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MOOSE RESEARCH CENTER REPORT

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Volume XIX
Project Progress Report
Federal Aid in Wildlife Restoration
Project W-17-10, Jobs 1.14R and 1.21R

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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: Albert W. Franzmann, Charles C. Schwartz, John L. Oldemeyer, Wayne L. Regelin

Project No.: W-17-10 Project Title: Big Game Investigations

Job No.: 1.14R Job Title: Evaluation and Testing Techniques for Moose Management

Period Covered: July 1, 1977 through June 30, 1978

SUMMARY

Several studies continued under this job during this report period. The combination of the immobilizing drugs etorphine and xylazine hydrochloride was used for both the calf mortality study and routine MRC moose immobilization. Supplemented with additional xylazine hydrochloride, the combination was used to move moose within the MRC enclosures.

Pellet group plots in Pen 1 were cleared on 1 October 1977 and the plots were counted and cleared again on 5 and 6 May 1978. The data from this year are being analyzed and will be combined with data from 1976-77 pellet counts and a paper prepared.

The fall application of fertilizer to plots in the rehabilitation area of Pen 1 was done on 3 October 1977. This study is continuing and results are not yet available.

Eight abandoned moose calves were brought to the MRC in May 1978, to be raised. Records of feed intake, growth rate, behavior, and training were maintained. The calves will be used for a variety of physiologic, digestive, and behavioral studies being planned in cooperation with various individuals, groups, and agencies. The development of a food ration that can sustain adult moose was undertaken.

Electronic measurement of tissue in live moose was tested using a Scanaprobe (Ithaco, Ithaca, NY). There were several problems with interpretation of readings, and comparison of electronic to actual measurements were not well correlated. The potential of this device remains good,however, and further testing will be done.

BACKGROUND

The Kenai Moose Research Center (MRC), with known numbers of confined animals, provides unique conditions for developing and testing techniques applicable to moose (*Alces alces*) management. Completion of programmed studies under this job was not always possible because developments in related fields providing drugs, equipment, and procedures potentially applicable to moose management determined the thrust of our activity. A final report covering activities under this project from July 1969 through June 1974 was completed (Franzmann et al. 1974). The 1976 and 1977 progress reports (Franzmann and Arneson 1976, and Franzmann and Bailey 1977) covering this job were primarily devoted to pellet count census evaluations at the MRC from 1970 through 1974, the use of combinations of immobilizing drugs, biotelemetry, fertilization of moose forage in rehabilitated areas, and moose calf mortality assessment. All of these studies continued through this report period except the biotelemetry study. The moose calf mortality study was continued as a separate study and job (Frannzmann and Swartz 1978). The background for the remaining studies continuing under this job are outlined in previous progress reports (Franzmann and Arneson 1976 and Franzmann and Bailey 1977).

A new activity under this job was begun essentially as a result of the calf mortality study. In 1977, we experienced a high calf abandonment rate in the moose calf mortality study when we immobilized the cow and processed both the cow and calf (Franzmann and Bailey 1977). We planned to immobilize the cows again for the calf mortality study in 1978, to obtain the critical physiologic data, but altered our procedures hoping to minimize calf abandonment. We had, however, made preparations at the MRC to raise any abandoned calves should that contingency arise. Immobilization of the cows this year also resulted in calf abandoment (Franzmann and Schwartz 1978) and the calves (6) were brought to the MRC to be raised. Two additional calves abandoned from other causes near Soldotna were brought to the MRC by Fish and Wildlife Protection officers.

Assessing condition of moose by the most direct and objective method possible has been attempted in past MRC studies (Franzmann et al. 1976a). The Scanaprobe ultrasonic system (Ithaco, Ithaca, NY) has been used in domestic animals to measure swine fat and loin depth and cattle fat and ribeye depth. A scanaprobe was purchased by the Kenai National Moose Range during 1977 for our use in testing the capability of the instrument for measuring fat and muscle deposits on moose and other large wild animals. The ultrasonic high frequency sound waves are emitted by the instrument and when placed on the hide, part of the waves are deflected at each differing area of tissue density and recorded. Successful application to wild animals would be an additional tool to assess animal condition.

