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ALASKA DEPARTMENT OF FISH AND GAME
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CARIBOU REPORT

by

Robert E. Pegau

Volume XV
Project Progress Report
Federal Aid in Wildlife Restoration
Projects W-17-5, Jobs 3.3R and 3.5R (2nd half)
and W-17-6, Jobs 3.3R and 3.5R (1st half)

(Printed June, 1974)

JOB PROGRESS REPORT (RESEARCH)

State:	Alaska		
Cooperator:	Robert E. Pegau		
Project Nos.:	W-17-5&W-17-6	Project Title:	Big Game Investigations
Job Nos.:	3.3R	Job Titles:	Caribou Food Habits in Northern Alaska
	3.5R		Exclosure Construction and Caribou Range Vegetation Analysis
Period Covered:	January 1, 1973 to December 31, 1973		

SUMMARY

The vegetation at the exclosures near Ambler and Selawik was reexamined in September 1973. During the four years since establishment of the exclosures there has been no detectable change in the vegetation inside or outside.

Considerable discrepancies were detected in fiber analyses, especially of lichens, conducted in different labs. Acid-detergent fiber and lignin content of lichens are usually very low. Most of the lichen fiber content is a hemicellulose or like substance.

Two papers have been coauthored summarizing all of the testing of the microhistological technique of rumen analysis. Digestion appears to have little effect on the discernibility of plant fragments of most plant species. Over or underestimation of dry weights based on relative density of plant fragments had the greatest effect. Correction factors can be developed for technician error so that relative density of plant fragments can be used to closely estimate dry weights of plant species in a diet.

CONTENTS

BACKGROUND

Caribou (*Rangifer tarandus*) are extensively hunted in Alaska for sport and subsistence by local residents. In some remote areas, residents rely extensively on wild animals, especially caribou, for food. A knowledge of caribou range relationships will aid in formulating management decisions designed 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. A microhistological technique for studying food habits of animals that finely masticate their foods has been developed and validated.

OBJECTIVES

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

PROCEDURES AND FINDINGS

Three separate aspects were investigated to meet the objectives of this project. Each aspect is discussed separately.

Reexamination of Vegetation at Ambler and Selawik Exclosures

The vegetation in all quadrats at the Ambler and Selawik exclosures #1 and #2 was reexamined using the same techniques used in 1969 when the exclosures were built (Hemming and Pegau 1970). The vegetation readings have been tabulated in association tables (Tables 1, 2, 3 and 4) and the photographs compared. There have been no detectable changes during four years inside or outside either exclosure.

Digestion Trials

Samples of forages used in last year's digestion trials (Pegau et al. 1973) and the residues from the nylon bags following digestion were analyzed at the Grassland Biome Lab, Colorado State University, for cell wall content, acid-detergent fiber, lignin, nitrogen and gross energy.

Table 1. Plant cover percentages inside Ambler exclosure. Six transects, 24 quadrats. September 10, 1973.

