

## AN EXPERIMENTAL MOOSE HUNT ON HECLA ISLAND, MANITOBA

Vince F. J. Crichton  
 Manitoba Department of Mines, Natural Resources and Environment  
 Winnipeg, Manitoba

*Abstract:* Evidence suggesting that the moose herd on Hecla Island, located in Lake Winnipeg, had surpassed the carrying capacity of the Island resulted in the implementation of a controlled moose hunt in the fall of 1978. Two seasons were held, an early fall season limited to 150 bow hunters and a winter season restricted to 100 hunters. All licences were obtained *via* a draw. Bow hunters harvested 3 bull moose while rifle hunters took 37 moose (18 bulls, 15 cows and 4 calves). The lungs, heart, liver, kidneys, female reproductive tract, stomach sample, jaw, front leg bone and blood samples were obtained from most animals. In addition, live and/or dressed weights were obtained from most animals. A summary of the analysis of the biological material collected is reported. An economic analysis of the hunt showed that 101 rifle hunters spent a total of \$9,774.78 of which \$8,338.56 was injected into the local economy. 139 bow hunters spent a total of \$13,910.30 of which \$4,815.50 was spent in the local area. This hunt, although designed to reduce the moose population closer to the Island's present carrying capacity, did little other than remove a number comparable to the number of calves in the population in early December. A post season survey revealed 177 moose and the population is estimated to be 221.

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Hecla Island, the largest island in Lake Winnipeg located in the south central portion of Manitoba encompasses about 161 Km<sup>2</sup> and is considered unique in the province because of its Icelandic history and its present day large moose population. The latter is presently est-

imated at about 221 or 1.3/Km<sup>2</sup>. Crichton (1977a) gave a general description of the Island and its moose herd. The situation relative to moose has been compounded in the last 8 years during which time the population has increased by about 75% - this has occurred with virtually no concomitant habitat manipulation, resulting in the habitat being severely overbrowsed. Relatively mild winters during the past 3 years have assisted in preventing a significant die-off of moose. Evidence was found in 1975-76, 76-77 and 77-78 to suggest that a few animals primarily calves, did perish.

The advent of Park status for the Island along with its associated activities has focused attention on the Island's moose herd. Hecla Island is not a natural system and thus the herd must be actively managed if it is to remain viable and accommodate the demands placed on it by Manitobans. It has been recommended (Crichton, 1977 a, b) that the moose management strategy must be 2-fold: i) removal of moose and ii) a habitat rejuvenation program and ideally, both should occur concomitantly.

The chances of a significant die-off are being enhanced by the absence of habitat rejuvenation and herd reduction. This has been foremost in the mind of those attempting to reduce the population to something compatible with the present condition of the habitat. The Island's provincial park status has resulted in sharp opposition to reduction of the moose herd via hunting. However, government approval for a hunt was received in the spring of 1978 - this was to take the form of a 4 week archery season followed by a 1 week winter rifle season for any moose. The primary objective of the hunt was to remove a portion of the moose herd while at the same time providing a segment

of Manitoba's moose hunters with a high quality recreational experience.

This paper presents details of the mechanics of the hunt and the results of some of the analysis of the biological data collected.

#### MATERIALS AND METHODS

License applications, for residents only, were made available throughout the Province. Those desiring to obtain a Hecla license were required to submit their completed application to the Department by July 14, 1978. Following this date a draw was made for 150 archery licenses (season September 18 - October 14 inclusive) and 100 rifle licenses (season December 4 - 9 inclusive).

Following the draw, successful archers were forwarded their licenses in the mail along with an information package detailing restrictions which would apply, some information relative to archery and a request to collect certain specimens if they were successful in making a kill. Relative to the latter, plastic bags and 3-50 ml tubes for collecting blood samples were sent to each individual. Successful applicants for the rifle season were advised by mail that their license could be picked up at a check station which would be in operation at the entrance to the Island 48 hours prior to the season opening.

Success in other parts of Manitoba with a designated route system for controlling the use of snowvehicles for moose hunting prompted the establishment of such a system on Hecla Island (Fig. 1). In addition, a no hunting zone was established in the vicinity of the built-up areas and 4 designated camping sites were indicated for those hunters desiring to use their own camping facilities.

