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CARIBOU REPORT

by
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Volume XIII
Project Progress Report
Federal Aid in Wildlife Restoration
Projects W-17-3, Jobs 3.1R, 3.3R, 3.4R, 3.5R and 3.6R (2nd half)
and W-17-4, Jobs 3.3R, 3.5R, 3.7R and 3.8R (1st half)

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JOB PROGRESS REPORT (RESEARCH)

State:	Alaska		
Cooperator:	Robert E. Pegau		
Project Nos.:	W-17-3 & W-17-4	Project Title:	Big Game Investigation
Job No.:	3.3R (W-17-3)	Job Title:	Caribou Investigations-Analysis of Range
Job No.:	3.3R (W-17-4)	Job Title:	Caribou Food Habits
Job No.:	3.5R (W-17-4)	Job Title:	Exclosure Construction
Period Covered:	January 1, 1971 to December 31, 1971		

SUMMARY

A one-acre exclosure was constructed near Purcell Mountain on the Arctic caribou herd's winter range. Vegetation transects inside and outside the exclosures were established, read and photographed.

Testing of a microhistological technique of rumen and pellet analysis was started.

Dry matter digestibility of the lichen *Cetraria islandica* averaged 89 per cent when suspended in reindeer rumens for 48 hours. Dry matter digestibility of four lichens ranged from 89 to 55 per cent while two mosses were only 9 and 19 per cent. Digestion of the same or similar species of lichens in reindeer and in bison and cows showed that reindeer digest lichens to a much greater degree.

CONTENTS

BACKGROUND

Caribou are extensively hunted in Alaska for sport and for subsistence by local residents. In some remote areas, residents are almost totally dependent on wild animals, especially caribou, for food. A knowledge of caribou-range relationships will aid in formulating management decisions to maintain adequate populations of caribou in Alaska.

Accurate diet information and range condition and trend data are essential prerequisites for understanding caribou-range relationships. Caribou thoroughly masticate their forage and in previous analyses of rumen contents investigators were unable to determine species composition of the majority of the contents. Recent literature describes a microhistological technique that should enable the identification of the finely masticated particles.

OBJECTIVES

To provide reliable data on caribou food habits and to determine the impact of caribou on range vegetation.

PROCEDURES

Exclosure Near Purcell Mountain

A one-acre exclosure was constructed on the Arctic caribou herd's wintering range during August 1971. It is located about 15 miles northeast of Purcell Mountain near a small lake within a group of gently rolling hills at an approximate location if 157°25' longitude and 66°25' latitude.

The lake lies about two miles south of the Selawik River and about one mile east of Shinilikrok Creek. There are several small lakes in the area which are not readily visible unless one is quite close to them

or at a high altitude, as they are all located between the small rolling hills. The area is used to a limited extent by wintering caribou.

Construction details and vegetative readings were similar to those used in 1969 (Hemming and Pegau, 1970), but this exclosure was built utilizing steel pipes instead of wooden posts for the corners. Four-foot hogwire with one strand of galvanized wire was used to give a total height of six feet. The east-west sides of the exclosure are 100 feet long and the north-south sides are 375 feet long.

Permafrost was encountered at depths of 33-38 inches during late August. The soil is mostly a brown clay with a few bands of a bluish-gray clay, and drainage is relatively poor. There are scattered small sand-gravel knolls on which the only good stands of lichens occur. Most stands have been heavily utilized in the past. Snow cover is relatively deep due to the extensive cover of shrubs, which causes snow accumulation.

Vegetation Analysis

Six permanent transects have been established inside the exclosure and nine outside. Transects and quadrats are the same as in the previous two exclosures (Hemming and Pegau, 1970) except that 4.8 square foot quadrats were utilized at this exclosure. The vegetation was examined by the modified Hult-Sernander scale and color photographs were taken of each quadrat.

Rumen Analysis

Rumen analysis has been widely used to determine food habits of various ruminants (Norris, 1943; Murie, 1951; Bergurud and Russel, 1964; Stevens, 1966; and Chamrad and Box, 1964). Analyses of caribou rumens have been attempted sporadically but most investigators have shown that caribou rumens contain a disproportionate amount of fine material that has been largely unidentified (Courtright, 1957, 1959a and 1959b; Bergurud and Russel, 1964; and Scotter, 1966).

A prerequisite for valid rumen analysis is that the material be identifiable and of uniform size. Recently a microhistological technique has been developed to determine plant composition of the diets of several types of animals (Ward, 1960; Van Dyne and Heady, 1965; Sparks, 1968; Theurer, 1970; Hansen and Ueckert, 1970; and Hansen, 1971). The technique is described in detail by Hansen (1971).

A sample of rumen material is dried and then ground in a mill over a 1 mm screen to reduce all plant fragments to a uniform size. Samples are then washed over a very fine screen (200 mesh) to remove dirt and to insure thorough mixing. Small quantities are placed on microscope slides and spread evenly and mounted, using Hertwig's solution and Hoyer's solution (Bear and Hansen, 1966). The slides are oven-dried at 60°C for three days.

The species of the plant fragments are identified based on characteristics of the epidermal tissues. Usually 10 to 80 locations on each of five to 10 slides, at 40 to 125 power magnification are observed. Data taken from reading the slides are expressed as per cent frequency of occurrence of each species or as per cent composition of each species. Frequency of occurrence is converted to density which is then converted to relative density (Sparks and Malechek, 1968) by the following formula:

$$\frac{\text{Density of particles of species A}}{\text{Total density of particles of all species}} (100) = \text{Relative Density}$$

The relative density is used to estimate per cent of dry weight of a species in the rumen samples. Sparks and Malechek (1968) reported a 1:1 relationship between estimated per cent dry weight to actual percent dry weight for grass only, forb only and grass-forb combinations.

Storr (1961), Heady and Van Dyne (1965) and Theurer (1970) reported that weight per unit area is not consistent at different stages of maturity or between all species. Therefore it is important that the technique be tested utilizing mixtures containing species from several plant groups such as would be expected to occur in a caribou rumen.

The Department of Fish and Game has contracted with Dr. Richard M. Hansen at Colorado State University to test the hypothesis that there is a 1 to 1 relationship between estimated and actual per cent dry weight with complex diets, and to analyze a limited number of rumen and pellet samples using this technique. Eight different mixtures containing known weights of 19 plant species collected near Nome were examined, utilizing the micro-technique, and regression equations for predicting per cent dry weight were calculated. The results are currently being evaluated and will be reported in next year's progress report. Dr. Hansen's preliminary report is on file at Fairbanks and Nome.

Digestion Trials

In vivo digestion trials using a nylon bag technique have been widely used in determining dry matter digestibility. The technique has been subjected to extensive testing and results have been reported by Van Dyne (1962), Van Dyne and Weir (1964 and 1966), and Harris et al, (1967). An annotated bibliography has been prepared by Van Dyne and Haug (1968).

Van Dyne (1962) conducted several tests to determine optimum amount and size of material, number of bags per trial, and fermentation time. Based on his results and other studies it is now standard to place 2 grams of material ground to 1 mm particle size in each nylon bag and allow them to ferment in the rumen for 48 hours. Usually three to five replicates of each sample and a total of 15 to 30 bags, depending on class of livestock, are run per trial.

In November 1971, two rumen fistulated reindeer were made available for use in digestion trials by the Institute of Arctic Biology, University

of Alaska. Drs. Jack Luick and Robert White, and Mr. Steve Person of the Institute are thankfully acknowledged for their assistance and comments.

