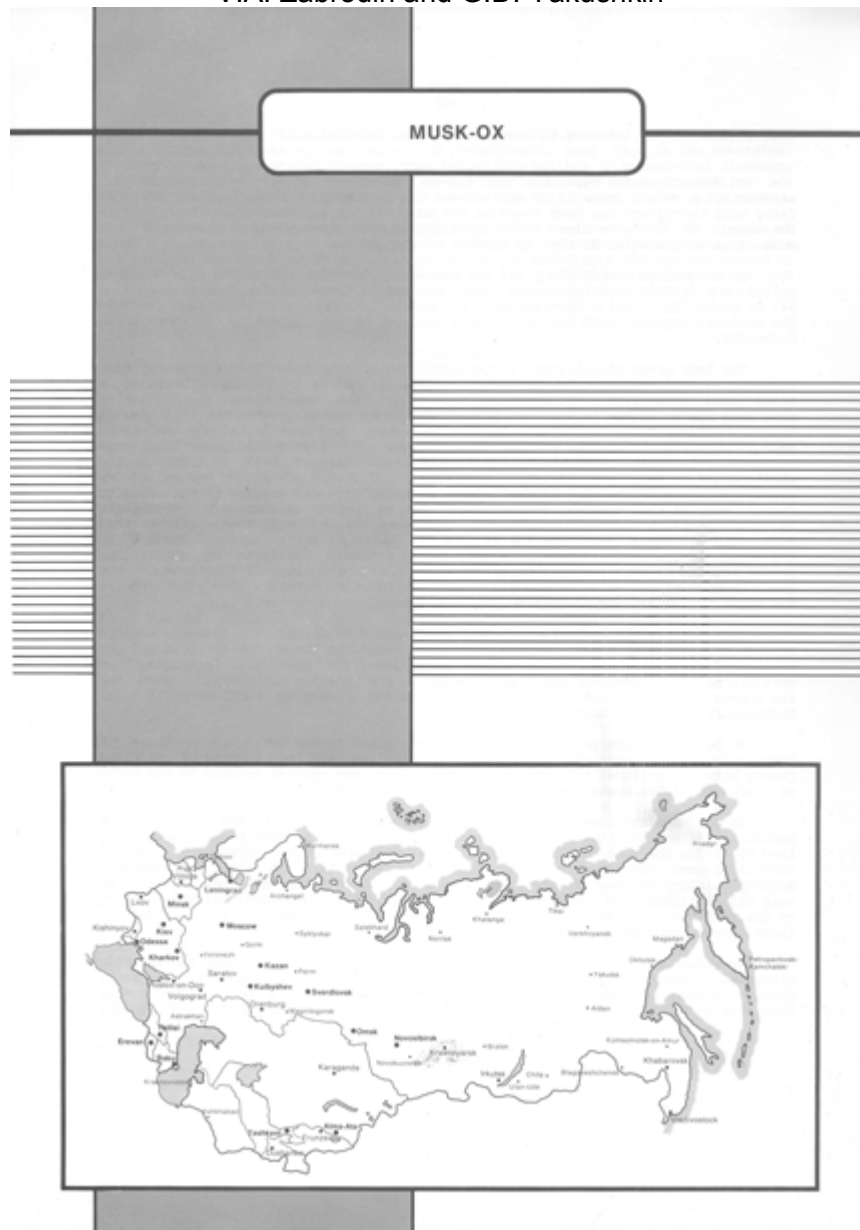


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## 10. MUSK-OXEN

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In appearance and behaviour the musk-ox resembles the ox; however, from the serological point of view it stands closer to the sheep. In particular, the C17 fatty acid (margaric) has been found in the musk-ox; it was previously known only in the sheep. At the same time it has been established that the whey protein of the musk-ox is very similar to that of animals of the genus Bos.

