

## Differences in the ecology and behaviour of reindeer populations in the USSR

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*Abstract:* The population differences in ecology and behaviour of reindeer (*Rangifer tarandus* spp.) is closely paralleled by the characteristic features of reindeer husbandry which reveals the close relationship between behaviour and husbandry. The western portion of the reindeer husbandry region in the USSR is vast. The reindeer are maintained on a semi-loose basis; the herd is scattered over the range; the social activity of the reindeer is lower; the herdsmen gather the herd using dogs, the herdsmen migrate together with the herd during the summer, grazing the herd in the vicinity of the tent for 2-5 days at a time. In the eastern portion of the region (Yakutia, Chukotka, Kamchatka), the ranges are more restrictive; the reindeer are grazed in a compact mass in summer; their feeding and movement are rigidly regulated; their social activity is high; the herd is gathered in foot without dogs. In summer, herdsmen follow the herd with light tents, the place of grazing being changed almost daily. In the taiga reindeer are raised mostly for transportation, although the hides and meat are also important; the reindeer are bigger, tamer and can be used for riding. The herds are small and the management of them is aimed at retaining the reindeer near home or the camp; migrations are short; often forest reindeer husbandry is of a sedentary nature. Attempts to change the pattern of reindeer husbandry and the methods of herding are not always successful. The harmony of environmental conditions, morphology, physiology, ecology and behaviour of reindeer and methods of husbandry are more easily disrupted than altered.

**Key words:** reindeer, wild, domesticated, USSR, behaviour, ecology.

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There are sharp distinctions between tundra and forest forms of reindeer (*Rangifer tarandus* spp.) in the USSR. The tundra reindeer include the Novaya Zemlya (*R.t. pearsoni*) and Lapland (*R.t. tarandus*) subspecies, and the Siberian tundra reindeer (*R.t. sibiricus*) which may be divided further into regional forms: the Taimyr-Bulun, Yano-Indigirka and Novosibirsk islands (Egorov, 1971). Flerov (1952) and Sokolov (1959) divided forest reindeer into Siberian (*R.t. valentinae*) and Okhotsk (*R.t. phylarchus*). Egorov (1971), Vodopyanov (1970), Stremilov (1973) and Mukhachev (1981), however, inferred from their studies that the forest reindeer of Evenkia, Trans-Baikal Territory, Southern Yakutia and Far East are the same subspecies. Domestic reindeer are sharply distinct in conformation and coloration and their morphological and ecological characteristics vary regi-

onally. Like their wild conspecifics, regional variation in domestic reindeer may be explained by environmental conditions.

The present paper is based on the author's personal studies in 1962-1965, 1966, 1967, 1969, 1980, in Murmansk Region, Taimyr, Wrangel Island and Kamchatka as well as published data.

### Population differences due to peculiarities of the environment

Differences in ecology and behaviour of reindeer from different populations are revealed by habitat preferences. Reindeer avoid cliffs and talus slopes, characteristic of the ridges of Eastern Siberia and the Trans-Baikal Territory. The tundra reindeer migrating from Taimyr to winter taiga pastures in Evenkia and the Putoran Mountains do not ascend the goletzes (alpine tundra - *Note:* all materials appearing in brackets

are editorial additions) beyond the mountain zone, because of the mountain wastes (rock barrens). Near Lake Ayan (Putoran Mountains) where such mountain wastes reach the water, bulls detoured the obstacles by walking uphill, while cows swam around the slopes along the lake shore (Lineitzev, 1983). Sobansky (1981), however, noted that reindeer dwelling on the uplands of Altai readily cross talus slopes.

Sobansky (1981) recorded two different reindeer populations in Altai. The northern population uses ranges at an altitude of 400-1500 m, where snow cover ranges from 130 to 250 cm. Those reindeer prefer the dense coniferous forests, where they feed on arboreal lichens, despite the availability of clearings, burns and felled areas.

The southern Altai population uses alpine tundra (2500-2700 m) where reindeer moss (*Cladonia rangiferina*) is abundant and the snow is only 50-70 cm deep. Those reindeer readily move downhill to the taiga where arboreal lichens are plentiful. Reindeer in the Trans-Baikal Territory avoid regions of sharp alpine relief and prefer areas of gently-rolling topography (Vodopyanov, 1970).

The taiga zone has richer reindeer moss pastures and more accessible green feed. The greater abundance of food is likely responsible for the larger size of forest reindeer compared with tundra conspecifics. Another reason is that reindeer migrate south 5-7° latitude where snow melts 20 days earlier, and the autumn is later, so green vegetation is available for 40-50 days longer. In the forest, mushrooms are more abundant.

