ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU, ALASKA

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CARIBOU REPORT

by

James L. Davis, Robert E. LeResche,
Robert E. Pegau and Kenneth Neiland

Volume XVI
Project Progress Report
Federal Aid in Widlife Restoration
Projects W-17-6, Jobs 3.3R, 3.5R and 3.9R (2nd half) and 3.13R, 3.15R, 3.16R and 19.14R and W-17-7, Jobs 3.3R, 3.5R, 3.9R, 3.13R, 3.15R and 3.16R (1st half)

(Printed May, 1975)

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: Robert E. Pegau

Project Nos.: W-17-6 and W-17-7 Project Title: Big Game Investigations

Job No.: 3.3R Job Title: Caribou Food Habits in Northern Alaska

Period Covered: January 1, 1974 to December 31, 1974

SUMMARY

Work on this job was completed during this period. A paper, entitled Plant Fragment Discernibility in Caribou Rumens, was presented at the 1st International Reindeer/Caribou Symposium in 1972. Proceedings of this symposium will be available spring 1975.

A second paper, Precision of Microscopic Estimates of Large Herbivore Diets, coauthored with B.L. Dearden and R.M. Hansen, will appear in the Journal of Wildlife Management in 1975.

These papers will comprise the final report for this job.

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: Robert E. Pegau

Project Nos.: W-17-6 and W-17-7 Project Title: Big Game Investigations

Job No.: 3.5R Job Title: Exclosure Construction and Caribou Range Vegetation Analysis

Period Covered: January 1, 1974 to December 31, 1974

SUMMARY

No work was accomplished since the last reporting period.

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: Kenneth Neiland

Project Nos.: W-17-6 and W-17-7 Project Title: Big Game Investigations

Job No.: 3.9R Job Title: Caribou Disease Studies

Period Covered: January 1, 1974 to December 31, 1974

SUMMARY

Work on this job during the reporting period consisted of finalizing two papers which will be published in the Journal of Wildlife Diseases. First drafts of these papers were presented in the last progress report.

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: James L. Davis and Robert E. LeResche

Project No.: W-17-6 and W-17-7 Project Title: Big Game Investigations

Job No.: 3.13R Job Title: Size, Composition and Productivity of the Fortymile Caribou Herd

Period Covered: July 1, 1973 through December 31, 1974

SUMMARY

The direct photo-count extrapolation technique was employed in 1973 to arrive at a minimum October population of about 5,300 animals in the Fortymile caribou herd. A similar census in 1974 resulted in a minimum September estimate of about 4,000 animals. Although a slight population reduction likely occurred from 1973 to 1974 it is believed that the 1974 census underestimated the population because of inclement weather, which precluded photographing post-calving aggregations at the optimal time.

Fall composition counts just prior to and during rutting, when animals are assumed to be most randomly mixed, resulted in the following ratios: October 16-18, 1973 (n=2700) 42 bulls/100 cows, 8 yearlings/100 cows, 16 calves/100 cows; September 20-21, 1974 (n=1738) 33 bulls/100 cows, 8 yearlings/100 cows and 20 calves/100 cows.

Initial productivity was reasonably good in both years but mortality through the summer was high: 57 calves/100 cows (n=1120) on June 6, 1973 to 16 calves/100 cows by October 16-18, 1973 (n=2700) and from 53 calves/100 cows (n=1304) on June 4-6, 1974 to 20 calves/100 cows (n=1738) on September 20-21, 1974.

BACKGROUND

The Fortymile caribou (*Rangifer tarandus granti*) herd has long been recognized as one of Alaska's most important herds. Hemming (1971) listed the herd as one of Alaska's six major caribou herds and Skoog (1956) described the Fortymile herd as being the major one in eastcentral Alaska throughout this century. This herd has been important in historic times by providing caribou for human use and also playing a major role in the population dynamics of adjacent herds, and in the possible creation of several smaller herds.

The Fortymile herd has been hunted regularly since gold rush days, primarily for meat and dog food (LeResche 1972). Since the early 1950's the Fortymile herd has been an important recreational hunting resource in Alaska. Through 1966 animals were killed as they migrated near the Steese Highway in August and September. Since that time caribou crossing the Steese Highway have been too few to attract a large number of hunters. Hunting on the Taylor Highway has increased in recent years and, depending upon timing of the migration and closing of the road by weather, the harvest has varied from 500-2,500 annually. In addition, a slight harvest of Fortymile animals occurs some years in the Yukon Territory.

