentia	Muridae Microtinae	M. 84/155	3771	72	74	17	12.5	♀	Kallar Kahar, Salt Range	H. W. Wells	22.04.1923
	Mus musculus bactrianus House Mouse (Blyth 1846). 1846. *Mus bactrianus* Blyth, J. Asiat. Soc. Bengal, 15:140 Kandahar, Afghanistan. 1853. *Mus gerbillinus* Blyth, J. Asiat, Soc. Bengal 22:410 Punjab.												
219	*Mus gerbillinus*	Rodentia	Muridae Microtinae	M. 85/156	3885	72	88	16	13	♂	Sakesar, Salt Range, Punjab	H. W. Wells	16.05.1923
	Mus musculus bactrianus House Mouse (Blyth 1846). 1846. *Mus bactrianus* Blyth, J. Asiat. Soc. Bengal, 15:140 Kandahar, Afghanistan. 1853. *Mus gerbillinus* Blyth, J.Asiat, Soc.Bengal 22:410 Punjab.												
220	*Mus gerbillinus*	Rodentia	Muridae Microtinae	M. 86/157	3936	67	74	15	12	♂	Jhelum Salt Range, Punjab	H. W. Wells	26.05.1923
	Mus musculus bactrianus House Mouse (Blyth 1846). 1846. *Mus bactrianus* Blyth, J. Asiat. Soc. Bengal, 15:140 Kandahar, Afghanistan. 1853. *Mus gerbillinus* Blyth, J.Asiat, Soc.Bengal 22:410 Punjab.												
221	*Mus gerbillinus*	Rodentia	Muridae Microtinae	M. 87/157	3939	65	72	15	13	♂	Jhelum Salt Range, Punjab	H. W. Wells	26.05.1923
	Mus musculus bactrianus House Mouse (Blyth 1846). 1846. *Mus bactrianus* Blyth, J. Asiat. Soc. Bengal, 15:140 Kandahar, Afghanistan. 1853. *Mus gerbillinus* Blyth, J.Asiat, Soc.Bengal 22:410 Punjab.												
222	*Mus gerbillinus*	Rodentia	Muridae Microtinae	M. 88/158	4100	73	85	17	14	♂	Banni, Murree, Punjab	H. W. Wells	17.06.1923
	Mus Musculus bactrianus House Mouse Blyth 1846 *Mus gerbillinus* Blyth, J. Asiat. Soc. Bengal, 22:410 Punjab.												

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						H & B	TL	HF	EAR				
284	*Bandicota bengalensis*	Rodentia	Muridae Microtinae	M.14A	73	128	116	31	21		Halwak, Santara Distt.	S. H. Prater	14.12.1914
	Bandicota bengalensis Lesser Bandicoot Rat, Indian Mole Rat (Gray & Hardwick, 1983). 1983. *Arvicola bengalensis* Gray & Hardwick, Illuster. Ind. Zool. 2, pl.21.Bengal.												
285	*Bandicota bengalensis varius*	Rodentia	Muridae Microtinae	M. 14/81	526	-	-	-	-		Vitkangale, Pegu Burma	B.N.H.S.	24.01.1916
	Bandicota bengalensis Lesser Bandicoot Rat, Indian Mole Rat (Gray & Hardwick, 1983). 1983. *Arvicola bengalensis* Gray & Hardwick, Illuster. Ind.Zool. 2, pl.21.Bengal.												
286	*Bandicota malabarica*	Rodentia	Muridae Microtinae	M. 18/85	1901	275	276	58	32	♀	Sasan, Junagadh - State Katiawar	C. A. Crump	03.11.1912
	Bandicota malabarica Large Bandicotoot Rat (Betchtein, 1800). 1800. *Bandicota indica indica* Betchtein, 1801. *Mus malabarica* Shaw Gen. Zool. 2:54 Malabar India												
287	*Bandicota nemorivaga*	Rodentia	Muridae Microtinae	M. 19/86	530	247	184	48	27.5	♀	Vitkangale, 12m. SE Pegu, Burma	Mackenzie	15.01.1916
	Bandicota nemorivaga Large Bandicoot Rat (Hodgson, 1836). *Bandicota indica nemorivaga* J. Asiat. Soc. Bengal 5:236 Nepal.												
288	*Bandicota nemorivaga*	Rodentia	Muridae Microtinae	M. 20/87	1073	198	220	49	30	♀	Hasimara, Bhutan Duars	C. A. Crump	06.11.1915
	Bandicota nemorivaga Large Bandicoot Rat (Hodgson, 1836). *Bandicota indica nemorivaga* J. Asiat. Soc. Bengal 5:236 Nepal.												
289	*Bandicota savilla*	Rodentia	Muridae Microtinae	M. 21/88	3266	200	192	40	24.5	♂	Mingum W. Saging U.Burma	G. C. Shortridge	11.07.1913
	Bandicota savilla Large Bandicoot Rat (Thomas, 1916). 1916. *bandicota indica savilei* Thomas, J. Bom. N. H. Soc. 24, 4:641 Mt. Popa about 2500 ft. Burma.												
290	*Bandicota savilla*	Rodentia	Muridae Microtinae	M. 22/89	3765	223	203	39	25	♀	U.Burma	G. C. Shortridge	14.09.1913
	Bandicota savilla Large Bandicoot Rat (Thomas, 1916). 1916. *Bandicota indica savilei* Thomas, J. Bom. N. H. Soc. 24, 4:641 Mt. Popa about 2500 ft. Burma.												
291	*Gunomys bengalensis*	Rodentia	Muridae Microtinae	M. 8/75	5586	167	147	32	23	♀	Salboni, Midnapur, Bengal.	C. A. Crump	18.09.1914
	Gunomys bengalensis Lessor Bandicoot Rat, Indian Mole Rat (Gray & Hardwicke, 1833). 1833. *Bandicota bengalensis* Gray & Hardwicke, Illustr. Ind.2001. 2.pl. 21 Bengal.												
292	*Gunomys bengalensis*	Rodentia	Muridae Microtinae	M. 9/76	12	180	125	35	20	♂	Chaklala, Rawalpindi.	Maj. C. H. Stockley	07.07.1921
	Gunomys bengalensis Lessor Bandicoot Rat, Indian Mole Rat (Gray & Hardwicke, 1833). 1833. *Bandicota bengalensis* Gray & Hardwicke, Illustr. Ind.2001. 2.pl. 21 Bengal.												
293	*Gunomys bengalensis*	Rodentia	Muridae Microtinae	M. 10/77	151	142	100	28	18	♂	Golaghat, Assam	H. W. Wells	10.01.1920
	Gunomys bengalensis Lessor Bandicoot Rat, Indian Mole Rat (Gray & Hardwicke, 1833). 1833. *Bandicota bengalensis* Gray & Hardwicke, Illustr. Ind.2001. 2.pl. 21 Bengal.												
294	*Gunomys gracilis*	Rodentia	Muridae Microtinae	M. 11/78	346	150	138	32	19	♂	-	-	23.09.1920
	Gunamys gracilis Lessor Bandicoot Rat, Indian Mole Rate (Nehring, 1902). 1902. *Bandicota bengalensis gracilis* Nehring, D. B. Ges. Nat. Fr. Berlin 116. Ceylon.												
295	*Gunomys gracilis*	Rodentia	Muridae Microtinae	M. 11A/ 78/1	347	135	132	29	17	♀	-	B.N.H.S.	23.09.1920
	Gunamys gracilis Lessor Bandicoot Rat, Indian Mole Rate (Nehring, 1902). 1902. *Bandicota bengalensis gracilis* Nehring, D. B. Ges. Nat. Fr. Berlin 116. Ceylon.												
296	*Gunomys gracilis*	Rodentia	Muridae Microtinae	M. 12/347	-	-	-	-	-	♀	-	Phillips	23.09.1920
	Gunamys gracilis Lessor Bandicoot Rat, Indian Mole Rate (Nehring, 1902). 1902. *Bandicota bengalensis gracilis* Nehring, D. B. Ges. Nat. Fr. Berlin 116. Ceylon.												
297	*Gunomys wardi*	Rodentia	Muridae Microtinae	M. 16/83	2117	187	122	36	24	♂	Loharmsala, Punjab.	H. W. Wells	08.02.1922
	Gunomys wardi Lessor Bandicoot Rat, Indian Mole Rat (Wroughton, 1908). 1908. *Bandicota bengalensis wardi* Wroughton, J. Bom. N. H. Soc. 18:745 Pandritton 5500 ft. Kashmir, Range: to Chamba, Punjab & a few localities in Kashmir.												
298	*Gunomys wardi*	Rodentia	Muridae Microtinae	M.17/84	2139	185	155	36	20.5	♀	Gopalpur, Kangra Valley	H. W. Wells	26.02.1922
	Gunomys wardi Lessor Bandicoot Rat, Indian Mole Rat (Wroughton, 1908). 1908. *Bandicota bengalensis wardi* Wroughton, J. Bom. N. H. Soc. 18:745 Pandritton 5500 ft. Kashmir, Range: to Chamba, Punjab & a few localities in Kashmir.												
299	*Gunomys kok*	Rodentia	Muridae Microtinae	M. 13	262	190	147	32	23	♀	Dharwar	G. C. Shortridge	13.12.1911
	Gunomys kok Lessor Bandicoot Rat, Indian Mole Rat (Gray, 1837). 1837. *Bandicota bengalensis kok* Gray, Charlesworths Mag.N.H.1:585 Dharwar, India.												
300	*Gunomys varius*	Rodentia	Muridae Microtinae	M. 15/820	1137	164	150	35	21	♀	Joungoo - Burma	Mackenzie	20.05.1927
	Gunomys varius (Thomas 1907). 1907. *Bandicota bengalensis varius* Thomas, Ann. Mag. N. H. 20: 204 Georgetown, Penang Island. Malay Peninsula. Range: Northwards to Tennaserim and Lower Burma.												
301	*Nesokia indica*	Rodentia	Muridae Microtinae	M. 25	264	147	118	29	18	♂	Thatta, Sind	-	26.10.1922
	Nesokia indica Short-tailed Bandicoot Rat, Short-tailed Mole Rat (Gray & Hardwicke, 1832). 1832. *Nesokia indica indica* Gray and Hardwicke, 1832 (Arvicola indica) Illustr. Ind. Zool. 1 P1: xi "India"												
302	*Nesokia indica*	Rodentia	Muridae Microtinae	M. 26/93	386	124	110	35	19	♂	Punjab	J.E.B.H.	06.04.1913
	Nesokia indica Short-tailed Bandicoot Rat, Short-tailed Mole Rat (Gray & Hardwicke, 1832). 1832. *Nesokia indica indica* Gray and Hardwicke, 1832 (Arvicola indica) Illustr. Ind. Zool. 1 P1: xi "India"												
303	*Nesokia griffithi*	Rodentia	Muridae Microtinae	M. 23/90	3837	119	90	28	15	♂	Kallar Kahar, Salt Range Punjab	H. W. Wells	01.05.1923
	Nesokia griffithi Short-tailed Bandicoot Rat, Short-tailed Mole Rat (Horsefield, 1851). 1851. *Nesokia indica indica* Horsefield, Cat. Mamm. Ind. Mus. 145. Pushut, North-West Frontier, India. 1851. *Nesokia griffithi* Horsefield, Cat. Mamm. Ind. Mus. 145. Pushut, North West Frontier, India.												
304	*Nesokia griffithi*	Rodentia	Muridae Microtinae	M. 4/90	3838	123	89	29	15	♀	Kallar Kahar, Salt Range Punjab	H. W. Wells	01.05.1923
	Nesokia griffithi Short-tailed Bandicoot Rat, Short-tailed Mole Rat (Horsefield, 1851). 1851. *Nesokia indica indica* Horsefield, Cat. Mamm. Ind. Mus. 145. Pushut, North-West Frontier, India. 1851. *Nesokia griffithi* Horsefield, Cat. Mamm. Ind. Mus. 145. Pushut, North West Frontier, India.												
305	*Calomyscus bailwardi*	Rodentia	Muridae Microtinae	M. 27/94	2412	73		20		♀	Kuh-i-Barti	Lt. Col. J.E.B.H.	11.07.1920
	Calomyscus bailwardi Mouse like Hamster, (Thomas, 1905). 1905. *Calomycus bailwardi* Thomas, Abstr. P.Z.S. 23: and P.Z.S. 524-6. Malamir, 70 miles north-east of Ahwaz, Persia.												
306	*Calomyscus bailwardi*	Rodentia	Muridae Microtinae	M. 28/95	703	720	88	20	19	♂	Kalat, Baluchistan	J.E.B.H.	07.07.1918
	Calomyscus bailwardi Mouse like Hamster, (Thomas, 1905). 1905. *Calomycus bailwardi* Thomas, Abstr. P.Z.S. 23: and P.Z.S. 524-6. Malamir, 70 miles north-east of Ahwaz, Persia.												
307	*Cricetulus migratorius*	Rodentia	Muridae Microtinae	M. 29/16	1702	83	32	17	20	♂	Sheraz	J.E.B.H.	21.12.1919
	Cricetulus migratorius Migratory Hamster, Grey Hamster (Pallas, 1773). 1773. *Cricetulus migratorius migratorius* Pallas, Reise, 2: 703. Lower River Ural Western Siberia.												
308	*Cricetulus migratorius*	Rodentia	Muridae Microtinae	M.30/97	1920	103	35	17	21	♀	Bagh Raza	J.E.B.H.	22.02.1920
	Cricetulus migratorius Migratory Hamster, Grey Hamster (Pallas, 1773). 1773. *Cricetulus migratorius migratorius* Pallas, Reise, 2: 703. Lower River Ural Western Siberia.												
309	*Cricetulus migratorius*	Rodentia	Muridae Microtinae	M. 30/1	1925	87	32	17	20		Bagh Raza	J.E.B.H.	22.02.1920
	Cricetulus migratorius Migratory Hamster, Grey Hamster (Pallas, 1773). 1773. *Cricetulus migratorius migratorius* Pallas, Reise, 2: 703. Lower River Ural Western Siberia.												
310	*Dipodillus indus*	Rodentia	Muridae Gerbillinae	M. 32.A/ 100	163	82	128	20	-	♀	Gharo Sind.	Mackenzie	08.10.1922
	Dipodillus indus Wagner's Gerbil (Thomas, 1920). 1920. *Gerbillus dasyurus indus* Thomas, J. Bombay N. H. Soc. 26, 4: 935 Gambat, Khairpur.												
311	*Dipodillus nanus*	Rodentia	Muridae Gerbillinae	M. 31/98	84	68	98	22	18	♀	Harbor, Baluchistan.	J.E.B.H.	08.08.1917
	Dipodillus nanus Baluchistan Gerbill (Blanford, 1875). 1875. *Gerbillus nanus nanus* Blanford, Ann. Mag N. H. 16:312 Gedrosia, West of Gwadar, Balochistan. Range: Balochistan, and Muscat in Eastern Arabia.												
312	*Dipodillus nanus*	Rodentia	Muridae Gerbillinae	M. 32/99	567	77	133	24	14	♂	Chaharbar P.Gulf	J.E.B.H.	19.02.1917
	Dipodillus nanus Baluchistan Gerbill (Blanford, 1875). 1875. *Gerbillus nanus nanus* Blanford, Ann. Mag N. H. 16:312 Gedrosia, West of Gwadar, Balochistan. Range: Balochistan, and Muscat in Eastern Arabia.												
313	*Tatera indica*	Rodentia	Muridae Gerbillinae	M. 35/105	33	132	174	37	21	♂	Chaklala, Rawalpindi.	Maj. C. H. Stockley	15.07.1921
	Tatera indica indica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Dipus indicus* Trans Linn. Soc. London. 8:279 Between Benares and Hardwar, United Provinces, Northern India.												
314	*Tatera indica*	Rodentia	Muridae Gerbillinae	M. 37/105/1	34	120	172	35	22	♀	Chaklala, Rawalpindi.	Maj. C. H. Stockley	15.07.1921
	Tatera indica indica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Dipus indicus* Trans Linn. Soc. London. 8:279 Between Benares and Hardwar, United Provinces, Northern India.												
315	*Tatera indica*	Rodentia	Muridae Gerbillinae	M. 38/106	3032	164	190	36	23		Dhantal Nouera Distt.	H. W. Wells	09.11.1922
	Tatera indica indica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Dipus indicus* Trans Linn. Soc. London. 8:279 Between Benares and Hardwar, United Provinces, Northern India.												

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						H & B	TL	HF	EAR				
316	*Tatera indica*	Rodentia	Muridae Gerbillinae	M.39/107	3377	143	162	36	23.5	♂	Madhopur, Punjan	H. W. Wells	10.02.1923
	Tatera indica indica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Dipus indicus* Trans Linn. Soc. London. 8:279 Between Benares and Hardwar, United Provinces, Northern India.												
317	*Tatera indica*	Rodentia	Muridae Gerbillinae	M. 40/108	3430	146	162	35	23	♂	Mogli, Salt Range Punjab	H. W. Wells	01.03.1923
	Tatera indica indica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Dipus indicus* Trans Linn. Soc. London. 8:279 Between Benares and Hardwar, United Proinces, Northern India.												
318	*Tatera indica*	Rodentia	Muridae Gerbillinae	M. 41/109	3455	146	167	36.5	23	♀	Chakri Salt Range Punjab	H. W. Wells	06.03.1923
	Tatera indica indica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Dipus indicus* Trans Linn. Soc. London. 8:279 Between Benares and Hardwar, United Provinces, Northern India.												
319	*Tatera indica*	Rodentia	Muridae Gerbillinae	M. 42/111	3733	154	169	37	23	♂	Ghandhara Salt Range Punjab	H. W. Wells	10.04.1923
	Tatera indica indica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Dipus indicus* Trans Linn. Soc. London. 8:279 Between Benares and Hardwar, United Provinces, Northern India.												
320	*Tatera indica*	Rodentia	Muridae Gerbillinae	M. 43/112	3890	163	174	35	24	♂	Sakra Salt Range Shahpur Distt.	-	17.05.1923
	Tatera indica indica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Dipus indicus* Trans Linn. Soc. London. 8:279 Between Benares and Hardwar, United Provinces, Northern India.												
321	*Tatera indica indica*	Rodentia	Muridae Gerbillinae	M. 44/113	124	-	-	-	-	♀	Tank	C. M. Ingoldhy	09.11.1919
	Tatera indica indica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Dipus indicus* Trans Linn. Soc. London. 8:279 Between Benares and Hardwar, United Provinces, Northern India.												
322	*Tatera indica indica*	Rodentia	Muridae Gerbillinae	M.45/114	135	-	-	-	-	♂	Thatta, Sind	-	24.01.1920
	Tatera indica indica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Dipus indicus* Trans Linn. Soc. London. 8:279 Between Benares and Hardwar, United Provinces, Northern India.												
323	*Tatera sherrini*	Rodentia	Muridae Gerbillinae	M.33/100	432	143	168	36	24	♂	Jacobabad, Sind	S. H. Prater	21.02.1915
	Tatera sherrini Indian Gerbil (Hardwicke 1807). 1807. *Tatera indica indica* Wroughton, J. Bombay N. H. Soc. Z5, 1:43 Jacobabad, Sind, India. 1917. *Tatera sherrini* Wroughton, Ann. Mag. N. H. 17:477, 496. Seistan, Persia												
324	*Tatera sherrini*	Rodentia	Muridae Gerbillinae	M. 34/103	498	139	150	33	22	♂	Kashmore U. Sind, Frontier	S. H. Prater	03.03.1915
	Tatera sherrini Indian Gerbil (Hardwicke 1807). 1807. Tatera indica indica Wroughton, J. Bombay N. H. Soc. Z5, 1:43 Jacobabad, Sind, India. 1917. *Tatera sherrini* Wroughton, Ann. Mag. N. H. 17:477, 496. Seistan, Persia												
325	*Tatera sherrini*	Rodentia	Muridae Gerbillinae	M.35/104	213	157	171	36	21	♂	Gholam, Sindh	-	18.10.1922
	Tatera sherrini Indian Gerbil (Hardwicke 1807). 1807. *Tatera indica indica* Wroughton, J. Bombay N. H. Soc. Z5, 1:43 Jacobabad, Sind, India.1917. *B667* Wroughton, Ann. Mag. N. H. 17:477, 496. Seistan, Persia												
326	*Tatera persica*	Rodentia	Muridae Gerbillinae	M. 47/116	47	143	162	36	23	♀	Maund	C. A. Crump	05.12.1917
	Tatera persica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Tatera indica indica* Wroughton, Ann. Mag. N. H. 17:477, 496 Seistan, Persia.												
327	*Tatera persica*	Rodentia	Muridae Gerbillinae	M. 46/115	26	125	162	37	24	♂	Turbat (Ketch)	J.E.B.H.	27.11.1917
	Tatera persica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Tatera indica indica* Wroughton, Ann. Mag. N. H. 17:477, 496 Seistan, Persia.												
328	*Tatera persica*	Rodentia	Muridae Gerbillinae	M. 48/117	75	134	164	35	24	♂	Sams 24 mls. East of Turbat	J.E.B.H.	16.12.1917
	Tatera persica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Tatera indica indica* Wroughton, Ann. Mag. N. H. 17:477, 496 Seistan, Persia.												
329	*Tatera persica*	Rodentia	Muridae Gerbillinae	M. 49/118	89	145	206	39	26	♀	Panjgoor	J.E.B.H.	27.12.1917
	Tatera persica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Tatera indica indica* Wroughton, Ann. Mag. N. H. 17:477, 496 Seistan, Persia.												
330	*Tatera persica*	Rodentia	Muridae Gerbillinae	M. 50/ 118/1	176	130	160	38	24	♀	Panjgoor	J.E.B.H.	27.12.1917
	Tatera persica Indian Gerbil, Antelope Rat (Hardwicke, 1807). 1807. *Tatera indica indica* Wroughton, Ann. Mag. N. H. 17:477, 496 Seistan, Persia.												
331	*Tatera cuvieri*	Rodentia	Muridae Gerbillinae	M. 56/124	478	115	170	42.5	22.5	♂	Kurrum bapthi Salim Distt. East Ghat.	N. A. Baptista	19.04.1929
	Tatera cuvieri Indian Gerbil , Antelope Rat (Waterhouse, 1838). 1838. *Gerbillus cuvieri* P.Z.S. 56. Arcot, Madras, India. Range: Nilgiri Hills, Mysore, Madras, Bellary, Shevaroy Hills and a few other places in Southern India.												
332	*Tatera cuvieri*	Rodentia	Muridae Gerbillinae	M. 52	2009	165	218	42	25.5	♀	Seringapatam, S. Mysore	G. C. Shortridge	26.10.1912
	Tatera cuvieri Indian Gerbil , Antelope Rat (Waterhouse, 1838). 1838. *Gerbillus cuvieri* P.Z.S. 56. Arcot, Madras, India. Range: Nilgiri Hills, Mysore, Madras, Bellary, Shevaroy Hills and a few other places in Southern India.												
333	*Tatera cuvieri*	Rodentia	Muridae Gerbillinae	M. 56/124	478	115	170	42.5	22.5	♀	Maukem, E.P.	Maj. E. W. Mayor	30.08.1913
	Tatera cuvieri Indian Gerbil , Antelope Rat (Waterhouse, 1838). 1838. *Gerbillus cuvieri* P.Z.S. 56. Arcot, Madras, India. Range: Nilgiri Hills, Mysore, Madras, Bellary, Shevaroy Hills and a few other places in Southern India.												
334	*Tatera hardwickii*	Rodentia	Muridae Gerbillinae	M. 53/275	275	164	177	41	24	♀	Dharwar S. Mahratta	G. C. Shortridge	14.12.1911
	Tatera hardwickei Indian Gerbil, Antelope Rat (Gray, 1843). 1843. *Gerbillus hardwickei* Gray, List. Mamm. 132 Dharwar, India. Based on Elliot's description of the Dharwar Tatera, 1839, Madraw J. Lih. Sci 10:211. Range: Coorge, Western Bom. Kardibetta Forest in Mysore.												
335	*Tatera hardwickii*	Rodentia	Muridae Gerbillinae	M. 54	1259	177	209	44	23	♂	Sagar, Shimoga, Distt. Mysore	G. C. Shortridge	07.06.1912
	Tatera hardwickei Indian Gerbil, Antelope Rat (Gray, 1843). 1843. *Gerbillus hardwickei* Gray, List. Mamm. 132 Dharwar, India. Based on Elliot's description of the Dharwar Tatera, 1839, Madraw J. Lih. Sci 10:211. Range: Coorge, Western Bom. Kardibetta Forest in Mysore.												
336	*Tatera ceylonica*	Rodentia	Muridae Gerbillinae	M. 55/123	147	169	207	45	24	♂	Hambantota, S. P. Ceylone	Maj. E. W.Mayor	27.05.1913
	Tatera ceylonica Indian Gerbil, Antelope Rat (Wroughton, 1906). *Tatera indica ceylonica* Ann. Mag. N. H. 17:477, 499 Ceylon.												
337	*Cheliones hurrianae*	Rodentia	Muridae Gerbillinae	M. 61	715	120	121	30	12	♂	Sukkur, Sindh	S. H. Prater	31.03.1915
	Meriones hurrianae Persian Jird (Jerdon, 1867). 1867. *Gerbillus hurrianae* Jerdon Mamm. India, 1867 (Hissar, Punjab, India. Thomas, J. Bom. N. H.Soc. 26:726 Kohat, North West Frontier Province, 1000 - 1700 ft. India.												
338	*Cheliones hurrianae*	Rodentia	Muridae Gerbillinae	M. 62	788	133	141	32	12	♀	Gambat, Khairpur State	S. H. Prater	17.04.1915
	Meriones hurrianae Persian Jird (Jerdon, 1867). 1867. *Gerbillus hurrianae* Jerdon Mamm. India, 1867 (Hissar, Punjab, India. Thomas, J. Bom. N. H. Soc. 26:726 Kohat, North West Frontier Province, 1000 - 1700 ft. India.												
339	*Cheliones hurrianae*	Rodentia	Muridae Gerbillinae	M. 63	204	112	153	29	13	♀	Near Mirpur Sakro, Sindh	Mackenzie	16.10.1922
	Meriones hurrianae Persian Jird (Jerdon, 1867). 1867. *Gerbillus hurrianae* Jerdon Mamm. India, 1867 (Hissar, Punjab, India. Thomas, J. Bom. N. H. Soc. 26:726 Kohat, North West Frontier Province, 1000 - 1700 ft. India.												
340	*Cheliones hurrianae jew*	Rodentia	Muridae Gerbillinae	M. 64	142	104	125	31	11	♀	Kotri, Sindh	Maj. C. H. Stockley	26.11.1923
	Meriones hurrianae Persian Jird (Jerdon, 1867). 1867. *Gerbillus hurrianae* Jerdon Mamm. India, 1867 (Hissar, Punjab, India. Thomas, J. Bom. N. 26:726 Kohat, North West Frontier Province, 1000 - 1700 ft. India.												
341	*Cheliones hurrianae collinus*	Rodentia	Muridae Gerbillinae	M. 65	279	122	140	33	14	♂	Kalat	J.E.B.H.	08.09.1917
	Meriones hurrianae Persian Jird (Jerdon, 1867). 1867. *Gerbillus hurrianae* Jerdon Mamm. India, 1867 (Hissar, Punjab, India. Thomas, J. Bom. N. H. Soc 26:726 Kohat, North West Frontier Province, 1000 - 1700 ft. India.												
342	*Cheliones hurrianae collinus*	Rodentia	Muridae Gerbillinae	M. 66	346	123	125	32	12	♀	-	J.E.B.H.	21.09.1917
	Meriones hurrianae Persian Jird (Jerdon, 1867). 1867. *Gerbillus hurrianae* Jerdon Mamm. India, 1867 (Hissar, Punjab, India. Thomas, J.Bom.N.H.Soc 26:726 Kohat, North West Frontier Province, 1000 - 1700 ft. India.												
343	*Meriones persicus*	Rodentia	Muridae Gerbillinae	M. 60-A/ 129	707	136	-	36	21	♀	Kalat, Baluchistan	J.E.B.H.	09.07.1918
	Merionus persicus persicus Persian Jird (Blanford, 1875). 1875. *Gerbillus persicus* Blanford, Ann. Mag. N. H. 16:312 (Kohrud, 150 miles North of Isfahan, Persia.												
344	*Neodon sikkimensis*	Rodentia	Muridae Gerbillinae	M. 59/127	5695	100	48	19	14	♀	Kapup, Sikkim	C. A. Crump	22.10.1914
	Pitymys sikkimensis Hogson, 1849 *Neodon sikkimensis* Hogson, Ann. Mag. N. H. 3:203. Sikkim. See also 1851, Cat. Mamm. Mus. E. India Co. 146.												
345	*Neodon sikkimensis*	Rodentia	Muridae Gerbillinae	M. 60/128	6174	100	45	20	14	♂	Thangu, Sikkim	J.E.B.H.	09.07.1918
	Pitymys sikkimensis Hogson, 1849 Neodon sikkimensis Hogson, Ann. Mag. N. H. 3:203. Sikkim. See also 1851, Cat. Mamm. Mus. E. India Co. 146.												
346	*Tupaia belangeri*	Insectivora	Tupaiidae Tupaiinae	M. 343/489	782	180	188		16.5		35 m. S.E. of Prome, Burma	Mackenzie	19.01.1917
	Tupaia glis belangeri (Wagner 1841). 1841 *Cladobates belongeri* Wagner, Schreber's Saugeth Suppl. 2:42 Siriam, near Rangoon, Pegu, Burma.												
347	*Tupaia belangeri*	Insectivora	Tupaiidae Tupaiinae	M. 344/490	1072	156	179	40	16		36 m. N. of Toungoo E. Burma	Mackenzie	04.04.1927
	Tupaia glis belangeri (Wagner 1841). 1841 *Cladobates belangeri* Wagner, Schreber's Saugeth Suppl. 2:42 Siriam, near Rangoon, Pegu, Burma.												

