

**WILD LIFE IN ANCIENT KHINGAR, MUSTANG
ARCHAEOLOGICAL EVIDENCE FOR LOCALLY EXTINCT ANIMAL SPECIES
IN THE DZONG KHOLA VALLEY, NORTHERN NEPAL**

ANGELA VON DEN DRIESCH

Institut für Palaeoanatomie, Domestikationsforschung und Geschichte der Tiermedizin.
München, Deutschland

ABSTRACT: Faunal analyses carried out in the settlement mound of Khingar, evidence the presence of a series of macromammalian species whose habitat optima do not correspond with the present landscape of the area. Assuming that the hunting and breeding of these species took place not far from the site itself, such inconsistency can best be accounted for through habitat changes, in particular deforestation, brought about as a combination of human and domestic animal activities.

KEYWORDS: FAUNA, NEPAL, MIDDLE AGES, HABITAT DEGRADATION

RESUMEN: Los análisis faunísticos llevados a cabo en el poblado de Khingar evidencian la presencia de una serie de macromamíferos cuyos óptimos ecológicos en absoluto se corresponden con la fisionomía del paisaje actual en la zona. Partiendo de la base que la caza y la cría de estas especies se produjo en los alrededores del asentamiento, tal inconsistencia podemos explicarla en términos de cambios ambientales, en especial deforestación, operados como consecuencia de la actividad combinada del hombre y de sus especies domésticas.

PALABRAS CLAVE: FAUNA, NEPAL, EDAD MEDIA, DEGRADACION AMBIENTAL

INTRODUCTION

In 1991 and 1992 the German Archaeological Institute in co-operation with HMG Department of Archaeology excavated the settlement mound of Khingar, a village situated halfway between Kagbeni and Muktinath on the left slope of the Dzong Khola creek (Figure 10). The excavations were carried out within the frame of the Nepal-German Project on High Mountain Archaeology under the direction of Dr. H.G. Hüttel (KAVA, Bonn). The old settlement of Khingar was inhabited over a long time span. The dating is based mainly upon imported ceramics from Kathmandu valley, Terai and Northern India, but also by means of radiocarbon dates. So far three periods of occupation can be established. Whereas the first settling period (I) was limited to the center of the mound, its occupation probably ending during the 2nd century A.D., a more extended habitation due to an increased population has been observed for the period II (3th/4th to 8th century A.D.) and for the subsequent period III dating approximately from the 10th to the 13th/14th century (see in detail Hüttel, 1993, 1993a, 1994).

During the excavations a great amount of faunal material was sampled which consists mainly of bones and bone fragments of slaughtered and hunted animals, and which can be considered kitchen refuse of the former settlers. A preliminary report on the bone material excavated in 1991 has already been published (von den Driesch, 1993). Twice as much material was collected in 1992 so that the total number of bone fragments of the ancient village now exceeds 18.000 bone specimens.

Based on my report on the material excavated in 1991, the faunal assemblage consists primarily of domesticated animals. Sheep, goat, cattle, yak and yak-cattle-hybrids played a dominant role in the economy of the settlement. People also kept horses, mules, donkeys and to a minor extent pigs, chickens, dogs and cats. Evidence for hunting activities is scarce and the percentage of bones of wild animals relative to the total amount of remains is below 3.

Due to the extensive sample which is now available, our knowledge of wild life has increased considerably. Apart from the species recognised on the basis of the 1991 samples, such as blue sheep, *Pseudois nayaur*, musk deer, *Moschus moschiferus*, marmot, *Marmota bobak*, woolly hare, *Lepus oriolostolus*, mouse-hare, *Ochotona roylei*, and some wild birds (see table 1 in von den Driesch, 1993), the new material contains other species of mammals and birds expected in the region (Table 1). Additionally it reveals some species of game and one domestic species which are not known to occur at present or to have occurred in the more recent past in the Muktinath valley and adjacent areas (Final Report, 1994). These extraordinary remains include the following species:

- 1) Water buffalo, *Bubalus arnee f. bubalis*
- 2) Himalayan tahr, *Hemitragus jemlahicus*
- 3) Goral, *Nemorhaedus goral*
- 4) Red deer, *Cervus elaphus*
- 5) Barking deer, *Muntiacus muntjak*
- 6) Wild boar, *Sus scrofa*
- 7) Himalayan weasel, *Mustela sibirica*
- 8) Weasel, *Mustela nivalis*

The purpose of this contribution is to describe the material and to illustrate the criteria used for identification. The presence of these species not only contributes to our knowledge of their former zoogeographic distribution, but it also helps to reconstruct the former landscape and the natural environment of the valley at the time of its early occupation.

An overview of the wild species collected from Khingar is given in Table 1. Those animals which conform to our knowledge of species' distribution in the study area do not need further discussion here.

MAMMALS	BIRDS
Blue sheep or Bharal, <i>Pseudois nayaur</i> (K)	Eurasian wigeon, <i>Anas penelope</i> (J)
Tahr, <i>Hemitragus jemlahicus</i> (K)	Garganey, <i>Anas querquedula</i> (J)
Goral, <i>Nemorhaedus goral</i> (K)	Common teal, <i>Anas crecca</i> (J)
Red deer, <i>Cervus elaphus</i> (K)	Black kite, <i>Milvus migrans</i> (K)
Barking deer, <i>Muntiacus muntjak</i> (K, J)	Himalayan griffon, <i>Gyps himalayensis</i> (K, J)
Musk deer, <i>Moschus moschiferus</i> (K, J)	Chukar partridge, <i>Alectoris graeca chukar</i> (K, J)
Wild boar, <i>Sus scrofa</i> (K)	Snow partridge, <i>Lerwa lerwa</i> (K)
Grey wolf, <i>Canis lupus</i> **	Indian gallinule, <i>Gallinula chloropus</i> (J)
Red fox, <i>Vulpes vulpes</i> (K)	Common crane, <i>Grus grus</i> (K)
Himalayan weasel, <i>Mustela sibirica</i> (K)	Snow pigeon, <i>Columba leuconta</i> (K, J)
Weasel, <i>Mustela nivalis</i> (K)	Blue rock or hill pigeon, <i>Columba livia</i> or <i>C. rupestris</i> (K, J)
Bobak, <i>Marmota bobak</i> (K)	Thrush, <i>Turdus sp.</i> (J)
Rat, <i>Rattus rattus</i> (K, J)	Red-billed covey, <i>Pyrrhocorax pyrrhocorax</i> (K, J)
Tree mouse, <i>Apodemus flavicollis</i> (K, J)	Tree sparrow, <i>Passer montanus</i> (K, J)
Woolly hare, <i>Lepus oriolostolus</i> (K, J)	
Mouse-hare, <i>Ochotona roylei</i> (K, J)	

TABLE 1. Wild species identified from the bone find from Khingar (K) and the cave system from Jharkot (J)*. (*) Most of the small mammal and bird bones from the cave system of Jharkot can be considered as regurgitated pellets from owls. (***) Identified from the faunal material from Dzar, 16th century.

