IN UTERO PRODUCTIVITY OF MOOSE IN MANITOBA

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Much information has been gathered via aerial surveys over the last 15 years in Manitoba on bull/cow and calf/cow ratios plus percentage of bulls, cow and calves within populations. Information on in utero productivity has been lacking and concern has been expressed that traditional bull only hunting seasons have resulted in fewer bulls and barren cows. A controlled hunting season on Hecla Island presented an opportunity to examine the reproductive tracts of all female moose taken - this paper details the results of this examination. In 1986, all hunters successful in obtaining a special permit to take female moose in selected areas of the Manitoba were asked to turn in the reproductive tracts of harvested animals for examination. The results of this examination are presented and reveal a significant sex ratio difference favouring females.

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There is a paucity of information in the literature on in utero productivity of moose and sex of foetuses. The work of Simkin (1965), Pimlott (1959) Edwards and Ritcey (1958) and Peek (1962) are noteworthy earlier works which significantly added to knowledge about moose reproduction and productivity. Without the benefit of moose

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 surveys. Many outdoor enthusiasts have frequently pointed out and used the term 'barren cow' to describe cows without calves and, with bull only hunting seasons as seen in many game hunting areas (G.H.A.'s) in Manitoba, this absence is all too frequently attributed to a lack of bulls for breeding purposes.

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

STUDY AREA

Specimens were collected from four designated areas within Manitoba (Figure 1) namely, Hecla Island and G.H.A.'s 23, 23A, 29, 29A, 21A and 36. These G.H.A.'s are found in southern Manitoba between the 49 parallel of latitude (Manitoba - United States boundary) and approximately 51^0 45 minutes north latitude.

METHODS

Two techniques were used to collect specimens from female moose harvested by hunters.

On Hecla Island, during the years 1978, 1979 and 1980, a check station was maintained on the island during the late November - early December hunting seasons. Hunters were requested to attend the station to obtain their licence at which time they were given instructions to follow if a moose was taken. All hunters were asked, if possible, to return to the check station immediately upon shooting a moose and staff would assist in retrieving the undressed moose. This enabled assorted body measurements and weights to be taken prior to dressing. Dressing in most cases was done by Department staff or under their supervision so that the appropriate material was collected in each case. All samples were frozen and submitted to the laboratory in this condition.

Prior to the hunting seasons of 1980 all hunters successful in obtaining 'any moose' licences on Hecla Island, and G.H.A.'s 23, 23A, 21A and 36 were contacted by letter in which they were requested to submit the entire reproductive tract (uterus, ovaries and foetuses (if present) from females along with the anterior 15.0 cm of the lower mandible for ageing purposes. Diagrams and photographs were provided to assist hunters in identifying the samples in situ. All hunters submitting specimens were rewarded with an attractive, specially designed belt buckle. Hunters were asked to freeze samples as soon as possible and submit them in this condition to any office of the Department of Natural Resources.

Department of Natural Resources staff collected specimens from a vehicle killed moose in G.H.A. 29/29A.

Ageing was done using the technique described by Sergeant and Pimlott (1959). Foetuses collected during the 1980 hunting season were weighed to the nearest gram and the crown-rump length measured to the nearest millimetre. The age of the foetuses were determined following the technique of Markgren (1969).

RESULTS

A total of 38 reproductive tracts were collected on Hecla Island moose from 1978 to 1980. Data on pregnancy, sex of foetus and foetuses per female are given in Table 1. 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. Overall, there was 1.05 foetuses/female.

Table 1: Pegnancy and foetus sex data from moose taken on Hecla Island, Manitoba from 1978-1980.

Female Age	Sample Size	Pregnant		Foetus Sex		No Twins	Foetuses/ Female
		Yes	No	Male	Female		
1 1/2	1		1				
2 1/2 to 4 1/2	16	12	4	9	3		0.75
5 1/2 to 9 1/2	11	11	0	6	6	1	1.09
10 1/2 to 14 1/2	10	9	1	6	9	8	1.50

NOTE: Twinning data: 1 - 5 1/2 = 2 males
All pregnant 10 1/2 - 14 1/2 females with twins except the 13 1/2 to 14 1/2 year old females which were not pregnant.e

The single 1 1/2 year old cow represented 2.6% of the known aged animals, the 2 1/2 - 4 1/2 year olds represented 42.1% of the sample, the 5 1/2 - 9 1/2 year old represented 28.9% of the sample while the last category, 10 1/2 - 14 1/2, comprised 26.3%.

55 reproductive tracts from adult moose were submitted by hunters durng the 1986 hunting seasons. The results of the macroscopic examination are tabulated in Table 2. Again, the age categories were arbitrarily chose to differentiate animals with anticipated different reproductive potentials. Overall, there was 1.07 foetuses/female, taking into account all those not pregnant.