Taxonomic and geographic information of the mammalian species collected a century ago from the Indian Subcontinent present in Pakistan Museum of Natural History (PMNH) Islamabad

S. #	SCIENTIFIC NAME	ORDER	FAM/ SUB FAM.	ZSP Code	ZSI Code	MEASUREMENTS				SEX	LOCALITY	COLLECTOR	DATE
						H & B	TL	HF	EAR				
416	*Suncus pygmaeoides*	Insectivora	Soricidae	M. 331/477	1256	40	32	8	5		Hasimara, Bhutan Duars	C. A. Crump	10.12.1915
	Suncus etruscus pygmaeoides Savi's Pygmy Shrew (Anderson 1877). 1877. *Crocidura pygmaeoides* Anderson J. Asiat. Soc. Bengal, 46:279. Himalayas.												
417	*Suncus pygmaeoides*	Insectivora	Soricidae	M. 332/478	1762	45	29	9	6	♀	Hasimara, Bhutan Duars	C. A. Crump	03.04.1916
	Suncus etruscus pygmaeoides Savi's Pygmy Shrew (Anderson 1877). 1877. *Crocidura pygmaeoides* Anderson J. Asiat. Soc. Bengal, 46:279. Himalayas.												
418	*Suncus soccatus*	Insectivora	Soricidae	M. 333/479	6530	134	64	20	14	♀	Sirah, Bengal	C.A. Crump	22.03.1915
	Suncus murinus soccatus House Shrew (Hodgson 1845). 1845. *Sorex soccatus* Hodgson, Ann. Mag. N. H. 15:270 Central Region of Neapal.												
419	*Suncus soccatus*	Insectivora	Soricidae	M. 334/480	13	116	78	20	12.5	♂	Poshak	R. Shister	16.10.1914
	Suncus murinus soccatus House Shrew (Hodgson 1845). 1845. *Sorex soccatus* Hodgson, Ann. Mag. N. H. 15:270 Central Region of Neapal.												
420	*Suncus stoliczkanus*	Insectivora	Soricidae	M. 335/481	467	5.9	4.4	1.1	1	♀	Gumb	-	21.10.1922
	Suncus stoliczkanus stoliczkanus Anderson's Shrew (Anderson, 1877). 1877. *Crocidura stoliczkana* Anderson, J. Asiat. Soc. Bengal, 46:270 Bombay, India.												
421	*Suncus subfulvus*	Insectivora	Soricidae	M. 336/483	2563	55	37	10	8	♀	Junagadh, Katiawar	C. A. Crump	27.01.1913
	Suncus stoliczkanus subfulvus Anderson's Shrew (Anderson 1877). 1877. *Crocidura subfulva* Anderson, J. Asiat. Soc. Bengal, 46:278 Cutch, India. Range includes Kathiawar and Sindh.												
422	*Suncus subfulvus*	Insectivora	Soricidae	M. 337/482	709	50	33	10	9	♂	Subhan Sindh	S. H. Prater	31.03.1915
	Suncus stoliczkanus subfulvus Anderson's Shrew (Anderson 1877). 1877. *Crocidura subfulva* Anderson, J. Asiat. Soc. Bengal 46:278 Cutch, India. Range includes Kathiawar and Sindh.												
423	*Suncus viridescens*	Insectivora	Soricidae	M. 338/484	1066	121	80	19	13	♂	Cumbum, Madura	S. H. Prater	29.05.1917
	Suncus murinus viridescens House Shrew (Blyth 1859). 1859. *Sorex viridescens* Blyth J. Asiat. Soc. Bengal, 46:263. Gauhati, Assam. Range: North Kamrup & Valley of Assam.												
424	*Suncus viridescens*	Insectivora	Soricidae	M. 339/485	1511	90	53	17	12	♀	Zakampatti Dharamapuri Range N.	N. A. Baptista	21.05.1930
	Suncus murinus viridescens House Shrew (Blyth 1859). 1859. *Sorex viridescens* Blyth J. Asiat. Soc. Bengal, 46:263. Gauhati, Assam. Range: North Kamrup & Valley of Assam.												
425	*Rousettus arabicus*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 519/772	139	-	-	-	-	♂	Panjgur	J.E.B.H.	09.01.1918
	Rosettus arabicus Egyptian Fruit Bat (Anderson & de Winton, 1902). 1902. *Rousettus arabicus* Anderson & de Winton, Zool. Egypt, Mamm. 86,88,89-90 Lahej, near Aden, Southern Arabia.												
426	*Rousettus arabicus*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 520/773	158	123	13	23	22	♀	Panjgur	J.E.B.H.	12.01.1918
	Rosettus arabicus Egyptian Fruit Bat (Anderson & de Winton, 1902). 1902. *Rousettus arabicus* Anderson & de Winton, Zool. Egypt, Mamm. 86,88,89-90 Lahej, near Aden, Southern Arabia.												
427	*Rousettus leschenaulti*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 521/774	4181	124	16	21.5	19.5	♂	Pagan, Burma	G. C. Shortridge	28.10.1913
	Rosettus leschenaulti leschenaulti Egyptian Fruit Bat (Desmarest, 1820). 1820. *Pteropus leschenaulti* Desmarest, Encycl. Meth. Mamm. 1:110 Pondicherry, India.												
428	*Rousettus leschenaulti*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 522/775	4182	122	13	20	23	♀	Pagan, Burma	G. C. Shortridge	28.10.1913
	Rosettus leschenaulti leschenaulti Egyptian Fruit Bat (Desmarest, 1820). 1820. *Pteropus leschenaulti* Desmarest, Encycl. Meth. Mamm. 1:110 Pondicherry, India.												
429	*Rousettus seminudus*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 518/772	-	-	-	-	-	♀	Kandy C. P. Ceylon	Maj. E.W. Mayor	06.02.1914
	Rousettus seminudus Egyptian Fruit Bat (Gray, 1870). 1870. *Xantharpyia scminuda* Gray, Cat. Monkeys Lemurs & Fruite Eating Bats. B. M. 115. Ceylon.												
430	*Rousettus seminudus*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 522/776	A-883	-	-	-	-		Kandy C. P. Ceylon	Maj. E.W. Mayor	06.02.1914
	Rousettus seminudus Egyptian Fruit Bat (Gray, 1870). 1870. *Xantharpyia scminuda* Gray, Cat.Monkeys Lemurs & Fruite Eatng Bats. B.M. 115. Ceylon.												
431	*Pteropus hyp. geminorum*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 499/750	-	190	-	144	26	♀	Sir John Hayes Island	C. Primrose	03.12.1921
	Pteropus hypomelanous geminorum Small Flying Fox (Miller 1903). 1903. *Pteropus geminourm* Miller, Smith's misc Coll 45:60. Sout Twin Island, Mergui Archipelago Range: includes certain West Siamese Islands. (See Chasen, 1940 Bull. Raffles Mus 15.22).												
432	*Pteropus vampyrus malacensis*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 546/A	-	-	-	-	-		Keserling Island	B.N.H.S.	-
	Pteropus vampyrus malacensis Small Flying Fox Anderson 1908) 1908. *Pteropus vampyrus malacensis* Anderson.Ann.Mag.N.H.2:368. Kuala Tembeling, Pahang, 200 ft, Malay Peninsula. Range:Malay States, Sumatra, Some adjaccent Islands, North wards to Indo China as noted above, and Tennaserim.												
433	*Cynopterus sphinx gangeticus*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 429/663	1374	98	18	13	20	♂	Ghanda	C. A. Crump	03.06.1921
	Cynopterus sphinx gangeticus Short-nosed Fruit Bat (Anderson, 1910) 1910. *Cynopterus sphinx gangeticus* Anderson, 1910 Ann. Mag. N. H. 6:623 Lucknow, United Provinces, India, Range includes central Provinces & Palanpur.												
434	*Cynopterus sphinx sphinx*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 430/666	115	107	8	15	20	♂	Golaghat, Assam	H. W. Wells	25.12.1919
	Cynopterus sphinx sphinx Short-nosed Fruit Bat (Vahl, 1797). 1797. *Vespertilio sphinx* Vahl, Skr. Nat. Selsk Copenhagen, 4, 1:123 Tranquebar, Madras, India.												
435	*Cynopterus sphinx gangeticus*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 431/665	5595	95	12	15	19	♀	Salbawi, Midnapeer Bengal	C.A. Crump	19.09.1914
	Cynopterus sphinx gangeticus Short-nosed Fruit Bat (Anderson, 1910) 1910. *Cynopterus sphinx gangeticus* Anderson, 1910 Ann. Mag. N. H. 6:623 Lucknow, United Provinces, India, Range includes central Provinces & Palanpur.												
436	*Cynopterus brachyotis anguletus*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 427/661	1043	96	8	14	21	♂	Taungoo, Burma	-	02.04.1917
	Cynopterus brachyotis Short-nosed Fruit Bat (Miller, 1898) 1898. *Cynopterus angulatus* Miller, Proc.Acad.Nat.Sci. Philadelphia, 316 Trang, Lower Siam Range Kindat Western Burma Tennaserim, Siam Cambodia and Annam, Natuna Islands and Anamba islands Various Small Islands of Siam.												
437	*Cynopterus brachyotis anguletus*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 428/662	423	96	71	-	20		Maleon Island	-	08.02.1922
	Cynopterus brachyotis Short-nosed Fruit Bat (Miller, 1898) 1898. *Cynopterus angulatus* Miller, Proc.Acad.Nat.Sci. Philadelphia, 316 Trang, Lower Siam Range Kindat Western Burma Tennaserim, Siam Cambodia and Annam, Natuna Islands and Anamba islands Various Small Islands of Siam.												
438	*Eonycteris spelaea*	Chiroptera Megachiroptera	Pteropidae Pteropinae	M. 434/668	5065	119	16.5	17.5	20.5	♂	Tagoot Gr, Tennaserim River	G. C. Shortridge	19.04.1914
	Eonycteris spelaea Dobson's Long-tongued Fruit Bat (Dobson 1871). 1871. *Macroglossus spelacus*, Dobsom Proc. Asiat. Soc. Bengal, 105,106. Farm Caves, Moulmein, Tennaserim. Range: includes Nan in Siam, Tonkin, Laos, Cochin-China in Indo-China, Malay States, Sumatra, Java, Borneo.												
439	*Rhinopoma kinneari*	Chiroptera Microchiroptera	Rhinopomatidae	M. 512/766	-	-	-	-	-	♀	Rohtas Salt Range	H. W. Wells	04.06.1923
	Rhinopoma kinneari Larger Rat-tailed Bat (Wroughton 1912) 1912. *Rhinopoma kinneari* Wroughton, J .Bombay N. H. Soc. 21, 3:767 Bhuj, Cutch, India.												
440	*Rhinopoma kinneari*	Chiroptera Microchiroptera	Rhinopomatidae	M. 513/767	-	-	-	-	-	♀	Ara, N.W. Punjab	Maj. C. H. Stockley	27.07.1921
	Rhinopoma kinneari Larger Rat-tailed Bat (Wroughton 1912) 1912. *Rhinopoma kinneari* Wroughton, J. Bombay N. H. Soc. 21, 3:767 Bhuj, Cutch, India.												
441	*Rhinopoma hardwichil*	Chiroptera Microchiroptera	Rhinopomatidae	M. 514/768	819	-	-	-	-	♀	Gambet, Khairpur, Sindh	S. H. Prater	14.04.1915
	Rhinopoma hardwickei hardwickei Lesser Rat-tailed Bat (Gray, 1831) 1831. *Rhinopoma hardwickei* Gray, Zool. Misc. 37. India Range: Indian range of species above and Lower Siam.												
442	*Rhinopoma hardwichil*	Chiroptera Microchiroptera	Rhinopomatidae	M. 515/769	-	-	-	-	-	♂	Ara, Punjab	Maj. C. H .Stockley	25.07.1921
	Rhinopoma hardwickei hardwickei Lesser Rat-tailed Bat (Gray, 1831) 1831. *Rhinopoma hardwickei* Gray, Zool. Misc. 37. India Range: Indian range of species aboove and Lower Siam.												
443	*Rhinopoma hardwichil*	Chiroptera Microchiroptera	Rhinopomatidae	M. 516/770	3896	-	-	-	-	♀	Amb, Salt Range, Punjab	H. W. Wells	18.05.1923
	Rhinopoma hardwickei hardwickei Lesser Rat-tailed Bat (Gray, 1831) 1831. *Rhinopoma hardwickei* Gray, Zool. Misc. 37. India Range: Indian range of species aboove and Lower Siam.												
444	*Rhinopoma hardwichil*	Chiroptera Microchiroptera	Rhinopomatidae	M. 517/771	3934	-	-	-	-	♀	Chilli Dil, Salt Range Punjab	H. W. Wells	22.05.1923
	Rhinopoma hardwickei hardwickei Lesser Rat-tailed Bat (Gray, 1831) 1831. *Rhinopoma hardwickei* Gray, Zool. Misc. 37 India Range: Indian range of species aboove and Lower Siam.												
445	*Emballonura monticola*	Chiroptera Microchiroptera	Emballonridae	M. 432/666	4275	48	13.5	8	14	♂	Victoria Point, S. Tennaserim	G. C.Shortridge	27.11.1913
	Emballonura monticola Sheath-tailed Bat (Temminck, 1838). 1838. *Emballonura monticola* Temminck, Tijdschr.Natture Gesch 5:25, Pl, ii, figs 1-2 Java.												
446	*Emballonura monticola*	Chiroptera Microchiroptera	Emballonridae	M. 433/667	229	47	14	45	14	♀	Ross Island	C. Primrose	15.11.1921
	Emballonura monticola Sheath-tailed Bat (Temminck, 1838). 1838. *Emballonura monticola* Temminck, Tijdschr. Nature Gesch 5:25, Pl, ii, figs 1-2 Java.												

Taxonomic and geographic information of the mammalian species collected a century ago from the Indian Subcontinent present in Pakistan Museum of Natural History (PMNH) Islamabad

S. #	SCIENTIFIC NAME	ORDER	FAM/ SUB FAM.	ZSP Code	ZSI Code	MEASUREMENTS				SEX	LOCALITY	COLLECTOR	DATE
						H & B	TL	HF	EAR				
447	*Liponycteris kuchhensis*	Chiroptera Microchiroptera	Emballonridae	M. 464/702	512	96	43	13	22	♂	Kashmore U. Sindh	S. H. Prater	06.03.1915
	Taphozous kachhensis kuchhensis Black-bearded Tomb Bat (Dobson, 1872). 1872. *Taphozous Kachhensis* Dobson, J. Asiat. Soc. Bengal, 41, 2:221. Cutch, India. Range: Indian Range, as parts of Penninsula, Mysore, Bengal & Sikkim; Malay States, Iraq.												
448	*Liponycteris kuchhensis*	Chiroptera Microchiroptera	Emballonridae	M. 464-A/703	3947	95	39	74	20	♂	Rohtas, Salt Range Punjab	H. W. Wells	28.05.1923
	Taphozous kachhensis kuchhensis Black-bearded Tomb Bat (Dobson, 1872). 1872. *Taphozous Kachhensis* Dobson, J. Asiat.Soc. Bengal, 41, 2:221. Cutch, India Range: Indian Range, as parts of penninsula, Mysore, Bengal & Sikkim; Malay States, Iraq.												
449	*Liponycteris kuchhensis nudaster*	Chiroptera Microchiroptera	Emballonridae	M. 465/705	3946	-	-	-	-	♀	Pagan, Burma	G. C. Shortridge	-
	Taphozous kuchhensis nudaster Black-bearded Tomb Bat (Thomas 1915) 1915. *Taphozous kachhensis nudaster* Thomas J. Bombay N. H. Soc. 24:59. Pagan, near Mt. Popa. Burma.												
450	*Taphozous longimanus*	Chiroptera Microchiroptera	Emballonridae	M. 539/793	5576	78	24	10	18	♂	Salbani, Midnapur, Bengal	C. A. Crump	18.07.1914
	Taphozous longimanus longimanus Tomb Bat (Hardwicke 1825). 1825. *Taphozous longimanus* Hardwicke, Trans, Linn. Soc. London, 14:525. Calcutta, Bengal, India.												
451	*Taphozous perforatus*	Chiroptera Microchiroptera	Emballonridae	M. 542/797	576	71	25	11	15	♂	Bhuj Cutch	B.N.H.S.	04.10.1911
	Taphozous perforatus perforatus Tomb Bat (E. Geoffroy 1818). 1818. *Taphozous perforatus* Geoffroy, Description de l' Egypte, 2:126 Egypt Range: also listed from Cutch and Kathiawar, India by Wroughton (1918).												
452	*Taphozous melanopogan*	Chiroptera Microchiroptera	Emballonridae	M. 540/795	3949	-	-	-	-	♂	Pagan, Burma	G. C. Shortridge	09.10.1913
	Taphozous melanopogan melanopogan Tomb Bat (Temminck, 1841). 1841. *Taphozous melanopogan* Temminck, Mon. Mamm. 2:287 Bantam Western Java. Range: Java also Indian localities, Yunnan and Laos.												
453	*Taphozous melanopogan*	Chiroptera Microchiroptera	Emballonridae	M. 541/796	1209	73	24	12	20	♀	Roridagor Lapenta Paikonda Hills	N. A. Baptista	10.07.1930
	Taphozous melanopogan melanopogan Tomb Bat (Temminck, 1841). 1841. *Taphozous melanopogan* Temminck, Mon.Mamm. 2:287 Bantam Western Java. Range: Java also Indian localities, Yunnan and Laos.												
454	*Megaderma spasma horsfieldi*	Chiroptera Microchiroptera	Megadermatidae	M. 471/711	876	75	-	17	38	♀	Sirsi, Kanara	G. C. Shortridge	09.04.1912
	Megaderma spasma horsfieldi Malay False Vampire (Blyth 1863). 1863 *Megaderma horsefieldi* Blyth Cat. Mamm. Mus. Asiat. Soc. Bengal 23, India. Range: Peninsula of India.												
455	*Megaderma spasma horsfieldi*	Chiroptera Microchiroptera	Megadermatidae	M. 472/712	1942	-	-	-	-	♂	Malakanndaperta Kurnurt Disstt.	N. A. Baptista	09.05.1930
	Megaderma spasma horsfieldi Malay False Vampire (Blyth 1863). 1863 *Megaderma horsefieldi* Blyth Cat. Mamm. Mus. Asiat. Soc. Bengal 23, India: Range Peninsula of India.												
456	*Megaderma spasma hemove medium*	Chiroptera Microchiroptera	Megadermatidae	M. 473/714	212	-	-	-	-	♀	Ross Island	C. Primrose	-
	Megaderma spasma medium Malay False Vampire (Anderson 1918). 1918. *Megaderma spasma medium* Andersn, Ann. Mag. N. H. 2:383 Singapore Islands.												
457	*Lyrderma lyra*	Chiroptera Microchiroptera	Megadermatidae	M. 466/706	4128	78	-	66	34.5	♀	Lehtrar, Murree, Punjab	H.W. Wells	22.06.1923
	Megaderma lyra lyra Indian False Vampire (Geoffroy, 1810) 1810. *Megaderma lyra* Geoffroy, Ann. Mus. H. N. Paris, 15:190 India.												
458	*Lyrderma lyra*	Chiroptera Microchiroptera	Megadermatidae	M. 467/707	4170	93	-	72	40	♂	Lehtrar, Murree, Punjab	H. W. Wells	27.06.1923
	Megaderma lyra lyra Indian False Vampire (Geoffroy, 1810) 1810. *Megaderma lyra* Geoffroy, Ann. Mus. H. N. Paris, 15:190 India.												
459	*Lyrderma lyra*	Chiroptera Microchiroptera	Megadermatidae	M. 468/708	708	84	-	16	38	♂	Jalpaiguri, Bengal	C. A. Crump	10.04.1915
	Megaderma lyra lyra Indian False Vampire (Geoffroy, 1810) 1810. *Megaderma lyra* Geoffroy, Ann. Mus. H. N.Paris, 15:190 India.												
460	*Lyrderma lyra*	Chiroptera Microchiroptera	Megadermatidae	M. 469/709	1262	93	-	195	39	♀	Sagar, Shimoga Distt. Mysore	G. C. Shortridge	07.06.1912
	Megaderma lyra lyra Indian False Vampire (Geoffroy, 1810) 1810. *Megaderma lyra* Geoffroy, Ann. Mus. H. N. Paris, 15:190 India.												
461	*Lyrderma lyra*	Chiroptera Microchiroptera	Megadermatidae	M. 470/710	-	-	-	-	-	♂	Malakanndaperta Kurnurt Disstt.	N. A. Baptista	21.05.1930
	Megaderma lyra lyra Indian False Vampire (Geoffroy, 1810) 1810. *Megaderma lyra* Geoffroy, Ann. Mus. H. N. Paris, 15:190 India.												
462	*Rhinolophus affinis himalayanus*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 500/753	912	60	-	51	17		Shangpung Jaintia hills	H. W. Wells	08.08.1920
	Rhinolophus affinis himalayanus Greater Horse-shoe Bat (Anderson 1905) 1905. *Rhinolophus affinis himalayanus* Anderson P.Z.S. 1905. 2:103 Mussoorie, Kumaon, North Western India Ranges: Eastwards to Burma & China.												
463	*Rhinolophus affinis himalayanus*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 501/754	962	-	-	-	-	♂	Shangpung Jaintia hills	H. W. Wells	12.08.1920
	Rhinolophus affinis himalayanus Greater Horse-shoe Bat (Anderson 1905) 1905. *Rhinolophus affinis himalayanus* Anderson P.Z.S. 1905. 2:103 Mussoorie, Kumaon, North Western India Ranges: Eastwards to Burma & China.												
464	*Rhinolophus rouxi*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 509/763	149	56	30	11	19	♂	Shevaroy Hills, Eastern Ghat	N. A. Baptista	13.05.1929
	Rhinolophus rouxi rouxi Greater Horse-shoe Bat (Temminck, 1835). 1835. *Rhinolophus rouxii* Temminck, Mon. Mamm. 2:30b Pondicherry & Calcutta, India.												
465	*Rhinolophus rouxi*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 510/764	540	-	-	-	-		Pololi, SE of Supa North Canora	G. C.Shortridge	19.01.1912
	Rhinolophus rouxi rouxi Greater Horse-shoe Bat (Temminck, 1835). 1835. *Rhinolophus rouxii* Temminck, Mon. Mamm. 2:30b Pondicherry & Calcutta, India.												
466	*Rhinolophus rouxi*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 511/765	1897	48	29	9	20	♂	Nimbong, Darjeeling	-	14.06.1916
	Rhinolophus rouxi rouxi Greater Horse-shoe Bat (Temminck, 1835). 1835. *Rhinolophus rouxii* Temminck, Mon. Mamm. 2:30b Pondicherry & Calcutta, India.												
467	*Rhinolophus lepidus*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 504/757	5587	48	23	7	16	♂	Salbani, Midnapur, Bengal	C. A. Crump	18.09.1914
	Rhinolophus lepidus lepidus Little Japaneese Horse-shoe Bat (Blyth 1844). 1844. *Rhinolophus lepidus* Blyth, J.Asiat Soc.Bengal, 13:486 Calcutta. Range:India Ganges Valley, Kumaon, Bengal Etc.												
468	*Rhinolophus lepidus*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 505/158	939	43	21	38	16	♀	Shangpung Jaintia Hills	H. W. Wells	10.08.1920
	Rhinolophus lepidus lepidus Little Japaneese Horse-shoe Bat (Blyth 1844). 1844. *Rhinolophus lepidus* Blyth, J. Asiat Soc. Bengal, 13:486 Calcutta. Range:India Ganges Valley, Kumaon, Bengal Etc.												
469	*Rhinolophus lepidus shortridgei*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 506/759	3983	50	23	9.75	18	♀	Pagan, Burma	G. C. Shortridge	11.10.1913
	Rhinolophus lepidus shortridgei Little Japaneese Horse-shoe Bat (Anderson, 1918). 1918. *Rhinolophus lepidus shortridgei* Anderson, Ann.Mag. N.H. 2:376, 377. Pagan, Burma, Range includes chindwin, Burma, also Szechuan and Yunan, China.												
470	*Rhinolophus lepidus shortridgei*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 507/760	4078	49	25.5	9.5	17.25	♀	Pagan, Burma	G. C. Shortridge	15.10.1913
	Rhinolophus lepidus shortridgei Little Japaneese Horse-shoe Bat (Anderson, 1918). 1918. *Rhinolophus lepidus shortridgei* Anderson, Ann. Mag. N. H. 2:376, 377. Pagan, Burma, Range includes Chindwin, Burma, also Szechuan and Yunan, China.												
471	*Rhinolophus pearsoni*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 508/761	719	-	-	-	-	♂	Khonshlong, Jaintia Hills	H. W. Wells	22.07.1920
	Rhinolophus pearsoni pearsoni Great Eastern Horse-shoe Bat (Horsefield 1851). 1851. *Rhinolophus pearsoni pearsoni* Horsefeld, Cat Mamm. Mus.E.Ind.Co. 33 Darjeeling, North-Eastern India.												
472	*Rhinolophus blythi szechwanus*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 502/755	1965	34	21	7	17	♀	Nimbang, Darjeeling	-	01.07.1916
	Rhinolophus cornutus szechwanus Little Japaneese Horse-shoe Bat (Anderson, 1918). 1918. *Rhinolophus blythi szechwanus* Anderson, Ann. Mag. N. H. 2:376, 377 Chunking, Szechuan, China Range:Szechuan, Hupeh, Yunnan, Burma, Darjeeling, Siam.												
473	*Rhinolophus ferrumequinum tragatus*	Chiroptera Microchiroptera	Rhinolophidae Rhinolophinae	M. 503/756	2433	70	33	62	24	♀	Manali Kuhe Valley	H. W. Wells	12.06.1922
	Rhinolophus ferrumequinum tragatus Greater Horse-shoe Bat Hodgson 1835). 1835. *Rhinolophus tragatus* Hodgson 1835, J. Asiat. Soc. Bengal, 4:699 Nepal.												
474	*Hipposideros armiger*	Chiroptera Microchiroptera	Rhinolophidae Hipposiderinae	M. 453A/670	753	92	50	88	30	♂	Khoshwong, Jaintia	H. W. Wells	25.07.1920
	Hipposideros armiger armiger Great Himalayan Leaf-nosed Bat (Hodgson 1835). 1835. *Rhinolophus armiger* Hodgson, J. Asiat. Soc. Bengal, 4:699 Nepal. Ranges from Kumaon to Burma, Tonkin, Yunnan and Szechuan, China.												
475	*Hipposideros armiger*	Chiroptera Microchiroptera	Rhinolophidae Hipposiderinae	M. 436/671	378	-	-	-	-	♀	Dura Baunda, Garo Hills	H.W. Wells	13.08.1920
	Hipposideros armiger armiger Great Himalayan Leaf-nosed Bat (Hodgson 1835). 1835. *Rhinolophus armiger* Hodgson, J.Asiat.Soc.Bengal, 4:699 Nepal. Ranges from Kumaon to Burma, Tonkin, Yunnan and Szechuan, China.												
476	*Hipposideros armiger*	Chiroptera Microchiroptera	Rhinolophidae Hipposiderinae	M. 462	952	90	59	16	31	♀	Bachak Gorkha Zkl. N. W. Nepal	N. A. Baptista	15.05.1923
	Hipposideros armiger armiger Great Himalayan Leaf-nosed Bat (Hodgson 1835). 1835. *Rhinolophus armiger* Hodgson, J.Asiat.Soc.Bengal, 4:699 Nepal. Ranges from Kumaon to Burma, Tonkin, Yunnan and Szechuan, China.												
477	*Hipposideros cineraceus*	Chiroptera Microchiroptera	Rhinolophidae Hipposiderinae	M. 437/672	970	-	-	-	-	♂	Shangpung Jaintia Hills	H. W. Wells	13.08.1920
	Hipposideros cineraceus cineraceus Bicoloured Leaf-nosed Bat (Blyth 1853). 1853. *Hipposideros cineraceus* Blyth, J.Asiat.Soc.Bengal, 22:410 Near Pind Dadan Khan, Salt Range, Punjab. Range: as above.												
478	*Hipposideros cineraceus*	Chiroptera Microchiroptera	Rhinolophidae Hipposiderinae	M. 438/673	2206	34	26	6	16		Sangser, Darjeeling	N. A. Baptista	28.08.1916
	Hipposideros cineraceus cineraceus Bicoloured Leaf-nosed Bat (Blyth 1853). 1853. *Hipposideros cineraceus* Blyth, J. Asiat. Soc. Bengal, 22:410 Near Pind Dadan Khan, Salt Range, Punjab. Range: as above.												

