IMPROVING POPULATION MANAGEMENT AND HARVEST QUOTAS OF MOOSE IN RUSSIA

Vladimir M. Glushkov

Research Institute of Game Management and Fur Farming, Kirov, Russia.

ABSTRACT: Annual harvest quotas for moose and other game species in Russia have been based on population estimates derived from traditional winter track counts and hunter surveys. This labor-intensive approach has failed to account for evident changes in population density of moose. Specifically, regional differences in survival and mortality data and the impact of increased poaching are not measured or included in population estimates, and overharvest of moose occurs. I propose implementing a standard management approach similar to that used in other countries with moose populations that includes population trend analyses, productivity and mortality data, and a regional management approach. Such changes will improve the professional management of moose and other game species in Russia.

ALCES VOL. 45: 43-47 (2009)

Key words: *Alces alces,* harvest, management strategy, moose, poaching, population estimate, Russia.

In Russia the population size of most game species including moose (*Alces alces* L., 1758) is estimated from winter track counts along established census routes. These annual counts are conducted in the latter half of winter after the hunting season, and include approximately 45,000 routes, each about 10 km long. The necessity and continuation of this large-scale annual effort and traditional approach stem from the desire to ensure an adequate harvest quota; however, this approach and related data sets have not recognized annual fluctuations in the moose population that are critically important when setting harvest quotas (Glushkov 1995).

Hunter surveys (about 10,000 questionnaires) conducted throughout Russia failed to reveal abnormal causes or rates of mortality that could cause population fluctuations in the moose population (Glushkov et al. 1989). The relative estimates of moose populations received from hunters at the start of winter under the program of "The Harvest Service of VNIIOZ" also failed to show any annual fluctuations in the population (Fig. 1). An analysis performed with a large sample size of biological data (2045 jaws from harvested moose, 555 female reproductive tracks, observation of 1360 family groups) collected in forests in the south taiga of the European part of Russia (Kirov Region) showed no dynamic changes in birth rate and natural mortality (Glushkov 1999). A decline in fecundity of sub-adult females was noted only when population density in a local area approached its maximum value (3.1-3.4 moose/1000 ha forest; 1981-1990), or when a decline in the proportion of females/litter (statistically significant only for females in the 4th age class) reduced the rate of population growth from 0.041 to 0.000. However, this decline was not only the result of self-regulation, but also of poaching that doubled from 1 to 2.1 moose per poaching incident (versus 1 moose/license). However, this population decline that started in 1987 is not reflected in the census data or hunter survey results.

A comparison of the data from the population estimates of the census and the hunter surveys at the beginning of winter revealed that both provided similar conclusions about the moose population growth rate; that is, stable

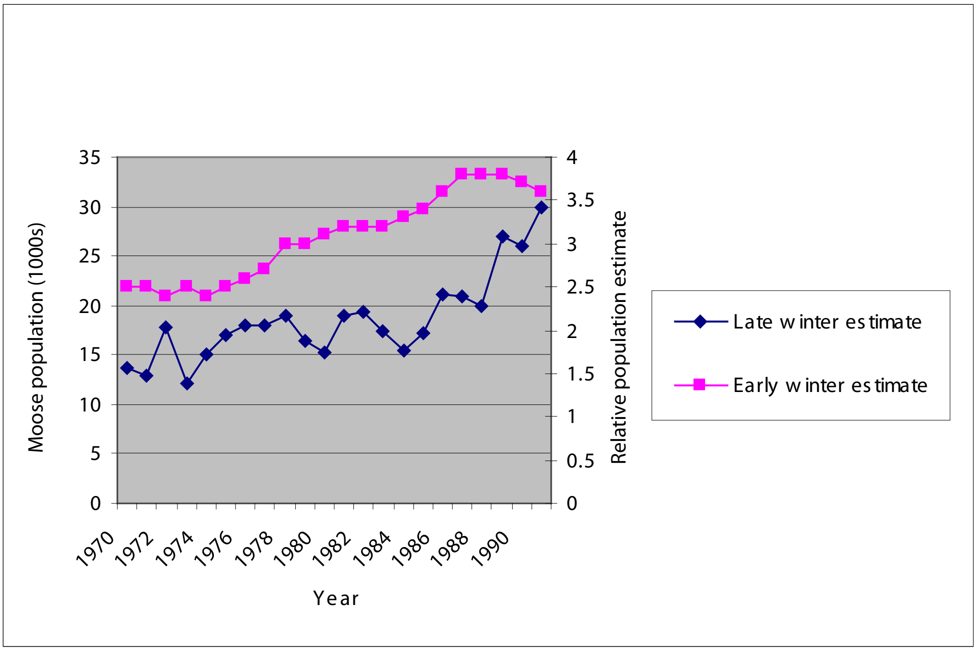

Fig. 1. Moose population estimates in the Kirov Region of Russia during early winter (relative scale) and from track counts in late winter (1000s of moose), 1970-1990.