Table 1 lists the plants that were collected from under 18 to 20 inches of snow in early November west of Nome and the portion of each that was fermented in the rumens. The area and vegetation have been described previously (Hemming and Pegau, 1970). The material should be very similar to plant material in the winter diet of caribou. Two similar lichen species, *Cladonia arbuscula* and *C. rangiferina*, were not separated. They are sometimes difficult to separate correctly, and ecological and chemical analysis indicate they can be appropriately lumped together. For most management studies they should be considered together. Only the living portion of the lichens was utilized in the digestion trials.

One reindeer was placed on a lichen-cattle starter pellet diet and the other on a hay-cattle starter pellet diet 10 days prior to the digestion trials to allow their rumen micro-organisms to stabilize. Plant material was ground in a Wiley mill over a 20-mesh screen. All material that passed through a 32-mesh screen was discarded so that the material used in the trials was between 1.0 to 0.5 mm in size.

Eighteen nylon bags per trial were placed in each reindeer's rumen. Three trials were completed with each reindeer. Two grams of material were placed in each bag and there were usually three replicates in each reindeer. *Empetrum nigrum* and *Vaccinium uliginosum* were only fermented in one reindeer due to insufficient sample material. The *Cladonia arbuscula* and *C. rangiferina* (*C. arb-rang.*) mixture was replicated six times in each reindeer. All samples were allowed to ferment for 48 hours after which they were removed and thoroughly rinsed in at least eight changes of water to extrude soluble components that may still be in the bags and to remove any material adhering to the outside of the bags. The bags and residues were oven-dried for 48 hours, weighed and the per cent dry matter digestibility was calculated (Table 2).

A mixture approximating a winter diet was prepared and used as a control in each trial. Sufficient quantity of the "Standard Reindeer Forage" was prepared so that it can be used in other digestion trials. The SRF was prepared from the same materials that were used to test the digestion of each species and was composed of the following:

Lichens	40%	Moss	5%
Cetraria islandica	10%	*Hylocomium splendens*	5%
Cladonia gracilis	10%		
C. arb-rang. mixture	20%		
Grass	**5%**	**Sedge**	**40%**
Calamagrostis canadensis	5%	*Carex aquatilis*	40%

Table 1. Plant species and plant parts used for dry matter digestion trials in reindeer, collected November 9, 1971, near Nome, Alaska.

Species	Plant Parts Utilized
Lichens	
Cladonia gracilis	living podetium
C. arbuscula and *C. rangiferina* mixture	consists of approximately 50% of each species, living podetium
Cetraria islandica	living podetium
Stereocaulon paschale	living podetium
Mosses	
Polytrichum juniperinum	entire stalks
Hylocomium splendens	entire stalks
Grass	
Calamagrostis canadensis	culms, leaves and spikes, very dry and fibrous, no green growth
Sedges	
Carex aquatilis	culms, spikes and mostly leaves, lower 2-3 inches of leaves green
Eriophorum angustifolium	culms and mostly leaves, no green growth
Shrubs	
Betula nana	terminal branches and buds only, no leaves, very resinous material
Vaccinium uliginosum	terminal branches and buds only
Empetrum nigrum	green leaves and attached stems

Table 2. Per cent dry matter digestion of 2 grams of materials fermented in reindeer rumens for 48 hours.

Species	Trial No.	Diet: Lichen-pellet unadjusted per cent	Diet: Lichen-pellet adjusted per cent	Diet: Hay-pellet unadjusted per cent	Diet: Hay-pellet adjusted per cent
Standard Reindeer Forage	1	58.1	53.4	59.8	54.9
" " "	1	56.3	51.6	56.6	51.7
" " "	1	58.2	53.5	56.7	51.8
" " "	2	54.9	53.0	55.5	56.2
" " "	2	55.1	53.2	55.7	56.5
" " "	2	54.0	52.1	48.2	48.9
" " "	3	46.6	53.2	51.5	54.8
" " "	3	43.2	49.8	48.9	52.2
" " "	3	48.7	55.3	51.2	54.5
Purina Cattle Starter	1	76.2	71.5	79.0	75.1
" " "	1	75.4	70.7	80.5	76.6
" " "	1	74.5	69.8	80.2	75.3
" " "	2	73.9	72.0	75.4	76.1
" " "	2	74.7	72.8	77.5	78.2
" " "	2	74.8	72.9	76.6	77.3
" " "	3	70.7	77.3	70.7	74.0
" " "	3	65.0	71.6	68.7	72.0
" " "	3	69.0	75.6	70.3	73.6
Cetraria islandica	1	86.9	82.2	95.7	90.8
" "	1	96.6	91.9	97.2	92.3
" "	1	95.2	90.5	94.9	90.0
Cladonia gracilis	2	82.6	80.9	77.4	78.1
" "	2	83.0	81.1	76.7	77.4
" "	2	81.0	79.1	76.1	76.8
Cladonia arb-rang.	3	58.3	64.9	72.0	75.3
" "	3	70.0	76.6	72.5	75.8
" "	3	64.1	70.7	73.2	76.5
" "	3	68.7	75.3	72.8	76.1
" "	3	69.3	75.9	75.7	79.0
" "	3	72.3	78.9	75.3	78.6
Stereocaulon paschale	2	57.0	55.1	53.5	54.2
" "	2	57.5	55.6	54.9	55.6
" "	2	56.6	54.7	53.3	54.0
Polytrichum juniperinum	3	1.2	7.8	6.8	10.1
" "	3	2.2	8.8	6.4	9.7
" "	3	6.2	12.8	3.6	6.9
Hylocomium Splendens	[a]	16.1	14.2	28.2	24.3
" "		17.6	15.7	28.0	24.1
" "		18.0	16.1	29.0	25.1
Calamagrostis canadensis	2	30.0	28.1	34.7	35.4
" "	2	29.3	27.4	37.5	38.2
" "	2	29.2	27.3	37.9	38.6

Table 2. (Cont'd.)

Species	Trial No.	Diet: Lichen-pellet unadjusted per cent	Diet: Lichen-pellet adjusted per cent	Diet: Hay-pellet unadjusted per cent	Diet: Hay-pellet adjusted per cent
Carex aquatilis	1	45.8	41.1	42.8	37.9
" "	1	44.9	40.2	49.7	44.8
" "	1	43.2	38.5	48.4	43.5
Eriophorum angustifolium	3	13.2	19.8	9.1	12.4
" "	3	7.7	14.3	7.6	10.9
" "	3	9.1	15.7	6.6	9.9
Betula nana	1	47.8	43.1	48.7	43.8
" "	1	47.4	42.7	52.3	47.4
" "	1	42.7	38.0	45.3	40.4
Vaccinium uliginosum	1	36.5	31.8		
" "	1	33.5	28.8	NOT TESTED	
" "	1	34.1	29.4		
Empetrum nigrum	2			70.6	71.3
" "	2	NOT TESTED		69.6	70.3
" "	2			69.2	69.9

[a] In lichen-pellet diet trial 2; in Hay-pellet diet trial 1.

Shrubs	10%
Betula nana	10%

Dr. White and Steve Person planned to use Purina Cattle Starter #1 as a control mixture in their *in vitro* and VFA production studies, to facilitate comparing their results with these *in vivo* digestion trials, the starter pellets were also used as a control.