Taxonomic and geographic information of the mammalian species collected a century ago from the Indian Subcontinent present in Pakistan Museum of Natural History (PMNH) Islamabad

S. #	SCIENTIFIC NAME	ORDER	FAM/ SUB FAM.	ZSP Code	ZSI Code	MEASUREMENTS				SEX	LOCALITY	COLLECTOR	DATE
						H & B	TL	HF	EAR				
539	*Scotomanes ornatus*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 525/779	6506	-	-	-	-	♀	Sivok, Bengal	C. A. Crump	19.03.1915
	Scotomanes ornatus ornatus Harlequin Bat (Blyth, 1851). 1851. *Nycticejus ornatus* Blyth, J. Asiat. Soc. Bengal, 20:517 Cherrapunji, Khasi Hills, Assam.												
540	*Scotophilus castaneus*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 526/780	964	67	43	10	14	♂	Taungoo (W)	Mackenzie	31.01.1927
	Scotophilus temmincki castaneus Lesser Yellow Bat (Gray, 1838). 1838. *Scotophilus castaneus* Gray, Mag. Zool. Bot. 2:498 Malaca Range includes Borneo, Annam & Tennaserim.												
541	*Scotophilus castaneus*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 527/781	4117	75	47.5	11.5	13	♀	Pagan, Burma	G. C. Shortridge	16.10.1913
	Scotophilus temmincki castaneus Lesser Yellow Bat (Gray, 1838). 1838. *Scotophilus castaneus Gray, Mag.Zool.Bot. 2:498 Malaca Range includes Borneo, annam & Tennaserim.*												
542	*Scotophilus kuhli*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 528/782	538	82	65	11	16	♀	Kashmore, U. Sindh	S. H. Prater	08.03.1915
	Genus Scotophilus Harlequin Bat (Leach 1821). 1821. *Scotophilus* Leach, Trans. Linn. Soc. London. 13:69, 71 *Scotophilus kuhli* Leach.												
543	*Scotophilus kuhli*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 529/783	638	82	64	10	16	♂	(Sehwan) Subkan Sindh	S. H. Prater	20.03.1915
	Genus Scotophilus Harlequin Bat (Leach 1821). 1821. *Scotophilus* Leach, Trans. Linn. Soc. London. 13:69, 71 *Scotophilus kuhli* Leach.												
544	*Scotophilus kuhli*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 530/784	-	-	-	-	-	♀	Chaklala-Rawalpindi	Maj. C. H. Stockley	21.07.1921
	Genus Scotophilus Harlequin Bat (Leach 1821). 1821. *Scotophilus* Leach, Trans. Linn. Soc. London. 13:69, 71 *Scotophilus kuhli* Leach.												
545	*Scotophilus kuhli*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 531/785	3400	-	-	-	-	♀	Sangoi Salt	H. W. Wells	24.03.1923
	Genus Scotophilus Harlequin Bat (Leach 1821). 1821. *Scotophilus* Leach, Trans. Linn. Soc. London. 13:69, 71 *Scotophilus kuhli* Leach.												
546	*Scotophilus kuhli*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 532/786	1080	88	52	62	18	♂	Rasapora S. Kamprup	H. W. Wells	15.11.1920
	Genus Scotophilus Harlequin Bat (Leach 1821). 1821. *Scotophilus* Leach, Trans. Linn. Soc. London. 13:69, 71 *Scotophilus kuhli* Leach.												
547	*Scotophilus kuhli*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 533/787	479	84	61	15	18	♀	Bahgoronie Dharbanga Distt.	N. A. Baptista	26.07.1912
	Genus Scotophilus Harlequin Bat (Leach 1821). 1821. *Scotophilus* Leach, Trans. Linn. Soc. London. 13:69, 71 *Scotophilus kuhli* Leach.												
548	*Scotophilus wroughtoni*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 534/788	5513	69	46	11	13	♂	Salbani, Mianapore, Bengal	C. A. Crump	14.09.1914
	Scotophilus temmincki wroughtoni, Lesser Yellow Bat (Thomas, 1897). 1897. *Scotophilus wroughtoni* Thomas, J. Bombay N. H. Soc. 11:275, Kim. Surat dist. Western India. Range: Ceylon & India, as above, east to Mt. Popa, Burma.												
549	*Scotophilus wroughtoni*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 535/789	1795	65	40	9	13	♂	Jalala, junagadh State katiawar	C.M.Crump	24.10.1912
	Scotophilus temmincki wroughtoni, Lesser Yellow Bat (Thomas, 1897). 1897. *Scotophilus wroughtoni* Thomas, J.Bombay N.H.Soc. 11:275 Kim. Surat dist. Western India. Range: Ceylon & India, as above, east to Mt. Popa, Burma.												
550	*Murina tubinaris*	Chiroptera Microchiroptera	Vespertilionidae Miniopterinae	M. 475/717	1779	43	35	33	14	♀	Dening, Mishmi	H. W. Wells	09.04.1921
	Murina huttoni tubinaris Great Tube-nosed Bat (Scully, 1881). 1881. *Harpiocephalus tubinaris*, Scully, P.Z.S. 2000 Gilgit, Kashmir has also been recorded from Tonkin & Laos by Osgood and from Darjeeling & Chin Hills. Tate States (1941, 577) Huttoni												
551	*Miniopterus fuliginosus*	Chiroptera Microchiroptera	Vespertilionidae Miniopterinae	M. 474/715	365	53	56	10	12	♂	-	S. H. Prater	04.01.1915
	Miniopterus schreibersi fuliginosus Schreiber's Bat (Hodgson 1835). 1835. *Vespertilio fuliginosa* Odgson, J. Asiat. Soc. Bengal 4:700 Nepal.												
552	*Kerivoula hardwickei*	Chiroptera Microchiroptera	Vespertilionidae Vespertilioninae	M. 463/701	741	-	-	-	-	♂	Khobshong, Jauntia Hills	H. W. Wells	25.07.1920
	Kerivoula hardwickei hardwickei Hardwicke's Bat (Horsefield, 1824). 1824. *Vespertilio hardwickii* Horsefield, Zool. Res. Java.												
553	*Loris lydekkerianus*	Primates Prosimii	Lorisidae	M. 406/628	-	-	-	-	-	♀	Katar Town Mysore	G. C. Shortridge	30.09.1912
	Loris tardigradus lydekkerianus Slender Loris (Cabrera, 1908). 1908. *Loris lydekkerianus* Cabrera Bol. Soc. Esp. H. N. Madrid, 139. Madras, India. Range Eastern Ghats, Westwards to Mangalore & Mysore, India.												
554	*Loris lydekkerianus*	Primates Prosimii	Lorisidae	M. 407/629	1980	190	-	51	28.5	♂	Katar Town Mysore	G.C.Shortridge	20.12.1912
	Loris tardigradus lydekkerianus Slender Loris (Cabrera, 1908). 1908. *Loris lydekkerianus* Cabrera Bol.Soc.Esp. H.N. Madrid, 139. Madras, India. Range Eastern Ghats, Westwards to Mangalore & Mysore, India.												
555	*Macaca assamensis*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 408/631	-	-	-	-	-		-	G. C. Shortridge	-
	Macaca assamensis assamensis Assamese Macaque (M'clelland, 1839). 1839. *Macaca assamensis* M. Clelland, in Horsefield, P.Z.S. 148 Assam.												
556	*Macaca irus*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 410/633	-	-	-	-	-		Tennaserim, Burma	G. C. Shortridge	31.03.1914
	Macaca irus irus Crab-eating Macacque (Cuvier, 1818. Extralimital). 1818. *Macacus irus* F. Cuvier, Mem. Mus. H. N. Paris, 4:120. Sumatra (according to Chasen, 1940). Substitute for cynamolgus schreber.												
557	*Macaca radiata*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 411/A	-	-	-	-	-	♂	Devikop	G. C. Shortridge	21.11.1911
	Macaca radiata radiata Bonnet Monkey (Geoffroy, 1812). 1812. *Cercocebus radiatus* E. Geoffroy, Ann. Mus. H. N. Paris, 19:98. Locality unknown. Range:Satara, Kanara, Mysore, Coorg, Nilgiri and Palni Hills, Cochin, Eastern Ghats, etc. in Peninsular India.												
558	*Macaca radiata*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 412/638	-	-	-	-	-		Palni Hills	C. U. Cann	21.11.1911
	Macaca radiata radiata Bonnet Monkey (Geoffroy, 1812). 1812. *Cercocebus radiatus* E. Geoffroy, Ann. Mus. H. N. Paris, 19:98. Locality unknown Range:Satara, Kanara, Mysore, Coorg. Nilgiri and Palni Hills, Cochin, Eastern Ghats, etc. in Peninsular India.												
559	*Macaca radiata*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 413/639	-	-	-	-	-		Dherar	-	-
	Macaca radiata radiata Bonnet Monkey (Geoffroy, 1812). 1812. *Cercocebus radiatus* E. Geoffroy, Ann. Mus. H. N. Paris, 19:98. Locality unknown. Range:Satara, Kanara, Mysore, Coorg. Nilgiri and Palni Hills, Cochin, Eastern Ghats, etc. in Peninsular India.												
560	*Macaca mulatta*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 411/634	-	-	-	-	-		Assam	C. W. Wells	-
	Macaca mulatta mulatta Rhesus Macaque Zimmermann, 1780. 1780. *Cercopithecus mulatta* Zimmermann, Geogr. Gesch. Mensch. 2:195. India.												
561	*Pithecus Shortridgei*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 423/654	-	-	-	-	-		Burma	S. A. Macmillan	27.07.1914
	Presbytis pileatus shortridgei Capped Monkey (Wroughton, 1915). 1915. *Presbytis shortridgei* Wroughton, J. Bombay N. H. Soc. 24:56 Hamalian, Upper Chindwin, Burma.												
562	*Pithecus entellus ajax*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 414/640	-	-	-	-	-		Gopalpur, Kangra	H. W. Wells	22.02.1922
	Presbytis entellus ajax Pocock, 1928. 1928. *Pithecus entellus ajax* Pocock, J. Bombay N. H. Soc. 32:480 pl. 2, fig. 1. Deolah, in Chamba, 6,000 ft, Punjab. Range:Chamba, Kangra & Kulu, at high altitudes; Kashmir.												
563	*Pithecus entellus nebatus*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 415/641	-	-	-	-	-		Dharwar	G. C. Shortridge	22.11.1911
	Presbytis entellus ajax Langur Pocock, 1928. 1928. *Pithecus entellus ajax* Pocock, J. Bombay N. H. Soc. 32:480 pl. 2, fig. 1. Deolah, in Chamba, 6,000 ft, Punjab. Range:Chamba, Kangra & Kulu, at high altitudes; Kashmir.												
564	*Pithecus entellus achates*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 416/642	-	-	-	-	-		Dharwar	G. C. Shortridge	12.03.1912
	Presbytis entellus achates Langur Pocock, 1928. 1928. *Pithecus entellus achates* Pocock, J. Bombay N. H. Soc. 32:488. Haunsbhavi Dharwar, 2,000 ft. India. Range:Dharwar, Bellary & Kanara.												
565	*Pithecus entellus entellus*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 417/644	-	-	-	-	-		Midnapur, Bengal	C. A. Crump	07.09.1914
	Presbytis entellus entellus Langur (Entellus Monkey) Dufresne, 1797, 1797. *Simia entellus* Dufresne, Bull. Soc. Philom Paris, 1, 7:49 Bengal, India. Range:Bengal to Gujrat & Kathiawar.												
566	*Pithecus entellus entellus*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 418/645	-	-	-	-	-		Sasan, Junagadh State	C. A. Crump	03.11.1912
	Presbytis entellus entellus Langur (Entellus Monkey) Dufresne, 1797, 1797. *Simia entellus* Dufresne, Bull. Soc. Philom Paris, 1, 7:49 Bengal, India. Range:Bengal to Gujrat & Kathiawar.												

Taxonomic and geographic information of the mammalian species collected a century ago from the Indian Subcontinent present in Pakistan Museum of Natural History (PMNH) Islamabad

S. #	SCIENTIFIC NAME	ORDER	FAM/ SUB FAM.	ZSP Code	ZSI Code	MEASUREMENTS				SEX	LOCALITY	COLLECTOR	DATE
						H & B	TL	HF	EAR				
567	*Pithecus entellus thersites*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 419/647	-	-	-	-	-		Ceylon	E. W. Mayor	12.09.1913
	Presbytis entellus thersites Langur (Entellus Monkey) Blyth, 1847. 1847. *Presbytis thersites* Blyth, J. Asiat. Soc. Bengal, 16: 1271. Trincomalee, Ceylon. Range: Ceylon & apparently Travancore (Pocock).												
568	*Pithecus flavicouda*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 420/649	-	-	-	-	-		S. Tennaserim, Burma	G. C. Shortridge	27.12.1913
	Presbyti obscurus flavicauda Dusky Leaf Monkey Elliot, 1910. 1910. *Pygathrix flavicauda* Elliot, Proc.U.S.Nat.Mus. 38:352 Trang Lower Siam.												
569	*Pithecus purrhus shanicus*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 421/651	-	-	-	-	-		Shan State, Buma	G. C. Shortridge	21.04.1913
	Presbytis phayrei shanicus Phayre's Leaf Monkey Wroughton 1917. 1917. *Pithecus shanicus* Wroughton, J. Bombay N. H. Soc. 25:47. Seen, Hsipaw State, Shan States, Burma. Range:North Shan States & their neighborhood to east of Irrawaddy in dry zone of Burma.												
570	*Pithecus obscurus*	Primates Anthropoidea	Cercopithecidae Cercopithecinae	M. 422/652	-	-	-	-	-		Yas River, Burma	G.C.Shortridge	04.06.1913
	Presbytis obscurus obscurus Dusky Leaf Monkey (Reid, 1837. Extralimital). 1837. *Semnopithecus obscurus* Reid, P.Z.S. 14. Malaca. See Chasen (1940).												
571	*Hylobates lar*	Primates Anthropoidea	Pongidae Hylobatinae	M. 405/624	-	-	-	-	-		S. Tennaserim, Burma	G.C.Shortridge	16.12.1913
	Hylobates lar lar Lar Gibbon (Linnaeus, 1771. Extralimital). 1771. *Homo lar* Linnaeus, Mant. Plant, 521. Malaca.												
572	*Hylobates hoolock*	Primates Anthropoidea	Pongidae Hylobatinae	M. 404/623	-	-	-	-	-		Shan, State-Burma	G. C. Shortridge	12.05.1913
	Hylobates hoolock Hoolock Gibbon (Harlan, 1834). 1834. *Simia hoolock* Harlan, 1834, Trans Amer Phil. Soc. 4:52, Pl. 2 Garo Hills, Assam.												
573	*Hylobates syndactylus*	Primates Anthropoidea	Pongidae Hylobatinae	M. 423/A	-	-	-	-	-		200 Garden, Calcutta	-	19.06.1919
	Hylobates syndactylus syndactylus Siamang (Raffles, 1821. Extralimital). *Simia syndactyla* Raffles. Trans. Linn. Soc. London. 13:241 Bencoolen, Sumatra.												
574	*Manis crassicaudata*	Pholidota	Manidae	M. 423/B	565	-	-	-	-		Canara	G. C. Shortridge	29.01.1912
	Manis crassicaudata Indian Pangolin (Gray, 1827). *Manis crassicaudatus* Gray in Griffith's Cuvier Anim. Kingd. 5:282 India. It is customary to date the name Crassicaudata from Geoffroy, 1803, Cat. Mamm. Mus. H. N. Paris, 213, but according to Sherborn, this work was never published.												
575	*Manis crassicaudata*	Pholidota	Manidae	M. 423/B	-	-	-	-	-		Bhoj	C. A. Crump	-
576	*Canis indicus kola*	Carnivora	Canidae	M. 372/537	-	-	-	-	-		Khairpur	S. H. Prater	10.04.1915
	Canis aureus aureus Asiatic Jackal (Linnaeus, 1758). 1916 *Canis indicus kola* Wroughton J. Bombay N. H.Soc. 24:651 Palanpur, Gujrat, Western India.												
577	*Canis indicus indicus*	Carnivora	Canidae	M. 373/538	-	-	-	-	-		Bhutan Duars	C. A. Crump	13.01.1916
	Canis aureus indicus Asiatic Jackal (Hodgson, 1833) 1833. *Canis aureus indicus* Hodgson, Asiat, Res. 18, 2:237. Nepal. Range:Nepal. Sikkim, Bhutan, Assam, Burma, Siam.												
578	*Canis indicus indicus*	Carnivora	Canidae	M. 374/539	-	320	115	80	40	♀	Dharwar, S. Mahratta	G. C. Shortridge	17.12.1911
	Canis aureus indicus Asiatic Jackal (Hodgson, 1833) 1833. *Canis aureus indicus* Hodgson, Asiat, Res. 18, 2:237. Nepal. Range:Nepal. Sikkim, Bhutan, Assam, Burma, Siam.												
579	*Canis indicus indicus*	Carnivora	Canidae	M. 374/A	-	-	-	-	-	♀	Rajpara	C. A. Crump	20.11.1920
	Canis aureus indicus Asiatic Jackal (Hodgson, 1833) 1833. *Canis aureus indicus* Hodgson, Asiat, Res. 18, 2:237. Nepal. Range:Nepal. Sikkim, Bhutan, Assam, Burma, Siam.												
580	*Vulpus persicus*	Carnivora	Canidae	M. 546/B	-	-	-	-	-	♀	Panjgur	J.E.B.H.	08.01.1918
	Vulpus vulpus pusilla Comman Red Fox (Blyth, 1854). 1875. *Vulpus persicus* Blanford, Ann. Mag. N. H. 16:310 Shiraz, Persia. Range: North-Western india, from Punjab to Rajputana Sindh Cutch, and Khardesh; Baluchistan, Southern Persia & Iraq.												
581	*Vulpus bengalensis*	Carnivora	Canidae	M. 546/C	-	-	-	-	-	♀	Hawsbhawi, S.Dharwar	G. C. Shortridge	12.02.1912
	Vulpus bengalensis Bengal Fox (Shaw, 1800). 1800. *Canis bengalensis* Shaw, Gen. Zool. 1,2:330 Bengal.												
582	*Mellivora capensis indica*	Carnivora	Mustellidae Mellivorinae	M. 405/A	-	-	-	-	-		Dhousa, Cutch	C. A. Crump	19.07.1911
	Mellivora capensis indica Ratel or Horney Badger (Kerr, 1792). *Ursus indicus* Kerr, Anim. Kin'd. 188 India.												
583	*Viverra zibetha*	Carnivora	Viverridae Viverrinae	M. 396/583	-	-	-	-	-		Darjeeling	N. A. Baptista	30.04.1915
	Viverra zibetha zibetha Large Indian Civet (Linnaeus, 1758). 1758. *Viverra zibetha* Linnaeus, Syst. Nat. 10th ed. 1:44 Bengal.												
584	*Viverra zibetha*	Carnivora	Viverridae Viverrinae	M. 397/587	-	-	-	-	-		Assam	H.W. Wells	22.01.1920
	Viverra zibetha zibetha Large Indian Civet (Linnaeus, 1758). 1758. *Viverra zibetha* Linnaeus, Syst. Nat. 10th ed. 1:44 Bengal.												
585	*Viverricula indica*	Carnivora	Viverridae Viverrinae	M. 390/577	-	-	-	-	-		Dharwar S. Mahratta	G. C. Shortridge	11.01.1912
	Viverricula indica indica Rasse or Small Indian Civet (Desmarest, 1817). 1817. *Viverra indica* Desmarest, Nouv. Dict. N. H. 7:170. India Range:Southern Peninsular India.												
586	*Viverricula indica baptista*	Carnivora	Viverridae Viverrinae	M. 394	-	-	-	-	-		Bhutan, Duars	N. A. Baptista	05.03.1916
	Viverricula indica baptistae Rasse or Small Indian Civet (Pocock, 1933). 1933. *Viverricula indica baptistae* Pocock, J. Bombay N. H. Soc. 36:643. Hasimara, Bhutan Duars, India Range: to Assam.												
587	*Viverricula malacensis*	Carnivora	Viverridae Viverrinae	M. 392/578	5659	-	-	-	-	♀	Kindat Upper, Burma	S.A.Macmillan	09.07.1914
	Pocock, 1933 J. Bombay N. H. Soc. 36:629-631, regarded the name *malacensis* proposed to use the name *indica* Geoffroy, 1803, Cat. Mamm.113. This name is not valid from Geoffroy, Since according to Sherborn, Geoffroy's work was never published & this was admitted by Pocock, 1939. Fauna of British India, Mamm, 1:364, in which it was stated that Desmarest may be regarded as the author of the name But Chasen, 1935, F.Siam Soc.N.H. Suppl. 10:41 throught the name *malaccensis* should be retained.												
588	*Viverricula malacensis*	Carnivora	Viverridae Viverrinae	M. 393	-	-	-	-	-		Ceylon	E.W.Mayor	24.11.1913
	Pocock, 1933 J. Bombay N.H.Soc. 36:629-631, regarded the name *malacensis* proposed to use the name *indica* Geoffroy, 1803, Cat.Mamm.113. This name is not valid from Geoffroy, Since according to Sherborn, Geoffroy's work was never published & this was admitted by Pocock, 1939. Fauna of British India, Mamm, 1:364, in which it was stated that Desmarest may be regarded as the author of the name But Chasen, 1935, F.Siam Soc.N.H. Suppl. 10:41 throught the name *malaccensis* should be retained.												
589	*Viverricula malacensis*	Carnivora	Viverridae Viverrinae	M. 395	-	-	-	-	-		near Calcutta	Dr. N. Annandale	08.04.1918
	Pocock, 1933 J. Bombay N.H.Soc. 36:629-631, regarded the name *malacensis* proposed to use the name *indica* Geoffroy, 1803, Cat.Mamm.113. This name is not valid from Geoffroy, Since according to Sherborn, Geoffroy's work was never published & this was admitted by Pocock, 1939. Fauna of British India, Mamm, 1:364, in which it was stated that Desmarest may be regarded as the author of the name But Chasen, 1935, F.Siam Soc.N.H. Suppl. 10:41 throught the name *malaccensis* should be retained.												
590	*Viverricula viverra malacensis*	Carnivora	Viverridae Viverrinae	M. 391/578	-	-	-	-	-	♂	Kindat Upper, Burma	S. A. Macmillan	09.07.1914
	Pocock, 1933 J. Bombay N.H.Soc. 36:629-631, regarced the name *malacensis* proposed to use the name *indica* Geoffroy, 1803, Cat.Mamm.113. This name is not valid from Geoffroy, Since according to Sherborn, Geoffroy's work was never published & this was admitted by Pocock, 1939. Fauna of British India, Mamm, 1:364, in which it was stated that Desmarest may be regarded as the author of the name but Chasen, 1935, F.Siam Soc. N. H. Suppl. 10:41 throught the name *malaccensis* should be retained.												
591	*Paradoxurus birmanicus*	Carnivora	Viverridae Paradoxurinae	M. 388/572	-	-	-	-	-		Tanagor E. Burma	J. M.	-
	Paradoxurus hermaphroditus laotum Common Palm Civet or Toddy Cat (Ghldenstople, 1917). 1917. *Paradoxurus birmanicus* Wroughton, J. Bombay N. H. Soc. 25:51 Mingun, near Sagaing, Upper Burma.												
592	*Paradoxurus birmanicus*	Carnivora	Viverridae Paradoxurinae	M. 389/573	-	-	-	-	-		Upper Burma	G. C. Shortridge	14.07.1913
	Paradoxurus hermaphroditus laotum Common Palm civet or Toddy Cat (Ghldenstople, 1917).. 1917. *Paradoxurus birmanicus* Wroughton, J. Bombay N. H. Soc. 25:51 Mingun, near Sagaing, Upper Burma.												
593	*Herpestes edwardsi*	Carnivora	Viverridae Herpestinae	M. 379/A	-	-	-	-	-		Binagang, Gwaliar	J.R.O.	28.11.1922
	Herpestes edwardsi edwardsi Indian Grey Mongoose (Geoffroy, 1818). 1818. *Ichneumon edwardsi* E. Geoffroy, Descr. Egypte, 2:139 "East Indies" (Madras, Pocock, 1938).												
594	*Herpestes edwardsi*	Carnivora	Viverridae Herpestinae	M. 377/549	71	320	328	68	28	♂	Dharwar S. Mahratta	G. C. Shortridge	07.11.1911
	Herpestes edwardsi edwardsi Indian Grey Mongoose (Geoffroy, 1818). 1818. *Ichneumon edwardsi* E. Geoffroy, Descr. Egypte, 2:139 "East Indies" (Madras, Pocock, 1938).												