Species	Transect Number 1	2	3	4	5	6	Ave. Species Comp.	Frequency %	Found in Number of quadrats
Total cover	93	98	93	95	95	94	95		
Moss	.7	1.2	1.2	0.5	1.7	2.0	1.2	83	20
Hierochloe alpina	1.5	1.5	0.5	1.2	0.2	1.0	1.0	54	13
Carex lugens	0.2	0.2	-	0.5	-	0.2	0.2	17	4
Betula nana	2.0	2.0	0.7	1.5	2.0	1.0	1.5	63	15
Empetrum nigrum	0.7	-	2.2	2.7	1.2	2.0	1.5	58	14
Ledum decumbens	1.2	1.5	2.7	2.5	2.0	1.7	1.9	83	20
Loiseleuria procumbens	1.2	1.0	2.7	3.2	1.2	2.5	2.0	79	19
Vaccinium vitis-idaea	0.2	0.5	0.2	0.5	0.2	-	0.3	29	7
Vaccinium uliginosum	0.2	0.5	0.5	0.7	0.2	0.2	0.4	29	7
Arctostaphylos alpina	0.2	-	-	0.7	-	0.2	0.2	13	3
Salix phlebophylla	-	-	-	0.5	-	-	0.1	4	1
Pedicularis Kanei	0.2	0.2	0.7	0.5	0.7	0.5	0.5	50	12
Unidentified forb	-	-	-	0.2	0.5	-	0.1	13	3
Lichens	5.0	5.7	5.2	5.0	5.2	5.7	5.3	100	24
Stereocaulon sp.	2.1	1.7	1.5	1.0	1.5	-	1.3	71	17
Cornicularia divergens	1.2	2.2	1.7	2.0	3.2	4.0	2.4	88	21
Sphaerophorus globosus	-	-	-	-	1.2	0.5	0.3	21	5
Peltigera sp.	-	0.7	-	-	-	-	0.1	4	1
Thamnolia vermicularis	-	-	0.7	0.5	0.7	1.0	0.5	50	12
Cetraria nivalis	1.7	1.7	2.2	2.5	2.2	2.7	2.1	100	24
C. cucullata	1.7	2.0	1.0	0.7	1.5	1.0	1.3	96	23
C. nigricans	0.2	-	0.2	0.2	-	-	0.1	13	3
C. islandica	1.2	1.2	0.2	0.5	0.5	1.0	0.8	63	15
Cladonia rangiferina	1.7	1.2	1.0	1.0	1.0	1.0	1.1	96	23
C. arbuscula	1.5	1.5	1.2	1.5	1.5	1.7	1.5	100	24
C. alpestris	1.2	2.2	1.5	1.7	1.2	1.7	1.6	88	21
C. uncialis	1.0	1.0	1.0	1.2	1.5	1.0	1.1	100	24
C. cup[a]	0.5	0.2	0.2	0.2	0.5	-	0.3	29	7
C. coccifera	1.0	-	-	-	-	-	0.2	13	3
C. boryi	0.2	-	0.2	-	0.2	0.2	0.2	17	4
Alectoria cehroleuca	0.5	0.5	-	0.5	-	1.0	0.4	42	10
A. nigricans	0.7	1.0	1.0	1.0	0.7	1.2	0.9	83	20

[a] *Cladonia* sp., cup lichen.

Table 2. Plant cover percentages outside Ambler exclosure. Ten transects, 40 quadrats. September 11, 1973.