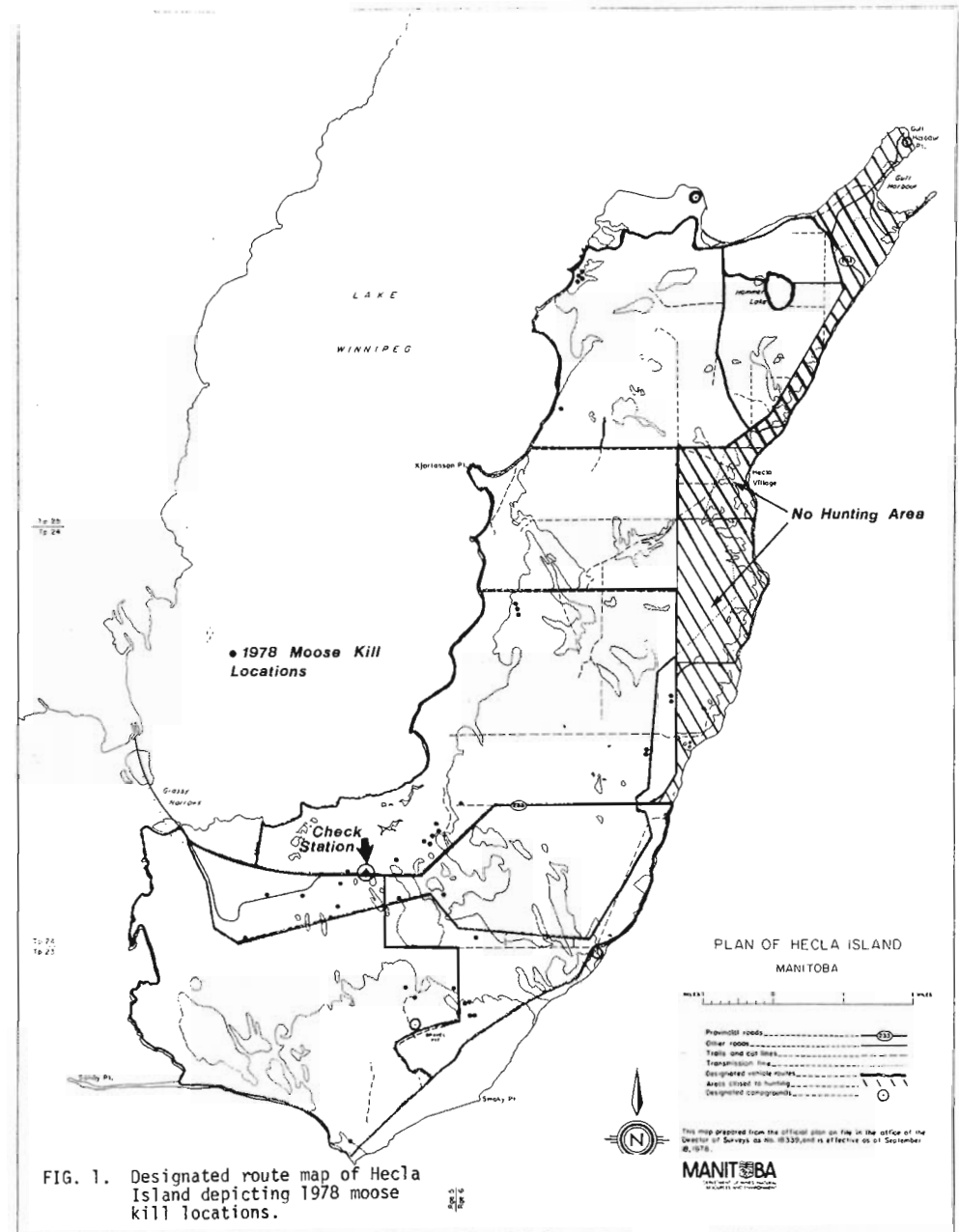


FIG. 1. Designated route map of Hecla Island depicting 1978 moose kill locations.

As a public relation gesture, those long time Island residents were given the opportunity to purchase moose licenses at the check station without having to submit their name in the draw. Criteria relative to 'Island oldtimer status' were drawn up and a list of names eligible for such licenses were given to check station personnel.

A check station complete with living accommodations was set up at the entrance to the Island and attended by personnel on a 24 hour basis. At the time rifle hunters picked up their licenses, each was given a verbal résumé of the requests that were being made of them and each hunter was given plastic bags, blood vials (non heparinized) and a general information package. In addition, they were advised of the interest in weighing animals prior to gutting that were shot close to the check station. As an incentive, they were informed that station attendants would assist in hauling their moose out of the bush. Hunters were requested to collect the following material from their animal: lungs, heart, liver, kidney and associated fat, female reproductive tract, 1 gallon of stomach content, lower jaw and 3 vials of blood preferably taken from the jugular vein. Each hunter was asked to check in and out of the check station each day if they were leaving the Island.

Whole and field dressed moose taken during the rifle season were weighed at the registration station using a 2000 pound capacity scale suspended from a 1 ton 'Jet' (trade name) chain hoist which in turn was attached to a scaffold.

Standard big game body measurements i.e. total length, forehead length, chest and shoulder height, heart girth, neck circumference and hind foot and leg were taken from each animal. All measurements were

made to the nearest centimetre using a steel tape. The heart girth of dressed animals was measured by pressing the split sternum together. Once weighed, whole animals were dragged to the adjacent marsh area where gutting took place and subsequently reweighed to attain a dressed weight. Following this, the lower portion of the front leg and about 1 kilogram of flesh from the sternum were removed by Atomic Energy of Canada personnel. The latter were using this material and stomach content in a study to ascertain the amount of radioactive cesium deposited in moose from fallout resulting from the detonation of nuclear test devices over the past 4 decades.

Ages were determined using the dental cementum technique described by Sergeant and Pimlott (1959).

Three basic antler measurements (burl circumference, maximum antler spread between the widest points judged to touch 2 parallel lines drawn perpendicular to the main axis of the skull, length of the palm including brow palm (this method is identical to that of the official scoring system for North American big game trophies) were recorded to the nearest half centimetre using a steel tape and the total number of points on each beam over 2.5 cm long and longer than the width at the base.

The kidney fat index (KFI) was derived following the technique of Riney (1955) with the modifications suggested by McGillis (1972).

Serum was extracted from the blood samples collected, placed in a storage container and frozen. It was transported in this condition to the Research Laboratory of the Minnesota Department of Natural Resources in Grand Rapids Minnesota where it was analyzed using standard techniques.

All tissue samples collected were frozen immediately and transported to the laboratory following the season. In those cases however, where hunters desired to keep the heart and/or liver a visual examination of them for parasites or anomalies was made at the check station. In the laboratory, each organ (liver, heart and lungs) was carefully examined for evidence of any disease condition. The reproductive tracts were examined for evidence of pregnancy - ovaries and fetuses were collected for future analysis.

Following completion of their hunt, each hunter was requested to fill out a questionnaire relative to the number of days hunted, success, number of moose seen, number shot at, number of confirmed hits, and an estimate of their expenditures in the local area and other parts of Manitoba.

#### RESULTS

137 archery licenses were allocated via the draw with 119 individuals applying for this season as their initial choice. The remaining 13 licenses were sold 'over the counter' on a 'first come first serve' basis. 710 individuals applied for the 100 rifle licenses as their first choice on the application.

A post season phone survey revealed that only 113 of the 150 archery hunters exercised their option to hunt. These hunters spent an average of 4.4 days hunting, saw 3.4 moose/hunter and killed 3 bulls. This resulted in 1 moose killed per 165.7 man days. 2 additional animals were hit but could not be found. Approximately 77% of the hunters used a compound bow with an average draw weight of 62 pounds.

95 of the 100 successful rifle applicants hunted during the season and 6 Island oldtimers exercised the opportunity to purchase a license. These individuals spent an average of 3.2 days hunting, saw 2.2 moose/hunter and killed 18 bulls, 15 cows and 4 calves resulting in 8.1 man days to harvest 1 moose. Evidence suggests that 2 animals were wounded and could not be found.