It appears that the Delta, Mentasta, and Chisana caribou herds possibly owe their existence to the Fortymile herd (Skoog 1968). They were all apparently formed at the same time and by the same circumstances, i.e. remnant groups of animals remaining after the large movements of the Fortymile herd ceased about 1932. Large scale emigrations of Fortymile animals to the Porcupine herd have occurred several times and have added significant numbers to that herd. The Fortymile herd also "swamped" the Nelchina herd many winters during the 1920's but the effect on Nelchina herd numbers is unknown (Skoog 1968).

The Fortymile herd is an international resource since major portions normally spend late fall and winter in the Yukon Territory and enter Alaska during spring migration for calving and must be managed with this in mind.

Recent experiences with the Nelchina herd have pointed out the need for maintaining an accurate annual assessment of the status of intensively utilized caribou populations. The minimum information necessary to maintain a working knowledge of the size and status of a caribou population is: 1) an accurate estimate of population size based on a photo-count extrapolation census for use as a baseline, 2) subsequent annual assessment of yearling recruitment and adult mortality (includes hunting harvest), 3) routine monitoring of gross distribution and numbers to detect egress or ingress and 4) periodic recensusing by the direct photo-count extrapolation technique.

The Fortymile herd was studied intensively during 1952-1955 primarily by Skoog (1956); less intensively during 1957-59 by Olson (1957, 1958, 1959), during 1960 and 1961 by Jones (1961, 1962) and by Skoog again in

1959 (1959), 1962 (1963), and 1963 (1964). From 1963 through 1969 the Fortymile herd was studied very little. During the late 1960's and early 1970's the apparent declining numbers of caribou, the prospect of imminent land ownership changes and probable development within the herd's habitat, as well as a general lack of knowledge on the overall status of the herd, clearly outlined the need for a current assessment of the population and its habitat.

OBJECTIVES

To determine size, composition and productivity of the Fortymile caribou herd.

PROCEDURES

Population Size

Population size was ascertained primarily by use of the direct photo-count extrapolation technique (Hemming and Glenn 1969, Pegau and Hemming 1972, Bos 1973, 1974). The technique involves photographing large post-calving concentrations, counting all peripheral groups not photographed and determining composition of the groups photographed by ground observation. Minimum number of adult females in the herd is determined in this way.

Fall composition counts by ground observers are conducted during rutting, when animals are assumed to be randomly mixed. The proportions of bulls, yearlings and calves thus determined are used to extrapolate from the minimum number of adult females to derive minimum total herd size.

Reconnaissance flights were conducted throughout the Steese-Fortymile range prior to calving to determine distribution of animals. Aircraft utilized were a Cessna 180, a Cessna 185, a PA-18 Supercub, and a 295 Helio Courier. Movements and distribution of caribou were followed through the calving period into the period of post-calving aggregation.

Numbers of animals in the post-calving aggregations were determined in 1973 from photos taken by a hand-held camera from a PA-18 Supercub. Photos were enlarged to prints and caribou enumerated.

In 1974 direct aerial enumeration and photos taken by a 35 mm SLR Pentax spotmatic and Minolta SR-1 were utilized. A 206B Bell-Jet Ranger helicopter was used in 1973 and 1974 in conjunction with photographic surveys to determine sex and age composition of the animals covered in the photographic survey. Most animals were classified from the ground using a 20-60x spotting scope. Ages were based on body morphology and sex was based on external genitalia. Fall composition counts were also conducted using a 206B helicopter. Groups over about 15 in number were classified from the ground. On larger groups, observers were positioned on the ground and the helicopter was used to move the animals past the observers.

Sex and Age Composition

Sex and age composition was determined from the helicopter counts discussed under the population size procedures above, review of age information collected from hunter-killed caribou and by ground observation throughout the summer, in conjunction with Job 19.14R (this report).

Productivity

Productivity was determined in conjunction with the population size, sex and age composition surveys discussed above.