Species	Transect Number 1	2	3	4	5	6	7	8	9	10	Ave. Species Comp.	Frequency %	Found in No. of quadrats
Total cover	98	100	97	85	95	97	98	96	93	95	95		
Moss	0.7	0.7	0.2	1.0	1.0	0.5	0.7	1.2	0.5	0.5	0.7	58	23
Hierochloe alpina	0.2	0.5	0.2	0.7	0.5	0.2	0.5	-	1.0	0.5	0.4	40	16
Carex lugens	-	1.2	0.5	-	0.2	0.2	1.2	1.2	1.0	0.7	0.6	38	15
Betula nana	0.5	0.7	2.5	1.7	1.7	1.7	-	1.0	-	-	1.0	48	19
Empetrum nigrum	0.7	-	0.2	1.0	1.7	1.2	1.7	0.5	2.5	0.7	1.0	55	22
Ledum decumbens	2.2	3.0	2.5	2.7	1.5	3.0	2.2	2.0	1.2	2.0	2.2	95	38
Loiseleuria procumbens	3.0	1.0	1.2	0.7	2.0	2.2	2.2	0.7	1.7	0.5	1.5	75	30
Vaccinium vitis-idaea	0.5	1.7	1.2	0.2	0.2	0.2	1.0	1.0	1.2	1.0	0.8	68	27
Vaccinium uliginosum	-	3.0	1.0	1.0	0.5	1.2	-	1.5	1.0	2.0	1.1	50	20
Arctostaphylos alpina	-	1.0	0.2	-	0.7	0.5	-	1.7	-	-	0.4	25	10
Salix arctica	-	-	0.5	-	-	-	-	-	-	-	T	3	1
Salix phlebophylla	-	-	-	0.5	-	-	-	-	-	-	T	3	1
Pedicularis Kanei	-	-	-	0.5	0.5	0.7	0.5	-	0.5	-	0.3	25	10
Unidentified forb	-	-	-	0.2	0.2	-	-	-	-	-	T	5	2
Lichens	6.0	6.0	6.0	5.0	5.5	6.0	5.2	6.0	5.5	6.0	5.7	100	40
Stereocaulon	1.2	0.2	1.2	2.0	2.2	1.2	0.2	0.7	1.5	2.5	1.3	65	26
Cornicularia divergens	1.0	0.7	1.5	3.2	2.7	3.0	2.0	1.5	2.0	1.0	1.9	73	29
Sphaerophorus globosus	-	-	-	-	-	0.5	-	-	-	-	T	3	1
Thamnolia vermicularis	0.2	0.2	-	0.5	1.2	0.2	-	0.2	1.0	0.5	0.4	38	15
Nephroma arctica	-	-	-	-	-	0.7	-	-	-	-	T	5	2
Cetraria nivalis	1.7	1.0	1.5	1.2	2.2	1.7	2.5	1.2	2.0	1.5	1.6	93	37
C. cucullata	2.0	2.2	1.7	1.2	1.2	2.2	1.2	1.5	1.5	1.7	1.6	100	40
C. nigricans	0.2	0.2	1.0	1.0	1.0	0.2	0.2	-	0.5	1.0	0.5	[illegible]	21
C. islandica	1.0	2.0	0.7	0.7	1.0	1.0	1.0	1.2	1.0	1.5	1.1	85	34
Cladonia rangiferina	2.5	2.5	2.0	1.2	1.2	1.7	2.2	3.0	2.0	2.5	2.1	100	40
C. arbuscula	1.2	1.7	1.7	1.2	1.2	1.5	1.7	2.0	1.5	1.0	1.5	100	40
C. alpestris	3.0	3.0	2.2	1.0	1.5	1.2	2.0	2.0	1.7	1.7	1.9	93	37
C. uncialis	1.0	1.0	1.0	1.0	1.0	1.0	0.7	1.0	1.2	1.0	1.0	98	39
C. cup[a]	-	-	-	-	-	-	0.2	-	0.5	-	T	8	3
C. boryi	0.2	-	-	0.2	0.5	0.5	1.2	1.7	1.7	1.2	0.7	58	23
Alectoria ochroleuca	0.7	-	-	0.5	0.7	-	0.7	0.2	0.7	0.2	0.4	30	12
A. nigricans	0.2	0.2	1.0	0.2	0.7	1.0	0.5	0.2	0.7	1.0	0.6	53	21

[a] *Cladonia* sp., cup lichen.

Table 3. Plant cover percentages inside Selawik exclosure. Six transects, 24 quadrats. September 8, 1973.

Species	Transect Number 1	2	3	4	5	6	Ave. Species Comp.	Frequency %	Found in Number of quadrats
Total cover	100	100	100	99	100	100	100		
Moss	1.2	2.0	1.7	2.7	2.7	4.7	2.5	100	24
Eriophorum vaginatum	3.2	3.2	3.2	3.2	2.2	1.5	2.8	92	22
Carex lugens	-	-	0.2	-	-	-	-	4	1
Carex rotundata	-	-	-	1.0	1.2	1.5	0.6	25	6
Betula nana	2.7	2.7	2.0	2.0	1.2	1.0	1.9	79	19
Ledum decumbens	3.5	3.2	4.0	3.0	2.7	1.0	2.9	88	21
Vaccinium vitis-idaea	2.0	1.7	1.5	1.2	1.0	0.5	1.3	92	22
Vaccinium uliginosum	1.7	0.7	1.0	1.7	1.2	0.5	1.1	67	16
Arctostaphylos alpina	-	-	-	0.7	-	-	T	4	1
Andromeda polifolia	-	-	-	1.0	1.0	1.0	0.5	25	6
Rubus chamaemorus	1.5	1.5	1.7	0.7	1.0	0.5	1.2	71	17
Lichens	4.0	4.2	4.2	3.0	5.0	2.5	3.8	92	22
Cetraria cucullata	2.2	2.2	2.2	2.0	2.5	0.7	2.0	92	22
C. islandica	1.0	1.0	1.0	0.7	1.7	1.0	1.1	83	20
C. nivalis	-	0.7	0.7	0.2	1.0	0.2	0.5	50	12
Cladonia rangiferina	1.5	1.7	1.7	1.0	2.7	1.7	1.7	88	21
C. arbuscula	1.7	2.0	2.2	1.2	1.5	1.2	1.6	88	21
C. uncialis	-	-	-	-	0.7	-	T	13	3
C. alpestris	0.2	0.7	0.2	0.2	0.7	0.5	0.4	46	11
C. boryi	-	-	-	-	0.2	-	T	4	1
C. amaurocraea	0.2	0.2	-	0.2	0.2	0.2	0.2	25	6
C. small cup[a]	-	-	-	-	-	0.2	T	4	1

