PROGRESS REPORT

CARIBOU PRODUCTIVITY AND RANGE INVESTIGATION, ADAK ISLAND, ALASKA.

November 1981

THIS IS A PRELIMINARY REPORT.

DATA SHOULD NOT BE USED FOR PUBLICATION.

by M. Masteller, B. Reiswig, and P. Beach

Key Words: Caribou
Aleutian Islands

ALEUTIAN ISLANDS UNIT
ALASKA MARITIME NATIONAL WILDLIFE REFUGE
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The 1981 Caribou (Rangifer tarandus) Producitivity and Range Investigation consisted of 5 major concentrations; winter work in February and March, a May calving survey, summer and fall range work, a peak-of-the-rut count in October, and repairs to range exclosures. This report will outline the methods used for each concentration, and the results obtained. Since this is an on-going project, this report will include only work done through October 1981.

STUDY AREA

Adak Island, lying at approximately 51° 50'N, 176° 40'W, is about 1,200 miles west-southwest of Anchorage, Alaska. It comprises about 290 square miles and is deeply indented with bays and inlets. The central portion is mountainous, glacially dissected, and has extensive lowland areas around the perimeter. The temperature at sea level in summer averages 47.8° F; the annual average is 40.6° F. Average annual precipitation, all forms, is 64.71 inches.

The winter work, involving collection of rumen samples and measurements, was completed in the Three-Arm Bay area of the island (Fig. 1). The locations of the other facets of the project are discussed later.

ACKNOWLEDGMENTS

The help of the following people is gratefully acknowledged; S. Kendall, L. Slater, J. Logan, D. Kafka, J. Mueller, J. Arnold, T. Varnell and C. Matson. Thanks go to Martha Terry as well, who worked on vegetation transects as a volunteer. The people of Ships Division, Naval Station Adak, and especially the Tug crews, were particularly helpful in providing transportation around the island. Field crews welcomed the cooperation given by the hunters in obtaining caribou rumen samples and measurements.

CARIBOU PROJECT CONCENTRATIONS

Winter Work, February and March

Winter work included the collection of rumen samples and measurements from 16 hunter-killed caribou. The results from rumen analysis will be used to investigate the relationship between animal condition and range use.

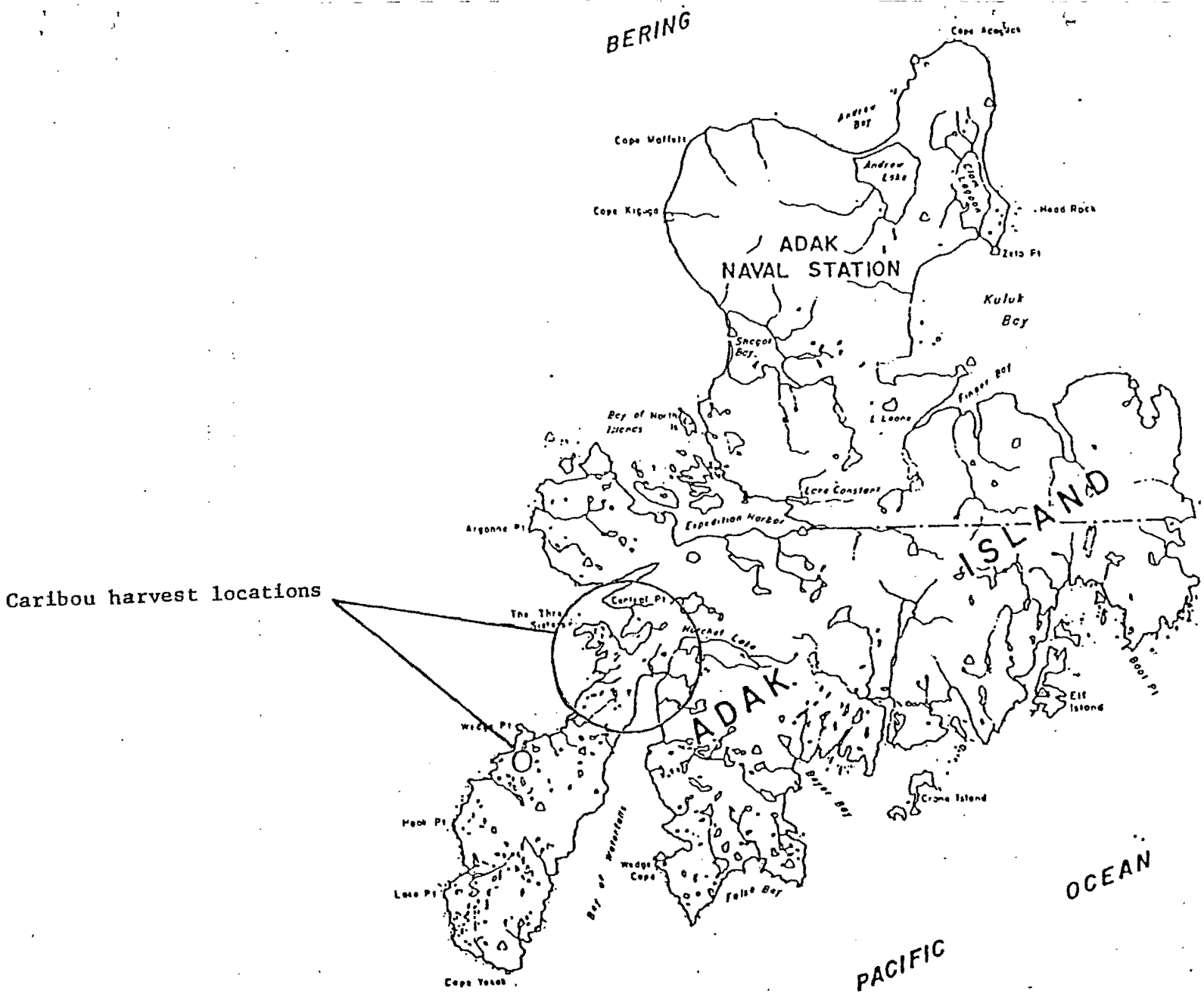


Fig. 1. Adak Island and caribou harvest Locations, Three-Arm Bay area, February and March, 1981.

Methods and Materials

The following materials were used for rumen sample collection:

3N Phosphoric acid
100 gram scale
Small measuring flask marked at 5 and 9 ml.
Cheesecloth
Sample containers (125 ml plastic bottles)
Small plastic weighing bag
Marine map (scale 1:25,000; Adak Island section maps)
Marking pens
Tape
Collection instructions
Knife and whetstone
Ice
Write-in-the-rain notebook
pencil

Formalin was used to preserve female reproductive tracts. A measuring tape was used to record measurements.

After locating a hunter-killed caribou, data collection depended on the stage the caribou was in while being field dressed. The measurements taken were total length of the caribou, which is a straight line measurement from tip of the nose to the posterior edge of the last bone in the tail; and the hind leg length, which was measured from the point of the hock to the tip of the hoof. Additional measurements of the femur and metatarsus were initiated in August 1981 (Fig. 2).

Rumen samples were collected as soon as possible after the death of the animal. If more than 5 hours elapsed after the kill, samples were not taken. If the biologist reached the caribou within 5 hours of its death, 4 samples were obtained. The rumen was cut open, and a portion of its contents were placed in cheesecloth. Fifty ml of rumen liquid was strained through the cheesecloth into a collection bottle and 5 ml of 3N Phosphoric acid was added to stop microbial action. This rumen liquor was labelled "L". The material in the cheesecloth was then washed in clear water. One hundred grams of the washed plant material were placed in a collection bottle, 9 ml of 3N Phosphoric acid was added and mixed thoroughly. A second washed plant material sample was also collected. Both of these were labelled "P". Next, 100 grams of unwashed, unstrained rumen material was placed in a collection bottle and 9 ml of 3N Phosphoric acid was added and mixed thoroughly. This was labelled "W". The entire reproductive tract was collected from females and preserved in formalin. The ends of the tract were tied off to prevent loss of blastocysts. If the entire tract wasn't found the animal was checked as thoroughly as possible for a fetus. Half of the lower jaw was collected for aging. Latitude and longitude from U. S. Marine Corps map coordinates were recorded for each kill location. Data was recorded in a notebook and transfered to data forms (Fig. 3). Each caribou was assigned a sample number. This number was

