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ALASKA DEPARTMENT OF FISH AND GAME

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SEX AND AGE COMPOSITION OF THE PORCUPINE CARIBOU HERD

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SUMMARY

This job was expanded in scope from the initial objective of obtaining fall sex and age composition data to the final objective of conducting a multi-agency cooperative 1977 aerial photo-direct count-extrapolation technique census of the Porcupine caribou herd. Although census estimates of caribou in the herd were similar for 1972 and 1977, data suggest that the number of adult females was substantially reduced. The calf:cow ratio observed during November (47.5:100) was higher than that observed in July (38.6:100), an inconsistency which could have been due to a number of factors. Persons residing outside the range of the Porcupine herd in Alaska harvested a minimum of 15 Porcupine caribou in 1976-77 and 57 in 1977-78.

CONTENTS

BACKGROUND

LeResche (1975b) presented a thorough discussion of the history and status of the Porcupine caribou (*Rangifer tarandus granti*) herd. He included a historical review of information from early explorers and native inhabitants of the area, a discussion of present and future values of the herd, a review of all existing population data, and a discussion of impacts the herd may incur in the near future.

Movements and distribution of the Porcupine herd have been intensively studied since 1971 (Calef and Lortie 1973, Roseneau and Stern 1974, Roseneau et al. 1974, LeResche 1975a, 1975b, Roseneau et al. 1975, Roseneau and Curatolo 1976, Surrendi and DeBock 1976, Russell 1977, Bente and Roseneau 1978). These researchers gathered information on certain aspects of behavior of the herd and some incidental information on summer herd composition and population size. However, no information on population characteristics, such as age structure, productivity, mortality, or estimates of herd size was gathered.

The aerial photo-direct count-extrapolation (APDCE) technique (Hemming 1972) was applied to the Porcupine caribou herd for the first time in 1972 as a cooperative effort between the Alaska Department of Fish and Game (ADF&G) and the Bureau of Land Management. Results were reported in detail by LeResche (1975b) and in part by LeResche (1972, 1975a) and others (Calef and Lortie 1973, Roseneau and Stern 1974).

In 1976 Renewable Resources Consulting Services Ltd., under contract to Alaskan Arctic Gas Study Company, made preparations for a second APDCE census estimate of this herd but efforts were cancelled because

the caribou did not form the post-calving aggregations which are prerequisite for effective use of the technique (Curatolo and Roseneau 1977).

Except for the limited fall sex and age composition data collected in 1972 as part of the APDCE census, no meaningful fall herd composition data existed for the herd. Such data are clearly necessary to understanding population dynamics. Consequently, in 1977 a cooperative study was initiated to provide a current estimate of herd size and composition and to compare this to the 1972 data. We hoped that such a comparison would help determine the status of the population.

OBJECTIVES

Original: To ascertain the fall sex and age composition of the Porcupine caribou herd.

Modified: To assist Renewable Resources Consulting Services (RRCS), Yukon Game Branch (YGB) and the U. S. Fish and Wildlife Service (USFWS) in the successful completion of all facets of the 1977 APDCE census of the Porcupine caribou herd.

PROCEDURES

The original focus of this job was limited to acquiring fall sex and age composition data. These data were necessary to complete the 1977 APDCE census of the Porcupine herd which RRCS and USFWS were planning to conduct. However, RRCS was unable to independently conduct as much of the initial portion of the APDCE census as planned because their contract funds were reduced with short notice after the National Energy Board of Canada ruled against the proposal of Alaskan Arctic Gas Study Company to transport Alaskan and Canadian North Slope natural gas. Because a major contribution toward completion of the census had already been made by RRCS, and it could not have been finished without additional support, ADF&G expanded the scope of this job to allow successful completion of the photo-census.

The census was a cooperative effort and the actual role of each participating group is not necessarily detailed in this report; however, RRCS made the largest contribution. The following excerpts from Bente and Roseneau (1978) describe the portions of the census which include data collected under this job.

Pre-Photography Reconnaissance

Reconnaissance flights were conducted from a Cessna 185, PA-18-150 Super Cub and a Helio Courier aircraft by RRCS Ltd. and ADF&G personnel. Aerial surveys were conducted on 24, 25, 28, 29 and 30 June and 2, 3, 4, 6, 7, 8, 9 and 10 July 1977 to determine the movements and distribution of the post-calving aggregations and bull-yearling groups. The area surveyed included:

1) that portion of northeastern Alaska from about 69°30'N, north to the coast between the Canning River and the international border. Some flights penetrated farther south than 69°30'N in the Hulahula, Jago, Aichilik, Egaksrak and Kongakut River valleys with most effort concentrated north of the Brooks Range; and

2) that portion of the Yukon Territory including the northern British Mountains, the Buckland Hills and the northern Barn Mountains as far east as the Blow River and north to the coast with most effort concentrated west of the Crow River.

