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BY

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Volume I

Project Progress Report
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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: Carl A. Grauvogel

Project No.: W-21-2 Project Title: Big Game Investigations

Job No.: 1.29R Job Title: Seward Peninsula Moose Population Identity Study

Period Covered: July 1, 1980 through June 30, 1981

SUMMARY

During April 1981, 40 adult moose (22 cows, 18 bulls) were radio-collared on 2 drainages in the central Seward Peninsula (Game Management Unit 22D). Thirty-four moose were immobilized from helicopters and 6 from the ground using snow machines. Snow machines proved effective in open terrain or when willow stands were less than 50 m in width. Radio collars were preadjusted to a circumference of 132 cm (50 in) for bulls. Four bulls (ages 3 to 4) lost their collars within 1 week after being instrumented. Body measurements suggested that Seward Peninsula moose are larger than comparable animals in several other Alaskan populations. All 22 cows were palpated and judged to be pregnant. Thirteen cows (50%) still had offspring at the end of June. Ten of 13 cows (77%) produced twins. Six weeks after capture moose had moved an average distance of 29 km (8 mi), 9 moose moved more than 46 km (29 mi), and 1 moved a straight-line distance of 96 km (60 mi).

CONTENTS

BACKGROUND

Moose (Alces alces) were virtually absent on the Seward Peninsula (Game Management Unit 22) 30 years ago. An aerial survey conducted by the Department in spring 1960 revealed only 13 moose, all in the eastern portion of the Peninsula. Aerial surveys in subsequent years documented a rapid increase in moose in the late 1960's and their expansion into all areas containing winter habitat. By the mid-1970's the population growth rate declined and numbers stabilized in some areas. Unit 22 now supports a moose population in excess of 2,500 animals (Grauvogel 1980). Winter browse is limited primarily to narrow stands of willows (Salix sp.) along major drainages. Density of moose on the winter range is high, especially in the central portion of the Seward Peninsula (Subunits 22B and 22D). These areas also supported an exceptionally dense population of snowshoe hares (Lepus americanus) from 1978 through winter 1980. High hare and moose densities may have decreased the productivity of the winter range through overbrowsing. Despite an apparent deterioration in range quality, moose calf survival to 10 months of age expressed as the percentage of calves in the population, has remained relatively high, but has declined steadily during the last decade from a high of 30% to a recent average of 20%. To manage the population and achieve the desired density of moose for the range conditions, information is needed to determine fidelity of moose to their wintering range, size of annual home ranges, timing of movements, and immigration into new areas.

Annual average harvests have increased from 56 moose in the late 1960s to 256 animals during the most recent 5-year period. Nearly half the harvest was reported from Subunit 22D, an area traversed by a gravel road that provides easy access from Nome. Demand for moose by recreational and subsistence hunters living within the Unit is high, and the number of nonlocal hunters has steadily increased. Determining moose population identities and seasonal movements is necessary to maintain optimum harvest rates and effectively allocate the resource among the different user groups. Radio-collaring moose in a high density, heavily harvested population and in a high density, lightly harvested population should provide needed management information.

OBJECTIVES

To determine population identities and seasonal movement patterns of moose in the central Seward Peninsula.

STUDY AREA

Two drainages within Subunit 22D were selected for the moose collaring work. The Kuzitrin drainage encompasses all of the eastern portion of 22D, and the Agiapuk drainage is located near the western edge of the Subunit (Fig. 1). These 2 rivers form a drainage basin of approximately 12,395 km2 (4,800 mi2) ranging in elevation from sea level to 1,541 m (4,700 ft). The basin is bounded on the south and east by 2 geologically young mountain ranges, the Kigluaik and Bendeleben Mountains. Each contains precipitous slopes, numerous rocky outcrops, and relatively sparse vegetation, except at low elevations. The mountains on the northern side of the basin are lower in elevation (maximum height 941 m [2,870 ft]), and the relief is predominately rolling hills with gentle slopes. Both rivers terminate in Imuruk Basin, a lake whose waters flow into the Bering Sea 56 km (35 mi) to the west.