In chromosome number ( $2n = 48$ ) the musk-ox is identical with the Asiatic water buffalo but differs from the bison, yak, and cattle ( $2n = 60$ ) and from sheep ( $2n = 54$ ) or goats ( $2n = 60$ ). Nevertheless, all modern taxonomic classifications include the musk-ox, together with all the related fossils, in the subfamily Caprinae, tribe Ovibovini.

The last great glaciations in the late Pleistocene (60 000-10 000 years ago) resulted in the emergence on the glacier-free plains of Europe and Siberia of a broad, cold zone with a rich steppe and tundra-like vegetation. At the time musk-oxen and other Arctic species, migrating further south, reached the latitudes of Britain, France, Moldavia and the Ukraine in Europe, and Lake Baikal and the River Amur in Siberia. At the end of the Holocene (12 000-10 000 years ago) the environmental conditions in which the mammoth fauna existed, began to change. Ice sheets began to melt and retreat. Tundra-like and steppe grasslands became marshy areas. These landscape transformations resulted in the destruction of the mammoth fauna; many of the species, including the musk-ox, became extinct. In Scandinavia and most parts of northern Eurasia the last mammoths and musk-oxen still existed 9000 to 10 000 years ago. The fossil musk-ox, *Ovibos palantis*, survived longest in the north of the Taimyr Peninsula, which was probably unaffected by glaciation. Recent studies by the radiocarbon dating method at the Geological Institute of the USSR Academy of Sciences on samples provided by the authors, show that fossil musk-oxen became extinct there some 3000 years ago.

In North America, during the last Wisconsin Glaciation, the musk-ox reached present-day Pennsylvania and Kansas. Later it died out there but survived on the margins of the ice sheet and in glacier-free areas, in particular in Alaska, the northern part of Greenland and some islands of the Canadian archipelago. When the ice sheets retreated musk-oxen gradually colonized the entire northern portion of North America and many Arctic islands.

At present native populations of musk-oxen exist in the north and northeast of Greenland, most islands of the Canadian archipelago, and the tundras of mainland Canada between latitudes 64° and 83° N. Until 1865 the species existed in the north of Alaska but later musk-oxen were entirely destroyed there.

As an ungulate species the musk-ox is valued because it has survived from prehistoric times and therefore is the carrier of a unique gene pool. During its long evolution the musk-ox has become extremely well adapted to severe environmental conditions and developed a number of specific traits in its conformation, morphophysiology and way of life. The musk-ox is the only ruminant that can exist in very high latitudes and subsist on sparse forage. There is another valuable aspect of the musk-ox: the young are easily domesticated and therefore can be raised on farms, producing high-quality wool, hides and tasty meat.

Musk-oxen are rather large animals. The body is compact, low-set and slightly elongated. They have large heads, short, thick necks, and short legs. At the crest, there is a hump over the nape. The tail is short, from 10 to 14 cm, concealed by the long hair coat. The ears are of medium length (up to 15 cm), pointed and usually noticeable. The dimensions of mature males are as follows: body length 225 cm, withers height 135 cm, live weight some 300 kg. Females are smaller by one-third. Wild females reach the live weight of mature animals at the age of 5-6 years, and males at the age of 6-7 years. On farms, when adequate feeding is provided, individual five or six-year-old males had live weights of 635 and 658 kg. The largest known wild male musk-ox weighed 408.2 kg.

The two main claws of the hoofs of the musk-ox are rather large and dark brown in colour. They are rounded in shape and slightly protuberant. The lower hoof edges are sharp, and the heels are relatively soft and broad from beneath. These features make it possible for the musk-ox to walk steadily on a thin crust of ice over snow, to avoid sliding and rapidly climb stony slopes. The front hoofs are larger than the back ones for the musk-ox has to pick out feed from under the snow. The dew claws are smaller and shorter than those of the reindeer or caribou and do not leave prints on firm snow or soil. The rounded footprints of the musk-ox, which are produced by the two main claws of the hoof, can easily be distinguished from the broader footprint left by the four hoofs of the reindeer. Musk-oxen sink in crumbly snow more easily than caribou.