MATERIAL AND OSTEOLOGICAL DATA

1) Water buffalo

Table 2 lists the skeletal parts which on the basis of their size and morphology can be assigned to domestic water buffalo. Figures 1 and 3 demonstrate the morphological differences of proximal metacarpus and phalanx 2 between water buffalo and other related species of large bovids, such as cattle, *Bos primigenius f. taurus*, yak *Bos mutus f. grunniens*, and gaur, *Bibos gaurus*. As can be seen, the morphology of the bones from Khingar fits best with the one observed in water buffalo. The notch between the proximal articular facets of the metacarpal in water buffalo and in cattle is considerably more pronounced than in that of yak and gaur (Figure 1), and the ridge between the two facets, considerably shorter than in the former species. Differences between *Bubalus* and *Bos primigenius* can be found in the two proximal articular facets being much more flattened in relation to the anterior-posterior length of the proximal articular surface in the first species (Figure 1 c-e). *Bubalus* possesses a strong tuberositas at the palmar margin of its articular surface which is also seen in the fossil specimen from Khingar.

The four water buffalo bones must derive from four different individuals because of their different location and dating. None of them is dated to the latest period. The metacarpal bone is large, the two phalanges even larger. The measurement of the metacarpus falls into the size range given for corresponding prehistoric water buffalo bones from Northeastern Thailand (Higham, 1975; Tables 1 and 4). Unfortunately no measurements of the 2nd phalanx from fossil and subfossil water buffalo could be found in the literature. But despite their large size, we consider the bones as belonging to the domesticated form of water buffalo, hence *Bubalus arnee f. bubalis* (see below).

LOCATION	PERIOD	SKELETAL PART	MEASUREMENTS*
BXXII 79/11	II late	fragment of frontal bone with part of the basis of the horncore of a male	-
BXXI 87/14	II	phalanx 3	-
BXXI 344	II late	proximal end of right metacarpus	Bp: 73.0; Dp: 44.0; Figure 1d
BXXII 5.3/25 I	I	phalanx 1 posterior, partially damaged, male	GLpe: (68.0); Bp: (37.0); Bd: (39.5)
BXXI 88/16 II	II	phalanx 2 anterior, male	GL: 47.5; Bp: 41.5; SD: 30.0; Bd: 33.0; Figure 3c

TABLE 2. Bone material from water buffalo. (*) Abbreviations as listed in von den Driesch (1976).

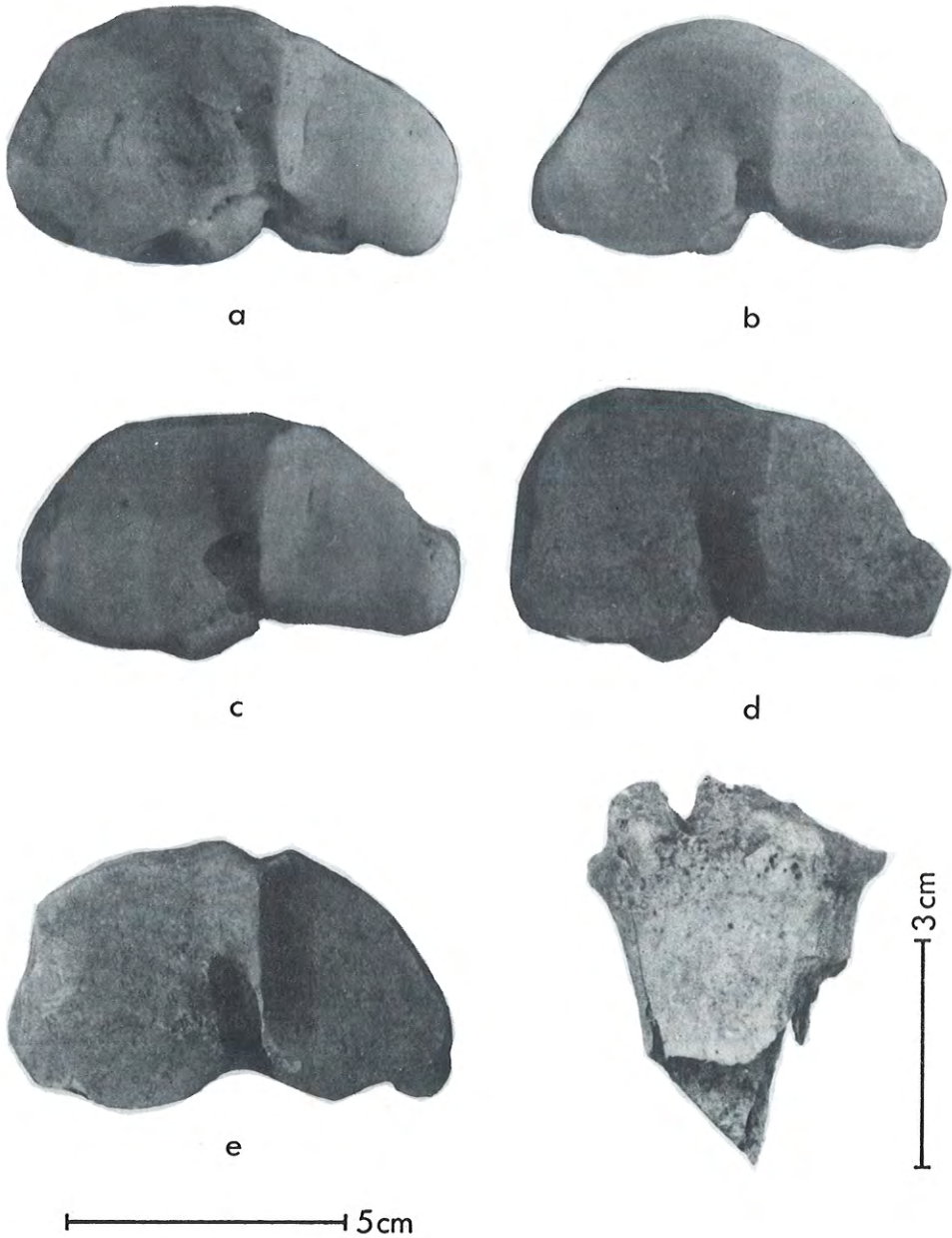


FIGURE 1. Proximal right metacarpi from large bovids in comparison. a. *Bibos gaurus* male recent; b. *Bos mutus grunniens* male recent; c. *Bubalus arnee* f. *bubalis* male recent; d. *Bubalus bubalis* from Khingar. e. *Bos primigenius* fossil from Bulgaria. Bp a-e: 74.5 mm, 69.0 mm, 74.0 mm, 73.0 mm, 73.0 mm.

