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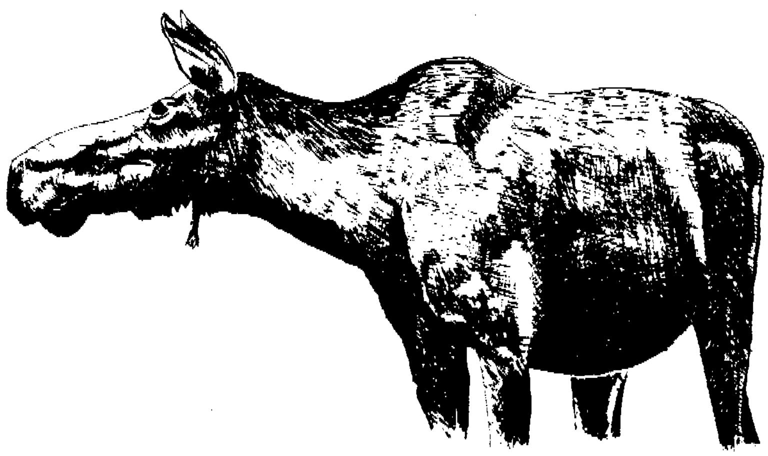
Alaska Department of Fish and Game
Division of Game
Federal Aid in Wildlife Restoration
Research Progress Report

LOWER SUSITNA VALLEY MOOSE POPULATION IDENTITY AND MOVEMENT STUDY



by
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Project W-22-5
Job 1.38R
February 1987

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PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: None

Project No.: W-22-5 Project Title: Big Game Investigations

Job No.: IB-1.38R Job Title: Lower Susitna Valley Moose Population Identity and Movement Study

Period Covered: 1 July 1985-30 June 1986

SUMMARY

This report includes aerial-survey, marking, and radio-relocating data collected from moose (*Alces alces gigas* Miller) observed and/or captured in an alpine study area in the western foothills of the Talkeetna Mountains in south-central Alaska, between October 1985 and May 1986.

Periodic aerial surveys conducted from October 1985 through April 1986 documented the increase, peak, and decrease phases in moose utilization of 102 mi^2 of alpine habitat. A maximum of 919 moose (9 per mi^2, 25% males, 63% females, and 11% calves) were observed in alpine habitats on 18 November 1985. Moose density and herd composition varied, from 4 to 19 moose per mi^2 and from 6 to 63 calves per 100 females, respectively, among areas. Distributional relationships remained relatively constant at all numerical levels.

From October through December, groups of up to 25 males segregated from other moose were commonly observed. Frequently, these male groups were observed in different habitats and at slightly higher elevations than other moose. Similar phenomena have been observed in studies in previous years. In mid-April, at which time antler growth (up to 12 in) was evident in many males, smaller male groups (8-10 moose), separate from other moose, were observed. Observations of male segregated groups in early spring occurred at similar elevations and in the same areas as those made in early winter.

Nineteen male moose (ages 1-12) and 25 females (ages 2-18) were captured, marked with ear tags and visual and radio-transmitting neck collars, and released, during 5 field excursions between late December 1985 and early February 1986. Three marked females subsequently died.

Data on distribution and movement patterns for 18 male and 23 female marked moose were obtained from 9 aerial radio-relocating surveys conducted between 6 January and 29 April 1986. Through mid-April, some marked moose exhibited short-distance, north-south directional movements across drainages while other moose exhibited longer east-west directional movements involving greater elevational changes. However, most marked moose remained closely (within 1 mi) associated with the alpine/forest ecotone habitat.

By 29 April 1986, almost all marked moose had moved westward to lower elevations and away from the alpine/forest ecotone habitat. At that same time, several female moose were relocated west of the Susitna River in lowland areas frequented by parturient females from other subpopulations. It was hypothesized that additional marked moose would behave similarly as parturition approached. During April, a marked male departed a lowland wintering area near the Susitna River and traveled eastward back toward his alpine capture site in the western foothills of the Talkeetna Mountains. A similar movement pattern was documented for another male moose in a previous study.

Alexander, Moose, and Kroto (Deshka River) Creeks, known to be important wintering areas for other lower Susitna River Valley moose subpopulations, were selected as future study areas. These lowland riparian moose winter habitats contrast ecologically with alpine winter habitats. Land-use proposals presently under consideration threaten to alter these habitats and to affect their value as moose winter range.

This report includes outlines of plans and scheduling for future surveys of herd distribution, abundance, and composition; radio-relocating surveys; and field excursions to identify browse plants utilized by moose in alpine/forest ecotone habitats.

CONTENTS

BACKGROUND

Prior to statehood, the Susitna River Valley was ranked as the most productive moose (*Alces alces gigas* Miller) habitat in the territory (Chatelain 1951). Today, the innate potential of this area as habitat for moose is probably unsurpassed statewide.

Presently, the lower Susitna Valley is the focal point of more development than any other region in the state. Proposed and in-progress projects involving grain and crop agriculture, dairy and grazing livestock, commercial forestry and logging, mining, land disposals, hydroelectric projects, capital site selections, wildlife ranges and refuges, human recreation, human settlement, urban expansion, further development of the highway system, and increased railroad traffic in the region may greatly detract from the potential of the area to support moose.

