ABSTRACTS

Following are abstracts of oral and poster presentations by delegates from the former Soviet Union which were scheduled for presentation at the Third International Moose Symposium. Formal papers of all or some of these presentations may appear in a future, all encompassing proceedings.

MOOSE BROWSING IMPACTS ON REFORESTATION IN CENTRAL EUROPEAN USSR

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Coniferous clearcuts are predominately reforested by aspen and birch, so that deciduous forests prevail. This classical type of reforestation is significantly modified due to intense moose browsing. Composition of reforestation varies with the moose population density.

A density of 3-5 moose per 1000 ha in the Moscow Region greatly suppresses growth of aspen, rowan and oak. As a result, aspen trees, which normally prevail during first years of regrowth, are eliminated. Birch, which is less damaged, becomes a dominant tree species but does not form a dense canopy. This condition allows spruce an advantage, hence to form the spruce-birch forest stands. On 2-year-old clearcuts, aspen height reaches 160 cm, while other species, particularly spruce, is less than 70 cm. On 17-year-old clearcuts, aspen regrowth is less than 93 cm and in some stage of decay, while mean height of spruce reaches 150 cm and birch reaches 144 cm.

A density of 8-10 moose per 1000 ha in the Yaroslavl Region severely represses aspen and birch, resulting in grassy glades on clearcuts. On 7-year-old clearcuts, only dry aspens occur and damaged birches reach 80%. Fencing of clearcuts causes rapid growth of aspen, which doubles in height after 5 years. When aspen attain that height, moose also browse young spruce. Although such browsing does not limit spruce growth, the damage to the bark eventually kills trees and degrades the forest stand. Hence, the result of moose browsing at this density cannot be predicted.

A density of 2-3 moose per 1000 ha in the Kostroma Region does not measurably affect reforestation, and deciduous trees predominate on clearcuts.

We conclude that a density of 3-5 moose per 1000 ha causes clearcuts to revegetate with spruce, thus ensuring a direct reestablishment of predominate spruce forest without a deciduous stage. However, excessive densities cause degradation of spruce stands. Such densities could result in elimination of aspen and cessation of rowan and oak, as occurred historically with pine. This information on impacts of moose browsing supports the rapid increase in spruce plantations and positively contributes to forestry efforts.

MODELLING OF MOOSE HUNTING: RESULTS OF PROTECTING COWS WITH TWINS

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In most districts of the European part of the Russian Federation, moose management strives to increase moose numbers. Selective hunting is infeasible due to a low hunting culture. Thus, achievable results based on selective hunting of cows has been modelled. Two hunting strategies were modelled: A—cows were killed irrespective of number of calves, and B—all cows with twins were protected.

A comparison of number of calves and number of embryos in Kostroma district suggested the presumption about individual predisposition of cows having twins (unpublished data, L. M. Baskin). The numerical simulation included the counts of calves born in hypothetical population of cows. The birth probability of a single calf, P1, varied in the range of 0.4-0.8 (probability for twins, P2, equaled to 1-P1), and the birth probability for a single calf the subsequent year, P3, in the range of 0.3-0.7 (twin reiteration, P4, equaled to 1-P3). The hunting losses of mature cows were 5, 10, 15 and 20% respectively. Other conditions, such as natural mortality, cow fecundity depending on the age, age- and sex-structure of the herd, weather and nutrition conditions were considered constant values or disregarded. Harvesting did not change the number of mature cows. Results were estimated as percentage of difference in born calves under hunting strategies A and B in relation to: 1) strategy A, 2) initial number of cows. The simulation covered a period of 10 years.

Results showed that over 10 years the application of strategy B resulted in 100-500 calf increase per 1000 cows, or up to 5% from all calves born. Depending on application needs, the method promotes increased moose numbers or provides increased shooting opportunities.

The full-conditioned moose management model takes into account the dynamics of age and sex structure of the herd, natural mortality, age-dependent reproductive aspects including the probability of twins and some hereditary aspects of twins borning, too, though the data on the latter two items are insufficient. Application of different hunting strategies in the model retains estimation differences between strategies A and B.

POPULATION DENSITY AND WINTER DISTRIBUTION OF MOOSE IN DIFFERENT LANDSCAPES OF LITHUANIA

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To determine moose population density and patterns of winter distribution in different landscapes of Lithuania, in April 1987-1988 two routes were layed across the Republic from west to east. Each route consisted of four 3-meter wide parallel census bands, 0.5 to 2.0 km apart. At 100 meter intervals, the numbers of piles of winter feces of moose were counted and the type of grounds determined. Using the typology of Lithuania landscape (Basalikas, 1977), four landscape groups were distinguished as based on map evidence: clayey, sandy, seaside plains, and undulating moraine uplands. On the 1793 km long census band, a total of 10.8 thousand piles of feces were recorded. When determining population density, we assumed that one moose deposits 2.88 thousand piles of feces during the non-growing season.

Every 1000 ha of forestland crossed by the route in 1987 averaged 9.6 ± 0.5 moose, while in 1988 averaged 9.1 ± 0.3 moose. The population density was highest on the seaside plains: 17.6 ± 1.9 and 9.3 ± 0.8 moose per 1000 ha in 1987 and 1988, respectively. It was relatively high on sandy plains (9.3 ± 0.4 and 12.1 ± 0.6 moose) and undulating moraine plains (7.3 ± 0.7 and 12.0 ± 2.0 moose). The lowest moose density for each year was recorded on clayey plains (4.4 ± 0.3 and 7.7 ± 0.4 moose), which comprises 55% of the Republic's territory.

The pattern of winter biotopic and spatial distribution of the animals also varied with type of landscape. We conclude differences in population density and distribution of moose are mainly determined by the dissimilar species composition of forestlands, and dissimilar biotopic and spatial structure of the landscapes under study, as well as dissimilar population density of the red deer.

OBSERVATIONS OF MOOSE BEHAVIOR ON A MOOSE FARM

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The Kostroma moose farm provided essentially new opportunities to study species-specific moose behavior; the farm moose live free in nature but allow humans to approach even in important life periods such as labor, calves sucking and defense, and sexual and tournamental interactions. Postnatal bonding and physiological mechanisms of suckling, feeding, defense, breeding and other behaviors, as well as the features of mother-calf bond formation and disintegration, were studied in 1977-1989. Heart rate and breathing dynamics were recorded for 35 adult cows, about 50 wild bulls (in the breeding seasons) and more than 250 newborn and developing calves. The radio-tracking system "Los-2" radiotelemetric system "Los-3", radio communication between scientists, photo-, film-, videorecording and magnetic recording of moose vocalization were used.

For the first time multiple observations of cows' labor activity was studied in detail. The set of inborn mother and calf reactions were found which direct the animals to each other. The stable mother-calf bond formed only on the 7-8th day of calf life as a result of continuous mother-calf interactions on the place of labor. It was found that sucking and defensive (active and passive) behavior of calves was formed during the first hours of life, and calves had learned the effective integration of inborn behavior elements to obtain the useful result. The first achieving of the result is a crucial moment in the forming of behavior.

