

A CHECK-LIST AND SOME NOTES CONCERNING THE MAMMALS OF THE LANGTANG NATIONAL PARK, NEPAL¹

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(With two plates and a map)

INTRODUCTION

The mammals of the Nepal Himalaya are a mixture of species derived from the Oriental (i.e. India and S.E. Asia) and Palaearctic (i.e. Eurasia excluding S.E. Asia) regions. Caughley (1969) noted that there are fewer mammalian species in the Himalaya of central Nepal, for example the Langtang area, than to the east and west. For instance, the red deer occurs in Kashmir and Bhutan and the Himalayan marmot occurs in west Nepal and Sikkim but neither species are present in the intervening range. Ibex, markhor, wild goat and urial occur in the western Himalaya of Ladakh, Kashmir and Kumaon but their distributions stop short of Nepal. Similarly, the distribution of the takin which occurs in the Bhutan Himalaya does not extend into Nepal. According to Caughley (1969) the paucity of species in the central region of Nepal may be 'the result of a forked post-pleistocene route of dispersal from the north'.

In April 1976 the Langtang area was officially established a national park. Encompassing an area of about 1,710 sq km and extending from just 32 km north of Kathmandu right up to the Chinese (Tibetan) border, it is the largest of Nepal's national parks. Altitude varies from 792 m to 7,245 m within which eight vegetation zones, ranging from upper tropical to upper alpine, are present (Dobremez *et al.* 1974).

Between April 1976 and May 1977 the Langtang National Park was surveyed by the Durham University Himalayan Expedition. Although much of the fieldwork was confined to the Langtang Valley, most of the other regions of the park were visited except for the Yangri Khola and the 'restricted' area to the north of Langtang Himal. The following account of the park's mammals is based on the DUHE's work unless otherwise acknowledged.

CHECK-LIST

The mammals which occur in the park are listed in Table 1, together with the altitudinal range and local name (if known) for each species. This check-list is incomplete because the alleged presence of some species awaits reliable confirmation. For example, the jackal (*Canis aureus*) has not been reported but may occur in the park. According to Fleming Jr (pers. comm.) the distribution of this species is extending northwards from the Terai into the Himalayan foothills. The presence of the jungle cat (*Felis chaus*) is likely but unconfirmed. Fox (1974a) mentions that the great Tibetan sheep or nayan (*Ovis ammon hodgsoni*) occurs in the upper Lende Khola in China (Tibet) and that the presence of the wolf (*Canis lupus*) is doubtful. All of these species are omitted from the check-list. Also bats have been seen in the park but no specimens have been caught for specific identification.

There is only one reliable record for the clouded leopard which was seen several years ago north of Melamchigaon (Fleming Jr

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pers. comm.). Some evidence indicates that the snow leopard occurs in the park. Near Gosainkund at 3,900 m, Fox (1974b) saw spoor which he attributed to snow leopard. In June

³ A goth is a temporary settlement which is used by local people during the summer months when the alpine pastures are grazed by their livestock.

1977 Miller and Rice (pers. comm.) saw leopard tracks at 4,540 m in the upper Langtang Valley, about 4 km northeast of Langsisa goth³. This animal may have been a visitor to the park which had crossed a high pass from China (Tibet). Reference to the other larger mammals which occur in the park is made in the mammal survey section.

TABLE 1
CHECK-LIST OF MAMMALS WHICH OCCUR IN THE LANGTANG NATIONAL PARK,
NEPAL

Species	Alt. range (m)
INSECTIVORA	
* <i>Soriculus caudatus</i> large clawed shrew ; chhuchundro ; ?	.. 2,000-3,800
* <i>Soriculus nigrescens</i>	.. 2,000-3,800
* <i>Suncus murinus</i> grey musk shrew ; ? ; ?	.. 1,800
CHIROPTERA	
No records	
PRIMATES	
<i>Macaca mulatta</i> rhesus macaque ; bandar ; priou	.. 1,520-2,440
<i>Presbytis entellus</i> common langur ; langur or lampuchare bandar ; praken	.. 1,520-4,120
LAGOMORPHA	
<i>Ochotona roylei roylei</i> Himalayan mouse-hare or pika ; muse - kharaya ; pakpu khonjin or poo-see	.. 2,590-5,090
RODENTIA	
<i>Dremomys lokriah</i> orangebellied Himalayan squirrel ; lokharke ; shimbo or rham	.. 1,830-3,050
* <i>Callosciurus pygerythrus lokroides</i> hoarybellied Himalayan squirrel ; ? ; ?	.. 1,800
* <i>Rattus rattoides</i> house rat ; thulo musa ; ?	.. 1,100-3,900
* <i>Rattus eha eha</i>	.. 3,000-4,100
* <i>Rattus niviventer niviventer</i>	.. 1,700-2,100
* <i>Mus musculus homourus</i> house mouse ; sano musa ; piezu	.. 3,600
* <i>Pitymys sikimensis</i> Sikkim vole ; ? ; ?	.. 3,600-3,900
<i>Hystrix indica</i> Indian porcupine ; dumsi ; beederee	.. 2,440