Young tundra reindeer transplanted to forests grow more rapidly. The metapodia respond the most rapidly to physiographic changes and migration conditions (Egorov, 1971), hence, forest reindeer have longer legs. Although the characteristic conformation is reached at 3-4 years of age, reindeer continue to grow until 5-6 years old when ossification is complete. The transplant of Murmansk tundra reindeer aged 1-2 years to the forest zone of Karelia resulted in an increase in size (Segal, 1962). Druri (1952) also reported that after transplantation to the forest, tundra reindeer become taller with longer legs, a more compact body and a better developed chest.

Forest reindeer have a darker coat and smaller antlers than their tundra conspecifics. The

terminal tines of antlers from forest reindeer are bent inside while supraocular tines are bent backward, particularly in cows. The antlers of forest reindeer are shorter because of the flat lateral and antero-posterior curve of the main beam. According to Egorov (1971), these features are particularly useful in the forest life. The European forest reindeer (*R.t. fennicus*) is also characterized by a flattened shape of the antlers (Sokolov and Chernyavsky, 1962). Reduced development or absence of antlers in females is relatively common (up to 25%).

Reindeer in the taiga eat more lichens (terrestrial and arboreal) and fewer graminoids than tundra reindeer. The diet of some populations of tundra reindeer (Novaya Zemlya, Malozemelskaya tundra, Yamal) is 40% or more green vegetation in winter (Sdobnikov, 1935, Aleksandrova, 1937; Avramchik, 1939). Nevertheless, previously more importance was attached to feeding on lichens such as reindeer moss in winter, as the very existence of reindeer was thought to be based on a reindeer moss diet. Correspondingly, under a program for range management optimum numbers of reindeer were estimated (Sochava, 1934; Andreev, 1940, 1948).

In the 1960s, the actual numbers of wild and domestic reindeer considerably exceeded the estimated numbers in some areas, with no detriment to the ranges. Syroechkovsky (1975) accounted for this phenomenon on the Taimyr, by describing differences between the diets of domestic and wild reindeer. In the latter, reindeer moss was only 30% of the winter diet, and green plants were 70%, a pattern which was the reverse in the diet of domestic reindeer (Andreev and Galaktionova, 1983).

Further observations have revealed that as the domestic ranges deteriorated the reindeer increased their feeding on undersnow green plants and dry herbs. On Chukotka, a range management program run in 1950-1953 and in 1976-1979 revealed that, although the biomass of lichen feed was halved, the number of reindeer increased (Arefyev and Chechunov, 1981).

Comparison of the feeding of domestic reindeer of different breeds can shed light on the time and number of generations required to develop a preference for green plant consumption in winter. The Yakutia population is segregated into three groups: Koryak, Evenki and Khargin. The Koryak reindeer are small and thin but wiry and strong, quick and hardy and

good draft animals. The Evenki reindeer are light-coloured, big, rough and hardy animals used for riding by hunters. The Khargin reindeer are dark-coated, fleshy, with a big head, thick legs and antlers. They are bred for meat, lard and for pulling heavy loads (Kokoring and Soskin, 1984).

The Khargin reindeer are of Chukotka origin and have different foraging habitats than the Evenki reindeer. The Khargin reindeer graze intensively, sometimes eating the vegetation to bare ground. The Khargin reindeer eat more green plants in winter compared with the Evenki reindeer and lose less weight than the Evenki reindeer (by 25-30%) during the winter. At the beginning of winter, the Khargin reindeer diet is 21% reindeer moss, 53.8% green feeds, while that of the Evenki reindeer is 56.0% reindeer moss and 21.8% green feed (Rumyanzev, 1976).

The Khargin reindeer developed a feeding pattern as a result of long-term maintenance on ranges with little or no reindeer moss. By contrast, the Evenki reindeer are raised on reindeer moss-rich forest ranges. The Chukchi exclusively hunted wild reindeer as late as the turn of the 18th century, whereupon they acquired reindeer husbandry from Koryaks. After they turned to reindeer husbandry, they moved to Yakutia with their reindeer which were already different in conformation, feeding habits and behaviour from their Koryak ancestors. In Yakutia, the Khargin reindeer found themselves alongside Evenki reindeer which were raised in the forests of the Okhotsk Sea coast and differed from their Chukotka conspecifics.

On the Chukotka itself, two reindeer breeds are now distinguished: Chukotka and Evenski. The major ranges of Chukotka have a harsh climate: in winter, strong winds blow and it may warm up unexpectedly to form a snow crust. The summer is cold, with few blood-sucking insects. Lichens are few and the major forage during the year is sedges, dwarf willows (*Salix* spp.) or birches (*Betula* spp.) and in drier areas, grasses and forbs. Up to 20% sedges remain green under the snow (Ustinov, 1956).