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						H & B	TL	HF	EAR				
595	*Herpestes edwardsi carnaticus*	Carnivora	Viverridae Herpestinae	M. 387	2433	350	330	68	24	♀	Verajput, South Coorg	G. C. Shortridge	28.01.1918
	Herpestes edwardsi edwardsi Indian Grey Mongcose (Geoffroy, 1818). 1818. *Herpestes edwardsi carnaticus* Thomas, J.Bombay N.H.Soc. 28:23 Dharwar, India.												
596	*Herpestes edwardsi ferrugineus*	Carnivora	Viverridae Herpestinae	M. 378/551	2208	390	320	64	26	♀	Kangra, Punjab	H. W. Wells	20.03.1922
	Herspestes edwardsi ferrugineus Indian Grey Mongoose (Blanford, 1874). 1874. *Herpestes ferrugineus* Blanford, P.Z.S. 661, Pl.81 Larkana, Sindh India.												
597	*Herpestes edwardsi pallens*	Carnivora	Viverridae Herpestinae	M. 379/552	3322	392	345	75	30	♂	Mt. Abu, Rajputana	C. A. Crump	28.05.1913
	Herspestes edwardsi ferrugineus Indian Grey Mongoose (Blanford, 1874). 1914. *Mongos mungo pallens* Ryley, J. Bombay N. H. Soc. 22:660 Palanpur, Northern Gujrat, India.												
598	*Herpestes edwardsi moerens*	Carnivora	Viverridae Herpestinae	M. 380/554	1759	312	298	74	27	♂	Verawal, Junagadh State Katiawar	C. M. Crump	15.10.1922
	Herspestes edwardsi nyula Indian Grey Mongoose (Hodgson, 1836). 1915. *Mungos mungo moerens* Wroughton, J.bombay N. H. Soc. 24:52 Ganoor, Nimar, India.												
599	*Herpestes auropunctatus*	Carnivora	Viverridae Herpestinae	M. 382/557	1008	285	230	52	20	♂	hasimara, Bhutan Dhuars	C. A. Crump	28.10.1915
	Herpestes auropunctatus auropunctatus Small Indian Mongoose (Hodgson, 1836). 1836. *Mangusta auropunctata* Hodgson, J.Asiat. Soc.,Bengal, 5:235 Nepal.												
600	*Herpestes auropunctatus pallipes*	Carnivora	Viverridae Herpestinae	M. 384/560	661	265	183	45	21	♂	Sukkur, Sindh	S. H. Prater	23.03.1915
	Herpestes auropunctatus pallipes Small Indian Mangoose Blyth, 1845. 1845. *Mangusta pallipes* Blyth, J. Asiat. Soc. Bengal, 14:346 Kandhar Afghanistan.												
601	*Herpestes auropunctatus pallipes*	Carnivora	Viverridae Herpestinae	M. 385/561	781	245	229	40	18	♀	Gambat, Khairpur, Sindh	S.H.Prater	06.04.1915
	Herpestes auropunctatus pallipes Small Indian Mangoose Blyth, 1845. 1845. *Mangusta pallipes* Blyth, J.Asiat.Soc.Bengal, 14:346 Kandhar Afghanistan.												
602	*Herpestes auropunctatus pallipes*	Carnivora	Viverridae Herpestinae	M. 386/562	965	265	213	34	20	♀	Naudero, Larkana	S.H.Prater	09.05.1915
	Herpestes auropunctatus pallipes Small Indian Mangoose Blyth, 1845. 1845. *Mangusta pallipes* Blyth, J.Asiat.Soc.Bengal, 14:346 Kandhar Afghanistan.												
603	*Herpestes vitticollis*	Carnivora	Viverridae Herpestinae	M. 377/A.	-	-	-	-	-		Coorg	G. C. Shortridge	21.01.1913
	Herpestes vitticollis vittivollis Striped- necked Mangoose (Bennet, 1835). 1835. *Herpestes vitticollis* Bennet, P.Z.S. 67 Travancore, India.												
604	*Herpestes nepalensis*	Carnivora	Viverridae Herpestinae	M. 381/556	215	277	216	48	18	♀	Kaseranga, Assam	H. W. Wells	19.01.1920
	Herpestes auropunctatus auropunctatus Small Indian Mongoose (Hodgson, 1836). 1836. *Herpestes nepalensis* Gray, Charles. Mag. N. H. 1:578 Northern India. Range: Kashmir to Manipur & Orissa.												
605	*Herpestes birmanicus*	Carnivora	Viverridae Herpestinae	M. 383/559	1192	310	259	58	23	♂	Taungoo (W) Burma	Mackenzie	05.06.1927
	Herpestes auropunctatus birmanicus Small Indian Mangoose (Thomas, 1886). 1886. *Herpestes auropunctatus birmanicus* thomas, Ann.Mag.N.H. 17:84 Pegu Burma Range:Burma from Taungoo to Tennaserim.												
606	*Felis affinis chaus*	Carnivora	Felidae	M. 375/544	-	-	-	-	-		Dharwar	G. C. Shortridge	04.08.1912
	Felis chaus chaus Jungle Cat (Guldenstaedt, 1776). 1776. *Felis chaus* Guldenstaedt, Nov. Com. Acad. Petrop 483. Terek River, north of the Caucasus.												
607	*Felis tarquata*	Carnivora	Felidae	M. 376/548	-	-	-	-	-		Pedong, Darjeeling	C. A. Crump	05.08.1916
	1863. *Felis torquata* Blyth, P.Z.S. 185 (in part; not of Cuvier, 1826, which is based on a feral domestic cat).												
608	*Felis chaus prateri*	Carnivora	Felidae	M. 376/A	-	-	-	-	-		-	-	-
	Felis chaus prateri Jungle Cat (Pocock, 1939). 1939. *Felis chaus prateri* Pocock, Fauna Brit. India, Mamm. 1:298 Jacobabad, Sindh, Western India.												
609	*Sus cristatus*	Artiodactyla Suiforms	Suidae	M. 546/D	-	-	-	-	-		E. Coorg	G. C. Shortridge	19.02.1913
	Sus scrofa cristatus Wild Boar (Wagner, 1839). 1839. *Sus cristatus* Wagner Munch. Gelehrt Anz. 9:435 (misprinted as "535") Probably the Malabar Coast, India.												
610	*Sus cristatus*	Artiodactyla Suiforms	Suidae	M. 546/E	-	-	-	-	-		Khairpur State	S. H. Prater	24.04.1915
	Sus scrofa cristatus Wild Boar (Wagner, 1839). 1839. *Sus cristatus* Wagner Munch. Gelehrt Anz. 9:435 (misprinted as "535") Probably the Malabar Coast, India.												
611	*Tragulus*	Artiodactyla Ruminantia	Tragulidae	M. 368/A	-	-	-	-	-		-	-	-
	Genus *Tragulus* Brisson, 1762. *Tragulus* Brisson, Regn. Anim. 65. *Tragulus indicus* Brisson ? = *Cervus javanicus* Osbeck.												
612	*Tragulus ravus*	Artiodactyla Ruminantia	Tragulidae	M. 368/527	-	-	-	-	-		Tennaserim	G. C.Shortridge	29.12.1923
	Tragulus javanicus affinis Lesser Malay Chevrotain (Mouse Deer) (Gray, 1861). 1902. *Tragulus ravus* Miller, Proc. Biol. Soc. Washington 15:173 Trang, Lower Siam, Ranges to Tennaserim.												
613	*Tragulus*	Artiodactyla Ruminantia	Tragulidae	M. 368/B	-	-	-	-	-		-	-	-
	Genus *Tragulus* Brisson, 1762. *Tragulus* Brisson, Regn. Anim. 65. *Tragulus indicus* Brisson ? = *Cervus javanicus Osbeck.*												
614	*Tragulus canescens*	Artiodactyla Ruminantia	Tragulidae	M. 369/528	-	-	-	-	-		Tennaserim	G. C. Shortridge	10.12.1913
	Tragulus napu napu Lesser Malay Chevrotain (Mouse-deer) (F. Cuvier, 1822). 1900. *Tragulus canescens* Miller Proc. Biol. Soc. Washington, ranges to Tennaserim.												
615	*Axis axis ceylonensis*	Artiodactyla Ruminantia	Cervidae Cervinae	M. 360/509	-	-	-	-	-		Sanctuary, S.P, Ceylon	E. W. Mayor	11.11.1913
	Axis axis ceylonensis chital Axis Deer. Spotted Deer (Fischer 1829). 1829. *Cervus axis var ceylonensis* Fischer Syn. Mamm. 619 Ceylon.												
616	*Axis axis*	Artiodactyla Ruminantia	Cervidae Cervinae	M. 360/A	-	-	-	-	-		North Canara	G. C. Shortridge	26.01.1912
	Axis axis axis Chital, Axis Deer, Spotted Deer (Erxleben, 1777). 1777. *Cervus axis* Erxleben. Syst. Regn. Anim 312. Banks of the Ganges, India.												
617	*Axis porcinus*	Artiodactyla Ruminantia	Cervidae Cervinae	M. 362/A	-	-	-	-	-	♂	Upper Chindwin, Burma	G. C. Shortridge	20.03.1914
	Axis porcinus porcinus Hog Deer (Para) (Zimmermann, 1780). 1780. *Cervus porcinus* Zimmermann, Gerogr. Gesch. 2:131 Bengal.												
618	*Muntiacus vaginalis*	Artiodactyla Ruminantia	Cervidae Cervinae	M. 364/579	-	-	-	-	-		Harbong, Darjeeling	C. A. Crump	-
	Muntiacus muntjak vaginalis Indian Muntjac (Barking Deer) (Boddaert, 1785). 1785. *Cervus vaginalis* Boddaert, Elench. Anim. 1:136. Bengal.												
619	*Muntiacus vaginalis*	Artiodactyla Ruminantia	Cervidae Cervinae	M. 365/520	-	-	-	-	-		Nepal	G. C. Shortridge	31.10.1920
	Muntiacus muntjak vaginalis Indian Muntjac (Barking Deer) (Boddaert, 1785). 1785. *Cervus vaginalis* Boddaert, Elench.Anim. 1:136 Bengal.												
620	*Muntiacus grandicornis*	Artiodactyla Ruminantia	Cervidae Cervinae	M. 362	-	-	-	-	-	♂	Tennaserim Village	G. C. Shortridge	20.03.1914
	Muntiacus muntjak grandicornis Indian Muntjac (Barking Deer) (Lydekker, 1904). 1904. *Cervulus muntjac grandicornis* Lydekker, Field, 104:780. Thouagyen Forest, Amherst district, Burma. Range:Burma & Tennaserim.												
621	*Muntiacus malabaricus*	Artiodactyla Ruminantia	Cervidae Cervinae	M. 363	-	-	-	-	-		E. Coorg	G. C. Shortridge	17.02.1913
	Muntiacus muntjak malabaricus Indian Muntjac (Barking Deer) (Lydekker, 1915). 1915. *Muntiacus muntjak malabaricus* Lydekker, Cat. Ungulate. Mamm. B.M. 4:24 Nagarhol, Coorg, Southern India. Range: Malabar Coast & Ceylon.												
622	*Sambur*	Artiodactyla Ruminantia	Cervidae Cervinae	M. 367	-	-	-	-	-		Diguvametta, Kamool. Distt.	N. A. Baptista	22.04.1930
	1888. Sambur Heude, Mem. H. N. Emp. Chin. 2:8. *Cervus aristotelis* Cuvier.												
623	*Tetracerus quadriconis*	Artiodactyla Ruminantia	Bovidae Bovinae	M. 370/529	-	-	-	-	-		Kamool Distt.	N. A. Baptista	06.05.1930
	Tetracerus quadriconis Four-horned Antelope; Chousinghar Blainville, 1816). 1816. *Cerophorus quadriconis* Blainville, Bull. Soc. Philom. Paris 75 & 78 Plains of Peninsular India.												
624	*Tetracerus quadriconis*	Artiodactyla Ruminantia	Bovidae Bovinae	M. 371/530	-	-	-	-	-	♀	Sembadoh, Berar	B.N.H.S.	29.05.1911
	Tetracerus quadricornis Four-horned Antelope; Chousinghar Blainville, 1816). 1816. *Cerophorus quadricornis* Blainville, Bull. Soc. Philom. Paris 75 & 78 Plains of Peninsular India.												

Taxonomic and geographic information of the mammalian species collected a century ago from the Indian Subcontinent present in Pakistan Museum of Natural History (PMNH) Islamabad

S. #	SCIENTIFIC NAME	ORDER	FAM/ SUB FAM.	ZSP Code	ZSI Code	MEASUREMENTS				SEX	LOCALITY	COLLECTOR	DATE
						H & B	TL	HF	EAR				
625	*Antelope cervicapra*	Artiodactyla Ruminantia	Bovidae Antilopinae	M. 534/502	-	-	-	-	-		E. Khandesh	C. A.Crump	14.04.1911
	Antilope cervicapra cervicapra Black Buck (Linnaeus 1758). 1758. *Capra cervicapra* Linnaeus Syst. Nat. 10th ed. 1:69 Island of Trivandrum, Travancore, India.												
626	*Antelope cervicapra*	Artiodactyla Ruminantia	Bovidae Antilopinae	M. 355/503	-	-	-	-	-		Bagla Junagadh	C.A.Crump	-
	Antilope cervicapra cervicapra Black Buck (Linnaeus 1758). 1758. *Capra cervicapra* Linnaeus Syst. Nat. 10th ed. 1:69 Islanc of Trivandrum, Travancore, India.												
627	*Gazella bennetti*	Artiodactyla Ruminantia	Bovidae Antilopinae	M. 357/A	-	-	-	-	-	♂	Mand	J.E.B.H.	04.12.1917
	Antilope bennettii 1831. Sykes, PZS 1830-1831:104. Deccan, India.												
628	*Gazella bennetti*	Artiodactyla Ruminantia	Bovidae Antilopinae	M. 358/507	-	-	-	-	-		Rawal	G. H. Stockley	03.08.1921
	Antilope bennettii 1831. Sykes, PZS 1830-1831:104. Deccan, India.												
629	*Gazella bennetti*	Artiodactyla Ruminantia	Bovidae Antilopinae	M. 359/508	-	-	-	-	-	♀	Mand	J.E.B.H.	06.12.1917
	Antilope bennettii 1831. Sykes, PZS 1830-1831:104. Deccan, India.												
630	*Gazella benetti*	Artiodactyla Ruminantia	Bovidae Antilopinae	M. 361	-	-	-	-	-		Mand	J.E.B.H.	06.12.1917
	Antilope cervicapra cervicapra Black Buck (Linnaeus 1758). 1758. *Capra cervicapra* Linnaeus Syst. Nat. 10th ed. 1:69 Island of Trivandrum, Travancore, India.												
631	*Capra hircus*	Artiodactyla Ruminantia	Bovidae Antilopinae	M. 356/504	-	-	-	-	-	♂	Khojdar, Baluchistan	J.E.B.H.	26.09.1917
	Capra hircus Wild Goats (Linnacus, 1758). *Capra hircus* Linnacus 1758., Sys. Nat. 10th ed. 1:68.												
632	*Capra hircus blythi*	Artiodactyla Ruminantia	Bovidae Caprinae	M. 357/505	-	-	-	-	-	♂	Kilikaur, about 55m.	J.E.B.H.	16.03.1915
	Capra hircus blythi, Wild Goats (Hume, 1875). 1875. *Capra blythi* Hume, Proc. Asiat. Soc. Bengal. 1874:240 Sindh, India.												
633	*Ovis vignei cycloceros*	Artiodactyla Ruminantia	Bovidae Caprinae	M. 366/521	-	-	-	-	-		Panjgoor, Sindh	J.E.B.H.	20.12.1917
	Ovis orientalis cycloceros Asiatic Mouflon, Red Sheep, Urial; Shapo etc. (Hutton, 1842). 1842. *Ovis cycloceros* Hutton, Calcutta J.N.H. 2:514 Hazara Hills Afghanistan.												
634	*Ochotona roylei*	Lagomorpha Ochotonidae	-	M. 398/617	807	176	-	33	23	♂	Sattar Hills Gorkha N.W. of Nepal	N. A. Baptista	12.01.1922
	Ochotona roylei roylei Royle's Pika (Ogilby, 1839). 1839. *Lagomys royle* Ogilby, Royle's 111. Botany Himalylaya, Ixis, Pl. 4 Choor Mountain 60 miles north of Saharanpur, Punjab.												
635	*Ochotona roylei*	Lagomorpha Ochotonidae	-	M. 399/618	925	192	-	32	24	♀	Barpak, Gorkha	N. A. Baptista	29.04.1922
	Ochotona roylei roylei Royle's Pika (Ogilby, 1839). 1839. *Lagomys royle* Ogilby, Royle's 111. Botany Himalaya, Ixis, Pl. 4 Choor Mountain 60 miles north of Saharanpur, Punjab.												
636	*Ochotona roylei roylei*	Lagomorpha Ochotonidae	-	M. 400/619	2522	175	-	32	25	♂	Jugatsubh Nullah	H. W. Wells	02.07.1922
	Ochotona roylei roylei Royle's Pika (Ogilby, 1839). 1839. *Lagomys royle* Ogilby, Royle's 111. Botany Himalaya, Ixis, Pl. 4 Choor Mountain 60 miles north of Saharanpur, Punjab.												
637	*Ochotona roylei roylei*	Lagomorpha Ochotonidae	-	M. 401/620	2776	157	-	31	27	♀	Pattan Valley	H. W. Wells	08.09.1922
	Ochotona roylei roylei Royle's Pika (Ogilby, 1839). 1839. *Lagomys royle* Ogilby, Royle's 111. Botany Himalaya, Ixis, Pl. 4 Choor Mountain 60 miles north of Saharanpur, Punjab.												
638	*Ochotona sikimaria*	Lagomorpha Ochotonidae	-	M. 402/621	5711	149	-	27	19	♂	Gnatong Sikkim	C. A. Crump	20.10.1914
	Ochotona thibetana sikimaria Moupin Pika (Thomas, 1922). 1922. *Ochotona sikimaria* Thomas, Ann. Mag. N.H. 9:191 Lacheng, 8,800 ft; Sikkim, North-Eastern India.												
639	*Ochotona sikimaria*	Lagomorpha Ochotonidae	-	M. 403/623	5729	148	-	28	21	♀	Gnatong Sikkim	C. A. Crump	03.11.1914
	Ochotona thibetana sikimaria Moupin Pika (Thomas, 1922). 1922. *Ochotona sikimaria* Thomas, Ann. Mag. N. H. 9:191 Lacheng, 8,800 ft; Sikkim, North-Eastern India.												

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Population status of Punjab Urial in Chumbi Surla Wildlife Sanctuary, district Chakwal, Salt Range, Punjab Province, Pakistan

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KEYWORDS

Sanctuary,

population estimates,

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habitat,

Punjab urial,

livestock,

Chumbi Surla,

Salt Range

ABSTRACT

Punjab urial is an endemic and unique species occurring in Salt Range. It is not found elsewhere in the world. Chumbi Surla wildlife Sanctuary is known a safe abode for Punjab urial. The animal is declared endangered and protected under all schedules. Therefore a study was conducted in the Sanctuary to estimate urial's population and determine ecological factors responsible in deteriorating the species population and its habitat. The typical habitat comprised of Wild olive, *Olea ferrugenia* Phulai *Acacia modesta* with the mixture of a variety of grasses. Illegal grazing of local herds is common, there is no restriction for grazing livestock herds, and shepherds frequently venture into the Sanctuary and degrade the flora of the habitat. Fuel Wood extraction was also observed as a common practice in the area. Human lamb poaching and human predation is significant to limiting populations of the species. The present study estimated a more recent total of only 180 Punjab urial occurring throughout in the area of the Sanctuary, suggesting a severe stability in the population size over the last many years. The population concentrated on central parts of the Sanctuary with characteristic vegetation mainly near hill ridges with small numbers elsewhere. The low rate of lamb per female (!:36) suggests that the populations of urial are not steadily growing to become greater populations in the Chumbi Surla Wildlife Sanctuary.