MAMMALS OF LANGTANG NATIONAL PARK

TABLE 1 (Continued)

Species	Alt. range (m)
CARNIVORA	
<i>Vulpes vulpes</i> red fox ; rato phauro ; wohprhakpa or wamo	.. 3,350-5,330
<i>Cuon alpinus</i> wild dog or dhole ; jungeli/ban kukur ; parah	.. 2,400-3,910
<i>Selenarctos thibetanus</i> Himalayan black bear ; bhalu ; thom	.. 1,830-2,590
<i>Ailurus fulgens</i> red panda ; hobrey or rato ba sano panda ; telekama	.. 2,440-3,660
<i>Mustela sibirica subhemachalana</i> Himalayan weasel ; daman or Himali weasel ; ringmu	.. 3,050-4,880
<i>Mustela altaica temon</i> pale-footed weasel ; ? ; ?	.. 4,150-4,720
<i>Martes foina</i> beech/stone marten ; dhunge malsappro ; kowar	.. 3,050-3,810
<i>Martes flavigula</i> Himalayan yellowthroated marten ; malsappro ; kukhauri or kowarken	.. 1,830-4,000
<i>Felis bengalensis</i> leopard-cat ; chituwa birala ; ?	.. 2,590
<i>Neofelis nebulosa</i> clouded leopard ; dhuwase chituwa ; ?	.. ?
<i>Panthera pardus</i> leopard ; chituwa ; sengen	.. 1,520-3,050
<i>Panthera uncia</i> snow leopard ; huen chituwa ; cerken	.. 3,900-4,540
ARTIODACTYLA	
<i>Sus scrofa</i> Indian wild boar ; badel or banel ; pha	.. 1,830-3,260
<i>Moschus moschiferus moschiferus</i> Himalayan musk deer ; kasturi mriga ; lawa	.. 3,000-4,330
<i>Muntiacus muntjac</i> muntjac or barking deer ; ratuwa mriga ; kesha or showa	.. 2,290-3,050
<i>Nemorhaedus goral hodgsoni</i> brown goral ; ghoral ; reeda or reegu	.. 1,680-3,350
<i>Capricornis sumatraensis thar</i> serow ; thar ; yha	.. 2,590-3,660
<i>Hemitragus jemlahicus</i> Himalayan tahr ; jharal ; nyang ghin	.. 2,740-5,200

- Notes : (i) Data are based on the records of DUHE (Borradaile *et al.* 1977), except for the asterisked species which refer to Niethammer and Weisser (pers. comm.).
- (ii) English, Nepalese (Mishra and Mierow 1976) and Tibetan names are given in sequence for each species.
- (iii) Altitudinal ranges are based on sightings of animals and on indirect evidence from tracks and faeces.

MAMMAL SURVEY

Information concerning the park's mammals was obtained from members of the expedition and tourists. As the park receives over 2,000 tourists per year (Borradaile *et al.* 1977), notices were displayed along the major trekking routes requesting visitors to report their sightings of mammals to DUHE. Tourists were also questioned whenever encountered by members of the expedition. From these data which are summarized in Table 2 it appears that, in descending order, the pika, common langur and orangebellied squirrel were the most frequently seen mammals in the park. These three species accounted for three quarters of the total number of sightings. Such data provide the visitor with a rough idea of which species he is most likely to see if he visits the Langtang National Park. However, the figures do not truly reflect the relative abundance of each species because they do not account for the relative amount of time spent by the observers in each species' habitat. Information of an anecdotal nature is given below for those species which are listed in Table 2.

