MOOSE (*ALCES ALCES*) POPULATION CONTROL IN THE URALS

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ABSTRACT: I discuss the spatial dynamics of moose numbers, contemporary hunting practices, and migrations based on the structure of the landscape and subsequent human modification. I conclude that a single population of moose, comprised of subpopulations of non-migratory and migratory animals, inhabits the Urals. An optimal ratio of those groups allows full usage of habitats and high population densities. Existing methods of using the resources of the Urals are considered. Forms, terms, norms, and structural characteristics of removal of animals belonging to different demographic classes are recommended for population productivity to be increased.

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Rational usage of game resources demands a whole set of measures for their exploitation, reproduction, and protection. These measures are based on optimal population control methods, where the main goal for exploited populations is to ensure maximum, and if possible, stable harvest while preserving optimal population structure and numbers. Research is required to achieve that goal via the following activities: managing game species on a population basis; estimating carrying capacity of habitat; revealing and eliminating limiting factors; controlling harvest; tailoring harvest quotas to population surpluses; and, orientation toward demographic classes with regard to the quantity and quality of exploitation.

A number of specialized and generalized works (Yazin 1972, Filonov 1977, Gordiyuk 1981, Nikulin 1981, Dvornikov 1984) on ecology of moose (*Alces alces*) have been conducted in the Ural Mountains. Until the present, however, the population approach to game management has not been well grounded, and no management strategies have been based on it. Therefore, we are trying to define the population as a management unit and outline a strategy for conservation of moose for the time being (Dvornikov 1989).

I chose a population on the basis of data taken from the above-mentioned works. It was possible to trace the population history in a particular region, where animals functioned and responded to environmental changes as a whole, in accordance with their ecological characteristics.

Bone remnants of moose can be found in Pleistocene deposits. Dynamics of habitation of the Urals by hoofed animals has been traced via paleontologic material. Moose, as a rule, inhabited forest biotopes. At the same time, findings of material in unusual habitats for moose gave grounds for supposition that during periods of landscape change the animals migrated towards places with a mosaic distribution of vegetation and considerable supplies of food.

Contemporary natural populations were formed in the Holocene. Meridional mountain ridges are spotted with communities of mountain tundra and meadows, fir (*Abies* spp.), spruce (*Picea* spp.), mountain pine (*Pinus* spp.), and pre-forest-steppe areas. At the foothills of the Northern Urals, fir, spruce, and mountain pine forest grow. In

the eastern part of the Southern and Middle Urals there are still some remnants of pine forest. Clearings in the mountain forest started to appear in the 18th Century, which contributed to the mosaic distribution of vegetation. Therefore, the perpetuation of moose in the Urals through periods of generally unfavorable conditions (Filinov 1983) has been facilitated thanks to the mosaic of ecological conditions present.

In the 20th Century, transformation of the landscape by humans influenced the dynamics, numbers, and distribution of moose inhabiting the Middle and Southern Urals. During the 1920s through the 1940s, moose were few in numbers in the Urals. Their migrations were but feebly noticeable. An intensive change in the forest structure during the 1940s through the 1960s contributed to increasing moose numbers. At present moose inhabit 64% of the basic forested areas. One can observe that moose favor biotopes situated in low places and medium-high mountains covered with saplings on clearings and with young, mature, and overmature coniferous forest. Thus, the dynamics of forest formation influenced the number and distribution of moose.

During the 1970s and 1980s the moose population became relatively stable and averaged 55-60,000 individuals. Traditional migrations took place throughout the Urals. In the absence of vegetation differences, animals may be observed across a range of 560,000 km^2 (350 x 1,600km). In places of high concentration, including remnant pine forests, the density reached 50-80 individuals per 1,000 ha. At the same time the density in plains areas averaged 1-5 moose per 1,000 ha. The available food supply in mountain and pre-mountain areas averaged 400-2,000 kg/ha, in forest-steppe areas the average was 60-800 kg/ha (dry mass). The amount of food used in the latter places was higher. In addition, there is some specificity in feeding among groups of animals inhabiting different areas. No doubt it confirms the theory that moose migrate to mosaic vegetation areas with large amounts of diverse forage.

The characteristics of traditional migrations are believed to be caused by the development of special mechanisms in response to the environment: the amount and the quality of forage and the depth of snow cover late in winter. Once a stimulus is received, animals inhabiting large areas begin to migrate. The traditional migration of moose in the Urals has been one of the main ecological events for a long time. Those characteristics in ungulates are fixed genetically and through parents' experience. The migrating groups are believed to appear as a common adaptive phenomenon, which later directionally changed the genetic structure of animals in accordance with the population cycle.

From the existing evidence, I conclude that there is one population of moose in the Urals. It includes subpopulations of non-migratory and migrating individuals in the same area. Their optimal ratio of abundance ensures their ability to use the forest fully and maintain high populations. At the same time one can see that the noticeable migration of moose is caused by the fact that in freezing weather moose prefer young coniferous stands as well as mature juniper stands over deciduous stands. Large virgin tracts of forests remained throughout the North Urals and in the Middle and Southern Urals at an elevation of 500-1,200 m. Thus, large groups of moose exist in the mountains where clearings border on large tracts of forest.

We know that population production may be increased through intensive management of hunting. Hunters take 6–7,000 moose in the region annually, 35–45% of them in November. The mortality rate including hunting is 22–31%. So taking into account the population of moose in the

North Pre-Urals and Trans-Urals, I recommend harvest rates of 10% in heavy coniferous forests in the mountain-, north- and middle-taiga habitats, and 15% in the light coniferous forests in the middle-taiga, with a ratio of yearlings:immature:mature animals of 15:10:70, and a sex ratio of 50:50.

In the Middle and Southern Urals, as well as in the Pre-Urals and Trans-Urals, harvest rates can reach 15% in dark, light, and broad-leaved coniferous forest if the aforementioned ratios are met. In mountain pine, sub-taiga, and broad-leaved, dark coniferous forests, it is possible to harvest 20%, with age ratios of 20:15:65 and a sex ratio of 55:45 (males:females). In broad-leaved and aspen (*Populus*)-birch (*Betula*) forest-steppes, the bag rate may amount to 25% with ratios of 20:15:65 and 50:50. In island pine-steppe forests, including forest-steppe reserves, the same harvest rate can be achieved with age and sex ratios of 25:18:57 and 60:40, respectively. It is reasonable to carry out hunting from 1 October to 30 November, sport hunting from 15 October to 15 December, hunting utilizing calling from 20 August to 20 September, and selective harvest from 15 December to 15 January.

In some papers there are data on the validity and efficiency of biotechnical measures directed at the weakening of limiting factors. I believe that biotechnical measures are necessary in mountain pine preforest, steppe-pine, and birch forests, and broad-leaved and aspen-birch forest steppes of the Middle and South Urals. It is necessary to concentrate those measures in biotopes situated in middle parts of mountain ridges and in low places with mixed 80–140-year-old forested stands with a diversity of young trees and high capacity of biological rotation. While carrying out these measures it is necessary to follow the norms given for the region.

Moose preservation and further observance of their sex and age structure by visual methods and hunting samples are the main conditions of their rational use. It is also necessary to envisage hunters returning one molar from their kill with a license in a special envelope. From the information received it will be possible to judge the status of the population and to correct the number and quality of animals harvested.

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