FINDINGS

Vegetation Analysis

The vegetation at the exclosure is primarily a dwarf shrub community that appears to be replacing a tussock-sedge type. The southern three-fourths of the exclosure is covered by the dwarf shrub type and the northern one-fourth is the tussock-sedge type. The sedges are primarily *Carex lugens* and *Eriophorum brachyantherum*. Principal shrubs include *Betula nana, Ledum decumbens, Salix glauca, Vaccinium vitis-idaea* and *V. uliginosum*. The shrubs are dense, mostly 1 to 2 feet tall. Lichen growth is poor, except on the scattered sand-gravel knolls. *Stereocaulon* spp. are the principal species that occur on these sites.

Association tables have been compiled from the vegetation readings inside and outside of the exclosure (Tables 3 and 4). The readings from the four quadrats at each transect have been combined to facilitate presentation of the data. Total cover, cover by species and frequency are presented in each table. Comparison of these tables with those from the other two exclosures (Hemming and Pegau, 1970) shows the difference in the vegetation at the three exclosures.

Digestion Trials

An analysis of variance showed no difference between the two reindeer, but a significant difference in the digestion of the Standard Reindeer Forage was noted between the three trials (Table 5).

It can be seen that the digestion decreased slightly from trial 1 to trial 3 (Table 2). To minimize the variability of digestion by the same reindeer between trials the results are adjusted using the mean digestion of the Standard Reindeer Forage by each reindeer. The overall digestion of SRF by the reindeer on the lichen-pellet diet was 52.8 per cent and on the hay-pellet diet it was 53.8 per cent. The average digestion of SRF by the two reindeer in each of the trials was 57.5 per cent and 57.7 per cent; 54.7 per cent and 53.1 per cent; 46.2 per cent and 50.5 per cent, therefore the per cent dry matter digestion from each sample is adjusted accordingly; trial 1, - 4.7 per cent and - 3.9 per cent; trial 2, - 1.9 per cent and +.7 per cent and in trial 3, +6.6 per cent and +3.3 per cent (Table 2). The adjusted digestion results are used to compare the digestibility of each plant species.

Table 3. Vegetation analysis inside the Purcell Mountain exclosure, by modified Hult-Sernander scale, August 28, 1971.

Species	TRANSECT # AND PER CENT COVER BY SPECIES 1	2	3	4	5	6	Ave. Species Comp. %	Freq. %	Number of Quadrats in which species occurred
Total Cover (%)	96	96	100	100	100	100	98.6	-	-
Moss	2.3	5.5	3.7	2.7	2.0	1.7	3.0	100	24
Betula nana	2.2	4.2	3.0	1.7	1.7	2.0	2.5	87	21
Ledum decumbens	2.2	3.0	4.5	3.7	3.7	3.7	3.5	92	22
Vaccinium uliginosum	2.0	0.7	1.0	0.5	1.2	1.0	0.7	67	16
V. vitis-idaea	1.7	2.2	2.7	2.7	3.2	3.0	2.9	96	23
Empetrum nigrum	0.7	1.2	1.0	-	-	-	t	33	8
Salix glauca	2.0	1.2	2.7	-	0.5	-	1.1	42	10
S. pulchra	0.2	-	-	-	-	-	t	4	1
Arctostaphylos alpina	1.0	-	-	1.0	-	-	t	8	2
Eriophorum brachyantherum	-	0.5	1.2	2.0	0.7	2.7	1.2	54	13
Carex lugens	3.2	1.7	1.2	2.2	3.0	1.7	2.2	87	21
Arctagrostis latifolia	1.0	1.5	1.7	0.5	0.5	-	t	63	15
Festuca brachyphylla	-	0.2	0.2	-	-	-	t	8	2
Poa spp.	-	-	0.2	-	-	-	t	4	1
Saussurea angustifolia	-	0.5	1.0	0.5	0.2	-	.40	25	6
Polygonum bistorta	0.2	-	-	-	-	-	t	4	1
Petasites frigidus	-	0.5	-	-	0.5	-	t	13	3
Saxifraga punctata	-	-	0.2	-	-	-	t	4	1
Polemonium acutiflorum	-	0.2	-	-	-	-	t	4	1
Unidentified forb	-	0.2	0.2	-	-	-	t	8	2
Lichens	1.2	2.5	2.0	1.7	2.2	1.0	1.8	87	21
Cladonia arbuscula	0.5	0.5	0.2	0.5	0.7	0.2	t	46	11
C. rangiferina	0.2	-	0.5	0.5	-	-	t	21	5
C. amaurocraea	-	-	0.2	-	0.2	-	t	8	2
C. gracilis	0.2	0.2	0.2	0.2	-	-	t	17	4
C. uncialis	-	-	-	0.2	-	-	t	4	1
C. alpestris	-	-	-	0.2	-	-	t	4	1

Table 3. (Cont'd.)

Species	TRANSECT # AND PERCENT COVER BY SPECIES 1	2	3	4	5	6	Ave. Species Comp. %	Freq. %	Number of Quadrats in which species occurred
C. crispata	-	-	-	-	-	0.2	t	4	1
C. cornuta	0.2	0.2	-	0.2	-	-	t	13	3
C. bellidiflora	-	-	-	0.5	0.2	0.2	t	17	4
C. gonecha	-	-	0.2	0.2	-	-	t	8	2
C. spp. (funnel-form)	-	0.2	0.2	0.2	0.2	-	t	17	4
Cetraria cucullata	0.2	0.2	0.5	0.5	0.5	0.5	t	42	10
Peltigera aphthosa	-	1.0	0.5	0.2	1.2	0.5	t	46	11
P. spp.	0.2	1.0	1.0	0.5	0.5	-	t	42	10

Table 4. Vegetation analysis outside the Purcell Mountain exclosure, by modified Hult-Sernander scale, August 28, 1971.