Enforcement staff reported only 1 violation during both hunts, this being in the rifle season.

Expenditures by hunters are given in Table 1. The check station was manned at all times by at least 3 staff. The cost of this operation excluding staff salaries was \$1100 - this included groceries, heating fuel, gas, containers for biological material, construction material and a hoist.

Live and dressed weights were obtained for 10 bulls, 7 cows and 1 female calf while dressed weights only were recorded from 8 bulls, 6 cows and 2 calves (Tables 2 and 3). 2 cows and 1 male calf were quartered prior to being brought out of the bush. The unquartered male calf had a dressed weight of 250 pounds while the 2 females dressed at 240 and 255 pounds respectively. The 240 pound dressed calf had a live weight of 390 pounds thus the weight loss due to gutting was 150 pounds or 38.5%. Using this weight loss, the estimated live weight of the other female was 415 pounds while that of the bull was 407 pounds. The average dressed weight of the 3 calves was 248 pounds. The ages of all adult animals are listed in Tables 2 and 3.

Table 4 illustrates the 3 standard antler measurements along with the ages of the respective animal.

All body measurements were taken from hanging animals and of

Table 1. Hunter expenditures during 1978 Hecla moose season.

| Archery season (113 hunters <sup>1</sup> )        |             |                   |                    |
|---|-------------|-------------------|--------------------|
|   | Cost/hunter | Total cost/hunter | Total expenditure  |
| Local area <sup>2</sup>                           | \$43.50     | \$123.10          | \$ 4,915.50        |
| Other <sup>3</sup>                                | \$79.60     |                   | 8,994.80           |
|   |             |                   | <u>\$13,910.30</u> |
| License revenue: 150 x \$16 = \$2400              |             |                   |                    |
| Rifle season (101 hunters <sup>4</sup> )          |             |                   |                    |
|   | Cost/hunter | Total cost/hunter | Total expenditure  |
| Local area  | 82.56       | 96.78             | \$ 8,338.56        |
| Other   | 14.22       |                   | 1,436.22           |
|   |             |                   | <u>\$ 9,774.78</u> |
| License revenue: 106 x \$16 = \$1696              |             |                   |                    |
| Cutting and wrapping: 15,605 lbs. x .20 = \$3,121 |             |                   |                    |
| Total hunter expenditure = \$30,902.08            |             |                   |                    |

<sup>1</sup>Only 113 of the 150 successful applicants hunted

<sup>2</sup>Hecla Island and Riverton, Manitoba

<sup>3</sup>All other areas of Manitoba

<sup>4</sup>Only 95 of the 100 successful applicants hunted plus 6 Island Oldtimers

Table 2. Age and weight of bull moose harvested on Hecla Island, 1978

| Age                      | Dressed weight | Live weight | Weight loss (%) |
|--------------------------|----------------|-------------|-----------------|
| 2 1/2                    | 440            | 634*        |                 |
| 3 1/2                    | 565            | 825         | 260 (31.5)      |
| 3 1/2                    | 575            | 830         | 255 (30.7)      |
| 3 1/2                    | 625            | 901*        |                 |
| 3 1/2                    | 555            | 820         | 265 (32.3)      |
| 4 1/2                    | 731            | 1060        | 329 (31.0)      |
| 4 1/2                    | 575            | 850         | 275 (32.4)      |
| 4 1/2                    | 590            | 850*        |                 |
| 5 1/2                    | 790            | 1115        | 325 (29.0)      |
| 5 1/2                    | 650            | 937         |                 |
| 5 1/2                    | 570            | 823*        |                 |
| 6 1/2                    | 720            | 1037*       |                 |
| 6 1/2                    | 670            | 910         | 240 (26.4)      |
| 6 1/2                    | 635            | 915*        |                 |
| 8 1/2                    | 650            | 937*        |                 |
| 8 1/2                    | 755            | 1095        | 340 (30.9)      |
| 9 1/2                    | 750            | 1080        | 330 (31)        |
| 10 1/2                   | 755            | 1095        | 340 (31.1)      |
| <sup>1</sup> A 5.7 + 2.3 | 645 + 92       | 929 + 30**  | 296 + 40 (30.6) |

\*live weight estimated on basis of an average 30.6% loss due to gut removal

\*\*the average excluding the estimated live weights is 968

<sup>1</sup>A = average

Table 3. Age and weight of female moose harvested on Hecla, 1978.

| Age            | Dressed Weight | Live weight | Weight loss (%) |
|----------------|----------------|-------------|-----------------|
| 1 1/2          | 360            | 540         | 180 (33.3)      |
| 2 1/2          | 540            | 780         | 240 (30.8)      |
| 3 1/2          | 655            | 840         | 185 (22.0)      |
| 3 1/2          | 515            | 790         | 275 (34.8)      |
| 3 1/2          | quartered      |             |                 |
| 3 1/2          | 520            | 754         |                 |
| 3 1/2          | 540            | 780*        |                 |
| 4 1/2          | 505            | 775         | 270 (34.8)      |
| 5 1/2          | 660            | 957*        |                 |
| 7 1/2          | 655            | 900         | 245 (27.2)      |
| 9 1/2          | 680            | 986*        |                 |
| 11 1/2         | 575            | 833*        |                 |
| 11 1/2         | 620            | 899*        |                 |
| 12 1/2         | 645            | 975         | 330 (33.8)      |
| 14 1/2         | quartered      |             |                 |
| <sup>1</sup> A | 6.6 ± 4.2      | 575 ± 90    | 841 ± 117**     |
|                |                |             | 246 ± 53 (31.0) |

\*live weight estimated on basis of an average of 31.0% loss due to gut removal

\*\*the average excluding the estimated live weight is 800

<sup>1</sup>A = average

Table 4. Moose antler measurements (cm) and age.