Photography and Supplementary Aerial Surveys

The post-calving aggregations were photographed near the Beaufort coast between Pokok Bay and the Tamayariak River during the morning of 8 July 1977 while simultaneous reconnaissance flights were conducted in and to the west, east and south of the photographed areas. Optimal weather conditions occurred on this date.

Simultaneously with the photography of photo-area J, a survey aircraft was used to count sparsely distributed caribou along seven parallel 1.6 km-wide (0.8 km on each side of the aircraft) transect lines in an adjacent area to the west and south of this block's boundaries. Additionally, 19 groups of caribou ranging in size from 1 to 475 individuals were encountered at the time of the photography between the Aichilik River delta and Camden Bay. These groups were visually counted by observers in reconnaissance aircraft and by the observer on board the camera aircraft. Several other groups of caribou were discovered near Stokes Point and south of Herschel Island in the Yukon Territory. These groups were either visually counted, visually estimated or photographed with hand-held 35 mm cameras.

Sex and Age Classification

Summer age and sex classification counts of post-calving caribou were conducted 6-9 July 1977 in Alaska on the ground by experienced ADF&G and RRCS Ltd. observers equipped with tripod-mounted scopes and hand-held three digit, five place tally registers. A Bell 206 B helicopter, PA-18-150 Super Cub and Helio Courier aircraft were used for transportation. Caribou were classified as bulls, cows, yearlings, or calves. Counts were made as the animals moved past the observers, who were located at river crossings and other positions with clear fields of view within the path of the animal movement. Criteria used for field identification of caribou were those suggested by Skoog (1968). Particular attention was given to genital characteristics because of their importance to making correct determinations.

Fall season aerial surveys to locate caribou for classification counts were flown by ADF&G, RRCS and United States Fish and Wildlife Service (USFWS) personnel using a ski-equipped USFWS Cessna 185 and and ADF&G ski-equipped Scout, and by Yukon Wildlife Branch (YWB) personnel using a contracted ski-equipped Cessna 185. The USFWS Cessna 185 was used to transport USFWS, RRCS and ADF&G personnel to the Chapman Lake YWB field camp and for support-reconnaissance flights in conjunction with crews performing the fall classification counts.

Fall age and sex classification counts were conducted 26 October-13 November 1977 by personnel of the YWB, RRCS and the ADF&G using equipment similar to that employed in the summer. Yukon Wildlife Branch personnel obtained the bulk of the data with the aid of a pickup truck as caribou migrated daily across the Dempster Highway in the Chapman Lake vicinity. Five hundred twenty-seven additional caribou were classified in Alaska near the lower Coleen River on 4 November by helicopter-supported ADF&G personnel. An additional 2,745 caribou were classified from the ground on 12-13 November in the western headwaters of the Porcupine River, the northwestern headwaters of the Ogilvie River and the northeastern headwaters of the Tatonduk River with the aid of a Bell 206 B helicopter. When time permitted bulls were further subdivided into large bulls (obviously mature, full size bodies and antlers) and small bulls (smaller bodied, presumably younger age class animals with smaller antlers). All animals were classified using the same criteria applied to the summer classification counts.

Harvest and Hunting Pressure

The amount of hunting exerted on the Porcupine herd in Alaska is measured by the number of Arctic Caribou Harvest Report cards returned by persons transporting their caribou outside of Game Management Units (GMU) 25 and 26C, and by village visits, reconnaissance flights, and interviews of people residing within the GMUs. The Alaska hunting regulations for 1977-78 stipulated that, 1) any person intending to transport caribou from Unit 25 and Unit 26C except that portion draining into the Yukon River from and including the drainage of the Tozitna River to and including the drainage of the Hodzana River, shall first obtain a nontransferable Arctic caribou harvest report, and 2) that the report shall be filled out and mailed within 15 days after the legal bag limit is taken or within 15 days after the closing date of the open season.