Species	TRANSECT # AND PER CENT COVER BY SPECIES									Ave. Species Comp. %	Freq. %	Number of Quadrats in which species occurred
	1	2	3	4	5	6	7	8	9			
Total Cover (%)	100	100	100	100	100	96	100	96	100	99	-	-
Moss	2.0	4.0	5.5	5.0	4.2	1.7	1.0	1.2	3.0	3.1	94	34
Betula nana	3.0	2.5	2.7	2.7	2.5	2.0	3.0	2.5	1.0	2.4	94	34
B. glandulosa	-	-	0.2	-	-	-	-	-	-	t	3	1
Ledum decumbens	1.7	2.5	2.0	3.2	2.5	3.0	3.0	3.7	4.0	2.8	94	34
Vaccinium uliginosum	2.2	2.5	0.5	2.0	1.7	0.7	1.7	1.7	2.2	1.7	75	27
V. vitis-idaea	3.5	2.2	2.0	2.2	2.7	2.5	1.0	2.0	2.2	2.3	100	36
Salix glauca	2.0	1.0	1.5	0.7	1.0	-	0.5	0.2	0.5	0.8	36	13
S. pulchra	-	-	-	-	-	-	0.2	-	-	t	3	1
Empetrum nigrum	0.5	1.5	0.5	1.2	0.5	-	-	0.5	1.0	.63	31	11
Picea glauca	-	-	0.2	-	-	-	-	-	-	t	3	1
Arctostaphylos alpina	-	-	-	0.7	-	-	-	-	-	t	-	-
Carex lugens	2.5	2.0	2.2	2.2	3.0	1.2	1.7	2.0	1.7	2.1	86	31
Eriophorum brachyantherum	0.2	-	-	-	0.2	4.7	3.0	2.0	1.7	1.3	42	15
Arctagrostis latifolia	1.5	0.7	0.7	1.5	0.5	-	-	-	-	t	33	12
Rubus chamaemorus	-	-	-	-	-	-	-	0.2	-	t	3	1
Petasites frigidus	-	0.2	-	0.2	-	-	-	-	-	t	6	2
Unidentified forb	-	-	-	0.2	-	-	-	-	-	t	3	1
Lichens	2.0	1.7	3.0	2.0	1.7	0.5	-	0.2	0.5	1.3	61	22
Cladonia arbuscula	-	1.0	1.0	1.0	0.5	0.2	-	-	0.2	.43	31	11
C. rangiferina	-	0.2	0.2	0.5	0.2	-	-	-	-	t	14	5
C. gracilis	0.2	-	-	0.2	0.5	-	-	-	-	t	11	4
C. uncialis	-	0.5	0.5	0.2	-	-	-	-	0.2	t	17	6
C. bellidiflora	-	-	-	0.2	-	-	-	-	-	t	3	1
C. cornuta	-	-	-	-	0.2	-	-	-	-	t	3	1
C. crispata	-	-	-	-	0.2	-	-	-	-	t	3	1
C. gonecha	-	-	-	-	-	0.2	-	-	-	t	3	1
C. spp. (funnel-form)	-	-	0.2	0.2	0.2	-	-	-	-	t	8	3
Cetraria cucullata	-	0.2	0.5	0.2	0.2	-	-	-	-	t	14	5
Peltigera aphthosa	1.0	0.2	2.0	1.2	0.7	0.5	-	0.2	0.2	.67	47	17
P. spp.	0.2	-	0.2	-	0.2	-	-	-	-	t	8	3

Table 5. Analysis of variance of unadjusted dry matter digestion of the Standard Reindeer Forage.

Trial #	Diet: Lichen-pellet	Diet: Hay-pellet	Σ
1	58.1	59.8	
	56.3	56.6	
	58.2	56.7	
	172.6	173.1	345.7
2	54.9	55.5	
	55.1	55.7	
	54.0	48.2	
	164.0	159.4	323.4
3	46.6	51.5	
	43.2	48.9	
	48.7	51.2	
	138.5	151.6	290.1
Σ	475.1	484.1	959.2

Source of Variation	df	SS	MS	
Subgroups	5	293.14	58.63	
Reindeer	1	4.50	4.50	.824 NS
trials	2	260.97	130.48	23.90***
Reindeer X trials interaction	2	27.67	13.83	2.53 NS
Within subgroups (error)	12	65.58	5.46	

The mean dry matter digestion, standard deviation and t-test between reindeer for each species are presented in Table 6. The diet apparently had little effect on the digestibility of most species, however, the reindeer on the lichen-pellet diet had a slightly but significantly higher digestion of the lichen *Cladonia gracilis* and the sedge *Eriophorum angustifolium* while the reindeer on the hay-pellet diet was higher with the Purina Cattle Starter, the grass *Calamagrostis canadensis* and the moss *Hylocomium splendens*.

Most of the differences were small, 3 to 10 per cent, but due to the low variability they were significant. The differences detected can not be explained by diet alone, as the reindeer on the lichen-pellet diet had a higher digestibility of one sedge and the reindeer on the hay-pellet diet had a higher digestibility of one moss. The lichens fed to the reindeer had a considerable amount of moss adhering to them. Hungate (1966) has amply demonstrated that diet effects the digestibility of feeds. Apparently either the diets will have to be more varied or more reindeer on each diet will be required to detect a greater degree of difference in dry matter digestion due to diet in reindeer.

The range of digestion among the species was considerable: 9 per cent for the moss *Polythrichum juniperinum* to 89 per cent for the lichen *Cetraria islandica*. Overall the lichens were the most digestible with the mosses the least (Table 2). In comparisons, the portion and condition of the plants should be considered. One sedge, *Carex aquatilis*, over-winters with two to three inches of green growth in the leaves, while the other sedge, *Eriophorum angustifolium*, and the grass *Calamagrostis canadensis* are devoid of any green material in the winter. The sub-shrub *Empetrum nigrum* is an evergreen, so the green leaves and attached thin stem were used as opposed to the larger stems and buds of the deciduous shrubs *Betula nana* and *Vaccinium uliginosum*. A check of the digestion rates determined in the reindeer is provided in the following breakdown of the Standard Reindeer Forage:

Species	% Composition		% Digestion		%
Cetraria islandica	10	X	89	=	8.9
Cladonia gracilis	10	X	78	=	7.8
C. arb-rang.	20	X	75	=	15.0
Hylocomium splendens	5	X	9	=	.4
Calamagrostis canadensis	5	X	32	=	1.6
Carex aquatilis	40	X	41	=	16.4
Betula nana	10	X	42	=	4.2
TOTAL					54.3%

This is very similar to the 53.3 per cent overall average digestion of SRF by both reindeer.

Table 6. Mean adjusted dry matter digestion, standard deviation and t-test between diets.

Species	Lichen-pellet Mean	S.D.	Hay-pellet Mean	S.D.	t
Cetraria islandica	88.2	5.24	91.0	1.16	-.91 NS
Cladonia gracilis	80.4	.77	77.4	.65	4.96 **
C. arb-rang.	73.7	5.08	76.9	1.54	-1.46 NS
Purina Cattle Starter	72.7	2.38	75.4	1.95	-2.62 **
Empetrum nigrum	not tested		70.5	.72	
Stereocaulon paschale	55.1	.46	54.6	.87	.93 NS
Standard Reindeer Forage	52.8	1.51	53.5	2.50	-.74 NS
Betula nana	41.3	2.83	43.9	3.50	-1.00 NS
Carex aquatilis	39.9	1.32	42.1	3.67	-.95 NS
Vaccinium uliginosum	30.0	1.59	Not tested		
Calamagrostis canadensis	27.6	.44	37.4	1.75	-9.42 ***
Hylocomium splendens	15.3	1.00	24.5	.53	-12.37 ***
Eriophorum angustifolium	16.6	2.86	11.1	1.25	3.07 **
Polytrichum juniperinum	9.8	2.64	8.9	1.74	.05 NS

** .05 significance level
*** .01 significance level

A Student-Newman-Keuls test for multiple comparisons among means (Sokal and Rohlf, 1969) is presented in Table 7. Means are ranked from least to most digestible and those in which the means are not significantly different, LSR=Q.05 k,82 MS within $\frac{n1+n2}{2n_1 n_2}$, are underlined. There were 108 observations in 26 categories which gives 82 degrees of freedom. The square root of the error mean square is 2.40. The critical values of the "Studentized" range for 82 df for 2 to 5 means ranged from 2.814 to 3.947 for the number of replications in these tests (3 to 9) and LSR ranged from 3.903 for 2 means to 5.47 for 5 means. As can be seen in Table 7, the largest group of means with nonsignificant differences was 5.

There is limited chemical analysis available for those species tested, especially from winter collections. Hopefully, planned analysis of the nutrient content of the pre-and post-digested materials by personnel of the Institute of Arctic Biology will provide some elucidation on this aspect. It appears that the fiber (cellulose, hemicellulose and lignin) content may have an inverse relationship with dry matter digestibility, however due to the very limited chemical data available for the mosses, these are only tentative conclusions.