Though development and associated activities may tend to decrease overall moose abundance in the Susitna Valley, there is contrary pressure from resource user groups to increase moose populations to satisfy their demand for greater direct allocations to commercial, consumptive, and nonconsumptive uses.

Together, development activities and conflicting demands of resource users have created a tremendous need for timely and accurate general and site-specific knowledge about moose populations in the lower Susitna Valley (Game Management

Subunits 14A, 14B, 16A, 16B, and 13E). The demand for this information originates from an array of local, state, and federal land and resource management agencies, and it will likely intensify in the future in response to: 1) increased pressure to develop additional lands, 2) increased numbers of users and types of resource uses, and 3) a more complex system for allocating the resource to potential users.

Game Division presently lacks appropriate and/or sufficient information about moose populations in the lower Susitna Valley to accurately, consistently, and satisfactorily assess ultimate impacts of contemporary demands on the moose resource. The Division is therefore unable to knowledgeably dispute or condone specific demands, or provide recommendations that would effectively regulate and minimize negative impacts on moose populations or habitat.

Since major decisions on land use and resource allocation in the lower Susitna River Valley are presently being made and will continue to be made in the future, it is imperative that Game Division: 1) proceed to review, unify, and summarize the present state of knowledge about lower Susitna Valley moose populations, and 2) proceed with new studies to augment this data base, so that future actions having an impact on moose populations or their habitat may be promptly recognized, evaluated, and minimized and/or mitigated.

Because the lower Susitna Valley is extensive in size, its habitats and environmental conditions varied, and many resource conflicts site-specific, numerous interrelated substudies will be required to adequately understand movement patterns and identities of major moose subpopulations. Initial studies should be conducted in areas where immediate problems or conflicts in moose management exist.

When we evaluated conflicts in resource use for the entire lower Susitna Valley, it was readily apparent that research efforts should be initiated first in the western foothills of the Talkeetna Mountains (Subunits 14A and B), because this area: possesses the largest and densest post-rutting aggregations of moose in the region and state; is the nucleus of development activities and resource use; provides recreation and resources accessible to over half of Alaska's human population; and has unique problems involving railroad and highway systems. Also, recent information obtained from Susitna River Hydroelectric environmental studies and a Habitat Suitability Assessment project has pointed out a lack of basic knowledge about moose in the area.

Historical information available on moose populations in the Susitna Valley is limited to hunter kill-statistics (ADF&G

files); annual but inconsistently conducted sex/age composition surveys (ADF&G files); inconsistently collected data for train and vehicle-killed moose (ADF&G files); an outdated population movement study based on resightings of "visually-collared" moose (ADF&G files); studies on productivity and railroad mortality of the railbelt subpopulation (Rausch 1959 and 1958; respectively); a sporadically monitored radiotelemetry population identity study in the Dutch and Peters Hills (Didrickson and Taylor 1978); a past, uncompleted study of moose/snowfall relationships in the Susitna Valley; and a study, for which there is no final report, of extensive moose mortality in a severe winter (1970-71).

A series of more recent studies designed to assess the impact of a proposed hydroelectric project on moose has provided substantial amounts of current data on populations in areas adjacent to the Susitna River and downstream from Devil Canyon (Arneson 1981, Modafferi 1982, 1983 and 1984). However, these data have not been analyzed and summarized to provide general information about moose, or specific information about those moose subpopulations when they are in areas removed from the Susitna River floodplain. Circumstantial evidence and cursory examination of these data suggest that traditional sex/age composition counts conducted in widely spaced alpine areas of Subunits 14A and B give biased results and do not include samples from large segments of hunted moose subpopulations. These data also suggest that moose killed during late-winter 14B hunting seasons originate in Subunit 16A, and that moose killed during hunting seasons in Subunit 16A are included in Subunit 14A and B composition surveys. I believe that moose subpopulations in most of Subunit 16A, (populations that remain largely unsurveyed because they occur in forested habitats), could possibly be surveyed during winter when found in riparian habitats common to both Subunits 14B and 16A. The aforementioned data, and the fact that traditional composition surveys have remained relatively insensitive to large annual changes in moose mortality rates, indicate that contemporary assumptions about movements and identities of moose subpopulations in the western foothills of the Talkeetna Mountains (Subunits 14A and B) are incorrect, or at least, too simplistic.

A recent joint study conducted by the Divisions of Game and Habitat (Modafferi and Albert, unpubl. data) was designed to evaluate methods for assessing moose population status and habitat suitability. The study has begun to identify important moose wintering areas and to document moose/snowfall relationships in a large portion of the lower Susitna River Valley (Subunits 14A and B, 16A and 16B, and 13E).

OBJECTIVES

Primary

1) To identify and delineate major moose subpopulations in the lower Susitna River Valley; 2) To more precisely delineate annual movement patterns and locations, and timing and duration of use of seasonal habitats; and 3) To identify habitats and land areas that are important for maintaining the integrity of moose subpopulations in the lower Susitna River Valley.