FINDINGS AND CONCLUSIONS

Population Size

Bente and Roseneau (1978) thoroughly discussed the 1977 APDCE census, and devoted much of their discussion to a resulting population size estimate. They generated a number of estimates based on different assumptions and made a major contribution to identifying problems associated with population estimates based on the technique.

We will restrict our discussion of the herd size estimate to one important aspect of the census that they did not stress: the possible decline in the number of adult cows in the population. Our calculations of the number of cows in the population during 1972 and 1977 using LeResche's (1975b) method was 48,726 in 1972 and 36,856 in 1977, a reduction of 11,870 cows or a 24 percent decline.

Conversely, Bente and Roseneau's analysis led them to conclude that although the large confidence intervals of their estimates limit the usefulness of the estimates, "the results suggest that no substantial change (many thousands) in numbers has occurred." This conclusion appears tenable. A very major change in the composition of the herd from 1972 to 1977 is implied by the data, a point which Bente and Roseneau (1978) did not emphasize. LeResche (1975b) estimated that the population contained 48,726 cows (2+ years old) in 1972 contrasted to Bente and Roseneau's best estimate of 41,025 cows in 1977. This would suggest a decline of 7,701 cows during the period or a decrease of 16 percent. Although it can be argued that the confidence intervals calculated for the estimates are wide enough to incorporate this spread of numbers, there is reason to suspect the difference may be substantially greater.

It should be emphasized that the methods used to estimate the number of cows in each of the two years differed considerably.

LeResche (1975b) estimated the number of cows by counting all caribou (including calves) on photos and applying the mean percent cows in the post-calving aggregation to extrapolate the number of cows on the photos (Appendix II). Bente and Roseneau (1978) believed there was a major potential problem with this approach so they counted all distinguishable calves on the photos and assumed that all other animals on the photos were older than calves and applied the best post-calving composition data to this number to extrapolate the number of cows. As shown in Table 1, Bente and Roseneau counted 7,469 calves in photo areas A through J during 1977. Using the procedure of LeResche for the 1977 census 13,832 calves are calculated to be present, a difference of 6,363 (Appendix I). The implication is that Bente and Roseneau were able to discern only 54 percent of the calves that were actually photographed. These are two possibilities that could account for this: 1) 46 percent of the calves were not seen because they were obscured by the other animals or they were not obscured but invisible for some other reason, or 2) the bulk of the 46 percent not discerned were erroneously included in the "large animal" category. Table 1 also shows that use of Bente and Roseneau's method would result in an estimate of 36,395 cows whereas LeResche's method would result in an estimate of 31,057 cows (difference of 5,338).

Although Bente and Roseneau's concerns about using LeResche's method are defensible, the assumption that only 54 percent of the calves are discernible but this 54 percent can be confidently identified is also a tenuous one. In fact, until the proportion of calves which are discernible on aerial photographs has been determined by intensive

Table 1. Composition and numbers of Porcupine caribou in the post-calving groups located during the 1977 census and a comparison of numbers derived by using Bente and Roseneau's (1978) assumptions and LeResche's (1975b) assumptions (modified from Bente and Roseneau 1978).

Area[1,4]	Number counted on photos, Bente and Roseneau (1978)			Number expected on photos[3] using method by LeResche (1975b)	
	Total	Calves	Cows[2]	Calves	Cows
Photo Area A	20,027	3,360	13,374	4,446	12,497
Photo Area B	4,280	555	2,989	950	2,671
Photo Area C	989	230	706	316	626
Photo Area D	5,508	687	4,482	1,763	3,487
Photo Area E	456	166	270	146	289
Photo Area F	57	5	48	18	36
Photo Area G	183	36	137	59	116
Photo Area H_1	417	0	388	133	264
Photo Area H_2	1,421	189	1,145	455	899
Photo Area I_1	550	0	447	169	310
Photo Area I_2	11,917	1,953	8,094	3,658	6,709
Photo Area J	5,600	288	4,315	1,719	3,153
Subtotal	51,405	7,469	36,395	13,832	31,057

	Number counted in peripheral areas, but not on photos	
	Total	Calves
Aerial transects	2,370	656
Alaskan observations	1,257	89
Canadian observations	5,365	500
Subtotal	8,992	1,245
TOTAL	60,397	8,714

[1] See Bente and Roseneau (1978) for area descriptions and locations.