The significance of the adaptation of reindeer to a winter diet comprised primarily of lichens is clearly demonstrated. This is further supported with the results of digestion trials utilizing bison and cows provided by Dr. Hansen. The same or similar species fermented in bison and cow rumens compared to those tested in reindeer are presented in Table 8. As shown, reindeer digest lichens to a greater degree than bison or cows. *Cetraria islandica* is highly digestible in reindeer and bison and cows.

Why is *C. islandica* so much more digestible (69%) than the next lichen *Stereocaulon grande* (26%) in bison and cows? The analysis of the residues following digestion compared to the nutritional quality prior to digestion should help explain this phenomenon. Bison and cows were able to digest grass and sedges to a greater degree than the reindeer.

It is apparent that dry matter digestion rates will have to be considered when analyzing caribou rumen contents and this will be particularly important with feces analysis. Free et al. (1970), Casebeer and Koss (1970), Hansen (1972), and Todd and Hansen (in press) have demonstrated that diets can be determined from examination of fecal pellets by the microhistological technique. Preliminary examination of caribou, reindeer, arctic hare and muskoxen pellets indicates that fragments of several plant species can be identified in these pellets. With controlled feeding trials it could be determined whether this is a practical approach to caribou and muskoxen diet studies. The advantage of using feces rather than rumen samples is readily apparent, especially with muskoxen.

Table 7. Multiple comparisons of the adjusted dry matter digestions means by the Student-Newman-Keuls test. Means with nonsignificant differences are underlined.

Diet[a]	Hay	Lichen	Hay	Lichen	Lichen	Hay	Lichen	Lichen
Species	*Polytrichum juniperinum*	*Polytrichum juniperinum*	*Eriophorum angustifolium*	*Hylocomium splendens*	*Eriophorum angustifolium*	*Hylocomium splendens*	*Calamagrostis canadensis*	*Vaccinium uliginosum*
Mean	8.9	9.8	11.1	15.3	16.6	24.5	27.6	30.0

Diet[a]	Hay	Lichen	Lichen	Hay	Hay	Lichen	Hay	Hay	Lichen
Species	*Calamagrostis canadensis*	*Carex aquatilis*	*Betula nana*	*Carex aquatilis*	*Betula nana*	S R F	S R F	*Stereocaulon paschale*	*Stereocaulon paschale*
Mean	37.4	39.9	41.3	42.1	43.9	52.8	53.5	54.6	55.1

Diet[a]	Hay	Lichen	Lichen	Hay	Hay	Hay	Lichen	Lichen	Hay
Species	*Empetrum nigrum*	*Starter pellets*	*Cladonia arb-rang.*	Starter pellets	*Cladonia arb-rang.*	*Cladonia gracilis*	*Cladonia gracilis*	*Cetraria islandica*	*Cetraria islandica*
Mean	70.5	72.7	73.7	75.4	76.9	77.4	80.4	88.2	91.0

[a] Hay=Hay-pellet diet; Lichen=Lichen-pellet diet.

Table 8. Percent dry matter digestion of the same or similar species in reindeer compared with bison and cows.

Species	Reindeer Mean %	Bison and Cows Mean %
Cetraria islandica	89.6	68.7
Cladonia rangiferina	----	8.0
C. arb-rang. mixture	75.0	----
C. gracilis	78.9	7.1
Stereocaulon paschale	55.0	----
S. grande	----	25.6
Standard Reindeer Forage	53.3	26.7
Carex aquatilis	41.0	46.0
Calamagrostis canadensis	32.5	54.2
Eriophorum angustifolium	13.8	52.0

RECOMMENDATIONS

Transects inside and outside the exclosure should be reexamined in 1976. The exclosure should be examined periodically to ascertain whether steel pipes are functional on Arctic ranges.

The evaluation of the microhistological technique should be accomplished and a determination made regarding its applicability for studying caribou food habits.

Feeding trials with fistulated reindeer or caribou should be conducted. Rumen and fecal samples from these trials should be analyzed by the micro-histological technique to determine its reliability and to ascertain whether fecal analysis is a valid method of determining diets of these herbivores.

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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: James E. Hemming

Project No.: W-17-3 Project Title: Big Game Investigations

Job No.: 3.4R Job Title: Refinement of Caribou Composition Counting Techniques

Period Covered: January 1, 1971 to June 30, 1971

SUMMARY

Work on this job terminated December 31, 1970 and results have been incorporated into current caribou survey and inventory techniques. In lieu of a final job report a paper describing this technique will be submitted to an appropriate journal.

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: James E. Hemming

Project No.: W-17-3 Project Title: Big Game Investigations

Job No.: 3.5R Job Title: Optimum Sex Ratios for Maximum Sustained Yield Management

Period Covered: January 1, 1971 to June 30, 1971

SUMMARY

No work was accomplished during this reporting period. This job has been discontinued because of changing program emphasis.

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: James E. Hemming and Gregory N. Bos

Project Nos.: W-17-3 & W-17-4 Project Title: Big Game Investigations

Job Nos.: 3.6R (W-17-3) & 3.8R (W-17-4) Job Title: Computerized Population Models for Use in Projected Caribou Management Plans

Period Covered: January 1, 1971 to December 31, 1971

SUMMARY

Because of a position vacancy (James Hemming resigned to work for BLM) no work was accomplished on this job. Mr. Bos, who replaced Mr. Hemming, plans to retain this job in active status.

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: Gregory N. Bos

Project No.: W-17-4 Project Title: Big Game Investigations

Job No.: 3.7R Job Title: Population Dynamics and the Influence of Hunting on the Nelchina Caribou Herd

Period Covered: July 1, 1971 to December 31, 1971

SUMMARY

Ground composition counts conducted during April, 1971 yielded 20.2 per cent short yearlings, a proportion comparable to an average of 21 per cent for the period since 1956. There was no reported natural mortality in 1971. During the 1970-71 hunting season, 3,710 reporting hunters took 4,106 caribou. The estimated total harvest was 6,399. The sex ratio of the harvest was 63 per cent males, 37 per cent females. Sex and age composition counts made in October, 1971 yielded a proportion of 18.4 per cent calves and a sex ratio for animals over one year of age of 25.2 per cent males. No range vegetation studies were conducted. The distribution and movements of the Nelchina herd were recorded throughout the year.

CONTENTS

BACKGROUND

Since inception of research and management programs for the Nelchina caribou in 1948, the Nelchina herd has been the most important sport-hunted herd in Alaska in terms of size of the harvest, averaging 5,000 animals annually since 1956. Concerted attempts to determine population size resulted in estimates of 37,000 in 1956 (Watson and Scott, 1956), 71,000 ± 11,867 in 1962 (Siniff and Skoog, 1964) and 61,000 in 1967 (Hemming and Glenn, 1968). The current status of the population is unknown.

The general sex and age structure of the population and estimates of yearling survival have been provided by sex and age composition counts conducted during early spring, early summer (post-calving) and during the rut. Although sex and age characteristics have been described in the literature (Banfield, 1954; Banfield et al, 1955; Bergerud, 1958; Kelsall, 1968 and Skoog, 1968), methods used for classifying the animals in Alaska have been variable, and seasonal segregation and stratification of these groups have not been adequately studied.