Rhesus macaque

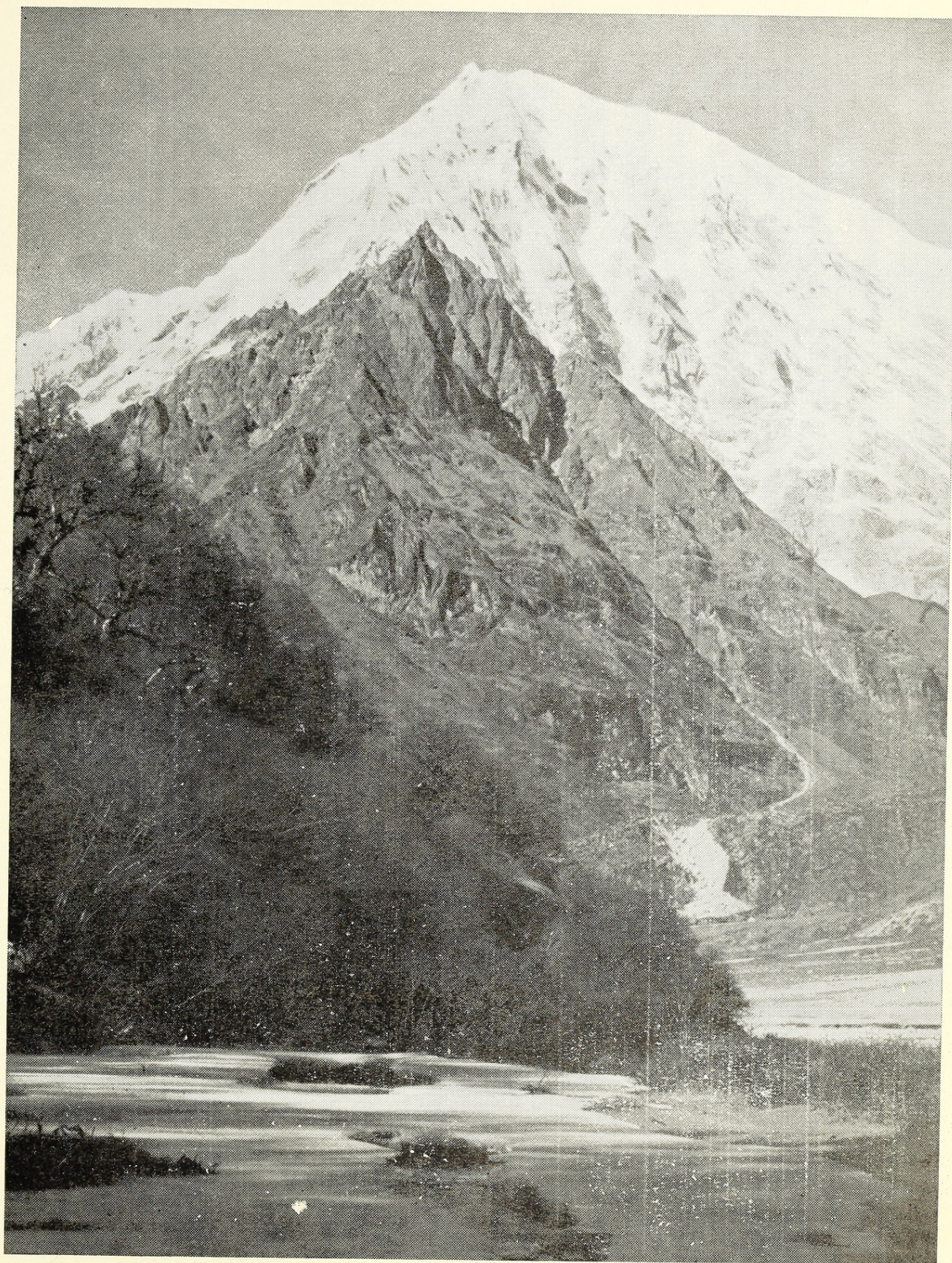
There is some confusion about the distinction between the rhesus (*M. mulatta*) and Assamese macaque (*M. assamensis*). Caughley (1969) 'saw a group of 16 rhesus monkeys (between Manigaon and Ramche) that lacked the rufous colouring on the hind quarters characteristic of the Assam rhesus' but he was not convinced that this form was anything other than a colour phase of the common rhesus. In 1971 Fleming Jr (pers. comm.) identified a group of about 16 Assamese macaques near Bhargu but this species is not mentioned by Fox (1974b). Until the issue is resolved by a detailed comparison of the two species, reference here is only made to the rhesus monkey.