OBJECTIVES

To test and evaluate techniques that are potentially useful for determining population status, movements, and other factors necessary for management of moose.

PROCEDURES

Immobilizing, Reversing and Adjunct Drugs

No new drugs were tested during this report period, but testing continued using the drug combination of etorphine (M-99, D-M Pharmaceuticals, Inc. Rockville, MD) and xylazine hydrochloride (Rompun, Haver-Lockhart Laboratories, Shawnee, KS).

During this report period, we began moving moose between enclosures and out of the enclosures (see Job 1.21R this report). Because extended immobilization was required, we utilized the same procedure as outlined for surgical procedures on moose (Franzmann and Bailey 1977), i.e., etorphine and xylazine hydrochloride mixture was used for initial immobilization in the traps. The depth and time of immobilization were altered by additional intraveneous injections of xylazine hydrochloride. Xylazine hydrochloride was also used as the sole immobilizing drug for moving moose.

Pellet Group Plots

Pellet group plots in Pen 1 (160 plots - 17.8 m^2) that were used for census evaluation 1970-74 (Franzmann et al. 1976) were cleared of pellet groups on 1 October 1977. These plots were counted and cleared on 5 and 6 May 1978 and moose days were calculated for this 218-day period. A paper is being prepared on pellet-count censusing using the procedures and data from Pen 1 since 1976.

Effects of Nitrogen Fertilization Upon Production of Moose Forage

Specific procedures for this study were outlined previously (Franzmann and Bailey 1977). The only alteration in that outline was that vegetation was not measured in August 1977. The fall applications of fertilizers as per outline were done on 3 October 1977.

Raising Moose Calves at the MRC

Abandoned moose calves were transported to the MRC for rearing and training. Animals were housed in individual 5.9 m^2 sheltered enclosures. To minimize the possibility of disease and/or its spread, pens were cleaned of droppings several times each day. Sawdust was used as bedding and replaced when neccessary. At five weeks of age calves were moved to individual 3.1 X 15.2 m enclosures where they could exercise. One end of the pen opened to a 4.1 ha enclosure where animals could periodically be released to browse natural vegetation.

Bottle feeding started shortly after calves arrived at the MRC. Milk was fed in 1.9 l plastic calf bottles with the nipple hole enlarged to ensure adequate flow of milk. All feeding utensils were washed with water after each feeding. Milk formula was heated to approximately 38°C for feeding. Calves were fed a commercial milk replacer (Suckle, Carnation Co., Los Angeles, CA) daily (Table 1) until the end of August when they were weaned. In addition to the milk formula, fresh cut *Salix* spp., *Betula papyrifera* and *Epilobium angustifolium* were available ad libitum. Freshly cut vegetation was also supplemented with a commercial pelleted ration of bovine calf starter (Don's Calf Starter, Alaska Mill and Feed Co., Anchorage, AK).

Table 1. Daily feeding schedule and amount of milk formula bottle-fed moose calves from day of capture to weaning (formula was a milk replacer: Suckle, Carnation Co., Los Angeles CA).

Day	Milk formula (ml)	No. feedings/day
1	590	5
8	710	5
22	770	5
26	830	5
38	830	4
49	830	3
72	830	2
88	830	1
100	0	0

Training of moose calves started immediately following their arrival at the MRC. As did Reichert (1972), we found "tender loving care" an essential element throughout the training period. For the first few days after capture, trainers spent most of their time gaining the confidence of the calves. This was accomplished by repeated contact with each animal during feeding periods. To monitor changes in body weight of calves throughout their lives, they were trained to stand on a cattle scale. This was accomplished by bottle feeding each calf at least once daily on the scale. In preparation for energy metabolism and digestive physiology studies, an intensive training program was started when calves were approximately 1-week old. Calves are being trained to lead with a rope halter and respond to auditory stimuli while being fed. At each feeding a whistle is blown whenever milk is fed to associate the sound with a reward. This ongoing operation schedule to condition and maintain responses to the handlers should enable us to stimulate the calves to return to their feeding area once released into Pen 2 of the MRC enclosure. Coupled with this program, each calf is led to a simulated metabolic chamber every other day. Once there, each calf is fed within the chamber. After feeding, the door is closed and the calf is left in the darkened enclosure for increasing lengths of time. Calves are also given calf starter while in the metabolic chamber. This training will continue until suitable animals are used in metabolic studies.