FIGURE 2. Proximal radius from tahr, Khingar.

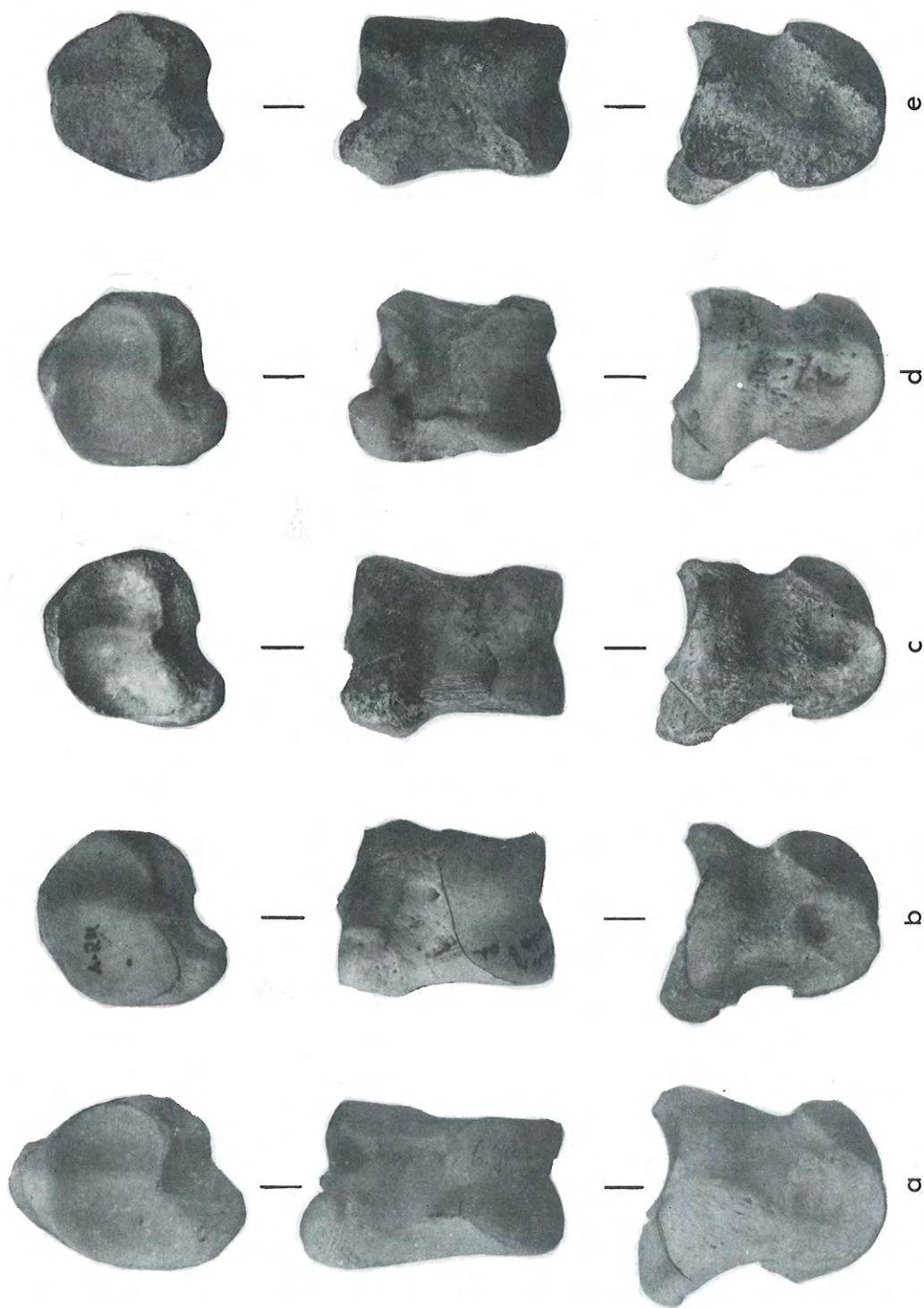


FIGURE 3. Second anterior phalanges from large bovids in comparison. a. *Bibos gaurus* male recent; b. *Eubalus arnee* f. *bubalis* male recent; c. *Eubalus bubalis* from Khingar; d. *Bos mutus grunniens* male recent; e. *Bos primigenius* fossil from Bulgaria. GLpe a-e: 53.0 mm, 46.0 mm, 47.5 mm, 41.0 mm, 47.0 mm.

2) Himalayan tahr

The faunal material from Khingar also contains bones of a wild caprid (Table 3) which considerably surpass the corresponding bones of domestic goats in size and show different morphological features. In the first stage of the investigation I thought that they pertain to ibex, *Capra ibex sibirica*, or to markhor, *Capra falconeri*, but these two species do not belong to the indigenous fauna of the Nepalese Himalayas. Regarding the ibex Prater (1971: 254) writes: “*The Himalayan ibex inhabits the western Himalayan range, and the mountain range which lie beyond in Kashmir and Baluchistan. Its eastern limits are set by the upper reaches of the Sutlej river east of which it does not occur*” (see also Haltenorth & Trense, 1956). The markhor is known to inhabit the Himalayas from the valley of Kashmir westwards, and the Hindukush (Prater, 1971: 257).

Intensive osteological comparison with skeletons of modern specimens revealed the three first bones listed in Table 3 belong to the tahr (Figures 2 and 4 e,f). This wild species is now extinct in the mountains surrounding the Muktinath valley but occurs on the southern flanks of the Himalayas (see below).

3) Goral

Two bone fragments of this medium size goat-antelope are identified (Table 3). Although the right scapula, dated to period III, is damaged, one can see the straight crest at the caudal margin of the column and the almost circular articular surface of the cavity process which is characteristic of members of the *rupicaprini* group.

LOCATION	PERIOD	SKELETAL PART	MEASUREMENTS
tahr: AXI 64/47	III	right scapula of a male	SLC: 29.0; GLP: 47.0; LG: 39.5; BG: 32.0; Figure 4f
BXXII 37/1	III	right proximal radius, male	Bp: 41.0; BFp: 37.5; Figure 2
BXXII R 5.3/23	II early	left centroquartale	GB: 35.0
goral: AXI 51/32	III	right scapula	BG: 21.2
BXXI 62,72/24	I (-II)	right distal metatarsus, probably male	Bd: 27.0

TABLE 3. Bone material from tahr and goral.