Peripheral

1) To identify locations of winter range and calving areas used by lower Susitna River Valley moose subpopulations; 2) To determine natality rate and timing of calf and adult mortality; 3) To assess effects of seasonal timing of sex/age composition surveys on results obtained; and 4) To identify moose subpopulations which sustain "accidental" mortality on highway and railroad rights-of-way, and mortality from open hunting seasons.

STUDY AREA

The overall study area encompasses the lower Susitna River Valley in southcentral Alaska (Fig. 1). This area includes all watersheds of the Susitna River south of Talkeetna. Initial field studies were centered in alpine habitat of the western foothills of the Talkeetna Mountains between the Little Susitna River and the Talkeetna River (Subunits 14A and B). This alpine study area will be expanded to encompass the annual range of the sample of radio-marked moose.

In subsequent years, additional field studies directed at different moose subpopulations will be initiated in other geographical areas within the lower Susitna River Valley.

METHODS

For ease of reference and to identify hypothetical moose subpopulations, the following 7 areas were denoted within the alpine study area: Bald Mountain, Moss Mountain, Willow Mountain, Witna Mountain, Brownie Mountain, Wolverine Mountain, and Sunshine Mountain (Fig. 2). Place names are those associated with VDBM marks on 1:250,000 scale USGS topographic maps.

To determine herd composition and magnitude of use and to delineate timing, location, and spatial distribution of use of alpine habitats during winter, a series of periodic surveys was conducted on alpine areas where moose were to be captured and radio-marked. Results of these surveys were used to determine when to initiate moose-marking procedures and how to distribute sampling effort among areas.

Marking procedures commenced after 18 November 1985, when the greatest numbers of moose were observed during alpine surveys. The distribution of sampling effort among areas roughly corresponded with moose distribution observed on that survey (Table 1). The proportion of male moose that were marked was higher than observed on distribution and abundance surveys, because male moose usually dominate the open hunting season kill and more complete information about their behavior (vs. females) was desired.

To differentiate individually identifiable animals that could be relocated regularly, 44 moose were captured and marked with ear tags and visual and radio-transmitting neck collars. Each ear tag featured a discrete numeral and each neck collar featured a discrete, highly visible numeral and radio-transmittal frequency.

For marking, moose were captured during the winter in 7 alpine areas of the western foothills of the Talkeetna Mountains between the Little Susitna River and the South Fork of Montana Creek (Subnits 14A and B) (Fig. 3).

Typically, moose were immobilized with 4-6 mg carfentanil (Wildlife Laboratories, Ft. Collins, Co.), dissolved in 2-3 cc H_2O, respectively, and administered with Palmer Cap-Chur equipment by personnel aboard a hovering Bell 206B or Hughes 500D helicopter. Immobilized moose were revived with an intramuscular injection of 90 mg naloxone hydrochloride (Wildlife Laboratories, Ft. Collins, Co.) per mg of carfentanil administered.

While immobilized, moose were marked with ear tags and neck collars and aged by visual inspection of wear on incisor teeth. Antler conformation was considered when assessing ages of males. Though specific birth years were assigned to captured moose, age categories of calf, yearling, 2-3, 4-6, 7-12, and 12+ years are more realistic due to imprecision in aging moose by incisor wear. Sex of marked moose and association with young-of-the-year were noted.

Survey flights in Cessna 185 aircraft equipped with two-element Yagi antennae (Telonics, Mesa, Ariz.) fixed on each wing were conducted periodically to relocate marked moose.

Dates for relocation surveys on which this report is based are as follows: 6 and 13 January; 10 and 28 February; 2, 14, and 17 March; and 9 and 29 April 1986.

Moose relocations (audio-visual or audio) were noted on 1:63,360 scale USGS topographic maps during aerial surveys. Relocation points were later transferred to Mylar overlays of those maps in preparation for computer digitization.

RESULTS AND DISCUSSION

This report presents field data collected from October 1985 through April 1986.

Eight distribution, abundance, and herd composition surveys documented an increase, peak, and decrease in numbers of moose in 7 alpine areas in the western foothills of the Talkeetna Mountains (Table 2). Numbers of moose observed increased from 42 on 4 October 1985, peaked at 919 on 18 November 1985, and decreased to 202 by 17 April 1986. Relationships of moose numbers among areas remained relatively constant through the increase, peak, and decrease phases. Maximum densities of moose observed ranged from 4 per mi^2 (Sunshine Mountain) to 19 per mi^2 (Bald Mountain) and averaged 9 moose per mi^2 for 102 mi^2 among all subareas (Table 2).

Composition data for all areas on 18 November 1985 revealed 25% males, 63% females, and 11% calves (Table 3). Composition percentages for males, females and calves, respectively, varied from 14-33%, 42-70%, and 4-26% among areas. Variation among areas was greatest for males and calves. Large variability may, in part, be attributed to the relatively small sample sizes obtained within some areas. However, the percentage of calves (16% vs. 5%) observed on Bald Mountain was over 3 times that observed on Willow Mountain where relatively large numbers of moose, 302 and 268, respectively, were classified. The ratio of males per 100 females varied from 20 to 75 and averaged 40. The number of calves per 100 females varied from 6 to 63 and averaged 18. The proportion of calves per 100 females on Bald Mountain (25) was over 3 times that observed on Willow Mountain (8). (Witna Mountain is not included in this comparison because of the small number of moose sampled there.)