Characteristically, the tendency of Chukotka domestic reindeer to eat little reindeer moss in winter has become more pronounced over the last 20 years. The wild reindeer of Chukotka, which migrate south to forests have, however, retained their preference for reindeer moss (Pomishin, 1981)

Little use of reindeer moss is also characteristic of reindeer dwelling on the islands of Novaya Zemlya and Novosibirsk. During the whole year, reindeer feed on grasses and sedges but rarely on dwarf willow (Egorov, 1971)

Consumption of reindeer moss is an important species-specific adaptation of the reindeer. The enzyme lichenase in their stomachs promotes the scarification of the carbohydrate lichenine (the main component of reindeer moss). The morphology of the teeth (Sokolov, 1959), the thin intestines and their larger size compared with other ruminants (Akaevsky, 1939), the hoof structure of the front legs adapted to digging up the snow (Tarasov, 1956) - all these features indicate that reindeer are adapted to consuming a forage for which it barely competes for with other animals.

Forest reindeer also have characteristic feeding patterns. In Yakutia, reindeer gather in groves of *Chosenia* (willow) along river beds to feed on horsetails (*Equisetum* spp.) which do not freeze. In Tofalaria, reindeer eat long-rooted onion (*Allium schoenoprasum*) on a mass scale as early as February while the Stanovoy Ridge reindeer, typically eat horsetails, the major source of protein, which they find at river shallows and near the ice. During the first half of May and the first half of June, larch needles (*Larix daurica*) are consumed in relatively large amounts (up to 40% of the gut content) (Vodopyanov, 1971, 1975; Pomishin, 1972).

In a number of regions, moss is important - up to 36% in the Putoran Mountains (Michuring and Vakhtina, 1968) and up to 15% in Altai (Shaposhnikov, 1955). Between 24 and 39% of the diet of domestic tundra reindeer is moss but possibly only wild reindeer are adapted to feeding on moss (Michuring and Vakhtina, 1968).

Forest reindeer suffer from mineral nutrient deficiency, which Segal (1962) relates to the small amount of undersnow green plants in their forage and also to leached moor soils. Presumably, indigenous forest reindeer are better adjusted to salt deficiency compared with the reindeer which came from the tundra. In Karelia 50 - 60% calves born by cows which came from tundra regions of the Murmansk Region to the forest part of Karelia died.

In the mountain regions of Siberia, reindeer regularly visit natural areas of loamy solonchic soil and in March the reindeer are concentrated

on mineralized ice. In the Trans-Baikal Territory, reindeer eat the contents of the middens of flying squirrels (*Pteromys volans*) at the base of trees, where frozen masses of feces and urine accumulate (Vodopyanov, 1971.)

The patterned use of space is not only and adaptation to environmental factors but also to the history of the development of the behaviour of populations and the passing on of traditions from generation to generation. I regard as spatial structure the use of (annual) home ranges and seasonal ranges, commonly including several home ranges and also major migration routes.

The USSR has many small reindeer populations, which find their requirements in a relatively small space and have only short migrations. In the Trans-Baikal Territory, in Sayany and Altai, reindeer migrate less than 50 km. Rarely do they move from one mountain system to another and migrate up to 150 km (Vodopyanov, 1970; Sokolov, 1983). In Sayany, during winters of shallow snow, reindeer stay on small home ranges in the taiga. After the snow is crusted, the reindeer move uphill to the subalpine zone, but as early as April they descend to calve on the south-facing slopes. In summer, the reindeer move to the exposed hilltops and ridges to avoid blood-sucking insects and return at the end of summer to the lower tree-line (Sokolov, 1983).

Tundra reindeer migrate great distances over routes largely determined not by terrain landmarks, but by availability of forage, changes in snow cover, dates of river freezing and breakup, climate, and the impact of blood-sucking insects.

A great deal of attention has been given to migrations of reindeer on the Taimyr. The winter ranges are the forest-tundra (transition-zone) and taiga from the river Taz in the west and to the Anabar in the east. In the 1960s up to 80% of reindeer wintered in the Putoran Mountains, but in the late 1970s most animals moved to the mountain taiga of the northern Evenkia and the western region of Yakutia. The shift in winter distribution occurred after the increase in population size, which resulted in deterioration of forage (Kuksoc, 1981).