We determined the features of the moose breeding ritual. The moose sexual activity appeared to be organized by the system principle. It is installed into the whole system of social interactions of moose in the study area. Practically the whole vocalization repertory of moose was recorded and described. It was found that cow moose inhabited rather restricted and stable home range areas (up to 60 sq km).

MILK CONTENT OF PECHORA TAIGA DOMESTICATED MOOSE DURING LACTATION

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Mineral and protein ketonic substances and fat content in milk of various ages of cow moose during lactation are reported. Colostrum is rich in protein (8.7 g%) the first day of lactation. There is also about 1400 mg% of common and 21 mg% of amino nitrogen, 215 m-eqv/kg of mineral ions among which there is much calcium, potassium and phosphate. Fat and ketonic substances contained in colostrum reach maximum only 2 or 3 days later (8.2 mg% and 7.5 mg%) and decrease to 6.1 mg% and 7.1 mg%.

Increasing milk productivity causes decreasing dry substance, common nitrogen and protein to 20 mg% but causes increasing amino nitrogen up to 35 mg%, which continues to have a high content of free amino acids. High content of calcium (185 m-eqv/kg), magnesium (19 m-eqv/kg) and phosphate (79 m-eqv/kg) is the distinct feature of this period.

While daily milk productivity decreases, the content of mineral ions, especially calcium, drops but the content of protein, common nitrogen, ketonic substances, dry substance and fat increases. The content of mineral substances in the forage decreases simultaneously. The content of fat is 10%.

High content of nitrogen, mineral and other nutritious substances in moose milk during lactation makes milk valuable as a food product. Much content of nitrogen substances and fat but less of mineral elements in moose milk depends on the individual animal. Dynamics of mineral substances in moose milk depends on content in forage plants.

"QUICKENED" MORPHO-PHYSIOLOGICAL ONTHOGENESIS IS ADAPTATION OF MOOSE FOR WINTER ENVIRONMENT

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Conditions for animal life are quite different at various climatic zones and seasons. Irregular distribution of heat and forage resources during a year, especially in northern regions, results in specific patterns of physiological processes. Preparation of organism for winter starts early with intensification of nutrition and storing of energy reserves. Some peculiarities of moose development during early postnatal onthogenesis include:

- High intensity of synthetic processes, which provides high rates of growth and increase of body and organs mass; average increasing of body mass is usually equal to 0.51 ±0.22 kg; relative rate of growth for moose is considerably higher than that for cattle;
- Early reorientation of indirect game forms of activity to forage and defensive activity;
- Change from milk to plant foraging occurs from first days of life;
- High and variable cardiac rate of newborn calves (171 ± 17) slows down and stabilizes under vagus influence; by the 20th day reaches 94 ± 2 cycle/min and by the 2nd month reaches the level of an adult animal;
- High metabolic intensity of a growing moose: oxygen utilization is equal to 6.6-8.2 ml/min = kg, heat production is equal to 1.9-2.3]d/hour = kg;
- Respiratory volumes by the 2nd month increases by 3.5-5 times, which results in intensive ventilation of lungs; accordingly, respiratory rate slows down with age increase;
- Age dynamic of heat thermoregulatory reactions is characterized by increase of heat production and heat dissipation role of respiration.

Development of morpho-physiological status of wild animals organism during early onthogenesis occurs according to "quickened", ecologically conditioned program. That is why preparation of a young organism to severe north winter takes place during a rather short summer-autumn period.

MOOSE HISTORY AND HABITAT CHARACTERISTICS IN NORTHEASTERN ASIA

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Evidence of moose (genus Alces) found in Wisconsin deposits of the Alaskan-Yukon refugium suggests that these ungulates inhabited the southern portions of Beringia as late as middle pleistocene. In late pleistocene, only rare moose populations occurred in those areas. Moose numbers greatly increased in Holocene period. Archaeologists presume that the development of specific early paleolithic culture was bound up with hunting these animals. The analogue of similar culture was found in Alaska.

Numbers of moose were high in northeastern Asia at the beginning of the 19th century, but their numbers were considerably reduced by the end of the century due to intensive hunting. Numbers of north-eastern moose increased in the 20th century. Currently, moose occupy all suitable habitats, except the areas subjected to great anthropogenic impact.

Total number of subspecies Alces alces buturlini northward of Chersky Mountain Range exceeds 20,000-25,000 moose. Moose are subjected to commercial and sport hunting. Unlike Yakutya, eastward of Kolyma, the area occupied by moose is not continuous due to orographic features.

Moose favor flood plains most of the year due to optimal combination of food resources and absence of danger. Average moose density on those areas ranges from 0.5 to 11 specimens per 1000 ha. Winter feeding is similar to that in Alaska. Feeding chiefly comprises wood forms of sprouts (poplar, birch, chosenia), while dwarf shrubs and herbaceous vegetation are of secondary importance, and coniferous are not eaten.

We determined moose only use 4.1% of available forage on flood plains in the middle stream of the Omolon River in winter. Reduced fertility in moose of northeastern Asia is considered an adaptive response to extremely severe winter conditions.

MOOSE AND WOLF

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The major and preferred prey of the wolf in northwest USSR is moose, despite a large variety of alternate species and high density of hooved animals which include moose, tundra and forest reindeer, wild boar, and roe deer. This conclusion is derived from:

1. Analysis of the ratio of hooved animals in nature to hooved animals as wolf prey is 70 and over 90%, respectively.
2. Wolf food in winter is comprised of 80+% moose, based on total stomachs and scats analyzed (n=2100).
3. Close correlation exists in fluctuations of moose and wolf numbers.

In Karelia (the region we have the most comprehensive data), wolf density in the late 1960s was 0.015 wolf/1000 ha and moose was 1.4/1000 ha. Thus the predator-prey ratio was 1:93. In late 1970s, moose population had almost tripled and the density reached the maximum in the study period of 3.3 moose/ 1000 ha. At the time wolf density grew four-fold and the predator-prey ratio became 1:57.

In recent years we observed the moose population decline and the ratio to decrease to 1:46 or in some areas to 1:30. As Pimlott (1967, 1970) found in areas where moose is major prey of wolf, the predator-prey ratio 1:30 is a well-balanced relationship in nature. Yet this conclusion is true only in ecosystems where moose population is not affected by hunters. In fact, hunters shoot moose up to 10% of its population, i.e. equal to the number taken by wolf. Therefore, the ratio should be no less than 1:60 and consider moose mortality from other causes such as bear predation (7-15%)*, pouching (10-17%)*, and transport. Therefore, an adequate ratio must be 1:70. To achieve this aim the wolf population density should be reduced to 0.010-0.015/1000 ha.

* % was derived from total number of moose found dead.

DOMESTICATION AND COMMERCIAL EXPLOITATION OF MOOSE ON KOSTROMA MOOSE FARM

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Research on an experimental moose farm has been conducted over 20 years. Over 400 moose were maintained and reared over that time, achieving some fifth generation individuals. The basic methods and zoological techniques of moose domestication have been devised and are being applied. These include: taming by hand-feeding milk to calves, imprinting humans on the first days of life when environmental factors are most influential, development of behavioral patterns characteristic of farm animals through obligate learning, regular reproduction and obtaining viable offspring, maintenance in natural habitat and seasonal round use of rangelands.