In mid-November, groups of male moose (up to 25) were commonly observed near the headwaters of the South Fork of Montana Creek and the North Fork of the Kashwitna River and on the northeasterly side-slope of Willow Mountain. In the former 2 locations, male groups utilized riparian shrub communities while other moose generally occurred at slightly lower elevations in grossly different habitat types. As winter progressed, these male groups apparently moved to lower elevations and joined other moose near the alpine/forest ecotone. It was not known whether male groups remained intact while utilizing ecotonal habitats commonly used by other moose earlier in winter. In mid-April, groups of 8-10 males were again observed at slightly higher elevations, somewhat segregated from other moose. New antler growth (up to about 10 in) was apparent on most males in mid-April.

In previous years, while conducting other activities in November and December, I have observed discrete segregated groups of up to 30 males in these same locations as well as on Bald Mountain and Willow Mountain. The significance of these male groupings, their utilization of different habitats, and their spatial separation from other moose, presently remain unknown. Nineteen male and 25 female moose were captured, marked, and released during field excursions conducted on 23 and 26 December 1985, 2 and 7 January, and 4 February 1986 in alpine areas of the western foothills of the Talkeetna Mountains (Appendix A).

Three of the marked females subsequently died. Two of those moose, estimated to be 8 and 18 years old, respectively, died within several days of release. The latter individual was also noticeably thin. The 3rd moose, a 2-year-old, was found dead about 6 mi from the site where it was released 45 days before. This moose was judged to be of small body size for its age and had femur marrow that was reddish in color. This individual was apparently undersized and in poor condition when it died.

In this report, movements of marked moose will not be treated extensively because the amount of data is limited.

Marked moose moved between, and out of, the alpine areas where they were captured. Many marked individuals remained near timberline through mid-April and were commonly relocated in either alpine habitat, forested habitat, or the alpine/forest ecotone habitat. Generally, it appeared that many marked moose remained in or near the alpine/forest ecotone habitat during that time period. Apparently, each habitat has components that are desirable at particular times (for feeding, bedding, etc.) and under particular environmental conditions (windy, sunny, deep snow, etc.) but no single habitat provided all preferred components.

Shortly after marking procedures, some individuals were found to move in a north-south direction across river drainages and between areas. These movements generally totaled less than 5 mi. However, 1 male traveled from Wolverine Mountain north about 20 mi to the Talkeetna and Sheep River valleys. Less extensive forays to Willow Mountain, followed by return movements to Brownie Mountain, were recorded coincidentally for several moose.

The most commonly observed movement pattern was predominantly elevational and east-west in direction. Shortly after marking, 5 moose moved west out of the mountains to lower elevations. Several of these individuals traveled about 10 mi and remained near the Parks Highway. During the same time period, 2 females were found to move eastward up the Kashwitna River Valley. One of these individuals eventually traveled about 20 mi up that drainage.

On the 29 April relocation flight, all but 4 marked moose had moved eastward to lower elevations and noticeably away from the alpine/forest ecotone. By that date, 2 individuals had traveled 20 mi and crossed the Susitna River and 2 other marked moose were relocated near the Susitna River floodplain. I feel confident that females which made this movement to lowland areas west of the Susitna River were seeking a particular type of habitat for calving. Studies of other moose subpopulations in the lower Susitna River Valley have documented extensive use of habitats in this area by parturient females (Modafferi 1983).

Weather conditions during the 1985-86 winter were generally assessed as being less severe than average. Even though the snowpack in the lower Susitna River Valley was considerably below average, snow depths in some alpine areas of the western foothills of the Talkeetna Mountains, particularly from Willow Mountain north to Sunshine Mountain, were in excess of 3 ft. However, in spite of low winter snowfall, unseasonably cold early-spring temperatures delayed the disappearance of snow-cover and slowed plant phenology. Both of these factors probably influenced early-spring behavior of moose in the area.

FUTURE RESEARCH PLANS

Radio-relocating of marked moose will continue through the next reporting period.

Herd distribution, abundance, and composition surveys will be conducted periodically, as snow cover permits, through the winter of 1986-87.

Several field excursions will be conducted in the alpine/forest ecotone, to identify plant species browsed by wintering moose.

Alexander, Moose, and Kroto (Deshka River) Creeks were selected as additional areas in a proposed extension of moose research in the lower Susitna River Valley. These riparian habitats are commonly known to be important moose wintering areas. Extensive use of these habitats, by moose, was documented during the winter of 1985-86 (Modafferi, unpubl. data). Areas considered in this Susitna River Flats study represent a wintering habitat (lowland riparian) which is grossly different from alpine areas in the western foothills of the Talkeetna Mountains. Lowland riparian habitats and adjacent lands in the Susitna River Flats are continually being considered for changes in land-use patterns; these changes would potentially affect the area's value to moose.

ACKNOWLEDGMENTS

I am especially grateful to Dennis C. McAllister, Alaska Department of Fish and Game, who made useful suggestions and pertinent criticisms, and who willingly provided his assistance throughout this study. Dennis always managed to be available when needed, sometimes at the expense of his own time, and was invaluable in field aspects of this study.