[2] These cows were not directly identified on the photos as cows. The numbers were extrapolated by counting the number of identifiable calves on the photos, subtracting that number from the total counted on the photos, assuming the difference is comprised of cows, bulls and yearlings, and applying the mean percent cows from composition counts to all animals other than calves in the photo to obtain the number of cows in the photos.

[3] Number expected is calculated by applying the mean percent of cows and calves in the post-calving composition counts to the total number counted on the photos (including calves).

[4] For extrapolations the following classification counts, from Appendix III, are judged to most closely represent the following areas: counts 5, 8, and 9 for photo areas A and B; counts 10 and 11 for photo areas I_1 and I_2; counts 6 and 7 for photo areas C, D, E, F, G, H_1, and H_2.

research, it is safer to use the low end of the range of population estimates using LeResche's procedure when making management decisions. This would also be consistent with Bente and Roseneau's conclusion 6) on page 57, "We suggest that until better censusing methods are devised, the following management strategy be employed: the lowest estimate obtained should be used when harvest quotas are implemented, and the highest estimate be used when the amount of available habitat is to be modified." The point of contrasting these two methods of calculation is that although the data from 1972 and 1977 support Bente and Roseneau's conclusion that, "...the results suggest that no substantial change (many thousands) in numbers has occurred...," they also state that, "It is possible that some clarification of changes in numbers may result from counting the number of calves present on the 1972 photographs and subjecting these data to analysis using the same methods applied to 1977 data." We believe that, although it may be instructive to do so, until we know how discernible calves are, there is limited value in recounting the 1972 photos. Further, in applying LeResche's method of analysis to both data sets, a substantial reduction is apparent in the number of adult females in the population between the two counts. Such a decrease in the number of females, if real, would have important implications for the reproductive potential of the herd, even if no change in total numbers occurred. Also, the apparent difference in the numbers of females suggests strongly that a second census method should be used to cross check estimates as suggested by Bente and Roseneau. A calving ground estimate of the number of cows in the herd would appear appropriate. This would allow comparison of the cow base estimated from the APDCE technique. This approach was used in censuses of Alaska's Western Arctic caribou herd in 1976 and 1977 (Davis et al., in prep). Again, it is more important to compare numbers of adult females than total numbers in the herd to evaluate the status of populations.

Post-Calving Sex and Age Composition Data

Although use of composition data obtained from the post-calving aggregation usually results in substantial underestimations of absolute bull and yearling numbers, a comparison of cow:calf ratios in different years may be useful in measuring changes in initial calf survival (i.e. for the first 3 or 4 weeks of life). These data have been collected annually since 1972 and are summarized in Table 2.

From Table 2 it is obvious that the 1977 data are the "least typical" of any year. The percentages of cows, calves, and yearlings observed in the herd in 1977 are all outside the range of values for the preceding five years. A change within any one of these sex or age classes would subsequently affect the percentages of the other cohorts. It is very likely that the significantly lower calf percentage in 1977 did affect the percentage of other sex and age classes. If we assume that the calf:cow ratio in 1977 was 54.6 calves:100 cows (the average for 1972-1976) then we can see from the last column in Table 2 (adjusted 1977 data) that all other sex and age classes come much closer to the average value for the preceding five years. All values then fall within the range of values for the preceding five years and all values fall within one standard deviation (S.D.) of the preceding five-year average. We

Table 2. Porcupine caribou herd composition observed during post-calving migration, 1972-1976 (obtained in first half of July).

Year	Source*	Cows No.	Cows %	Calves No.	Calves %	Calves/ 100 cows	Yearlings No.	Yearlings %	Bulls No.	Bulls %	Total No.
1972	ADF&G	6,157	53	3,052	26	50	1,079	9	1,433	12	11,721
1973	RRCS/ADF&G	11,037	58	5,144	27	47	1,070	6	1,830	10	19,101
1974	RRCS	7,818	55	5,176	37	66	437	3	696	5	14,127
1975	RRCS	9,823	52	4,986	27	51	1,711	9	2,294	12	18,814
1976	RRCS	7,579	55	4,456	32	59	1,428	10	299	2	13,762
1972-1976		$\bar{X}$=54.6 S.D.=2.3		$\bar{X}$=29.8 S.D.=4.7		$\bar{X}$=54.6 S.D.=7.8	$\bar{X}$=7.4 S.D.=2.9		$\bar{X}$=8.2 S.D.=4.49		
1977	ADF&G/RRCS	15,675	61	6,057	24	39	2,786	11	1,002	4	25,520
Adjusted 1977 data based on assuming that 54.6 calves/ 100 cows were present		15,675	56	8,559	31	54.6	2,786	10	1,002	4	28,022

* Alaska Department of Fish and Game = ADF&G
Renewable Resources Consulting Services = RRCS

Table 3. 1972 fall sex and age composition data from the Porcupine caribou herd.