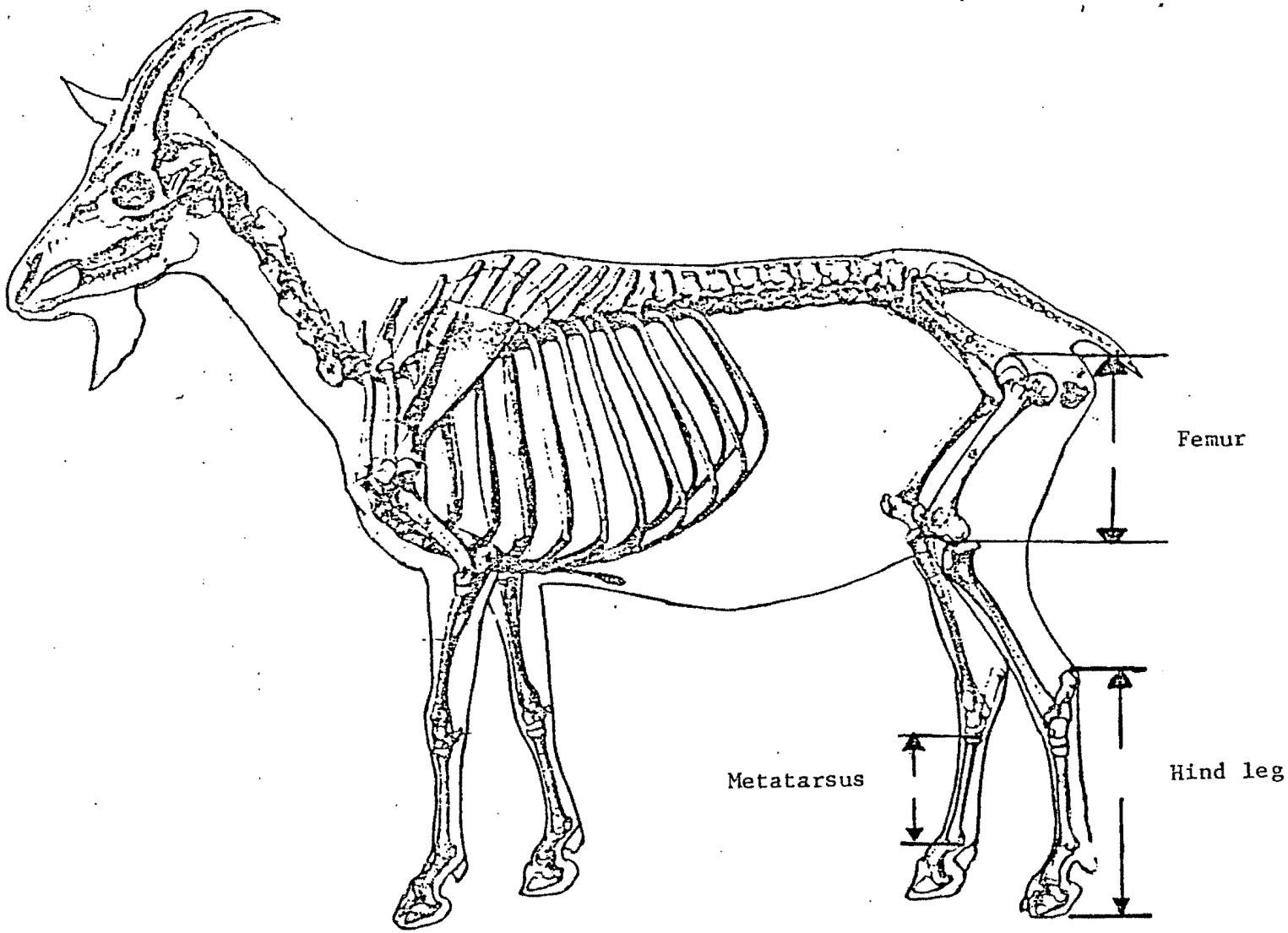


Fig. 2. Leg measurements taken from hunter-killed caribou, Adak Island, Alaska.

CARIBOU MEASUREMENTS AND RUMEN DATA SHEET

Sample # _____

Date _____

Location _____

Observer _____

Coll. Time _____

Time EL. _____

Weather _____

Time El
to Freeze _____

Sex _____

Pregnancy _____

Age _____

MEASUREMENTS

Total Length _____

Hind Leg _____

Femur _____

Metatarsus _____

COLLECTIONS

Femur ____

Rumen Liquor ____

Unwashed rumen material ____

Washed Rumen material I ____

Washed Rumen material II ____

Reproductive tract ____

Jaw ____

COMMENTS

Fig. 3. Data form for collection of caribou rumen samples and measurements; Adak Island, Alaska.

placed on sample bottles, along with the sample type, immediately after collection. All rumen samples were frozen as soon as possible and a permanent label was attached with the following information:

Date
Latitude
Longitude
Sex; 0 = male, 1 = female
Sample number (caribou kill number)
Hunter's name
Type of sample; L = liquor, P = washed plant material, W= whole rumen sample.

Upon arrival at refuge headquarters, 1 of the 2 washed plant material samples was dried at less than 50°C in the drying oven. The second washed plant material sample was kept frozen, and will be used, along with a reference collection of dried plant samples, for food habits analysis. The liquor, whole rumen, and dried washed plant material samples were sent to the Institute of Arctic Biology, University of Alaska, Fairbanks, and to the Agricultural Experiment Station, Palmer Research Center, for proximate analysis (using the Van Soest method).

Results

Rumen samples were submitted for analysis in June 1981, and analyzed for the following:

Percent Nitrogen
Percent Phosphorus
Percent Calcium
IVDMD
ADF
NDF
Cellulose
Lignin
Ash
Volatile Fatty Acids

A total of 32 samples from 12 caribou were sent for analysis (Table 1). All analysis have not yet been completed. Measurements were obtained from 16 caribou. Sixteen caribou jaws sent to the Alaska Department of Fish and Game (ADF&G) for aging were lost in the mail. Two of the 16 jaws were aged accurately before being sent to ADF&G. Thirteen of the 16 caribou harvested were female; of these, 10 (80%) were pregnant (Table 2).

Table 1. Rumen sample analyses calculated on dry matter at 110°C using the Van Soest procedures. Washed plant material is indicated by "W", unwashed plant material is indicated by a "U".

Animal number	Per cent dry matter from 60°C to 100°C		Average per cent NDF (cell walls)		Average per cent ADF		Average per cent Cellulose		Average per cent residual insoluble Ash.		Average per cent Lignin		Per cent Nitrogen		Per cent Phosphorous		Per cent Calcium	
	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W	U	W	U
100	95.5	95.5	57.2	44.5	20.9	14.2	12.2	7.6	1.3	2.5	7.4	4.1	2.91	3.61	1.76	1.96	.25	.29
101	93.0	95.4	43.6	42.1	13.9	12.4	7.2	6.2	0.3	0.7	6.5	5.6	3.35	3.21	1.97	1.76	.22	.12
103	95.3	95.0	55.2	47.3	14.0	14.7	6.8	7.6	0.5	0.3	6.7	6.8	2.73	2.88	1.88	1.63	.11	.19
105	93.0	95.0	39.0	42.6	16.1	14.2	9.2	8.3	0.5	0.3	6.5	5.5	2.78	3.36	2.05	1.87	.33	.37
106	93.3	95.7	48.2	53.5	21.3	16.6	12.9	8.6	0.5	1.4	7.9	6.6	2.78	2.95	1.78	1.67	.13	.24
107	93.1	94.9	44.4	43.6	14.2	12.3	7.7	7.8	0.3	0.04	6.2	4.4	2.95	2.74	2.10	1.60	.57	.52
108	95.7		54.3		22.3		12.6		2.0		7.7		2.75	2.50	2.50		.28	
109	93.8		48.0		17.4		9.8		1.1		6.5		2.97	1.84	1.84		.17	
110	95.6	95.6	52.7	50.0	12.9	10.6	6.3	4.9	1.1	0.5	5.5	5.3	2.95	3.04	2.31	2.33	.21	.21
111	94.7	95.6	52.1	44.9	17.5	13.7	10.0	6.9	2.2	1.0	5.3	5.9	2.86	3.17	2.60	2.47	.22	.21
114	95.6	95.5	43.6	58.5	20.9	14.6	13.1	9.1	0.7	0.4	7.0	5.1	2.50	3.98	2.60	2.48	.45	.46
115	93.3	96.1	41.8	62.5	19.8	23.3	10.8	14.6	0.7	0.3	8.4	8.3	3.45	2.29	2.21	2.33	.40	.41

Table 2. Caribou measurements, age, sex and pregnancy data from 1981 winter work.