K. Schneider, regional research coordinator, is acknowledged for support and advice through biological and administrative aspects of this study.

The following persons also deserve special thanks: C. Lofstead (Kenai Air Alaska, Kenai) and K. Barnes and C. Soloy (Soloy Heli-Ops, Wasilla) for expertly piloting helicopters during moose capture procedures; B. Wiederkehr (Wiederkehr, Inc., Palmer), J. Hudson (Hudson Air Service, Talkeetna), and J. Okenek (K2 Aviation, Talkeetna), for piloting Super Cub aircraft during herd distribution, abundance, and composition surveys; and W. and "Bud" Woods (Woods Air Service, Palmer), for piloting the Cessna 185 on moose radio-relocation surveys.

These individuals are commended for piloting aircraft safely and efficiently during low-level flight operations.

B. Taylor, M. Chihuly, J. Didrickson, and P. Hessing are recognized for assistance in field aspects of this study.

J. Didrickson and N. Steen, area game management biologists responsible for Subunits 14A and B, are acknowledged for freely providing local knowledge, logistic assistance, a congenial working atmosphere, and "area support" from conception through the present stage of this study.

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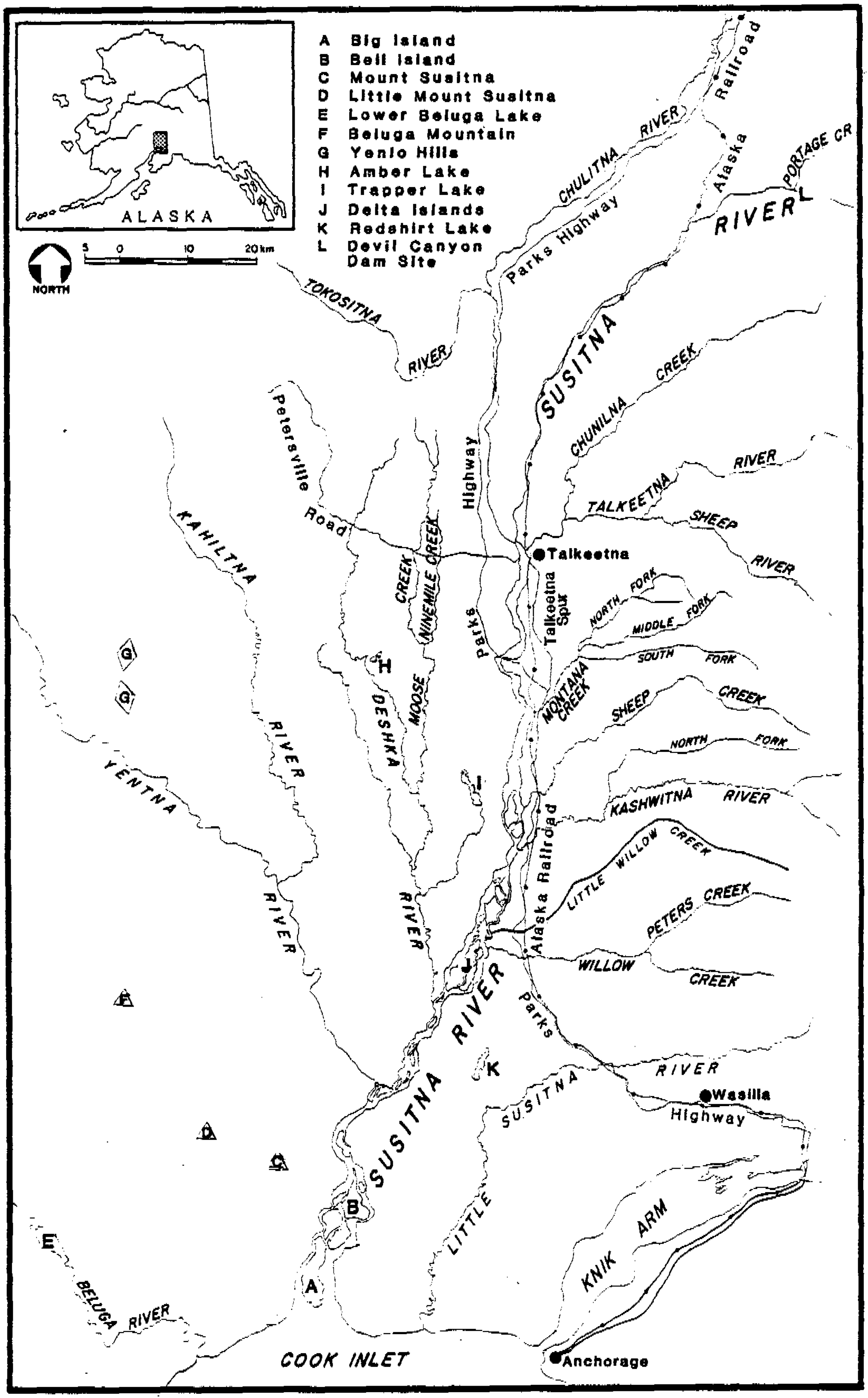

Figure 1. Map showing location of the study area in Alaska with names listed for rivers, lakes and other prominent landscape features.