Date	Bulls/ 100 Cows	Yrlg./ 100 Cows	Calves/ 100 Cows	Yrlg. % in herd	N_1 = ( )	Calf % in herd	N_2 = ( )	Cow % in herd	N_3 = ( )	Bull % in herd	N_4 = ( )	Sample size sum of N_1 thru N_4	
1972													
10/17[1]	57.2	17.6	30.3	8.6	(257)	14.8	(443)	48.7	(1461)	27.9	(836)	2,997	
1977													
10/26-11/10	99.3	33.5	45.5	12.1	(683)	16.4	(927)	35.9	(2036)	35.7	(2022)	5,668[2]	JR/WO[5]
11/12	52.9	30.2	52.0	12.8	(206)	22.1	(355)	42.6	(683)	22.5	(361)	1,605[3]	PV/WO[5]
11/13	47.8	28.7	47.8	12.8	(146)	21.3	(243)	44.6	(508)	21.3	(243)	1,140[3]	PV/WO[5]
10/27	31.2	20.8	50.8	10.2	(54)	25.0	(132)	49.3	(260)	15.4	(81)	527[4]	JD/PV[5]
1977 Mean by Sample Size	77.6	31.2	47.5	12.2	(1089)	18.5	(1657)	39.0	(3487)	30.3	(2707)	8,940	

[1] These data collected by Grant Lortie and reported in LeResche (1975b).
[2] Crossing Dempster Highway - representative of 15,000 caribou.
[3] Upper Porcupine River, Ogilvie River and Tatonduk River - representative of 20,000 caribou.
[4] Lower Coleen River - representative of 4000 caribou.
[5] JR (John Russell), WO (Wayne Olson), PV (Pat Valkenberg), JD (Jim Davis).

therefore conclude that the only major difference between 1977 values and 1972-76 values is the inferred calf production (i.e. survival to mid-July) of 39 calves/100 cows.

In attempting to explain this reduced calf survival (or production), it first appeared plausible that substantial mortality had occurred as a result of calving by these animals farther east than normal and subsequent rapid movements westward into Alaska during a period of adverse weather (Bente 1977). Roseneau and Bente (pers. comm.) received reports of several dead calves near the Alaska-Yukon border shortly after a period of snowstorms and strong winds. However, fall sex and age composition data revealed a calf:cow ratio of 47.5:100 which confounded our initial interpretation of calf survival. Several possibilities exist to explain the discrepancy: 1) different portions of the cow and calf segments of the herd may have been sampled in summer (July) and fall (November). One possible extreme of this could occur if a large number of cows with a high calf:cow ratio were totally missed in the census; 2) a large number of adult females died between July and November thus causing inflated calf:cow ratios in November; 3) animals were inaccurately classified. For example, a large number of young bulls and/or yearlings classified as adult females in summer but as young bulls in fall could account for the change in calf:cow ratios. Similarly, if animals were accurately classified in summer and many adult females were classified as yearlings or young bulls in fall, the result would be the same; or 4) any combination of the above.

We have concluded, after examining data and calculations based on various assumptions, that there seems to be no single explanation for the discrepancy.

Fall Sex and Age Composition Data

Although the post-calving aggregation has been intensively sampled annually since 1972, few fall data have been collected. A limited collection of fall composition data was made during 1972 and a concerted effort was made in 1977 to get reliable data (Table 3). Despite this, the 1977 data are still equivocable (see Bente and Roseneau 1978). Comparing the 1972 and 1977 data is tenuous considering the problems of interpretation. We feel several consecutive annual fall composition counts are needed to assess the status of the population adequately.

1976-77 Harvest and Hunting Pressure Data

For the first time, during the regulatory year 1 July 1976 through 30 June 1977, hunters were required to fill out a harvest report to transport caribou south of the Yukon River. These harvest reports provided a measure of hunting pressure and harvest level by persons residing outside of Game Management Units 25 and 26C. Seasons and bag limits for 1976-77 and 1977-78 for the Porcupine herd are presented in Appendix IV.