Animal Number	Hind leg lgth (cm)	Total lgth (cm)	Age	Sex	Pregnancy
100	56	175		F	no
101	60	160		F	single
102	60	190		M	-
103				F	single[b]
104				F	single
105	58	175		F	single
106				F	single
107	56	180		F	single
108	61	199	5[a]	F	single
109	58	210		F	single
110				F	no
111	52	169		M	-
112				F	no
113	52	183	2	F	single
114	53	191		F	single
115	60	188		M	-

[a]Caribou jaws were sent to the Alaska Department of Fish and Game for aging. Two jaws were aged prior to being sent, the rest were lost in the mail.

[b]Pregnancy reported by hunter, not confirmed by biologists.

Discussion/Recommendations

There was variable delay in reaching the caribou after they were shot. It is advisable to hike with or near a hunting party for quickest access to the harvested caribou. Notifying the hunters of the samples needed and why samples are being collected encourages hunter cooperation. Measurements can only be obtained if the biologist arrives immediately after the kill, before the hunters dress their animals. Plenty of ice is needed to keep rumen samples frozen. Reproductive tracts are not frozen.

May Calving Survey

Methods and Results

A caribou calving survey was conducted during 18-23 May 1981, in the area of Beyer and Hidden Bays. Daily hikes were made using the field cabin at Hidden Bay as a base camp. Also, a 1-day trip was taken on 1 June to the area south of Big Thumb Bay. A pair of Leitz 10X40 binoculars and a spotting scope (15-45X) with a tripod were used to classify animals. Observations were noted on standard form (Fig. 4). A total of 106 caribou (including duplicates) were seen in 32 observations. In an aerial survey on 7 May, flown with a Grumman Goose, 87 caribou were seen in the Hidden Bay - Beyer Bay area.

Females were identified by presence of antlers, urinating posture and udder development. In the Hidden and Beyer Bay areas, 14 of 23 animals (60%) identified as female were accompanied by calves. The calves varied in age from a few hours to 2-3 days. No twins were observed, nor were any yearlings seen with calves. Of the remaining 9 females, 5 had either 1 or 2 antlers. One female (antlered) was noticeably pregnant, while 1 (no antlers) was determined not to be pregnant. It could not be determined if the other 3 were pregnant. Of the remaining 67 caribou in that area, there were 10 males, 18 yearlings and 39 unidentified. Cow-calf pairs were seen from 10-390 m (30-1300 ft) in elevation, and 8 of the 14 cows seen with calves had either 1 or 2 antlers. It is estimated that 10 percent of all breeding cows in the Adak herd were observed.

During the hike near Big Thumb Bay, 1 cow-calf pair were the only animals seen. The cow did not have antlers. Appendix 1 contains a list of observations.

Discussion

On the basis of the observations, it is felt that the Adak caribou herd does not use a particular area for a calving ground. Cow-calf pairs were seen at higher elevations than expected, often among high patches of snow where there was very little vegetation.

Parturient females tend to be isolated and therefore more difficult to locate, especially in the rugged terrain found on Adak. Since only a low number of females were seen, it would not be correct to assume that only 60% of all cows of breeding age were pregnant. The rate of increase of this herd would also contradict this assumption.

It is suggested that this survey be conducted a few weeks later in the season, around the beginning of June, when the animals may be in post-calving groups. It would also help to have observers at Chapel Cove as well, to achieve more coverage of the island.

CARIBOU OBSERVATION FORM

OBSERVER _____ DATE _____

INITIAL TIME _____ FINAL TIME _____

% CLOUDS _____ WINDSPEED _____ DIR _____

GEN. WEATHER CONDS. _____

_____

LOCATION (Start)_____ (End)_____

ELEV. _____ SLOPE _____ASPECT _____

VEGETATION TYPE _____

_____

GROUP COMPOSITION

Males _____

Females _____

Ylngs _____

Calves _____

Unident. _____

TOTAL _____

REMARKS (nursing, spacing, aggression, etc.)

ACTIVITY

Feeding _____

Bedding _____

Traveling _____

Fig. 4. Observation form used for caribou work.

Caribou Range Investigation

The caribou range investigation was also divided into 5 concentrations; mapping and calculating the area of the winter range, determination of vegetation types on the winter range, vegetation transects, random vegetation point sampling, and developing a plant collection for mineral and protein analysis.

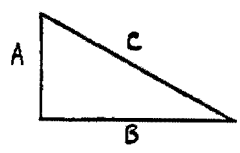
Mapping Winter Range

Methods and Results

The potential caribou winter range was delineated as those areas below 182 m (600 feet) in elevation and south of the military reservation, except for Thumb Valley, Gannet Valley, Scabbard Bay and the Kagalaska Straits area (Fig. 5). A large map of Adak (scale 1:25,000) was assembled for delineation of the winter range boundaries. Then a grid square was constructed from clear plastic, using the km-square blocks (already on the map) as a reference. Each grid square was then of a known area. The winter range was divided into sub-units and the area of each determined by counting grid squares.

It was then necessary to adjust the area of each sub-unit to allow for topographical variation, since actual area differs from that obtained from a flat map. This was done by placing a dot grid over 5 sections of the winter range and randomly selecting 20 points in each section. The selected areas were Caribou Peninsula, Yakak Peninsula, Chapel Cove, Hidden Bay and Boot Bay. After a point was selected, a 1 cm line representing 0.25 km on the 1:25,000 scale map was drawn perpendicular to the contour lines and the number of contour lines crossed was recorded. An average number of contour lines crossed was obtained for each section of 20 points, yielding the average change in elevation for a 0.25 km line on a flat map. Since contour intervals were in feet, the values were converted to meters. This number was then multiplied by 0.004 to obtain the average change in elevation per kilometer. To obtain the actual distance represented on a flat map by a line 1 km long, the Pythagorean formula for right triangles was used:

A = average change in elevation (km)
B = 1 km on a flat map
C = actual distance (km) on ground