FINDINGS

Size

In 1973 the direct photo-count extrapolation technique was employed to obtain an October population estimate of about 5,300 caribou minimum. Post-calving aggregations were photographed adjacent to the calving area in the general vicinity of the headwaters of the East Fork of the Chena River, Little Windy Gulch, Williams and Gulch Creeks and the west side of Crescent Creek. These aggregations were photographed on several days preceding June 6. On June 6 composition counts were conducted and 1,120 animals classified. The minimum estimated number of adult females in the population on this date extrapolated to 3,200.

Sex and age composition counts were carried out during the rut on October 16-18, 1973 to obtain representative sex and age ratios for extrapolation of a population estimate from the July cow base. The obtained ratios were 42 bulls/100 cows, 8 yearlings/100 cows and 16 calves/100 cows; thus the population included 25 percent bulls, 5 percent yearlings, 10 percent calves and 60 percent cows (Table 1). Using these ratios, the October population size estimate was derived as follows:

cow base from post-calving extrapolation = 3,200 cows
3200 x .42 bulls = 1,344 bulls
3200 x .16 calves = 512 calves
3200 x .08 yearlings = 256 yearlings

3,200 cows
≥5,312 Total minimum estimate

During 1974 a direct photo-count extrapolation census was again conducted. Direct visual enumeration of animals in the 1974 post-calving aggregation, obtained on reconnaissance flights made to determine distribution of post-calving groups, gave a higher count of adults than any day of photo-coverage.

On June 13, 1974, 2,587 animals older than calves were enumerated and on June 14, 2,448 animals older than calves were enumerated. Because photos weren't taken these days no composition counts were conducted.

Table 1. Results of 1973 and 1974 sex and age composition counts - Steese-Fortymile herd.

Date	Total Bulls/ 100 Cows	Yrlg./ 100 Cows	Calves/ 100 Cows	Yrlg. % in Herd	N_1 = ( )	Calf % in Herd	N_2 = ( )	Cow % in Herd	N_3 = ( )	Bull % in Herd	N_4 = ( )	Sample Size Sum of N_1 thru N_4
10/16-18/73	42	8	16	5	(128)	10	(264)	60	(1630)	25	(678)	2700
9/20-21/	33	8	20	5	(81)	13	(218)	62	(1078)	21	(361)	1738

Table 2. Productivity of Steese-Fortymile caribou as reflected in calf:cow ratios during 1973 and 1974.

	Date	Calves/100 Cows	Date	Calves/100 Cows	Date	Calves/100 Cows
1973	June 6	57 (n=1120)*	June 30	36 (n=ca: 500)	October 16-18	16 (n=2700)
1974	June 4-6	53 (n=2038)	June 28	23 (n=1672)	September 20-21	20 (n=1738)

* n = sample size

The June 13 observations were from a Helio Courier and close inspection of the animals was made to grossly detect if any significant number of bulls had joined the group since the June 4-6 composition counts. Only four animals with "bull-type antlers" were observed, suggesting that the bull portion of the population lagging to the east had not yet joined the post-calving aggregations. Thus, based on the June 4-6 composition data the calculated number of adult females in the June 13 count was 2,510 adult cows.

In 1974, fall composition counts conducted on September 20-21 yielded ratios of 33 bulls/100 cows, 8 yearlings/100 cows and 20 calves/100 cows. Expressed as percent of herd the ratios are 21 percent bulls, 5 percent yearlings, 13 percent calves, and 62 percent cows. Using these ratios the September population size estimate was derived as follows:

cow base from post-calving extrapolation = 2,510
2510 x .33 bulls = 828 bulls
2510 x .20 calves = 502 calves
2510 x .08 yearlings = 201 yearlings

2,510 cows
≥4,041 Total minimum estimate

The 1974 estimate is 24 percent lower than the 1973 estimate when compared directly. Although a slight population decline likely occurred between 1973 and 1974 it is likely that the major difference in the estimates is the result of caribou not aggregating in post-calving concentrations in 1974 to a degree to make census photography optimal. Also inclement flying weather coincided with optimal aggregation thus reducing the proportion of the herd photographed. This discrepancy will be elaborated upon in the final report for this job.

Composition and Productivity

Partial results of composition and productivity surveys are tabulated in Tables 1 and 2. Interpretation of these data will appear in the final report along with a complete presentation of all data collected.

RECOMMENDATIONS

Because of the relatively small population size and poor yearling recruitment levels, hunting should be regulated so that the annual harvest does not exceed 100 animals until recruitment improves.