The following additional techniques are used in domestication and use of moose. Moose feed on seasonal plant feeds preferred by moose, which in winter comprise arborous, voluminous, dry vegetation and in summer are arborous, herbaceous and succulent types. Breeding strives for domestication features such as characteristics useful in farming, while retaining and developing valuable biological features. Breeding and zoo technology also strive to utilize and augment meat, milk, unossified antler productivity and other characteristics.

Extensive arborous feed for moose is available from over 2 million hectares of clearcut forests. Moose effectively feed on remains at logging sites.

A wide range of products result from breeding on moose farms. Products include dietic meat, healthful moose milk, unossified antlers to produce pantocrine, and hides. Moose milk is believed to be effective in treatment of stomach ulcers and other gastro-intestinal diseases. The high content of lysozyme in moose milk may theoretically be used to treat radiation lesions.

ADVANCES AND PROBLEMS OF KOSTROMA MOOSE FARM

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Two decades of work on domestication of moose at the Kostroma State Agricultural Station have resulted in numerous findings:

1. Moose of all age classes can be maintained during winter by using supplemental feeding. During spring, summer, and autumn, lactating females and moose older or younger than one year are managable. Some animals are more closely attached to the farm, and breeding attempts to select for this trait.
2. Primary supplemental feeds used are ground oats, potato and tree branches with dry leaves. Milk substitute is initiated when calves are 15-20 days old. Females and young moose are free-ranging or semi-free ranging. During winter, all age classes are maintained in movable camps because prolonged maintenance at one site causes damage to crops and disturbance of metabolism and reproductory function due to incomplete diet.
3. In ranges of 1,000 hectares, 15 to 25 animals can be maintained if provided supplemental feeds from clearcut remains.
4. Barren females on the farm reached 5-10%. Placenta delay has occurred. First birth is normally one calf, while older females have twins and triplets. No significant "heat" indicators are observable.
5. Sperm from male moose is successfully taken using a special ejaculator following immobilization. Six-month old males can be castrated, but weight is retarded and antler growth is abnormal. Tamed males sustain cutting of unossified antlers in June. The extract from unossified antlers (alcecine) is similar to pantocrine.
6. Females are successfully hand and machine milked. Methods to increase milk flow should be initiated at 3-4 months old until calving. Moose milk is richer than cow milk in nutrient content, macro- and microelements, and is believed to have medicinal properties.

SIMULATION OF INTRASPECIFIC RELATIONS BY METHODS OF BINARY RATIOS

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According to N. Vavilov's definition, species is the integrity, comprised of interconnected components which cannot be separated. Species classification is a definite, complex system. Therefore, methodology is necessary to achieve a systematic prognosis of direct and indirect influences on the system and genetic reproduction of the same system with all interrelationships.

F. Rassel, N. Burbaki, and others define mathematics as a science of ratios. According to M. Mesarovich, we can suppose that methods of mathematical ratios can be successfully used in the analysis of a complex system. Mathematical ratio is a hypothetic rule, which connects two or more symbolic objects. Mathematics used directly or Decart's product of M-set is the totality of various regulate pairs {(a,b)}, where a, b belongs to M, and a binary ratio is some subset of regulate pairs R={(a,b)}, R=M*M of direct product.

Many ecological terms such as similarity, difference, and identity are defined by means of binary ratios. In ordinary speech, these terms can be used in a broad sense, but in mathematics they are distinctly defined. Binary ratio can be represented as a set of points on a plane, which are connected with segments, mathematically defined as a graph. Bounding segments are the graph edges and characterize relations between the components (e.g., population) of a system.

In studying species as a system, all mutual relations and ratios are united in an integrity. Breaking one or another relation, we destroy the integrity of a product and a simplified copy results (i.e., model). Mathematics in biology operates with a model because no biologists can comprehend all possible relationship variations. The mathematical model is a set of M = [X, R1, R2, . . ., Rn], consisting of base set X and total relations K1, K2, . . ., Kn, defined to X. Use of binary ratios for study of intraspecific relations allows successful prognosis of species structure.

MOOSE POPULATION CONTROL IN RSFSR

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The moose population increased in the last 40 years from 226,000 (1950) to 754,000 (1989). Three rates of population growth were observed during this period: 121% increase (to 500,000) during 1950-1960; 32% increase (to 660,000) during 1961-1975, and; 14% increase (to 754,000) during 1976-1989. Currently the moose population in the European part of the RSFSR is 42.1% of the total, 12.9% occur in the Urals, 10.7% in West Siberia, and 34.3% occur in the area of east Siberia and Far East.

Planned and licensed moose killing in the RSFSR started in 1946. From 1946-1988, the legal harvest in RSFSR totalled 1,278,300 moose, which is estimated to have provided 166,200 tons of edible meat. Harvests per decade were: 75,400 during 1946-1955; 167,600 during 1956-1965; 258,100 during 1966-1975; 573,400 during 1976-1985, and; 203,800 during 1986-1988. During 1985-1988, the annual licensed harvests comprised 8.4% of the spring population. The figure varied from 2.8% in West Siberia to 27.2% in Volga basin. The harvests are composed of 78.3% adults, 9% yearlings, and 12.7% calves.

In recent years, the RSFSR wildlife department has refined methods of better management of moose, improving the organization, planning and technology of killing. The numbers of moose to be harvested under license has increased, however, no drastic improvement in use of wildlife resources has occurred.

Moose harvests are to be based on maximum killing at minimum size of the winter population while retaining optimum percentage of most productive animals, adequate distribution of killing in specified area, and controlled relationships with forestry based on principles of mutual benefit. Simultaneously, management will decrease predator populations, non-licensed harvests, and deaths by woundings and will improve methods of moose population management.

MOOSE IN WILDLIFE RESERVES OF THE USSR

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An analysis of the condition of moose populations in wildlife reserves of the USSR is presented. As of 1988, moose inhabit 67 of 160 reserves and 10 of 19 national parks occurring the USSR. Moose in reserves total 7575 and in parks, 1355. Density is 1.2 and 1.9 moose per 1000 hectares of forest area in reserves and parks, respectively.

Protected groups of moose in reserves reach from 5-10 to more than 900 individuals. Depending on the character of anthropogenic changes occurring in areas around reserves, moose populations behave more or less independent. Dynamics of moose number in reserves depends on their numbers in surrounding areas.

The importance of protecting natural areas in preservation of species and some results of moose studies in reserves are discussed.

MOOSE MANAGEMENT IN LATVIA

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Moose in Latvia in 1975 numbered about 45,000 and in 1989 nearly 17,000. Sex ratio (0:0 = 1.0) for 1935-1937 and 1963 was 1.7 and for 1989 was 1:1.3. The sex ratio for calves remained a constant 1:0.8. Bull:cow ratios of moose harvested in 1988 by age group were: 20%:13% for 1.5 to 3.5 year-olds; 75%:83% for 4.5 to 11.5 year-olds; and 5%:4% for 12.5 year-old and over. A similar sex-age distribution occurred 1974-1979.