$$A^2 + B^2 = C^2 \quad \text{or} \quad C = \sqrt{A^2 + B^2}$$

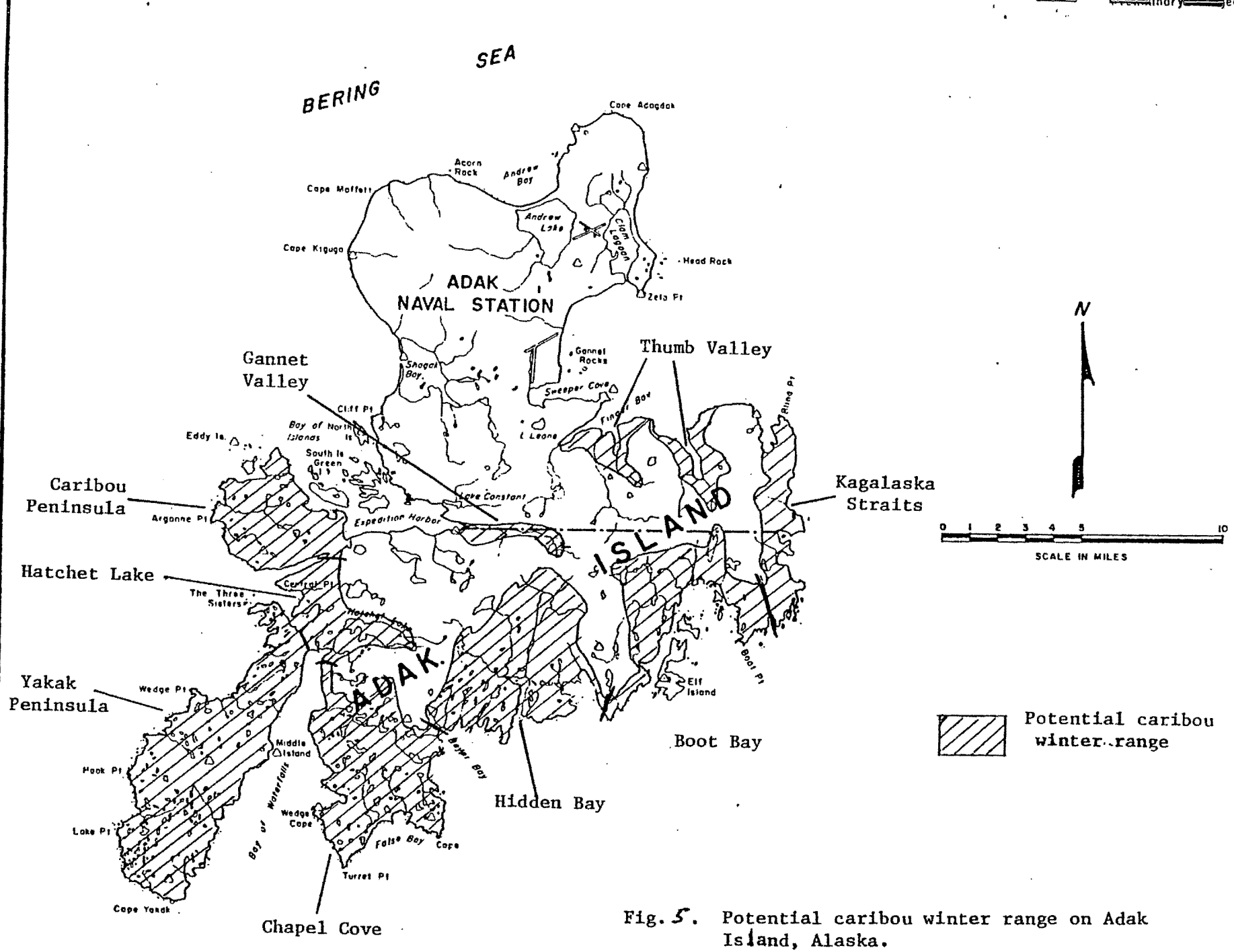


Fig. 5. Potential caribou winter range on Adak Island, Alaska.

The value obtained in C was then squared to yield the correction factor to adjust area on a flat map to actual area. Areas determined for each sub-unit were adjusted using the correction factor applicable (Table 3).

Table 3. Sub-units of potential caribou winter range and their respective areas, both as measured on a flat map and after adjustment with a correction factor to determine actual area.

Sub-unit	ha winter range-flat	correction factor	ha winter range-corrected	% of winter range
Yakak Peninsula	8503	1.005	8545	27.5
Hidden Bay	5135	1.029	5284	16.5
Chapel Cove	4816	1.029	4956	15.5
Boot Bay	3460	1.029	3560	11.2
Caribou Peninsula	3266	1.016	3318	10.5
Hatchet Lake	2392	1.029	2451	7.7
Kagalaska Straits	1968	1.029	2025	6.4
Thumb Bay	870	1.029	895	2.8
Gannet Valley	583	1.029	600	1.9
Total	30983		31634	100.0

As expected, the correction factors for Yakak and Caribou Peninsulas were lower than those for the rest of the island, since the peninsulas have less topographical variation. The correction factors obtained for the Chapel Cove, Hidden Bay and Boot Bay areas were so similar that an average of those values was used as the correction factor for all sub-units except Yakak and Caribou peninsulas. The actual total area, after adjustment for topography, was 2.1% larger than that measured on the flat map.

Determination of Vegetation Types

Methods

Vegetation types in the caribou winter range on the island were determined by 2 on-the-ground surveys conducted by 2-person teams backpacking over selected areas. One team went from Finger Bay to Beyer Bay and then to Camel Cove; the other surveyed Yakak and Caribou Peninisulas, going from Wedge Point to Unalga Bight. Color photographs of the different vegetation types were taken with a 35mm camera.

Results

Five vegetation types were identified: seashore, lowland meadow, heath, fen and alpine meadow. Table 4 briefly describes the 5 vegetation types. Non-vegetative types on the island included open water and inland bedrock, for a total of 7 community types.

Table 4. Description of the 5 vegetation types identified on the caribou winter range, Adak Island, Alaska.

1. Seashore - Elymus mollis and Calamagrostis spp. are dominant grasses, with Heracleum lanatum the dominant forb. Vegetation may reach up to 150 cm in height. Found near the ocean, along low-elevation lakes, and in steep moisture seeps.

2. Lowland Meadow - Calamagrostis spp. and Carex spp. are dominant. Other grasses include Poa spp., Phleum spp. and Agrostis spp. Vegetation up to 60 cm in height, covering low meadows and hillsides. May contain Empetrum nigrum but it is not a dominant species.

3. Heath - Empetrum nigrum, Carex spp. and Cladonia (lichen) spp. are dominant. Many forbs (Anemone spp., Lupinus spp., Geum spp.) as well. Vegetation up to 40 cm tall. This is the most common vegetation type on the island.

4. Fen - Carex spp. dominate, along with various rushes (Juncus spp. and Luzula spp.). Many forbs also, but vegetation generally not over 30 cm tall. Found on flat or gently sloping wet areas. May contain Empetrum nigrum but the type is distinguished by its wetness.

5. Alpine Meadow - Empetrum nigrum mixed with Vaccinium spp. and sparse Carex spp. Some low-growing forbs as well (Anemone spp., Lupinus spp., Campanula spp.). Vegetation rarely over 20 cm in height. Found generally above 80 m elevation, on hilltops. On Yakak Peninsula Salix spp. is much more abundant than Vaccinium spp.

Vegetation Transects

Vegetation transects were run in each of the 5 vegetation types to describe each type (species composition) and also to collect information on net production of both vascular plants and lichens. It was proposed that 20 transects be run in each type. The number of transects located in each major sub-unit of the winter range was to be determined by the percent of the winter range covered by that sub-unit.

Methods

Two 2-person crews ran the transects; 1 person estimated (the percent cover and wet weight of each species) and 1 recorded the data on a standard observation form (Fig. 6). Each team used the following equipment:

1 50-m tape measure
1 tent stake (to secure the tape)
1 1-m^2 quadrat frame
1 0.1-m^2 plot frame
2 pairs scissors
small ziploc bags
spring scale (200 gram)
blank paper (to label samples)
empty backpack (to carry samples)

Each transect was 50 m long, containing 10 1-m^2 quadrats at 5 m intervals. These quadrats were used to estimate percent cover and determine frequency of each species. A 50 m tape measure was stretched across the ground, and the 1-m^2 quadrat frame was always laid to the right of the tape.

Each quadrat contained a 0.1-m^2 (20 X 50 cm) plot, laid in the lower left-hand corner. These plots were used to collect information on net production. In each plot, the wet weight (in grams) of each species was estimated, except that all Carex spp., Poa spp. and lichens were not identified to the species level. In each transect, 3 plots were randomly selected (numbers drawn from a hat at the beginning of the day) by the team member who was not estimating weights. Only the non-estimator knew which plots were to be clipped. This eliminated a possible bias on the part of the estimator; if that person knew a plot was to be clipped he may have tried to be more accurate than on plots that were not clipped. Only after the plot was estimated did the non-estimator reveal whether clipping was required.

In the 3 plots chosen for clipping, all green/new growth vegetation was taken (again by species), except those species that were estimated to weigh less than 1 gram. Samples were stored in plastic bags (with a label indicating vegetation type, transect number, plot number and species) and weighed with a spring scale. The bags were left open to prevent the plants from molding. In the lab the samples were transferred to paper bags and air dried, with their weights checked periodically to determine when they reached a final dry weight. The weight of the bag was then subtracted to yield the annual production of each species.

Results

Due to inclement weather only 12 transects (out of the proposed 100) were completed, all in the Hidden Bay area during 8-10 August. Appendix 2 shows species composition in each type, along with frequency of occurrence and average percent coverage in each quadrat.

Net production for the 4 major vegetation types is shown in Table 5.

Transect # ____ Veg. Type _____ Date _____ Observers _____ Location _____ Rec. # _____

SPECIES	1			2			3			4			5			6			7			8			9			e
	% cov	est wt	act wt	% cov	est wt	act wt	% cov	est wt	act wt	% cov	est wt	act wt	% cov	est wt	act wt	% cov	est wt	act wt	% cov	est wt	act wt	% cov	est wt	act wt	% cov	est wt	act wt	% cov

Fig. 6. Observation form for vegetation transects.

