1977-

MIGRATORY BEHAVIOR OF MOOSE IN SOUTHCENTRAL ALASKA

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INTRODUCTION

Certain populations of moose (*Alces alces*) in subarctic areas of Europe, Asia and North America have long been known to migrate seasonally between well defined summer and winter ranges (Pulliainen 1974, Kistchinski 1974, LeResche 1974). Although numerous papers document the occurrence of moose migrations, precise data have seldom been gathered on the extent, duration, timing and year-to-year variability of such movements. Good data on these parameters are needed both for effective management of moose populations subject to hunting and to predict the impact of northern development on moose populations.

This study was designed to describe the ecology of moose migratory behavior in the Nelchina Basin of southcentral Alaska as part of a larger research effort to determine the impact of the Trans-Alaska Pipeline on moose populations. Alyeska Pipeline Service Company funded this study in cooperation with the Alaska Department of Fish and Game.

STUDY AREA

The study area of 10,000 km^2 was located in the eastern quarter of the Nelchina Basin in southcentral Alaska (62° north latitude, 146° west longitude), an area well described by Rausch (1969) and Bishop and Rausch (1974). Southern portions of the study area consist largely of a plateau (elevation approximately 500 to 600 m) dissected by tributaries of the Copper River. Foothills of the Alaska Range occur in northern portions of the area and moose seasonally use habitats there at elevations up to 1400 m.

Black spruce (*Picea mariana*) forests dominate many areas below 850 m elevation. Tree densities thin significantly between 850 and 1000 m and dense shrub understories of dwarf birch (*Betula nana*) and various willow species (*Salix* spp.) occur in most subalpine areas. Sedge (*Carex* spp.) meadows are common throughout the study area and some of the numerous small lakes contain stands of aquatic plants that moose utilize during the ice-free seasons. The major drainages and their headwaters contain riparian willow communities, upland willow communities, and balsam poplar (*Populus balsamifera*) stands that moose use extensively during certain seasons. Burns resulting from man caused fires or lightening strikes are present in the study area but few fires have burned significant acreages during the past 20 years.

Bishop and Rausch (1974) provided a generalized history of moose population trends in the Nelchina Basin during the period 1950 to 1972. During the 1950's moose numbers were thought to be increasing. Moose densities remained high, perhaps approaching 0.4 moose per km^2, through the late 1960's despite severe winters that caused extensive mortality in 1961-62 and 1965-66. Recruitment declined significantly during the 1960's and a record snowfall during the winter of 1971-72 caused high mortality among all age classes and lowered production and survival indices significantly the following autumn. Calf:cow ratios have remained low through 1976 and the combined effects of poor recruitment, hunting, predation, winter mortality, and deterioriating range conditions have reduced moose numbers by perhaps 50 percent since the late 1960's (Alaska Department of Fish and Game, unpublished data).

METHODS

In order to identify moose population segments and to provide marked study animals that could be regularly relocated, moose were tagged with canvas collars or were fitted with radiotransmitter collars. Canvas collars were color coded and bore 15 cm high numerals that were readable during low passes with fixed wing aircraft. Radio collars were distinguishable by discrete frequencies; each tagged moose was individually identifiable.

Tagging was conducted when moose were concentrated in post-rutting groups or were confined on their winter range. Moose were immobilized with succinylcholine chloride (Anectine, Burroughs Wellcome Co.) injected with Cap-Chur equipment (Palmer Chemical and Equipment Company) employed from a Bell 206B helicopter.

Monitoring flights with Piper PA18-150 or STOL Cessna 180 fixed wing aircraft equipped with directional yagi antennas (Mech 1974) were made two to three times per week during all seasons to locate radiocollared moose and search for collared individuals. Collared moose were frequently seen incidental to radiotracking or were found in the company of radiocollared moose. During the period December 1974 through February 1977, 28 radiocollared moose provided a combined total of 34 moose years of radiotracking data consisting of more than 2000 radio relocations.

RESULTS

Autumn Migration

During autumn 1975 and autumn 1976, certain moose were observed to leave their summer range as early as November 1 while others failed to migrate until early February (Table 1). Cows with calves tended to migrate before cows without calves or bulls, but much individual variation was noted within all segments of a given population. Much variation in time spent migrating was also observed among individuals; certain moose moved directly to their winter range during a period of approximately ten days while others moved slowly along their migratory routes and took up to six weeks to move the entire distance. Moose began arriving on winter range as early as mid-November (Table 1) but most did not arrive until mid-December or later. During migration, certain individuals lingered in areas exploited as winter range by other moose but did not reach their final destination until late February.

Year-to-year differences in the extent and timing of autumn migration were evident during the three years of this study. During winter 1974-75, some radiocollared moose had left their summer range by late November and most had arrived on their winter range by mid-January. By February 1975, snow depths in the Nelchina Basin were about 60 percent above the 10-year mean with depths exceeding 70 cm common in the northern one-third of the study area. During winter 1975-76, seven radiocollared moose failed to spend significant time in areas they had occupied during the previous winter. Most migrated short distances and some moved back to their summer range by mid-winter or moved to traditional wintering areas in early spring. Snow depths were 40 percent below the 10-year mean throughout the study area by February 1976 and depths exceeding 40 cm were rare. Snowfall characteristics of winter 1976-77 were similar to those of winter 1974-75 and moose migrated in a similar fashion during both winters. Thus, depth of snow appeared to importantly determine the timing and extent of autumn migratory movements.