The distribution of the rhesus macaque overlaps with the lower altitudinal range of the common langur but the former is much less common. Groups were seen near Dhunche, Munga, Syabru, Syabrubensi and Timure and in the lower Langtang Valley amidst a variety of vegetation types, including mixed deciduous and *Pinus roxburghii* forest and *Euphorbia royleana* heath. They were not seen in cultivated fields but according to Caughley (1969) they 'feed almost exclusively on crops when in the vicinity of villages'. The mean group size of 9.8 is underestimated because of the difficulty of counting all the members of a group in forested habitat. A lone animal was only once recorded, at 2,440 m near Chingtang; otherwise groups were seen between 1,520 m and 2,130 m. Caughley (1969) observed rhesus macaques 'at 3,800 m in winter when the snow-line was then at 3,400 m.'

Common langur

Langurs were seen in temperate forests and subalpine scrub in the Balephi, Ghatte, Langtang, Melamchi, Phalung and Trisuli Valleys. Solitary animals were seen on 42 (28%) occasions. Maximum group size was 50 but it should be mentioned that Fox (1974b) once saw over 140 langurs in fields adjacent to the Bhote Kosi, just outside the park's boundary.

In the Langtang Valley langurs were usually seen between 1,520 m and 3,510 m. Repeated sightings of one group, which numbered up to 46 animals, indicated that it ranged from below Ghora Tabela (3,050 m) to Langtang Village (3,510 m)—a distance of 17 km. Between July and December the group was often seen around Langtang Village but during the winter and spring months it remained in the vicinity of Ghora Tabela. A lone adult, which probably originated from this group, was seen above Pana goth on 28 September at 4,050 m, above Nubmathang goth on 3 October at 4,020 m



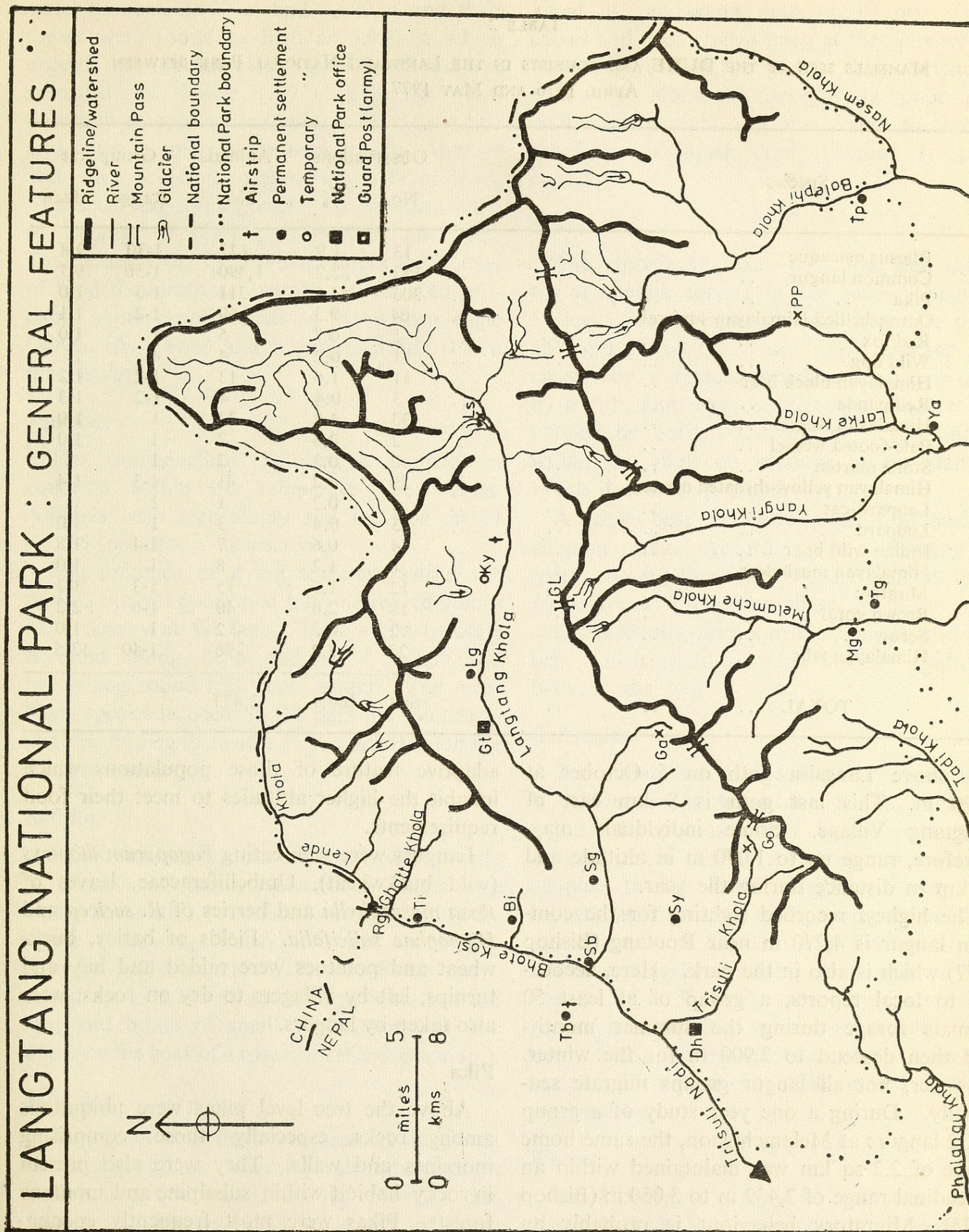
Langtang Lirung (7,245 m), the highest peak in the Langtang National Park, Nepal.
(Photo : Michael J. B. Green)



