IMPLICATIONS OF HARVESTING MOOSE DURING PRE-RUT AND RUT ACTIVITY

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ABSTRACT: Concern that open gun seasons across North America may coincide with breeding activity, when moose (*Alces alces*) are highly vulnerable to harvest, gave rise to this study. Correspondence with Provincial, Territorial, and State agencies indicated that there were at least 147 open gun seasons for moose across North America in 1991-92, representing 139 different time periods between August 1st and March 31st. Despite geographical, latitudinal, and altitudinal differences across the continent, peak pre-rut/rut activity appears to occur between mid-September and mid-October when many gun seasons are open. Increased vulnerability of prime breeding animals immediately prior to and during peak rut activity may be compromising the gene pool by the removal of individuals exhibiting physical traits linked to dominance, and their potential offspring.

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The practice of calling moose has long been a tradition among North American hunters. Successful calling often rewards moose hunters with trophy bulls. If individual moose exhibiting inherited characteristics such as body and antler size, which may determine dominance during male encounters, are more susceptible to calling immediately prior to or during peak rut activity, hunters may remove these individuals before they breed, thereby adversely affecting the gene pool and subsequent generations, if seasons are set too early.

The objective of this study was to review the chronology of moose hunting seasons across North America, and discuss the implications on genetic fitness of moose populations.

METHODS

In addition to an intensive literature search, in 1991 letters were sent to all moose jurisdictions across North America (N=20) requesting information regarding the timing of rut and moose hunting seasons. Assuming that the best information available would be forwarded, no particular format was adopted for response. It was suggested however, that a hunting summary or map with the approximate peak dates of rut activity indicated directly thereon would be most helpful. A follow-up reminder was sent to jurisdictions not having responded after an appropriate interval.

For purposes of this paper, the "rut" refers to the period of breeding activity during which a majority of adult cows are usually bred.

Analysis of seasons was applied to gun hunting only, since this method of hunting accounted for most of the harvests. In Ontario, primitive weapon and archery moose hunts account for less than 10% of annual moose harvests (Ontario Ministry of Natural Resources files). Sustenance hunts were also excluded from this report.

RESULTS

Sixteen of 19 (84.2%) responding jurisdictions estimated that main pre-rut/rut behaviour occurred between mid-September and mid-October (i.e. September 16-October 15 inclusive).

In 1991 there were at least 147 open gun seasons for moose across North America, representing 139 discrete time periods. The earliest season opening was August 1st with the latest closing date set at March 31st.

One hundred and two of the 139 (73.4%) hunting seasons partially or completely over-

lapped what is considered to be the main pre-rut/rut period, while 37 (26.6%) did not.

Seasons by jurisdiction and pre-rut/rut activity estimates are summarized in Table 1.

DISCUSSION

Dussault and Huot (1986) suggested that photoperiod is the major factor responsible for the onset of pre-rut/rutting activities displayed by bull moose, at least in northern latitudes. Other studies (Monfort *et al.* 1990, French *et al.* 1960, Mirarchi *et al.* 1978) which demonstrated the relationship between testosterone production, photoperiod and rutting behaviour would further help to explain why the timing of seasonal rut activity across North America appears to be rather consistent in spite of geographical, latitudinal and altitudinal differences.

Miquelle (1992) separated pre-rut/rut behaviour at Denali National Park, Alaska, into 3 periods. During period 1, August 25-September 10, velvet was shed from antlers and bulls commonly aggregated. During period 2, September 11-25, bulls courted and defended cows from other bulls. Period 3, September 26-October 10, was considered the peak of the rut because 97% of all observed copulations occurred then.

Lent (1974) found that the peak of rut activity in four North American locations (Newfoundland, British Columbia, Montana, central Alaska) occurred between the latter part of September and mid-October, which agrees with observations made in Ontario by Gollat *et al.* (1981).

Claveau and Courtois (1990), collected utero-vaginal smears from cows and esti-

Table 1. Summary of 1991 North American Moose Seasons and estimated timing of main pre-rut/rut activity, by jurisdiction.