Based on autumn estimates, the annual increment rate was 29% for 1963, slightly lower during the 1970s, and averaged 23% for the last two decades. Of the antler trophies, 0.1% correspond to the top award in international standards, with no regional or seasonal variations in quality, and the best antlers from individuals aged 11 ± 3. Moose and elk exhibit no distinct intervariety competition.

Recently, moose started to feed on agricultural crops. Winter feed for moose is: Salix sp., Rhamnus frangule, Populus tremula, Juniperus communis, and Sorbus aucuparia. Browsing young shoots of pine and spruce bark is observed in cases of feed shortage.

Total reported kill for 1954-1988 is 111,829 moose. Current population density is 1-5 moose per 1,000 ha of forest. Optimum index of carrying capacity for Latvia is believed to be 5-10 moose per 1,000 ha. Population density has been managed for minimal forest crop damage. Legal hunting is the only management tool of moose. Since 1979, wolf predation has locally affected moose populations. Prolonged, intensive hunting and fencing have had no adverse impact on moose. Population reductions will no longer be pursued, and natural feed resources are being increased. Only an integrated approach will positively solve moose/forest management conflicts toward increasing overall productivity of forest biogeocenose.

PHYSIOLOGICAL COMPOSITION OF MOOSE BLOOD

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Parameters of moose blood are related to the peculiarities of its habitat and pre- and postnatal development. The most significant changes in blood occur during the first half of embryogenesis and first months after birth. Parameters of adult animals depend on seasons and lactation.

In early fetuses of body weight up to 75 g, blood oxygen capacity may reach the value of newborn moose owing to comparatively high concentration of erythrocytes (up to 4.10^{12}/1 versus 4.81 to $7.86.10^{12}$/1 immediately after birth) and hemoglobin (up to 100 g/1). Although quantity of hemoglobin in other animals increases gradually during entire embryogenesis, this parameter in young moose embryo reaches the value of newborn (about 10 g/kg body weight). Newborn moose have less concentration and quantity of hemoglobin in blood compared to other species of hoofed mammals. That may be associated with low moving activity of moose during first days of postnatal life. In adult moose, these parameters are relatively low also.

Body weight increases rapidly for the newborn period, though blood changes occur related to hemolysis of embryonical erythrocytes and replacing them by the new type of erythrocytes. The peculiarity of moose red blood physiology is also high oxygen affinity of hemoglobin in newborn (p50 is 21.4 ± 2.5 mm Hg) and in adult animals (p50 is 28.5 ± 0.8 mm Hg). The development of the red blood system during newborn period is such a rapid process that several 1.5-week-old moose have the oxygen affinity value of hemoglobin in adults.

Moose have the same very low content of 2.3-DPG in erythrocytes immediately after birth (mean value is 0.49 mcm/ml cells) as in mature age (mean value is 0.49 mcm/ml cells). The biological peculiarities of moose red blood needs a complex analysis together with data on system of respiration, hemodynamics and other factors.

METABOLISM IN MOOSE RELATED TO SEASON

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Many years of physiological investigations conducted on animals (cows, sheep, reindeer, and moose) conclude that metabolism differs among species and depends on seasonal feeding. In summer, moose have more available feed. The basic reaction of metabolism in moose is maintained by ion metabolism in the rumen. As a result of carbohydrates and proteins fermentation, a significant amount of carbon dioxide, volatile fatty acids, amino acid, urea, ammonia, and other metabolic elements is formed. During the dissociation of mineral and organic compounds, a low acidity of the rumen contents is regulated by bicarbonate ions and carbon dioxide. As a result of hydration of CO2 in the rumen, papilla cells by means of carboanhydrase bicarbonate anions are formed. Ions equilibrium of bicarbonate into anions of acetate, propionate, butyrate is parallel to transportation of organic anions together with cations. All are included into the metabolic reaction of lemon acid cycle.

In winter, moose are not fully provided with nutritious and organic substances. Metabolic processes were observed changing. The content of potassium and anions decreases in the feed, but the content of calcium and manganese together with phosphates increases. To maintain normal metabolism in the rumen, the deficit of ions is equalized by increasing saliva ion compound which is also changing. Metabolism processes in the rumen slowed, and equilibrium ions and their transportation also changed. Acidos

USE OF MOOSE AND REINDEER BY KOMI-ZYRYAN ANCESTORS

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Moose and reindeer, wild artiodactyl animals of the taiga region of the Northern Sub-Urals, played an important role for ancient occupants of the Vychegda Basin, mainly komi-zyryan ancestors. This is supported by analysis of osteological materials, obtained from the cultural layer of a number of Middle Vychegda settlements of the Early Iron and Early Middle Ages. The share of artiodactyl animals in faunistic remains of mammals in archaeological monuments is as follows:

	Dzhudzhidyag	Ugdim II	Shoinaty II	Shoinaty III
Moose	4	47	60	60
Reindeer	96	-	18	15
Artiodactyls	100	47	78	75

In the fauna of Dzhudzhidyag monument of the Early Iron Age reindeer prevails, while in the monuments of Vanvizdin culture of the VI-X centuries (Ugdim II, Shoinaty II, III), which preceded the culture of ancient komi-zyryans (Vychegda Perm) XI-XIV centuries, moose is a predominant animal. In the first case, special reindeer hunting is presumed. In Vanvizdians, considerable hunting of furbearers occurred in addition to moose and reindeer hunting (from bone remains). Moose and reindeer were the main source of animal food of ancient peoples of the Vychegda region with traditional hunting-fishing economic structure. Of importance were the skins and bones of these animals for clothes and hunting tools. In the Early Iron and Vanvizdin Ages flint scrapers were used for skin processing, and hunting implements are represented mainly by bone and iron arrowheads. The periods of hunting on moose and reindeer were fixed in ancient komi calendar, which testifies to the importance for hunting trade of komi-zyryan ancestors. The wide variety of hunting implements for large animals in Vychegda Perm includes numerous arrowheads of different type, iron spears and darts.

PASSIVE HUNTING SYSTEM OF LARGE UNGULATES IN TAIGA ETHNOSES OF WESTERN SIBERIA

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Hunting plays an important role in the cultural-economic complex of the native people in Western Siberia. The importance for their economic structure is difficult to overestimate. Passive hunting played a dominant role in the hunting complex at different stages of historical development, especially hunting on large ungulates.

This peculiarity of the economy of native ethnoses in the taiga zone of Western Siberia (khanty, mansi, selkoops, siberian tatars) was due to the conditions of the surroundings and ways of household (economic) activities. The products of hunting large ungulates were fully utilized: meat and internal organs were eaten; clothes and parts of wellings were made of skins; various implements, harness and arms were made of bones and horns. The importance of passive hunting was it allowed the rest of the population, not busy in hunting, to be occupied with household activities, such as fishing, mushrooms and berries gathering.

The main implements of passive hunting on ungulates at the end of the XIX century and first quarter of the XXth century were crossbows, the loop, clips, hugs and trap-peats were used not only in the taiga zone but also in other zones of Western Siberia. The loop is found in khanty of the Tomsk of the Northern Barabino steep-forest zone. Clips were also used by the above people, while hugs were used only by khanty and selkoops of the Narym region. The level of the development of passive hunting on large ungulates made it possible to meet the needs in meat and skins of the native population of the siberian taiga, as well as the market demands on these products.

