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## IN UTERO PRODUCTIVITY OF MOOSE IN MANITOBA

Vince Crichton,

Manitoba Department of Natural Resources, Box 24, 1495 St. James Street, Winnipeg, Manitoba R3H 0W9

**ABSTRACT:** Information on in utero productivity in Manitoba moose has been lacking. Concern has been expressed that traditional bull only hunting seasons have resulted in fewer bulls and barren cows. This paper presents preliminary information garnered from an ongoing investigation, the objectives of which are to determine if potentially productive cows are being bred, the pregnancy rate for different age cohorts, the sex ratio of fetuses and the breeding period of moose. Data presented show a high twinning rate in older animals on Hecla Island (1978-1980), a skewed sex ratio in favour of females from five game hunting areas in 1986 which was absent in the Hecla Island data. In addition, high reproduction was noted in the yearling cows taken in 1986.

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There is a paucity of information in the North American literature on in utero productivity of moose and sex of fetuses. Edwards and Ritcey (1958), Pimlott (1959), Peek (1962), Simkin (1965) and Markgren (1969) however, made significant contributions to knowledge about moose reproduction and productivity. Without the benefit of reproduction studies based on the examination of reproductive tracts, the only known measure of the reproduction of cow moose and thus herd productivity is the presence of calves with cows during annual surveys. Many outdoor enthusiasts use the term 'barren cow' to describe cows without calves at heel and, with bull only hunting seasons as seen in many game hunting areas (G.H.A.'s) in Manitoba, this absence is frequently attributed to a lack of bulls in the population.

This report presents preliminary data from an ongoing study in Manitoba the objectives of which are to determine if potentially productive cows are being bred, the pregnancy rate of different age cohorts within populations, the sex ratio of fetuses and the breeding period for moose in the province.

### METHODS

Specimens were collected from 6 designated areas within Manitoba (Figure 1) namely, Hecla Island and G.H.A.'s 23, 23A,

21A, 29A and 36.

Two techniques were used to collect specimens from female moose. A check station was maintained on Hecla Island in 1978, 1979 and 1980 during the late November - early December hunting seasons. Hunters were given instructions and diagrams to assist in the collection of specimens. All were given the option of having Department staff retrieve animals if they were left in an undressed condition and access was relatively easy. This enabled body measurements including weights to be taken prior to dressing and staff were able to examine each animal and make the appropriate collections. All samples were frozen and submitted to the laboratory.

Prior to the 1986 hunting seasons all hunters successful in obtaining 'any moose' licenses for GHA's other than Hecla Island were contacted by letter and asked to submit the reproductive tract from females and the anterior 15.0 cm of the lower mandible for ageing purposes. Diagrams and photographs were provided to assist in the identification of the required specimens. Specimens were to be frozen and submitted to any office of the Department of Natural Resources. All hunters submitting the requested specimens were rewarded with a specially designed belt buckle and crest.

Ageing of incisor teeth was done using the technique described by Sergeant and Pimlott