An adult female tahr which subsequently fell off a cliff, killing itself.



A yearling tahr, probably a male owing to its slight ruff.
(Photos : Michael J.B. Green)



MAP : Based on satellite photographs (Fox 1974b). Drawing by L. J. Borradale.

TABLE 2

MAMMALS SEEN BY THE DUHE AND TOURISTS IN THE LANGTANG NATIONAL PARK BETWEEN
APRIL 1976 AND MAY 1977

Species	Observations		Animals	Group size	
	No.	%	No.	Range	Mean
Rhesus macaque	13	1.9	127	1-30	9.8
Common langur	153	22.2	1,490	1-50	9.7
Pika	303	44.0	311	1-3	1.0
Orangebellied Himalayan squirrel	64	9.3	69	1-2	1.1
Red fox	5	0.7	5	1	1.0
Wild dog	1	0.2	4	4	..
Himalayan black bear	11	1.6	13	1-2	1.2
Red panda	3	0.4	4	1-2	1.3
Himalayan weasel	33	4.8	33	1	1.0
Pale-footed weasel	2	0.3	2	1	1.0
Stone marten	2	0.3	2	1	..
Himalayan yellow-throated marten	29	4.2	41	1-3	1.4
Leopard-cat	1	0.2	1	1	..
Leopard	3	0.4	3	1	1.0
Indian wild boar	4	0.6	7	1-4	1.8
Himalayan musk deer	8	1.2	8	1	1.0
Muntjac	12	1.7	15	1-3	1.3
Brown goral	18	2.6	40	1-6	2.2
Serow	2	0.3	2	1	1.0
Himalayan tahr	22	3.2	296	1-40	13.5
TOTAL	689	100.1	2,473		

and above Langsisa goth on 5 October at 4,120 m. This last goth is 8 km east of Langtang Village. Some individuals may, therefore, range up to 1,070 m in altitude and 25 km in distance during the year.

The highest recorded sighting for the common langur is 4,270 m near Routang (Bishop 1977) which is also in the park. Here, according to local reports, a group of at least 50 animals forage during the summer months and then descend to 2,900 m for the winter. However, not all langur groups migrate seasonally. During a one year study of a group of 32 langurs at Melamchigaon, the same home range of 2.2 sq km was maintained within an altitudinal range of 2,439 m to 3,050 m (Bishop 1975). Migratory behaviour is probably an

adaptive feature of those populations which inhabit the higher altitudes to meet their food requirements.

Langurs were seen eating *Fagopyrum dibotrys* (wild buckwheat), Umbelliferaceae, leaves of *Rosa macrophylla* and berries of *R. sericea* and *Hippophae salicifolia*. Fields of barley, buckwheat and potatoes were raided and hay and turnips, left by villagers to dry on rocks, were also taken by langurs.