and/or slow one-way growth (growth rate was 0.026). According to Odum (1986), this type of growth rate is sigma-shaped (logistic) and is regulated directly by factors that are population density dependent. Such growth is described simply by the logistic equation:

$$dN/dt = rN\,(K - N)/K$$

As the population reaches the upper asymptote K, growth rate (dN/dt) decreases and approaches zero. Harvest and lower birth rate further reduce the growth rate and prevent the density of exploited moose populations from reaching their maximum level; this would be illustrated by a low angle or minimal slope of the population growth rate curve. The population estimates estimated from the winter census routes (Fig. 1) show some irregularity as the population increased slowly (average growth rate was 0.048). This growth curve was similar to those depicting population changes caused by natural conditions for various species of birds (Williamson 1975).

Migration of moose in the Kirov Region was reduced during years with late snow cover; presumably there is a relationship between fluctuating population estimates from the winter census data and the occurrence and intensity of migration. A number of aerial surveys were carried out in early and late winter during a 5-year period (1981-1985) that confirmed this assumption. Further, it was also evident that the early winter aerial surveys could not identify small population growth rates (0.041 or 4.1 % per year) determined afterward from demographic tables; the aerial censuses indicated stable populations.

Data from moose populations in Finland and Canada confirmed 2 fundamentally important features concerning the type of population growth of a given species (i.e., stability and one-way direction; Glushkov 2001), but those populations were characterized by higher growth rates and more measurable response to harvest regulations than those in Russia. This occurs for two primary reasons: 1) the use of selective harvesting that produces a highly productive population, and 2) the absence of poaching that allows effective use of selective harvest quotas to manage populations effectively.

Analysis of our moose population growth rates and population responses of other hunted species indicated that all species with logistic growth rates (density dependent) are regulated by common internal (population) mechanisms. These include: 1) slow, difficult-to-measure population growth rates, 2) anthropogenic factors that cause measurable population decline (i.e., hunting mortality), 3) extended periods of population growth and decline, and 4) slow recovery when special conservation and bio-technical management techniques are required to restore the population. For conventional purposes, I described such species as "controlled" (Glushkov 2008) in contrast to species with fluctuating (trigger) growth rates. It is clear that the continued existence of "controlled" species depends substantially on the intensity of hunting, and implementing conservation and biotechnical measures. Effective harvest regulations provide the most reliable tool to control and reduce mortality to conserve hunted populations with logistic growth rates.

The harvest quota for moose is set by comparing the difference between birth and natural mortality rates. However, annual juvenile mortality is influenced by variable environmental conditions that affect food resources, weather, and predation. Because high calf mortality occurs in the first 3 months, harvest rates must account for calf survival not the actual birth rate (i.e., that is the growth rate at start of winter). This approach will provide the best estimate of the number of animals available for harvest. Because natural winter mortality is much lower than calf mortality, it is often ignored when setting harvest quotas. However, in Russia the rate of non-selective harvest has resulted in a negligible growth rate because it represents the difference between the population growth rate prior to the hunting season and winter mortality due to poaching.

For example, the average population growth rate in the Kirov Region is 0.190 at the beginning of winter. If this rate were effectively reduced to compensate for winter predation (0.02), natural mortality from diseases, wounds, other unknown causes (0.015-0.020), poaching (0.08), and a population reserve for increased reproduction (0.02), the non-selective harvest should not exceed 5.5% (0.190 – 0.135). However, this broad calculation does not account for partial replacement of certain mortality factors; the overall mortality rate could be lower than the sum of the rates of individual mortality factors (Glushkov 2002). Therefore, the integrity of the harvest quota is principally dependent upon the accurate estimate of the autumn population and calf survival prior to the hunting season; the relative importance of winter mortality due to poaching and natural factors is magnified by errors in this estimate.