LOCATION	PERIOD	SKELETAL PART	MEASUREMENTS
BXXII R 7.1/20	II	right scapula of a male	GLP: 29.8; LG: 21.5; BG: 21.0
AXI 72/39	III	right adult mandibula	-
AXI H 1.6/47	II-III	right juvenile mandibula (M3 not yet erupted)	-

TABLE 4. Bone material from muntjak.

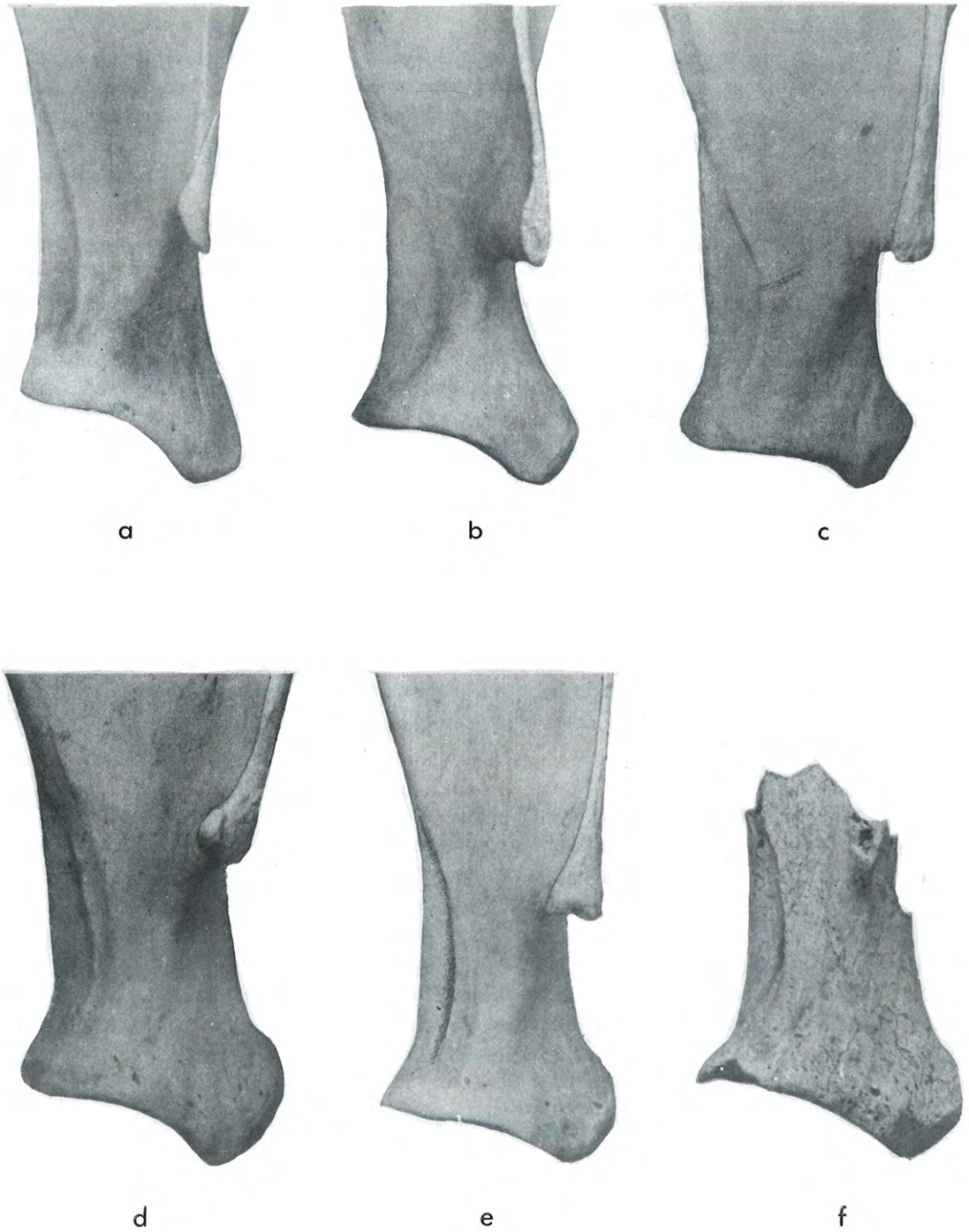


FIGURE 4. Right scapulae from ovicaprini in comparison. a. *Pseudois nayaur* male recent; b. *Ovis ammon hodgsoni* male recent; c. *Capra falconeri* male recent; d. *Capra ibex sibirica* male recent; e. *Hemitragus jemlahicus* male recent; f. *Hemitragus jemlahicus* Khingar. GLP a-f: 40.5 mm, 39.0 mm, 41.2 mm, 45.0 mm, 44.0 mm, 47.0 mm.

4) Red deer

Completely unexpected are two bone fragments from a large deer species. One represents a small piece from the crista ischiadica of a pelvic bone from BXXII 34/1, typical of the family *Cervidae* with its pronounced muscle attachment lines. The second find is a distal end of a right radius measuring 52.5 mm Bd (Figure 5d). It was found in BXXII 74, 64/2. Both finds date to period III. However, the excavator suggests that the archaeological material from these two locations is mixed up and could contain older material.

As no species of large deer is reported to live in the southern part of the Mustang district, I first tried to establish from what species the radius might derive. Osteological comparison with deer species of about the same size and occurring in the Indian and Central Asiatic region clearly reveals that the bone in question belongs to the red deer group. As can be ascertained, the most distinctive osteological feature are the two sharp ridges on the dorsal side of the bone which are shorter and stand closer together in *Cervus elaphus* than in the other two species, the barasingha or swamp deer, *Cervus (Rucervus) duvauceli* and the sambar, *Cervus unicolor* (Figure 5 a, b). The distribution and habitats of the two latter species can exclude them from consideration as part of the fauna of the Muktinath valley or the nearby Kali Gandaki valley, even in prehistoric times.

The distal breadth of 52.5 mm falls within the variation known from radii of prehistoric red deer from southeastern Turkey. Following Pietschmann (1977; Table 1) the size range of the distal radius of Chalcolithic and Early Bronze Age turkish red deer, belonging to the subspecies *maral* varies from 51.0 mm to 64.0 mm. The maral whose distribution reaches eastwards as far as Pakistan, belongs to the largest subspecies of red deer known from the Old World. As quoted by Kurt & Zhiwotschenko (1988: 194) red deer is represented in Central Asia and in the Himalayas with relatively small subspecies. Unfortunately bone measurements from other subspecies of red deer from Central Asia, e.g. from the hangul, *Cervus elaphus hangul*, or the somewhat larger shou, *Cervus elaphus wallichi*, are not available.