Table 5. Annual net production[a] for the 4 major vegetation types in the caribou winter range, Adak Island, Alaska.

	Annual Net Production (kg/ha)							
	Lowland Meadow (9 plots)		Alpine Meadow (6 plots)		Heath (9 plots)		Fen (9 plots)	
	$\bar{x}$	range	$\bar{x}$	range	$\bar{x}$	range	$\bar{x}$	range
Grasses	1090	0-1750	50	0- 220	370	0-780	30	0-220
Sedges	310	0- 880	110	0- 680	450	0-1480	980	190-1590
Lichens	110	0-1000	4390	1900-6330	460	0-1270	130	0- 920
Forbs	220	0-1410	10	0- 20	110	0- 810	250	0- 900
Sub-shrubs	180	0- 830	2040	1190-2590	2660	980-5220	210	0- 750
Mosses	640	0-2080	820	0-3230	950	0-2070	340	0-1310
Ferns	10	0- 30	-	-	-	-	-	-

[a]Production for lichens is not annual production. Lichens were clipped at ground level; with their slow growth rate this may have been 30 years worth of production.

Production for the seashore type was not computed because it does not cover a significant percent of the winter range. Sample sizes are admittedly low.

Data from these 12 transects can be used as a "pilot study" to help determine the number of plots (in each type) necessary for selected statistical significance. This was not possible when nothing was known on the variance of net production between plots in the same vegetation type. In 3 of the types (lowland meadow, heath and fen) 9 plots were clipped. The seashore and alpine meadow types had 3 and 6 plots clipped, respectively. To determine the number of plots necessary for accurate analysis, the following formula (Gysel, L. W. and L. J. Lyon. 1980. Habitat analysis and evaluation. Pages 311-312 in Schemnitz, S. D. Wildlife management techniques manual. The Wildlife Society. Washington, D. C.) was used:

$$N = \frac{s^2 t^2}{d^2}$$

in which N = number of plots required
s = standard deviation
t = normal deviate at confidence limit level and given degre s of freedom (from t table)
d = margin of error (arithmetic mean times designated accuracy)

The designated accuracy used was 10% (0.10), and results were computed for confidence limit levels of both 0.05 and 0.10 (Table 6).

Table 6. Average annual production from vegetation transects, and computed values of the number of plots (N) necessary for good statistical analysis.

Vegetation Type	Average net prod. (g)	Standard dev.	Number plots sampled	Number plots (N) required, $P < 0.05$	Number plots (N) required, $P < 0.10$
Lowland Meadow	25.7	11.3	9	102	67
Heath	50.1	18.2	9	70	45
Fen	19.5	12.0	9	200	131
Alpine Meadow	74.4	15.5	6	29	18
Seashore	29.9	13.6	3	382	176

Discussion

Sample standard deviation within each type was high, so the results should be interpreted cautiously. This is probably due to the few number of samples taken and/or a high level of variation within each type. A general idea of each type is evident, however. When enough plots are completed, it will be possible to determine the annual production for sedges, grasses, forbs and lichens in each vegetation type.

The purpose behind estimating the wet weight of each species was to possibly determine a linear relationship between wet and dry weight, yielding a method of estimating dry weight production without clipping all vegetation. However, plant weights in the Aleutian Islands can vary greatly from day to day. For this reason, it was determined that a linear relationship does not exist. Therefore, as long as all clipped samples are dried and weighed, there is no use estimating the wet weight of each species. Storage and collection of all plant samples may prove difficult, but they would provide excellent data.

With all the background work completed, the transect work is the only major step undone, and could easily be completed in a summer. Both July and August would be ideal to run transects. It was possible for the field crews to complete 2 and sometimes 3 transects per day. Clipping the vegetation obviously took the most time, especially clipping Empetrum spp.

Random Vegetation Point Sampling

Methods

A random vegetation point sampling method was selected to determine what percent of each vegetation type made up the caribou winter range. Originally, this was to be determined from aerial photographs. However, suitable color aerial photographs could not be obtained. Placing a dot grid, with individually coded dots, over selected areas of the winter range, 305 points were randomly chosen by picking numbers out of a bag. Those that fell on lakes were immediately recorded as "Open Water." The areas selected were Yakak Peninsula, Caribou Peninsula, Chapel Cove and Hidden Bay.

Point sampling was completed during 1-8 September (Yakak and Caribou Peninsulas), 15-22 September (Chapel Cove), and 29 September - 6 October (Hidden Bay). Two-person crews using maps, compasses and altimeters located the selected points on the ground and recorded the vegetation community type on a standard observation form (Fig. 7). Transportation to Three-Arm Bay, Chapel Cove and Hidden Bay was provided by the Navy tugboat. A 13-foot Zodiac was used to get from the Three-Arm Bay cabin to the end of North Arm for work on Caribou Peninsula.

Results and Discussion

All 305 vegetation sampling points were completed. Table 7 shows the percent winter range of each type in each area sampled, as well as the combined results.

Table 7. Percent of the caribou winter range occupied by each community type (as determined by random vegetation point sampling). Numbers in parentheses indicate actual number of sample points in each type.

	PERCENT WINTER RANGE AND AREA SAMPLED					
Community Type	Caribou Peninsula	Yakak Peninsula	Chapel Cove	Hidden Bay	% of total winter range	Hectares in winter range
Seashore	9.3 (7)	6.6 (5)	2.6 (2)	1.2 (1)	4.9 (15)	1550
Lowland Meadow	32.0 (24)	22.6 (17)	4.0 (3)	10.0 (8)	17.0 (52)	5378
Fen	13.3 (10)	6.6 (5)	8.0 (6)	11.2 (9)	9.8 (30)	3101
Heath	28.0 (21)	38.6 (29)	37.3 (28)	48.7 (39)	38.5 (117)	12177
Alpine Meadow	12.0 (9)	13.3 (10)	32.0 (24)	18.7 (15)	19.0 (58)	6011
Open Water	5.3 (4)	8.0 (6)	9.3 (7)	6.2 (5)	7.2 (22)	2278
Inland Bedrock	0	4.0 (3)	6.6 (5)	3.7 (3)	3.6 (11)	1139
Total Points	(75)	(75)	(75)	(80)	(305)	31634

HIDDEN BAY

Point #	Location	Map	Comm. Type
226	245299	B-2	
227	238306	"	
228	226298	B-3	
229	267327	B-2	
230	247327	B-2	
231	226291	B-3	
232	248309	B-2	Open water
233	226325	B-3	
234	251320	B-2	
235	232301	"	
236	227295	B-3	
237	232328	B-2	
238	239326	"	
239	250286	"	
240	244314	"	
241	252323	"	
242	266275	"	
243	228303	B-3	
244	253293	B-2	
245	236302	"	
246	237291	"	
247	240286	"	
248	243331	"	
249	250303	"	
250	230286	B-3	Open water
251	260295	B-2	
252	243293	"	
253	230314	B-3	

Fig. 7. Observation form used for random vegetation point sampling; caribou range investigation, Adak Island, Alaska.

In an attempt to check the accuracy of this method, the area of "Open Water" was determined from the map (using grid squares) in the area around Hidden Bay. It was done only in this area because that was the only color map available. The area determined from the map (7.1%) was fairly close to the area of "Open Water" determined by random vegetation point sampling (6.2%).

The field teams found it possible in some instances to use binoculars to determine vegetation type, and thus save some walking. It was feared that, working late in the growing season, there might be some problem distinguishing vegetation types, but it was not a problem.

Plant Collection

Methods and Results

Forty-two species of vascular plants and 2 lichens were collected during the summer, to be used for mineral and protein analysis. They will also be used as a reference collection for food habits analysis of caribou rumen samples. The plants were pressed and oven-dried. It was necessary to collect enough of each species to render 6-10 grams dried weight of material. Emphasis was put on collecting those species found on the caribou winter range. Table 8 lists those plants collected. The collection is by no means complete, but the major species are present. The collection will be sent to the University of Alaska, Agricultural Experiment Station, Palmer Research Center for analysis.

Table 2. Plants collected for mineral and protein analysis, Adak Island, Alaska.