Ineffective and harmful harvest quotas in Russia occur because of inaccurate population estimates, erroneous documentation about migration, lack of regional population growth rates and related mortality (e.g., poaching) data, and the temporal nature and population response to these factors. The introduction of a selective harvest system could increase both the birth and population growth rates of moose and help nullify their current, stagnant growth rate. However, its implementation and resultant change in harvest quotas will be difficult in the current system, and will require adaptive economics, harvest, and scientific management of moose in Russia.

This task may be simplified somewhat by following the example of foreign game biologists. Rather than depend entirely upon absolute, quantitative population estimates from annual data, they typically analyze trends in annual population data to assess and set harvest quotas. For example, harvest quotas are set relative to the previous year's quota by assessing special indices of population density (responses to the current level of harvest) on a regional basis. Proposed changes in harvest quotas could be delayed 2 years to reassess the status of the current quota and to reduce the potential negative impact of a changed harvest quota on the structure and productivity of the population.

The ability of a selective harvest management system to increase population growth rates and harvest has been documented many times. For example, I used examples from Scandinavian countries to illustrate moose harvest rates of 35%, or about 5x that in Russia. Management problems in these countries are also quite different; the Scandinavians typically manage their moose population to maximize harvest, avoid overpopulation, and prevent agricultural and forestry damage. In Russia, we strive to reduce poaching and hope to restore our moose population to a level sustainable with the natural productivity of the landscape.

CONCLUSIONS

1) The current method of setting moose harvest quotas is principally flawed because of error in estimating regional populations and mortality rates, and the regional and temporal variation of these parameters. Harvest quotas based on erroneous and incomplete data reduce the efficiency and economics of moose management, and for both practical and scientific purposes, an improved method is needed to set moose harvest quotas.

2) An improved strategy in setting regional harvest quotas would mimic common approaches in other countries that include an analysis of the population response to the previous year's harvest quota. If this system was introduced in Russia, federal managers should focus on strategic elements including the overall harvest quota and structure, and implementing management changes; tactical elements such as regional/local harvest quotas should be determined by regional management branches.

3) Population assessment of moose and other game species at the onset of winter should be done with annual population trend/index data. Each administrative district should have one game biologist responsible for such analyses; such an approach will reduce laborious fieldwork and overall costs substantially.

4) Biological assessment of population dynamics will need to improve. Moose populations need to be managed regionally in order to address variable population growth rates and environmental conditions. Standardized methods are needed to index/census populations of game species in order to produce reliable population density estimates. Administrative protocols need to be adopted to guide population monitoring efforts.

5) The current system employed to set the moose harvest quota in Russia has many weak components including lack of specific population dynamic information and laborious annual fieldwork to estimate population density. I propose a more simplified procedure of calculating harvest quotas for moose by using better estimates of population density, calf survival, mortality factors including the rate of poaching, and establishing population trend analyzes. These changes will make management of moose and other game species more professional and accurate, and provide an improved practical approach in conservation efforts with these valuable species.

REFERENCES

Glushkov, V. M. 1995. Method of winter route census as a factor of irrational use of resources of wild ungulates. Pages 55-56 *in* Hunting Science and Nature Use. Kirov, Russia. (In Russian).

_____. 1999. Moose. Pages 117-163 *in* Management of Game Animal Populations. Collected scientific papers of VNIIOZ. Kirov, Russia. (In Russian).

_____. 2001. Moose: Ecology and Management of Populations. Kirov, Russia. (In Russian).

_____. 2002. Ecological bases of population management. Pages 115-119 *in* Problems in Recent Hunting Science. Proceedings of Scientific and Practical Conference, December 5-6, 2002. Centrokhotcontrol, Moscow, Russia. (In Russian).

_____. 2008. Okhota i okhotnichie khozyastvo (Is it a rate or a quota)? 12: 1-2. (In Russian).

_____, V. N. Piminov, and B. P. Ponomaryev. 1989. Winter mortality and reserves of wild ungulate harvesting. Pages 81-92 *in* Management of Populations of Wild Ungulates. Collected scientific papers of VNIIOZ. Kirov, Russia. (In Russian).

Odum, E. 1986. Ecology, Vol. 2. Moscow, Russia. (Translated from English).

Williamson, M. 1975. The Analysis of Biological Populations. Mir, Moscow, Russia. (Translated from 1972 English version).