Electronic Tissue Measurement

The Scanaprobe was used on nearly all moose handled during this report period. Two locations for measuring fat and muscle were selected (1) over the loin at the junction of the last rib and (2) over the rump in the triangle formed by the back bone and the point of the hip. Hair was plucked from the areas and mineral oil applied. The Scanaprobe was then placed on the areas and the tissue levels recorded.

We also applied the Scanaprobe to similar areas on captured black bears (*Ursus americanus*) (Franzmann and Schwartz 1978).

A moose and a black bear inadvertently killed during capture provided the opportunity to apply the Scanaprobe and then check the ultrasonic recorded tissue depths with depths directly measured by disecting the tissues.

FINDINGS

Immobilizing, Reversing, and Adjunct Drugs

Results of the immobilizing drug mixture of etorphine and xylazine hydrochloride used on free-ranging moose were reported (Gasaway et al. 1978).

Results using this mixture with the addition of hyaluronidase (Wydase, Wyeth Laboratories, Inc., Philadelphia, PA) were reported for adult cows immobilized during the moose calf mortality study in 1977

(Franzmann and Bailey 1977). These results were compared to the results obtained during the moose calf mortality study in 1978 when hyaluronidase was not used in the immobilizing mixture (Franzmann and Swartz 1978).

Pellet Group Plots

Findings from this report period are being analyzed and combined with findings from the 1976-77 season for use in the preparation of a paper on pellet group censusing and habitat use by Alaskan moose.

Effect of Nitrogen Fertilization Upon Moose Forage

This study is continuing and results are not yet available.

Raising Moose Calves at the MRC

On 30 June 1978, all eight calves were healthy and responding to training. New holding pens were close to completion and the animals have adapted to their new facility. Training is continuing for energy metabolism studies which will be conducted by Wayne Regelin of the U.S. Fish and Wildlife Service, Kenai. A study plan outlining his studies is currently in preparation. Additional investigations to test the feasibility of digestive physiology studies will begin this winter. Study plans for this segment are contingent on the formulation of a ration that can sustain moose. A preliminary ration has already been formulated. In conjunction with these studies, Arthur Flynn (Cleveland Clinic Foundation, Cleveland, OH) will monitor changes in androgen levels associated with calcium uptake during antler growth. Availability of tame animals will also allow us to test new telemetry equipment and to obtain controlled baseline information on physiological studies currently being conducted at the MRC (Franzmann and Bailey 1977, Franzmann and Arneson 1976).

Electronic Tissue Measurement

The Scanaprobe was used on most moose handled this past year and the readings recorded. We did not, however, have the opportunity to test our electronic measurements on moose until 7 June 1978 when a two-year-old male moose died from overheating while we were attempting to move him. We took this opportunity to test the electronic versus the actual tissue measurements (Table 2). Actual measurements and Scanaprobe measurements were not correlated, particularly when skin was on. There was some relationship between actual measurements and Scanaprobe measurements on the skinned animal. The dual readings on the Scanaprobe (Table 2) confounded readings. In most cases one reading is similar to the measured reading and one is completely different. The difficulty occurs in determing which is correct on the live animal.

This spring we had the opportunity to measure and Scanaprobe two black bears (Table 3). As with the moose, some measurements were similar between the skinned Scanaprobe reading and the measured. The Scanaprobe measurements with the skin on were not similar at all.

Table 2. Scanaprobe versus actual measurements of a 2-year-old male moose muscle tissue.