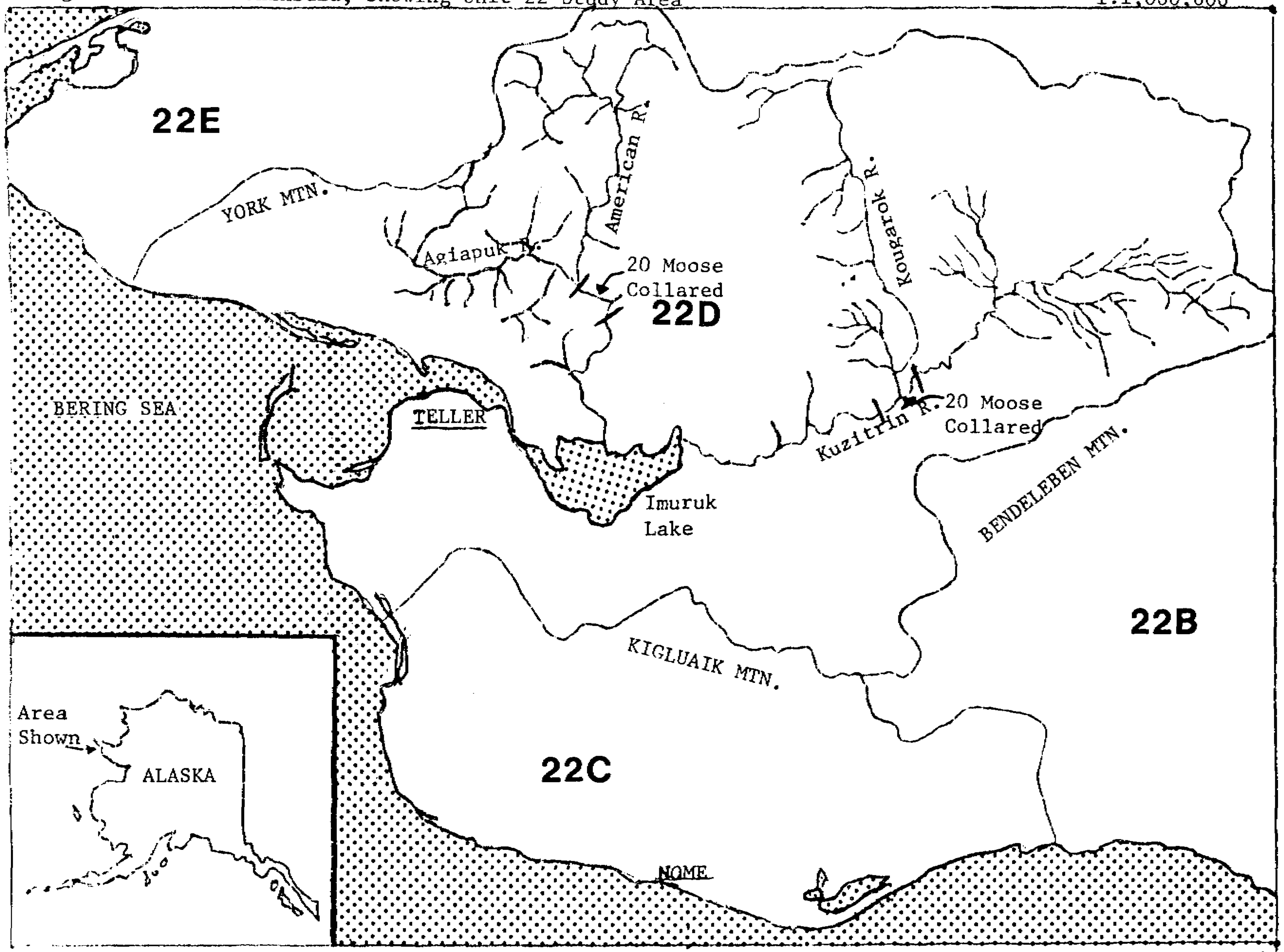
The vegetation of the region is predominately wet tundra at lower elevations, but it usually grades into dry tundra as the land slopes upward and has higher relief. Willows commonly grow along all rivers and into the headwaters of small tributaries. Along the lower portions of the major rivers, willows attain heights from 3 to 4½ m (10 to 15 ft), and the stands commonly extend as far as 400 m from either side of the main water course. Willows generally become less abundant upstream. Willows growing in the upper tributaries and alpine areas average 1 to 3 m in height, and growth is typically limited to a few meters on either side of streams. However, extensive stands of "shrub" willows occur on hillsides where sufficient moisture is present.