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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: James L. Davis and Robert E. LeResche

Project Nos.: W-17-6 and W-17-7 Project Title: Big Game Investigations

Job No.: 3.15R Job Title: Movements and Distribution of the Fortymile Caribou Herd

Period Covered: July 1, 1973 through December 31, 1974

SUMMARY

The annual movements and distribution of the Fortymile caribou herd were determined by periodic aerial reconnaissance. Traditional migration routes were determined by literature review, direct observation of migrations and aerial observation of caribou trails. Winter observations of movement responses to environmental factors were not accomplished because of prohibitive, costly logistic problems and because this aspect of caribou ecology is being emphasized in current studies in northwest Alaska.

BACKGROUND

Skoog (1968) presented a thorough review of the literature available on the movements and distribution of the Steese-Fortymile caribou *(Rangifer tarandus granti)* herd from the 1880's through 1968. Hemming (1971) summarized and mapped the known distribution and movement patterns of the Steese-Fortymile herd accrued through 1970. With the present interest in the Fortymile herd and the apparent dramatic population decline the herd has suffered, the determination of movements, distribution and traditional migration routes is of obvious importance.

Also see Background Job 19.14 (this report) for background relating to determining movement responses to environmental factors.

PROCEDURES

Periodic aerial surveys were conducted to determine the distribution and movements of the herd.

Review of available literature and notation of caribou trails during aerial surveys were utilized for determining traditional migration routes.

Movement responses to environmental factors were studied in conjunction with Job 19.14 (this report) and procedures are outlined in that job.

OBJECTIVES

To determine movements, distribution and traditional migration routes of the Fortymile caribou herd in Alaska.

To determine movement responses to environmental factors.

FINDINGS

Annual movements, distribution and traditional migration routes were determined and will appear in the forthcoming final report.

Little information on movement responses to environmental factors was accrued other than those reported under Job 19.14, this report. Generally it was felt that the results of Job 19.14 documented these responses reasonably well for the period June through October so they were not repeated during this period. Plans were made to gather winter observations to supplement the above but logistic problems, because of wintering locations of the herd, precluded this. Also, current studies being conducted in northwest Alaska in relation to evaluation of the impact of the Trans-Alaska Pipeline on caribou movements are emphasizing winter studies of movement responses to environmental factors. These should help bridge this important void in caribou ecology.

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Skoog, R. O. 1968. Ecology of the caribou (*Rangifer tarandus granti*) in Alaska. Ph.D. Thesis. Univ. Calif., Berkeley. 699pp.

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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: James L. Davis and Robert E. LeResche

Project Nos.: W-17-6 and W-17-7 Project Title: Big Game Investigations

Job No.: 3.16R Job Title: Range Reconnaissance Fortymile Caribou Herd

Period Covered: July 1, 1973 through December 31, 1974

SUMMARY

The habitat of the Fortymile caribou herd was delineated by monitoring year-round distribution via periodic aerial surveys and reports from individuals. Plans to compare current proportions of plant communities present on the Fortymile range with those determined earlier by Skoog (1956) to assess successional changes were not feasible. A map delineating recent forest fires on the Fortymile herd's range is being developed in lieu of a general range unit map based primarily on ERTS-A multispectral photography.

BACKGROUND

The biological axiom that animals are a product of their environment makes it obvious that in order to evaluate the status of an animal population its habitat must be studied as well as its population biology. The first investigator of the Fortymile herd, Skoog (1956), recognized this fact and attempted to assess and describe the habitat of the Fortymile caribou (*Rangifer tarandus granti*) herd. This early work was essentially the only habitat study that has ever been conducted on this herd's habitat.

In view of the apparent recent decline in numbers of the Fortymile caribou herd, a renewed interest has occurred in assessing the herd's habitat to see if changes could have occurred that played a role in the apparent decline in numbers.

OBJECTIVES

To delineate, characterize and map habitat used by the Fortymile caribou herd in Alaska.

PROCEDURES

Habitat delineation was accomplished in conjunction with Jobs 3.13 and 3.15 by periodic aerial reconnaissance (see Procedures Job 3.13 this report).