Scanaprobe Measurements (mm)			Actual Measurements (mm)
Area	Skin On	Skinned	
Rump	31-52*	48	54
Rib	28-70	30-68	30
Between rib and rump	4-40	17-33	38
Upper loin	4-34	36	28

* A Scanaprobe reading of 31-52 hypothetically indicates that the first tissue layer is 31 mm thick and the second layer is 21 mm (52 minus 31) thick.

Table 3. Scanaprobe versus actual measurement two black bears.

Scanaprobe Measurements (mm)				Actual Measurements (mm)
Area	Bear #	Skin On	Skinned	
Rump	B-4	1-10-20*	34	35
Rib		1-10	32	38
Rump	B-4		32	
Rib	45° L to body		31	
Rump	B-7	2-12	2-12	8 (fat) 40 (muscle)
Rib		2-12	2-12-22	5 (fat) 28 (muscle)

* A Scanaprobe reading of 1-10-20 hypothetically indicates that the first tissue layer is 1 mm thick, the second layer is 9 mm (10-1) thick, and the third layer is 9 mm (20-11) thick.

There appears to be a potential for use of the Scanaprobe on a live animal if we can sort out causes for the erratic readings. We want to test it on animals with a fat layer. Both of our animals for testing were devoid of fat. It may be that the fat layer, because of the drastic difference in density between it and muscle tissue, may be more detectable with the electronic probe. If we are only successful in measuring the fat layer, the technique would have field application potential. Obviously, further testing and comparison with known thickness of tissue is required.

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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: Albert W. Franzmann, and Charles C. Schwartz

Project No.: W-17-10 Project Title: Big Game Investigations

Job No.: 1.21R Job Title: Moose Productivity and Physiology

Period Covered: July 1, 1977 through June 30, 1978

SUMMARY

Data collection continued for outlined studies of moose hair element metabolism, blood chemistry and hematology, morphometric measurements, productivity and mortality of Kenai Moose Research Center (MRC) moose, and browse production, utilization and quality. Results were not compiled or analyzed during this report period due to lack of programming capabilities.

BACKGROUND

Initial results of this long-term study were summarized by Franzmann et al. (1976). The study is being continued to complete various phases of ongoing investigations and to accomodate expansion of physiologic data collection and interpretation from other Alaskan moose (*Alces alces*) populations. Background for these continuing studies is outlined in Franzmann et al. (1976).

During this report period several manuscripts were published (Oldemeyer et al. 1977, Franzmann et al. 1978 and Franzmann and LeResche 1978). Two non-technical articles emanating from this job were also published (Franzmann 1977b and Franzmann 1978).

OBJECTIVES

To establish baselines by sex, age, season, reproductive status, area, drug used, excitability and condition for blood, hair, and milk parameters in moose, and to evaluate their usefulness as indicators of nutritional and general condition status of moose.

To apply the above criteria to various moose populations over the state.

To estimate browse production and utilization and to quantitatively and qualitatively estimate consumption of all plant materials by moose at the Kenai Moose Research Center (MRC).

To determine nutritional values and digestibilities of the more common moose forage species and to relate hair element monitoring to moose mineral metabolism.

To measure natality, mortality and general condition of moose at the MRC.

The overall objective is to obtain a more thorough and specific knowledge of how moose affect vegetation and how vegetation affect moose. The applications of the indicator species concept to moose by gaining knowledge specific to moose physiology was an integral part of this objective.

PROCEDURES

Hair (Metabolism)

Specific procedures for collecting, handling, and analyzing moose hair samples have been previously reported (Franzmann et al. 1975 and Franzmann et al. 1976). During this report period, hair samples were collected from the moose populations listed in the Blood Chemistry and Hematology Procedures section of this report.

Blood Chemistry and Hematology

Specific procedures for collecting, handling and analyzing blood also were outlined in another report (Franzmann et al. 1976). During this report period, blood and physiologic samples were collected 20-23 March 1978, from Thomas Bay near Petersburg in cooperation with the U.S. Forest Service; 28 March through 1 April 1978 near Yakutat in cooperation with Christian Smith (Job 1.25R); and 24 May through 13 June 1978, on the Moose River Flats and Willow Lake areas on the Kenai Peninsula. Samples were also obtained from moose trapped at the MRC.