The absence of trees is a striking characteristic of the region. Spruce (Picea spp.) is found in a few scattered locations only in the extreme eastern portion of the Subunit. Aspen (Populus tremuloides) grows only in a few isolated stands along the major rivers. The lack of trees and the predominate tundra vegetation creates extensive open habitat.

METHODS

From 14-16 April, 40 adult moose were captured and fitted with visual and radio collars. Collars were placed on 10 bulls and 10 cows in the Kuzitrin drainage and 8 bulls and 12 cows in the

Fig. 1. Seward Peninsula, Showing Unit 22 Study Area 1:1,000,000



0 10 20 30 miles
SCALE

Agiapuk drainage. Biologists immobilized 34 moose using standard helicopter darting techniques (Gasaway 1977) with fixed-wing aircraft flying support cover. Six animals were captured from the ground.

The feasibility of capturing moose using ground transportation was tested by using snow machines in conjunction with fixed-wing aircraft. Three snow machines were used, each with 2 riders, 1 acting as operator and the other as gunner. The operator carried a hand-held radio capable of communicating with the aircraft above. An aircraft pilot accompanied by a radio operator located moose and relayed instructions to the ground crews to coordinate their movements in relation to targeted moose.

Initial drug dosages were delivered in 10 cc tubular darts containing a mixture of 8 cc of M-99 (etorphine hydrochloride 1 mg/cc) and 2 cc of Rompun (xylazine hydrochloride 100 mg/cc), fired by a Palmer Cap-Chur gun. If moose required additional dosages for complete immobilization, 3 cc of M-99 were delivered in a 3 cc dart. Of the 40 moose captured, 14 required a 2nd dosage and 1 required a 3rd dose of 3 cc of M-99. Additional dosages were usually required because the 1st dart failed to function properly or struck a part of the body where the drug was not readily absorbed into the circulatory system.

No mortalities occurred as a result of capture or marking by either the helicopter or snow machine crews. One adult bull captured by the snow machine crew lay down after moving 100 m following injection of the antagonist (M50-50). This animal had been chased for 27 minutes before it was completely immobilized and probably experienced considerable physiological stress. It subsequently recovered with no apparent ill effects.

Each immobilized moose was processed in a similar manner, and the data were recorded on 5 x 8 in field cards. Body measurements included total length, hind foot length, and heart girth. Overall body condition was assessed on a scale from 1 to 10 according to criteria developed by Franzmann et al. (1976). The I-1 incisor tooth was extracted for age determination using methods employed by Sergeant and Pimlott (1959). Up to 40 ml of blood was collected from the jugular vein in sterile evacuated containers to determine hemoglobin content, packed cell volume (PCV), and blood chemistry as outlined by Franzmann et al. (1976). A tuft of hair was plucked from the right or left shoulder for analysis of trace elements (Franzmann et al. 1975).

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Visual collars were manufactured by Denver Tent and Awning, Boulder, CO, and constructed to specifications similar to those described by Franzmann et al. (1974). Each collar contained 3 identical sets of black numbers 14 cm high on a yellow background. Numbers were situated so they could be viewed from either side of the moose or from above when the collar was in place. Radio collars were manufactured by Telonics Inc., Mesa, AZ, and operated on discrete frequencies from 151.021 to 151.802 MHz. When activated, the radio collars emitted approximately 1.2 pulses/second, and were equipped with a mortality sensor which caused the pulse rate to double if movement ceased for 11 hours. Both visual and radio collars were placed on each moose independently without attachment between collars. Most collars remained in place because they were usually snug when slipped over the moose's head, and the ears (or antlers) acted as a natural retaining mechanism.