| Age    | Beam* (average) | Width (average) | Total points (average) |
|--------|-----------------|-----------------|------------------------|
| 2 1/2  | 13.5 ] (13.5)   | 77 ] (77)       | 7 ] (7)                |
| 3 1/2  | 15.5 ]          | 86 ]            | 12 ]                   |
| 3 1/2  | 13.5 ] (14.6)   | 79 ] (86.8)     | 11 ] (11.8)            |
| 3 1/2  | 13.5 ]          | 97 ]            | 11 ]                   |
| 3 1/2  | 16.0 ]          | 85 ]            | 13 ]                   |
| 4 1/2  | 16.3 ]          | 109 ]           | 21 ]                   |
| 4 1/2  | 14.5 ] (15.1)   | 94 ] (96.3)     | 15 ] (18.3)            |
| 4 1/2  | 14.5 ]          | 86 ]            | 19 ]                   |
| 5 1/2  | 16.0 ]          | 87 ]            | 18 ]                   |
| 5 1/2  | 14.3 ] (14.3)   | 102 ] (89.7)    | 19 ] (15.7)            |
| 5 1/2  | 12.5 ]          | 80 ]            | 10 ]                   |
| 6 1/2  | 16.0 ]          | 115 ]           | 21 ]                   |
| 6 1/2  | 17 ] (15.8)     | 108 ] (108)     | 19 ] (19.7)            |
| 6 1/2  | 14.3 ]          | 101 ]           | 19 ]                   |
| 8 1/2  | 18.8 ] (18.8)   | 122 ] (122)     | 29 ] (29)              |
| 10 1/2 | 16.8 ] (16.8)   | 120 ] (120)     | 23 ] (23)              |

\*circumference

the 8 recorded most tended to increase as the animal increased in age from calf to the 2 1/2 - 3 1/2 age classes. As with weight and with height the exception of calves, males are larger in body form than females.

Linear, quadratic, exponential and power regressions were explored to ascertain the best fit between heart girth and live weight, heart girth and dressed weight and live weight and dressed weight. The relationship between heart girth and live weight and heart girth and dressed weight for males was found to be essentially linear. Similarly, for females the same relationship held but the correlation coefficients were much lower (Table 5).

Figure 2 and 3 enable one to predict the live and dressed weight (kgms) of animals from Hecla Island. For practical purposes, the approximate dressed weight of males can be calculated by multiplying the heart girth (cm) by 5 and subtracting 650. The data indicated a weak statistical relationship between the heart girth and weight parameters for females thus no accurate prediction of weights can be determined. However, the approximate live weight (kgms) can be calculated by multiplying the heart girth (cm) by 6 and subtracting 700. There was a high correlation (Table 5) between live weight and dressed weight for both males and females due to the consistent contribution the viscera made to the live weight. Thus, live weights can be calculated from dressed weights knowing that the average weight loss in gutting was 30.6% for males and 31.0% for females.

Kidney fat indexes are given in Table 6. With the exception of calves, the KFI's are significantly lower for bulls than cows. It is interesting to note that the KFI for the 3 adult non-pregnant cows is 42.8 compared to 51.7 for the pregnant cows. The value of 25.0 for

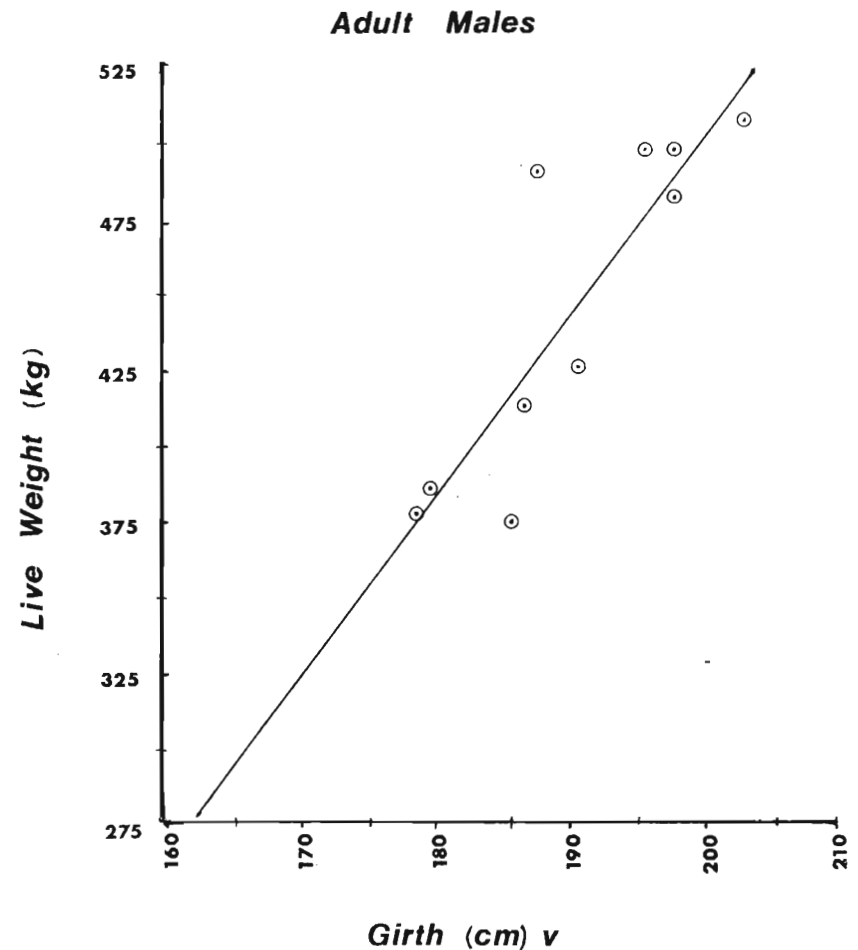


FIG. 2. Girth - live weight (Kgm) relationship for Hecla Island adult bull moose.

