Chapter 15

Musk Deer: A Story Of Himalayan Survival

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Inspired by mountains to study musk deer

Brought up in the East Africa, where I became enthralled by its 'big game', Mount Kenya was the first mountain that I ever set eyes on - often elusive but fleetingly glanced through the clouds. Those early childhood inspirations led me to the Himalaya, first in Nepal and later India. Here I took up the challenge of trying to match my skills and endurance with some of its little-known ungulates in order to understand their lifestyles and explore my fascination for large animals in such a demanding and stunningly beautiful environment.

It was in Nepal that I first saw a musk deer while wading through knee-high rhododendron scrub in the upper Langtang Valley. I watched her for over ten minutes as she fed from crustose lichens - a spectacular and memorable sighting of her perched on a rock, silhouetted at dusk against the pink 6,391 m fluted peak of Gang Chenpo. That was my only sighting of musk deer during a fifteen-month survey of Langtang National Park.

Elusive and solitary, like many mountain peaks, the musk deer is the most valuable flagship species of animal or plant to be found in the Himalaya: its musk[1], produced only by males[2], is worth up to four times its weight in gold (US $ 45,000 kg^{-}). Its value is reflected in the tremendous lengths that hunters will go to catch musk deer. It was in 1976, while trekking through the little frequented Larke Khola in Langtang National Park, that I encountered several kilometres of trap-lines where the rhododendron and other scrub had been cut to make one-metre high barricades of brushwood that ran from the river up the valley sides to the alpine pastures, intersected by others traversing the slopes. Snares[3] were set in openings through the barricades at 10-30 m intervals and, having removed 30 from along a 350 m stretch, I estimated there to be 100-600 snares /km^2 - more than enough, surely, to wipe out that musk deer population within a few years.

Most hunting is done by local hill people and, although they receive only a fraction of the international market price of musk, their revenue from one musk gland or pod

[1] Musk is a secretion used by adult males for scent-marking. Highly valued for its scent, fixative, and medicinal properties, it has been used in traditional medicines and perfumery from as far back as 3,500 BC. Traditionally it is obtained by killing the animal and removing the musk gland (25 g average weight), depicted here, but musk can be milked from live males, as practised in Chinese musk deer farms.

[2] Males can be distinguished from females by their canine tusks. These weapons are used in displays and fights between males, performing a similar function to the antlers of true deer.

[3] Snare set for musk deer, with brushwood barricade on either side. This form of hunting is indiscriminate, killing females and juveniles as well as other wildlife species.

can equate to their annual cash income. Just how the musk deer is able to able to survive such intense hunting pressures, while living in seemingly inhospitable environments and in competition with other mountain ungulates became more apparent during my subsequent three-year study (1979-81) of the Himalayan species (*Moschus chrysogaster*) in Kedarnath Wildlife Sanctuary[4].

The musk deer proved to be a particularly elusive animal to study, being small (body weight about 10 –13 kg) and solitary, and taking refuge in the dense undergrowth of montane forests and sub-alpine scrub during the daytime. This was reflected in my observations, limited to 151 sightings (totalling about 64 hours) or about one sighting for every 10 hours in the field. Most observations were made at night, with the aid of a nightscope, when musk deer often emerged from hiding to feed on the alpine pastures. Telemetry would have helped immensely but I was singularly unsuccessful in capturing any animals to fit radio-collars, despite trying the traditional brushwood barricade but fitted with box traps, stalking with a dart-gun and driving animals into nets. However, tracking in snow during winter provided information about home ranges and regular monitoring of latrines, sites where musk deer repeatedly defaecate, told me much about their means of communication. I also collected hundreds of samples of pellets to find out what musk deer eat.

Coping with hunters and natural predators

My observations confirmed that musk deer lead very solitary lives: only once did I ever encounter two when an older male, judging from its longer canines, was seen pursuing a younger one at night. They occupied adjacent territories and must have been engaged in a border dispute. The fact that I never saw females accompanied by their young, combined with the knowledge that the young become independent of their mothers by about six weeks, is further evidence of their solitary behaviour - a characteristic of small forest ruminants that rely on being inconspicuous to avoid predators. This becomes even more crucial in winter when snow blankets the ground layer of vegetation that otherwise typically affords good cover for musk deer. But in snow conditions they are adept at remaining concealed in rhododendron thickets during the day, not easily detected even by the trained eye. Once I followed the tracks of a female in deep soft snow to within 9 metres of where she lay under a bush in a gully without seeing her. The animal flushed only after I had unknowingly retreated from her sight, behind a rock.