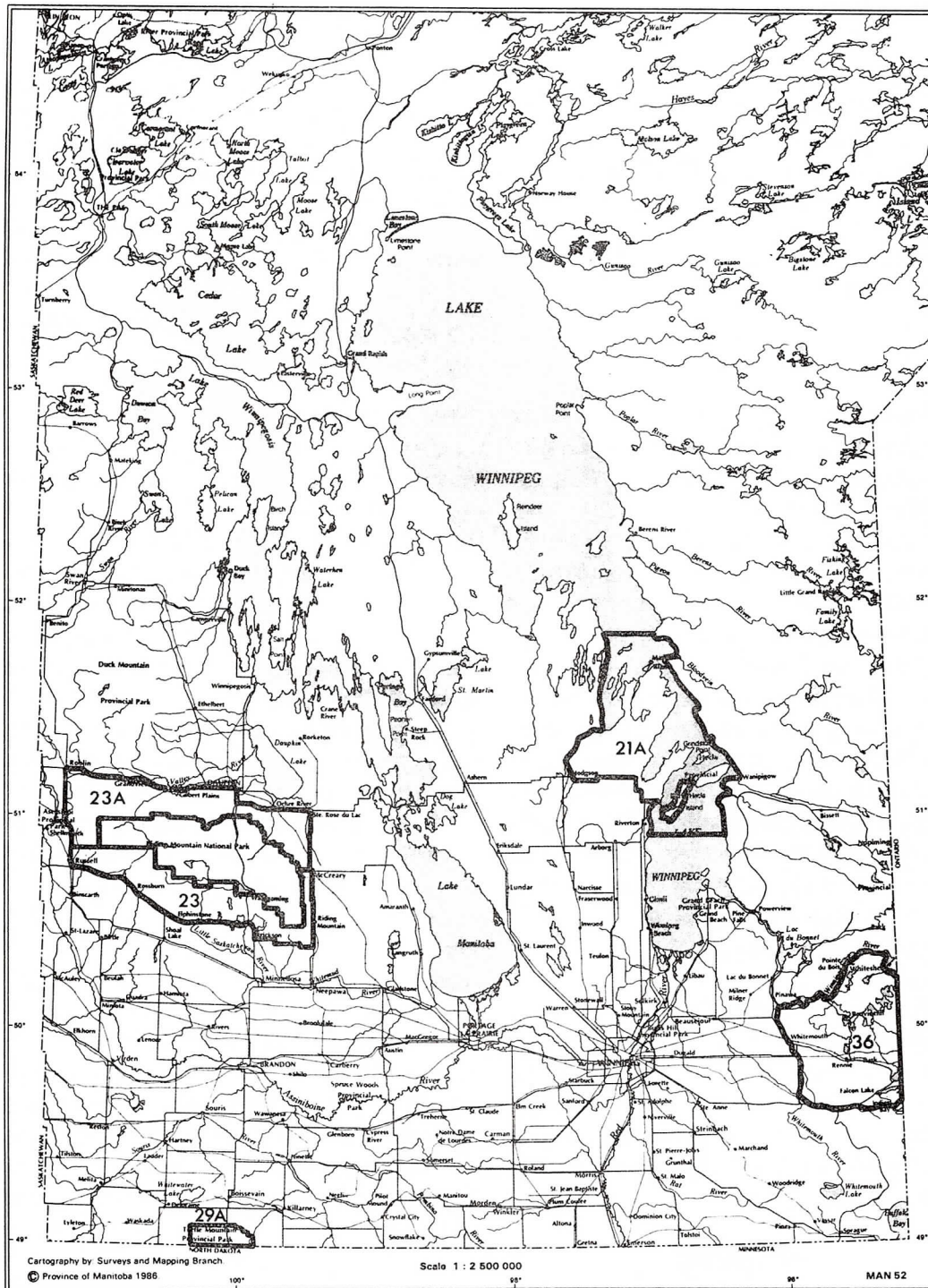


Figure 1. Location of Manitoba game hunting areas sampled.



(1959). Fetuses collected during the 1986 hunting season were weighed to the nearest gram and the crown-rump length measured to the nearest millimetre. Fetal age was determined following the technique of Markgren (1969) where the crown-rump measurement is used to indicate the size and hence age of the fetus. Back dating from the day of kill gives the approximate date of fertilization.

## RESULTS

A total of 38 reproductive tracts were collected from Hecla Island moose and 41 fetuses found. Table 1 presents the data generated from an analysis of this material. Twins were present in 9 tracts and singles in 23 for a twinning rate of 28%. In the 10 1/2 - 14 1/2 year old animals, all carried twins with the exception of 1 animal aged at 14 1/2 which was not pregnant. Overall, there was 1.08 fetuses per female. It is important to note that cows in the oldest age category had 8 sets of twins and 1 single while the younger aged cows (less than 9 1/2) had 1 set of twins and 22 singles, a difference at  $P < 0.001$  ( $X^2 = 21.9$ ).

The age categories were arbitrarily chosen to differentiate those animals with potentially the greatest fecundity (5 1/2 - 9 1/2) from those generally thought to be less productive.

Reproductive tracts from 55 adult moose were submitted during the 1986 hunting season and 49 fetuses collected. Table 2 combines data from 6 G.H.A.'s in southern Manitoba. Twins were present in 10 and singles in 39 animals for a twinning rate of 20%. The 10 1/2 - 15 1/2 year olds animals did not produce any twins. Overall, there was 1.07 fetuses/female (including non-pregnant cows), a value essentially identical to that obtained on Hecla Island (Table 1).