Horns are present in both sexes; they are usually 70-75 cm long in bulls and 40 cm long in cows and are never shed. Broken horn tips in old animals are not unknown. Horns appear in the first year and grow sideways from the middle of the skull up to the age of four, when they reach their maximum width, and mature at the age of six. Horns are thicker and widely separated at the base; they are almost circular in cross-section along the rest of their length. In mature males, they are large, dipping downward at the sides of the head and curving upward and somewhat forward at the sharp ends. From the age of five onwards, the horn bases become thicker and resemble knobs; they almost meet at the crown and forehead (the distance between them is only 15 mm) and they develop longitudinal grooves. Horns and knobs serve as effective weapons against attackers and are used by males for fighting in the rutting season. In females horns are thinner, without thickened bases. In young and adult animals of both sexes horns are light in colour; old animals have dark horns.

The skull is massive; the cerebral and facial portions are broad and of approximately the same length. The top of the skull is very thick, slightly concave; the occipital bone is short; the eye-sockets are tube-shaped, sharply protruding sideways; ear drums are small.

The teeth are typical of bovids and well-equipped for chewing rough forage. The incisors have the shape of symmetrical blades. The dental formula is

$$\frac{i0}{3} \frac{c0}{1} \frac{p3}{3} \frac{m3}{3} = 32.$$

Calves are born with all the incisors and premolars; the first molars are hidden in the alveoli. The molars appear in the first and second year of life. The replacement of milk teeth begins at two and ends by the age of four or five.

Musk-oxen have a coat of dark brown, almost black hair. The saddle and legs, however, are whitish or light cream. Adult females, young and immature males also have white hair on the forehead and around the horns. Such white markings are particularly characteristic of the subspecies *O. m. wardi* of mainland Canada, which is sometimes called the white-headed musk-ox. Mature males differ in having a large, red mane. The mane always stands on end making the animal look bigger.

The hair covering consists of guiding and guard hair, intermediate hair, and undercoat. The guiding and guard hairs are the longest. They are dark-coloured and bright. The woolly undercoat is reddish brown or greyish brown. The guiding and guard hairs project beyond the undercoat forming a long skirt that reaches nearly to the feet. The hair coat is strong and coarse; it acts as a sort of bedding when the animal rests. In spring the coat loses

its lustre and becomes reddish brown in colour. In adult bulls, the longest locks (up to 62 cm) are found on the chin. Because of them, the Greenland Eskimo nicknamed the musk-ox "the bearded". On the sides, belly, neck and rump, the guard hair reaches 45 cm. The hair is shorter on the back and saddle. The woolly undercoat (or quiviut) accounts for 60-80% of the fleece; it is 5-7 cm long, very fine, soft, and curly. The undercoat densely covers the entire body. It is precisely because of their fine, silky quiviut, that musk-oxen are valued so highly.

The coat of the newborn calf is short, curly and dark reddish-brown in colour. It consists of the same hair categories but the guard hair is rather uniform all over the body and reaches 50-60 mm in length. The wool is shorter - 20-25 mm.

Shedding in young and adult animals lasts from May through July. The peak of shedding is in June. Males and barren cows are the first to shed. In lactating cows, yearlings, and adult males, shedding is delayed. During shedding, the old wool tears away from the skin, mingles with guard hair, and hangs on the body in the form of large shreds or strips. During this period animals have an unattractive, shaggy appearance. They try to eliminate the wool by rubbing the body on stones and trees. Numerous shreds are left on the earth when animals lie on it. Together with the wool, other categories of hair fall out. Obviously, the replacement of hair takes some time. When shedding is over, animals acquire a coat with a smooth, dark surface. The birth coat begins to shed in the middle of July and by the beginning of winter it is totally replaced by a new one. The new coat is dense and consists of thick hair over most of the body. By the next winter the coat of young animals becomes longer and thicker, and by the third winter its development is complete. Musk-oxen are resistant to low temperatures; this is achieved primarily through the insulation of the body by the thick coat as well as by the high metabolic rate. The critical temperature which musk-oxen can survive is -70 C. The rectal temperature is 38.4°C.