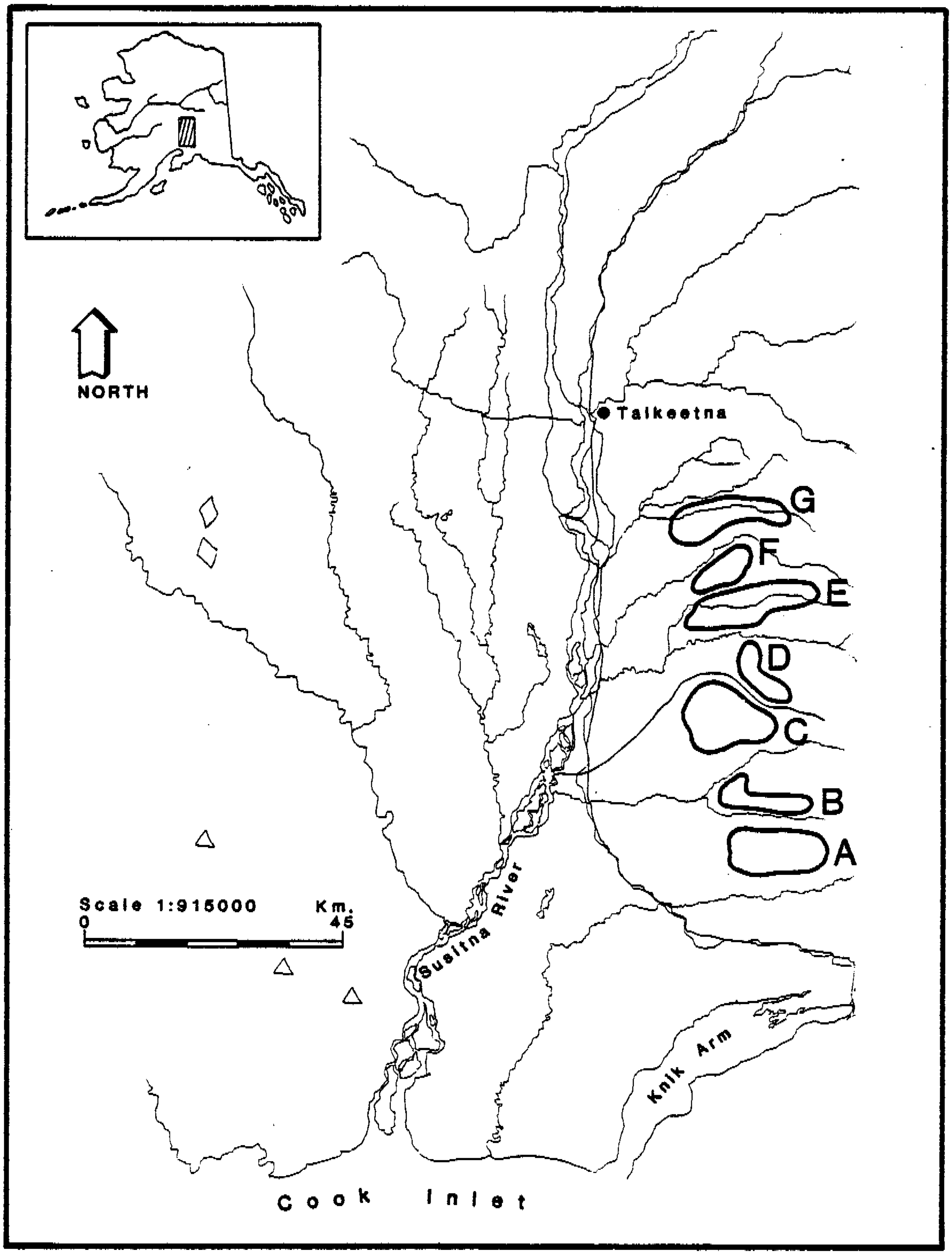

Figure 2. Locations and place names for alpine subareas (A-G) where moose surveys were conducted in the Talkeetna Mountains foothill substudy area in southcentral Alaska, 1985-86. (A=Bald Mtn, B=Moss Mtn, C=Willow Mtn, D=Witna Mtn, E=Brownie Mtn, F=Wolverine Mtn and G=Sunshine Mtn)