Spring Migration

Data on spring migration for 1975 and 1976 (Table 1) indicate that moose departed from their wintering areas between mid-April and mid-June. Some individuals began migrating with the first hint of extensive snow melt and by late May most study animals had initiated extensive movements. No discernable differences in the initiation of spring migration were evident for the various sex and age classes of a given population.

During spring migration, moose moved rapidly once they had begun to migrate; by late June all radiocollared moose had reached summer range. Significant year-to-year variation in date of arrival on summer range was not noted.

Date of parturition seemed to influence date of arrival on summer range for many female moose. During spring 1976, six radiocollared females displayed extensive migratory movements prior to parturition in late May and early June. All were seen with calves subsequently. Two additional females that were never seen with calves migrated during the period June 1-15 and either did not give birth or lost their calves shortly after parturition.

Spatial Relationships of Seasonal Ranges

Migratory movements exceeding 45 km straight-line distance were commonly undertaken by the radiocollared moose of this study, but certain individuals moved less than 10 km between seasonally occupied ranges (Table 1). Certain moose wearing numbered canvas collars were observed to migrate farther than any radiocollared animals; the longest migratory movement recorded was 110 km.

Radiocollared moose displayed reduced migratory movements during winter 1975-76 (Table 1) apparently because shallow snow depths permitted exploitation of many habitats that could not be used during winters of greater snow accumulation. Seven radiocollared individuals occupied wintering areas removed by distances ranging from 16 to 46 km from areas they had used during the previous winter. Six of these seven moose again migrated extensively during winter 1976-77 when snow accumulated to normal or above normal depths by mid-winter.

Moose in the study area generally migrated south or southeast during autumn in order to seek suitable winter range at elevations of 500 to 700 m. Moose from different populations frequently shared wintering areas with nonmigratory, resident animals. Because snow conditions varied during different years, certain winter ranges supported widely varying densities of moose. During years of below normal snow accumulation, summer ranges that moose normally occupied only during the period June through November supported significant numbers of moose yearlong.

Traditional Use of Areas

During October 1975, 22 moose from one discrete population in the northern part of the study area were tagged with numbered canvas collars. Moose in this area were readily observable because they used shrub dominated plant communities extensively. By April 1976, no collared moose were known to inhabit the area and in October and November 1976 an intensive effort was made to determine how many of the collared moose had returned. Nineteen of the 22 animals originally tagged were detected in the area during autumn 1976 indicating a high degree of range fidelity among members of this population.

Radiocollared moose were observed to return to summer and winter home ranges used during previous years even when environmental conditions broke the pattern of migration during one seasonal cycle. Limited data also suggested that migratory routes, as well as destinations, were traditionally used by individuals.

DISCUSSION

The data collected during this study indicated that moose in the Nelchina Basin migrated to winter range during a prolonged period of 10 to 12 weeks beginning in early November. Moose from different populations that shared a common wintering area left their summer ranges at different times due to variations in local environmental conditions. Spring migration began as early as mid-April and extended over a five to eight week period. During spring, environmental conditions tended to be more uniform over large areas than during autumn and year-to-year differences in the arrival of moose on summer range seemed minimal. Also, parturition and the subsequent presence of young calves of limited mobility reduced the capacity of adult females to vary the timing of their spring migrations.

Year-to-year variation in the timing and extent of autumn migration seemed well correlated with snow depth. During a winter of well below normal snow accumulation moose were observed to migrate shorter distances than they did during previous or subsequent winters when snow depths were normal or above normal. Some moose spent most of one winter on their summer range when snow depths were generally less than 40 cm.

Moose demonstrated considerable flexibility in their capacity to use a wide variety of habitats under varying environmental conditions. By adjusting the timing, extent and duration of their migratory movements to the relative habitability of a given area, moose could optimally exploit a patchy environment of low overall carrying capacity. Moose demonstrated their ability to vary their rate of movement during autumn migration thus increasing their efficiency of exploitation of habitats along migratory routes that sometimes exceeded 100 km in length. Such habitats were used as long as they were useable; forage supplies in wintering areas were thereby conserved or not utilized at all during the mildest winters.

LITERATURE CITED

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Table 1. Migratory data gathered on radiocollared moose in the Nelchina Basin, Southcentral Alaska, November 1974 through February 1977.

Season-Year	Number of Radiocollared Moose	Date of Departure from Summer Range or Winter Range		Date of Arrival on Summer Range or Winter Range		Extent of Individual Migratory Movement (Straight-line distance in km)		
		Earliest	Latest	Earliest	Latest	Minimum	Maximum	Mean
Autumn 1974 1/	12	-	-	17 Dec	11 Feb	8	58	26
Spring 1975	9	15 Apr	14 Jun	23 May	24 Jun	18	77	48
Autumn 1975	7	11 Nov	29 Jan	11 Dec	24 Feb	8	34	21
Spring 1976	8	6 May	11 Jun	11 May	16 Jun	11	46	30
Autumn 1976	17	1 Nov	3 Feb	11 Nov	22 Feb	18	94	52

1/ Study animals not radiocollared until late November.