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

Female Age	Sample Size	Pregnant		Foetus Sex			No Twins	Foetuses/ Female
		Yes	No	Male	Female	Unknown		
1 1/2	8	5	3	2	2	1	0	0.63
2 1/2 to 4 1/2	12	11	1	4	9	1	3	1.17
5 1/2 to 9 1/2	18	18	0	7	16	1	6	1.33
10 1/2 to 15 1/2	8	10	3	4	3		0	0.70
Unknown	9	5	1	0	8	1	1	

NOTE: U - Unknown sex

With the Hecla Island data, there was no significant difference between the sex of the foetuses. Males represented 53.8% of the total and females 46.2%.

Referring to the 1986 data, tests were conducted to determine if the sex ratio of the foetuses was significant. 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 .005) with 1 degree of freedom. The expected values in this case were 52:48 in favour of males. If the expected was 50:50, the difference is still significant (Gadjusted = 8.851) with one degree of freedom.

Of the 55 foetuses which could be sexed, 69% were females with 31% being males. Jaws were not submitted with 9 of the samples thus, with the exception of determining pregnancy and sex of foetuses, these samples were excluded from the remainer of the calculations. 70% of the calves produced by the 1 1/2 - 9 1/2 year old cows were females whereas only 43% of those produced by the 10 1/2 + cows were males. Three sets of twins were produced by the 1 1/2 - 4 1/2 year old cows, 6 by the 5 1/2 - 9 1/2 year olds and none by the older cows. 43% of the females were 1 1/2 - 4 1/2 years old, 37% in the 5 1/2 - 9 1/2 year old category and 20% 10 1/2 years or older. Six sets of twins were all females, 1 set was all male while there were 3 sets with one of each sex.

Conception dates based on the 1986 data for the 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. The results vividly illustrate that initial breeding age, sex of foetuses, and reproductive capabilities of different age cohorts can 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 30-35 years. Although the sample sizes admittedly are small, it suggests that other factors are acting on this population that are not fully understood. The density of moose on Hecla Island prior to the first hunting season in 1978 was estimated to be 1.6 moose per km^2 (4 per mi^2) or, about 2.5 per km^2 (6.5 per mi^2) of available moose habitat. Following the first three seasons, the moose population was less than that in 1978. With a sharp curtailment in bag limit and licence availability, it has been impossible in recent years to collect comparable data to ascertain if such trends are 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 the population to the high

densities and lack of access to high quality summer foods. During the 1977/78 winter, evidence of moose dying of malnutrition on the island was found. The above still does not answer the obvious question of why the high productivity in the older animals. Markgren (1969) and others (Longhurst et al 1952; Edwards and Ritcey 1958; Julander et al 1961; and Klein 1962) all concluded that differences in ovulation rate 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 here be due to the older cows being more experienced, are 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. A number of factors are involved in this turn around, one of which has been 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. Mech (1975) found sex differences in wolf pups and attributed it to food availability. Such events auger well for the ability of moose populations to increase when the calves enter the breeding cycle particularly when they reach the high fecundity years. This predominance of female calves may in fact be a physiological response on behalf of Manitoba's moose population to vacant habitat, and increased food supply and thus a population mechanism for increasing itself. Although the sample sizes from each of the G.H.A.'s named is small, the trend producing more females were evident in all and not simply

high female production in one masking a more equitable sex ratio in the others.

Manitoba has a long 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 few years, the management strategy has been to curtail or significantly alter in other ways the any moose winter seasons and replacing them with bull only seasons. The intent of this is to protect cows and direct hunters toward bulls. This strategy may be backfiring if in fact there is about a 40% reduction in bull production from an equal sex ratio at birth or one slightly favouring bulls. The end result will be fewer bulls in the population and as populations increase particularly the female aspect, there may in fact not be enough bulls to service the available cows during a single oestrous period resulting in late born calves whose survival opportunities will be lessened.

Presently, G.H.A. 21A is experiencing a rapid increase in the adult cohort with all the increase being in the cow segment. The bull cohort is remaining stationary and if the status quo in terms of hunting seasons is maintained the prediction is it will continue in this fashion or decline. Noteworthy, is the fact 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 1988 hunting seasons has been made and if an increase in the bull population is not noted, more drastic deviations from the traditional approach will be undertaken.

Prior to examining the 1986 specimens, the reproductive capabilities of 1 1/2 year old females in Manitoba was acknowledged to be

low primarily because little evidence was available to suggest anything to the contrary. The number of samples collected is small however, it is noteworthy that 63% of the females were pregnant.

A problem inherent in asking hunters to collect reproductive material is that one is uncertain if they are only collecting from obviously pregnant animals because of the difficulty in finding the uterus in those not pregnant. In addition to asking moose hunters to collect samples, elk hunters were asked the same question and a total of 119 samples were submitted of which only 2 were not the correct sample. Of these, 19 were from non-pregnant adults and calves. It is believed that the diagrams, photographs and instructions provided as well as the personal contact through seminars was instrumental in ensuring success. Thus, it is believed that the ratios calculated represent very closely 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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