A SIMULATION MODEL OF THE DYNAMICS OF MOOSE POPULATION

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A simulation mathematical model of the population dynamics and biomass of moose in a heterogenous environment is proposed. The population in the model is regarded as a set of subpopulations associated with migrations. For each population, factors of the environment, interaction with the resource, predation and exploitation can be taken into account. The most detailed description is for moose population dynamics, where for each subpopulation fecundity, natural mortality, age structure, and the mechanisms of self-regulation are taken into account. The dynamics of resources is modelled without taking into account the age structure, predation rate being a function of time only. For simulation models of principal importance is the method or organization of respective computer programs.

The model of moose dynamics has been implemented as a program product for IBM-compatible computers. The program has been devised for a biologist, permitting editing initial data and selecting results for table or graphic output. The program has been written in the medium of TURBO PASCAL v 5.5. For the graphic representation of the results the QUATTRO system is used, into which a specially organized results file is imported.

Using the above model, the population state and moose removal quota in the Sverdlovsk Region was estimated. Allowance for space permits setting different quotas for subpopulations in the given case, administrative regions. Different regimes of removal have been analyzed, and the one optimal for the present state of moose population in the Sverdlovsk Region selected.

REPRODUCTIVE POTENTIAL OF *ALCES ALCES* UNDER DOMESTICATION

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Data acquired on moose farms contradict and correct information presented in the literature on lifespan, reproductive period, fecundity and offspring sex ratio. Domesticated moose life span is 18-20 years, and they breed from 2 to 17 years. The majority give birth to twins. On farms, instances of triplets and in nature quadruplets were recorded, indicating potential polyploidy, which can be realized under domestication. The gestation period is 215-230 days. Experiments demonstrated the polycyclicity of females at 18-21 day interval in the field season of over 2.5 months. Data which characterize the dynamics of fecundity (average 1.55) and offspring composition (100:94 bull:cow ratio total) in different age females are presented.

ANABOLIC AND ANTI-ULCER PROPERTIES OF MOOSE MILK

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Studies of moose milk reveal that this product can be effectively used in therapeutic practice. In a special sanatorium, effect of moose milk on closure of Ulcus ventriculi and Ulcus duodeni was studied. Moose milk was used in therapy of 175 patients in acute condition. The controls were 42 patients, receiving fresh undiluted cow milk. Both groups of patients were chosen at random from patients entering at different times. They were identical in composition, clinical picture, and had similar sanatorium treatment.

Patients received moose and undiluted cow milk (as a placebo) in a single pattern: 100 ml 6-times a day, at room temperature, 40 minutes before the meal and before sleep. The course of treatment was 21 days. Patients were examined when they entered the sanatorium, during the course and at the end of treatment in a standard pattern, including intra-stomach x-metry and endoscopy. Clinical observations indicated that moose milk was well-sustained, and in some patients stool was delayed. Moose milk had a pronounced effect on a reverse development of the majority of symptoms of peptic ulcer: an improvement of general condition, disappearance of pains and nausea and scarring of the ulcer.

According to results of endoscopy after three weeks of therapy using moose milk, the ulcer defect was closed in 87.8%, and in those given cow milk only 55.8% ($p < 0.001$). In 12.2% the defect of the mucous membrane of ventriculi and duodeni remained unchanged (7.0%) or increased (5.0%), in contrast to patients who received moose milk. During moose milk treatment, body weight of patients considerably increased compared with the controls. Thus, moose milk in an integrated therapy of Ulcus ventriculi and Ulcus duodeni can compete in efficiency with the newest drugs. Its advantage is that this is a natural product of increased biological value, apparently having diverse therapeutic mechanisms.

THE IMAGE OF MOOSE IN FINNO-UGRIC MYTHOLOGY AND PEOPLE'S PEDAGOGICS

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In the mythology of many peoples inhabiting Pre-Ural and Volga course territories (permian, Ob-ugric, volgo-finnish), a moose cult is reflected from ancient times. Evidently in ancient beliefs, moose served as a totem ancestor. In the komi-ziryan and komi-permian languages, the names of moose (iora, lola) underline its strength and power as well as its relations with such a mysterious world as a human soul. In the komi-yazva dialect, vorpian (moose) is compared to the child of nature. The taboo signs may be found in udmurt and mari names. The image of moose in the people's pedagogics of the finno-ugric groups of the population is associated with the bearer of kindness having a number of positive features, such as self-sacrifice, resourcefulness, diligence, and nobility. In numerous legends, tales, and other folklore, genres moose is a savior of people and animals: to those weak, moose gives strength (gives his antlers); in some ugric and turkic (bashkir) legends, moose is a guide among hunting groups searching for new places (a new parent motherland?). Our ancestors following a moose obtained their new refuge. One-type animal cult, motifs and images in the mythology of many peoples are not only the result of contacts and typological similarity, they are also evidence of ethno-genetic relations between ethnoses formed.

ESTIMATION OF THE CONDITION AND PRODUCTIVITY OF MOOSE POPULATION

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In connection with the growth of anthropogenic influences on natural systems, the need to estimate condition and productivity of animal populations is of particular importance. Expansion of traditional study methods of ecology and usage of system analysis, that is concrete definition of purposes, formulation of conceptual models, mathematical model development and, as a result of all this, estimation of the condition of a population and its management are necessary for resolving these problems.

Data on age structure and cow productivity have been used to build up the mathematical model of moose populations dynamics (Rusakov 1979, Peterson 1977). Age mortality was defined on the basis of demographic analysis, and natural losses were defined on the basis of hunting data. On the basis of these data, the matrix model of moose dynamics in northwestern USSR has been developed. Nomogramme of the changes of the main Leslie matrix eigenvalue, which depends on birth and death rates, has been calculated. Taking into consideration the data on calf:cow numbers and mortality, one can predict numbers for the next year.

Based on moose dynamics, the stationary trajectory (e.g., the limit cycle) was plotted on the nomogramme, and the trajectory of changes in animal numbers was plotted in condition space. It defines not only a phase of dynamics, but it gives an estimation of the productivity process. The trajectory of this process was plotted on the basis of the limit cycle. According to the diagrams, one can estimate the expected changes of numbers, maximal productivity, and expediency of moose exploitation.

The analysis shows that maximal productivity is gained on the phase of increasing numbers which equals approximately between maximal and minimal quantity. Minimal productivity is gained at the decline phase while the numbers are approximately the same. Thus the obtained diagrams make it possible to estimate current condition of a moose population, its productivity, and expediency of exploitation of the population.

TELEMETRY STUDY OF MOOSE BEHAVIOR UNDER DOMESTICATION

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Two telemetry systems were designed by the author for studying wild animals in their natural environment. "Moose-2" is simple radio-tracking equipment, and "Moose-3" transmits physiological parameters, such as electrocardiogram (ECG) and breath frequency (BF), from free-ranging animals. A telemetry study of moose behavior was conducted at Kostroma moose farm in cooperation with the Scientific Research Institute of Normal Physiology (USSR Acad. of Medical Sciences). The methods used were based on a simultaneous ECG, BF and observer comment recordings by means of parallel radio-channels. The significance of stimuli was evaluated by use of physiological data concerning the organism control systems reactions.