Vascular Plants

Achillea borealis
Aconitum maximum
Agrostis exarata
Anaphilis margaritacea
Angelica lucida - both stem and root
Antennaria dioica
Arnica unalaschcensis
Athyrium filix-femina
Campanula Chamissonis
Carex macrochaeta
Conioselinum chinense
Cornus suecica
Elymus mollis
Empetrum nigrum
Epilobium glandulosum
E. macrophyllum
Equisetum arvense
Erigeron peregrinus
Eriophorum angustifolium
Fritillaria camschatcensis
Geranium erianthum
Geum calthifolium
Heracleum lanatum - both stem and root
Honkenya peploides
Juncus arcticus
Leptarrhena pyrolifolia
Lupinus nootkatensis
Luzula parviflora
Pedicularis Chamissonis
Petasites frigidus
Phleum communtatum
Platanthera convallariaefolia
P. dilatata
Poa hispidula
Ranunculus occidentalis
Rhinathus minor
Rubus arcticus
Rumex acetosella
Salix rotundifolia
Senecio pseudo-arnica
Vaccinium uliginosum
Viola Langsdorfii

Lichens

Cladonia rangiferina
Thamnolia subuliformis

Peak-of-Rut Count

Methods

A fall peak-of-the-rut count was conducted during 14-20 October. Observers were stationed at Unalga Bight, Three-Arm Bay and Chapel Cove. Unfortunately, not enough workers were available to be stationed at Hidden Bay as well. Daily hikes were made from camp, and the teams carried spotting scopes (20X or 15-45X), tripods and binoculars (10X40). Observers attempted to classify all animals, using body size and antler development to distinguish calves from older animals. Large bulls could also be distinguished by antler development, and cows could sometimes be identified by genital characteristics or their association with a calf. Observations were noted on a standard observation form (Fig. 4).

Results

A minimum population of 316 animals was observed. Table 9 lists the observations made during the count.

Table 9. Caribou observations during the peak-of-rut count, 14-20 Oct. 1981. Locations are from maps B-3 and C-3, Adak Island; published by the Defense Mapping Agency, series Q701, sheets 2624I and 2624II (not included in the report).

Obs. #	Date	Location	Time	Bulls	Cows	Calves	Unident.	Total
1	10-14	098327	1100	1	1		18	20
2	10-15	095289	1045	1				1
3	10-15	055252	1400		2	1		3
4	10-15	042249	1600		1			1
5	10-15	029248	1100	3	13	4		20
6	10-15	092378	1400			6	8	14
7	10-15	070387	1500	2			61	63
8	10-15	106343	1050				3	3
9	10-15	103388	1715			1	1	2
10	10-16	027208	1220	4		7	26	37
11	10-16	025164	1300	5		11	41	57
12	10-16	025198	1715			1	1	2
13	10-16	022202	1730	1	2	2		5
14	10-16	134243	1530	3		1	5	9
15	10-16	163336	1515	4		3	37	44
16	10-17	021211	0920			3	1	4
17	10-17	025221	0940		1	1		2
18	10-17	111372	1330				6	6
19	10-19	093389	1000				23	23
TOTAL				24	20	41	231	316

All are believed to be non-duplicate sightings. It is difficult to distinguish sex and age (except calves) of caribou in the field, since it is difficult to get close enough to use genital characteristics. These factors contributed to a high number of unidentified animals, which prohibits any conclusions regarding sex and age composition of the herd. However, an accurate classification of a group of 59 caribou on 23 October included 18 (30%) calves. Some recommendations are made later.

Range Exclosures

Methods and Results

Two of the 6 range exclosures on Adak were repaired (Teardrop Lake and Unalga Bight). Materials needed included; 1 full roll (50 m) of 2-m high woven wire fencing, an additional 20 m of fencing, replacement metal fence posts, approximately 30 m of barbed wire, 20 m of aluminum wire, claw hammers, fencing and cutting pliers. Crews of 3 people backpacked the materials to the exclosure sites, and it usually required only half a day to rebuild the exclosure.

A 2-day trip was made to locate the exclosure in Thumb Valley. The exact location of the exclosure in the Cataract Bight area (north of Chapel Cove) is not known. The exclosure on Kagalaska Straits was repaired last year, and the exclosure at Three-Arm Bay will be repaired in early 1982. Appendix 3 shows the known location of 5 exclosures.

RECOMMENDATIONS

With increasing requests for reindeer introductions in the Aleutian Islands, it is essential this study be completed. With continued collection of rumen samples, and the background vegetation work already completed, all that needs to be done are the vegetation transects. These can be started in July, when plant growth is at its peak, and finished by the end of August. Equipment for the transects should be well maintained (scissors oiled, etc.) to insure proper functioning. More plants should be collected for the reference collection used in rumen sample analysis, especially those species listed in the vegetation transects. Evidence indicated that caribou were using the roots of Anemone spp., so this should be collected as well.

The calving survey in May should include observers at Chapel Cove as well as Hidden Bay. For the October peak-of-rut count, all observers should be well trained in the methods of aging and sexing caribou, so that an accurate classification can be obtained. It is very important to have observers in the Hidden Bay area for this count.

A concerted effort should be made to locate the exclosure in Cataract Bight, and to record the equipment needed for its repair. With the caribou herd increasing at its present rate, it may be advantageous to begin running comparative plots inside and outside the exclosures. Annual comparative photographs are also recommended.

Appendix 1. Caribou calving survey observations, May and June, 1981.

Observation number	Date	Time	Elevation (m)	Total # animals	Number of known females	Number of calves
1	5-18	1200	40	5	2	2
2	5-18	1200	40	4		
3	5-18	1230	25	5	2	
4	5-19	1830	25	5	2	
5	5-20	0900	15	6	1	
6	5-20	0920	50	4		
7	5-20	1115	120	1		
8	5-20	1245	100	2		
9	5-20	1400	160	1	1	
10	5-20	1415	150	2	1	1
11	5-20	1515	180	4	2	2
12	5-20	1550	235	9	4	4
13	5-20	1630	215	2	1	1
14	5-20	1640	390	2	1	1
15	5-21	1015	100	1		
16	5-21	1030	110	6		
17	5-21	1140	80	2		
18	5-21	1225	100	1		
19	5-21	1315	10	4		
20	5-21	1315	20	2	1	1
21	5-21	1520	320	3	1	1
22	5-21	1735	90	1		
23	5-21	1855	15	7		
24	5-22	1110	30	1		
25	5-22	1210	120	3	1	1
26	5-22	1355	10	3	3	
27	5-22	1530	10	3		
28	5-22	1600	50	3		
29	5-23	1340	25	9		
30	5-23	1510	130	1		
31	5-23	1555	40	2		
32	6-1	1330	75	2	1	1

Appendix 2. Frequency of occurrence and average percent cover of each species found during vegetation transect work.

Vegetation Type: Seashore Number of Transects: 1

Species	% occurrence in quadrats (frequency)	Average % coverage in quadrat
Athyrium filix-femina	90	29.2
Calamagrostis spp.	90	25.5
Elymus mollis	90	10.5
Streptopus amplexifolius	90	7.6
Heracleum lanatum	70	11.4
Aconitum maximum	70	11.7
Carex spp.	30	13.6
Geum macrophyllum	30	2.6
Artemisia tilesii	20	9.0
Epilobium spp.	20	2.0
Mosses	20	30.0
Cardamine spp.	10	5.0
Geranium erianthum	10	2.0
Fritillaria camschatcensis	10	2.0
Ranunculus occidentalis	10	1.0
Anaphilis margaritacea	10	1.0
Poa spp.	10	1.0
Unidentified grass	10	2.0

Vegetation Type: Heath Number of Transects: 3

Species	% occurrence in quadrats (frequency)	Average % coverage in quadrat
Empetrum nigrum	100	41.2
Agrostis exarata	100	9.8
Carex spp.	97	14.9
Lichens	97	18.4
Mosses	97	10.5
Trientalis europaea	97	2.0
Linnaea borealis	57	1.8
Anemone narcissiflora	33	3.2
Angelica lucida	33	2.0
Coptis trifolia	30	1.7
Cornus suecica	27	2.0