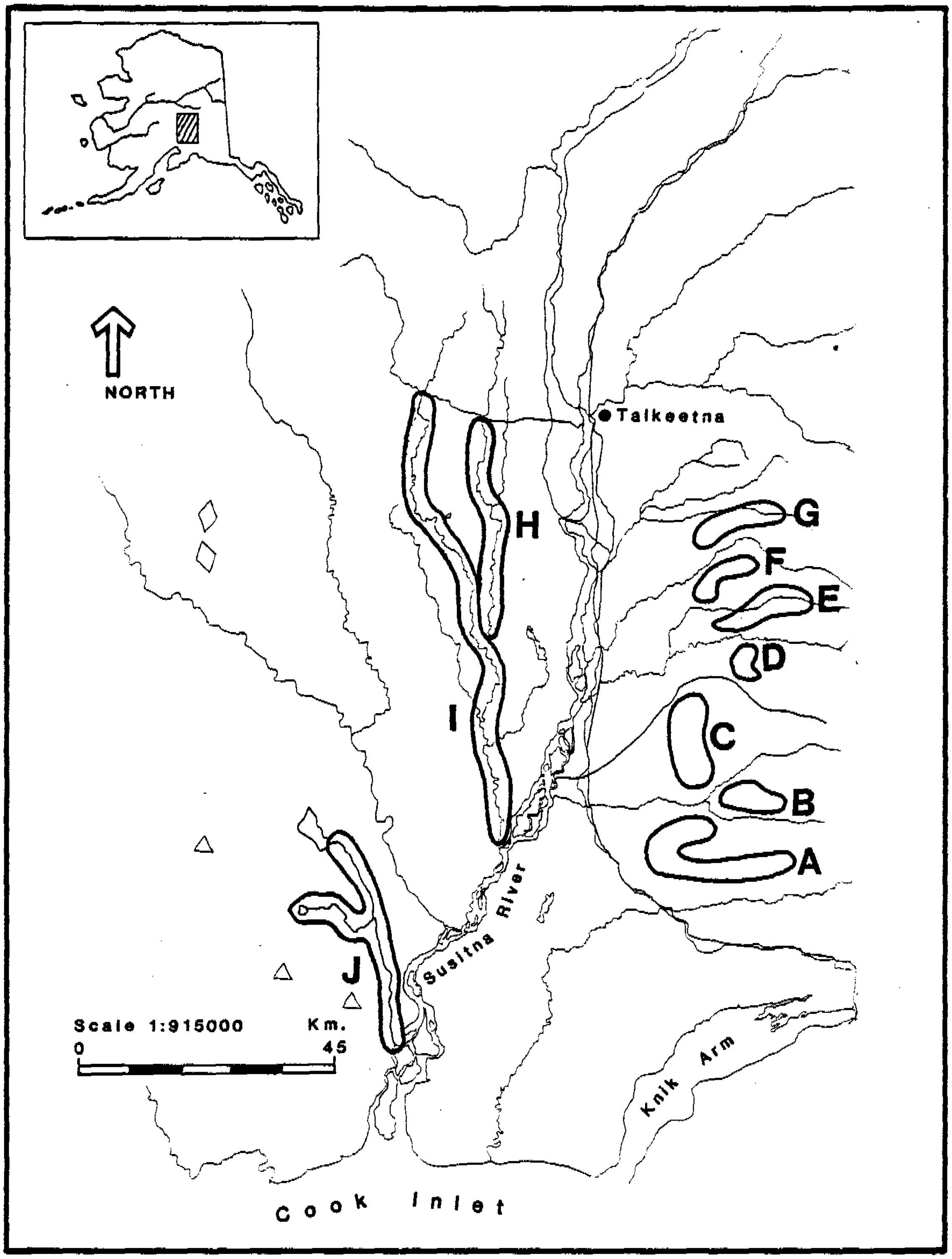

Figure 3. Locations of alpine subareas (A-G) in Talkeetna Mountains foothills where moose were marked in winter 1985-86 and lowland riparian subareas (H-J) in the Susitna River Flats substudy where moose will be marked in winter 1986-87. (H=Moose Creek, I=Kroto Creek and J=Alexander Creek)

Table 1. Sex composition of radio-marked moose and comparisons between distribution of marked moose and moose observed on the 18 November alpine survey in the Talkeetna Mountains foothills, southcentral Alaska, 1985.

	Marked sample[a]			Percent of Moose	
Subarea	Males	Females	Total	In marked sample	Observed on alpine survey
Bald Mtn	5	4(2)	9	22	33
Moss Mtn	1	1	2	5	5
Willow Mtn	6	8	14	34	29
Witna Mtn	0	1	1	2	2
Brownie Mtn	3	4	7	17	14
Wolverine Mtn	2	3(1)	5	12	14
Sunshine Mtn	2	1	3	7	3
Total	19	22(3)	41	99	100

[a] Numbers in parentheses indicate numbers of moose that were captured and marked but subsequently died. These moose are not included in sample size.

Table 2. Number and density (moose per mi^2 for highest survey count) of moose observed on periodic surveys in different-sized alpine areas of the Talkeetna Mountains foothills in southcentral Alaska, 1985-86.

Area		1985					1986			
Name	Size (mi^2)	4 Oct	17 Oct	8 Nov	18 Nov	3 Dec	23 Feb	31 Mar	17 Apr	Density
Bald Mtn	16	37	109	264	302[a]	260	275	191	40	19
Moss Mtn	9	0	19	37	50	54[a]	33	26	15	6
Willow Mtn	39	5	148	265	268	313[a]	164	121	59	8
Witna Mtn	6	0	9	24	19	20	42[a]	13	11	7
Brownie Mtn	10	0	25	110	125[a]	112	104	96	49	13
Wolverine Mtn	9	0	41	54	129[a]	93	32	22	14	14
Sunshine Mtn	13	0	2	21	26	39	50[a]	21	14	4
Total	102	42	353	775	919[a]	890	703	487	202	9

[a] Number utilized for density calculation.