Implicit with such solitary behaviour is the rapid onset of sexual maturity. Musk deer attain most of their adult body weight by six months and become sexually mature by 18 months of age. Females are

The study area, complete with a wooden hut built by the Uttar Pradesh Wildlife Preservation Organisation, is located just below Tungnath Temple in evergreen oak forest and birch-rhododendron scrub. It subsequently became a popular site for fieldwork and training with researchers, students and trainees of the Wildlife Institute of India.

capable of breeding in their first year and in the forest musk deer (*M. berezovskii*) and Siberian musk deer (*M. moschiferus*), but not the Himalayan species, the incidence of twins is higher than single births. Such reproductive strategies have undoubtedly enabled musk deer to combat the tremendous hunting pressures experienced over centuries.

Hunters use a variety of techniques to kill musk deer, which includes snaring and shooting, the latter sometimes aided by dogs. There is nothing within the musk deer's repertoire of anti-predator strategies to counter the use of brush barricades in conjunction with snares, unless the animal is able to learn to recognise the danger of snares, which seems particularly unlikely for a solitary species. But the musk deer's solitariness and ability to remain concealed, often in dense scrub on precipitous terrain, equip it with some chance of evading hunters with guns.

Musk deer usually take flight when approached to within 30 metres but often then stop in their tracks to look back and, presumably, take stock of their situation. While this trait may help prevent animals being attacked by natural predators, it does provide the hunter with an extra chance of a shot. In snow conditions, however, musk deer have a considerable advantage over both hunters and natural predators: it's dew claws are enlarged, helping to spread its body weight over a larger surface area and thereby minimising sinking in soft snow. Wading knee-deep through snow, I found that musk deer never sank more than 26 cm and usually only about half this depth.

Natural predators in the Tungnath study area include both common and snow leopard (*Panthera pardus* and *P. uncia*), fox (*Vulpes vulpes*) and Himalayan yellow-throated marten (*Martes flavigula*). The hair and hoof remains of musk deer were found in leopard and fox scats but none of 12 scats of martens. However, there were two instances of juvenile musk deer being attacked by martens, which more often than not were seen hunting in pairs and small family groups. Leopard and snow leopard were both seen in the study area but it was impossible to differentiate between their scats.

I shall never forget my sighting of a snow leopard in March 1979. My attention having been attracted by the barking from a group of six common langurs (*Presbytis entellus*) on some cliffs above the forest level at about 2,740 m, I then saw one member of the group of six being pursued by a leopard. Closer inspection, aided by a telescope, showed this to be a snow leopard with its characteristic pale to mid-grey coat and squat face. Remarkably, after the snow leopard had given up chasing its quarry and perched itself on a nearby rock, the langurs continued to bark from just 10 metres away and on occasion to charge to within 5 metres of the snow leopard. This continued for about half-an-hour after which the snow leopard moved off up a ravine, out of sight, with the langurs following it. Part of the strategy of the snow leopard would seem to be to wait patiently until a langur ventured too close. This is certainly born out by my analysis of leopard scats which showed langur to be the single most important prey item (21% by volume), followed by goral *Nemorhaedus goral* (18%), Himalayan tahr *Hemitagus jemlahicus* (16%) and serow *Nemorhaedus sumatraensis* (11%). Musk deer registered only 2% of the total volume of 28 leopard scats.

Keeping in contact with each other

Given their solitary nature, how do musk deer communicate with each other? Musk deer are essentially sedentary and, based on mapping their tracks in snow, range over areas of 15-32 ha. Males are territorial: their home ranges do not overlap with each other but they do overlap with those of females. Thus, animals may come into contact with each other from time to time by means of visual cues, but the likelihood is reduced by the dense nature of their forest or scrub habitat. Moreover, vocalisation, as a means of long-range communication, is presumed to be incompatible with an anti-predator strategy that relies on remaining inconspicuous.

Scent is the musk deer's key means of communication - droppings, urine and, in the case of males, secretions from the musk and caudal (tail) glands are used as scent marks. There is also the interdigital gland, found in the front feet of the male, but its role in communication remains unknown.