**Adult Males**

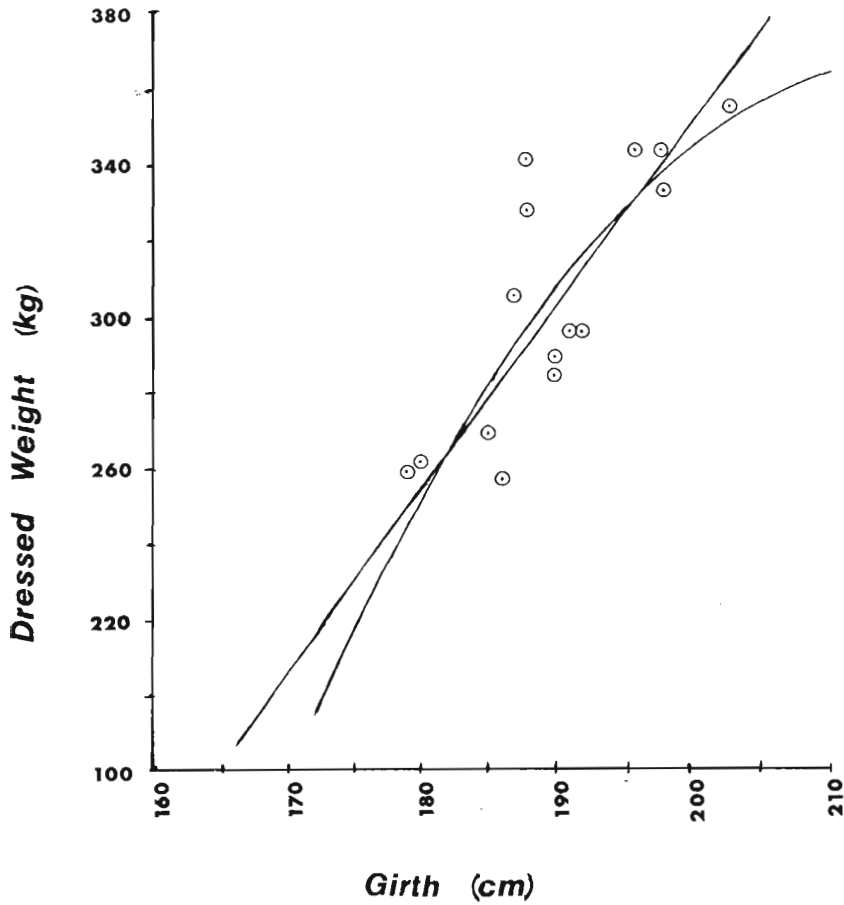


FIG. 3. Girth - dressed weight (Kgm) relationship for Hecla Island adult bull moose.

Table 5. Correlation coefficients and linear regressions of heart girth to dressed weight and live weight and live weight to dressed weight for Hecla moose.

| Relationship                  | Sex | n  | r     | r <sup>2</sup> | y = A + BX          |
|-------------------------------|-----|----|-------|----------------|---------------------|
| heart girth to live weight    | M   | 10 | 0.864 | 0.747          | = -679.318 + 5.896X |
| heart girth to dressed weight | M   | 17 | 0.859 | 0.738          | = -605.760 + 4.773X |
| dressed weight to live weight | M   | 10 | 0.985 | <b>0.971</b>   | = 15.982 + 1.389X   |
| heart girth to live weight    | F   | 10 | 0.831 | 0.692          | = -479.440 + 4.798X |
| heart girth to dressed weight | F   | 14 | 0.684 | 0.468          | = -259.013 + 2.876X |
| dressed weight to live weight | F   | 10 | 0.944 | 0.892          | = 59.346 + 1.225X   |

heart girth = cms  
weight kilograms



Table 6. Kidney fat index of moose shot on Hecla Island, December 1978.

| Male      |            |         | Female  |           |         |
|-----------|------------|---------|---------|-----------|---------|
| Age       | KFI        | Average | Age     | KFI       | Average |
| 1/2       | 17.6       | 13.5    | 1/2     | 10.3      | 10.1    |
| 1/2       | 9.3        |         | 1/2     | 9.9       |         |
| 2 1/2     | 12.9       | 12.9    | 1 1/2   | 38.2      | 38.2    |
| 3 1/2     | 14.3       | 13.9    | 2 1/2*  | 61.1      | 61.1    |
| 3 1/2     | -          |         | 3 1/2*  | -         |         |
| 3 1/2     | -          |         | 3 1/2*  | 58.9      |         |
| 3 1/2     | 13.5       |         | 3 1/2   | 48.4      | 56.1    |
| 4 1/2     | 20.4       | 14.4    | 3 1/2*  | 56.3      |         |
| 4 1/2     | 7.9        |         | 3 1/2*  | 60.6      |         |
| 4 1/2     | 14.8       |         | 4 1/2*  | 25.0      | 25.0    |
| 5 1/2     | 13.3       |         | 5 1/2*  | 71.6      | 71.6    |
| 5 1/2     | 16.1       | 16.0    | 7 1/2*  | 54.8      | 46.3    |
| 5 1/2     | 18.5       | 9 1/2*  | 55.8    |           |         |
| 6 1/2     | 30.0       | 11 1/2* | 43.2    |           |         |
| 6 1/2     | 13.3       | 18.3    | 11 1/2* | 53.3      |         |
| 6 1/2     | 11.5       | 15.6    | 12 1/2* | 28.6      |         |
| 8 1/2     | 17.9       |         | 14 1/2  | 41.8      |         |
| 8 1/2     | -          |         |         |           |         |
| 9 1/2     | 16.7       |         |         |           |         |
| 10 1/2    | 12.1       |         |         |           |         |
| Average** | 15.5 ± 5.1 |         |         | 49.8 ± 13 |         |

\*denotes pregnant female

\*\*excluding calves

a 4 1/2 year old cow may be an artifact of collecting i.e. fat may have been inadvertently removed during dressing. With the exception of this cow, those 2 1/2 - 5 1/2 year old females as a group had a substantially higher KFI than those 7 1/2 years of age and older.

Some of the blood collected had been haemolyzed because of freezing thus making an analysis for most parameters impossible. Of the data collected, those 3 considered most important in assessing condition are listed in Tables 7 and 8. Relative to blood urea - nitrogen, if the 1 high value (21) for males is excluded, the average is  $9.3 \pm 3.3$  and if a similar value (24) is excluded for females the average is  $8.5 \pm 2.7$ .