Estimates of the harvest by residents of Alaskan villages within the herd's range and the harvest by Canadians in 1976-77 have been

presented in the 1976-77 S&I report (Reynolds, in press), so only the harvest report data will be presented here (see Table 4). At least 614 Arctic Caribou Harvest Tickets were issued in 1976-77. However, during this year these tickets were required to ship caribou taken anywhere north of the Yukon River to any point south of the river. Consequently a large number of people obtaining these tickets likely intended to hunt in the range of the Western Arctic and Central Arctic herds prior to the August 1977 emergency closure of seasons on both these herds. Five hunters took 6 bulls in the range of the Central Arctic herd and 13 hunters took 12 bulls and 2 animals of unknown sex in the range of the Western Arctic herd prior to the emergency closure.

Thirteen "out-of-unit" hunters took 15 caribou from the Porcupine herd in 1976-77 with 7 animals being taken in Unit 25 and 8 in Unit 26C. Two of the 13 hunters took 2 caribou each while the other 11 took 1 each. In Unit 25 four bulls, two cows and one caribou of unknown sex were taken. Seven bulls and one cow were taken in Unit 26C.

Statistics for successful hunters are summarized in Table 5. Of the successful hunters in Unit 25, four were from Anchorage, one was from Fairbanks, and one was from out of state. In Unit 26C four successful hunters were from out of state, two were from Fairbanks, and one was from the Colville River delta. All hunters in each unit listed airplanes as their primary means of transportation except one in each unit listed boats.

Forty-six other Arctic Caribou Harvest Ticket holders hunted but were not successful. Of these, 5 hunted in Unit 26C, 30 hunted in Unit 25, 1 hunted in 26B, and 3 hunted in Unit 24. Six hunters did not report where they hunted. Characteristics of unsuccessful hunters appear in Table 6.

One reason why few Porcupine herd caribou were harvested by out-of-unit hunters was that during fall 1976 (i.e. late August and September) fewer caribou were in Alaska than any other year during the 1970s.

In summary, for 1976-77, 614 Arctic Caribou Harvest Tickets were issued and 264 were returned. Of those returning harvest reports, 31 hunters reported being successful, 46 hunted but were unsuccessful, and 187 did not hunt. No reminder letters were sent to persons not returning their harvest reports and since this was the first year the reports were mandatory, we have no past data to guess what percentage of the non-reporting hunters would fall in each of the above categories. However, most experiences in other areas of the state or with harvest reports of other species suggest that successful hunters are most apt to voluntarily send in their reports so it is improbable that the actual harvest was more than double that reported above.

1977-78 Harvest and Hunting Pressure Data

In the 1977-78 regulatory year the harvest reports required for the various caribou herds residing north of the Yukon River were separate,

Table 4. Porcupine caribou herd harvest ticket reports for regulatory years 1976-77 and 1977-78.

Year	Number harvest tickets issued	Number returned	Did not hunt	Hunted, but unsuccessful	Harvest data					
					CAH&WAH[1] harvest	No. of hunters	Unit 25 harvest	No. of hunters	Unit 26C harvest	No. of hunters
1976-77	614	264	187	46	18 bulls 2 sex unk.	18	4 bulls 2 cows 1 sex unk.	6	7 bulls 1 cow	7
1977-78[2]	466	214	122	35	--	--	43 bulls 22 cows	49	7 bulls 4 cows	8

[1] Central Arctic herd (CAH) and Western Arctic herd (WAH).
[2] This is based on returns received by 10 May 1978. Additional returns are anticipated.

Table 5. Characteristics of successful hunters of the Porcupine caribou herd, for regulatory years 1976-77 and 1977-78.

Residency of hunter	1976-77	1977-78
Anchorage	4	3
Chicken	0	3
Colville River delta	1	0
Eagle	0	4
Fairbanks	3	18
Fort Wainwright	0	1
Fort Richardson	0	1
Haines	0	2
Kenai	0	0
Seldovia	0	1
Sitka	0	2
Soldotna	0	1
Tok	0	2
Out-of-state	5	12
Out-of-country	0	1
Unknown	0	6
Total	13	57

Means of transportation	Unit 25	Unit 26C	Unit 25	Unit 26C
Airplane	6	5	44	8
Boat	1	1	3	0
Highway vehicle	0	0	2(?)	0

Table 6. Characteristics of unsuccessful hunters of the Porcupine caribou herd for regulatory years 1976-77 and 1977-78.