Lineitzev's (1983) observations at the biological station at Ayan Lake in the Putoran Mountains revealed the pattern of reindeer distribution in the piedmont. After some critical density was exceeded, migration was initiated through the Putoran plateau to the south.

The new wintering grounds of the Taimyr reindeer are 1000-1200 km away from the calving grounds, and consequently the reindeer reach the Taimyr lowland later. The reindeer linger where the snow melts earlier on the winter mountain ranges. Then the reindeer have to migrate quickly but frequently do not reach the rivers before breakup. Then the reindeer have to stop at the river barrier to calve along the right bank of the Pyasina River and at the bend of the middle flow (central section) of the Agape River (Kuksoc, 1981).

In years with a warm autumn, reindeer were observed to linger on the southern Taimyr tundra until December (up to 100 thousand head). Those animals headed for new winter ranges at the left bank of the Enisei River, and when the ice conditions prevented them from crossing, they dispersed southward along the Enisei bank up to Turukhansk (Yakushkin *et al.*, 1970).

The variation in timing of the Taimyr population's migration suggests that migration dates are not fixed by constant factors such as the photoperiod. Temperature, dates of snow melting and abundance of food may trigger or delay migration as may chance reasons such as ice conditions, loose and deep snow, gas-main construction, sudden decline or, conversely, enhancement of forage, and sudden increase in population density, due to the arrival of new animals. Undoubtedly, both the passive submission of reindeer to the environmental conditions and their active correction of the trends and times of movements may be equally adaptive and useful.

Population traditions play an important role. The death of most of the Novosibirsk Island populations in the 1930s resulted in the loss of the tradition of crossing the straits to the mainland (Verkhoyansk Ridge mountains, and Primorie arctic tundra). By 1970, the population on the island was restored, and the numbers reached 17-18 thousand, but the reindeer do not cross the straits.

In many regions, reindeer from different populations use the same winter range but the reindeer subsequently leave for their own ranges. In the Putoran Mountains both forest and tundra reindeer winter on the same range but disperse before the summer (Yakushkin, *et al.*, 1975). On the Verkhoyansk Ridge are the winter ranges of

reindeer from several populations (Egorov, 1971; Kischinsky, 1971.)

Reindeer may repeat their previous year's experience of using certain ranges the next year. For example, by 1970 reindeer learned to pass round the railway Norilsk-Dudinka, the gas-main and the settlement Talnakh, but during 1967 to 1969, the herd lingered at the gas-main line and the railway for more than a month (Geller and Borzgonov, 1975).

In 1967, a part of the Taimyr tundra population (50-60 thousand) came for the first time to winter on the right bank of the Enisei River. In 1968, the reindeer attempted to follow the same route, but ice conditions stopped them (Yakushkin *et al.*, 1970).

Reindeer do not invariably migrate north in the spring or towards the sea, and south in the autumn. On the Gydan Peninsula on Novaya Zemlya, tundra reindeer migrate north in the autumn because forage is more abundant and available, as winds expose the vegetation (Naumov, 1933).

The variability in dates and routes of migration is of practical importance, as most of the harvest of the Taimyr population is during migration across rivers. The Taimyr State Reindeer Ranch is the leading reindeer harvesting enterprise, it harvests 50 thousand reindeer annually.

### Population properties of behaviour

There are many differences between the behaviour of wild and domestic, forest and tundra reindeer and between breeds and from different regions as well as between herds of dissimilar sex and age composition. Those differences may stem from external differences: the presence of effective stimuli causing a definite behaviour (wolves (*Canis lupus*), greening-up of cottongrass (*Eriophorum* spp.), differences in communication conditions especially visual communication in open space.)

The strongest stimuli causing defensive and related social response is the sight of a predator, frightened reindeer, or the sight, noise or odour of a frightened herd. A herd of domestic reindeer gathered in a forest shows a different level of excitement than a herd gathered on the tundra. On the tundra, the herdsman has only to call loudly at several of the nearest reindeer for the rest of the reindeer to become excited and come together which takes several minutes. In taiga where reindeer cannot see one another, almost

every individual has to be pursued with dogs. Collecting the reindeer takes one or occasionally several days, unless the animals are grazing in a large clearing. In the Murmansk Region, some herds are grazed in winter on the slopes of high hills, so that changes in the behaviour of the reindeer can be seen in moving the herd from the forest uphill to the exposed top of the ridges (Baskin, 1970).

Forest reindeer live in small groups similar to the family groups of red deer (*Cervus elaphus*). The deer are largely sedentary with only short migrations. In forests with shallow snow and abundant food, the deer live together for several weeks until the forage is exhausted (Shaposkhnikov, 1955; Vodopyanov, 1971; Stremilov, 1973.)