The various parasites found are listed in Table 9. All hydatid cysts were found in the lungs except in one case where a liver contained 1 cyst. The number of cysts found in those infected were 1, 1, 2, 2, 5, 9 and 13. The age of the animals with 9 and 13 cysts were 14 1/2 and 9 1/2 respectively. The only location searched for *Taenia krabbei* was the heart thus conceivably the prevalence could be higher. *Taenia hydatigena* was found in the liver and the number of cysts were 1, 1, 1, 1, 1, 1, 1, 2 and 9. The animal with the 9 cysts was 12 1/2 years old. The prevalence of *Setaria* is probably greater than reported as staff did not have the time to closely search the abdominal cavity for it and were not present when all animals were gutted. Frequently, evidence of *Setaria* was found as calcified worms on the connective tissue collected with the uterus - the opportunity to examine more connective tissue from females than males probably accounts for the fact only 11% of the males were infected and 59% of the females. 15 of the livers collected were covered with an obvious layer of fibrin.

Table 7. Blood chemistry of male moose from Hecla Island, December 1978.

| Age     | Urea-nitrogen<br>(gm/dl) | Cholesterol<br>(gm/dl) | Total protein<br>(gm/dl) |
|---------|--------------------------|------------------------|--------------------------|
| 1/2     | 12                       |                        |                          |
| 1/2     | 5                        | 70                     | 5.6                      |
| 2 1/2   | 5                        | 67                     | 6.2                      |
| 3 1/2   | 11                       | 55                     | 6.4                      |
| 3 1/2*  | 10                       |                        |                          |
| 3 1/2   | 8                        | 56                     | 5.3                      |
| 4 1/2   | 5                        | 66                     | 6.3                      |
| 4 1/2   | 13                       | 77                     | 6.0                      |
| 5 1/2   | 10                       | 88                     | 6.1                      |
| 5 1/2*  | 9                        |                        |                          |
| 5 1/2   | 4                        | 64                     | 5.9                      |
| 6 1/2   | 10                       | 73                     | 6.2                      |
| 6 1/2   | 14                       | 57                     | 5.5                      |
| 6 1/2   | 7                        | 73                     | 6.0                      |
| 8 1/2   | 14                       | 65                     | 5.8                      |
| 9 1/2   | 11                       | 89                     | 6.9                      |
| 10 1/2* | 21                       |                        |                          |
| Average | 9.9 ± 4.3**              | 69 ± 11                | 6.0 ± 0.4                |

\*haemolyzed blood

\*\*the average excluding the one high value of 21 is 9.3 ± 3.3

Table 8. Blood chemistry of female moose from Hecla Island, December 1978.

| Age     | Urea-nitrogen<br>(gm/dl) | Cholesterol<br>(gm/dl) | Total protein<br>(gm/dl) |
|---------|--------------------------|------------------------|--------------------------|
| 1/2*    | 5                        | 52                     | 5.2                      |
| 1/2*    | 5                        | 68                     | 5.6                      |
| 1 1/2*  | 7                        | 73                     | 6.6                      |
| 2 1/2   | 4                        | 64                     | 7.0                      |
| 3 1/2   | 24                       | 59                     | 5.4                      |
| 3 1/2*  | 7                        | 65                     | 6.1                      |
| 3 1/2** | 11                       |                        |                          |
| 4 1/2   | 9                        | 77                     | 6.8                      |
| 5 1/2   | 11                       | 78                     | 7.3                      |
| 7 1/2   | 10                       | 47                     | 5.4                      |
| 9 1/2** | 11                       |                        |                          |
| 11 1/2  | 8                        | 64                     | 6.5                      |
| 11 1/2  | 10                       |                        |                          |
| 12 1/2  | 12                       | 66                     | 6.1                      |
| Average | 9.6 ± 4.9***             | 65 ± 10                | 6.2 ± 0.7                |

\*denotes not pregnant

\*\*haemolyzed blood

\*\*\*the average excluding the one high value of 24 is 8.5 ± 2.7

Table 9. Parasite species and prevalence in Hecla Island moose.

| Species                        | Number positive | Percent |
|--------------------------------|-----------------|---------|
| <i>Echinococcus granulosus</i> | 8               | 22      |
| <i>Taenia krabbei</i>          | 1               | 3       |
| <i>Taenia hydatigena</i>       | 9               | 25      |
| <i>Setaria</i> sp.             | 12              | 33      |
| <i>Diotyocaulus</i> sp.        | 3               | 8       |

Sample size: 19 males, 17 females

Evidence of infection with *Fascioloides magna* was not found.

An examination of the uteri and ovaries collected from the 15 adult females revealed 12 (80%) were pregnant. Of interest is the fact that 2 of the non-pregnant animals (3 1/2 and 14 1/2 years old) were together when shot and both had calves in previous years. The other non-pregnant adult was 1 1/2 years old. In utero productivity was 100 calves/100 cows (9 males, 6 females) and 3 (25%) of the pregnant cows were carrying twins. At the time of writing a detailed examination of the ovaries and fetuses collected has not been completed.

#### DISCUSSION

It was a well known fact throughout the hunting fraternity in Manitoba that Hecla Island contained a large moose population. This resulted in many individuals applying for a license who had either not hunted moose previously or who were not serious hunters but were encouraged to apply because of what appeared to be an excellent opportunity to kill a moose. Some of those individuals were fortunate to obtain a license and undoubtedly this type of hunter contributed to the low success rate in the rifle season despite the large population. Another contributing factor was the extremely cold temperatures which forced some hunters to depart after the first day.

The low success for archers was anticipated however, it did give those participating a new experience and comments received indicate that the hunt generated many pleasant and exciting memories. 73 percent of those who hunted have indicated their intention to apply for a license the next time such a hunt is offered to them. Skepticism has been expressed relative to the killing ability of the bow and arrow

and the answer varies from person to person. Two of the animals that were killed travelled 65 to 75 yards respectively before dropping.

Effort expended by check station staff to accommodate rifle hunters and to assist them in having a pleasant hunt was well received. Prior to the hunt, all hunters were advised that should problems arise from their activities and non co-operation, the chance of such an event occurring in the future would be seriously jeopardized. In this regard, hunters were most co-operative and their interest in collecting the specimens requested was beyond reproach - they are to be commended for their efforts.