Appendix 2 continued

Heath (continued) Species	% occurrence in quadrats (frequency)	Average % coverage in quadrat
Achillea borealis	27	1.4
Athyrium filix-femina	23	1.0
Epilobium spp.	10	< 1.0
Campanula Chamissonis	10	1.7
Geum macrophyllum	6	1.0
Lupinus nootkatensis	6	10.0
Platanthera spp.	3	1.0
Poa spp.	3	1.0
Viola Langsdorfii	3	1.0
Phyllodoce aleutica	3	1.0
Bare Ground	3	3.0

Vegetation Type: Fen Number of Transects: 3

Species	% occurrence in quadrats (frequency)	Average % coverage in quadrat
Carex spp.	100	47.3
Platanthera spp.	100	5.6
Empetrum nigrum	97	4.6
Linnaea borealis	80	1.4
Equisetum arvense	73	5.7
Geum macrophyllum	67	2.7
Erigeron peregrinus	67	6.0
Mosses	67	13.8
Poa spp.	63	2.0
Trientalis europaea	60	1.9
Coptis trifolia	56	1.0
Achillea borealis	47	1.6
Viola Langsdorfii	47	1.6
Cornus suecica	43	1.0
Rubus arcticus	40	< 1.0
Lichens	37	6.4
Luzula tundricola	33	7.8
Juncus spp.	30	7.9
Anemone narcissiflora	30	2.2
Unidentified grass	30	3.0
Rhinathus minor	13	1.5
Angelica lucida	13	1.0
Maianthemum dilatatum	13	< 1.0
Conioselinum chinense	6	1.0
Fungus	6	< 1.0
Arnica unalaschcensis	6	< 1.0

Appendix 2 continued

Fen (continued) Species	% occurrence in quadrat (frequency)	Average % coverage in quadrat
Fritillaria camschatcensis	6	<1.0
Tofieldia coccinea	3	1.0
Eriophorum spp.	3	1.0
Salix spp.	3	2.0
Geranium erianthum	3	1.0
Bare Ground	40	6.2
Open Water	27	14.0

Vegetation Type: Lowland Meadow Number of Transects: 3

Species	% occurrence in quadrats (frequency)	Average % coverage quadrat
Carex spp.	100	32.1
Mosses	83	11.7
Poa spp.	83	11.7
Agrostis exarata	73	22.9
Trientalis europaea	63	1.9
Coptis trifolia	60	3.9
Achillea borealis	60	3.8
Linnaea borealis	43	2.0
Athyrium filix-femina	43	2.2
Calamagrostis nutkaensis	40	25.3
Anemone narcissiflora	37	2.5
Cornus suecica	37	2.7
Angelica lucida	37	2.6
Empetrum nigrum	33	9.9
Lichens	33	6.7
Platanthera dilatata	30	3.2
Geranium erianthum	23	3.7
Epilobium spp.	20	1.0
Rubus arcticus	20	1.8
Pedicularis Chamissonis	17	< 1.0
Ranunculus occidentalis	17	2.0
Geum macrophyllum	17	2.0
Platanthera convallariaefolia	10	< 1.0
Phleum spp.	10	< 1.0
Erigeron peregrinus	6	1.0
Arnica unalaschcensis	6	2.5
Equisetum arvense	6	< 1.0
Fritillaria camschatcensis	6	1.0
Aconitum maximum	6	2.0
Viola Langsdorfii	3	< 1.0

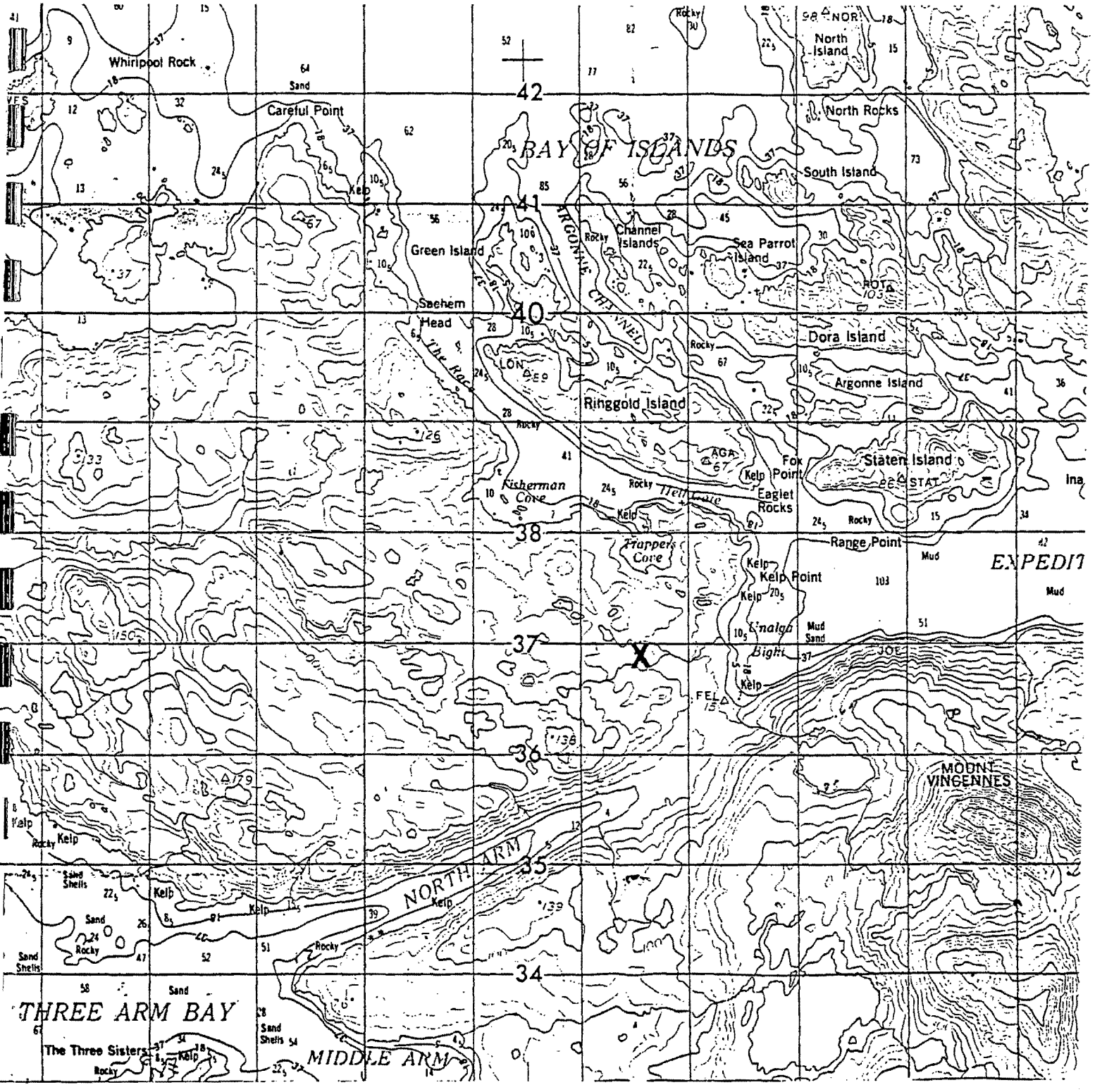
Appendix 2 continued

Lowland Meadow (continued) Species	% occurrence in quadrat (frequency)	Average % coverage in quadrat
Conioselinum chinense	3	2.0
Iris setosa	3	50.0
Maianthemum dilatatum	3	<1.0
Lupinus nootkatensis	3	2.0
Unidentified forb	10	2.7
Bare Ground	13	7.3