Aerial surveys were flown in a Cessna 185 on 22 April to determine if all radios were still operational and whether any moose died from the collaring procedure. To ascertain the magnitude of seasonal movements, timing of parturition, and the numbers of calves produced, each moose was relocated 1 or 2 times using a Piper PA-12 (Supercub) during late May and early June.

RESULTS AND DISCUSSION

Capture Methods

Snow machines proved to be a successful means of capturing moose if the proper terrain was selected. The spacing between willows (willow density) and the width of the stands greatly influenced the efficiency of the ground crews. When stands were too dense to allow passage of a snow machine or exceeded 200 m in width, ground crews experienced difficulty in flushing moose into the open in a timely manner. Moose were often reluctant to leave the sanctuary of dense willow stands or were able to escape to other stands before snow machiners could close to effective shooting distance.

The crews were most effective when the willows along the rivers grew in alternating "clumps" and/or discontinuous ribbons less than 50 m wide. Narrow discontinuous willow stands increased sightability of moose, improved coordination of movements between ground crews, and provided access for snow machine crews to keep moose away from escape routes. When 1 or more moose was herded into the open, the snow machine with both occupants could easily overtake it. In 6 of 6 attempts on the Kougarok River (a tributary of the Kuzitrin River, (Fig. 1) the gunner shot an immobilizing dart within 1 to 5 minutes from the onset of the chase. However, when traveling over the bumpy tundra at speeds in excess of 45 km per hour, the gunner had difficulty holding on with 1 arm while sighting the rifle with the other. Accuracy would have been improved if the gunner had used a seat belt and/or a hand gun. Poor dart placement extended time to immobilization up to 27 minutes (3 moose needed 2 or more injections). Conversely, 3 moose struck in the large muscles of the hindquarters were all immobilized within 10 to 12 minutes. The snow machine crew captured and processed 6 moose in 7 hours excluding travel time to and from the work site. In similar terrain on the same day, an experienced helicopter crew processed 10 moose during a 5 hour period. If terrain and moose density are favorable, a snow machine may be a viable transportation option to immobilize moose, especially if operating funds are limited.

Equipment

Visual and radio collars were preadjusted to a circumference of 107 cm (42 in) for cows and 127 cm (50 in) for bulls. These sizes allowed moose freedom of movement and provided sufficient space for neck growth. However, problems were encountered when preadjusted collars were placed on bulls. Four bulls (ages 3 to 4) shed their radio collars within a week after being instrumented. The collars were apparently too loose for some of the bulls younger than 4 years of age. Gasaway (pers. commun.) found this problem could be alleviated by folding the excess collar slack into a loop and securing it with 2 turns of electrical tape. The tape will deteriorate and eventually break as the moose grows.

Body Condition, Size, and Pregnancy Rate

Table 1 lists the 10 classes used to assess body condition (Franzmann et al. 1976). Of 30 animals so judged, body conditions ranged from a low of 5 to a high of 8. The percentages in each class were as follows; Class 5, 20%; Class 6, 53%; Class 7, 24%; and Class 8, 3%. Although over half the moose were judged to be less than "average," in body condition, Franzmann (pers. commun.) indicated this condition was not unusual for moose in late winter. He participated in this capture work, and

Table 1. Ten criteria used to assess body condition of moose. (Franzmann et al. 1976).

Class 10.	A prime, fat moose with visibly thick, firm rump fat. Well fleshed over back and loin. Shoulders are round and full.
Class 9.	A choice, fat moose with evidence of rump fat by feel. Fleshed over back and loin. Shoulders are round and full.
Class 8.	A good, fat moose with slight evidence of rump fat by feel. Bony structures of back and loin not prominent. Shoulders well fleshed.
Class 7.	An "average" moose with no evidence of rump fat, but well fleshed. Bony structures of back and loin evident by feel. Shoulders with some angularity.
Class 6.	A moderately fleshed moose beginning to demonstrate <u>one</u> of the following conditions: (A) definition of neck from shoulders; (B) upper foreleg (humerus and musculature) distinct from chest; or (C) rib cage is prominent.
Class 5.	A condition in which <u>two</u> of the characteristics listed Class 6 are evident.
Class 4.	A condition in which all <u>three</u> of the characteristics listed in Class 6 are evident.
Class 3.	A condition in which the hide fits loosely about neck and shoulders. Head is carried at a lower profile. Walking and running postures appear normal.
Class 2.	Signs of malnutrition are obvious. The outline of the scapula is evident. Head and neck low and extended. The moose walks normally but trots and paces with difficulty, and cannot canter.
Class 1.	A point of no return. A generalized appearance of weakness. The moose walks with difficulty and can no longer trot, pace or canter.
Class 0.	A dead moose, from malnutrition and/or accompanying circumstances.