Introduction

Chumbi Surla Wildlife sanctuary (CSWS) declared as protected in 1978 for conservation of an endemic species, the Punjab urial (*Ovis vignei punjabiensis*). The area is located coordinating at 32°-50'N latitude and 72°- 46'E longitude as an intact landmass of district Chakwal. It is situated at a distance of about 15 km in the north-east of Chakwal Town in the Salt Range of Punjab Province, Pakistan. It covers a total area of 55987 hectares with the core zone 6075 hectares state forest located almost in the middle of the sanctuary area, mainly on the hill slopes ranging in elevation from 460m to 1050m above the mean sea level. The name of the sanctuary is attributed to the village Chumbi and Surla which are Reserved Forests forming main mass of the sanctuary. The area surrounding the core zone is mainly community forests, shamilats or other community lands, agriculture and grazing land. Two small patches of the forest called Ram Halawan and Dhram Terath are also included in the Sanctuary. Core area of the Sanctuary has good vegetation cover with open canopy suitable not only for urial but also for a number of other mammals and including other groups of vertebrates such as birds and reptiles.

There is a huge human induced pressure on the Sanctuary. About twenty five villages are situated on the periphery or within the Sanctuary area. People of the villages and their livestock are mostly dependent on the Chumbi Surla Wildlife Sanctuary forests for agriculture, livestock grazing and brushwood cutting for fuel and fodder. There also is scattered small coal mining operations on the south-eastern side of the Sanctuary. The community forests are poorly managed and have been exposed to pressures in the form of clearing of land for agriculture and various other community needs resulting in profound biodiversity loss.

Physical Features of the Range

The area of the Sanctuary includes in the Salt Range situated in the northern Punjab. The name Salt Range was used first time in 1808 by Elphinston, a British Envoy, when he visited the area and observed the extraction of salt in bulk quantity. The salt deposits of the area were deposited as a result of evaporation by sinking the Tethys Sea and formation of Indus plains from collision of Indian plate with Asian plate resulting from continental drift (King and Vincent, 1993). The landscape forming the sedimentary rocks and fossils preserved therein are believed belonging to the tertiary formations some 40 million years in age and give a complete geological evidence and biological history of the landmass of the region. The rocks layers in the area have been tilted vertically, even inclining inverted in some places, so that the older fossil strewn layers exposed now lie on the surface (Shaw et al., 1989). The rocks are not pure and solid; they are composed of shale, limestone, sandstone and red clay, and therefore are highly susceptible to erosion during the rainy season and wind storms. The over use of vegetation has also serious impact and accelerates rates of erosion resulting in bare expanse rocks devoid of any soil layers. The plant cover is poor on sandstone and red clay. The richness of vegetation on southern aspects is very poor while the northern slopes are comparatively better covered.

The area of the sanctuary is an east-west trending thrust some 25 km long forming an impressive downed landmass bounded on the north by a chain of hill-ridges (1050m altitude), in the south a monotonous scrub lining (450m altitude). Between them a number of small roughly parallel ridges modified by a marked tendency for linked and looped formations are the preferred habitat area of the endemic wild sheep. The breadth of the Sanctuary is variable in the core zone from 3 to 5 km approximately. A broad valley known as Kahoon is situated in the southern part of the sanctuary area while the Dhok Ban Amir Khatoon is in the extreme of western end. Some other remarkable valleys in the south are known as Khokharzer, Dhok Sahala and Chhumbi building up a great pressure on the biological diversity of the Sanctuary.

Climate of the Park

The climate of the area is sub-humid sub-tropical continental type. The thirty-year average precipitation was 853 mm (Met. Inf.). There are two distinct rainy seasons: the summer season or the monsoon rains start by about mid-July and last until the mid of September. Most of the precipitation is received during July and August. The winter rains begin in January and persist up to beginning of March. The mean monthly temperature ranges 5.9-38.4°C, January being the coldest and June the hottest month of the year. During winters the temperature often drops to below zero, usually in December and January (Met. Inf.).

Flora of the Park

The climate type prevailing in the area is dry sub-tropical semi-evergreen scrub forest (Roberts, 1991). The forests of the Sanctuary mainly comprise of phulai *Acacia modesta,* wild olive *Olea ferrugenia,* wann *Salvadora alights,* malla *Zizyphus nummularia,* sanatha *Dodonea viscosa,* Jangli kikkar *Prosopis glandulosa*, bekhar *Justiciar adhatoda*, and aak *Calotropis procera*. Shrubs are sparse with scattered *Zizyphus nummularia.* Except in some ravines and on the high ridges where *Daytona viscosa* is prominent, important grass species like *Cymbopogon jwarancusa, Eleusine compressa, Chrysopogon serrulatus, Heteropogon contortus, Aristida adscensionis, Digitaria sanguinalis*, *Dichanthium foveolatum* also grow as ground flora. *Dactyloctenium scindicum*, *Cynodon dactylon* and *Saccharum species* are significant as grass species in the area.

A view of the wild olive forest in the Chumbi Surla Wildlife Sanctuary, district Chakwal

Fauna of the Park

The area of Salt Range had a varied and abundant wildlife species in the historic times. Punjab urial, important carnivores including the wolf, jackal, red fox, Indian civet and mongooses occur in the Sanctuary. Chukar, See-See partridge, Grey and Black partridges were in plenty due to nature of vegetation and topography. They have been over hunted in the past and led to marked reduction in the population sizes and restriction of the range of most species. At present the game birds enjoy their favourite habitat and protection in CSWS. Chinkara is nearly extinct from the Salt Range. Punjab urial population is under extreme stress and not increasing. To protect urial population, one National Park, five Wildlife Sanctuaries and two Game Reserves have been established in its distribution range. But this protective system of management has not been able to rise in its population or even stop decline in population. Chhumbi Surla and Jalalpur Wildlife Sanctuaries and Kalabagh Game Reserve (KGR) have comparatively better population than other areas of urial distribution.

Objectives and Scope of Study

Diverse habitat and vegetation of the Chumbi Surla Wildlife Sanctuary is the home of Punjab Urial (*Ovis vignei punjabiensis*) as well as many other important species of wild mammals. Punjab urial (wild sheep) is an endangered species endemic to Pakistan. The total world population consists of nearly 1500 individuals occurring in the Salt Range of Punjab. International Conventions on Conservation of Biological Diversity (CBD) and Convention on International Trade for Endangered Species of Fauna and Flora (CITES) are deeply concerned towards protection and regular monitoring of the species. Therefore, this survey was conducted to assess the population status of Punjab urial in the Chumbi Surla Wildlife Sanctuary and to document the factors involved threatening to the populations of the species and habitat.

The Sanctuary inhabits a number of mammals such as the Indian pangolin, red fox, yellow-throated martin (endemic), golden jackal, jungle cat, wild pig and Indian hare are common species of the area sharing the habitat with Punjab urial. The Indian pangolin has become highly threatened species due to its illegal trade and export to China and other countries.

The Punjab Urial *Ovis vignei punjabiensis* Lydekker, 1913

Conservation Status:

CITES:	Listed in Appendix I
IUCN:	Endangered

Physical Features of the Species

Punjab urial is a graceful species of wild sheep very similar to Marco Polo Sheep but averagely smaller in size with a reddish coat than other urials, males have a white bib and a long black neck ruff extends down to the sternum in the winter coat. However, one specimen collected near Rawalpindi had a white neck ruff. In summer, the ruff coat is much shorter. Most Punjab urials have a narrow, two-colored saddle patch, black in front and white on back, but in some individuals it may differ as all white or absent entirely. The rump patch, belly and lower legs are white and there is a dark, narrow stripe between belly and upper body. The horns are cervical, slender and angular curving tightly in some animals and less so in others. Females have smaller horns slender and curving upwards.

Punjab Urial *Ovis vignei punjabiensis* in Chhubi Surla Wildlife Sanctuary, district Chakwal, Salt Range, Punjab

- The taxonomy of the genus Ovis is very confusing. Different arrangements of species and subspecies have been proposed

- by various authors. Roberts (1997) described Punjab Urial as a sub-species of *Ovis vignei* Blyth, 1841.
    - *Ovis vignei blanfordi*. Type locality Bolan Pass Balochistan.
    - *Ovis vignei vignei*. Type locality Astore, Baltistan and Gilgit.
    - *Ovis vignei punjabiensis*. Type locality the Salt Range.

Schaller and Mirza (1974) and Roberts (1997) described, Punjab urial ram attains full size at an age of seven. It has long massive horns, curved outwards and backwards reaching the level of the neck in a crescentic circle. The large throat ruff, which may be white at the upper portion, hangs half way to the knees. The coat colour is dark rusty usually with white saddle mark. Often there is a blackish line on the saddle and a black side stripe. Females have slender horns, which are as long as their ears. There is no neck ruff in females and they also don't have a saddle.

Taxonomic Status of the Species

According to Walker (1975) there are six species in the genus Ovis. The genus has its distribution in all the higher mountain masses both in the Eastern part of Eurasia and the western part of North America (Roberts, 1997). Walker (1975) described the distribution of the six species as follow:

- *Ovis canadensis*: North America, north to British Columbia and, Canada and east to the Black Hills of North Dakota
- *Ovis dalli*: North western Canada & Alaska
- *Ovis ammon*: Western China, Russia South to Ladakh and Nepal
- *Ovis ammon polii*, during early winter, enters Pakistan, from Chinese Turkestan across the Khunjerab in to northern Hunza, and from the Hindu Kush mountains (Roberts, 1997)
- *Ovis laristanica*: Southern Iran
- *Ovis musimon*: Sardinia, introduced in Europe
- *Ovis orientalis*: Iran, Afghanistan, Kashmir and Pakistan

According to Aleem (1977), Roberts (1977) three sub species so far have been described for the species *Ovis orientalis* Gmelin, 1774, as follows:

- *Ovis orientalis vignei* Blyth, 1841, Ladakh urial, found in northern areas and Chitral.
- *Ovis orientalis blanfordi* Hume, 1877, Baluchistan urial, found in Balochistan and Sindh.
- *Ovis orientalis punjabiensis* Lydekker, 1913, Punjab urial, occupying Salt and Kala Chitta Ranges in the Punjab province.

Roberts (1997) placed the Nearctic sheep in a separate subgenus *Pachyceros* and split the Asiatic 'Red Sheep' into two species.

- *Ovis vignei*, the urial occurring from Soviet Central Asia, north-eastern Iran, Afghanistan, Pakistan, and north-west India; and
- *Ovis orientalis*, the Asiatic Mouflon, being confined to Asia Minor and western Iran.

Punjab urial is a sub-species of *Ovis vignei* Blyth, 1841 having at least three sub-species in Pakistan:

- *Ovis vignei vignei* Type locality Astore Gilgit
- *Ovis vignei blanfordi* Type locality Bolan Pass Balochistan, Astore Gilgit
- *Ovis vignei punjabiensis* Type locality the Salt Range

Material and Methods

This investigation focuses an important caprin, the Punjab urial occurring in the Chumbi Surla Wildlife Sanctuary (CSWS). The present study is an attempt to collect basic ecological information on the target species. The overall aim of the survey was to accurately determine the population status and distribution of the Punjab urial throughout its distribution in the CSWS district Chakwal and to determine what its ideal habitat requirements are. The line transect method was used, using a simple count of the number of animals came acrossed during the transect line. (A line transect is a survey line across country, usually walked by an observer or team of observers). This method is straightforward to use and, when used with care in a relatively uniform set of observing conditions, can identify trends in population numbers over time (Johnson, 1997 and Shafique, 2006).

While using indirect method for identification of animals, foot prints and scats were also examined for identification of species. The local wildlife watchers were also interviewed for presence or absence of mammals in the area.

Field observations were made using spotting scope 15-60x60 x and (10x50 and 8x40) binoculars. The animal was watched, while walking along ridges and ravines in the early morning and late afternoon or sitting quietly on cliffs and watching the aspects facing the observer. On spotting an urial herd, the number of individuals was counted. The age and sex were determined. During field observations it was often very difficult to determine the sex of the animal, for the yearling males, and the ewes looked, very much similar except for minor differences in their size.

The technique set out for monitoring population of urial in the Sanctuary. The following need was considered in planning for a survey of this kind: 1) The type of survey chosen should be feasible with limited resources, and yet provide a useful measure on the status of a population 2) Predetermined survey lines (fixed routes) within the CSWS were used for encountering the numbers of the target species. 3) The nature of the terrain in the Sanctuary suggested that the maximum distance walked by a field survey team in a day did not exceed 10 kilometers.

To avoid biasing the survey towards animals in any particular part of a mountain range, mountains were sampled by means of a transect line running either from the base of the range on one side across the crest to the base of the range on the other side, or from the base to the crest of the range, then down again by another route. To minimize the sternness of the climb while maximizing the distance walked on the range, the route was climbed on the range at an oblique angle and returned to the lowlands in the same way. A suitable time to begin transects was as early as possible in the morning, and finished before dark.

Census strategy

The Sanctuary was divided into two parts; the eastern and western units to conduct urial census. Each part had two transects running parallel east to west. Each census unit was surveyed on a different day, allocating two days to each unit area. Two transects were selected in each unit. The central parts of the unit areas, having a greater possibility of inter unit movement of urial, were surveyed on consecutive days. The entire census was repeated in 2013 after the initial survey conducted in 2010 and followed by the recent survey conducted in August-September 2014.

Population age structure

Geist (1968) based on physical features, established different age classes for mountain sheep. Schaller and Mirza (1974), Johnson (1997) and Shafique (2006) used the same procedure to classify age group classes for Punjab urial, which for rams were partly based on the horn size.

The identified sex and age classes were:

Lamb/Young; Female; Yearlings (1½ Years); Class 1 male (2½ Years); Class II male (3½ years); Class III male (4½ years); and Class IV male (fully-grown).

Body size, body proportion, horn shape, horn length, presence and size of neck ruff and colour of hair were used as criteria to distinguish the sex and age and differentiate between different age classes. For population age structure studies, age classes were taken as proposed and defined by Schaller and Mirza (1974) and was also applied by Awan (1998).

Counting procedure

All animals crossed ahead of the observer were counted from the start to the end point of each transect. Care was taken not to count an individual more than once; care also taken in counting groups because, once groups are disturbed and start to move, additional animals may join the group. Binoculars used only to check identifications and to assist counts of distant groups; they were not used as a standard aid to searching. Following a survey, the numbers of each transect totaled separately. An alternative procedure is to divide the totals by the total length of transects walked to give a population estimate expressed as overall number per kilometer walked.

Estimating densities

An estimate of population densities or even total populations is made for an individual transect section, a complete transect, or the full set of transects, by using the following equation: Estimated Density (no/sq. km) = [no. detected/distance walked. For example: 82 individuals/40 kilometers=2.05 animal/sq.km.

Making observations

Animals ahead were counted only, from 90° to the left of the path to straight-ahead to 90° to the right. Try to give all directions ahead an equal attention. Whenever sighted any animal stop and counted the number in the group. Recorded the sex, age and the number of individuals in each group. When the animal took flight and move away recounted the number of individuals as they moved to check that recorded the correct number. Every effort was made not to double count the animals. While walking, noted the main habitat type around and the prevailing other conditions. The first detailed survey of the Sanctuary was conducted in March 2010, second in February 2012 and, third in August-September 2014 while adopting the abovementioned methodology for monitoring urial abundance. After processing the data the population calculates were estimated along with other details.

Being an important habitat for the Urial (*Ovis vignei punjabiensis*) Chumbi Surla Wildlife Sanctuary has been playing an important role in conservation of this endangered species. During the surveys, conducted in March 2010, February 2013 and August-September 2014, the census provided 75, 81 and 89 individuals in 40% of the total habitat area. The total population calculated for the core area (40 km²) of the Sanctuary provided an estimate of 180 individuals distributing at the rate of 2.05 individuals/km² in the CSWS. The composition of Urial (*Ovis vignei punjabiensis*) populations contained 37 females (52.1%), 11.3 lambs and yearlings (13%) and 34 males (47.9%) (Table 1 and 2). The present data was also compared with Mirza et al. (1980) and it was concluded that few year back there was a sharp decline in the population structure of Urial. On the other hand, Chaudhry et al. (1997) reported 85 individuals of urial, based on survey census conducted in 1995 in the area of Chumbi Surla Wildlife Sanctuary. The comparison of the current results with Chaudhry et al. (1997) indicates a significant increase in urial population over the two decades in this area; however, since the first survey of this study taken in 2010, the populations of urial have not shown any considerable increase in numbers even after spawning a period of 4 years. Although in the current survey, the number of yearlings was found to be constituting 13% of the total population. This percentage of yearlings within the population of urial occurring in CSWS indicates a good sign for a stable population and the species reproducing efficacy but the percentage of lambs as growing healthy populations is a low number.

Table 1: Observations on the Punjab urial in Chumbi Surla Wildlife Sanctuary taken in 2010.

No of Transects	Covered area	Females,	Yearlings or lambs	Males class I	Males class II	Males class III	Males class IV	Total
1	10 km	8	2	2	2	3	1	18
2	10 km	9	1	1	1	2	2	16
3	10 km	8	3	2	2	4	1	20
4	10 km	10	4	1	3	1	2	21
Total	40 km	35	10	6	8	10	6	75

Observations on the Punjab urial in Chumbi Surla Wildlife Sanctuary taken in 2013

No of Transects	Covered area	Females	Yearlings	Males class I	Males class II	Males class III	Males class IV	Total
1	10 km	10	1	3	2	4	1	21
2	10 km	9	2	1	3	2	1	18
3	10 km	5	3	2	2	3	2	17
4	10 km	11	5	3	3	2	1	25
Total	40 km	35	11	9	10	11	5	81

Observations on the Punjab urial in Chumbi Surla Wildlife Sanctuary taken in 2014

No of Transects	Covered area	Females	Yearlings	Males class I	Males class II	Males class III	Males class IV	Total
1	10 km	12	4	2	2	5	1	26
2	10 km	9	1	3	2	2	1	18
3	10 km	11	5	3	1	3	2	25
4	10 km	8	3	2	2	4	1	20
Total	40 km	40	13	10	7	14	5	89

Table 2: Average populations of Punjab urial for three surveys carried out in 2010, 2013 and 2014.

Year	Females	Lamb/Yearlings	Male I	Male II	Male III	Male IV
2010	35	10	6	8	10	6
2013	35	11	9	10	11	5
2014	40	13	10	7	14	5
Average	36.67	11.33	8.33	8.33	11.67	5.33
Percentage	45	13.5	10	10	14.5	7

The observed males belonged to all age groups. However the number of observed mature males belonging to class III was more as compared to any other class. The relative scarcity of the old-aged males class IV may be due to discriminate hunting of this class or due to chance or inadequately smaller sample sizes. The presence of the young one (13.5%) in the composition suggests that the population is reproductively active. However the number of young ones in the population and the number of young ones per adult female was quite low which give an estimate of approximately 1:3.6 (1 young/3.6 females). The census results and the conclusion derived from them may be considered as base line information at present time upon which an accurate population model may ultimately be developed for species conservation and management efforts.

Population Estimates

A total population can be estimated by multiplying the density estimate by the total area containing the animals. For example, suppose that 40 km² of the entire area (40% of the entire core area) was covered and it detected 82 urials Thus, giving a density estimate animals per square kilometer. The total population estimate for the entire area would be nearly 180 urial giving a density estimate 2.05 individuals/km² area.

Habitat of Punjab urial

Punjab urial is the prime mammalian game species of the scrub forest in Chumbi Surla Wildlife Sanctuary adapted to Salt Range, Punjab distributed between the Indus and Jhelum rivers from an altitude of 450 - 1050m. In the Sanctuary and the low hill ranges in southern scarp they are typically associated with lower rounded stony hills dotted with wild Olive *Olea ferruginea* and Phulai. *Acacia modesta*. The landmass supports a variety of plant species including the *Dactyloctenium scindicum*, *Cymbopogon jwarancusa*, *Sporobolus ioclados*, *Digitaria sanguinalis* and *Dichanthium foveolatum*, *Eleusine flagellifera*, *Digitaria bicornis* and *Cenchrus pennisetiformis*, among grasses; Acacia modesta, *Olea ferruginea, Zizyphus nummularia, Dodonaea viscosa* and *Justicia adhatoda* among trees/large shrubs, and *Lespedeza floribunda*, *Pupalia lappacea* and *Diclyptera bupleuroides* among under-shrubs/herbs supporting as food and shelter for the species. Punjab urial (*Ovis vignei punjabiensis*) habitat is extremely rich with regard to the palatable grass and dicotyledonous species ensuring ample food supply but there is a need to improve the status of useful trees and large shrubs like *Olea ferruginea*, *Dodonaea viscosa*, *Maytenus royleanus* and *Zizyphus nummularia* with regard to shelter, nesting and food variety for many wildlife species, especially the Punjab urial. Illegal practices like grazing and human influence inside the Wildlife Sanctuary should be controlled to save the habitat of most endangered species, the Punjab urial.

In Chumbi Surla Wildlife Sanctuary feeding activity was observed in the early morning and evening. Their preferred food was observed including the major part of grass species which also described by Roberts (1997). In CSWS, a variety of grasses grow including the *Eleusine flagellifera, Digitaria bicornis* and *Cenchrus pennisetiformis* in its habitat (Schaller and Mirza, 1974). *Acacia modesta* was the favourite browse and *Lasiurus hirsutus* was also a relished grass (Mirza et al, 1979). While browsing they feed themselves on low hanging branches of *Olea ferruginea, Acacia modesta* and *Zizyphus nummularia* in the present study site. Grass and grass like plants contribute a greater proportion of the feed used by the Punjab urial in the CSWS.

Review Information

The Punjab urial is an endemic sub species occurring within the Salt Range, Pakistan and is protected under all provincial laws. It is known to have a restricted distribution range and found only in the Salt and Kala Chitta Mountain ranges and is confined by a coniferous forest belt in the north, the Jhelum River in the east and south and Indus River in the west (Schaller and Mirza 1974, Schaller 1977). Schaller (1977) suggested that the animal must have immigrated from the west, a herd perhaps crossing the Indus at a time when landslides temporarily dammed the river in the mountains. It formerly was distributed throughout these mountains, but it underwent a substantial decline in the twentieth century. By the early 2000's, the greatest concentration occurred within the Salt Range, mainly at Kalabagh in the western extremity near the River Indus.

There is no way to know precisely the historic population size of the species. Reports from expeditions, naturalists, and hunters to the region in the early 1900's (Lydekker 1898, 1908 and 1913, Burton 1920, Stockley 1922, Mounfort 1969) suggest that urials were once plentiful in the mountains of northern Punjab, but no figure has ever been given. Schaller (1977) gave quantitative figure and depicted that the world population of this subspecies may not exceed 2,000 animals. With the exception of observations made by Mountfort (1969), Schaller and Mirza (1974), Schaller (1977), Chaudhry et al (1997) and Mirza et al. (1979), virtually nothing is known about this species (Edge and Olson-Edge 1987).

Discussion

Mirza, et al (1979) surveyed the Kalabagh 'Game Reserve' in April 1976, Jhelum District in March, May & June 1976 and Kala Chitta Range in November & December 1976 to determine the status of Punjab urial and estimated a population of 2157 individuals. Aleem (1977) estimated a total of 47 urial in Chak Jabbi, a small part of the Kala Chitta Range. Estimates by Chaudhry et al (1997) gave a minimum total population of 1550 throughout its whole range. Chaudhry, et al (1988) reported a significant decline in Urial numbers over only one year; from 733 in 1986 to 528 in 1987. The population of urial, was believed to be only 60 head in the Chumbi Surla Wildlife Sanctuary (IUCN, 1997). During the present study carried out between 2010 and 2014, the population was estimated to be nearly 180 individuals, the population increased from 60 individuals of Punjab urial in 1997 (IUCN, 1997) to 180 individuals in 2014. According to the present study, it increased considerably within the few years when it was given protection but it stopped increasing after 2010. The population of urial is stable around 180 individuals since 2010. This trend in population is not in favour of species in CSWS because the yearlings/lambs ratio is low in the population growth trend.

Schaller & Mirza (1974) classified 1987 urial with respect to their age class and sex and described the composition of the population in Salt Range as: Males 38.4% as compared to 37.7% females with almost a 1:1 sex ratio. During the present study in a composition of 180 urial it was calculated 45:42 (female:male), which gives an estimate that male and female were almost equal in numbers (1:1). Aleem (1977) described composition of the population in Kala Chitta range as: Males, 32% as compared to 57% females. The male/female ratio was about 1:2. Edge and Edge (1987) while studying ecology of wild goats and urial in Kirthar National Park reported male/female ratio 0.58:1 for adult urial. Often 1:1 sex ratio is common in mountain sheep populations (Buechner, 1960 and Shafique, 2006) as well the present investigation also calculated sex ratio (1:1) almost as equal in the composition of Punjab urial populations in the CSWS.

In Salt Range, Punjab, Aleem (1977) reported 0.19 young per female, which is quite lower than Schaller & Mirza (1974), they reported 0.75 per female. In Chumbi Surla, during the present investigation it was estimated about 0.30 young per female, however, it showed low rate of lamb/yearlings per female which indicates alarming threat for steady and growing populations while more than 80% females were adult in the composition. Schaller & Mirza (1974) while studying birth and survival rates of urial in 1969 and 1973 in the Salt Range, Punjab stated that 75% of the adult females were adult breeding females. About half of the young disappeared between the ages of 6-18 months. This study shows the low rate of young ones in the composition and the young-female ratio is also low for a steadily growing populations. This low rate of young per female ratio needs immediate in-depth studies to know about the actual causes. Festa (1988, 1991) while studying breeding and survival in big horn sheep in south western Alberta, Canada found that the viability of lambs born after 10 June was extremely low. When forage quality declined, the mother could not produce sufficient milk to ensure lamb survival. In the present case, the situation is also critical for the lamb survival because 0.30 lamb/youngs per female is a low rate. If there are no Summer rains, the food quality and quantity is badly declined and the competition occur between the Urial and domestic livestock to compete limited resources of food. Inadequate nutrition was found to be the cause of mortality and the lambs are also stolen for keeping as pets. Aleem (1977) and Mirza, et al (1979) reported high poaching rates for urial in Salt and Kala Chitta Ranges. Aleem (1977) has reported poaching of young ones for keeping urial as pets.