Pika

Above the tree level pikas were ubiquitous among rocks, especially those comprising moraines and walls. They were also present in rocky habitat within subalpine and montane forests. Pikas were most frequently encoun-

tered between 2,590 m and 4,880 m and their faeces were found as high as 5,090 m which exceeds the altitudinal range of 3,400-4,300 m recorded by Prater (1971). Sightings were normally of solitary individuals (98%) but two and three animals were seen together on six and one occasion, respectively. Pikas were seen scurrying among rocks, in between bouts of feeding, or sunning themselves on rocks. Undoubtedly the species is an important source of food for martens, weasels, red fox and probably some raptors such as the golden eagle (*Aquila chrysaetus*) and Eurasian kestrel (*Falco tinnunculus*).

Squirrels

The orangebellied Himalayan squirrel is common within the temperate forest zone. Animals were seen singly and in twos on 59 and 5 occasions, respectively.

The presence of flying squirrels within the park is not yet confirmed but one record comes from nearby at Gatlang. Here some trekkers reported seeing locals maltreat a female and her young which had been caught. The most likely species to occur in the park are *Petaurista elegans*, *P. magnifica* and *P. petaurista* (Fleming Jr, pers. comm.).

Red fox

Above the tree line the red fox is widespread; its tracks and faeces were often found here along footpaths. Animals were seen in the upper Langtang Valley on five occasions, between 3,410 m and 4,970 m. Faeces were found up to 5,330 m and always contained the hair and bones of small rodents and on one occasion the beak of a rose finch (*Carpodacus* sp.).

Wild dog

A pack of four dogs was seen in the forest above Khangjima. Elsewhere in the Langtang Valley livestock sometimes fall prey to this species. In March 1977 two young yak were

killed at Buldagaon goth (3,910 m). These calves had been ripped open at the belly which, according to local people, is characteristic of wild dog. North of Tarkeghyang spoor, probably that of wild dog, was found to contain the hair of musk deer (Fleming Jr, pers. comm.).

Bears

The Himalayan black bear was seen within the temperate forests of the lower Langtang Valley. Solitary animals were seen nine times and groups of two twice. One trekker was chased by a female, which was accompanied by a cub, and every year several villagers are mauled by bears. The species is still hunted within the park on account of the damage which it causes to crops.

A brown bear reputedly exists in the Melamchigaon area. According to Fleming Jr (pers. comm.) this form is most unlikely to be *Ursus arctos*. A brown phase, when the white collar is absent, occurs in the Himalayan black bear which could account for any confusion between the two species.

Red panda

This inhabitant of the montane forest zone is seldom encountered due to its nocturnal habits. Its presence may be detected by a distinctive call which is recognized by local people. In the lower Langtang Valley two solitary animals and one group of two were sighted between 2,440 m and 3,050 m. The faeces were easily identified on account of their size (c. 18 × 35 mm), oval shape and dark green colour. They were twice found at the base of *Abies spectabilis* trees in the Langtang and Trisuli Valleys, at 3,660 m and 3,200 m respectively.

Weasels

The Himalayan weasel (*M. sibirica subhemachalana*), with its distinctive rufous coloured

pelage, dark muzzle and black-tipped tail, was often seen in stone walls in the upper Langtang Valley. Weasels in and around the expedition's house in Langtang Village accounted for 26 of the 33 sightings. Animals were only ever seen singly, indicating that they are solitary hunters.

The pale-footed weasel (*M. altaica temon*), which has a light brown body with a yellow throat and belly and white paws, was seen twice amidst alpine scrub and moraine at 4,150 m and 4,720 m, respectively.

Martens

The Himalayan yellowthroated marten was seen in a diverse range of habitats which included terraced fields and forest of the temperate zone and cliffs and scrub of the subalpine and alpine zones. Animals were seen as high as 4,000 m which is above the upper altitudinal limit cited by Prater (1971) who states that 'In the Himalayas they keep to forest limits and are not found above the treeline.' Out of 29 sightings, solitary animals were seen 18 times, groups of two 10 times and a family of three once. Such data indicate that animals often hunt in pairs, reinforcing the particular view held by local people that musk deer are chased until exhausted by pairs of martens. Animals were seen to be active at all times of the day and once around mid-night. They were observed more frequently on the ground (13 times) than in trees (5 times). This is not a true reflection of the amount of time which animals spend on and above the ground because they are more easily seen in the former habitat. Once a marten was seen catching white-capped river chats (*Chaimarrornis leucocephalis*) by the banks of the Langtang Khola. Having caught one bird in its mouth, the marten was then mobbed by three other river chats. Distracted by these mobbers, the marten briefly relinquished its prey in order to chase and jump up after them. Seconds later the prey was retrieved

but then, noticing the observer, the marten dropped this and made a hasty retreat. The river chat flew away, presumably unharmed. The hair of musk deer, seeds of berries and cuticle of insects have been found in the faeces of martens.