[a] *Cladonia* sp., cup lichen.

Table 4. Plant cover percentages outside Selawik exclosure. Ten transects, 40 quadrats. September 9, 1973.

Species	Transect Number 1	2	3	4	5	6	7	8	9	10	Ave. Species Comp.	Frequency %	Found in No. of quadrats
Total cover	98	100	99	100	100	100	100	100	100	99	99		
Moss	2.0	2.7	1.7	1.2	3.5	1.7	4.7	3.0	2.2	2.2	2.5	100	40
Eriophorum vaginatum	3.5	3.5	3.7	3.0	2.7	3.2	3.0	2.7	2.5	2.5	3.0	100	40
Carex lugens	-	0.2	-	0.5	0.2	-	1.2	1.7	1.2	1.0	0.6	33	13
Carex rotundata	-	-	-	-	0.2	-	-	-	-	-	T	3	1
Betula nana	2.2	1.2	2.5	2.0	1.5	2.5	0.5	2.0	1.5	1.0	1.7	75	30
Ledum decumbens	3.2	2.5	2.7	3.2	2.5	2.5	2.2	3.0	3.5	3.5	2.9	100	40
Vaccinium vitis-idaea	1.2	1.7	1.2	1.0	1.2	1.0	1.0	1.2	2.5	1.7	1.4	100	40
Vaccinium uliginosum	1.0	2.5	1.0	0.7	1.5	0.5	2.7	0.7	1.5	1.7	1.4	63	25
Empetrum nigrum	1.0	1.2	0.5	-	-	-	-	-	-	0.2	0.3	15	6
Arctostaphylos alpina	-	-	-	-	-	0.2	-	-	-	-	T	3	1
Oxycoccus microcarpus	-	-	-	-	0.2	-	-	-	-	-	T	3	1
Andromeda polifolia	-	-	-	-	0.5	-	0.2	-	-	-	T	8	3
Rubus chamaemorus	0.2	1.2	0.7	1.0	1.5	0.5	1.0	1.5	1.5	1.2	1.0	80	32
Lichens	3.7	3.7	3.2	4.5	2.7	4.2	3.5	3.7	4.2	4.7	3.8	100	40
Cetraria cucullata	2.0	1.7	2.0	2.0	1.2	2.0	2.2	2.5	2.5	2.2	2.0	100	40
C. islandica	1.0	1.2	1.0	1.0	0.7	1.0	1.2	1.2	1.2	1.0	1.1	95	83
C. nivalis	0.5	0.2	0.2	0.5	-	0.2	0.2	0.2	0.2	0.2	0.2	28	11
Cladonia rangiferina	1.7	1.7	1.2	1.7	1.2	1.5	1.5	1.0	1.0	1.7	1.4	98	39
C. arbuscula	1.0	1.5	1.5	1.5	1.0	1.2	1.7	1.7	2.0	2.0	1.5	98	39
C. alpestris	0.2	0.2	0.5	0.7	0.2	-	0.7	-	0.2	-	0.3	28	11
C. uncialis	-	-	-	-	-	0.2	-	-	-	0.2	T	5	2
C. amaurocraea	-	0.2	-	-	0.4	0.2	0.2	-	-	0.2	0.1	5	6
C. small cup[a]	-	-	0.2	-	0.4	0.2	-	-	-	-	T	10	4

[a] *Cladonia* sp., cup lichen.