Condition

Procedures for assessing moose condition have been outlined (Franzmann 1977a and Franzmann et al. 1978). In addition to these outlined procedures we tested the use of an electronic fat and muscle probe (Scanaprobe, Ithaco, Ithaca NY) to assess moose condition (see Job 1.14R this report).

Morphometric Measurements and Body Weight

Specific procedures for obtaining measurement and weight information from moose have been outlined (Franzmann et al. 1978). Measurement and, when possible, weight data were obtained from all moose handled during this report period.

Productivity and Mortality of MRC Moose

Mortality and natality within the MRC enclosures were assessed by ground observations, periodical aerial observations, trapping and radiotelemetry.

Moose within the MRC enclosures were moved from one enclosure to another or transferred outside the enclosures to ultimately obtain approximately the following numbers and distribution: Pen 1--3 bulls

and 3 cows; Pen 2--1 bull and 2 cows in addition to tame moose being raised at MRC; Pen 3--8 cows and no bulls until late in rut when 1 bull will be introduced; and Pen 4--no moose (study effects on vegetation with removal of moose from the area which has been overstocked for nearly 10 years.

Moose were moved utilizing etorphine (M-99) and xylazine hydrochloride (Rompun) mixture for initial immobilization of trapped animals and retaining the immobilized state by subsequent doses of intravenous xylazine. Animals that could not be removed from one enclosure to another or to the outside by opening the fence, were loaded by a winch-hoist device and placed on a trailer and moved to the appropriate place. Diprenorphine (M 50-50) was given intravenously to negate the effects of etorphine. Each animal was routinely processed when immobilized (Franzmann et al. 1976).

Browse Productivity, Utilization, and Quality

Procedures were published by Oldemeyer et al. (1977).

FINDINGS

Hair

Samples were collected and analyzed from all moose handled during this report period, but results were not compiled or analyzed, due to lack of programming capabilities during this report period.

Blood Chemistry and Hematology

Samples were collected and analyzed from all moose handled during this report period, but results were not compiled or analyzed, due to lack of programming capabilities during this report period.

Condition

Each moose handled during this report period was assigned a subjective condition grade (Franzmann and LeResche 1978). In addition, the Scanaprobe was used on some of the moose to assess its use as a method to objectively quantify condition (see Job 1.14R this report).

Morphometric Measurements and Body Weight

Measurement and weight data from Alaskan moose were reported (Franzmann et al. 1978). Measurement and weight data were collected from moose handled during this report period when feasible.

Productivity and Mortality of MRC Moose

Annual progress reports have listed histories of individual moose and have listed moose mortalities at the MRC. Tables 1,2,3,4, and 5 update these accounts to 30 June 1978.

Table 1. Histories of Pen 1 individual moose at Kenai Moose Research Center, July 1, 1977 though June 30, 1978.

Moose No.	Sex	Year of Birth	Significant Observations			No. Times Observed	No. Times Captured
			Date	Event	Circumstances		
35	M	1968	3 March 1978 10 July 1978	Last sighted Found dead	Observed Bone pile sighted from Supercub	3	0
43	M	1967	21 June 1978	Found dead Last sighted	Observed	12	0
58	M	1970	14 June 1978	Last sighted	Observed	5	0
R-70-8	F	1968	26 May 1978	With calf	Supercub	4	0
125	F	1966	8 June 1978	With calf	Supercub	7	0
UC	M	1976	9 May 1978	Last sighted calf of 125	Helicopter	7	0

Table 2. Histories of Pen 2 individual moose at Kenai Moose Research Center, July 1, 1977 though June 30, 1978.