An increasing population can be identified if the percentage of young population is higher and corresponding to low percentage of older individuals. A ratio between the young (lamb and yearlings) and adult females was found 23:77 per hundred for Afghan urial. Populations existing in Torghar Hills were recognized with adequate amount and favourable condition in terms of sex and age ratio (Shafique, 2006) that populations might be considered viable and for genetic processes (Soule 1987, Hebert 1991). Sex ratios however were felt to be biased due to misleading identification of yearlings and the more frequent observations of the rams during the rutting season because they had higher mobility in the flocks. Perhaps, this may be negligible due to extremely low bias rate. The sex ratio between male and female was 31.8:68.2 for Afghan urial per hundred (Shafique, 2006).

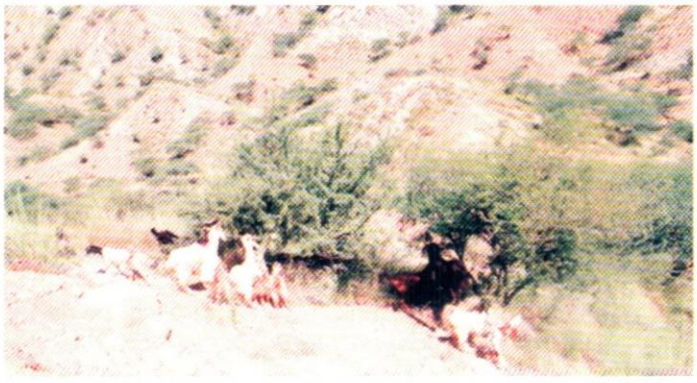
Threats to Species and Habitat

Local people are poor living around the sanctuary and mostly they keep livestocks. Livestock is serious competitor of urial for food due to overlapping niches, which have generally been overgrazed, much beyond the carrying capacity levels and this is the serious threat to growing populations (lambs and yearlings). Thus the lamb/female ratio is very low and the urial population has been restricted to increase over 200 in the Sanctuary. The urial has been forced to occupy central parts of the Sanctuary or the marginal habitat patches in the face of this competition. Wolves, leopards and caracal cats have been observed preying on urial (Stockley, 1936 cf. Roberts, 1977). In the Sanctuary, the leopard and caracal are now very rare and human predation is probably the only significant factor, and so is the competition from domestic grazing flocks which was commonly observed during the surveys. Striped Hyaena (*Hyena hyaena*) has become extinct in the Chumbi Surla Wildlife Sanctuary. Besides this, there are no recent records of Wolf (*Canis lupus)* in the Sanctuary (Pers. Comm). Few sightings of Wild Boar *(Sus scrofa)* were also recorded and the Asiatic Jackal was found common because of Poultry Farms near the Sanctuary area. The Asiatic jackal (*Canis aureus*), yellow-throated Marten (*Martes flavigula*) and red fox (*Vulpes vulpes griffithii*) were also found in the area as predators.

Due to sub-aridian habitat of the area, dry seasons are very crucial for the survival of the wildlife species including Punjab Urial. During this period, the animals rush to the limited water points and are at the point of illegal hunters. These poachers would like to shoot this valuable species particularly near the water bodies during drought seasons (Chaudhry et al. 1997). Besides that, local shepherds are also involved in deterioration of the habitat through illegal grazing of their herds. This illegal grazing of the local herds is also involved in the spreading of different diseases among the wildlife along with the degradation of the flora of the area. Moreover, the Chumbi Surla Wildlife Sanctuary provides a good habitat for many other wild animals which is required for stability of the Sanctuary.

There is no restriction on grazing even in the core areas, livestock was observed frequently venturing all over the sanctuary areas. Predation is the most significant mortality factor. Natural predation does not, however, influence the urial population in the Sanctuary. Human predation, on the other hand, has been much more decisive in declining populations. There is a long tradition of hunting in the Salt Range, and successful hunters are believed in high respect. It was informed by a warden that the Army officers were as the prime offenders in these violations. During interview with local community people recited that poaching/shooting in the area is only possible in connection of wildlife officials.

Habitat of the Punjab urial is declining in area because of agriculture, tracks, roads and other human developments. Local people living in the villages around the Sanctuary use walking tracks through the Sanctuary and degrade the habitat quality for wild animals. Lambs are poached at birth to keep as pets. They are a status symbol and although capture is illegal, the Pakistani government is now selling licenses to keep urial as pets. Some are hybridized with mouflon and domestic sheep. Apart from the protected population in the Chumbi Surla Wildlife Sanctuary (estimated in the present study 180 urial), the Punjab urial suffers heavy hunting pressure and has declined drastically in some of its distribution in only a short period (Chaudhry et al., 1988). It persists only in small populations and at low densities (Roberts, 1985). In addition, competition and transmission of diseases from domestic animals are major threats. Lambs are kept as pets, ram horns are a prized trophy, and the meat is eaten.



Domestic flocks of goats grazing in the Chhumbi Surla Wildlife Sanctuary

Habitat utilization by human communities

The inhabitants of villages around the forests enjoy grazing rights over the forest. Livestock rearing is the major source of their livelihood. Each house hold keeps livestock and their numbers have increased over time. No effective grazing management system is being used and all the livestock is grazed openly in most of the area. The practice of gathering fuel wood by villagers has continued for hundreds of years. Herdsmen also cut the smaller branches of trees, especially *Acacia modesta* and *Zizyphus nummularia* for forage for livestock during winter months. Allowing this practice to continue will alter the natural balance of the affected ecosystem and, therefore will impede the protection and preservation of the fauna and flora in its natural state.

A domestic goat is trampling and browsing in the habitat of Punjab Urial in Chumbi Surla Wildlife Sanctuary

Construction of a mettalled road through the mid of the sanctuary was stopped in reaction of conservationists from all over the country in June 2014. According to the Wildlife Act, section 16 of Wildlife Act 2007, any sort of construction is prohibited in a protected area if the law is violated by anyone, he is punished with heavy fine and imprisonment. Chumbi Surla Wildlife Sanctuary is known a safe abode for endemic Punjab urial, Endangered Indian Pangolin, Foxes and Jackals. Partridges also enjoy safe breeding and sheltering in the Sanctuary. Punjab urial is a unique species in Salt Range, it is not found elsewhere in the world.

Nearly 12 km long road stretch from Khokharzer to Darialah Kahoon villages located on the right and left fringes of the Sanctuary divided the core habitat area of the Punjab urial. Although the further work of construction on the road has been stopped but the rough track is open for venturing and crossing over the Sanctuary with livestock flocks through the core habitat areas of the urial. Now, this track is frequently used by the shepherds and they graze their livestock approaching the core forest areas on both the sides (east & west) of this track.

Formation of road track crossing through the sanctuary was stopped but it destroyed a large core habitat area of the Punjab Urial

Forest cover of Chumbi Surla provides safe cover for many species of animals and birds for sheltering, feeding and breeding. CSWS is last refuge for the future sustenance of Punjab urial. Earlier with the construction of Motorway (M-2) divided the populations existing in connected ranges of Salt Range which affected badly and showed significant decline in genetically isolating populations of urial. Growing viability increases in favourable larger and safe habitats. Since the Sanctuary was established the urial showed rapid growth and recovery over the last two decades when populations suffered to smaller populations. The habitat of urial is easily accessible and therefore is facing rapid degradation.

Conservation measures proposed:

Enforce protection measures in the relatively all the habitat areas; this is urgently required. Chumbi Surla Wildlife Sanctuary could be selected as focal areas. Animals from this population could be used for a re-introduction program. The Punjab Government has declared 12 protected areas of different categories in the range of distribution of Punjab urial. Law enforcement in these protected areas is poor, and there are no legal restrictions for grazing of domestic livestock, collection of fuel wood and green forage. This needed to be wisely addressed.

Chumbi Surla Wildlife Sanctuary is a natural habitat of Grey Partridge: populations are enjoying with the protection provided in CSWS.

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Observations

Details of Mammalian Species

Insectivores

These are primitive and ancient mammalian forms preferred to live in the darkness which are not highly specialized for adaptation; they resemble some of the original mammalian forms on the earth (Walker, 1965). They are small insectivorous mammals. Two insectivores, the house shrew and Asiatic white-toothed shrew were found to be occurring in different habitat ranges of the Park.

House Shrew *Suncus murinus* Linnaeus 1766

This shrew is the commonest shrew adapted as commensal life with humans and mostly associated with human settlements. It was not found far from the villages, into deep forest but may occur in the adjoining forest with human settlement valleys. It is terraced usually below 2500m elevation. The shrew is an oriental species but it has been able to spread out of the Himalayas because of its association with man. It is not found in Balochistan but occurs in some parts of Sindh, Punjab and KPK. In lower valleys of the Park, it was found however not much common. Ecological Role: keeps away insects from the house. Conservation Status: Least Concern IUCN-2004.

Adult House Shrew with its three immature successors

Asiatic white-toothed shrew *Crocidura pullata* Miller 1911

The shrew is typically confined to moist forest or near the stream banks with sufficient ground cover in the form of bushes and shrubs growing in rocky strata. The first author of this paper has recorded this shrew in Chitral Gol National Park, it was the first ever record of its occurring in this region (Shafique, 2004). The small tiny shrew is commonly preyed upon by owls, snakes or other predators in its vicinity. However, the small size benefit the shrew to hide itself from the predators. In the Park, the shrew was found to be distributed with cracked rocks dominant with grass layer but below 2800m elevation. It was not found in dense layer of top canopy forest. Being so small size, the shrew looks very intelligent because it avoids entering in Sherman traps. Ecological Role: Shrews are commonly nocturnal in activity and hunt on various kind of insects. Conservation Status: Least Concern IUCN.

Chiropterans

Members of this order are capable of true flights by their specialized membranous wings. Two types of bats are found all over the world as well as in Pakistan, the fruit-eating bats (megachiropterans) and insectivore bats (microchiropterans). Both of these forms are fairly distributed in Pakistan. However, during this study fruit bats were not found in the Park, but three species of insectivorous bats were recorded in this survey. Previously in a study carried out by Baig (2004) and reported 4 species of bats in the Park, out of which 2 species are unconvinced. Indian flying fox *Pteropus giganteus* is a fruit-eating bat and roosts commonly on the large trees of broad leaved plant species. The bat is very rare today and it has no records of its occurrence at high altitude areas or any previous records of its occurrence in AJK, therefore, its presence in the Park area is presenting uncertain. Indian flying fox is a pest of fruit trees. Likewise Baig (2004) has enlisted Common Pipistrelle *Pipistrellus pipistrellus* in his checklist; presence of this insectivorous bat is also amazing in the Park area. Bats can only be identified when they are in hand for detailed examination, otherwise their identification often misleads to similar forms of bats. Therefore, comprehensive field work is still needed particularly to explore bat species taxonomic status and because they are least studied order of mammals. They are the only members of mammals that are capable of true flights for long distances. Being nocturnal, migrations occur during nights.

Threats

Felling of roost trees is a common threat to bats. Deforestation for different reasons such as road building, housing, landslides, excessive tree felling, and lack of implementation of the forest plantations has also had a negative impact on various species. Bats that are living in caves, which are tourist attractions, such as ruins in Taxila, Wah Gardens, and many places near Lahore, are prone to roost disturbance. Some species of bats such as fruit bats are considered pests and are persecuted as such.

Dark Whiskered Bat *Myotis muricola* Gray 1840

The bat is a species of insectivore bats, a small sized bat roosts in crevices of rocks, caves, cracks or under the roofs of buildings. This is the commonest bat in the area. In the Park area, the bat was commonly found below 2500m altitude. As soon as darkness prevails, it emerges from its roosting sites and may be encountered in the lower valleys of the Park but particularly in summer season. During winter the bat definitely hibernates in the caves, crevices of rocks or buildings (observations). During winter it was caught asleep hibernating in colony holes from Galliat forest at an elevation of 2450m (Shafique, 2012). Ecological Role: Controls insect population in its habitat. Conservation Status: Least Concern IUCN.

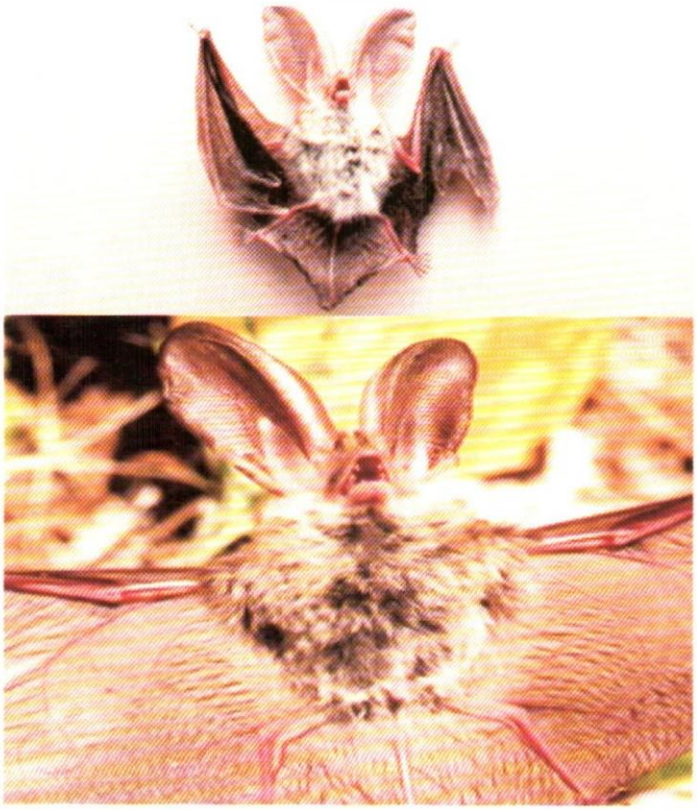
Dark Whiskered Bat *Myotis muricola* Gray

Common Serotine *Eptesicus serotinus* Schreber 1774

The bat also belongs to insectivorous bats adapted to tree cavities, hollows and crevices of rocks and caves. It occurs mainly in lowland valleys associated to human settlements. The bat has become very well adapted to man-made structures at the edge of forest, so much so that it is now only rarely found in extreme natural sites, means far from the human valleys. In winter, the bat hibernates singly or in pairs and was found in sympatric with dark-whiskered bat because both species share the same habitat in general. It is slightly larger than *Myotis muricola*. The bat is rarely found hibernating in colonies of dark whiskered bat in winter. Because of its adaptation at lower altitudes, the bat will not hibernate for prolonged periods but it surely hibernates (Roberts, 1997). The serotine bat was observed flying over the trees between 2000-2500m altitudes in the Park areas. Ecological Role: truly insectivore and controls insect pests of crops. Conservation Status: Data Deficient IUCN.

Grey Long-eared Bat *Plecotus austriacus* Fischer 1829

Grey long-eared bat is adapted to high altitude mountainous areas of the Park. In winter locally migrates to lower altitude valleys and may be encountered as low as 1500m altitude. While in summer it ascends up to higher reaches of mountains in the Park. The bat was associated with mixed forests of coniferous and broadleaf of temperate zone where it is provided roosting in crevices of rocky terrain or in the cavities of old trees. At night, it was observed flying into the trees and hunting on insects. The bat was caught at 2800m altitude at Gokhshall Valley in Chitral Gol National Park, Chitral (Shafique, 2009) while in the present study site it was recorded at 3490m elevation, incredibly a highest occurring record in this region. The bat was roosting in the livestock hut. Ecological Role: Controls insect population to increase in the ecosystem. Conservation Status: Least Concern IUCN.



Caray Long-eard Bat *Plecotus austriacus*

Lagomorphs

They are purely herbivorous animals like rodents. Two species of lagomorphs were recorded at higher altitudes in the Park, the cape hare and Royal's pika.

Cape Hare *Lepus capensis* Linnaeus 1758

The cape hare is associated with semi-arid conditions of mountain terrain ranging from 1800m to the highest reaches of alpine meadows in the present study site. The cap hare is particularly adapted to sub-alpine ranges (1800m-4000m) in open valleys with *Artemisia* scrub but locally migrates with seasonal changes (Roberts, 1997). It was observed in Chiltan Hazar Ganji National Park, Balochistan, during the day time they take rest hiding under bush cover which is dominant character of the flora in its range. Besides grasses, the preferable plant species like *Salix*, *Potentilla* and *Allium* are most important in its habitat. The hare is an important prey species for many carnivores, especially for the larger carnivores and also for few small carnivores like stoat and weasel, which are commonly distributed in the same range. The hare is also hunt by the local hunters to meet the requirement as a part of their delicious food. Ecological Role: prey species for a number of carnivore and omnivore predators. Conservation Status: Vulnerable IUCN.

Royal's Pika *Ochotana royalei* Ogilby 1839

The Royal's pika was observed associated typically with boulder strewn slopes, under broken rocks surrounded with well covered bush layer at altitudes between 3000m-3600m. They are rock dwelling species, rarely make underground burrows. They feed on variety of grasses and herbs found commonly in their habitat, including the most common species of *Artemisia*, *Astragallus* and *Lonicera*. Particularly, in the Park area during winter, when there is heavy snowfall, they make tunnels beneath the snow to store various food items to use during difficult weather conditions (Roberts, 1997). The habitat of the pika is shared by many species of carnivores. They include stoat, weasel, hill fox and Himalayan palm civet which are skillful predators and the pika will be hunt easily. Similarly, large carnivores also inhabit the range to find prey like pikas (herbivore species). Ecological Role: prey species for many carnivore predators. Conservation Status: Least Concern IUCN.

Royal's Pika *Ochotona royalei*

Primates

Two species of primates occur in the Park adapted to an arboreal life. They are herbivorous most commonly known primates in the Indian subcontinent distributed throughout Himalayan region. They are not much common in the Park although forests of the Park are much supportive for greater populations.

Himalayan Rhesus *Macaca mulatta villosa* True 1896

Himalayan rhesus monkey is confined to moist forest cover relatively at lower altitudes as compared to grey langur. Himalayan rhesus is typically associated with mixed coniferous and broad leaf moist temperate forest zone in the Park. The macaque is found mostly on blue pine, Himalayan silver fir, oaks, Himalayan popler and ash trees. They tend to move to lower valleys during winter but venture to higher elevations in search of seasonal food in the form of various fruits, nuts including many other plant items. They come on the ground to forage on grasses and fruits of bushes. They also feed on agriculture crops, cultivated fruit plants in the lower forest valleys. They are diurnal in feeding activity and take rest during the whole night in large trees. Mostly, they use lower temperate zone upto 2700m in the Park area. Rhesus monkey (*Macaca mulatta mulatta*) are finding less wild food and have adapted to living near the cities such as Islamabad, Nathia Gali, Kala Bagh and Murree to find food and, in fact, have become habituated to the food provided by the residents/visitors. Ecological Role: play vital role in food chain, helps in regeneration through dispersal of seeds and make them prey for leopards. Conservation Status: Near Threatened IUCN.

Himalayan Rhesus *Macaca mulatta villosa* female with its small baby

Grey langur *Semnopithecus entellus* Pocock 1928

As an arboreal species, the grey langur was associated to the top canopy of the mixed forest of coniferous and broad leaf - evergreen and deciduous trees like Himalayan silver fir, blue pine, yew (conifer), oaks (evergreen), maple and horse chestnut were observed more preferable for feeding and resting sites in the Park. They rarely come on the ground. Few wild fruits are important to attract the langur to come on the ground. They have been seen feeding on the nuts of Viburnum and Raspberry. The langur is diurnal in activity, exclusively herbivorous and sleeps during the night in top forest canopy. The Forest Canopy Habitat is competed with other arboreal mammals including the two species of flying squirrels ranging usually between 2400m-3300m and the Rhesus Macaque confined to the moist-temperate forest ranging upto 2700m in the Park. Ecological Role: plays vital role in food chain, helps in regeneration through dispersal of seeds and prey for leopards. Conservation Status: Near Threatened IUCN.

Rodents of the Park

Rodents belong to the order Rodentia, are widespread group of mammals in the world (Wilson and Reeder, 2005), they are mostly herbivorous small mammals, though some species are common pests for humans (Roberts, 1997), rodents being food prey also play an important ecological role in the ecosystems particularly in their habitat ranges because they make prey for a large variety of carnivore and omnivore species of mammals, birds and reptiles (Shafique, 2009). This study includes nearly 10 species of rodents occurring in Machiara National Park.

Threats

Rodents are affected by land clearing, road development, extensive housing projects, wastewater disposal in wild areas, and an eventual decrease in burrowing sites. Inconsistent conservation policies and lack of implementation of action plans has also resulted in many negative impacts on the species.

Flying Squirrels

Red Himalayan Giant Flying Squirrel *P. Petaurista albiventer* Gray 1834

Small Kashmir Flying Squirrel *Eoglaucomys fimbriatus* Gray 1837

Flying Squirrels are unique mammalian members which have the capability of gliding; they are basically arboreal in nature. Two species of flying squirrels, the red Himalayan giant flying squirrel and small Kashmir flying squirrel were found in the top forest canopy of the Machiara National Park. Flying squirrels (Pteromyids) are separated from non-flying squirrels (Sciurids) and are placed under the family Pteromyidae based on their phyllogenetic differences from tree squirrels (Roberts, 1997; Corbet and Hill, 1992). Flying squirrels are nocturnal in activity and are considered true forest indicators of mixed coniferous and broad leaf (evergreen and deciduous) tree species. They are spcialized and adapted as arboreal life at the top of the forest canopy. The forest includes some of the common tree species like *Aesculus indica*, *Acer caesium*, *Cornus macrophylla*, *Ulmus wallichiana* and *Populus cilliata* (deciduous broadleaf), *Quercus florilbunda* and *Q. incana* (evergreen broadleaf). Among the evergreen conifers *Pinus wallichiana*, *Abies pindrow*, *Picea smithiana, Taxus wallichiana* and *Cedrus deodara* are significant for sheltering and feeding activity. *Pinus wallichiana* and *Abies pindrow* are the most preferred coniferous plant species while in broadleaf *Quercus spp, Aesculus indica, Populus cilliata* and *Acer caesium* were observed as most preferred broad leaf tree species providing nesting and feeding sites where they enjoy with fruits, seeds, nuts and other plant items.

Red Himalayan Giant Flying Squirrel *P. Petaurista albiventer* Gray

They were never observed to come on the ground; therefore their whole subsistence depends on the fairly dense forest canopy because they move tree to tree in the forest (Shafique, 2004). They usually acquired ranges between 2300m to 3000m in the Park. Flying squirrels are preyed upon by many arboreal and aerial predators. Arboreal predators include yellow-throated marten and Himalayan palm civet while owls, hawks and eagles are significant as aerial predators.

Both flying squirrels used tree cavities as their nesting, breeding and hiding sites. They were never seen building leaf drays in conifers or broad leaved plants particularly for permanent nesting. However, they make nests in forked branches of the trees, these

are used in emergency (and are vulnerable) when natural cavities are scarce and unavailable for their diurnal roosting. This concludes that both the flying squirrels shared this feature with other cavity dwelling creatures of the area. The removal of snags from the area might act as a limiting factor for the flying squirrels as the human settlement of the area usually remove the snags to use them as a source of energy in their homes while most snags provide cavities and holes for nesting and breeding of flying squirrels.

Red Himalayan Giant Flying Squirrels *P. Petaurista albiventer* during the feeding session at night sitting at the branch, the Blue Pine, *Pinus wallichiana*.

Small Kashrnir Flying Squirrel landed on the trunk of *Pinus wallichiana* and climbing to the top of tree.

The most remarkable feature is competition between arboreal mammals inhabiting the same plant species for feeding, resting and nesting. The difference is that squirrels are nocturnal and monkeys are diurnal. The conflict occurs between the two at the time when squirrels move out of their resting sites and monkeys arrived to occupy the same trees for night resting. In this situation, flying squirrels will face distress to reach their feeding sites (trees). Ecological Role: plays vital role in food chain, helps in regeneration through dispersal of seeds, prey for many predators. Conservation Status: Vulnerable IUCN.

Cavities in the pine trunks provide sheltering and nesting to flying squirrel species as well as many other vertebrate species

Kashmir Marmot *Marmota caudata* Geoffroy 1844

Kashmir marmot is the second largest rodent associated to alpine-subalpine range in the Park. The animal is confined to betula-juniper plant community with the mixture of sub-alpine grasses ranging between 3300-4200m altitudes. During winter, the ground is covered with deep snow and the marmot goes for a long period of hibernation and stores large quantity of food in its tunnel to meet the requirement for long underground wintering. Animal adapted to high altitude is not beyond the reach of predators (Snow leopard, Common leopard, and Kashmir red fox) which are present in its habitat areas (Blumstein 1992A). Ecological Role: preyed on by some predators. Conservation Status: Least Concern IUCN.

Kashmir Marmot *Marmota caudata* Geoffroy

Indian Crested Porcupine *Hystrix indica* Kerr 1792

The population of Indian crested porcupine (*Hystrix indica*) is thought to be considerable as evidenced by the large number of droppings and territorial marking points present in all the lower valleys up to 2600m elevation in the Park. Porcupine is adaptable in variable environment. It occurs throughout in Pakistan from the deserts of Sindh and Balochistan in the south and mountains of KPK and Gigit-Baltistan in the north. Earlier, in a study carried out by the author in Ayubia National Park, the leopard attacked porcupine on the ventral side at the neck and belly lacking with quills, quills of the porcupine are too sharp which could badly injure the predator but he was intelligent. The injured porcupine slipped and fell down the hill ridge. It had died we examined its injuries and left the prey for hunter. Ecological Role: Porcupines are herbivorous and considered to be a pest of agriculture. Porcupine was observed scratching the ground to expose roots of grasses for dietary needs (Shafique, 1997). Presence in the Park was confirmed by sighting and indices. Ecological Role: They are preyed upon by leopards and wolves. Conservation Status: Least Concern IUCN.