A striking characteristic of musk deer is the way in which it uses specific sites for defaecation. Over 58,400 pellets were counted from one latrine, sheltered from the rain by an overhanging rock, and I estimated that it must have been used at least 169 times over a period of at least seven years. I was amazed by the musk deer's ability to precisely relocate its latrines, reflecting its intimate knowledge of its home range. I once tracked an individual return to and use a latrine that had not been used for ten months. Not only did the latrine lie beneath 40 cm of snow but all the old pellets had long since disintegrated during the intervening monsoon.

By fortnightly monitoring the use of 120 latrines over a 27-month period, I found that their use is seasonal and peaks in December at the height of the mating season (rut). Particularly intriguing is the musk deer's habit of often covering its pellets with leaf litter, soil and other adjacent debris during this season of peak use. This is the driest time of year and I concluded that musk deer deliberately try to keep their pellets moist and, therefore, smelly. There was no evidence from their distribution to suggest that latrines served as boundary markers. In fact measurements of pellet weights suggest that some latrines were used by exclusively by one individual while others were used by several. The extent to which latrines were shared corresponds to the degree of overlap between individuals' ranges. There was evidence of males sharing some latrines with females but not other males. Thus, latrines are communication centres providing information on the identification, whereabouts and perhaps even the reproductive condition of the occupant(s) of a particular home range or set of overlapping home ranges.

Surprisingly, given centuries of use of musk by societies and the farming of musk deer by the Chinese since 1958, very little is understood about the role of musk in scent-marking. The musk gland lies in the male's genital region, opening just a few millimetres anterior to the urethra. It seems that musk is used to scent the male's urine. While tracking males in winter, I noticed that the snow was often stained pink or red from their urine and had a sweet scent when warmed in the hands, whereas the urine of females stained the snow amber and did not smell sweet.

The caudal gland of the male occurs as a thickening at the base of the short (*ca*. 2.5 cm) tail. It exudes a viscous yellow secretion, with an offensive odour, from pores either side of the tail. Typically, male musk deer rub the base of their tail against the stems of bushes or dried herbs and grasses, which results in the tail being naked except at its end. I observed such pasting behaviour on a number of occasions. A more detailed study in Russia has shown that male musk deer mark in this way throughout their home ranges.

While poorly understood, it is clear that musk deer used a variety of scents to communicate over time and space. Over shorter distances, acoustic signals also play a role. For example, I have heard a young musk deer bleating whilst in search of its mother, and when alarmed musk deer often emit a double hiss. Most extraordinary was the trill that I heard one night, reminiscent of peacock quivering its fanned feathers, after seeing a young male suddenly get up from resting and walk quickly out of sight towards the border of his home range. More amazing still was the whiff of musk, distinctive from its sweet scent, which reached me a few minutes later. I concluded that this male was seeing off another older male, known to occupy the adjacent home range.

Finding enough quality food

Being small animals, musk deer have relatively high-energy requirements, and, therefore, are much more selective in their choice of food than other larger Himalayan ungulates. Due to the difficulty of observing animals in daylight, I resorted to identifying plant fragments from their droppings using a microscope. I also analysed the chemical composition of the droppings to ascertain the nutritional quality of the musk deer's diet. Essentially, musk deer are browsers and select easily digestible, nutritious foods that are high in protein and energy (sugars) and low in fibre. Forbs (i.e. herbs excluding grasses) and woody plants constitute the bulk of the diet in summer and winter, respectively. During winter, when food is in short supply, musk deer survive on poorer quality diets. Where available, musk deer may switch to feeding largely on arboreal lichens (*Usnea* spp.), which are low in protein but high in energy. Evergreen foliage, such as *Rhododendron campanulatum*, and arboreal lichens may be the only readily available food plants during winter when the snow may be a metre deep. This was certainly true in parts of the study area and, while tracking musk deer in snow, I often came across rhododendron bushes whose leaves had been eaten - up to 97 leaves per feeding bout.

The availability of food in winter is obviously crucial and, together with hunting, I believe explains why musk deer are no longer found in some parts of their former distribution. Overgrazing by domestic livestock is a widespread problem throughout the Himalaya. It can result in severe depletion of the forest understorey, leaving no shrubs for musk deer to browse during winter when snow covers the ground.