Many visual observations would be impossible without radio-tracking. Most of the behavior categories were studied. Mother-calf system relations during first days of development are based only on a minimal number of inherent reactions. This system consolidates and exists until new calf birth next year. Some typical behavioral elements produce specific patterns of physiological parameters. "Freesing of prone response" is followed by fear bradycardia. Moose, since first hours of life, almost always attacks a small moving object with great excitement. Alerted behavior, as a rule, is accompanied with emotional stress, ECG, BF, being varied significantly. The difference in agonistic behavior between domesticated and wild moose can be explained by the difference in recognition of danger, i.e. in alerted behavior. During the first days, moose calves are forced to adapt to their mother's activity rhythm. At the end of summer, the rhythms and traveling across the inhabited area of calves and their mother become synchronized. Sound and chemical types of communication mechanisms are the most important ones for a forest animal. The rut behavior of a domesticated moose is similar to one observed in a wild moose. In summer, a moose with two calves inhabitated an area of 12-43 km^2.

STATE - LEGAL PRESERVATION OF MOOSE

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Governmental law preservation of the environment is based on the principles of state property of major natural resources, state planning, socialist legislation, and combination of national and international tasks. These principles are stated in the Constitution of the USSR and in the Union and Republican legislations.

One of the most important directions in the realization of ecological function of law is the development and modernization of legislation on moose and other ungulates preservation. Another direction is ecologization of legislation, planning, projecting, localization, construction and introduction into exploitation enterprises effecting the environment, economic, organizational, jurisdictional, and ideological guarantees of plans achievement of economic and social development.

There is also a civil law method of moose and other animals' preservation. It is actually an instrument of damage minimization. However, there are no measurable guidelines to evaluate damage. In some republics, fine size depends on the place of animal hunting (fine size on attributed farms, green zones and ranches is 1 and 1/2 and in preserves 2 times as much as on free farms), but in other republics, it has no such dependence. In some cases the fine size depends on the animal age, but in others it is estimated without considering animal age.

From the position of intensive utilization of northern resources, one can witness such phenomenon as the earth cover destruction. This is why the ungulates depending on vegetation present a serious problem. But the estimation of the world damage by animals is not fully realized. Sometimes in the process of industrial and nature reformation, it is ignored, especially in the northern regions.

The third group of problems is connected with the increase of ecological, legislative responsibility, and prevention of ecological breaches of law as far as game animals preservation is concerned.

DISTRIBUTION OF MOOSE IN THE SIKHOTE-ALIN RESERVE

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Nature records of the Sikhote-Alin Reserve over 1962-1983 are analyzed. The southern range edge of the Ussuri moose subspecies (Alces alces cameloides) passes through the Reserve area. Main moose habitats are the western slopes of the Sikhote-Alin Range, 1100 km2 in area, accounting for one third of the Reserve area. On the eastern slopes the moose lives only in the upper reaches of the rivers. It prefers coniferous forests with a mixture of deciduous trees (spruce-fir and larch). Moose are common on old burns. Summer and winter habitats differ. In summer moose concentrate along the Kolumbe river valley with numerous alkali soil sites. Moose winter in the upper slopes of the Central Range, and some animals leave beyond the Reserve to the upper reaches of the Amur River.

In 1962-1969, 13 instances of mortality were recorded. Of these, 11 moose were killed by predators (64% by bear, 27% by wolf, and 9% by tiger.) In 4 cases, moose were killed at the alkali soil sites. Beginning in 1958, the moose range expanded by its edge shifting to the south within 30 km of the sea coast. In the 1970s, the moose range dwindled and the moose occurred rarely on the eastern slopes. In 1971-1975 on the western slopes of the Kolumbe River, moose were sighted 26 times; on the eastern Taezhanaya River, 14; Serebryanka River, 3; Zabolochennaya River, 3; Dzigitovka River, 1. The number of tracks per 10 km of route was 1-3. The mean density was about 0.1 individuals/km2. During the 1980s, in connection with the growth of the tiger population, the wolf virtually disappeared from the Reserve. The brown bear population also declined. Hence, moose mortality was negligible and was not recorded every year. Changes in the range occurred due to the general decline of the moose population in the region under study. North of the Reserve, in the upper reaches of the Bikin and Samarga rivers, the moose occurs more commonly. On the sea coast, the eastern edge of the range is 150 km north of the Terney settlement. There moose appear in summer in swamped areas rich in wetland vegetation.

THE CURRENT STATE OF THE UPPER PECHORA MOOSE POPULATION

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The dynamics of the Upper Pechora population of migrating moose has been monitored since 1937. Over the 50 year period, one population peak (1955-1959) and one depression (1975-1979) were recorded. The amplitude between these phases is 34-fold.

In the 1980s, the population started increasing. By 1985, the number of migrants increased 3.5-fold, and during the subsequent five-year period (1985-1989), the number relatively stabilized at 211 ± 11. During that period, moose at wintering grounds within the reserved area (721,000 ha) was estimated at 434 ± 37 and the total population at about 1500.

The high population density at major wintering grounds led to a considerable depletion of branch food resources. As early as 1984, the degradation of rangelands where animals assembled reached 70-90% in late winter. Regardless, the majority of moose annually return to traditional wintering grounds. Only a few animals settle new areas, where despite rich forage resources, no wintering grounds were recorded during the last decades.

In the 1980s, the population was characterized by the high level of regeneration. The mean index of fecundity per pregnant female older than 1 year (n=97) was 1.5 ± 0.05 embryos; the percentage of females with twins 37.2%. The total sample (n=121) females without embryos constituted 19.8%. In May-October (n=450), the contributions of different age classes was: adults 58.9%, yearlings 26.7%, and calves 14.4%. Among sexed animals (n=379), a minor predominance was shown by females (53.8%). The annual population losses were mainly determined by anthropogenic factors: licensed hunting and poaching (up to 20%). Natural mortality (about 5%) was mainly caused by predation and drowning in the course of migrations. In the total sample (n=73), the proportion of moose killed by predators was 52% (bears 22%, wolverine 18%, and wolf 12%) and 33% of moose drowned.

MORPHOLOGICAL CHANGES OF ORGANS AND SYSTEMS IN ONTOGENESIS OF MOOSE, CATTLE, AND SMALL CATTLE AS RUMINANTS WITH DIFFERENCES IN THEIR ECOLOGY

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Research analysis indicates that the growth of live weight, skeleton, digestive organs, and endocrine glands in ontogenetic development of moose, cattle, and sheep had taken place with one and the same regularity of decrease in its intensity depending on age. On the background of common regularity, different age peculiarities of increase and decrease of growth rates in total weight and weight of separate organs and systems were found in examined animals. Histological studies showed that the growth intensity decrease of all the organs was followed by their structural complication. In comparison with domestic animals, moose is noted to have earlier origin and formation of thyroid and adrenal glands, tymus, foci of ossification in skeleton, characteristic structure formation in digestive organs due to historical changes in ecology, in particular, in cattle and sheep as a result of their domestication. This resemblance in their growth and development probably points to their adaptability and similar previous conditions of their existence.