Unfortunately, however, considerable discrepancies existed between results from the Grassland Biome Lab and the same or similar samples analyzed by Mr. Steve Person at the Institute of Arctic Biology, University of Alaska. A group of 16 samples was then sent to the Institute of Agricultural Sciences at Palmer, in an effort to determine which analyses were correct. These results (Table 5) and subsequent correspondence with Dr. Van Soest, the principal developer of the fiber analysis techniques, indicate that the analyses from the Grassland Biome were apparently erroneous, particularly acid-detergent fiber and lignin of lichens. Analyses of lichens at the Institute of Arctic Biology and the Institute of Agricultural Sciences show that their ligno-cellulose content is usually very low. Cell wall content of the lichens tested, except *Cetraria cucullata*, was similar or slightly higher than vascular plants, thus the major component of the lichen fiber is hemicellulose or a like substance (Van Soest and Moore 1965). We are currently corresponding with the Grassland Biome Lab to determine if the error in their analyses can be found. Until then the data are not being used.

Rumen Analysis

Two papers have been coauthored with Boyd Dearden and Richard M. Hansen which compile and present the data from this study. A brief synopsis of each is presented.

Plant fragment discernibility in caribou rumens.
B. L. Dearden, R. E. Pegau, and R. M. Hansen
Proceedings of 1st International Reindeer/Caribou Symposium. (In press.)

> A microscopic technique was used to identify and quantify plants found in 57 rumens of Alaskan caribou. Thirty-two categories of plants were identified in the analyses. There were eight forage plants that individually comprised at least one percent of the diets of these caribou.
>
> Eight hand-compounded mixtures of 19 species of plants, each containing from 5 to 12 species, were used to observe variation between species and functional categories of plants for over or underestimation by technicians of percent dry weights. The predictive equations, $Y = (c)\ X$, for the hand-compounded mixtures of the major species of plants identified in the rumens of caribou each showed a high correlation between the estimated percent relative density (X) and the actual percent dry weight (Y). This relationship was not strictly 1:1, but little difference in a corrected or uncorrected mean estimate of dry weight was observed for a majority of the plants. Correction factors "c" were calculated to determine the technicians' degree of over or underestimation of each plant species. It appeared that trained technicians could usually record the frequency of plant species fragments in undigested mixtures containing plants that have a distinct cellular

Table 5. Fiber analysis of forages used in digestion trials in 1972, by different labs. Values in percent.