Habitat was to be characterized by delineating range units and determining distribution and extent of plant communities within these range units. Range units were to be designated as outlined by Skoog (1956). Units as determined in 1973-74 were to be compared with those described for the same herd by Skoog in 1956, as indicative of associated changes in vegetation and caribou distribution.

Proportions of plant communities present will be determined by autumn aerial transects, as performed by Skoog, and successional changes will be assessed.

A general range unit map was to be prepared using information gathered during aerial and ground surveys and ERTS-A multispectral photography. The two types of data were to be correlated to provide "ground-truth" information necessary for interpreting ERTS data.

RESULTS

The habitat of the Fortymile caribou herd was delineated by recording observed seasonal movements and distribution and by recording observations made from periodic aerial surveys and reports from individuals. These data are being analyzed and will be reported in the forthcoming final report.

A thorough review of Skoog's work from 1952-1955 (Skoog 1956) showed that the proposed approach of determining the proportions of plant communities currently present via autumn aerial transects and comparison with Skoog's earlier findings had limited applicability because of the original procedure employed. This procedure is briefly stated as follows, from Skoog (1956):

> An accurate range analysis of the plant distribution would require the use of random flight-lines over the range. A lack of time and money, however, prevented the flying of such lines. Instead, a flight made to locate the caribou herd provided the only means for accomplishing the task. During such a flight a tendency exists to traverse mainly the areas above timberline, where one can see the animals more easily. As a result, the data obtained do not provide a true picture of the actual plant distribution. The flight took place on September 21, 1953...

Considering this procedure it was decided that the only way to obtain comparable data would be to duplicate the original flight line and procedure. Correspondence with the original investigator, to obtain the original flight line has indicated that these data may not be available. If they are available by September 1975, the flight will be duplicated to ascertain changes in vegetation succession.

Range units were not designated by Skoog (1956) in such a manner that any present range unit designation would allow a comparison.

In lieu of a general range unit map prepared from ERTS-A multi-spectral photography a map delineating recent forest fires (primarily on winter range) will be prepared from aerial surveys and from United States Bureau of Land Management files.

Plans for mapping this caribou range utilizing ERTS-A multispectral photography have been delayed because the technology of interpreting ERTS photos has not advanced as rapidly as was anticipated. As a consequence it is prohibitively costly at present. Secondly, BLM personnel are considering intensive vegetation mapping of this general area which would, in part, be duplicated by our efforts.

LITERATURE CITED

Skoog, R. O. 1956. Range, movements, population, and food habits of the Steese-Fortymile caribou herd. M.S. Thesis. Univ. Alaska. 145pp.

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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: Robert E. LeResche and Jim Curatolo

Project No.: W-17-6 Project Title: Big Game Investigations

Job No.: 19.14R Job Title: Summer/Fall Movements and Behavior of the Steese-Fortymile Caribou Herd

Period Covered: July 1, 1973 through June 30, 1974

SUMMARY

All field work was completed during the period and a M.S. Thesis entitled The Influence of Environmental Factors on the Movements and Behavior of the Steese-Fortymile Caribou Herd was submitted to the University of Alaska graduate school. The thesis abstract follows:

Abstract: The Steese-Fortymile caribou herd was studied from June 1 through October 16, 1973. Field work was done from 23 tent camps situated throughout the Tanana Hills. The main objective of the study was to determine the role of various environmental factors on the caribou's movements and behavior.

Caribou groups were observed for as long as possible. Data were recorded as "point-in-time" samples every 15 minutes. The environmental factors which were measured related to time, weather, insects, predators, caribou behavior, group size and group composition.

Wind and temperature were found to be important influential factors on movements and behavior due to their ability to regulate insect numbers. Caribou can tolerate rather high densities of mosquitos before reacting, which may result in selecting windswept ridges, north-facing slopes or walking into the wind. Oestrid fly harassment may be an important factor in causing August dispersal. Wolves are the only important predator, acting as an evolutionary force in selecting for gregarious behavior and possibly, in the case of the Steese-Fortymile herd, as a significant mortality factor keeping the herd from increasing; a situation intensified as the result of high mortality due to recreational hunting in 1970, 1971 and 1972. Caribou stayed above timberline throughout the summer and fall, utilizing sedge-grass and birch-willow communities almost exclusively. The caribou's social behavior is important in controlling movements. Cow-calf pairs appear to be the basic social unit of group and herd structure.