The more abundant tundra reindeer have often been transplanted to the forest to replenish or establish local populations. Those transplants demonstrate the difference in the behaviour between the tundra and forest reindeer, and the poor and difficult adaption of tundra reindeer to the taiga.

During the first year, the transplanted reindeer invariably wander in their unfamiliar areas, though the wandering will familiarize the reindeer with their new habitat. To tie the reindeer to the desired site, they have to be enclosed during the first year (Segal, 1962).

When moved to taiga, tundra reindeer readily disperse, without forming herds and are frequently lost by herdsmen (Poltoradnev, 1932). The dispersion and movements create many problems for the herdsmen which are aggravated by the different methods of grazing reindeer in taiga or tundra. The herdsmen only check where the reindeer are located on the tundra to turn back those that advanced far ahead and chase the animals which lag. No efforts are made to keep permanent guard on the herd and maintain it in a compact mass.

On many occasions, the above reasons were responsible for the failure of transplants of tundra reindeer to taiga. Large numbers of reindeer strayed and died (Vostryakov and Brodnev, 1964; Baskin, 1970).

Tundra reindeer are more excitable than their forest conspecifics, hence are more responsive to the approach and calls of herdsmen, but more agitated when saddled or in a team. In the forests as reindeer are largely bred as draft animals needed for hunting, tame, calm reindeer are

needed that will be quiet when ridden and will not stray away when released for grazing.

There are differences in the behaviour between the Taimyr reindeer (western reindeer husbandry, involving dogs) and Kamchatka (eastern) reindeer husbandry which does not rely upon dogs. My personal experience of working for experimental purposes as a herdsman on one of the Taimyr collective reindeer ranches was that it provided impossible to graze the deer in the Kamchatka and Chukotka pattern, i.e. maintaining the animals in a rather compact mass without using dogs. The reason was vast ranges with scanty forage and weak defensive response of the reindeer.

The eastern Bolshezemelskaya Tundra has continuous summer ranges compared to the bands of ranges along the rivers of the Olutosky Peninsula in the Bering Sea. Hence, the herds have to be moved daily to new places, up to 15 km on the latter ranges.

A compact herd structure during grazing in the eastern type of reindeer husbandry determines the retention of a high level of social motivation in the herd and preservation of the herd as a single unit. This type of structure makes it possible for the herdsman to manage the herd continuously - his call addressed to a particular animal will alert other nearby reindeer.

If the animals are scattered, they only respond slightly to their neighbours and a stronger stimulus is required such as the sight of a predator or a dog. Use of a dog has, however, disadvantages as the reindeer become unresponsive to weaker stimuli and it is difficult if not impossible to elicit defense response by calls and gestures. Inadequate defense motivation may be obvious in early summer and in the autumn mushroom season, when feeding behaviour dominates.

Herds of varied sex and age composition behave differently, related to the difference in the number of potential leaders among different sexes and ages. The number of potential leaders may be determined in spring when cows are separated from yearlings and bulls, which interfere with calving and rearing of newborn calves. The herd is corralled, with a herder harassing them while the other herdsman form «a living corridor» at the exit. The cows, many of which are potential leaders, escape outside through the corridor, but the reindeer which try

to follow the leader are frightened away or lassoed for return to the corral.

A large proportion of the cows leave on their own, while others seemingly less independent, follow them after some period of time. Still others do not leave and have to be lassoed to be taken out of the corral (Baskin, 1970).

There are few leaders among young animals (Baskin, 1970). Calves rarely become leaders and their behaviour is motivated more by the desire to find their mother than by fright. There proved to be many breeding bulls that could leave the herd on their own, but normally herders leave only a few breeding bulls in their herds (Baskin, 1970.)

The need to drive reindeer is frequent as reindeer are driven to butchering points, from herd to herd, and also for formation of herds. Sex and age structure of the driven groups may vary which allows comparison between the behaviour of herds with different age and sex structures. Herds composed of only calves or yearlings are passive with respect to the environment and respond to any stimulus in a similar manner by walking in a definite direction only (e.g. downwind, uphill, to a familiar place, towards some landmark). It is impossible to drive such herds or even keep them at some place. If a single young cow or a few riding reindeer are added to the herd, or a bull is driven in front of the herd (an artificial leader), the behaviour of the group is drastically changed. The group becomes manageable as the potential leader which appeared in the herd actively responds to the environment and takes the lead. The leader brings along its experience, its peculiar attitude to the environment and a behavioural pattern: the leadership operates as an adaptive mechanism as the leader's adaptations become common to the entire herd (Baskin, 1970).

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