Females in the Hecla Island data, represented 46.3% of the total fetuses collected, which is not different from the expected of 52:48 in favour of males ( $X^2 = 0.04$ ;  $P > 0.05$ ).

Referring to the 1986 data, tests were conducted to determine if the sex ratio of the fetuses was significantly different. Using a G-test for goodness of fit (Sokal and Rohlf 1981, p. 692) with a Williams correction applied the G value is 9.904 which is highly significant ( $P < 0.005$ ) with 1 degree of freedom. The expected values in this case were 52:48 in

Table 1. Pregnancy and fetus sex data of moose taken on Hecla Island, Manitoba from 1978-1980.

Female Age	Sample Size	Pregnant		Fetus Sex		Number		Fetuses/Female
		Yes	No	M	F	Twins	Singles	
1 1/2	1		1					
2 1/2 to 4 1/2	16	12	4	9	3		12	0.75
5 1/2 to 9 1/2	11	11	0	6	6	1	10	1.09
10 1/2 to 14 1/2	10	9	1	6	9	8	1	1.50
Totals	38	32	6	22	19	9	23	

favour of males. If the expected was 50:50, the difference is still significant ( $G$  adjusted = 8.951) with one degree of freedom. Of the 55 fetuses which could be sexed, 69% were female. Cows aged 1 1/2 - 9 1/2 produced fetuses that were 68% female, whereas only 43% of those produced by the 10 1/2+ cows were female. Six sets of twins were all females, 1 set was all male and 3 sets had one of each sex.

Conception dates using the 1986 data for 1 1/2 - 4 1/2 year old cows (1 outlier of November 22 excluded) was September 28, that for the 5 1/2 - 9 1/2 year olds was September 25 (1 outlier of November 3 excluded) and that for the 10 1/2 - 12 1/2 year olds was October 3 (1 outlier of October 22 excluded). The overall average conception date (outliers excluded) was September 28.

## DISCUSSION

Prior to calculating rate of increase and gross productivity, a knowledge of the sex

ratio, reproductive rates and age class structure is essential. It is widely accepted that the productivity of female ungulates is governed by the complex interplay of various physiological, environmental and sociological factors. The results vividly illustrate that initial breeding age, sex of fetuses, and reproductive capabilities of different age cohorts do vary considerably between moose.

Hosley (1949), Peterson (1955), Denniston (1956), Edwards and Ritcey (1958), Pimlott (1959) and Simkin (1965) suggested that the ratio of twin to single births may vary with range condition. It is difficult to explain the high reproductive potential for the old age cohort on Hecla Island, an island that has seen virtually no significant habitat manipulation for at least 35 years. Although the sample sizes are small, it is speculated that factors are acting on this population which are not fully understood. The density of moose on Hecla Island prior to the 1978 hunting season was estimated to be 1.6 moose per km<sup>2</sup> (4 per mi<sup>2</sup>) or, about 2.5 per km<sup>2</sup> (6.5 per mi<sup>2</sup>) of available

Table 2: Pregnancy and fetus sex data from moose taken from Manitoba Game Hunting Areas 23, 23A, 21A, 29, 36 and Hecla Island during the 1986 hunting season.

Female Age	Sample Size	Pregnant		Fetus Sex			Number		Fetuses/ Female
		Yes	No	M	F	U	Twins	Singles	
1 1/2	8	5	3	2	2	1	0	5	0.63
2 1/2 to 4 1/2	13	12	1	4	9	1	3	8	1.17
5 1/2 to 9 1/2	18	18	0	7	16	1	6	12	1.33
10 1/2 to 15 1/2	10	7	3	4	3		0	10	0.70
Unknown	6	5	1	0		1	1	4	
Totals	55	47	8	17	38	4	10	39	