saw nothing to indicate moose were experiencing malnutrition or abnormal physiological stress. Considering the relatively high density of animals on the winter range, moose generally appeared to be in good condition.

Measurements of total length, hind foot length, and chest girth were compared with measurements of moose from other populations throughout the state (Table 2). The largest mean measurements of any moose population sampled came from the Copper River Delta. Seward Peninsula moose were slightly smaller in overall body length, larger in hind foot length, and similar in chest girth compared to moose in other samples. Data from some populations did not differentiate between sex and age classes, so direct comparison of body size between populations may lead to biased conclusions. Moose from the Seward Peninsula appear to be as large as any in the State. However, statistical testing is necessary before differences can be judged significant. Comparisons of antler growth by age class (Gasaway 1975) showed moose from the Seward Peninsula produced antlers larger than "average" compared to moose in other populations in the State.

The age of 37 collared moose was determined by examining sectioned incisor teeth. Table 3 shows the percentage of animals in each of 8 age classes and the sample size. Ages of moose taken by hunters from 1973 through 1980 are available for comparison (Grauvogel 1980) and are included in Table 3. The ages from the hunter sample revealed a relatively young population of moose. From 1973 through 1980, 38% of the hunter kill was composed of 2- or 3-year-old moose, and only 7% of the sample contained moose over 8 years of age. In contrast, the sample of radio-collared moose indicated an older population. Two and 3-year-old moose made up 27% of the sample, and 26% were over 8 years of age. However, a strict comparison should not be made because both samples have biases. The hunter-killed sample favors young animals due to hunter selectivity and non-random distribution of age classes during the hunting season. The radio-collared sample age class percentages result in an older age distribution because 1 year class moose were excluded. No attempt was made to collar short yearlings (moose 10 months old). Excluding calves and yearlings, I assume the age structure of collared moose resembles the age distribution of moose in Unit 22.

Table 4 shows the reproductive history of 22 collared cows through 9 June 1981. When the cows were first captured, 64% were accompanied by offspring; 9 had 1 calf (short yearling), 5 had twins, and 8 had no offspring with them. When cows were palpated, all 22 were judged to be pregnant. The earliest known birth occurred on 26 May, and at least 1 birth was confirmed after 9 June. By 27 May, 7 of 14 observed cows had neonate calves. During surveys on 9 June, 7 of 20 observed cows were without offspring because parturition had not occurred or they had already lost their calves. Surveys were not flown on

Table 2. Comparison of body measurements from six populations of Alaskan moose (sample size in parenthesis).

AREA IN ALASKA	TOTAL LENGTH		CHEST GIRTH		HIND FOOT LENGTH	
	Mean cm	SD	Mean cm	SD	Mean cm	SD
Moose Research Center (Feb, Mar, Apr)	282.6	9.1(254)	179.5	11.1(252)	79.3	1.9(246)
GMU 15C (Apr 1975)	288.9	14.2(210)	182.3	16.3(194)	79.9	3.8(203)
GMU 13 (Apr 1973)	295.6	10.9(115)	191.3	14.3(105)	80.0	2.9(79)
GMU 9 (Apr 1977)	302.1	6.8(54)	201.1	12.2(53)	80.0	1.8(12)
Copper River Delta (Mar 1974)	301.5	8.1(23)	201.3	13.8(25)	81.5	1.8(16)
Seward Peninsula (Apr 1981)	288.6	18.8(40)	199.6	16.6(40)	88.3	3.2(34)

Table 3. Percentages of moose in various age classes comprising annual harvests in Unit 22 from 1973-1980, compared to ages from radio-collared moose.