The stone marten also occurs in the montane and subalpine zones. Solitary animals were seen twice amidst rocky habitat.

Leopards

In the lower Langtang Valley leopards were seen in open rocky habitat at 1,520 m and montane forest at 2,740 m. In the former instance the leopard was watched on the cliffs above Syabrubensi as it stalked towards where four goral had been feeding. It then took fright because of the excited crowd of spectators which had gathered in the village just below. Park guards saw a leopard in Ghatte Khola and reported another being killed near Syabru in March 1977. Leopard faeces were often found up to 3,050 m elsewhere in the park which indicates that the species is common.

The leopard-cat also occurs in the park. One was seen in the upper Balephi Valley, east of Chingtang Gompa.

Indian wild boar

Within temperate forests this species is common. Solitary animals were seen on three occasions and a group of four once. In the Trisuli Watershed area Caughley (1969) found animals as high as 4,200 m. In view of the extensive damage which this species causes to crops it is often hunted.

Himalayan musk deer

Living in birch, rhododendron and fir forests of the subalpine and alpine zones, the Himalayan musk deer is rarely seen because of its shy nature, crepuscular habits and low population density. Animals were encountered

on seven occasions in the upper Langtang Valley between 3,000 m and 4,100 m and once elsewhere. Twice animals, which may have been feeding, were disturbed around midnight. Fox (1974a) estimated 20-30 animals on the south side of the Langtang Khola, between Palpal and Chhona.

Musk deer are generally solitary except during the rut. Observations of a female, which was repeatedly found within the same area of about 200 m × 400 m, suggest that the home range is small (Fleming Jr, pers. comm.). Animals defecate in certain places on a repeated basis but the role of such latrine sites is uncertain. Natural predators include the leopard, wild dog and Himalayan yellow-throated marten.

It is a well-known fact that the species is hunted for its musk which is used in medicines and cosmetics and is worth about four times its weight in gold. Musk deer populations have been drastically reduced throughout the park and poaching is still rife in the remoter areas. Suitable habitat for the species comprises 6.5% (111 sq km) of the park's area. About one fifth of this habitat was visited (e.g. Panch Pokhari and the upper Langtang, Larke, Melamchi and Balephi Valleys) of which 86% was found to have been trapped within the last three years. Trapping involves the construction of brush barricades, along which gates are placed at intervals and set with sprung nooses to ensnare the animal's head or foot. From 100 to 600 gates may be in operation in a single one kilometre section of valley. Such figures provide some idea of the intense pressures which musk deer face from poaching (Green 1978a).

Muntjac

Muntjac or barking deer occur in the temperate forest zone. In forests animals could be detected by their characteristic dog-like bark but also they were often seen grazing

in clearings and cultivated fields. Along the Bhote Kosi, lower Langtang and Balephi Valleys animals were seen or heard on 15 occasions; solitary individuals were seen eight times and groups of two and three both once.

Brown goral

On the grassy cliffs above the Bhote Kosi and lower Langtang Khola goral are common. Group size numbered up to six but solitary animals were seen on 10 (56%) occasions. A young animal, about three months old, which had been found 'abandoned' by some Tibetans at Ghora Tabela was successfully reared on a diet of rice, tsampa (roasted barley flour) and milk.

Serow

Due to its preference for forest with impenetrable stands of bamboo and its solitary nature the serow is seldom seen. Two single animals were sighted in the lower Langtang Valley. Faeces, which can be readily distinguished from those of tahr or sheep on account of their larger size, were often found in birch, fir and rhododendron forest up to 3,660 m.