House Mouse *Mus musculus* Linnnaeus 1758

The house mouse is mostly associated to buildings in human settlements and can move to crop land in search of a variety of grass grains. Previously we have trapped it away from the villages inhabiting moist temperate forest of Galliat in district Abbotabad at 2450m and in scrub dry mountainous area of Chiltan Hazargangi National Park at 1900m elevation. In the present study site it occurs in the wild and with human settlements at lower elevation. Mostly it lives in crevices, holes or cavities found around the buildings. It is usually considered a pest of grains. Ecological Role: not significant. Conservation Status: Least Concern IUCN.

House Mouse *Mus musculus* Linnaeus

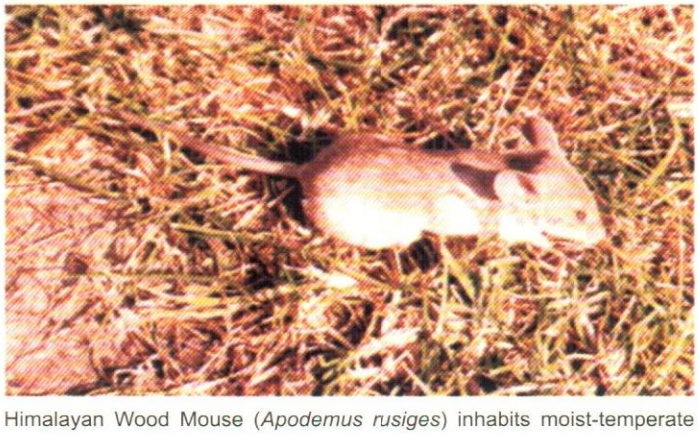
Turkestan Rat *Rattus turkestanicus* Satunin 1903

The rat is habitant both as commensal of man as well as in the wild. It occurs in the wild few hundred meters deep in the forest, not far from the human settlements. In the park, it was found occurring at forest edges. It has been collected in Ayubia National Park situated in the moist-temperate forest of western Himalaya at 2600m elevation and at 2750m elevation in Chitral Gol National Park in the dry-temperate forest of Hindukush Mountain Range. During a night survey in a mountain valley (Merin) of Chitral Gol National Park in 2004, the rat was observed feeding on the fresh ripen apricots (*Prunus spp*) nearly 8m above the ground; it was jumping in the branches when lighted with the torch (Shafique, 2004). In the present site, it was found common near human settlement valleys where local people grow fruit crops including the same species of *Prunus* and others. The rat also occurs in the wild near the water channels and with livestock structures. It was observed mostly associated with evergreen mixed forests of conifer and deciduous trees. The rat is a species of omnivore. Ecological Role: prey species for many kinds of predators. Conservation Status: Least Concern IUCN.

Turkestan Rat *Rattus turkestanicus* Satunin

Himalayan Wood Mouse *Apodemus rusiges* Miller 1913

Himalayan wood mouse is widely distributed in northern Pakistan inhabiting from the arid-rocky mountain slopes to the moist temperate forest region of western Himalayas. It is plentiful wherever it is colonized. In the Park, it was collected at 2500m and lower at 2300m elevation associated with pine forest.



Himalayan Wood Mouse (*Apodemus rusiges*) inhabits moist-temperate conifer forests of Western Himalaya

It was more common in the Galliat forest, district Abbotabad and in Chitral Gol National Park, district Chitral. It was found almost sympatric with Turkestan rat in south-eastern Hindukush range and

western Himalayan region including the AJK. It is common in the forest region of district Abbotabad, Mansehra and Murree Hills, district Rawalpindi (Shafique, 2012). Ecological Role: prey food for many predator species of mammals, birds and reptiles. Conservation Status: Vulnerable IUCN – 2004.

Royal's High Mountain Vole *Alticola roylei* Gray 1842

The vole is a habitant of high altitude which occurs as below as 2700m in Chitral Gol National Park (Shafique, 2004) and up to the tree line it was trapped at 3500m during this study in Machiara National Park. The vole is truly adapted to subalpine grassy meadows and cope variable environment. The vole is diurnal in activity and a bold rodent. The first author of this paper has an interesting interaction with this vole while staying in Sust, district Gilgit, the vole appeared at his bed in the room which was caught by hand. After identifying it was released in the room and it again climbed on his bed and started playing with him without wavering. Sust is a valley situated at Karakorum Highway ranging nearly 2700m altitude. In Machiara National Park it was found abundant above 3400m in boulder strewn scrub. They share like habitat as Royal's pika but occasionally they cross over the elevations than pika. In its habitat floral species like *Thymus serpyllum*, *Leontopodium alpinum* and *Astragallus alpinus* are important as food they deposit for wintering like Royal's pika. Ecological Role: The vole is an important food prey for alpine predators such as stoat, weasel and predatory birds. Conservation Status: Least Concern IUCN.

Royal's High Mountain Vole *Alticola roylei* Gray

Murree Vole *Hyperacrius wynnei* Blanford 1841

The Murree vole, an endemic species to the western Himalayan region was collected in temperate zone from 2450m up to 3000m associated with gentle grassy slopes. Above this range it is replaced by the True's vole. Both are adapted to same habits, the difference being that the ranges are different and the latter is adapted relatively to more low temperatures at high altitude. We collected True's vole at 3490m altitude. It was a broad valley of a mountain ridge with sub-alpine features. Ecological Role: Both of these herbivores act as prey for many predators, particularly the hill fox was observed visiting frequently at night to this area. Conservation Status: Least Concern IUCN.

True's Vole or Burrowing Vole *Hyperacrius fertilis* True, 1894.

Murree Vole *Hyperacrius wynnei*

Carnivores

Grey Wolf *Canis lupus*

Indian Wolf *Canis lupus pallipes* Linnaeus, 1758

Tibetan Wolf *Canis lupus chanco* Gray, 1863

Two subspecies of wolves occurs in Pakistan, *pallipes* in the lowland areas of southern scrub deserts while the *chanco* in the highland mountain regions of northern Pakistan (Roberts, 1997). The Tibetan wolf (*Canis lupus chanco*), also known as the woolly wolf, is a gray wolf subspecies native to Asia from Turkestan throughout Tibet to Mongolia, northern China and the Indian subcontinent.

Tibetan wolf *Canis lupus chanco* is regarded as a synonym of Indian wolf *Canis lupus lupus* Tibetan wolves hunt singly or in pairs, sometimes in small groups up to three, but only rarely in larger numbers. The wolf is less common in the northern mountain regions of Chitral, Swat, Kohistan, Gilgit, and Hunza. It is reported to be more common in Baltistan, adjoining to the Neelum Valley, in the south. The wolf also occurs in the alpine-sub alpine ranges of the Park, they are mostly diurnal in activity but take rest during the summer heats of the day. They feed largely on cape hares, Royal's pika including some other rodent species that occur in its reach. This agile predator in the Park also hunts Himalayan musk deer and Himalayan goral. Marmots are hunt during summer because they hibernate in the winter.

Threats

Continued threats to wolves are persecution due to depredation on livestock; fragmentation of habitat, with resulting areas becoming too small for populations with long-term viability. There is unsustainable utilization of the species for its fur in Pakistan. Conservation Status: Canis lupus populations in Pakistan are listed on CITES Appendix I. Canis lupus is relatively widespread with a stable population trend and has therefore been assessed as Least Concern IUCN.

Golden Jackal *Canis aureus* Linnaeus 1758

Habitat and Distribution:

The populations of golden jackal occurring throughout in Pakistan belongs to the nominate subspecies *C. aureus aureus*. The golden jackal is widespread species, fairly common throughout its range with high densities observed in areas supported with abundant food resources and shelter. Due to their tolerance of dry landscape and their omnivorous food variety, golden jackal lives in a wide variety of habitats.

Asiatic Jackal (*Canis aureus*), distributed in a wide-range up to 1500m elevation in Pakistan

They are opportunistic and will venture in human habitation at night to feed on garbage. Golden jackal is a very adaptable animal like wolf, it inhabits the dry open country in the southern parts, irrigated plantations in the central parts of Punjab and to the hilly areas of Murree and Hazara, in the north-west they occur up to Chitral. Golden jackal is found throughout Balochistan, Sindh, Punjab and KPK, although it does not penetrate into higher mountain regions but still occurs in most of the broader valleys of western Himalaya as well as in the lower valleys of Machiara National Park, particularly encountered in the summer. Being an omnivore predator like its relative, the jackal feeds on a variety of rodent species and fruits of plants available in its range.

Threats

Through its entire range except in protected areas, golden jackal population is steadily declining. Jackals may occasionally be hunted as a game species for pelts. Red List Category: Least Concern Sillero-Zubiri & Hoffmann M (2008). Least Concern Baillie and Groombridge (1996). Conservation Status: Not Listed CITES.

Common Red Fox *Vulpes* Linnaeus 1758

Kashmir or Hill Fox *Vulpes vulpes griffithi* Blyth 1854

The red fox (*Vulpes vulpes*) is the largest of the true foxes and the most geographically spread member of the carnivora, being distributed across the entire country. It is considered harmful to small mammals and bird populations.

The overall distribution in the country of the red fox, ranging from tundra to the desert that suggests that it can survive in most sorts of environments.

Kashmir Hill Fox (*Vulpes vulpes griffithi*), a female red fox died after collision with some vehicle while crossing the road at night.

Kashmir hill fox is a mountainous forested species, open environments are less favored. The subspecies inhabits commonly the mountainous environment throughout Indus Kohistan, Dir and southern parts of Chitral. The fox is widespread in the mountain regions of KPK and Balochistan. Further it extends to the Murree Hills and throughout Azad Jammu and Kashmir. The red foxes have been seen on a number of occasions, and also heard their calls frequently at night near our camps. They were seen common in the Park at higher altitudes with alpine and sub-alpine zone. They were not seen entirely within closed canopy forests but can penetrate some distance into them in search of prey. They prefer relatively broader and open valleys. Fox was observed most commonly on the top mountain valleys at night where vole species were found common at 3400m–3600m elevation as food prey. Ecological Role: The species has a long history of association with humans, having been extensively hunted as a pest and furbearer kill for its valuable pelts. Because of its widespread distribution and large population, the red fox is one of the most important furbearing animals harvested for the fur trade. Ecological Role: Red foxes may kill rodents, mustelids like weasels and stoats in their territorial ranges. Conservation Status: Least Concern IUCN.

Red Foxes as Pest

Red foxes are implicated in the destruction of game and song birds, hares, rabbits, and young ungulates, particularly in protected reserves, and game reserves where ground nesting birds are protected and raised, as well as in poultry farms. Foxes may on occasions prey on lambs of Himalayan musk deer and, Himalayan goral.

Yellow-throated Marten *Martes flavigula* Bodaert 1785

Yellow-throated Marten is associated with western Himalayan mixed forest of conifer and broad-leaf species (blue pine, Himalayan silver fir, deodar, spruce, and Quercus species). It was found common in the Park and occupies the temperate lower zone. Yellow-throated marten is mostly diurnal, though they have been observed being active at night and following to hunt flying squirrels or birds in the tree. They have been seen moving in groups on the ground but can successfully climb trees and jump from tree to tree. Yellow-throated martens are omnivorous, and consume a variety of small mammals (squirrels, hares, rodents, etc.), birds, insects, fruit, grains and nuts etc. Ecosystem Roles: Yellow-throated martens act as top-level predators and may impact prey populations. Because they eat seeds and nuts, they may also disperse seeds throughout the forest. Conservation Status: Data Deficient IUCN.

Himalayan Palm Civet *Paguma larvata* Hamilton-Smith 1827

The Himalayan palm civet is associated with the same habitat as that of the yellow-throated marten. It can also climb trees in search of prey. The animal usually ranges below 2600m in the Park. The masked palm civet is solitary traveling animal, only comes out under the cover of night to hunt and catch food. This nocturnal animal is primarily ground-dwelling and highly terrestrial as they mark their ranges by dragging their anal glands along the ground (Roberts, 1997). The masked palm civet survives on a meat-based diet, supplemented by the plant items or fruit and flowers. Small animals such as rodents, lizards make up the majority of the masked palm civet's diet but we have also observed it foraging on the rescue dropped at a mountain slope. Ecological Role: controls rodents' populations, invertebrates and reptile population. Conservation Status: Data Deficient IUCN.

Himalayan Palm Civet, *Paguma larvata* occurs in the moist-temperate forest of the Park

Stoat or Ermine *Mustela erminea* Linn 1758

The stoat is entirely similar to the weasel in general proportions, manner of posture and movement. In the Park it was fairly common as encountered between 2500m to 3100m altitude. In its habitat, two species of rodents (Royal's high mountain vole and Murree vole), and two species of lagomorphs (Royal's pika and cape hare) were inhabited as its common prey. The stoat is an opportunistic predator, which moves rapidly and checks every available burrow or crevice for food. Ecological Role: Stoat is a carnivore predator of small mammals, birds, amphibians, reptiles, and even insects. Conservation Status: Least Concern – IUCN.

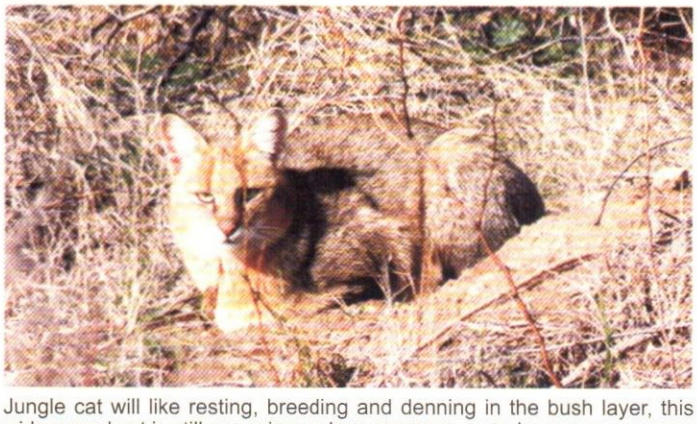
Alpine Weasel *Mustella altaica* Pallas 1811

The alpine weasel is confined to the open high mountain alpine and sub alpine meadows avoiding cover of dense forest. It was often found in the habitat of high mountain vole and it preys exclusively on this small rodent. The high mountain vole was abundant in its range as prey species. The other significant species for its prey includes lagomorphs; the Royal's pika and cape hare, both herbivores are common in this range between 3200m – 4200m altitude. The alpine weasel primarily lives in high altitude environment of rocky tundra with grassy woodland colonized by betula, rhododendron and crawling junipers. Overgrazing in alpine pastures by livestock (goats, and sheep) causes the prey of the

weasel to diminish. Ecological Role: Predator of the small mammals and birds. Conservation Status: Data Deficient IUCN.

Jungle Cat *Felis chaus* Gueldenstaedt 1776

This medium sized beautiful cat is widely distributed in variable environmental conditions. The Park has a good refuge providing shelter and a variety of prey included in its food. Although, it was not observed during the current survey but its presence was confirmed by the local watchers. Earlier, it has been recorded in a similar environment in Ayubia National Park (Shafique, 2004). Therefore, it may occur below 2700m in the Park as its prey is abundant in the form of small mammals. The cat is still common in well wooded areas of Pakistan. Ecological Role: A variety of food items are included in its food as small mammals, birds, invertebrates and insects etc. Conservation Status: Listed on CITES Appendix II. Least Concern, IUCN – 2004.



Jungle cat will like resting, breeding and denning in the bush layer, this widespread cat is still occurring as less common, once known as common where occured.

Leopard Cat Prionailurus *bengalensis* Kerr 1792

Leopard cat is adapted to the forested regions in Pakistan but most commonly confined to the mixed conifer and broadleaf temperate and arid region. Its ability to adapt in warmer regions, extended ranges to desert forests extremely at low altitude (Lal Sohanra National Park, pers. obs.) In Machiara National Park, it is associated with fairly forested temperate and dry zone particularly below 3000m. Though, it was not directly observed but it was evidenced by its pug marks and faeces it left on the ground in the thick forest consisting of oaks, pine and fir species at 2700m elevation, a habitat of flying squirrels and monkeys. Previously, the first author of this article recorded this cat in Ayubia National Park in 1999 (Shafique, 2004; 2012), the area characterizing very similar features to the present study site. Ecological Role: very active predator of rodents, birds and reptiles. Conservation Status: Data Deficient IUCN.

Common Leopard *Panthera pardus millardi* Pocock 1930

The leopard is widely but thinly distributed felid in Pakistan, significantly confined to Himalayan forest region below the alpine zone but in its whole distribution it is found as low as tropical and sub-tropical region in Pakistan. Since the establishment of protected areas system in Pakistan and AJK, the population of leopard has increased manifold. The common leopard is protected species under all provincial laws. It is typically associated with the moist temperate forest with mixed deciduous and coniferous forests. Pocock (1939-42) while working on Mammalia (Fauna of British India Series) identified four subspecies of the leopard, listed in the mammals of Pakistan (Roberts, 1997). However, it is difficult to differentiate between the subspecies as most of its population is restricted to AJK and northern Pakistan. Previously, in a study carried out in Galliat forest, District Abbottabad, the leopard was recorded to have bred in the area; it was encountered with few sightings with small cubs during the nights (Shafique, 2004). In the present site, the Machiara National Park, it was estimated to be common as evidenced and supported by its attacks on livestock and indices (pugmarks, faecal pellets, scratching of ground and resting sites) found in the fairly forested zone at ranges between 2300m – 3200m altitude. Ecological Role: In the Park it will hunt Himalayan goral and Himalayan musk deer; other prey includes cape hare, marmots, and birds including livestock species. Conservation Status: Critically Endangered IUCN.

Asiatic Black Bear *Ursus thibetanus* Cuvier G 1823

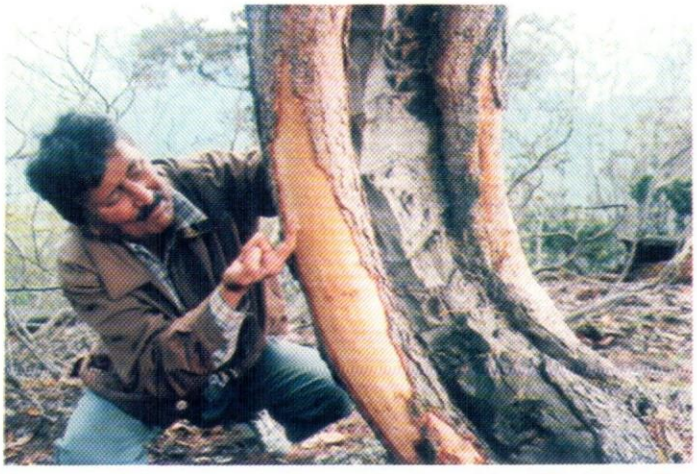
This black bear prefers Himalayan moist temperate forests, including the lower parts of Kaghan valley, Shogran Forest reserves and Shahran Reserves Forest in District Mansehra, and surrounding areas of Nanga Parbat, Neelum Valley and the Machiara National Park in Azad Jammu and Kashmir. In most of its former ranges it has been completely exterminated (e.g. Galliat Forest, District Abbottabad). In the Park, it was evidenced by its feces, foot tracks and the feeding activity on resin of the blue pine, extracted fresh resin tearing the pine trunk two feet above the ground. The bear scratched and removed the bark from tree trunk of young pine trees (*Pinus wallichiana*). Much of its occurrence was evidenced by its activity in the park which suggests that it does not cross the limit of over 3600m elevation. Most of its activities were observed around habitats utilized by the two herbivore animals; the Himalayan musk deer and Himalayan goral. The black beer has been reported attacking livestock species including the horse and goats in the area. It acquires larger territorial ranges which are well supported in the Park refuge. Ecological Role: predator as well as omnivore. Conservation Status: Critically Endangered IUCN.

Fresh faeces of Black Bear at 3400m altitudes in Machiara National Park, AJK

Paw print of the common leopard, *Panthera pardus* in MNP

Snow Leopard *Uncia uncia* Schreber 1776

The snow leopard is adapted to arid alpine snow covered region in Pakistan. It is slightly a smaller species than the common leopard with relatively luxurious body coat. In summer, it climbs to the highest alpine meadows up to 5200m elevation (Roberts, 1997). In winter, it descends down and occasionally visits the alpine meadows of Machiara National Park in search of prey as the Himalayan ibex ranges in this area. Little is known about its activity in the Park area. Since it has been given protection, its population is thriving but occasionally may be hunted by grazers'. It has been recorded at a number of occasions by the watchers of the Park at Ganga Mountain range. Occasionally, the same area is visited by the Himalayan ibex. Ecological Role: Exclusively predator on large mammals (Himalayan ibex); other prey includes cape hare, marmots, and birds including livestock species which are grazed at alpine pastures. Conservation Status: Critically Endangered IUCN – 2004. IUCN Red Data Book lists the Snow leopard (*Uncia uncia*) as a globally endangered species.



A member of the survey team is examining the activity of Black Bear. The black bear scratched and removed the bark on the trunk of *Pinus wallichiana* to feed on the resin flows under the bark.

Artiodactylans

Capra ibex Linnaeus 1758; Ibex

Capra [ibex] *sibirica* Pallas, 1776; Siberian or Himalayan Ibex, also called Asiatic Ibex

Himalayan ibex was sighted at many places in Neelum Valley typically confined to the precipitous snow covered mountainous terrain above 3700m elevation (Shafique, 2009). The habitat of present study site provides similar terrain at few places, therefore larger populations are not possible to sustain in the present situation. They are gregarious like all other goats and live in groups. The ibex is inhabitant of high altitude of inaccessible habitat which enables the animal grazing at high altitude of difficult mountain slopes. The ibex usually occurs from about 3600m to over 5000m in Pakistan (Roberts, 1997). In the present study site they have been recorded occurring in alpine tundra above 4000m elevation. A small population venture in this area particularly in winter from the adjoining northern mountains. They were not found permanent resident of the Park. In Neelum Valley, they occur in small populations (small groups of 2-5 animals). They constitute usually larger groups varying from 6 to 30 individuals, and also have been encountered in largest group above 50 individuals in Khunjerab valley, northern areas of Pakistan (Blumestein 1994). Ecological Role: preyed upon by large carnivores (common leopard, snow leopard). Conservation Status: According to the IUCN Red List Category; the Himalayan ibex is categorized as Least Concern in view of its wide-ranged distribution assumed the large population (Reading and Shank 2008; Baillie and Groombridge 1996).

Himalayan Goral *Naemorhedus goral* Hardwicke 1825

Himalayan goral is widely spread in Pakistan and AJK but in smaller populations. It occurs in Margalla Hills associated with chir pine and barberry between 820m–2000m elevation. The goral also occurs in Sakra Hills associated with *Quercus ilex* ranging at 1700m-2000m elevation (Shafique and Mehrban, 2011), it occurs in Swat, Hazara, Malakand Agency and in AJK (Roberts, 1997). Himalayan goral preferred *Quercus incana* in temperate forest of Machiara National Park, with excellent understory cover. They are not gregarious, and therefore they were encountered in small groups or solitary. There is still more to explore about this animal in the Park. Being shy and secretive, they were not easy to locate within the dense cover of shrub layer. They are not common today in places they were found abundantly. Ecological Role: prey for large carnivores (leopards, wolf). Conservation Status: declared as Endangered IUCN – 2004.

Faeces of Himalayan Grey Goral - *Naemorhedus goral* - A resting place during daytime at the flat rocks.

Himalayan Musk Deer *Moschus chrysogaster* Hogson 1838

Musk dear is a small member of the deer family with innocent posture. They move solitary hiding under the bushes, habitually agile therefore they do not make even smaller groups. Populations of musk deer in all eco regions are gradually declining even in the protected areas. It occurs in small populations scattered in sub-alpine range of the Park. The word musk derives from the ancient Indian word testicles (lit). This probably attributes to the musk pouch of the male musk deer which is located close to the genitals. The animal is indiscriminately hunted for its valued musk; therefore, the survival of musk deer is in danger. The animal is under great pressure due to alpine pastures located in the same range the animal is inhabited. Thus the competition occurs to share the available resources between the wild animals and livestock. The deer association to the typical flora in this zone which includes forest species of *Abies pindrow*, *Pinus wallichiana*, *Quercus incana*, *Salix himalayana*, *Viburnum spp*, *Lonicera spp*, *Ribes spp*, *Berberis spp*, *Sorbus spp* and *Primula spp* and *Artemesia spp* constitute the habitat in subalpine range of the Park. Ecological Role: prey for many predators including the leopard and wolf. Conservation Status: Endangered IUCN – 2004. Listed in Appendix-I CITES.

Results and Discussion

The mammalian fauna of the Park is diverse due to its unique location and climatic conditions. The present investigation has recorded ecological details on mammalian distribution including their ranges and habitat type. Plant diversity is rich life support of all terrestrial (arborel, fossorial and aerial) mammalian species being entirely dependent on plants directly or indirectly. Diverse mammalian forms which occur in the Park including the predators, omnivores, herbivores and carnivores constitute a well-balanced ecosystem for thriving healthy populations.

Scientific studies of fauna and flora of Machiara National Park have received attention during the project (Protected Areas Management Plan - 2004) in 2004. Preliminary, surveys of fauna and flora have been undertaken. These surveys include studies on the human–leopard conflict (Dar et.al 2007, Chattha et al, 2013), social organization and population status of grey langur (Minhas, et.al. 2007, 2010), population status of Himalayan musk deer (Qamar et al, 2008), distribution patterns of small mammals (Minhas et al, 2003), study on the preliminary wildlife assessment (Baig (2004) and records on the floristic composition (Dar et al, 2007) has contributed much in exploring the biodiversity of the

Park. What seems somewhat surprising, however, is that there does not seem to have been comprehensive in-depth studies on small mammals. Small mammals are essential component of biodiversity of the Park. More surprising is an apparent lack of any intensive investigation of large mammals including the Asiatic black bear and Himalayan goral apart from the approximately a few fragmentary and the annual census on key species of large mammals. Few one-off investigations including the distribution of grey langur and the study on human-leopard conflict has considerably added much to the information on the biodiversity of the Park but these do not constitute any comprehensive investigation of the biology and ecology. Therefore, the present study due to limitation of survey period has focused on ecological inter-connections of mammals which occurred in their habitats of the Park.