Location of hunt	1976-77[1]	1977-78
Unit 24	3	0
Unit 25	30	21
Unit 26	6	9
No response	7	4
Residency of hunter		
Anchorage	4	5
Clear	1	0
Colville River delta	0	0
Eagle	1	1
Eagle River	2	0
Eielson AFB	1	1
Fairbanks	21	12
Fort Wainwright	4	0
Fort Yukon	2	0
Haines	1	1
Homer	1	1
Tok	1	1
Out-of-state	7	1
Unknown	0	12
Total	46	35

Means of transportation	Unit 25	Unit 26	Unit 25	Unit 26
Airplane	13.5[2]	3	9	2
Boat	3.5[2]	0	5	0
Foot	0	0	0	0
Highway vehicle	0	0	0	0
No response	15	3	5	7

which eliminated much of the interpretation problems associated with the 1976-77 harvest report returns. Regulations for the 1977-78 regulatory year are shown in Appendix IV.

Results of harvest ticket reports are included in Table 4.

During 1977-78, 466 Porcupine herd transport tickets were issued. Of the 214 people returning harvest reports, 122 did not hunt, 35 hunted but were unsuccessful, and 57 were successful.

Of the 57 successful hunters, 49 hunted in Unit 25 and took 43 bulls and 22 cows. Twenty-eight hunters took one caribou and 21 took two each. All hunters reported aircraft as their primary transportation, except three who indicated boats and two unlikely reports from hunters who claimed taking four caribou northwest of Eagle via cars.

Of the successful hunters, eight hunted in Unit 26C and all used aircraft as their principal transportation means (Table 5). Five of the hunters harvested one caribou each and three hunters took two each. A total of seven bulls and four cows were taken in Unit 26C.

Approximately 68 percent of the successful hunters hunted in the Arctic National Wildlife Range (GMU 26C and northeastern portions of GMU 25).

Approximately 75 percent of the unsuccessful hunters hunted in the Arctic National Wildlife Refuge (ANWR). Four unsuccessful hunters did not designate where they hunted. Of the 21 unsuccessful hunters in Unit 25, 5 reported using boats as primary transportation means and the rest airplanes (Table 6). In Unit 26C the nine unsuccessful hunters all used aircraft.

Harvest chronology is summarized in Table 7. All of the harvest in Unit 26C occurred between 1 August and 10 September. It is quite likely that taking of caribou occurs in connection with hunts for sheep and moose.

Size of the harvest by Alaskans residing within the range of the Porcupine herd in 1977-78 is a matter of conjecture because no formal program exists to monitor it. The people of Kaktovik probably harvested less than 200 caribou during the year. Although the people at Arctic Village had caribou available during August and early September, and likely took 100-200 then, during winter and spring when most of their harvest normally occurs very few caribou were available and likely no more than 100 were taken. The caribou which wintered in Alaska west of the Porcupine River in winter 1977-78 were fewer in number and were distributed farther south than normal. An estimated 2000 to 4000 caribou wintered in the area.

Table 7. Chronology of caribou harvest from the Porcupine caribou herd during the 1977-78 season.

Date	Unit 25			Unit 26C	
	Males	Females	Unknown	Males	Females
8/1-10	1	2		2	3
8/11-20	5	1		2	1
8/21-30	5	4	1	2	1
8/31-9/9	15	6	1	4	-
9/10-19	2	-	1	-	-
9/20-29	7	5		-	-
9/30-10/9	-	-		-	-
10/10-19	1	-		-	-
10/20-29	-	-		-	-
10/30-11/8	-	3	1	-	-
11/9-18	-	-		-	-
11/19-28	-	-		-	-
11/29-12/8	-	-		-	-
12/9-18	-	-	1	-	-
12/19-28	-	-		-	-
12/29-1/7	-	-		-	-
3/1-10	-	-		-	-
3/11-20	-	-		-	-
3/21-30	3	-	-	-	-
Total	39	21	5	10	5

Harvest estimates from Canada are as follows:

1) John Russell (pers. comm.) reported the harvest in Yukon Territory as:

17 by hunters during fall on Dempster Highway
12-15 by hunters after Christmas on Dempster Highway
3 by traffic on Dempster Highway
145 by Old Crow residents in spring 1977
225 by Old Crow residents in September and October (of those interviewed)
ca. 100 by Old Crow residents in fall (not interviewed)
ca. 505 total

2) Bruce Stephenson and Ron Hawkins (pers. comm.) reported the harvest in Yukon Territory as:

150 by Ft. McPherson hunters in fall 1977
ca. 200 by Ft. McPherson hunters in April and May 1978
114 by Aklavik hunters during fall 1977
100 estimated during the year for Inuvik and Arctic Red River
564 total

Total harvest during the 1977-78 season in both countries was about one-third the average annual harvest.