5) Barking deer

Those skeletal parts which are attributed to this small deer are listed in Table 4. Identification is possible by means of intensive osteological comparison of the small deer bone material excavated in Khingar with recent skeletons of musk deer and muntjak. Whereas remains of musk deer, a species which still lives today in the scrub covered ravines of the Dzong Khola, are much more abundant in the faunal material from Khingar, three bone specimens turned out to be from muntjak. The presence of the scapula indicates that the whole carcass was brought into the settlement and that we are not dealing with a traded skin. However, it must be noted that in some tombs excavated in the cave system of Jharkot isolated upper canines of male musk deer and muntjak were found. These teeth are often perforated and have served as jewellery. No doubt, these finds represent trade object.

6) Wild boar

Two broken halves of a jaw of a male wild boar are identified from BXXII 79/9-11 (period II). The following measurements could be taken:

Length of the molar row: 83 mm

Length of M3: 44.5 mm (left), 45 mm (right)

Breadth of M3: 17.5 mm (left), 18 mm (right)

The third molars show medium wear (Figure 6b). The tooth dimensions leave no doubt that this huge jaw comes from a wild boar and not from a domestic pig.

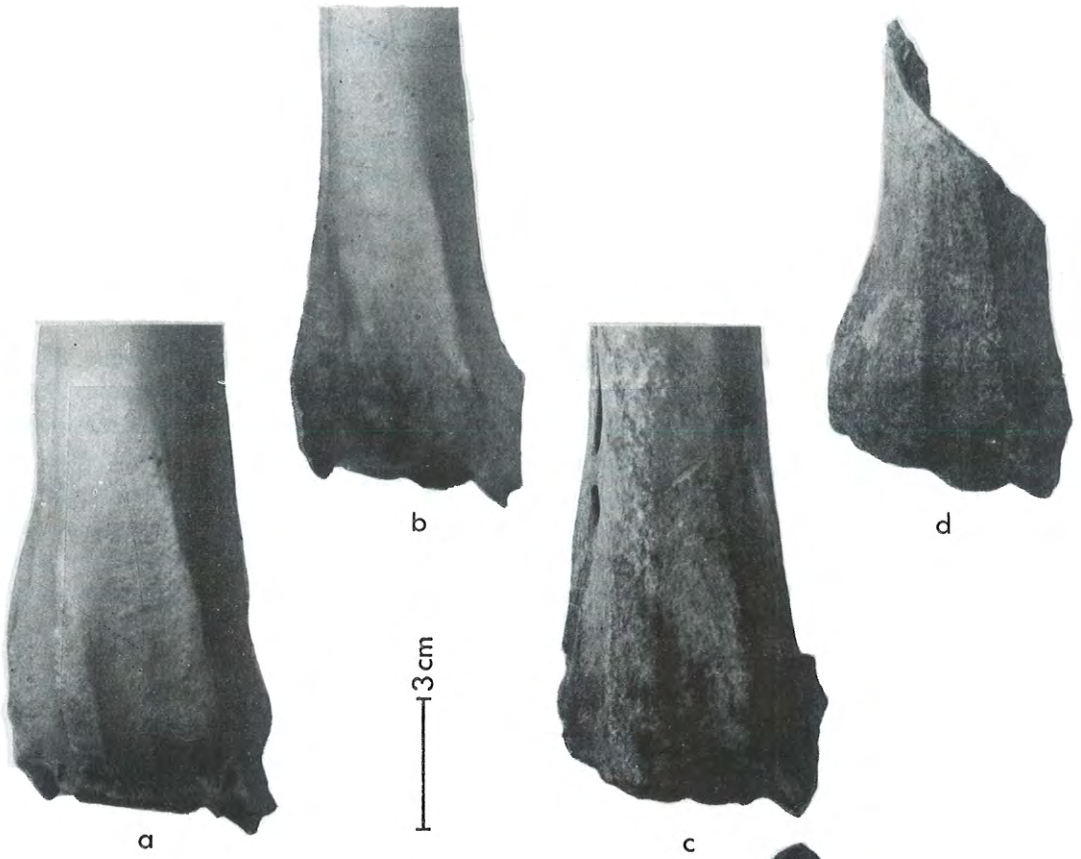


FIGURE 5. Right distal radii from large deer in comparison. a. *Cervus duvauceli* male recent; b. *Cervus unicolor* male recent; c. *Cervus elaphus maral* fossil from Turkey; d. *Cervus elaphus* ssp., Khingar. Bd a-e: 56.0 mm, 50.0 mm, 58.0 mm, 52.5 mm.

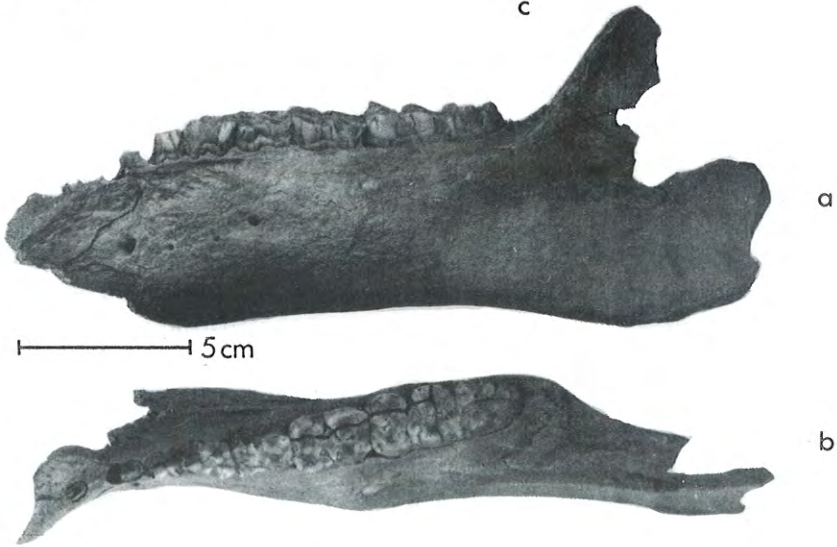


FIGURE 6. Left jawbone of *Sus scrofa* ssp. from Khingar.

7) Himalayan weasel

The faunal material from Khingar reveal the complete jaw (right and left side) of a rather large weasel originating from AXI 61/31, period III. Measurements: total length of one half 29 mm, greatest height of the coronar process 13.2 mm, length of the tooth row (M2-J) 19.3 mm, length of the tooth row (M2-P1) 14 mm, length of M1 15.5 mm. These dimensions fit well into the size range given for modern Siberian weasels, *Mustela sibirica*, (Glover, 1938: 372 ff) which is the largest of the weasels from the Indomalayan region (Prater, 1971: 157). Its recent distribution is given by Corbet & Hill (1992, map 90, see also Figure 9).