Jurisdiction	Number of Seasons	Main Pre-Rut/Rut Activity (By Week) September October
Alaska	43	
Alberta	6	
British Columbia	19	
Maine	1	
Manitoba	13	
Minnesota	1	
Montana	3	
New Brunswick	1	
Newfoundland	3	
New Hampshire	1	
NW Territories	2	
Nova Scotia	1	
Ontario	6	
Quebec	19	
Saskatchewan	13	
Vermont	NIL	
Washington	1	
Wyoming	13	
Yukon	1	
TOTAL	**147**	

mated that the peak of breeding in eastern Quebec occurred between October 5 and 15, while Killaby *et al.* (1990) ascertained through uterine examination of 69 cow moose harvested from northern Saskatchewan that 25% of cows were bred by September 26, 50% by September 29 and 75% by October 3. All authors indicated that breeding activity was consistent among years studied.

While bull moose are responsive to calling from about September 11-25 when courting and defending cows from other bulls, they may remain with one cow for up to 12 days during the peak of the rut (Altmann 1959). During this time they may not be as responsive to calling since they are very attentive to a single cow, but may lose their innate fear of humans (thus remaining vulnerable to hunting) owing to preoccupation with the sexual drive. Altmann further noted that younger, unpaired bulls are more likely to respond to calling during the peak of the rut because they are less likely to be actively defending a cow from other bulls.

Miquelle (1991) suggested that scent urination by adult bull moose is primarily directed toward females and supports the hypothesis that scent urination induces ovulation in cows. He further stated that mature bulls which scent urinate may increase reproductive success by inducing ovulation before their body condition declines, thus attracting cows by their scent, particularly in low-density populations, so that courtship is possible.

Barrette and Vandal (1985) stated that dominance must be observed and should not be assumed, and thus requires an interaction between two animals (dyad) for its establishment. They further stated that among the attributes studied (e.g. sex, age, body weight and antler size) in wild woodland caribou (*Rangifer tarandus caribou*) antler size was by far the best predictor of the occurrence and outcome of interactions.

If certain physical attributes such as antler size help to determine dominance, it is important to know whether these attributes are established through heredity or as a result of environmental conditions such as range (habitat). If dominant traits are hereditary then it is important to protect those individuals demonstrating dominant traits. If dominant traits are a function of range (habitat) conditions then range management becomes the main consideration in herd management. If dominant traits are determined through heredity and augmented by range conditions however, then a proper combination of gene pool protection and range manipulation should result in the greatest herd health.

Scribner *et al.* (1989) found that in white-tailed deer (*Odocoileus virginianus*) higher heterozygosity may positively influence metabolic efficiency resulting in enhanced nutritional condition, body stature and antler size, that potentially could affect dominance status and reproductive success.

Bubenik (1991) hypothesized that overharvesting of prime males in a moose population may lead to competition between remaining primes, sub-primes and even teen males for access to females. Since teens possess lower semen reserves, this may result in extension of the rut with resultant late-born calves. As well, high sex hormone levels in younger moose may induce early mineralization of epiphyses causing the animals to remain small in body size. Bubenik further hypothesized that these smaller animals would also produce offspring of a lower fitness and shorter longevity.

It is apparent that the concept of dominance is as yet imperfectly understood, but seems to depend upon such factors as metabolic efficiency, antler size, and adult body size, all of which appear to be positively associated with maximized genetic diversity (heterozygosity). Managers should be aware of these factors when setting seasons and harvest limits to avoid creating imbalances in moose populations which may lead to deterioration of the gene pool.

Season openings should be timed to ensure that animals exhibiting physical traits linked to dominance are not subjected to undue vulnerability during pre-rut/rut activity. Consideration may also be given to imposing descriptive restrictions (e.g. antler size) on the hunt which will limit or curtail the harvest of such important animals.

There appears to be an obvious need for more research in this direction.

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