		AGE IN YEARS								
Year	Sex	1	2	3	4	5	6	7	8+	Sample Size
1973	Bulls	44	4	15	23	7	3	4	0	73
1974	Bulls	33	26	15	8	10	2	4	2	94
1975	Bulls	23	32	10	17	7	5	4	2	87
1976	Bulls	24	37	20	9	3	3	1	3	124
1977	Bulls	17	22	16	14	8	9	5	9	98
1978	Bulls	37	23	15	10	6	3	1	5	100
1979	Bulls	34	21	11	17	7	5	1	3	91
1980	Bulls	37	35	8	5	3	7	1	4	76
Total 1973 -	Bulls 1980	30	26	14	12	6	5	2	3	742
1980	Cows	36	31	11	3	3	3	7	6	36
Total 1973 -	Cows 1980	23	20	15	11	6	6	5	14	299
Total Sample Bulls & Cows 1973 - 1980		28	24	14	12	6	5	3	7	1041
Radio-Collared Moose		*	5	22	11	8	14	14	26	37

* Short yearlings not sampled

Table 4. Reproductive history of collared cows from mid-April through June 1981.

Collar #	Age	Number Offspring At Time of Collaring 14-16 April	First Date with 1 new Calf	First Date with 2 new Calves	Dates Observed with no Offspring
1	6	2 yearlings*			6/09/81
2	9	2 yearlings		6/09/81	
3	8	None		6/09/81	
4	7	1 yearling		5/27/81	
5	5	2 yearlings	5/26/81		
6	6	2 yearlings		5/26/81	
7	3	None	6/03/81		
8	3	None	6/03/81		
9	9	2 yearlings			6/09/81
10	4	1 yearling			6/4&9/81
11	16	None			6/03/81
12	7	1 yearling		6/03/81	
13	3	1 yearling		5/27/81	
14	14	1 yearling		6/09/81	
15	2	1 yearling			6/3&9/81
16	5	1 yearling			6/09/81
17	12	None			6/09/81
18	3	None			5/26/81
19	8	None			5/26/81
20	6	1 yearling		5/26/81	
29	9	None		5/27/81	
42	UNK	1 yearling		5/27/81	
TOTALS		8 None 9 1 yearling 5 2 yearlings	3	10	9

* Yearling = 10 months age

consecutive days during parturition, and it was not possible to document a daily reproductive history. However, through 9 June, 13 of 22 cows (59%) supported live offspring. Seventy-seven percent of the cows with calves (10 of 13) had twins.

Blood Parameter Characteristics

Chemical analysis of blood has been used to compare the physiological condition of moose populations (Franzmann et al. 1976). Laboratory analysis of blood samples has not been completed; results will be discussed in a subsequent progress report.

Movements

Movement data are available only for a 2 1/2 month period from mid April through June 1981. Individual animals were located no more than 2 or 3 times during this period. Table 5 provides information on movements of each collared moose, showing group composition at each observation, distance traveled between observations, and distance traveled from the point of capture.

Moose from the Kuzitrin and Agiapuk drainages exhibited similar movement patterns. During April, moose remained on winter ranges near their points of capture; 1 week after capture moose had moved an average distance of less than 1.6 km (1 mi). This condition was expected because snow depth changed little and temperatures averaged below freezing. Movements from winter ranges are normally triggered by warming temperatures and melting snow. In April, the broad river valleys probably provided the most favorable food and cover, and there was no incentive to move long distances. By late May, temperatures were above freezing during the day, and snow cover was patchy except on north-facing slopes where it was usually continuous. During this warming period, moose began moving from their winter ranges. Movement was predominantly north or east, (300° through 90° magnetic) and usually toward higher terrain. Only 11% of the collared moose moved south more than 16 km (10 mi) from their point of capture. Six weeks after collaring, the average distance moved was 29.9 km (18.6 mi), but there were some notable exceptions. Nine animals (38%) moved a straight-line distance of 46.5 km (29 mi) or more. Collared moose number 11 (a 16-year-old cow) covered 96.5 km (60 mi), crossing at least 3 major river drainages to the northern tip of the Seward Peninsula where she gave birth to a new calf.