Species accounts on the baseline study of wildlife species occurring in the Park was given by Baig (2004) but this has either come to nothing or has only produced a checklist including many species based on misleading information, no formal or concrete piece of systematic work on exploring the mammals habitats in connection to their habits has been evaluated. The Checklist (Baig, 2004) includes Indian grey mongoose, Himalayan otter (carnivores), Indian flying fox, common pipistrelle (Chiropterans), long-eared hedgehog (insectivore), Indian mole rat and five-striped palm squirrel (rodents). While these species are mostly adapted to desert biome and low altitude therefore presence of these species in the Park latitudes is required still more work. While, Awan and Minhas have conducted small mammals in a study carried out in 2003, they provided fine work whatever they covered in the Park. Since these studies, there appears to have been no further work on the taxonomy of small mammals so that they can accurately be identified in their preferred habitats. Further action is recommended in the plan itself and includes additional research on the ecology and biology of large mammals. In addition, exploring and identifying of small mammals needs to be undertaken if a thorough knowledge of the small mammals of the Park is to be understood and effectively managed.

Mammals of the Park

The park contains nearly 34 mammal species including the shrew, the smallest mammal and the Himalayan ibex, the largest mammal of the Park. The Park is representative of diverse forms of mammals including 7 orders of the total 10 mammalian orders representative of Pakistan. Carnivores is the richest mammalian group contributing with 12 species enclosed in 10 genera and 5 families following by Rodents which contribute 10 species presented in 9 genera and 4 families. Primates, insectivores and lagomorhs each one is representative of 2 species whereas ungulates are represented by 3 species. Chiropterans are fascinating flying mammals which have 3 distinct forms distributed in 3 genera and 1 family. The Park is also home to several endangered and threatened animals including the most splendid looking forms of large mammals as Asiatic black bear, snow leopard and common Indian leopard. Similarly 2 species of forest indicators are gliding mammals (flying squirrels) which occur in sympatric association with fairly mixed dense forest of the Park. Of the 3 species of ungulates, the elegant herbivore mammals such as the Himalayan ibex, Himalayan musk deer and Himalayan goral were recorded from the Park, these ungulates are Critically Endangered as enlisted in Red List IUCN (2004) and declared as globally threatened.

Ecological Dispersal of Mammals

Mammals of the Park can be characterized by their adaptation to particular habitats reflected by unique assemblage of plant species in distinct ranges. This distribution of the species would not be a criterion as a whole for other regions, however, as viewed in the Park, the distinctive habitat ranges as occupied by the local species were necessary for their well-beings. The habitats and their groupings are based partly on the forest zones. Many changes in species dispersal or adaptations have been occurred due to climatic and ecological factors. These factors have caused changes in species adaptations to relatively unfavorable ecological conditions. In addition, large parts of ecological habitats have been so heavily influenced by human altering as to degraded habitats of wild animals which cannot be related to any ecosystem from the point of view of mammalian distribution in Machiara National Park

Floral Characteristics of the Park

The Park lies within the Western Himalayan temperate, sub-alpine shrub and alpine meadows tundra eco-region of Azad Jammu and Kashmir. The higher parts of the Park are situated from the tree line to the top elevations. The alpine shrub and meadows lie between approximately 3600–4800m elevations. Below 3600m elevation lie the western Himalayan sub-alpine conifer forests. The Park is host to temperate forests in the middle altitudes; higher elevations are dotted by coniferous, sub-alpine and alpine scrub forests, and further up by alpine grasslands and high-altitude wild flowers. Several distinct forest types are found in this ecosystem. Fir and pine trees are the dominant characteristic of coniferous species and are found in many places in nearly pure stands below 3600m altitude. In other aspects they mix with oaks, rhododendron, spruce and yew from this common assemblage. The blue pine is relatively thinly populated at lower altitudes (2300m) near the local human settlements. Much of the pine species have been cleared from the forest floor at lower altitudes. At this range they are sparsely dotted giving way to open large areas on mountain slopes.

The area of the Park broadly comes under Champion and Seth's (1965) classification type. The area falls in the western Himalayan highlands where woods are almost like cool temperate forests which grow above 2000m altitude (Negi, 1990). Thus, the flora of the Park can broadly be subdivided into three forest zones growing between approximately 2000m -4800m elevation. Himalayan Moist Temperate Forests, Sub-Alpine Scrub Forests and Alpine Scrubs and Alpine Pastures.

1. *Himalayan Moist Temperate Forests* – dominated by blue pine, deodar, oaks and Himalayan silver fur with a variety broadleaf and shrub cover between 2000m – 2800m

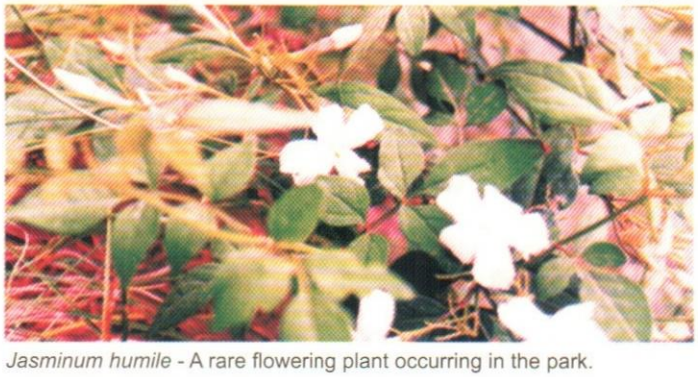
2. *Sub-alpine Scrub Forests* - dominated by mixed variety of coniferous, broadleaf, oaks, shrubs and herbs species growing between 2800 – 3600m.

3. *Alpine Scrub and Grass* - dominated by common shrubs and herbs growing above 3600m. Species like Primula species, crawling junipers, Iris, Gentiana, Anemone and Delhpinium and hundreds more are found here. Besides, there are many medicinal herbs too like *Aconitum species and Rheum emodi.*

Himalayan temperate forests, at altitude between 2000–2800m; the vegetation typically dominates by the species (Forests Himalayan Temperate Type) like blue pine *Pinus wallichiana*, deodar *Cedrus deodara*, spruce *Picea smithiana*, Himalayan silver fir *Abies pindrow*, yew (Barmi) *Taxus wallichiana*, holly oak *Quercus floribunda*, white oak *Q. incana*, Himalayan popler *Populus cilliata*, large-leaved elm *Ulmus wallichiana*, small-leaved elm *U. villosa*, horse chestnut *Aesculus indica*, maple *Acer caesium*, ash *Fraxinus excelsior* forming the top and fairly dense (storey) canopy. The second storey is constituted by willow tree *Salix tetrasperma*, *Salix alba*, Himalayan birdcherry *Prunus cornuta*, ash *Fraxinus xanthozyloides*, *Rhus cotinus*, cotoneaster *Cotoneaster rose*, *C. nummularia*, *C. macrophylla*, *C. affinis* and Himalayan dogwood *Cornus macrophylla.* Shrubby and scrub elements include species of *Rosa webbiana*, *Viburnum grandiflorum*, *Indigofera heterantha*, *Jasminum humile*, *Sorbaria*

tomentosa, *Lonicera quinquelocularis*, *L. vaccinioides*, *Daphne oleoides*, *Geranium rotundifolium*, *Potentilla sericophylla*, *Rubus fruiticosus*, *R. niveus*, *R. sanctus*, *R. ellipticus*, Wayfairing plant *Sorbus cashmiriana*, from dense scrub covering vast tracts of slopes in the area. Species of mammals which are associated to this zone are house shrew, asiatic white-toothed shrew, dark whiskered bat, common serotine, grey long-eared bat, Himalayan rhesus, grey langur, red Himalayan giant flying squirrel, small Kashmir flying squirrel, Indian crested porcupine, house mouse, Turkestan rat, Himalayan wood Mouse, Murree vole, golden jackal, Kashmir hill fox, yellow-throated marten, Himalayan palm civet, stoat or ermine, jungle cat, leopard cat, common leopard, asiatic black bear and Himalayan goral.

At altitude between 2800–3600m elevation, the vegetation is sub-alpine type represented by still some large trees of conifers and broad-leaf as like blue pine *Pinus wallichiana*, Himalayan silver fir *Abies pindrow* crawling juniper *Juniperus communis* white oak *Quercus incana* horse chestnut *Aesculus indica* willow tree, *Salix tetrasperma*, *Salix flabellaris* and rhododendron *Rhododendron hypenanthum* are significant species in this range including a variety of bushes and herbs as *Allium humile*, *Carum carvi*, *Geranium wallichianum*, *Bupleurum falcatum*, *Heracleum thomsoni*, *Arisaema flavum*, *Primula denticulum*, *P. rosea*, *P. glomeratum*, *Saussurea jacea*, *Ranunculus arvensis*, *R. hirtellus*, *Ribes alpestre*, *Polygonatum multiflorum*, *P. verticillatum*, *Plantago depressa*, *Polygonum affinis*, *P. aviculare*, *Corydalus diphylla*,



Jasminum humile - A rare flowering plant occurring in the park.

Humalayan Silver Fir with young cones

Potentilla gerardiana, *Artemisia laciniata*, *A. dubia and A. parviflora*, *Anemone obtusifolia*, *A. rupicola*, *A. polyanthus*, *A. falconeri*, *Aconitum ferox*, *A. rotundifolium*, *Pedicularis pectinata*, *Berberis lyceum*, *Potentilla gerardiana*, *P. nepalensis*, *Phleum alpinum*, *Agrostis gigantea*, *Euphorbia thomsoniana*, *Agropyron dentatum*, *Trifolium pratense*, *Impetiens scabrida*, and *I. glandulifera*. Mammals of this zone includes as cape hare, Royal's pika, grey langur, red Himalayan giant flying squirrel, small Kashmir lying squirrel, Kashmir marmot, True's vole, Murree vole, Royals high mountain vole, Indian wolf, golden jackal, leopard cat, asiatic black bear and musk deer.

High altitude wild flowers (*Anemone polyanthus*) growing at moist-wet places

Anemone rupicola - high altitude growing flowers

Primula glomerata - The flower clusters make balls for few days

Alpine zone ranging from 3600m onward, the vegetation is mainly dominated by species of Himalayan birch *Betula utilis*, Rhododendron *Rhododendron hypenanthum*, *Cyperus cyperus diffornis, C. squarrosus*, Crawling Juniper *Juniperus communis*, Willow tree *Salix flabellaris*, *S. denticulata* and including others *Allium humile*, *Heracleum thomsoni*, *Inula royleana*, *Plantago depressa*, *Saussurea jacea*, *Iris kashmiriana*, *Frittilaria roylei*, *Polygonum affine*, *P. alpinum*, *Rheum webbianum*, *Aconitum heterophyllum*, *A. rotundifolium*, *A. Violaceum*, *A. chasmanthum*, *Euphorbia thomsoniana*, *Anemone obtusifolia*, *Carum carvi*, *Phleum alpinum*, *Ranunculus hirtellus*, *Delphinium cashmirianum*, *D. vestitum*, *Saussurea jacea*, *Aquillegia pubiflora*, *Onosoma hispidum*, *Geranium himalayense*, *Impetiens glandulifera* and *Primula macrophylla*, *P. glomerata, P. denticulate*, *Artemisia macrocephala*, *A. laciniata*, *Agropyron dentatum*. Mammals associated to this range are cape hare, Kashmir marmot, Royals

high mountain vole, True's vole, alpine weasel, snow leopard, musk deer and Himalayan ibex.

Important Habitats in Temperate Forests of the Park

The Park ecosystem plays a critical ecological role due to its diversified flora containing over 400 species (Dar et. al., 2007). As part of the interconnected processes foothills (2000m altitude) at the bottom of the Park to high alpine meadows (above 3600m altitude), and boulder strewn scree that lie above the tree line produce a variety in habitats. Several species of mammals exhibit seasonal local migrations up and down the steep mountain slopes and depend on contiguous habitat for these movements. If any of the habitat layers are lost or degraded, these movements can be disrupted, therefore, conservation of this zone will be critical to maintain the populations of threatened mammalian species.

Broadleaf Forest Habitat

These forests are characterized by the broadleaved in herbs, shrubs and plants. This forest is usually found in temperate environment below the alpine range. Horse chestnut *Aesculus indica* Himalayan popler, *Populus cilliata* maple *Acer caesium* and Himalayan bird cherry (*Prunus cornuta*) are significant species. Broad leaf forest grows in general at moist and in depressions and therefore are more fragmented but they are still valuable habitat especially as part of the habitats found on the mountain sides.

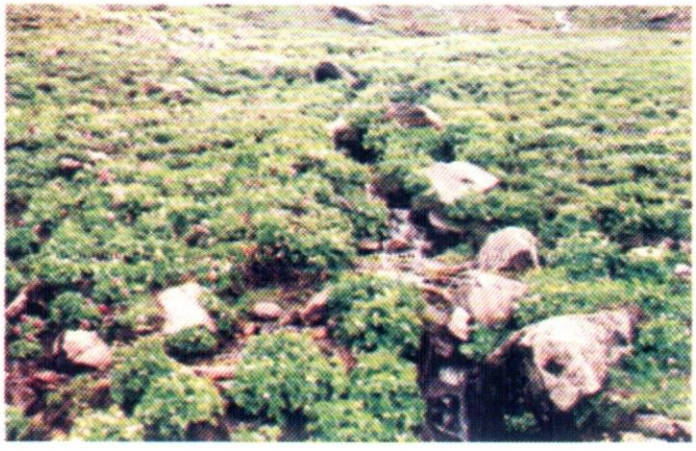
Evergreen Broadleaf and Coniferous Forest Habitat

Evergreen Broadleaf and Coniferous Forest Habitat

The evergreen broadleaf and coniferous forests are dominated by oaks consisting of *Quercus sps,* and coniferous - dominated by Himalayan silver fir, yew and spruce. This forest is typically found on moisture southern slopes, which are more influenced by the monsoon. The understory of broadleaf forests features a rich assemblage of ferns and mosses. Being evergreen, the forest provides excellent habitats for great variety of mammals. On northern slopes, dryer areas, and higher elevations, evergreen coniferous forests of deodar and blue pine dominate.

Forest Floor Habitat

This habitat grows a large variety of herbs and shrubs. Besides, the broadleaf deciduous trees lose their leaves each year, the forest floor has a particularly rich layer of decaying leaf litter and fertile soil which provides nutrition and shelter for ground dwelling animals. Mammals that live on the forest floor include rodents, shrews, moles, voles and others that find their food requirements from the forest debris. Some small predators such as foxes, weasels are then attracted following in search of forest floor prey. Therefore, forest floor is a rich habitat for small mammals.



Forest Floor Habitat: ground vegetation

Forest Canopy Habitat

Forest canopy refers to the dense cover of tall trees featuring like an umbrella. Tops of the trees are interconnected from tree to tree movement of many mammal species. This top canopy (portion) of a community of trees or plants serves as the interface between the atmosphere and the ground. The canopy is also an upper habitat for other mammals in the ecosystem. The forest canopy is a habitat in itself as it supports a variety of arboreal mammals. Examples are two species of flying squirrels (red Himalayan giant flying squirrel, small grey Kashmir flying squirrel), two primates (rhesus macaque and Himalayan grey langur and two arboreal carnivores (yellow-throated marten and Himalayan palm civet).

Temperate forests

Change in Habitats

The changing seasons are a substantial cause for changing animal habitats in temperate evergreen and deciduous forests. These changes occur during the course of the year. Since the trees are bare of leaves during the winter months, animals whose habitat is primarily in the foliage must find alternative places to seek shelter in evergreen forest species. During the winter when the ground is frozen or covered with snow, many species hibernate such as voles, pika and marmots, and others must move to lower habitat.

Mammals Dispersal in the Forest Layers (Habitats)

Within a temperate mixed forests [coniferous and broadleaf (deciduous and evergreen)], there are different layers of vegetation. The highest layer is the canopy layer, which is made up of the tallest mature trees. The leaves of deciduous trees are thin,

so sunlight can penetrate through the canopy to the layers underneath. Just below the canopy is a layer of smaller trees. This layer is known as the understory. Beneath the understory is a layer of dense shrubs - the shrub layer. Even closer to the ground is a layer of grasses, herbs, mosses and ferns. This is called as the ground layer. Soil and litter (debris from decaying organisms) can be found at ground level. Much of the forest litter consists of decaying leaves; therefore, it may be called leaf litter. Mammals usually depend more on the general structure of the forest than on any individual plant species. Important factors include the height of the vegetation, the presence of a shrub layer or a ground layer, and the amount of open land available. Mammals For example, the Murree vole, Royals high mountain vole and True's vole were usually found in forests with dense herbaceous flora, while the Himalayan wood mouse in forests with an open ground layer.

The upper layers of the deciduous forest are inhabited with several species of small mammals including the flying squirrels, monkeys and bats. Bats (dark whiskered bat, common serotine) hunt around the tops of trees for flying insects and the grey long-eared bat, picked insects off leaves. Bats often live in holes near the tops of tree trunks or in crevices and holes of rocks. The flying squirrels and monkeys were commonly found in the trees of temperate mixed conifers and deciduous forests, where they eat nuts, fruits, seeds, bark, shoots and other plant items.

During the day, squirrels sleep in a nest built in forked branches of large trees but mostly in tree holes and crevices. While, monkeys take rest at night in the forest canopy of large trees and are active in the day. Himalayan musk deer and goral inhabit the shrub layer, the under story of the forest. For most of the day, they remain hidden in the bush layer. In the evening, they leave cover to graze, and then return to cover at dawn. They may be active during the day in undisturbed areas. They will mostly browse on the leaves, branches, shoots, bark of broad-leaved plants or herbaceous layer of the forest floor.

Himalayan wood mouse, True's voles, Murree vole, asiatic white-toothed shrew, cap hares and Royal's pika live in the forests' lower layers - ground layer. Predators such as alpine weasels, stoats (ermines), Himalayan palm civet, yellow-throated marten and leopard also live here. The stoat and the weasel are most active during the day. They mostly hunt on the ground. Their prey consists of small to medium sized mammals, such as hares, mice and voles. Himalayan palm civet and yellow-throated marten are both omnivore predators specialized for a part of life as arboreal, inhabiting the lower layers they will have greater chances of variety in their food items. They will sometimes feed on plant matter. Even the fox, which is highly carnivorous, takes a share of these. Some mammals of the lower layers are active in both the day and the nighttime. They were observed as stoat, weasel, yellow-throated marten (predators), Royal's pika and Royal's high mountain vole (as prey). The House shrew also known as the common shrew, makes runways and tunnels through the litter and soil, also lives in the lower layers. The Murree vole and True's vole is active burrower, they make underground tunnels and get most of their food from the ground layer. Some mammals, such as Royal's pika, Kashmir marmot hibernate in winter. They deposit food in their tunnels from the ground layer.

Ecological Characteristics of Mammals

Different species of mammals have adapted to distinct habits in maintaining food chains for their long survival. They are mechanically found as herbivores, predators, omnivores and scavengers.

Predators are animals that hunt and kill other animals for food. Both carnivores and omnivores can be predators. Carnivores and omnivores are also called scavengers, which means they can feed off on animals that were already dead. Small predators can also be preyed upon by large carnivores, depending on where they fall in the food chain. For example, a fox and jackal is a predator because it eats mice, rats and birds but they are also prey for others because they can be eaten by large predators, the best example is the leopard. Omnivores are mammals that eat both plants and other animals. They are categorized as secondary consumers because they eat primary producers (plants) and primary consumers (small mammals). Omnivores can be both scavengers and predators. Examples of omnivores include bears, jackals, foxes, Himalayan palm civet and yellow-throated marten. Animals that feed only on plant matter, including grasses and plants are called herbivores. They are primary consumers because they eat primary producers; but are eaten by omnivores and carnivores. Examples of herbivores include in ungulates, rodents and lagomorphs. Park is rich inhabiting a large variety of herbivores as prey which can support larger populations of predators. Carnivores eat only other animals mostly including the herbivores, but can also eat omnivores and other carnivores. They can be either predators or scavengers. Examples of predatory carnivores include wolves, jackals, leopards, weasels etc. An example of a scavenger carnivore is a jackal and bear in the Park. Carnivores are essential part of an ecosystem, because they help to maintain the population of herbivores and omnivores.

Mammals are evolved to various kinds of life style: Three species of bats were recorded from the Park. Bats are mammals which have been evolved aerial life, bats are true flyers, and insectivorous bats feed themselves while flying in the air. There also occur some arboreal mammals. Examples are two species of flying squirrels and two species of primates (monkeys). In search of food, some mammals are adapted a part of their life as arboreal, they include carnivores such as yellow-throated marten and Himalayan palm civet. Few more rodents have been observed to climb in the trees for seasonal fruits, example is Turkestan rat. Most of the rodent species found in the Park are adapted as fossorial life – means that they dig the ground and make burrows or holes to live in. A large variety of rodents besides those adapted to as arboreal, live underground as fossorial life. Examples are rats, mice and voles etc. Few species of small mammals are adapted to as commensally life – means they are dependent on human and live in close proximity. Examples found there, were house mouse, house shrew and house rat. All species of mammals recorded in the Park are called to be as terrestrial because none of them is evolved to live in water or, otherwise, they use water as for drinking, bathing or crossing over to use other land area.

Conclusion

The common leopard is the last surviving large cat in Pakistan. After extinction of the Asiatic lion in the early 19th century (1810), and the tiger in early 20th century (1906), leopard has received intensive attention of conservationists. Although leopards are generalists carnivores and can tolerate different habitat conditions and prey sizes, the leopard has been severely reduced within much of the former ranges. Since the establishment of protected areas system, the population of leopard is increasing in protected areas. They are

now extending their ranges to their former ranges. Virtually, these ranges have been encroached by increasing human settlements. Therefore, severe conflicts occur in the valleys due to their live stock attacked by leopard resulting in enormous loss. One of the main threats to leopard is reduction in natural prey and its habitat ranges. Hunting of ungulates in the Park (Himalayan ibex, Himalayan goral and Himalayan musk deer) is a major cause in reducing prey of leopard. However, the scale and dynamics of these incidents and effects on the leopard abundance and distribution are still to be measured.

Ungulate species face hunting pressure from the local communities as well as lack of watch and ward by authorities. Most of these species are hunted for recreation and meat. However, introduction of more sustainable programs such as trophy hunting and community-based conservation programs will restrict this threat. Human intrusion in the habitats of many species has caused catastrophic effects on animal ecology and population dispersal. Species such as the Himalayan musk deer (*Moschus chrysogaster*) and the Himalayan goral (*Naemorhedus goral*) have rigorously declined in the Park. And, in many former ranges they have almost disappeared from the wild following the rapid growth of human settlements on such areas occupied by these wild mammals.

Forest conservation and development policies have not been properly implemented. Losses generated by deforestation cause reduction in habitat quality. Having such diversity and variety of habitat association, the mammals of the Park have undergone tremendous pressures from human approach to their vital habitats. Forest degradation, land erosion, and landslides are some of the common and major factors in the area that have led to habitat loss of mammalian species. Many species, which were thriving in their wild habitats, and were common, have disappeared from sight and are restricted to core habitats in remote localities.

With the inception of PAMP, a community-based management approach was adopted. The Village Conservation Committees (VCCs) and union council level clusters were established in the area, which are now playing an important role in conservation of natural resources of the park area. Before the MNP was declared as a National Park, illegal hunting and poaching of wildlife was common. Though reduced to some extent, cases of illegal hunting and poaching are still reported. Local hunters, nomadic herders, and intruders from adjoining areas are the most potent threat to the wildlife of the Park. The major causes of illegal hunting are lack of awareness, lack of alternate recreational facilities, market demand (musk, pelts, trophies, etc.), retaliatory killing of predators, ineffective watch and ward due to shortage of field staff, outdated legal framework, etc. Illegal and uncontrolled forest cutting, natural and manmade damage to natural resources, uncontrolled grazing, unsustainable extraction of medicinal plants, encroachment and land use change due to unclear boundaries, lack of data on forest resources, are some of the threats faced in the Park.

Protecting some areas as model of relatively pristine biotopes is considered a good approach because human impact on biological resources has shown to have affected qualitatively and quantitatively to many plant and animal populations. However over the last few decades it has been recognized that protected area management is not effective because of conflicts with local populations who strive to meet their livelihood needs and who have no choice than using these protected areas; besides livelihood needs, some traditional societies are also in conflict with conservation agencies as some of the protected areas overlap with areas which occupied by the local communities are not only economically but also culturally linked; trade of natural products may also have high impacts on natural resources, often irrespective of any kind of protection of the resource itself, leaving bare areas where vulnerable species have few chances for survival. This approach often contrasts with local people's approaches which in many areas is more conservative and based on traditional knowledge because their own interest has been to conserve the resources over generations to ensure that the supply meets the demand. However, as in the case of MNP, local people also lack management control over resources even in core-zone and buffer zone which lies in the hands of Forest Department. Permission of Forest Department is required for any type of wood resource use from the MNP.

Cutting and felling of old trees from fairly dense forest areas permitted by the Forest Department is deteriorating the habitats of many wild species while there is total restriction on any type of resource use from the National Park according to the protection act of the protected areas. However, people living at the periphery of MNP are highly dependent on its wild plant resources for mainly fuel wood, fodder and timber needs. Collection of fuel wood and fodder is mostly done by women who regularly visit the National Park and the surrounding forests in groups. In addition to fuel wood and fodder the local people (including both genders; observed during the survey) collect mushrooms, medicinal plants and wild vegetables from the National Park. This type of illegal use of resources on the part of local communities from the park often results into conflicts with the management agencies of the Park which in turn results into further degradation of resources in the Park as people have no other choice rather to collect whatever they can without any consideration for sustainable use.

Collection of Gucchi (*Morchella esculenta*) a precious mushroom species, is an important economic activity in most parts of the Park. Along with Guchi some other species of mushrooms and wild vegetables are also collected from these areas. Gucchi tends to grow on moist shady places under small bushes and at the bottom of big trees. Gucchi is actually exported to Europe and other countries and the Gucchi traders earn a lot from its illegal trade.

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