moose habitat. Following the first three seasons, the moose population was reduced to about 1.1 per km<sup>2</sup> (2.7 per mi<sup>2</sup>). A sharp curtailment of licenses and bag restrictions due to a reduced population and opposition to hunting on Hecla Island made it impossible in subsequent years to collect comparable data to ascertain if such trends were continuing. It is speculated that the unexpectedly low 'in utero' performance in those animals in which one would anticipate the highest reproductive performance may be a response of individual moose to high densities and lack of access to high quality summer foods. During the 1977/78 winter, evidence of moose dying of malnutrition on Hecla Island was found. The above still does not answer an obvious question. Why is there such high productivity in the older animals? Longhurst *et al* (1952), Edwards and Ritcey (1958), Julander *et al*. (1961), Klein (1962) and Markgren (1969) concluded that differences in ovulation rates which can occur between two or more moose ranges with comparable browsing pressure appear to be related to quality of nutrition during the summer period. Could the differences observed be due to the older and more experienced cows selecting or residing for longer periods on better summer range resulting in better condition?

Manitoba's moose population has been decreasing since the late 70's. This trend has continued into the 80's and only now is beginning to show signs of reversing. One factor prominent in this reversal has been the high calf survival to 6 months of age. 1986 was the first year that reproductive tracts were collected on a large scale thus, it is unknown how long the skewed sex ratio in favour of females has been prevalent. Lowe (1968) and Verme (1969) found sex differences in deer fawns produced by females on high quality versus those on low quality diets with more females being produced by the former. Such events auger well for the ability of moose populations to increase when these female calves enter the breeding cycle particularly when

they reach the high fecundity years. This predominance of female calves may in fact be a physiological and sociological reaction on behalf of individual moose responding to vacant habitat and increased food supply. Although the sample size from each G.H.A. is small, the trend to producing more females is evident in all and not simply a skewed sex ratio in one masking a more equitable sex ratio in the others.

Manitoba has a tradition of bull only hunting seasons during the fall followed by 'limited entry' any moose seasons in December. With a depressed population over the last decade, the management strategy has been to curtail the any moose winter seasons and replace them with bull only seasons. The intent of this is to protect cows and direct harvest toward bulls. This strategy will need re-examination if in fact there is about a 40% reduction in bull production from a sex ratio that is about equal at parturition. The end result will be fewer bulls in the population and as the female cohort increases there may not be sufficient bulls to service all cows during a single estrous period. The end result will be late born calves with diminished survival opportunities. Very few calves are taken thus nothing of significance can be related about sex ratio of calves in the harvest from these data.

Presently, G.H.A. 21A is experiencing a sharp increase in the number of females in the population while the number of bulls is remaining stationary. If the status quo in terms of hunting seasons is maintained it is predicted that the bull population will remain steady or decline. Aerial survey data revealed that the bull:cow ratio has declined from 98.1 bulls/100 cows in 1985/86 to 59.2 in 1986/87 to 44.0 in 1987/88. This is predicted by the moose model currently in use and is of concern. A revision to the 1988 hunting seasons was made in an attempt to reverse this trend and if an increase in the bull population does not occur, more drastic deviations from the traditional approach must



be examined.

Prior to examining the 1986 specimens, the reproductive capabilities of 1 1/2 year old females in Manitoba was acknowledged to be low as little evidence was available to suggest the contrary. The number of samples collected is small however, it is noteworthy that 5 of the 8 yearling cows were pregnant. Also of significance is that the productivity of 10 1/2 - 14 1/2 year old female moose on Hecla Island from 1978 to 1980 (1.54 fetuses per female) was about double that seen in the 1986 material (0.70 fetuses/female) from 6 G.H.A.'s including Hecla Island.

A problem inherent in asking hunters to collect reproductive material is the uncertainty in knowing if they are collecting only from obviously pregnant animals due to the difficulty in finding the uterus in non-pregnant animals. In addition to asking moose hunters for assistance, elk (*Cervus elaphus manitobensis*) hunters were also approached and of 119 samples submitted only 2 were not the correct sample. 19 of the 117 reproductive tracts obtained were from non-pregnant adults and calves. It is suggested that the diagrams, photographs, and informational material provided relative to the need for the material as well as the personal contact was instrumental in ensuring success. Thus, it is believed that the ratios calculated align closely with what is occurring in the population and are not biased as would happen if only specimens from pregnant animals were submitted.

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