Competing with other ungulates

Another interesting feature of the musk deer is its thick, coarse, wavy hair, which under the electron microscope is like a honeycomb of air-filled cells. The hair has a plastic-like appearance and seemingly is waterproof. No doubt, these modifications provide extremely good insulation from the cold, both in snow and rain conditions. Its ability to live in cold

conditions and move easily through deep, soft snow provides it with a competitive advantage over other ungulates that share its habitat.

Goral, serow and sambar also reside in the Tungnath study area, but there is very little overlap in their use of habitat and in their diet. These ungulates, like musk deer, are essentially solitary, forest-dwellers that are active both during the day and at night. Sambar descend to lower altitudes in winter, leaving only three ungulate species to compete for resources during this critical season. While musk deer and goral are most similar in their use of the habitat in terms of vegetation cover, slope and to a lesser extent aspect (musk deer tend to use more northerly aspects than goral), their diets are the most different. Grasses make up the bulk of the goral's diet in spring and summer. During winter, when herbs are generally snow-covered other than on south-facing cliffs, the species switches to bamboo and to a lesser extent tree (oak) and shrub leaves. The only other ungulates found in the study area were wild boar (*Sus scrofa*) and Himalayan tahr[5]. Evidence of the former was rare, indicating that it was not a significant component of the ungulate community. Tahr inhabited the cliffs along the eastern edge of the study area and, sometimes, small herds emerged to graze the alpine pastures. My previous research in Langtang had shown their diet to comprise mainly grasses and other herbaceous plants.

Of ungulates, men and mountains

India shares with a number of other countries the world's greatest mountain system, the Himalaya, and with them the responsibility to safeguard their natural resources and the cultural heritage and lifestyles of their inhabitants. The challenges are immense, the more so because mountains are particularly difficult environments to manage, being fragile in nature and demanding to work in for even the most intrepid.

Mountains bring out the best and worst in human nature, challenging and inspiring us to ever greater heights of physical feats and depths of personal development, while also providing the battle ground for ethnic and international conflicts. That 23 of today's 27 conflicts are taking place in mountain environments casts a dark shadow on this International Year of the Mountains, but says something about their enormous importance and value to societies around the world.

My own respect and love of mountains matured quickly through my work with tahr on an alp overlooked by the 6,581 m peak of Langtang II. Most of my limited skills in rock climbing were acquired out of necessity during my meagre attempts to keep track of these agile mountain goats. One afternoon I nearly came unstuck. Intent on following a herd of 21 tahr, I followed their route along a narrow ledge. Next I began to traverse a rock face but ran out of handholds. Looking down I realised the enormity of my situation - a sheer drop of perhaps a hundred metres. My arms and legs began to tremble, panic began to take hold me, and I knew that I only had a minute or two before losing all my strength. The way back was probably further than my strength would last - after a moment of prayer to regain my composure, I resolved to venture upwards, clinging somehow with all of my

[5] Himalayan tahr - the ruff is well developed in adult males.

body onto the grain of the rock and aided by the odd grass tussock and wodge of moss. My resolve bore fruit and I vowed never again to be led astray by tahr!

That memory came flooding back ten years later when trying to reach Nanda Devi (7,832 m)[6]. I had admired this peak from afar for three years while studying musk deer. My chance to get a closer peep came in 1987 when I was asked by IUCN-The World Conservation Union to help evaluate the nomination of Nanda Devi National Park for World Heritage status. Not only was I thrilled by the prospect of seeing the magnificent glacial basin, ringed by such other famous peaks as Dunagiri (7,066m), Changabang (6,864 m) and Trisul (7,120 m), but I also hoped to see another Himalayan ungulate for the first time - the so-called blue sheep or bharal (*Pseudois nayaur*). Access to this natural sanctuary is difficult and our route via Dharansi Col at 4,250 m involved a short section where the trail is narrow and hugs the side of the cliffs for 100 m or so. The frozen trail was covered in 20 cm of snow and, unprepared, we had no rope to fix to the pitons left by previous expeditions. Anyone slipping from the trail would have tumbled down the smooth rock face and then dropped a thousand metres towards the Rishi Gorge. My previous sobering experience with tahr got the better of my ambitions and so I slowly turned my back on Nanda Devi. It was a wretched decision but made easier because on this occasion the lives of others were also at stake - others who trusted me.

[6]View from the study area of India's second highest mountain, Nanda Devi, on the extreme left and Trisul to the right of centre.