On the face there is a pair of orbital glands which function throughout the year, but especially when the animal is on heat. It seems that the musk-ox is so called because of the smell of the secretion produced by these glands in bulls. Some authors report the presence of foot glands between the toes. Groin glands are absent. The udder in females is small, covered with dense, short, light-coloured hair. There are two pairs of short (3.5-4.5 cm) teats with big nipples. The chemical composition of the milk is: fat 8.0-12.4%, protein 10.9-12.9%, lactose 3.6-4.2%. The milk fat contains a high content of unsaturated fatty acids (38%), particularly of oleic acid. The milk of the musk-ox has twice the fat content of sheep's milk.

In nature males reach maturity at the age of four years, females at two to four years. The dates depend on the fodder yield of grasslands. Animals mature early in the areas which are rich in forage. On farms, when adequate feeding is provided, individual females may calve down even at the age of two years and males of the same age come in season. In natural populations, females are served by males of six years old and older. Before the breeding season, in July, dominant males form their harem herds and expel their competitors. Herds usually consist of 7-9 head of adult females, immature animals, and calves. The breeding season lasts from the end of July to early October, the peak mating period being from the middle

of August to early September. Females are polyoestrous. The oestrous cycle lasts 25-30 days. Gestation lasts 8.5 months, with a variation from 8 to 9 months. In forage-rich areas mature females calve every year; in areas with poor forage they often calve only every other year, producing one calf. Two calves are born on very rare occasions. The sex ratio at birth is almost equal; however, in adult populations there are many more males than females. Calving usually takes place in the herd. The birth weight of calves in natural conditions is 7-8 kg; farm-born calves weight up to 10-12 kg. Two or three hours after birth calves follow their mothers. During their first days calves receive high and frequent milk feeding (up to 18-20 times a day). Newborn calves have extensive reserves of brown fat which is used to generate heat. At the age of one week calves become interested in grass. Milk feeding continues up to the age of 3 or 4 months, sometimes longer. Maternal guidance lasts until the age of one year.

Calves double their live weight in 32-35 days. Males grow faster than females. The one-year-old animals weigh 75-80 kg, two-year-olds 110-120 kg. The reproductive cycle in females continues until the age of 11-13 years; old cows, however, often calve only once in two years. The maximum age of calving recorded in wild populations is 23 years. Most animals die before reaching this age.

Frequent disorders of musk-oxen are contagious pustular dermatitis, actinomycosis, stomach ulcers, lung nematodes, muscular sarcocystosis, pneumonia, purulent abscesses, wounds and traumatic contusions. Potential diseases of wild and farm-raised musk-oxen are anthrax, brucellosis, rabies, and listerellosis. It is important to keep the domesticated animals isolated from parasites and infectious diseases to which they are not accustomed.

The musk-ox is an Arctic animal, well-adapted to an icy or Arctic climate. It lives mainly in the tundra zone; however, it is able to live in Arctic stony deserts and to subsist on the poorest forage. It does not like a damp climate, winter thaws with ice-covered ground, and deep snow.

Musk-oxen are gregarious animals. This trait is well pronounced in adult females and immature animals. Herds vary from 7-8 to 25-30 head.

Behavioural patterns of the musk-ox are numerous and flexible, with a large set of defence reactions. The memory is good. The sense of smell and eyesight are excellent. The main enemy of musk-oxen is the wolf, and the main source of disturbance is man with his technology.

The musk-ox is a protected species of the Arctic. Its numbers are small, although musk-oxen are not rare today. Therefore it is not included in the International Red Book. Not very long ago musk-oxen were savagely killed in North America.

At present there are 45 000+1100 musk-oxen in the north of Canada, some 14 000-15 000 of which live on the mainland and up to 30 000-31 000 on Arctic islands. Particularly large herds exist on Banks, Victoria, Melville and Ellesmere islands. In Greenland, according to various sources, the stock of musk-oxen is estimated to be between 15 000 and 50 000. The actual figure is probably not less than 20 000 head. In other words the entire wild population of musk-oxen in the world today numbers some 60 000-65 000 head.