8) Weasel

From BXXI F 348 (period I) comes a very small left femur of a weasel: GL = 25.0 mm, SD = 1.9 mm, Bd = 4.7 mm. These dimensions fit best to the weasel, *Mustela nivalis* (see Reichstein, 1993; table 112 f). According to Corbet & Hill (1992: 195) the range of *Mustela nivalis* in Central and Eastern Asia comprises "N Vietnam, and high altitude in Sichuan, SW China and throughout most of the Palearctic and Nearctic regions; approaching this region in Afghanistan but apparently absent from the high Himalayas" (see also Figure 9). Two other species of weasel occurring in the Annapurna conservation area, the yellow-bellied weasel, *Mustela kathiah*, and the stoat, *Mustela erminea*, grow larger than the animal from which this small femur derived, but no postcranial bone measurements for the yellow-bellied weasel are available.

ZOOGEOGRAPHIC DISTRIBUTION AND NATURAL HABITAT

As stated by Prater (1971: 248) tall grass jungles and reed brakes in the neighbourhood of swamp provide the ideal habitat for the **wild buffalo**. It is, therefore, a typical inhabitant of the grass jungles of the Nepal Terai and the plains of the Brahmaputra in Assam. Pools of water to lie in, and mud wallows in which to roll and cake themselves with earth is the environment still required for its domestic descendant, the **water buffalo**. Judging from their habitat preference wild buffalo probably did not penetrate into the Kali Gandaki valley as far and high as the upper Thakkola in earlier times. In spite of the large size of the bones found at Khingar (see measurements in Table 2), it is more likely to assume that the early settlers who reached the Muktinath valley in the very early Middle Ages brought domestic water buffalo with them; a fact which from an ecological point of view is interesting, since today the keeping of water buffalo is no longer possible in the area. We saw water buffalo in the lower parts of the Kali Gandaki valley between Tatopani and Ghasa. Today the animals are kept at lower altitudes, generally not higher than 2.500 m above sea level.

In Nepal the **Himalayan tahr** ranges from the broad-leaved forest zone to the alpine meadows but favours grassy cliffs with patches of trees (Corbet & Hill, 1992: 272). All authors agree that the animals select the most inaccessible ground to live in and are found on cliffs, rocks, in dense scrub, and forest (Figure 7). It is known to prefer forests of oak, rungal and cane, generally favouring altitudes of 2.500 m to 4.400 m. According to recent investigations on distribution, status and factors responsible for population trends (Bauer, 1990), the Himalayan tahr inhabits a narrow strip along the southern flanks of the Himalayas (Figure 7). Tahr seems to be much more abundant in the eastern regions of Nepal with high precipitation rates. This does not correspond with Schallers (1977)

observations that the animal is not able to tolerate warmer and more humid conditions (Bauer, 1990). In western Nepal the tahr is restricted to rugged terrain at lower altitudes, and is not found at high altitudes where it has been replaced by the bharal. Nowadays the whole Mustang district is without any occurrence of tahr (Figure 7).

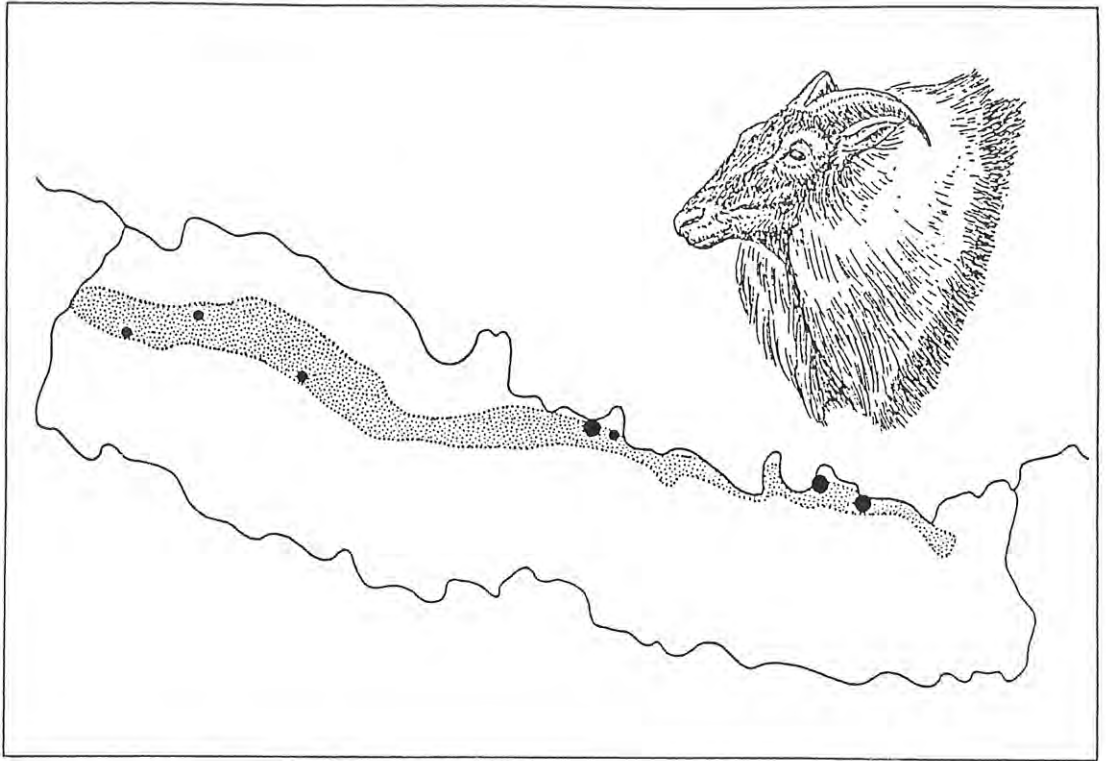


FIGURE 7. Distribution of tahr, *Hemitragus jemlahicus*, in Nepal (according to Bauer, 1990, figure 1.).

A similar picture emerges for the **goral**. Like tahr, goral also is confined today to the southern flanks of the Himalaya. It shows high climatic flexibility ranging from 300 m in the subtropical Terai to the cold himalayan regions in 4.000 m above sea level. Bauer (1990) argued that its present distribution -mainly on steep, dry southern and western slopes between altitudes of 2.000 m to 2.800 m- suggests that this species now occupies more marginal habitats, whereas it has disappeared from many regions of the densely populated middle hills and in the northern valleys. Goral still occurs in considerable numbers in the lower altitudes of Langtang National Park. The Bio-diversity Conservation Data Project of the Annapurna Conservation Area (1994) has recorded the goral throughout the southern slopes of the Annapurna range (see also Figure 8).