Moose No.	Sex	Year of Birth	Significant Observations			No. Times Observed	No. Times Captured
			Date	Event	Circumstances		
36[1/]	M	1967	29 Sept. 1977	Sighted Pen 2	Observed	1	1
			5 Oct. 1977	Sighted Pen 3	Broke through fence into Pen 3	1	0
73 (140)[1/]	M	1969	30 Sept. 1977	Collared in Pen 2 as 140	Trapped in CP 1	1	1
			5 Oct. 1977	Sighted Pen 3	Broke through fence into Pen 3	7	0
670	F	1970	9 May 1978	Sighted with calf	Helicopter	2	0
130 (Olivia)	F	1975	18 June 1978	Sighted with calf	Observed	12	2
141 (Mike)	M	1976	16 June 1978	Trapped 25	Released	8	2
142[1/] (Ike)	M	1976	6 Oct. 1977	Trapped CP 1	Released to outside	2	1
129 (Calf of #1)	F	1976	21 June 1978	Trapped 2E	Released	8	2
59[1/]	M	Unknown	8 June 1978	Trapped 2S	Released to outside	6	2
67[1/]	M	Unknown	12 Dec. 1977	Sighted Pen 2	Helicopter survey	1	1
			16 March 1978	Sighted Pen 3	Went through break in fence	2	0
UC[1/]	M	1976	5 Sept. 1978	Trapped CP 1	Released to outside	1	1
UC	F	?	29 June 1978	Sighted	Escaped from Pen 3	1	0

1/ These individuals are no longer residences of Pen 2.

Table 3. Histories of Pen 3 individual moose at Kenai Moose Research Center, July 1, 1977 though June 30, 1978.

Moose No.	Sex	Year of Birth	Significant Observations			No. Times Observed	No. Times Captured
			Date	Event	Circumstances		
80	M	1969	12 Dec. 1978	50" antlers, no collar, assumed to be 80	Helicopter survey	1	0
2870	F	1970	12 Dec. 1978	Last sighted	Helicopter survey	1	0
75	F	1969	12 Dec. 1978	Last sighted	Helicopter survey	1	0
72	F	1970	- NO DATA THIS YEAR -				
98	F		- NO DATA THIS YEAR -				
140(73)	M	1969	5 Oct. 1978	Sighted Pen 3	Broke through fence from Pen 2		
			16 March 1978	Last sighted	Supercub	6	0
36	M	1967	5 Oct. 1978	Sighted Pen 3 Last sighted	Broke through fence from Pen 2	1	0
67[1/]	M	?	6 Dec. 1977	Trapped 2W	First time processed	1	1
			16 March 1978	Observed Pen 3	Probably went through fence 6 Jan. 1978 after a tree broke down fence	1	0
			8 June 1978	Trapped 3N	Processed and released to outside	1	1
UC[1/]	M	1976	14 June 1978	Trapped 3N	Processed and released to outside	1	1
UC[1/]	M	1976	14 June 1978	Trapped 3N	Processed and released to outside	1	1
UC[1/]	M	1976 or 1975	15 June 1978	Trapped 3S	Processed and released to outside	1	1

Table 3 (Cont.) Histories of Pen 3 individual moose at Kenai Moose Research Center, July 1, 1977 though June 30, 1978.

Moose No.	Sex	Year of Birth	Significant Observations			No. Times Observed	No. Times Captured
			Date	Event	Circumstances		
UC	F	1976	18 June 1978	Trapped 3S	Broke out before processing	2	0
UC	M	1975	12 Dec. 1977	30" antlers	Helicopter survey	1	0
133	F		28 June 1978	Trapped 4NE	Moved to Pen 3 with calf	1	1

1/ These individuals are no longer residences of Pen 3.

Table 5. Mortalities within Kenai Moose Research Center enclosures July 1, 1977 through June 30, 1978.