Many northern countries where the musk-ox was destroyed or became extinct have decided to reintroduce this species. The reintroduction and

acclimatization of the musk-ox in foreign northern countries began in the beginning of this century. Musk-oxen were imported to Sweden, Norway (both the mainland and Spitzbergen), Iceland, the USA (Alaska), and western Greenland. Some of these countries imported musk-oxen several times. Animals were imported from the northeast of Greenland. The reintroduction of the musk-ox into Iceland and Sweden at that time was a failure.

The efforts of American biologists to acclimatize the musk-ox were a success. In 1930, 34 head of young musk-oxen were imported to Alaska from eastern Greenland. In 1969, there were 750 head of musk-oxen in Alaska. Today there are five stable populations there. In mainland Alaska, large populations have emerged in the northwest (Seward peninsula, the Feter river) and in the northeast, within the Arctic National Park.

Also successful were the efforts to acclimatize the musk-ox in western Greenland where this species did not exist in the past. In 1982, there were some 500-600 head there.

According to 1982 data, there were some 1700-1800 head of musk-oxen acclimatized in foreign countries.

The Soviet Union has a vast Arctic region, which is suitable for the musk-ox. In 1974-75, when there was closer cooperation between USA, USSR, and Canada, a group of musk-oxen were shipped to Taimyr and to Vrangal island. On the Taimyr peninsula, musk-oxen were introduced in the vast valley of the river Bikada, to the east of Lake Taimyr. The valley lies in the latitude 74 -75°N in the southern zone of the Arctic tundra. Vrangal island lies in the Chukotka<sub>2</sub> sea in the latitude 70 -71 N in the zone of cold Arctic climate. The area is 7670 km<sup>2</sup>; the relief is dominated by mountains and Arctic tundras.

The first ten young musk-oxen were shipped to the USSR from Canada in September 1974. The animals had been caught on Banks Island (74 30'N) and were airlifted to the Taimyr Peninsula and introduced in the lower reaches of the Bikada river (74°40'N).

In April 1975, forty musk-oxen were brought to this country from the USA. They had been caught at Nunivak island off Alaska (60 N). Twenty animals of both sexes and different ages from this group were introduced on the Taimyr peninsula where Canadian animals were already living. The other twenty were flown to Vrangal island. There they were kept at a ranch (1.5 ha) for three weeks and were freed in May 1975.

The initial acclimatization period on the Taimyr peninsula showed that Canadian animals found the ecological conditions there very similar to their native habitat. They were moved to the same latitude and placed in an analogous subzone of Arctic tundras. For this reason the initial period of their acclimatization was more or less a success. The American musk-oxen, which had been resettled in Taimyr, found themselves in a more severe environment since they had been moved from sub-Arctic to Arctic tundra with a latitude difference of 11 -14 . There they found extremely severe climatic conditions and poorer grasslands. In both regions of acclimatization a large number of animals, chiefly young, weak and ill, died.

The first small crop of young was obtained from four or five-year-old females in the spring of 1978. Next year saw a "population explosion" in the Taimyr herd where the animals were still kept in pens. Both the American and Canadian cows calved. Thus, the initial stock was reestablished. More

calves began to appear on Vrangal island, although it took several years to reach the original number of musk-oxen there.