Migrations are largely traditional movements whose focal point is the calving ground. The various environmental components (vegetation, insects, wolves, caribou, weather) both individually and in combination

impinge on the caribou's overall traditional movement patterns, affecting both their gregarious behavior and movements. The ability of caribou to show a plastic response to environmental variables allows caribou to show a somewhat predictable annual cycle with a large degree of variability dependent on the actions of the many environmetal components.

CONTENTS

BACKGROUND

The gregarious behavior and migratory habits of the barren ground caribou (*Rangifer tarandus granti*) are among its most distinctive characteristics. These two traits combine to form an annual cycle of spring migrations, calving concentrations, post-calving migration, late summer dispersal, and fall migration. Seasonal changes in meteorological factors, food preferences, food production and reproductive requirements are believed to be important factors influencing this cycle (Banfield 1954).

In Alaska, migration of caribou toward the calving grounds occurs during the months of March and April (Hemming 1971). Timing of this migration is tied to the arrival of spring (Banfield 1954, Moisan 1959, Lent 1966a, Kelsall 1968, Skoog 1968). Skoog (1968) believed that the spring movement was directed by the search for new plant growth in snow-free areas, where "caribou avidly seek the new green shoots which appear quickly once the snow leaves," thus causing a drift toward the calving grounds which eventually develops into a full-scale migration. Pruitt (1959) felt that caribou move because of the changing hardness of the snow cover. Superimposed on these hypothesized immediate causes is the traditional aspect of caribou migrations where herds annually follow well-worn paths to the same areas for a period of years (Banfield 1954, Miller 1972, Kelsall 1968). Spring migration involves a herd composed mainly of cows and yearlings with cows nearest parturition forming the vanguard, while the bulls lag behind on the wintering grounds (Skoog 1956, Kelsall 1957). The vanguard of pregnant cows may reflect a hormonal state which results in a migratory drive.

Migration ceases once the calving grounds are reached and then only local movements occur (Skoog 1968). Calving usually occurs sometime between mid-May and mid-June (Skoog 1964, 1968; Lent 1966b, Hemming 1971).

The post-calving migration begins in mid-June and is characterized by an increase in movement and a coalescing of individuals into larger groups (Lent 1966b). At first the groups are composed mainly of cow-calf pairs, but these are gradually joined by non-calving cows, yearlings and adult bulls (Pruitt 1960, deVos 1960, Lent 1966b, Skoog 1968). This migration may be socially oriented, resulting from the increase in

caribou densities and triggered by the appearance of flies (Skoog 1968). Insect harassment during this time of year has been said to keep animals aggregated and moving (Skoog 1956, 1968; Kelsall 1968). Movement may also be related to the search for favored food types (Lent 1966a) which would allow the caribou to attain prime condition before the winter months (Klein 1970).

The post-calving aggregations dissipate and movement slows about the end of July, heralding the beginning of the August dispersal, when caribou are scattered in many small groups (Kelsall 1960). Some biologists believe this phase results from the decline in harassment which accompanies the end of the mosquito season, thus allowing caribou to feed and rest (Zhigunov 1961, Kelsall 1968). Others postulate that escape from warble flies (*Oedemagena tarandi*) tends to disperse the animals (Harper 1955).

September again finds the caribou aggregating, a preliminary step which leads to the fall migration and rut. The rut begins in late September and peaks in October (Lent 1965, Skoog 1968, Kelsall 1968). The animals are usually in large aggregations at this time (Lent 1965, Skoog 1968, Kelsall 1968) with all age classes and sexes fully represented (Skoog 1968). The rut and fall migration usually coincide (Skoog 1968, Hemming 1971), but there is no evidence that one may influence the timing of the other (Kelsall 1968). The stimulus for fall migration is believed to be triggered by the first heavy snowfall (Dugmore 1913, Lent 1960, Harper 1955, Kelsall 1968), while the rut appears closely linked to changes in photoperiod (Skoog 1968). The fall migration is of adaptive value since it terminates in the taiga where there is the shelter of trees, favorable snow conditions and adequate forage of lichens and twigs (Banfield 1954).