Vegetation Type: Alpine Meadow Number of Transects: 2

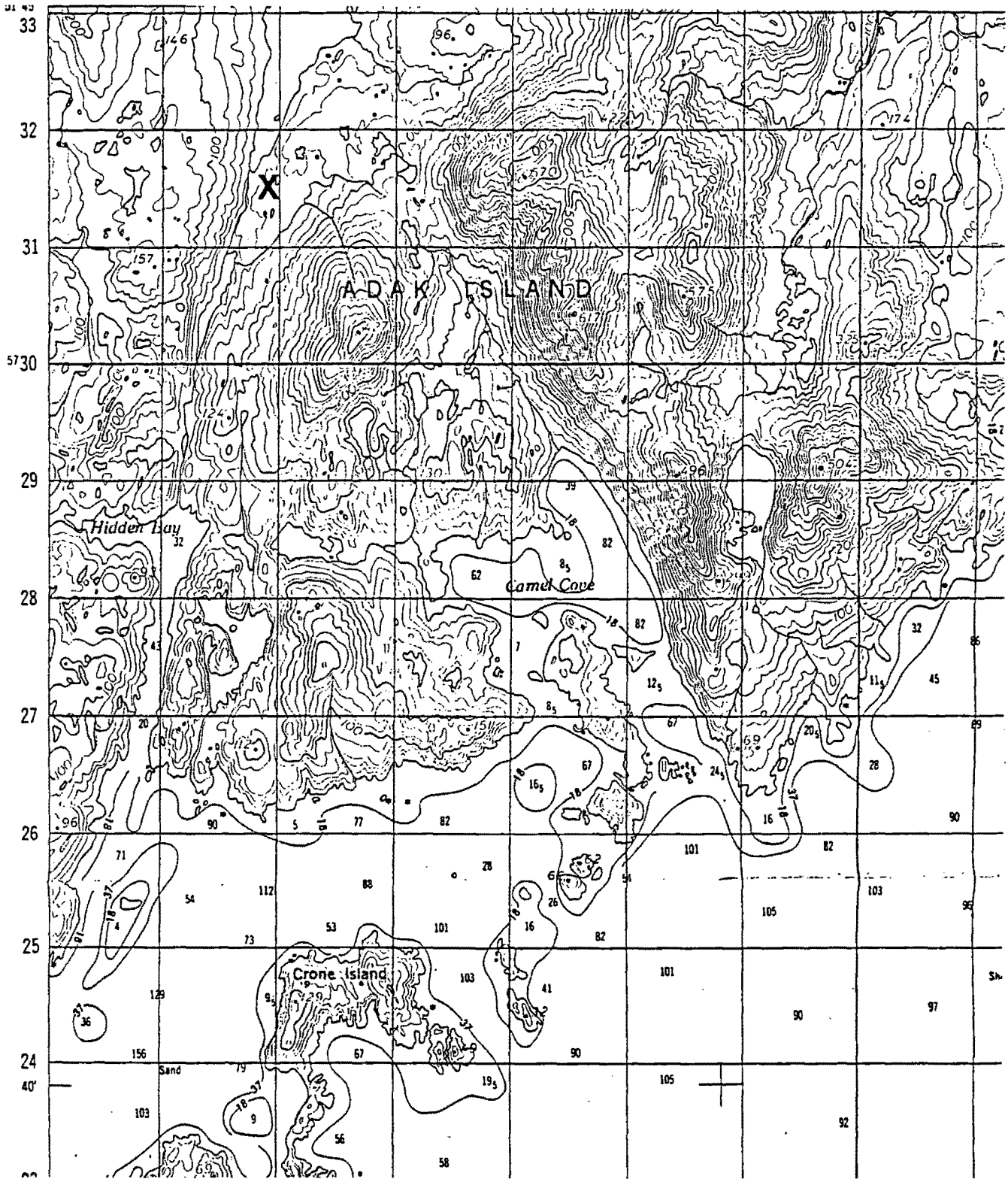
Species	% occurrence in quadrat (frequency)	Average % coverage in quadrat
Empetrum nigrum	100	34.3
Lichens	100	25.6
Mosses	90	9.6
Carex spp.	85	5.8
Calamagrostis nutkaensis	75	6.0
Vaccinium spp.	70	15.2
Campanula Chamissonis	65	1.0
Anemone narcissiflora	60	1.2
Phyllodoce aleutica	60	5.5
Trientalis europaea	40	2.4
Cornus suecica	40	2.5
Arnica unalaschcensis	35	3.8
Achillea borealis	30	1.7
Coptis trifolia	30	< 1.0
Lupinus nootkatensis	20	1.7
Tofieldia coccinea	20	< 1.0
Agrostis exarata	10	1.5
Linnaea borealis	10	< 1.0
Poa spp.	5	2.0
Geum macrophyllum	5	2.0
Viola Langsdorfii	5	< 1.0
Hieracium triste	5	< 1.0
Angelica lucida	5	< 1.0
Bare Ground	25	11.8

Appendix 3. Caribou range exclosure maps.



Unalga Bight exclosure, Map C-3, Adak Island.

Appendix 3 continued.

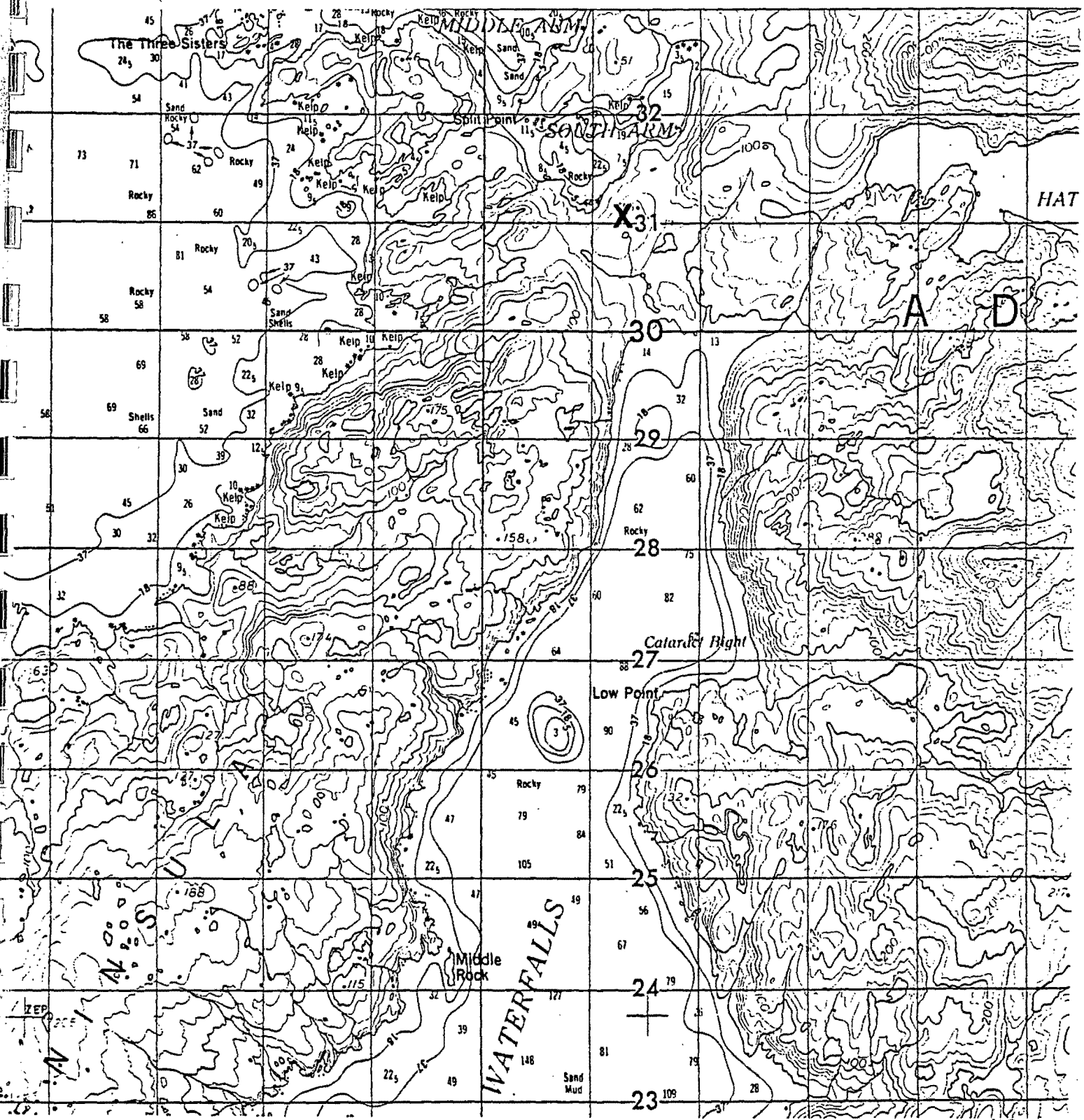


Teardrop Lake exclosure, Map B-2, Adak Island.

Thumb Valley exclosure, Map C-2, Adak Island.

Kagalaska Straits exclosure, Map C-2, Adak Island.

Appendix 3 continued.



Three-Arm Bay exclosure, Map B-3, Adak Island.