THE ROLE OF MODELLING IN THE SOLUTION OF GAME POPULATION MANAGEMENT TASKS

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The task of management of wild hooved animals population as a game resource is to control the quantity and age-sexual structure which provides the maximum game production under conditions of limited fodder supply with the requirement of the population vitality, i.e., the maintenance of essential genetic variety and health of specimens. The difficulty of achieving these goals is based on two reasons. First, inadequate information about the fodder supply, the population structure, the cattle-plaque, and the migrations. Second, the low game selection, limited by the visible animals groups. As a result, the effective management of the population seems to be impossible without modelling for the control and agreement of the primary data and without computing variants for choosing the best way of the population exploitation.

To solve the problems in Taymir, the following complex of models was worked out: the model of permanent state of population, which solved the problem of structure optimization within the limits of visible distinction of age-sexual groups of moose; the aggregate balance model of the population for determination of co-efficient alteration of natural cattle-plaque and the correction of game quota; the model of "population - foder supply - game economy" for the investigation of the quantity dynamics, age-sexual structure and the animal mass of natural and guided population at different external influence. The components of the distributed model of the game system have been worked out for the simulation of migration processes and spatial arrangement of animals. Assessing the results of the application of the model complex, we consider that this approach may be useful for studying the problem connected with exploitation of moose.

DEPENDENCE OF MOOSE POPULATION PRODUCTIVITY ON SEX RATIO AND DENSITY

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Three ecological moose populations living in spruce-pine, mixed spruce-deciduous and deciduous forests with an admixture of spruce were analyzed. The total area of these forest types covered 43,000 ha. Forage load, sex ratio, and the number of young in these populations were determined from winter pellet group counts. Pellet groups were identified as left by males and females older than 1 year and animals younger than 1 year. A total of 3,050 moose pellet groups were counted along 4,572 (4x100) transect belts. The data gathered was subjected to a regression analysis.

It was determined that the greatest number of young (25-26%) in the ecological moose population occurred when the ratio between males and females varied from 1:0.9 to 1:1.1. This relationship is expressed by the following equations:

in spruce-deciduous forests

$y = 1.99e^{5.31x - 3.31x2 - 0.57x3}$ (n = 0.747; S = 5.1)

in spruce-pine and spruce-deciduous forests

$y = 5.38e^{3.36x - 2.20x' - 0.38x3}$ (n = 0.694; S = 5.2)

where y = the number of young in the population; and x = relative number of females in the population.

The greatest number of young in the population of moose is reached (25-26%) under forage load from 3 to 6 moose-seasons on 1000 ha of forest. This relationship is expressed by equations:

in deciduous forests

$y = 19.20 - 89.04/x - 312.65/x2$ (n = 0.729; S = 4.8)

in spruce-deciduous forests

$y = 31.96 - 1.08x - 0.23x2 - 0.02x3$ (n = 0.371; S = 8.5)

where y = the number of young in the moose population; and x = forage load of moose on 1000 ha, in animal-seasons.

In order to sustain the most suitable sex ratio (from 1:0.9 to 1:1.1) and high productivity of moose population, animals younger than 1 year should make up 40-50%, while adults make up 50-60% of all hunted animals. Among the latter, the most productive 4 to 8-year old animals and females with two offspring are protected.

THE STRUCTURE OF MOOSE POPULATION AND ITS EXPLOITATION IN THE KOMI REGION

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The increase in areas of young deciduous stands indicates an increase in biological productivity of moose habitats. In Komi, the total population of moose is estimated at 26-27,000. Legal harvests in recent years increased 2.1-fold, from 1450 to 3070. Males of all age classes comprise the majority of harvest. In recent years in the southern regions, the percentage of adult females has been increasing and the proportion of young decreasing. In the rest of the region, young constitute >20%. Dead weight data indicate that the majority of adult males are harvested at 3.5-5.5 years. In females the age range is broader.

Pregnant females account for 56 to 100% of all adults, 65-75% of which are recorded. Half of this number give birth to twins. In the southern part of the region, the percentage of twins is lower (24-40%). Cows with three embryos are rare (0.07%). The accuracy of the estimation of the weight of killed moose is low. A standard reliable criterion for weight estimation is needed, e.g., the heart weight, which is easily determined at home.

Harvest is most efficient at the end of season. In 1983-1984 when the hunting season included January, in October 5.8%, in November 15.3% and in January 50% of the licenses were used. The 1988-1989 hunting season lasted to 15 February. In October 1.5%, in November 19.5%, in December and January 21.0%, and in February 27% of the licenses were used. A shift of the season to a later time is determined by climatic factors. The main method of moose hunting is shooting as the hunter approaches the animal. The harvest depends on the pattern of snow cover, weather conditions, the possibility of exploitation of distant grounds, and urgent transportation of the meat. Hence, the dates of hunting should be set on the basis of the regional conditions and hunting regime.

MYTHOLOGICAL "SEVEN-LEGGED MOOSE" OF FOREST NENETZ IN CONTEXT OF THE UNIVERSAL COSMOLOGICAL NOTIONS

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The existence of numerous legends of different Siberian peoples about hunting heavenly moose, which has solar symbolisms, is one of the forms of animal-like code of natural, social relations. Additional possibility for developed reconstruction of cosmological notions of Siberian peoples is given by the numeral characteristics of heavenly moose—number 7 has special meaning. Thus, heavenly hunter "Tyaptukage" (the Great Bear) tries to overtake the "seven-legged moose" along the Milky Way. At the same time, the "seven-legged moose" occupies a special place in mythological notions of the hunts, but the spirit of the "seven-legged horse" was called by the shamans of forest Nenetz during camlanie. This fact indicates again the special meaning of number 7 in cosmological descriptions. Therefore, Nenetz "historic" legends narrate about 7 brothers, which originated 5 kinds of hunting worlds, and 2 Nenetz families (Verbov, 1939).

It is notable that spiritualization existed not only in folklore materials of Hugro-Samodians but also in the Yakutsk "olonho". It is here that 7 families, 7 swans, 7 girls, 7 sides, 7 heads of the epic hero, and other images appear. They are connected with the description of mythological image of the world. Thus, number 7 expresses the common idea of the Universe, which consists of "upper-level" and "underground" worlds. Additionally, in the context of numeral symbolics unevenness is characteristic for the "upper-level" world and evenness for the "underground" world.

We note that, having overtaken the heavenly "seven-legged moose", the heavenly hunter "Tyaptukage" separates his 3 legs and lets him go to the Earth in his habitual appearance for us as the object of hunting. So, the "seven-legged moose", expressing the idea of cosmos, becomes the object of worship, and the earthly moose becomes the source of life.