Table 3. Herd composition (M = males, F = females, and C = calves) for moose observed in alpine areas of the Talkeetna Mountains foothills in southcentral Alaska, 18 November 1985.

Areas	No. of moose	Males		Females		Calves		Males: 100 Females	Calves: 100 Females
		No.	%	No.	%	No.	%		
Bald Mtn	302	66	22	189	63	47	16	35	25
Moss Mtn	50	7	14	35	70	8	16	20	23
Willow Mtn	268	81	30	173	65	14	5	47	8
Witna Mtn	19	6	32	8	42	5	26	75	63
Wolverine Mtn	125	41	33	71	57	13	10	58	18
Sunshine Mtn	129	23	18	90	70	16	12	26	18
Brownie Mtn	26	8	31	17	65	1	4	47	6
Total	919	232	25	583	63	104	11	40	18

APPENDIX A

Field data recorded for moose captured and marked in alpine subareas of the western foothills of the Talkeetna Mountains in southcentral Alaska, 1985-86.

Capture date	Capture location	Sex	Age[a]	No. ear tag Left	No. ear tag Right	Number Visual collar	Number Trans-mitter	Alive yes/no
12/23/85	Bald Mtn.	M	3	2354	1546	31	18135	Y
12/23/85	Bald Mtn.	F	8	2360	1506	262	18136	N
12/23/85	Bald Mtn.	F	8	2389	2388	33	18130	Y
12/23/85	Bald Mtn.	F	5	2400	2395	27	10591	Y
12/23/85	Bald Mtn.	F	5	1510	2485	29	10598	Y
12/23/85	Bald Mtn.	F	2	2392	2399	371	6359	N
12/23/85	Bald Mtn.	M	1	2397	2396	35	18131	Y
12/23/85	Willow Mtn.	F	10	1551	1524	34	18137	Y
12/23/85	Willow Mtn.	F	6	1575	1570	36	18138	Y
12/23/85	Willow Mtn.	F	4	2482	2440	3	6397	Y
12/23/85	Willow Mtn.	F	4	2433	2368	9	6396	Y
12/23/85	Willow Mtn.	M	8	1568	1569	8	6383	Y
12/23/85	Willow Mtn.	M	4	2394	2391	32	18134	Y
12/23/85	Willow Mtn.	M	5	2398	2393	5	6374	Y
12/26/85	Bald Mtn.	F	3	2357	1512	2	12807	Y
12/26/85	Bald Mtn.	M	12	1573	1574	1	10498	Y
12/26/85	Bald Mtn.	M	9	1501	1554	4	6372	Y
12/26/85	Bald Mtn.	M	4	1504	2390	7	6356	Y
12/26/85	Moss Mtn.	F	15	1538	1513	38	10498	Y
12/26/85	Moss Mtn.	M	4	1517	1532	25	6438	Y
12/26/85	Willow Mtn.	M	6	1571	2497	28	6425	Y
01/02/86	Brownie Mtn.	F	7	2387	2382	49	6460	Y
01/02/86	Brownie Mtn.	F	4	2380	2386	50	6495	Y
01/02/86	Brownie Mtn.	F	3	2378	2385	54	6499	Y
01/02/86	Brownie Mtn.	M	4	2381	2383	52	6454	Y
01/02/86	Brownie Mtn.	M	3	2379	2384	53	6504	Y
01/02/86	Witna Mtn.	F	5	1508	1503	55	6422	Y
01/02/86	Wolverine Mtn.	F	9	2376	2377	51	6496	Y
01/07/86	Brownie Mtn.	F	3	1562	2414	43	10496	Y
01/07/86	Brownie Mtn.	M	8	1528	2409	30	6411	Y
01/07/86	Sunshine Mtn.	F	3	1511	1555	11	6410	Y
01/07/86	Sunshine Mtn.	M	5	1560	1561	47	6500	Y
01/07/86	Sunshine Mtn.	M	3	2411	2479	10	6494	Y
01/07/86	Wolverine Mtn.	F	18	1586	2436	481	6501	N
01/07/86	Wolverine Mtn.	F	12	2423	2370	46	18133	Y
01/07/86	Wolverine Mtn.	M	5	1505	1509	44	10594	Y
02/04/86	Willow Mtn.	F	8	2071	2106	72	6458	Y
02/04/86	Willow Mtn.	F	4	2161	2116	60	6457	Y

APPENDIX A. Continued.

Capture date	Capture location	Sex	Age[a]	No. ear tag Left	No. ear tag Right	Number Visual collar	Number Trans-mitter	Alive yes/no
02/04/86	Willow Mtn.	F	3	2156	1652	61	6517	Y
02/04/86	Willow Mtn.	M	11	2200	2059	17	6380	Y
02/04/86	Willow Mtn.	M	7	2162	2190	16	6365	Y
02/04/86	Willow Mtn.	F	3	2101	2142	261	18136	Y
02/04/86	Wolverine Mtn.	F	13	2073	2150	58	23933	Y
02/04/86	Wolverine Mtn.	M	7	1698	2158	48	6501	Y

[a] Age determined from incisor wear. Assigned age probably encompassed within intervals of: 1, 2-3, 4-6, 7-12, and 12+ years.