The economic analysis illustrates that moose hunting can result in a significant economic return to those catering to hunters. This is one aspect that should be recognized when attempting to justify controlled hunts as opposed to other types of herd reduction programs. The return garnered by the Province of Manitoba from license sales was \$4,096 while the cost of putting on the hunt was \$1,100 (excluding salaries) for a profit of \$2,996. Including license fees, the Hecla hunt generated a hunter expenditure of \$30,902.08.

Using the technique of Oliver (1977) (Table 10) for capitalizing the value of wildlife, a better approximation of the perennial value of moose on Hecla can be ascertained. Data relative to non-consumptive use are not available thus this aspect of the total value has not been computed. Suffice to say, it would add significantly to the value of Hecla's moose herd. The harvest of 40 moose and a cash flow of \$30,902.08 represents gross income. The remaining 220 animals represent the capital investment and with the present conditions of the habitat, are essential to sustain the

Table 10. Bioeconomic consumptive value of the Hecla Island moose herd - 1978.

|                             |                          |             |
|-----------------------------|--------------------------|-------------|
| Moose population            |                          | 260         |
| Harvest rate                |                          | 15%         |
| Number harvested            |                          | 40          |
| Mandays to harvest/moose    |                          | 24.6        |
| Mandays produced            |                          | 820.4       |
| Value per manday            |                          | \$37.68     |
| Hunting value in 1978       |                          | \$30,902.08 |
| Interest rate               |                          | 12%         |
| Value of each moose killed  | $\frac{30,902.08}{40}$   | \$772.55    |
| Capitalized value per moose | $\frac{257,517.33}{220}$ | \$1170.53   |



productive capacity of the herd. Thus, to return a hunting value of \$30,902.08 at prime interest of 12% we would need a capital investment of \$257,517.33. Although non consumptive values are not computed, it is known that during the period May 15 - September 15, 1978, 76,953 people (25,531 vehicles with average of 3 occupants each) visited Hecla. Winter use does occur but numbers relative to visitors are not available. Conversations with field staff suggest that about 70% of Island's visitors are interested in seeing or talking about the moose herd. This combined value of consumptive and non consumptive use vividly illustrate the value of managing the herd.

The average age of adult bulls ( $5.7 \pm 2.3$ ) was similar to that reported ( $5.8 \pm 2.7$ ) by Karns (1972) for the first moose hunt in Minnesota in 49 years while our cows were older at  $6.6 \pm 4.2$  compared to  $5.7 \pm 3.5$  for Minnesota. A reduced calf crop and/or diminished survival for the previous 3 years (1975-76, 76-77 and 77-78) on Hecla has resulted in fewer young animals entering the adult population thus increasing the average age. In those 2 years, there was an average of 19.3% of the winter population comprised of calves whereas the 4 winters previous to that averaged 23.2% calves. It is speculated from the evidence gathered that calf survival to 1 year of age in the past 3 winters has also been substantially reduced. Although the previous 3 winters were not considered severe by Manitoba standards, evidence of calf mortality due to malnutrition was found and in the spring of 1978 a few dead adults were spotted from the air leading one to speculate that they may have died from similar causes. A significant calf mortality whether it be in utero or in the first year of life will result in an older adult population with reduced reproductive

capacity.

The dressed weights of the Hecla moose are similar to those found by Karns (1976) in northwest Minnesota. Although weight data from other areas of Manitoba are sketchy, it appears that Hecla moose are substantially lighter than those from other areas of the province. The author had occasion to weigh the 4 quarters of a 4 1/2 year old bull shot in Manitoba's eastern zone which weighed 765 pounds. This weight is not much less than the heaviest dressed weight (790 pounds) of the largest bull removed from Hecla. Karns' (1976) data also indicate that moose from the northeast of Minnesota are generally larger and physiologically in better condition than moose from the northwest. The weights are also substantially less than that reported by Timmermann (1972) for the Black Sturgeon area in Ontario. Nunan (1965 *vide* Timmermann 1972) suggested there was an average 24% weight loss during the gutting process. The results of this present investigation indicate that the average weight loss for bulls and cows is generally about 31%. An examination of Hecla moose suggested that hunters did not remove large amounts of waste flesh and hide during the gutting process thus the weight loss indicated is considered to be representative of what occurs. The technique suggested by Karns (1976) for estimating the weight of moose gives an estimated dressed weight for bulls averaging 238 pounds too much and 101 pounds too little for cows.

Few studies exist regarding moose antler development and age. In the years the author has surveyed the Hecla moose herd, exceptionally large antlers have never been noted. This is in sharp contrast to the precambrian shield area east of Lake Winnipeg where many animals with

noteworthy antlers have been observed. Cringan's (1955) findings related antler development to age and concluded that the greatest development occurred in ages 8 to 10. Timmermann (1971) found that the antlers of moose from the Black Sturgeon area in Ontario produced the largest development in the 8 1/2 to 11 1/2 year olds. The present data, recognizing the small samples, suggests that although the size is not as great as reported by others, the greatest development does occur in the 8 1/2 to 10 1/2 year olds. Data available (Crichton unpublished) from Manitoba's game hunting area 26 indicates that the antlers of moose from the precambrian shield have greater development than those from Hecla Island.

Excluding calves, there was a significant difference between the KFI of males and females with the latter having a higher value. McGillis (1972) postulated that the low KFI's in 1968 and 1969 in Elk Island National Park were perhaps a reflection of very high moose densities (5.4/sq km). His January - February values were similar to ours calculated in December. On Hecla, there is about 2.3 moose per sq km of moose habitat with densities in some areas of the island being up to 5.2/sq km. Morrison (1958) stated that pregnancy tends to make animals gain in weight and fatten more rapidly. Thus, it is not surprising to find that the KFI of the 3 non pregnant cows to be lower than that of those pregnant.

La Resche et al (1974) reviewed the methods of measuring nutritional status of wild moose populations and presented details of ongoing studies of moose blood chemistry. Franzmann et al (1976) stated that blood calcium, phosphorus, total protein, haemoglobin and packed cell volume were a good reflection of the condition status of moose.