Pen No.	Moose No.	Sex	Age	Date	Cause
1	69	F	9	14 Jan. 1977	Last sighted--assumed dead
	35	M	10	10 July 1978	Carcass found--suspected winter starvation
2	1	F	?	3 July 1978	Found dead
	120	F	7	13 Dec. 1976	Last sighting--assumed dead
	Raquel	F	9	12 April 1977	Last sighting--assumed dead
	UC	F	Calf of 670	June 1978	Carcass found--suspected winter starvation
3	27	F	10	28 June	Found dead--calf skelton with cow--may have died giving birth
4	57	F	8	5 Nov. 1976	Last sighted--assumed dead
	UC	M	2	7 June 1978	Trapped, died overheating
	103	F	8	5 Nov. 1976	Last sighted--assumed dead
	124	F	9	5 July 1976	Last sighted--assumed dead

Table 4. Histories of Pen 4 individual moose at Kenai Moose Research Center, July 1, 1977 though June 30, 1978.

Moose No.	Sex	Year of Birth	Significant Observations			No. Times Observed	No. Times Captured
			Date	Event	Circumstances		
7	M	1969	16 June 1978	Trapped 4NW	Processed and released	3	1
100[1/]	M	1969	7 July 1978	Trapped 4SE	Processed and released to outside	2	1
37	F	1969	26 May 1978	With calf	Sighted	1	0
			29 May 1978	Calf dead	Sighted	1	0
71	F	1969	3 June 1978	With calf	Sighted	5	1
81	F	1969	3 June 1978	No calf	Sighted	7	0
UC[1/]	M	1975	16 June 1978	Trapped 4NE (calf of F81)	Processed and released to outside	2	1
131	M	1977	16 Feb. 1978	Sighted	Observed	3	1
132	F	?	30 May 1978	With calf	Sighted from helicopter	6	1
133[1/]	F	?	28 June 1978	With calf Trapped 4NE	Moved to Pen 3 with calf	10	1
UC[1/]	M	1976	7 June 1978	Trapped 4SE 1976 calf 37	Died overheating	2	1
UC	F	?	29 May 1978	With calf Calf taken to MRC	Sighted from helicopter	2	0
UC	?	1977	7 Feb. 1978	Sighted	Observed	3	0

1/ These individuals are no longer residences of Pen 4.

Winter conditions at the MRC during 1977-78 were more severe than those of 1976-77, with considerably more snow accumulation. The first major snow storm occurred on 28 October with 19 cm of snow. This snow lasted until 29 December 1977 when a second major snow storm increased snow depth by an additional 31 to 33 cm. A severe storm with high winds and much drifting snow occurred 9 February 1978. After this storm, snow accumulations varied from 83 cm in open areas to 70-79 cm in regrowth vegetation and 51-59 cm in mature forests. These snow depths lasted only for a 7- to 10- day period when warm temperatures caused the snow to settle to approximately 50 percent of its original depth. Most of this snow melted by the first week of April with warming temperatures and clear skies.

Calf productivity for spring 1978 was high with 12 mature cows producing 13 calves; only two adults to date have not been sighted with new calves. Both of these are uncollared females, one each in Pen 2 and 3, and have not been handled this year, so their ages are not known at this date. The injured calf of female 37 was sacrificed on 29 May 1978. Necropsy of the carcass revealed extensive damage to the skin and muscle tissue on the right shoulder with advanced stages of infection. The shoulder appeared to have been damaged by some predator attempting to catch and kill the calf. A mature coyote was sighted 10 m from the site. The cow was not aggressive when approached and ran off into the forest. The calf of an uncollared female in Pen 4 was also taken to the MRC headquarters to be reared for additional studies.

Moose within the enclosures up to 30 June 1978 consisted of: Pen 1--2 adult males, 2 adult females both with calves, and a two-year-old male; Pen 2--4 adult females and 2 calves, 1 2-year-old male (Mike) and 8 hand-reared calves; Pen 3--4 our adult males and 6 six adult females with 5 calves; Pen 4--1 adult male, 1 yearling male, and 5 adult females with 3 calves. In addition, five yearling and four adult males were trapped within and released outside of the MRC enclosures (see Tables 1 to 4 for details).

Browse Production, Utilization and Quality

Browse production, utilization and quality studies at the MRC conducted by John L. Oldemeyer and Wayne L. Regelin (U.S. Fish and Wildlife Service) continued. Much of the field work has been completed and analyses and write up of data were underway during this report period.

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