Acquisition of harvest statistics prior to 1968 was largely done by field contacts, questionnaires and check station data. Estimations of harvest levels since 1968 have been considerably refined by the use of a harvest ticket program. Cementum aging techniques combined with harvest ticket information have enabled some interpretation of the sex and age structure of the harvest and of the population. At present the Nelchina herd is the only herd in which the annual harvest approximates the annual increment. Hunting pressure has been increasing in recent years due to

increased numbers of resident and nonresident hunters, improved access on new roads and use of all-terrain vehicles which has allowed hunters to move to the animals, particularly in winter. The resultant increased harvest now is thought to approximate the maximum desirable harvest level assuming a relatively stable population of about 60,000 caribou. Increased land use pressure and the proposed Trans-Alaska Pipeline route traversing the range of the Nelchina herd provide further impetus to the establishment of an intensive management effort on the Nelchina herd.

OBJECTIVES

To provide information for an annual status evaluation of the Nelchina caribou herd in terms of total numbers, productivity, mortality, sex and age structure and condition of the animals and their environment.

PROCEDURES

Population Estimate

To obtain an estimate of total numbers, a modification of a direct caribou count method is used whereby a population estimate is extrapolated from counts made on vertical aerial photographs of the post-calving concentrations of caribou. Extrapolations involve use of ratios obtained from sex and age ground composition counts made at the time of photography and also during the period of the rut in October. The post-calving composition data are used to compute the percentages of bulls, yearlings and calves in the post-calving segment. The totals of each are subtracted to compute total cows. Composition data obtained during the rut are used to estimate the true composition of the population, as the most random sex and age representation occurs at that time. The bull/cow, yearling/cow, and calf/cow ratios are then used to compute by extrapolation an estimate of the total population.

Care must be taken to ensure that composition counts are made of samples representative of the population to which data are applied as well as being as accurate as possible in the sex and age classification. It is most important that the estimate of the cow segment is accurate since this segment is the basis of extrapolations for other sex and age classes.

Productivity

To obtain an estimate of productivity, the natality rate is computed from ground composition counts conducted during the period of post-calving concentration each year. This procedure assumes that counts are conducted after the period of newborn mortality, but at a time when comparable natality rates can be established.

In addition to natality rates, composition counts conducted in the period from March 15 to April 15 provide information on survival of

calves through the first year and consequent addition of yearlings to the adult population in May. Age criteria used involve size and body form of animals; sex criteria are based on genital characteristics.

Mortality

A. Natural mortality of adults (1 year+) will be recorded as observed. Data from past years indicate losses to diseases, parasites, accidents or starvation are minimal. Skoog (1968) estimated natural mortality of adults (including predation) at six per cent.

B. Natural mortality and hunter harvest of calves through the first year will be determined by using the difference between natality rates and early spring calf proportions when the calves are approximately 12 months old.

C. Hunter harvest of adults is determined from returns of harvest tickets from hunters. The sex and age structure of the kill is determined by cementum aging techniques on the teeth of collected specimens in conjunction with field sex identification. A sample of 10 per cent of the hunter harvest is desirable for significant results in analyzing sex and age structure.

D. Yearly increments to, or losses from, the total population are determined by subtracting total computed losses from the computed yearling addition to the population in the spring.

Sex and Age Structure

Sex and age structure of the population is computed by combining and analyzing information from sex and age composition counts taken in the early spring, during the post calving period, and during the rut, as well as sex and age structure of the harvest.

Condition of Animals

Condition of the animals is determined by field observations, collections, gross examination of hunter-killed specimens, and laboratory examination of specimen material.

Condition of Range

Information on the condition of the environment, or range, is acquired on a long-term basis from field vegetation studies. Range vegetation transects and exclosures have been studied since the 1950's and are now beginning to provide information on recovery of vegetation from grazing, and on allowable use levels. Range condition levels are measured in July with the aid of the Pegau Caribou Winter Range Condition and Trend Score Card. Rumen analyses should yield specific food habits information which can be related to winter range condition and trend. Patterns of caribou distribution as related to range vegetation types are determined from monthly reconnaissance flights.

FINDINGS

Population Estimate

An attempt to census the post-calving concentration of the Nelchina herd was unsuccessful. Inclement weather delayed the possible execution of the aerial photo mission beyond the contract expiration date. A last-minute possibility of a successful count on July 9, 1971 was thwarted by unavailability of a helicopter.

Productivity

Ground composition counts were not conducted during the post-calving period, hence no estimate of natality is avilable for 1971. The 18 per cent calves classified during the October 1971 composition counts is below the average of 22 per cent calves classified on fall counts since 1956. Assuming all counts involved are representative of the fall population structure, the data suggest below average production of calves and/or lower survival of calves during the summer of 1971.

Short yearling counts were made from the ground and from an FH1100 helicopter during April 22-24, 1971. The counts were conducted on the northwest slopes of Mt. Drum, along the Copper River flats near Chistochina, and between the Richardson Highway and the Gakona River near Sourdough. A sample size of 3,446 (1,436 ground and 2,010 aerial) yielded 20.2 per cent short yearlings. Results are presented in Table 1. Small sample sizes preclude comparisons between counts taken on the ground and those from the air except for those counts taken in the Mt. Drum area. The difference between 21.96 per cent short yearlings (ground) versus 18.93 per cent short yearlings (aerial) is significant ($P = .025$).

Mortality

A. There was no reported observed natural mortality. Losses to predation are thought to be light. Extensive monthly aerial reconnaissance flights revealed few caribou kills, even in caribou concentration areas where wolf activity was observed. Only four dead caribou were found of which two were ascribed to wolf predation. On the other hand, remains of moose were frequently seen, and although evidence of wolves feeding on such remains was common, the cause of death was not determined. No losses to starvation were noted and animals appeared to be in good condition throughout the year. Diseases and parasites are believed to be at low levels. Blood samples were submitted to the Alaska State-Federal Laboratory at Palmer, and to the Veterinary Science Department of the University of Wisconsin, at Madison, for *Brucella* analysis. All 87 samples tested were negative by agglutination and complement fixation procedures.

B. No composition counts were conducted in the summer or fall of 1970 to enable computation of survival of 1970 calves. However, the 20 per cent short yearling figure for 1971 compares closely with the average

Table 1. Nelchina short yearling composition counts, April 22-24, 1971.

Area		Short Yrlg.	Percent	Cows	Percent	Bulls	Percent	M per 100 F*	Short yrlg. per 100 F*	Sample Size
	Ground	-	-	-	-	-	-	-	-	-
Sourdough	Aerial	25	13.59	127	69.02	32	17.39	25.20	19.69	184
	Total	25	13.59	127	69.02	32	17.39	25.20	19.69	184
	Ground	9	9.28	75	77.32	13	13.40	17.33	12.00	97
Chistochina	Aerial	180	21.61	505	60.62	148	17.77	29.31	35.64	833
	Total	189	20.32	580	62.36	161	17.31	27.76	32.59	930
	Ground	294	21.96	827	61.76	218	16.28	26.36	35.55	1339
Mt. Drum	Aerial	188	18.93	535	53.87	270	27.19	50.47	35.14	993
	Total	482	20.67	1362	58.40	488	20.93	35.83	35.39	2332
Grand Total		696	20.20	2069	60.04	681	19.76	32.91	33.64	3446

* Sex ratios apply only to animals over one year of age.

of 21 per cent for short yearling counts since 1956. Average mortality of calves through their first year of life has been 41 per cent since 1956.