Albumin, beta globulin and glucose also reflect condition status but under certain circumstances of collection (drugging) these parameters can be influenced by excitability. Faro and Franzmann (1978) found that 3 key blood parameters were indicative of nutritionally stressed moose on the Alaskan Peninsula - low packed cell volume, low protein intake indicated by low blood urea nitrogen and low fatty acid indicated by low cholesterol. The Hecla study is the first attempt at examining the blood chemistry of Manitoba moose thus, data for comparison and to assist in assessing the population/habitat relationship are not available. However, La Resche et al (1974) found the total protein values for Minnesota moose to be  $6.9 \pm 0.7$  gms/dl, blood urea nitrogen to be  $8.5 \pm 3.2$  and cholesterol to be  $54 \pm 10$ . The corresponding values from Hecla Island are  $6.0 \pm 0.4$  for bulls and  $6.2 \pm 0.7$  for cows;  $9.3 \pm 3.2$  (excluding the one high value of 21) for bulls and  $8.5 \pm 2.6$  (excluding the one high value of 24) for cows;  $69 \pm 11$  for bulls and  $65 \pm 10$  for cows.

The parasites found in the moose of the Island are commonly found in moose in Manitoba and other locales in the central part of the continent. Karns (1972) found 60% of the moose in northeast Minnesota infected with *E. granulosis* and 10% in the northwest. *T. krabbeol* has been found in 60% of the moose from ranges in Alberta (Samuel 1972). The presence of this parasite in Hecla moose is probably greater than that discovered as time only permitted a detailed examination of the heart for this species. Karns (1972) implicated the timber wolf (*Canis lupus*) population in northeast Minnesota with the higher prevalence of the aforementioned 2 parasites. In the past 7 years no evidence has been found for wolves killing moose on Hecla and generally wolves are

transients to the Island rather than permanent residents. Thus, the absence of the wolves is the primary reason for the low prevalence of *E. granulosus* and *T. krabbei* in the moose population. Coyotes do occur on the Island but the absence of material to scavenge on negates their effectiveness as a definite host for *E. granulosus* and *Taenia* spp. During the winter months, wolves on Hecla as well as the mainland and the other associated islands feed to a large extent on rough fish left around basin holes by commercial fishermen and as a result of this are frequently killed out on the ice by fishermen and trappers. This, along with the fact that cattle ranches in the near vicinity lead to the removal of problem wolves by departmental staff, is believed to be the reason why the wolf population does not build up to a substantial numbers. *Setaria* is a very common parasite of moose in Manitoba and has been observed by the author on many occasions in moose and less frequently in deer and caribou. The presence of dead and calcified worms which appear to be *Setaria* are more frequently found than live worms.

Data relative to in utero productivity for moose in other ranges in Manitoba are limited. However, in the western portion of the province it has averaged 114 calves/100 cows over a 3 year period. Sample sizes from Eastern Manitoba are small, however the in utero productivity is about 120 calves/100 cows. It is a well known fact that productivity is affected by range quality. In the spring of 1977, a large fire burned approximately 200,000 acres northwest of Hecla Island. During this present winter in the burn area there are 86 calves/100 cows in the population and it is speculated that in utero productivity in this area would be in the vicinity of 130-140

calves/100 cows. Karns (personal communication) indicated that the normal for Minnesota moose is about 130 calves/100 cows.

Significant amounts of habitat improvement have not taken place on Hecla Island since the cessation of logging in the mid 50's. This has resulted in an overmature habitat today and combined with the reduction of available habitat by development activities, the implications to the moose herd are far reaching. If allowed to continue, browsing will become more severe with the obvious results on the habitat resulting in generally poor condition of the animals. The losses due to malnutrition of the past 3 years are attributable to deficiencies in the quantitative and qualitative aspect of browse. It is hypothesized that a similar relationship exists between the moose of Hecla Island and other moose ranges in Manitoba as suggested by Karns (1976) for Minnesota. Although the sample size is small, it is the feeling that in utero productivity of Hecla's moose herd has been about the same for the past 3 years. Calf survival to 6 months of age has been poor for the past 3 years (1976-77, 77-78 and 78-79) with an average of 41.0 calves/100 cows being found while the average for the Eastern portion of the province has been 56.6 calves/100 cows. As the range continues to deteriorate, calf survival will be affected and the point has been made consistently over the past 3 years that given a severe winter a significant proportion of the herd will perish. The magnitude of the loss will be governed by severity of the winter. Approximately 10% of the herd was affected in this way by the severe winter of 1973-74. Since then, the range has been even more severely browsed. The present winter is shaping up as the most severe of the past 4 years and has been the coldest in 42 years. Present snow depths

are about 60 centimetres.

A pre-season estimate of the population was 263 animals and surveys following the season put the present population at 221. This population is estimated to contain 40 calves. Thus, it is apparent that all the hunting season did in the way of reducing the population was to remove a number of animals consistent with the number of calves in the population.

Following the winter, an assessment of the population will be made and the magnitude of any die-off will be ascertained after which a decision will be made as to whether or not a controlled hunt will be instituted for 1979. Presently, an integrated resource management plan is in the process of being developed for the Island. Included in this package are various alternatives for rejuvenating habitat. This is inevitable if the population is to remain viable and meet the demand that is being placed on it. The value of this Island ecosystem is recognized as far as a moose laboratory is concerned and hopefully studies can be initiated which will enable us to have an insight into what makes this herd 'tick'. Future blood work is being planned with a number of changes being incorporated to get the maximum value from our collections. In this way, it is felt much can be learned about Manitoba's moose population by comparing different herds with that of Hecla Island which is probably more stressed nutritionally than any other in the province.

In summary, the 1978 Hecla moose hunt was considered a success from the standpoint of providing a new form of recreation (archery) for our moose hunter, the quality rifle hunt, from the biological data collected and the economic return generated to the economy. The one

negative aspect is the few animals that were harvested. Although the sample size admittedly is small, it is felt that the results give a fair picture of the status of the Island's moose herd as it exists today.



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