Perhaps the most interesting finding to date has been the lack of fidelity to a particular drainage. Forty-five percent of the moose collared in the Agiapuk drainage and 35% of those collared in the Kuzitrin drainage moved to other river systems. Sixteen collared moose (44%) moved completely out of the Kuzitrin basin and crossed the "continental divide" to the north. Ballard et al. (1980) found that collared moose from 1 portion of their study area exhibited extensive migratory movements while those from other areas were more sedentary.

Table 5. Movements and group composition of radio-collared moose on the Seward Peninsula from April through June 1981.

Visual Collar No.	Radio Serial No.	Sex	Dates Seen	Group Composition (not including collared moose)	Distance Traveled From Last Sighting Km	Distance Traveled From Last Sighting Mi	Distance Traveled from Point of Capture Km	Distance Traveled from Point of Capture Mi
1	8143	F	4/22/81	2 yrl offspring	-	-	-	-
			5/27/81	2 yrl offspring	22.5	13.5	22.5	13.5
			6/09/81	Alone	7.4	4.6	29.1	18.1
2	8143	F	4/22/81	2 yrl offspring	-	-	-	-
			5/26/81	2 yrl offspring	37.0	23.0	37.0	23.0
			6/09/81	2 new calves	6.4	4.0	30.7	19.3
3	8113	F	4/22/81	Alone	-	-	-	-
			5/26/81	Alone	14.5	9.0	14.5	9.0
			6/09/81	2 new calves	3.7	2.3	17.7	11.0
4	8130	F	4/22/81	1 yrl offspring	-	-	-	-
			5/27/81	2 new calves	8.0	5.0	8.0	5.0
5	8137	F	4/22/81	2 yrl offspring	-	-	-	-
			5/26/81	1 new calf	27.3	17.0	27.3	17.0
6	8115	F	4/22/81	2 yrl offspring	-	-	-	-
			5/27/81	2 new calves	2.4	1.5	2.4	1.5
7	8138	F	4/22/81	Alone	-	-	-	-
			6/03/81	1 new calf	66.0	41.0	66.0	41.0
8	8104	F	4/22/81	Alone	-	-	-	-
			6/03/81	1 new calf	64.3	40.0	64.3	40.0
9	8123	F	4/22/81	Alone	-	-	-	-
			6/09/81	Not sighted	40.1	24.9	40.1	24.9
10	8128	F	4/22/81	1 yrl offspring	-	-	-	-
			6/04/81	1 bull	72.4	45.0	72.4	45.0
			6/09/81	Alone	3.2	2.0	74.8	46.5
11	8106	F	4/22/81	Alone	-	-	-	-
			6/03/81	Alone	96.5	60.0	96.5	60.0
12	8124	F	4/22/81	1 yrl offspring	-	-	-	-
			6/03/81	2 new calves	48.3	30.0	48.3	30.0

Table 5 cont'd.