C. The IBM reported harvest for the 1970-71 season (Aug. 10-Sept. 30 and Nov. 1-March 31) indicated 3,710 hunters took 4,106 caribou. Extrapolation for harvest by nonrespondents yielded a total estimated harvest of 6,399. This was below the 7,814 estimated harvest in 1969-70. The season closure during October was probably not responsible for this apparent reduction in the harvest since harvest chronology data indicate a very low harvest (3.6 per cent) during October 1969 as well as in October 1970 (1.6 per cent). Harvest chronology data for the 1969-70 and 1970-71 seasons are presented in Fig. 1. These data show similar patterns of progression of the harvest over the season for both years.

The proportion of males in the harvest was 63 per cent in 1970-71. This is comparable to the average of 59 per cent for the past 10 years, but differs substantially from the 49 per cent males in the 1969-70 harvest. Table 2 presents distribution of hunter success information for the past two years. The percentages of hunters successful in taking at least one caribou were 62 per cent and 60 per cent, respectively. Of 2,119 successful hunters who reported their residency, 81 per cent were residents. This compares closely with the 83 per cent residents of the 2,938 successful hunters reporting in 1969-70.

The sex and age structure of the harvest was determined by fluoro-microscopic cementum aging of 389 tooth specimens of known sex. Table 3 presents the data on sex and age of the harvest.

Sex and Age Structure

Sex and age composition counts were made in the vicinity of Lake Louise during October 1971. Caribou distribution in thick timber necessitated counting from the air. Consequently, the only age classes determined were calves and adults. Calves were identified on the basis of size, color and antler development. Sex of all animals was determined by examination of external genitalia at very low altitude from a Jet Ranger helicopter. Calves made up 18.4 per cent of the sample of 3,540 classified caribou. Cows and bulls over one year of age made up 61.0 per cent and 20.6 per cent, respectively, of the herd. For animals over one year of age, males comprised 25.2 per cent or 33.7 males per 100 females (N = 2888).

Condition of Animals and Their Environment

Animals - No studies or collections were made to determine physical condition of the animals.

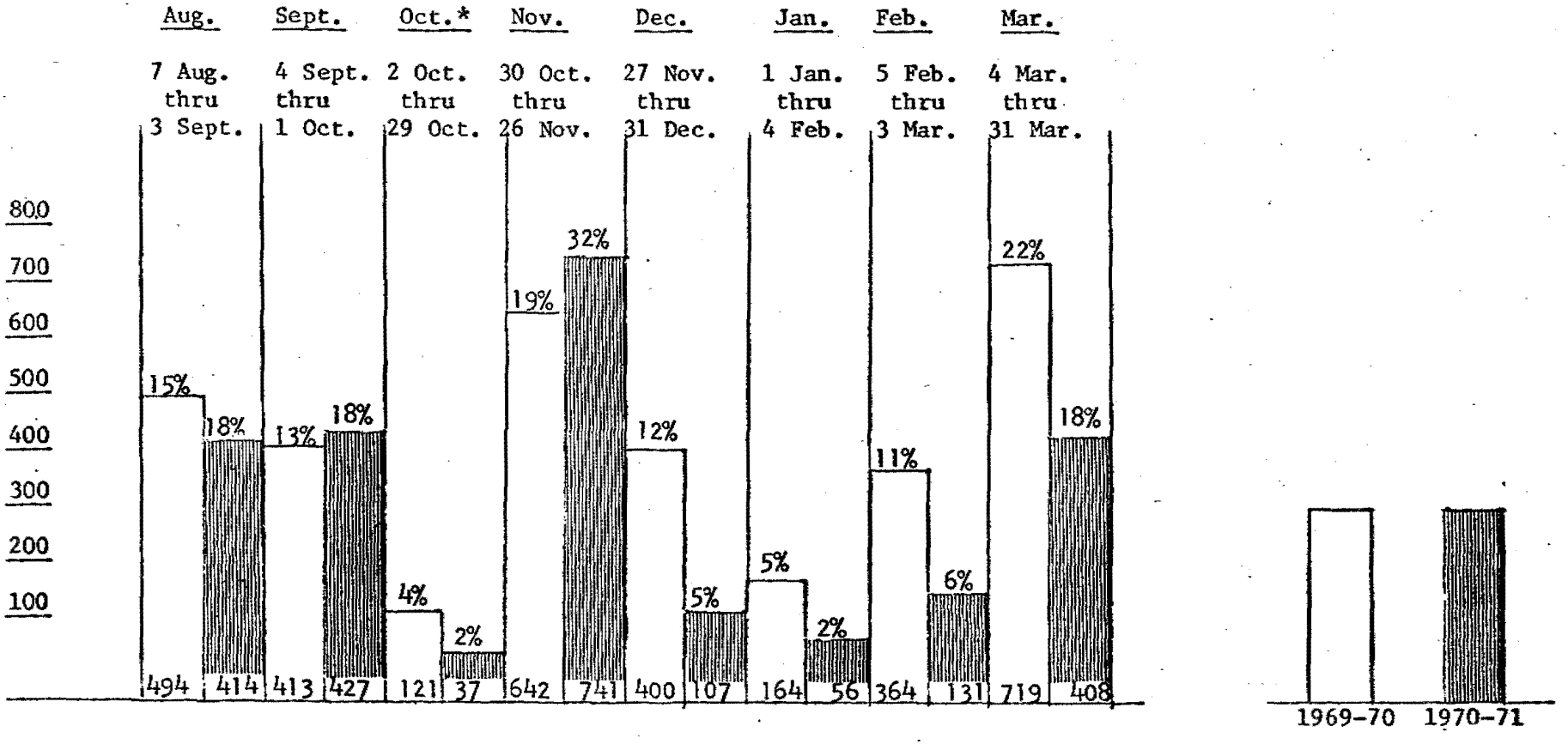
Environment - No range vegetation studies were conducted during the year. The geographical distribution and movements of caribou over the range were recorded from periodic reconnaissance flights. No attempt was made to record distribution according to range type.

Fig. 1. Nelchina caribou herd - harvest chronology 1969-70 and 1970-71.

Actual IBM data, no extrapolation included.

Chronological totals based on IBM returns where time period is known.

Reporting biologist - Jerry Sexton



* Caribou season was closed in Units 11 and 13 during the month of October, 1970. All 37 harvested caribou reported for October were taken from Unit 13.

Table 2. Proportion of hunters taking 0, 1, 2 and 3 caribou - Nelchina herd.

Year	Unsuccessful No.	%	W/1	%	W/2	%	W/3	%	Total Hunters	% Suc. Hunters
1970-71	1415	38.1	1220	37.8	655	17.6	420	11.3	3710	61.9
1969-70	2075	40.0	1549	29.8	807	15.5	753	14.5	3184	60.0

Table 3. Sex and age structure of 1970-71 Nelchina harvest.