A COMPARATIVE CHARACTERISTIC OF LACTATIONS IN MOOSE AND ELAND

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Currently, 2 species are being domesticated in order to acquire medicinal milk: moose (Alces) and eland (Taurotragus Oryx). During the post-war years, 29 moose cows and 72 eland cows have been milked. More than 30,000 and 60,000 liter of milk, respectively, have been acquired with the following maximum indices: duration of lactation = 160 and 390 days; milk yield per lactation = 575 and 642 kg, milk yield per day = 7.4 and 6.9 kg, and fat yeld per year = 14.7 and 14.2%, respectively. Average indices of the entire period of milking moose and eland are considerably lower: 113 and 200 days, 190 and 300 kg, 1.02 and 1.80 kg, 10.87 and 10.43%, respectively. These data have been reached without selection for milk yield, using only natural performance of these still semi-wild animals, which are at initial stages of domestication, and their ecological peculiarities. The lactation curve has a steeply descending character that is characteristic of all the wild animals and primitive breeds of farm animals. The majority of the cows did not give milk long. Only 12 moose cows and 42 eland cows were milked longer than 5 lactations. The moose and eland can be introduced into zooculture and into practice as producers of medicinal milk and used in the development of domestication theory.

THE CONCENTRATION OF AMINO ACIDS IN DIFFERENT PARTS OF THE DIGESTIVE TRACT OF MOOSE

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In autumn, moose ration consists of twigs of trees and shrubs, the concentration of crude protein is 7-8% in diet. The concentration of amino acids in dry matter of moose rumen contents in 1.5-2.0 times higher than in feed of diet, following synthesis of microbial protein and inflow endogenic nitrogen. In omasum, the concentration of amino acids is lower than in rumen, because small parts of feed and solubility proteins passage to abomasum, but only large parts of feed remain. The concentration of amino acids is equal in rumen and abomasum content.

In the beginning of small intestine, the concentration of amino acids is 5-10 times higher than in feed of diet. It is probably endogenic protein secreted with abomasum, pancreas juices, and bile. The concentration of amino acids is less in the small intestine due to absorption than through intestine wall to the blood.

The contents of hindgut has no fermentative activity and processes of fermentation goes due to enzymes of microorganisms. Fermentation intensity depends on energetic substrates entering from small intestine being available to microorganisms. Evidently in hindgut the energetic substrates are not sufficient because tendency to increase concentration of amino acid is observed only in colon due to microbial populations.

Thus in the chymus of digestive tract of moose, the concentration of amino acids is increased due to transformation diet protein to microbial in the rumen and in beginning small intestine as a result secretion protein-enzymes in composition of digestive tract juices.

FOREST UNGULATES IN ARCHAEOLOGICAL MATERIALS OF EARLY AND MIDDLE HOLOCENE

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The fauna of Mesolithic, Heolithic, and Eneolithic sites of the Pechora and Vychegda basins is considered. In spite of unfavorable soil conditions of the region for conservation of faunistic remains, considerable data have been accumulated. The upper Vychegda sites Parch 2 and 3 (Boreal-1) are the earliest Mesolithic sites where bones of moose and beaver were identified. The later (supposedly Atlantic-1) sites Leck-Lesa (two complexes), Ust-Ukhta 1 on the Izhma gave the remains of moose, beaver, and bear. In the Early Neolithic Vychegda settlements Kochmas A, Chernaya Vadya, Review 1, and Niremka 3 (Atlantic-2 and Atlantic-3), moose and beaver prevail, but reindeer, bear, wolf, and fox are also found. On the Chernoborsk 3 site on the Izhma, moose and reindeer remains are present. Three eneolithic complexes of Niremka 1 settlement on the river Vym (subboreal-2) do not have remains of moose; reindeer and beaver are present. The sites under consideration belong to populations of different cultures and differ in types, including summer and winter, base settlements, and short-time camp sites.

In spite of all given above and changes in natural conditions (changes of subzones of middle and southern taiga), throughout Early and Middle Holocene, forest ungulates were the primary hunted species. The significance of this trend (hunting) for the economy is that it affected the ideology of the population. In the Vis-1 peat bog on the Sindor Lake, a ski with the carved moose's head was discovered, dating back to the Mesolithic times (Atlantic-1). A reconstruction of ancient hunting requires an analysis of hunting implements in existing collections, and ethnographical data are necessary. The absence of spearheads and darts in most sites shows the possible use of arms with heads fitted with microliths.

ADAPTATION OF PECHORA TAIGA MOOSE TO SEASONAL MINERAL FEEDING

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Forage reserve for moose, conditions of their feeding, and metabolism in their organism depends on seasonal feeding. Summer forage, especially young leaves of plants, are rich in nutritious substances. In this period, the animals get <4.3 kg of dry matter forage and <100 kg of living mass/day. They also get much potassium, calcium, and magnesium but less sodium and chloride. Favorable conditions for intensive fermentation in the moose rumen provide high concentration of organic and mineral ions. Nutritious substances contained in summer forage are well assimilated in the moose digestive tract. For example, 2.3 of animals having ion content are peculiar for this period. Acid-base balance in blood also characterizes base relations in the organism of moose. In winter, moose get half as much dry matter of feed as in summer. When supplementing with potassium, the animal becomes 6.5, with magnesium = 5, and calcium and phosphate = 2-3 times lower. Seasonal changes of feeding conditions influence the digestive processes too. The intensity of rumen fermentation as well as the concentration of volatile acids and much of the ions, except for sodium and phosphates, decreases. Relative constant content of ions in the rumen is maintained by the electrolytes of secreted saliva and their metabolism through the rumen wall. Assimilation of minerals in the digestive tract lower 7 times. The organism of moose adapts to seasonal changes of mineral feeding. This is due to dropping urine and the quantity of excrements, as well as changing the concentration and ratio of ions in their excretion. Nevertheless, the possibilities of moose adaptation to seasonal mineral feeding are limited. Due to the long winter period, the lack of nutritious substances causes 80 kg weight loss by adult animals and acid-base balance in the organism changes to metabolic acidosis.

ANTHROPOGENIC INFLUENCE ON THE CONDITION OF THE MOOSE POPULATION IN THE SOUTHERN TAIGA

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Large clearcut areas of the East-European Plain during World War II (1941-1945) were replaced by opulent new growth of pine and deciduous trees in afterwar times. As a result, major increases in moose numbers occurred in extensive areas. We conducted investigations of dynamics of moose numbers in 1949-1986 in the central part of this region, Prioksko-Terrasny Reserve, which is situated on the left bank of the Oka in its latitudinal part, and in surrounding forests.

Winter density of moose increased from 5 in 1949 to 68-98 in 1959-1960, subsequently decreasing to 2-7/1000 ha of forest. During the period of high moose numbers, seasonal wanderings and mass migrations of moose to the south entered territories where moose had been absent for a long time. During years of peak moose numbers, we observed the following: decrease of female fertility (0.8-1.13 embyos/ adult cow), accumulation of older age classes (>9 years old), increased mortality of youngsters in first winter (reached 30%), and deterioration of antler quality.

By the 1960s, winter foods of moose were exhausted. Young growth of pines on former cut areas dryed. As a result, a change of species occurred; undergrowth of pines in forests get a form of dwarf shrub and this is lasting more than 30 years. The great increase in moose numbers will have a long term impact on the regeneration of pines and junipers. Without doubt the influence of human activity on dynamics of moose numbers is long-established. Palaealitic campsites found in the northern half of East Europe are usually bound to the latitudinal parts of rivers where winter concentrations of moose formed.