Visual Collar No.	Radio Serial No.	Sex	Dates Seen	Group Composition (not including collared moose)	Distance Traveled From Last Sighting Km	Mi	Distance Traveled from Point of Capture Km	Mi
13	8119	F	4/22/81	1 yrl offspring	-	-	-	-
			5/27/81	2 new calves	6.4	4.0	6.4	4.0
14	2112	F	4/22/81	1 yrl offspring	-	-	-	-
			5/27/81	1 yrl offspring	16.1	10.0	16.1	10.0
			6/09/81	2 new calves	2.6	1.6	16.9	10.5
15	8132	F	4/22/81	1 yrl offspring	-	-	-	-
			6/03/81	Alone	47.6	29.6	47.6	29.6
			6/09/81	1 cow - 1 yrl	14.5	9.0	61.8	38.4
16	8110	F	4/22/81	1 yrl offspring	-	-	-	-
			5/26/81	Alone	8.9	5.5	8.9	5.5
			6/09/81	1 yrl	1.3	.8	10.5	6.5
17	8140	F	4/22/81	Alone	-	-	-	-
			5/27/81	Alone	4.2	2.6	4.2	2.6
			6/09/81	Alone	12.1	7.5	8.4	5.2
18	8136	F	4/22/81	Alone	-	-	-	-
			5/26/81	Alone	46.7	29.0	46.7	29.0
19	8111	F	4/22/81	Alone	-	-	-	-
			5/26/81	Alone	27.3	17.0	27.3	17.0
20	8118	F	4/22/81	1 yrl offspring	-	-	-	-
			5/26/81	2 new calves	16.1	10.0	16.1	10.0
21	8105	M	4/22/81	Alone	-	-	-	-
			5/27/81	Alone	57.9	36.0	57.9	36.0
22	8129	M	4/22/81	Alone	-	-	-	-
			5/27/81	1 bull Col #39	2.1	1.3	2.1	1.3
23	8117	M	4/22/81	Alone	-	-	-	-
			5/26/81	Cow & Calf	7.2	4.5	7.2	4.5
26	8142	M	4/22/81	Alone	-	-	-	-
			5/26/81	Yrl bull	8.7	5.4	8.7	5.4
27	8141	M	4/22/81	Alone	-	-	-	-
			5/26/81	3 Cows 1 yrl bull	13.5	8.4	13.5	8.4
29	8135	F	4/22/81	Alone	-	-	-	-
			5/27/81	2 new calves	57.6	35.8	57.6	34.8

Table 5 cont'd.

Visual Collar No.	Radio Serial No.	Sex	Dates Seen	Group Composition (not including collared moose)	Distance Traveled From Last Sighting Km	Mi	Distance Traveled from Point of Capture Km	Mi
30	8109	M	4/22/81	Alone	-	-	-	-
			6/03/81	Along	57.1	35.5	57.1	35.5
31	8131	M	4/22/81	Alone	-	-	-	-
			5/27/81	1 Bull	10.9	6.8	10.9	6.8
32	8122	M	4/22/81	Alone	-	-	-	-
			5/26/81	Alone	20.6	12.8	20.6	12.8
34	8134	M	4/22/81	Alone	-	-	-	-
			5/27/81	3 Bulls 1 Cow	20.8	12.9	20.8	12.9
35	8121	M	4/22/81	Alone	-	-	-	-
			5/26/81	Alone	26.2	16.3	26.2	16.3
36	8133	M	4/22/81	Alone	-	-	-	-
			5/27/81	Alone	1.6	1.0	1.6	1.0
37	8125	M	4/22/81	Alone	-	-	-	-
			5/26/81	1 Bull 2 Cows	12.8	8.0	12.8	8.0
39	8127	M	4/22/81	Alone	-	-	-	-
			5/27/81	1 Bull Col #22	12.7	7.9	12.7	7.9
40	8120	M	4/22/81	Alone	-	-	-	-
			6/08/81	Alone	3.9	2.4	3.9	2.4
42	8114	F	4/22/81	1 Yrl offspring	-	-	-	-
			5/27/81	2 New calves	38.6	24.0	38.6	24.0
					Mean		29.9	18.6

These preliminary movement data suggest that a portion of the moose wintering on the Kuzitrin and Agiapuk drainages migrated to summer ranges on the northern half of the Seward Peninsula where moose density is low. Pulliainen (1974) concluded moose often dispersed to new habitats where unutilized forage was available. Summer forage, however, does not appear to be significantly different between the 2 areas on the Seward Peninsula, and winter browse in the northern portion of the peninsula is certainly inferior in quantity if not quality. Home ranges of moose on the Seward Peninsula are probably large, although some dispersal may also be occurring. Movement data obtained during this study should provide more information on home ranges and dispersal.

RECOMMENDATIONS

1. If radio-collared moose die or radio collars fail, an equal number of animals should be captured and fitted with new radio collars during the 2 years the study is in progress.

2. Movements of radio-collared moose should be monitored at regular intervals to determine timing and magnitude of seasonal movements, adult mortality, fecundity, survival rates of calves, and home range sizes.

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