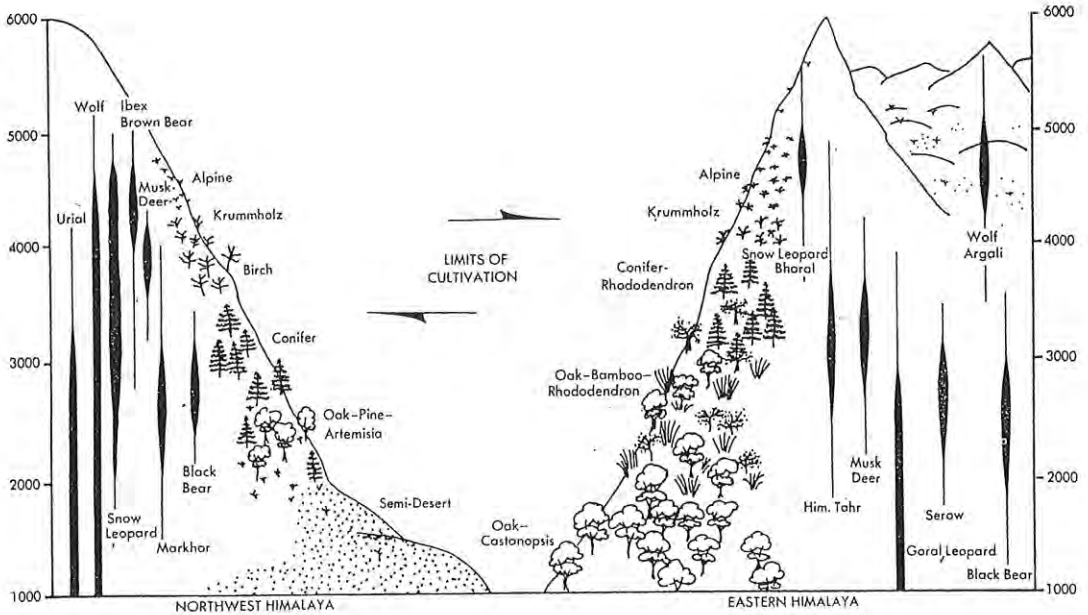


FIGURE 8. The vertical zonation of the vegetation and the altitudinal distribution of large mammals in the northwestern and eastern Himalayas (according to Schaller, 1977, figure 19).

Of all the members of the family *Cervidae* **red deer** once occupied the widest distribution area comprising Europe, Asia and North America. Due to deforestation, overhunting and ever extending usurpation of land by man, the territory has shrunk considerably and red deer has disappeared from regions where they were common. Although very adaptable, their habitat depends on grazing conditions and season, they are mainly inhabitants of forests or grass jungles. Deer are never found in desert and open land. The Kashmir stag for example, now limited to the north side of the valley of Kashmir and some adjacent valleys (Prater, 1971: 287), seldom remains long in one area but roams from forest to find good grazing. Winter is spent at lower altitudes, summer on the heights going uphill as far as the snow-line.

As such, the presence of bones of red deer in an archaeological context always indicates forests or high vegetation where the animals could find sufficient covering.

Like all other deer species **muntjak** also need protection through vegetation and avoids dry steppe biotope. It keeps to more or less thick jungle and comes out to graze in the outskirts of forest or in open clearings (Prater, 1971: 294). Although it occurs up to altitudes of 2.500 m and even higher, it can no longer live in the surroundings of the Dzong Khola valley with its poor cover and scarce vegetation, and therefore has disappeared from the region.

The Bio-diversity Conservation Data Project (1994) reported **Indian wild boar**, *Sus scrofa cristatus*, as occurring in the past in Lamjung area. Now it is supposed to be exterminated as no recent reports are available from the Annapurna Conservation Area where it was presumably found as high as 1.500 m. The jaw bones of *Sus scrofa* (Figure 6) excavated in Khingar from layers of period II show clearly that the distribution area reached further north and probably at higher altitudes, at least during the earlier Middle Ages. Boar require grass or scanty bush jungle or forest. This type of

biotope can be postulated along the Kali Gandaki river from Jomsom northwards before deforestation by people and overgrazing by their domestic stock destroyed the vegetation.

As can be seen from Figure 9 the **Himalayan weasel** at present ranges in the E Himalayas, -mostly above 2.400 m-, and from there east to the northern parts of Burma, Thailand, Laos and Vietnam, most of China, Taiwan also throughout N China, much of Siberia and Japan (Corbet & Hill, 1992: 196). Interesting to note that evidences for the **weasel**, *Mustela nivalis*, are known on the one hand from N Vietnam and at high altitudes in SW China and on the other hand from Afghanistan westwards (Figure 9). The species' apparent absence from the high Himalayas may be due to lack of records especially when considering the fact that *Mustela nivalis* is generally very rare in Eastern Asia.