Sample	Lab[a]	CWC[d]	ADF[e]	Lignin
1. Purina Cattle Starter	GB	68.0	39.9	8.9
1. Purina Cattle Starter	IAS	48.2	27.0	4.3
1. Purina Cattle Starter	IAB	46.4	27.2	3.0
2. Standard Reindeer Forage	GB	72.2	48.2	9.3
2. Standard Reindeer Forage	IAS	68.6	29.9	5.5
3. *Carex aquatilis*-feed	GB	74.2	50.1	12.9
3. *Carex aquatilis*-feed	IAS	70.9	39.5	6.9
4. *Eriphorum vaginatum*	GB	74.2	53.1	12.5
4. *Eriphorum vaginatum*	IAS	76.3	48.9	8.3
5. Brome-feed	GB	64.2	36.5	9.0
5. Brome-feed	IAS	66.6	40.4	5.9
6. *Festuca altaica*	GB	72.6	48.5	13.8
6. *Festuca altaica*	IAS	70.1	46.9	5.2
7. Bluegrama - Colorado	GB	72.5	45.1	13.1
7. Bluegrama - Colorado	IAS	77.8	42.3	4.7
8. *Salix pulchra*	GB	72.4	48.1	12.9
8. *Salix pulchra*	IAS	27.0	32.2	18.0
9. *Vaccinium vitis-idaea*	GB	87.6	46.6	14.8
9. *Vaccinium vitis-idaea*	IAS	46.1	49.1	25.8
10. Lichens-feed	GB	70.0	50.1	11.9
10. Lichens-feed	IAS	83.4	13.3	4.9
11. *Cladonia alpestris*	GB	85.2	62.4	14.1
11. *Cladonia alpestris*	IAS	83.3	2.9	0.4
11. *Cladonia alpestris*	IAB	83.3	2.3	3.6
12. *Cetraria cucullata*	GB	67.4	41.7	9.2
12. *Cetraria cucullata*	IAS	35.2	2.9	0.7
12. *Cetraria cucullata*[b]	IAB	31.6	3.7	4.3
13. *Cetraria nivalis* - Kenai	GB	70.1	42.2	10.3
13. *Cetraria nivalis* - Kenai	IAS	55.9	6.2	1.7
14. *Stereocaulon rivulorum* - Kenai	GB	74.2	50.2	15.1
14. *Stereocaulon rivulorum* - Kenai	IAS	79.9	15.9	7.0
15. *Stereocaulon alpina*	GB	80.1	56.9	16.1
15. *Stereocaulon alpina*	IAS	66.6	16.2	8.2
16. *Sphagnum magellanicum*	GB	72.4	57.9	11.9
16. *Sphagnum magellanicum*[c]	IAS	92.3	68.7	11.3

[a] GB = Grassland Biome Lab, CSU; IAS = Institute of Agricultural Science, Palmer; IAB = Institute of Arctic Biology, Fairbanks.

[b] Same species but not from the same collection.

[c] Same species collected from same area one year later than sample analyzed by GB.

[d] CWC = Cell wall content.

[e] Acid detergent fiber.

pattern, but the dry weights of a few species are over or underestimated because they have epidermal cells that are either easy or difficult for a technician to identify.

Precision of microscopic estimates of large herbivore diets. B. L. Dearden, R. E. Pegau, and R. M. Hansen Journal of Wildlife Management (Submitted).

This study compared the percentages of plant species estimated by the microhistological technique when residues of the same material received digestion treatments and simulated digestion treatments. It was hypothesized that different plant species varied in their microscopically discernible characteristics and each might be altered during digestion.

Eight major forage plants consumed by reindeer were hand-compounded to simulate the relative proportions that might occur in their diets. Rumen and fecal samples were collected from the reindeer while they were on this diet. Microdigestion trials using nylon bags were conducted with reindeer, bison and cattle.

Adjustment for the technicians' degree of over or underestimation of the relative density accounts for the majority of the differences between the dry weights and the adjusted relative density regardless of whether digestion has taken place or not. Apparently digestion reduces the mean weight of fragments rather than eliminating the whole fragment.

RECOMMENDATIONS

The vegetation at the Ambler and Selawik exclosures should be reexamined in 1979. Periodic maintenance checks of the exclosures should be continued.

Rumen samples and fecal pellets from hunter-killed caribou from different ranges should be examined by the microhistological technique.

LITERATURE CITED

Hemming, J. E., and R. E. Pegau. 1970. Caribou Proj. Annu. Prog. Rep., Alaska Dept. Fish and Game, Fed. Aid. Wildl. Rest., W-17-1 and W-17-2, Jobs 6 and 3.3R. Juneau, Alaska. 42pp.

Pegau, R. E., G. N. Bos, and K. A. Neiland. 1973. Caribou Proj. Annu. Prog. Rep., Alaska Dept. Fish and Game, Fed. Aid Wildl. Rest., W-17-4 and W-17-5, Jobs 3.3R and 3.5R. Juneau, Alaska. 68pp.

Van Soest, P. J., and L. A. Moore. 1965. New chemical methods for analysis of forages for the purpose of predicting nutritive value. Proc. 9th Int. Grassland Congr., Sao Paulo, Brazil, Paper 424.

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