Ten years have passed since the introduction of musk-oxen to the Soviet Union's Arctic regions. Reassuring results have been achieved during these years. After the adaptation period ended and the animals matured more than one crop of young calves has been obtained. The numbers of musk-oxen are rapidly growing in both areas. The musk-oxen have already lived through two short phases of acclimatization. Currently, the third, longer period of naturalization is under way when a local form of the species is taking shape. The area populated by musk-oxen is growing every year. The musk-oxen which inhabit the Bikada valley and the northern portion of Vrangal island, have approximately the same feeding conditions, although the first region lies three degrees further north. In the Bikada valley there are 107 species of vascular plants which are eaten by the musk-ox. These plants account for 47% of the species that grow there (230 species). Of particular feeding value are 25 species. On Vrangal Island the ration of musk-oxen consists of 42 species of plants (out of 312). Fifteen species constitute the major feeding stock and belong to the same families. The animals eagerly consume cotton grass (*Eriophorum*) sedge (*Carex*), milk vetch (*Astragalus*), reedgrass (*Calamagrostis*), lousewort (*Pedicularis*), meadow grass (*Poa pratensis*), hair grass (*Deschampsia*), foxtail (*Alopecurus*), *Arctagrostis*, *Arctophila*, *Dupontsia*, *Dryas* and many species of willow (*Salix*).

After the successful adaptation to the local conditions nearly all imported females calve every year, and many young females which were born on Taimyr and Vrangal island come on heat at the age of 2 or 3 years. This is still another proof of the adequacy of the local grasslands. A similar picture is visible abroad in the areas where the feeding conditions are good - northern Norway, western Greenland and Alaska.

Harem herds in Taimyr begin to form at the end of July or the beginning of August. Harem herds usually consist of 12-16 animals. The leader of a harem herd is very aggressive and can be dangerous. The observations over a number of years show that the breeding season lasts from early August to the first week of October. The peak of the season is the end of April to mid-May. The earliest and the latest dates of calving were recorded only in 1979. They are 15 May and 25 June, respectively. The calvings occurred when the animals were still kept in stalls. As in other Arctic regions, the Taimyr females produce only one calf. However, on 6 May, 1979 a Canadian female mated to an American bull, gave birth to two female calves which did not survive.

Between the first calving in 1978, and 1984, more than 90 calves were born in Taimyr, 85 of which (93.4%) have survived. On Vrangal Island the actual increase in the population was some 30 animals over the same period.

Consequently, 115 calves were obtained over the period of seven years.

From 1978 to 1984 the numbers of musk-oxen in Taimyr increased 4.5 times, and on Vrangal Island, 2.7 times. In both regions the growth rate of the population is as high as that in similar man-created populations abroad.

Table 10.1 GROWTH IN THE NUMBER OF MUSK-OXEN IN THE ARCTIC REGIONS OF THE USSR

Year	Taimyr Peninsula			Vrangel Island			
	Total head	Calf crop	Increase %	Total head	Calf crop	Increase %	Total
1981	54	11	27.5	17	4	30.8	71
1982	66	15	29.5	21	4	23.5	87
1983	83	17	25.7	27	6	28.5	110
1984	102	22	22.9	35 1/	8 1/	29.6	137

1/ Approximate figures

The emergence of large populations of musk-oxen in the USSR will make it possible to introduce these animals into other Arctic regions of the Soviet Union and set up experimental farms for domesticated musk-oxen with a view to investigating physiological and other questions, and carrying out selection.

Domestication of musk-oxen abroad began in the 1950s. Between 1954 and 1976 five farms were established in North America. In 1969 a musk-ox farm was set up at Bardu in northern Norway. Spring and autumn calves and yearlings from various wild populations were domesticated. Young animals are easily domesticated; calves began to trust the farmhands at the age of one week.

Farms not only carry out research work but also produce qiviut. For example, the University of Alaska farm in 1981 produced 295 kg of qiviut worth 50 000 US dollars. The long, silky qiviut gives a uniform, fine, and therefore economical yarn, which is used for various warm garments. These items can be easily dyed in different colours; they are attractive and expensive. The sale of fur articles constitutes an important source of income for the cooperators who run the farms.

The musk-ox in the USSR should be regarded at the present stage as a valuable species with a unique gene pool.

We believe that in the near future male gametes of the species should be deposited in a gene bank and a reserve group of musk-oxen should be designated for the Chegre Genetic Centre in Siberia, which will be set up under the auspices of the Siberian Branch of the USSR Academy of Sciences.

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