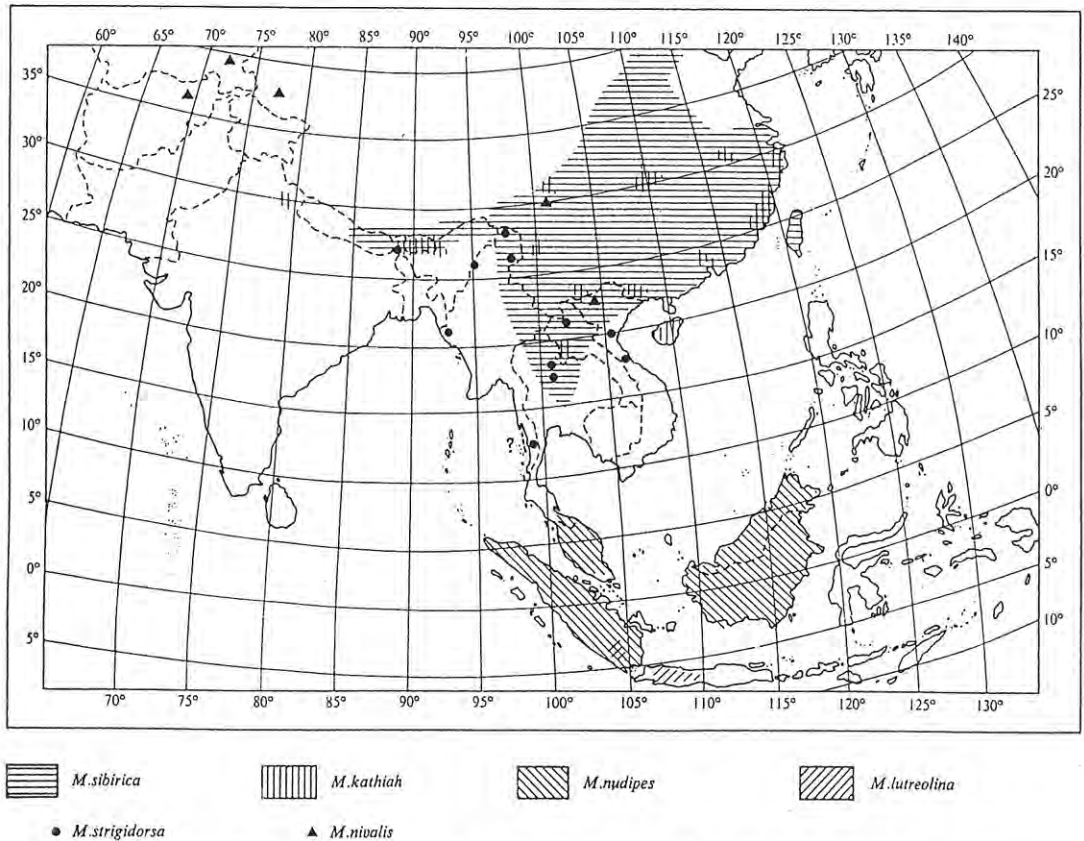


FIGURE 9. Distribution of *Mustela* in the Indomalayan region (according to Corbet & Hill, 1992, map 90).

CONCLUSIONS

Today Khingar lies in a semi-desert environment with little precipitation and scarce vegetation. Apart from willows, mostly poplars are found only in and near the villages and are cultivated and exploited intensively. The natural vegetation includes shrubs of junipers, caragana, rosa, and cotoneaster. This type of biotope is also found around Kagbeni in the Kali Gandaki valley.

The region above Kalopani up to Jomsom is designated as a transition zone with a similar plant cover known for the sub-alpine and alpine characteristics. This area connects the humid type of environment in the south with the dry-arid or tundra type in the north. Two important valleys cross the transitional area, i.e. Manang valley and Kali Gandaki valley (Figure 10). The Manang valley east to the Thorung La and Tilichio himal receives comparatively higher precipitation than the Kali Gandaki valley near Jomsom (200-300 mm/year). As such the Manang valley retains better greenery than the Thakkola valley. Seen zoogeographically, the transition zone acts as a bridge for migratory fauna. The Thakkola passageway seems to represent a better migratory route than the Manang valley (Final Report, 1994).

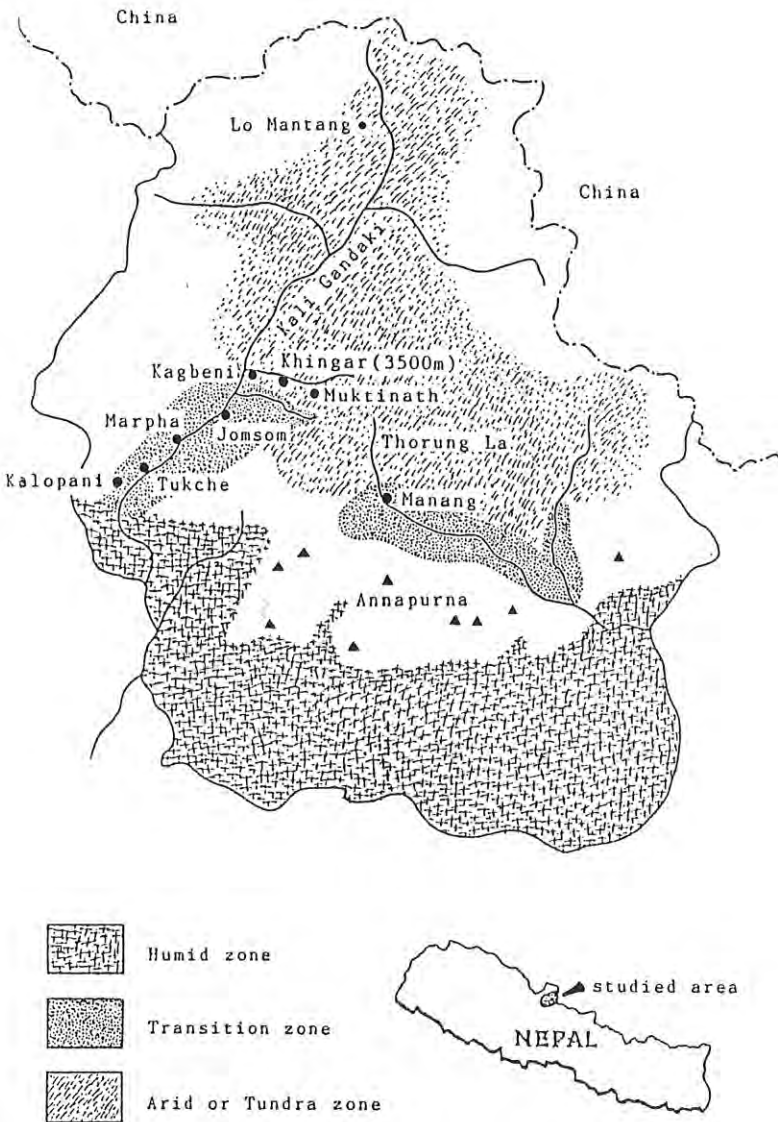


FIGURE 10. Zoogeographical regions for the Annapurna Conservation Area (according to Final Report, 1994, figure 4.2).

The faunal material from ancient Khingar dates back as far as the early Middle Ages or even earlier. So far, the faunal samples yielded seven wild mammal and one domestic species which do not belong to the recent fauna known from the area and which are now distributed either in more southern (tahr, goral muntjak, wild boar and water buffalo) or in more eastern and northwestern regions (red deer, weasels). All eight species mentioned above cannot live under arid or tundra like conditions. Especially big game species such as tahr, red deer and wild boar, need forest or grass jungles with patches of trees where they can find refuge. Judging from their preferred habitat, the assessment is allowed that the land north of Jomsom up to Kagbeni and the Muktinath valley should have supported forests and thickets comparable to those vegetational structures found on the eastern slopes of the Nilgiri himal opposite to Marpha and Tukche. Thus it can be deduced from the fauna identified in ancient Khingar that the sparse vegetational cover of present day is solely the result of human activities, especially the cutting of bushes and trees. Whereas deforestation continued, the soil became exposed to wind and water erosion. The little precipitation did not favour the growing of new wood. Combined with overgrazing by domestic animals, in particular by sheep and goat, one can imagine that all those factors transformed the region into a habitat of arid and sparsely vegetated conditions.

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