Age in Years	Males	%	Females	%	Total	%
0-1	1	33	2	67	3	8
1-2	15	63	9	37	24	6
2-3	43	57	32	43	75	19
3-4	51	61	33	39	84	22
4-5	25	64	14	36	39	10
5-6	21	75	7	25	28	7
6-7	13	57	10	43	23	6
7-8	12	41	17	59	29	7
8-9	9	35	17	65	26	7
9-10	2	12	15	88	17	4
10-11	3	18	14	82	17	4
11+	4	17	20	83	24	6

The majority of the Nelchina caribou herd wintered in 1970-71 on the north and west slopes of Mt. Drum in Game Management Unit 11. They shared a common winter range with the Mentasta herd. A lesser number of the Nelchina animals wintered in the area between the Richardson Highway and Gakona River near Sourdough. The Nelchina animals began moving north and west in April and united with the Sourdough animals. They continued moving westerly and by mid-May, most were west of the Richardson Highway. By the end of May the calving segment was in the area between the Oshetna River north to Clarence Lake and the Susitna River. There were numerous bulls and yearlings in the calving segment. However, it appeared that many of the yearlings and bulls had split off from the main migration in May and had gone up the Oshetna and Black rivers to the south. The animals calved primarily in the Clarence Lake area. Most of the Nelchina herd dispersed throughout the northern part of the Talkeetna Mountains, roughly east of the Talkeetna River, south of the Denali Highway, west of Tyone Creek, north of the Oshetna River, all summer. The calving segment crossed the Susitna River at least four times in May and June. About mid-September, the animals began moving south and east from the Big Bend of the Susitna River, arriving at Lake Louise-Susitna by early October. They rutted in two main groups, one near Crosswind Lake; the other north of Old Man Lake. The animals did considerable wandering until about mid-November when they separated into two groups, some going west toward the Little Nelchina River. The remainder moved easterly along the Glenn Highway through the Glennallen-Sourdough area. Caribou were seen by a Bureau of Land Management helicopter pilot south of the Tazlina River, which is the first recorded sighting that far south. The eastern migration continued through the Chistochina area and apparently these animals joined the Mentasta herd in the vicinity of Drop Creek in Unit 11. Most of these animals were in the timbered country around the Nabesna Road in December, 1971. A few animals were found in the Cantwell-Monahan Flats area during late fall-early winter 1971. Fig. 2 shows locations of major concentrations of Nelchina caribou on winter ranges, calving grounds and summer ranges, as well as spring and fall migration routes.

RECOMMENDATIONS

The accuracy of a population assessment will necessarily depend on the accuracy of the field measurements of basic population parameters--sex and age structure, mortality and recruitment. Sex and age composition counts need to be conducted at standardized times between years. In addition, the criteria for sex and age classification must be standardized. Sex determination for all age classes should be based on external genitalia only. Further work is needed to develop accurate age determination criteria. A knowledge of the extent of sex and age segregation is necessary during times when composition counts are conducted. Such knowledge can be used to compare sex and age ratios from counts made during different seasons of the year. Information on segregation before, during and after the rut period is especially important since composition data gained during the rut are used to extrapolate a total population estimate with the aerial photo census technique.

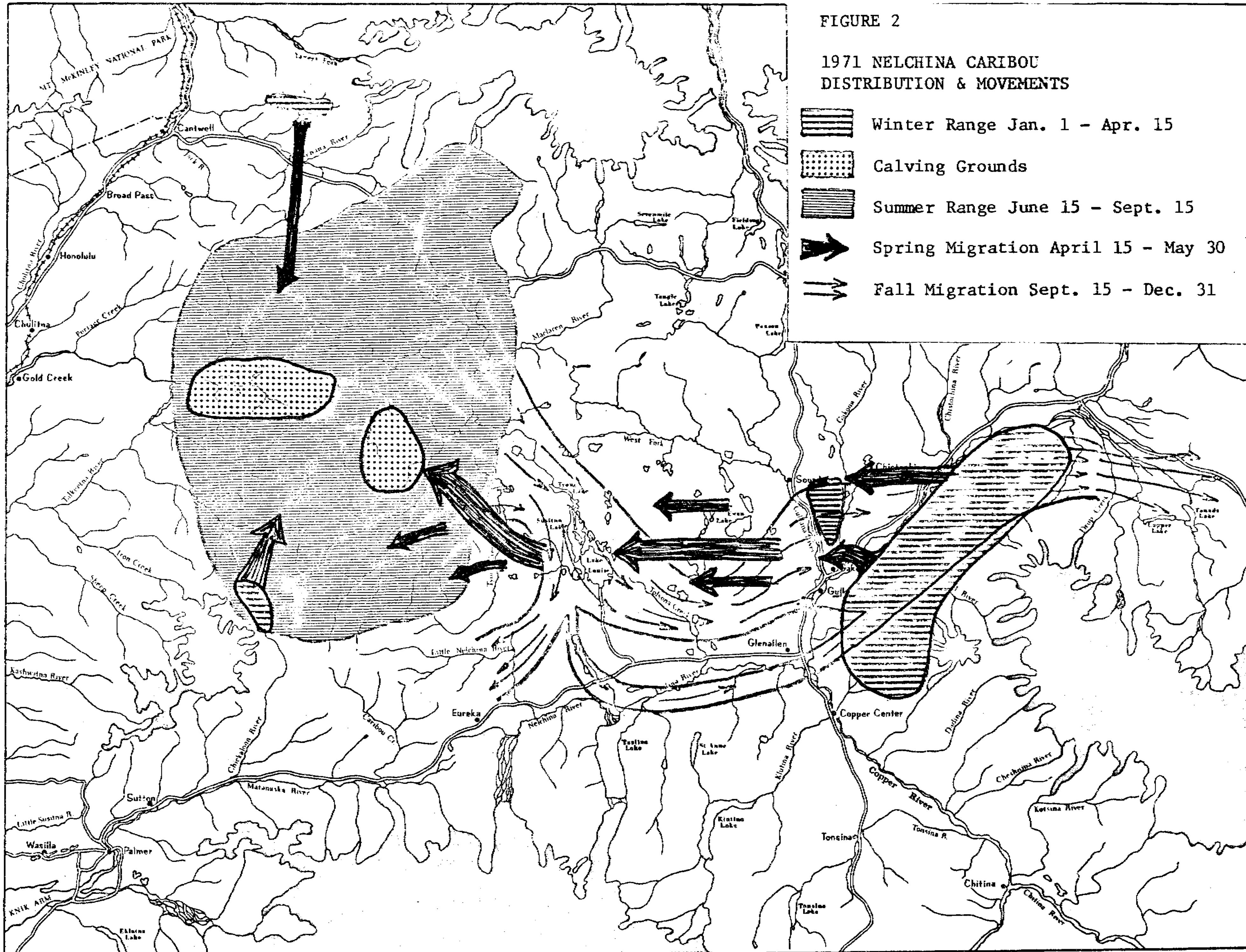


FIGURE 2

1971 NELCHINA CARIBOU DISTRIBUTION & MOVEMENTS

More effort should be extended to determine the level of predation by wolves and the correlation of wolf abundance to predation on caribou. All caribou remains should be examined when possible to determine cause of death and findings of on-going wolf studies relating to population levels and food habits can be considered. Observations of wolves in areas of caribou concentrations should be recorded.

Large samples of accurately sexed jaws should be collected from the harvest (preferably over 10 per cent of the harvest) for age determinations. Such information can be used to determine the age structure of the population.

It is recommended that an effort be made to collect as many female reproductive tracts as possible during the post-rut hunting season. Information from ovarian analysis would provide valuable information on herd productivity and would supplement natality estimates made during the post-calving composition counts.

Much greater emphasis needs to be placed on range studies to 1) continue studies already begun on classical Nelchina range, 2) extend studies to current Nelchina winter ranges in the Mentasta and Wrangell mountains, and 3) ensure continuous yearly evaluations of ranges under study. (Past range work has had a rather discontinuous record of accomplishment, with unfortunate lapses in information.)

Range studies should be directed to establishing a vegetation type map for the Nelchina range, past and present, as well as developing a program for determining condition and trend of the Nelchina Range.

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