Himalayan tahr

A detailed study of the Himalayan tahr was made in the upper Langtang Valley (Green 1978b, 1979). Here, in the subalpine scrub and alpine pastures, two populations of about 170 and 46 animals each ranged over areas of 7 sq km between 3,500 m and 4,600 m. Density varied between 5 and 46 tahr per sq km depending on the habitat and the degree of competition with livestock. Mean group size was 14.8, based on a total of 239 sightings. This figure differs little from the mean of 13.5 which is separately derived from the observations of DUHE and visitors (Table 2). During the thirteen month study period 77 was the largest recorded group of tahr. Groups tended

to consist of adult males or adult females and juveniles of both sexes, except in the rut when groups of mixed sex and age categories predominated. Adult females and juveniles maintained the same home ranges throughout the year, migrating about 700 m vertically on a daily basis. Adult males tended to range laterally. The rut lasted from about November until mid-February; most mating probably occurred in December. Young were born between mid-June and mid-July.

In the lower Langtang Valley about 40 tahr were seen near Buldagaon goth (Treunier, pers. comm.) which suggests a total population size of up to 300 tahr for the Langtang Valley.

Elsewhere in the park a group of 13 tahr were seen on the cliffs above Saraswatikund and 31 were sighted on the slopes above Pemasol goth in the eastern headwaters of the Balephi Khola. Also Fox (1974a) reported that tahr occur in the vicinity of Rasuwa Garhi and Ganesh Kund. The former is the border post with China (Tibet) to which access is restricted and, therefore, could not be surveyed. The latter, a lake at 4,800 m, was visited but no tahr were seen although their faeces were evident.

More recent work has shown that the tahr is exclusively neither a forest animal (Prater 1971) nor an inhabitant of the subalpine zone between 3,900 m and 5,200 m (Caughley 1969). In the present study tahr were seen between 2,700 m and 5,000 m which, together with Schaller's (1973) observations of animals between 2,500 m and 4,400 m, indicates that the species occupies a wider altitudinal range than was previously believed.

CONSERVATION

A national park such as Langtang, within which there are a large number of residents, poses particular problems because the conservation of the wildlife must be reconciled with

the needs of the local people. In view of such a dilemma it has been recommended that the park should be zoned into areas of differing conservation status (Borradaile *et al.* 1977). Certain 'protected natural areas' should be set aside for the preservation of wildlife whereas other 'cultivated landscapes' should be designated for use by residents to meet local timber, fuelwood, agricultural and pastoral requirements. 'Protected natural areas' amounting to 673 sq km (about 40% of the park's area) have been proposed in order to ensure that a representative sample of the park's wildlife will be completely protected from human pressures.

In the case of the park's mammals some five species merit particular attention because their status is 'threatened' according to the Red Data Book (IUCN 1974). These are the wild dog, leopard, clouded leopard, snow leopard and the Himalayan musk deer.

Although hunting mostly ceased after the park's establishment, it still persists in the case of certain species. However, a distinction should be made between those species which are killed because they pose a threat to crops, livestock or human life and those which are hunted for their meat, hide or other valuable assets. The former is justifiable—the latter must be curbed.

Species which fall into the first category include the rhesus macaque, common langur, Himalayan black bear, Indian wild boar and muntjac, which raid and damage crops extensively, and the wild dog and leopard which occasionally prey on livestock. In the daytime monkeys are the principal marauders. For religious reasons they are never killed but may be chased away from fields. At night cultivations are vigilantly guarded from nearby machans. Fires and noises are made to frighten away bears in particular. However, such measures may sometimes be inadequate and so the authorised killing of persistent marauders

may be necessary within 'cultivated landscapes'. Such action would be difficult to justify in the case of wild dog or leopard in view of their 'threatened' status. It would be in the interests of good public relations for the park authorities to consider either a scheme of compensation to local people for livestock killed by these predators or to trap them for relocation elsewhere in the park.

The only species to fall within the second category is the Himalayan musk deer. Poaching for musk has already been discussed. Unless effective measures are taken to curb such illicit activities, populations will cease to be large enough for breeding to be viable and the species will become extinct, not only in Nepal but throughout the Himalaya.

Apart from hunting, most mammalian species are adversely affected wherever their habitat is utilized by man. For instance, the brown goral, Himalayan tahr and serow compete with livestock for fodder. Fortunately, from a conservation viewpoint, certain areas are too

precipitous to be reached by domestic animals but are accessible to these more agile wild ungulates.

Generally speaking, provided that sufficient habitat can be conserved and poaching is stopped, no specific measures need to be taken to preserve the mammalian fauna because it will look after itself.

ACKNOWLEDGEMENTS

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