Fall migration ends in a dispersal over the wintering grounds where movement becomes localized and may be largely dependent on snow conditions (Pruitt 1959, Henshaw 1968, Skoog 1968). Pruitt (1959) found that caribou could use a given spot for feeding only twice before snow hardness became critical. He believed this accounted for much of the winter movement by forcing caribou to find new feeding areas. At this time of year wind chill influences altitudinal movement by discouraging animals from utilizing the more exposed ridgetops and slopes (Henshaw 1968).

Little is known of the external stimuli and social forces which influence the caribou's annual cycle (Miller 1972). This project was initiated in an attempt to answer some of the previously unanswered questions concerning caribou movements.

OBJECTIVES

To quantify the biotic and abiotic environmental factors while simultaneously recording caribou movements and behavior in order to determine the importance of environmental factors as causes of local and migrational movement patterns.

To observe the effects of hunting pressure on caribou during their fall migrational period and to determine the relative importance of this phenomenon on the caribou's behavior and movements. Should hunting be limited, the effects of a road system and vehicular traffic will be observed to determine their importance in affecting caribou movements.

PROCEDURES

Summer Movements and Behavior

The study of summer movements and behavior was initiated for several reasons. The summer work helped familiarize the investigator with caribou in general, the Steese-Fortymile herd in particular. Data collected were used in formulating explanations for caribou movements during the summer period. Reasons for the fall aggregation-migration occurrence may be gleaned from the study of the pre-migration period.

In order to best judge the impact of environmental factors on movements, it was necessary to quantify certain parameters while recording the corresponding behavior patterns which occurred.

A. These environmental factors included:

1. Abiotic Factors

   a. wind - approximate speed, direction, type (gusty, steady, etc.)
   b. precipitation - type, approximate or relative amount
   c. cloud cover - approximate amount
   d. photoperiod - amount of daylight (from weather bureau)
   e. temperature - taken at time of observation
   f. barometric pressure
   g. humidity
   h. noise - generated from rivers, wind, etc.
   i. topography - effects of ridges, rivers, steep slopes, etc.

2. Biotic Factors

   a. insect harassment - mosquito densities were quantified subjectively on a linear scale (1 through 10)

   b. predator harassment - movements due to wolves (*Canis lupus*), bears, wolverines (*Gulo gulo*), etc.
   c. human interaction - effects of boats, planes, helicopters and observers

Note: Each of these parameters was quantified on a daily basis for correlation in overall trends.

B. The caribou behavior patterns and group statistics recorded were:

1. Group Statistics

   a. number in group
   b. sex (as many as possible)

c. age (adult, calf, yearling)
d. date and time of day of observations

2. Group Behavior

a. direction of movement
b. activity patterns - grazing, lying, standing, walking, trotting or running
c. vegetation types utilized - those described by Skoog (1956) line transects taken for community description
d. individual distances
e. tolerance within and between groups
f. leadership of groups (if any)
g. which animals initiate action in the groups (to insect harassment, human interaction, etc.)
h. shape of group - herd, single file, etc.
i. aberrant behavior

Fall Migrational Period

Observational work continued through the fall migrational period. The same parameters were measured, as in the summer, as well as any new occurrence, such as:

A. Early manifestations of the rut (antler rubbing, sparring, etc.)

B. Description of the staging area, if possible.

Taylor Highway Encounter

The third aspect of the study centered around the Taylor Highway. Depending on the hunting season, bag limits imposed and hunting pressure the following items were to be considered:

A. Hunter - Caribou Encounter

1. Possible changes in direction of movement upon encountering hunters

2. Notation of animals shot by hunters, especially the group leader, and the resulting behavior and movements-determination of crippling loss

3. Encounter at the highway proper with and without hunter activity

B. Unaffected Caribou

1. For comparative purposes, similar observations were made on caribou that did not encounter hunters.

Note: Ground observations were correlated with overall movements and distribution.

Aerial observations were conducted by Robert LeResche.

2. Data analysis included:

   a. Correlation of environmental factors with movement patterns and behavior, description of community types utilized and quantification of the amount of time spent in each

   b. Quantifying effects of predator harassment on group dynamics

   c. Estimation of crippling loss and effect of hunting pressure

FINDINGS

The results of this study have been presented in a University of Alaska M.S. Thesis entitled The Influence of Environmental Factors on the Summer/Fall Movements and Behavior of the Steese-Fortymile Caribou Herd. This thesis was submitted to the graduate committee during February 1975.

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