RECOMMENDATIONS

1. Although total numbers estimated in the herd in 1972 and 1977 are comparable, the apparent decline in the number of adult females suggests that two or three consecutive censuses should be conducted.

2. Annual fall sex and age composition counts should be initiated.

3. Research should be initiated to refine the aerial photo-direct count-extrapolation technique. Key considerations should include: 1) evaluating the discernibility of calves on aerial photos, 2) exploring methods of improving the accuracy of composition data, and 3) making estimates and calculating confidence limits for the number of caribou in groups peripheral to the main post-calving migration aggregation.

4. A formal system for measuring village harvest levels should be implemented.

5. Bente and Roseneau's (1978) conclusions should be addressed in evaluating present status of the herd, in planning future studies, and in making management decisions.

ACKNOWLEDGMENTS

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and Wildlife Service, and the Yukon Game Branch were actively involved. Also village residents in Kaktovik and Old Crow aided in many ways.

We would particularly like to thank ADF&G Game Division Director, Robert A. Rausch, for allowing us on one day's notice to greatly increase the scope of this job to assist RRCS in completing the photo mission and post-calving composition survey. In this age of burgeoning bureaucracy and red tape it is heartening to realize that contingencies can effectively be dealt with if someone wants to make things work. John Coady, ADF&G Research Coordinator, was also helpful in many ways, and Marilyn Sigman helped collate data and proof-read the report. Don McKnight edited the report.

Peter Bente and Dave Roseneau of RRCS are to be commended for their comprehensive data analysis and reporting of the census.

Although complications are inevitable when multi-agency and international cooperative studies are conducted, the singular "good will" of all parties involved allowed this work to function with amazing smoothness. The primary field workers of each group are to be congratulated: RRCS, Dave Roseneau and Peter Bente; USFWS, Don Ross; Yukon Game Branch, John Russell and Wayne Olson;and the several pilots involved. Also the supervisors of each of the groups who were behind the scene making things go are to be thanked - RRCS, Glen Semenchuk; USFWS, Ave Thayer; Yukon Game Branch, Manfred Hoefs and Gordon Hartman; and ADF&G, John Coady and Dick Bishop.

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APPENDIX I. Calculation of the 1977 Porcupine herd population estimate using the assumptions and procedures used by LeResche (1975b) in the 1972 estimate.

1. Number of caribou (including calves) counted on aerial photos of post-calving concentrations in 1977 = 51,405

2. Number of caribou (including calves) counted in peripheral groups:

		#cows	#calves	#yrls	#bulls
2,370 on aerial transects	-	1,335	727	116	192
1,257 Alaska observations	-	707	386	62	102
5,365 Canadian observations	-	3,097	500	1,768	
8,992		5,139	1,613	2,240	

Total = 8,992

3. Total caribou in post-calving concentration group:

51,405 + 8,992 = 60,397

4. Animals in each cohort of post-calving group:

	Photographed		Others	Total
cows	(51,405)(.617) = 31,717	+	5,139 =	36,856
calves	(51,405)(.250) = 12,851	+	1,613 =	14,464
bulls	(51,405)(.031) = 1,594	+	combined bulls	
yrls	(51,405)(.101) = 5,192	+	and yearlings =	9,026

5. Number of cows in post-calving group (and therefore minimum number of cows in entire herd): 36,856

6. Composition of entire herd, as determined from November composition counts (assuming random mixing at the time):

	No. counted	Percent of Total
a) cows	3,487	39.0
b) calves	1,657	18.5
c) bulls	2,707	30.3
d) yearlings	1,089	12.2
Total	8,940	100.0

7. Minimum size of entire herd, assuming 36,856 cows (step 5) represents 39 percent (step 6) of the herd:

$$\frac{36,856}{.390} = 94,503$$

8. For comparison, if we had 48,726 cows in 1977 as in 1972 the total estimate would have been:

$$\frac{48,726}{.390} = 124,938$$

APPENDIX II. LeResche's 1972 calculation of the Porcupine herd's size.

Minimum size of the Porcupine subpopulation was 100,000 animals in October 1972. This estimate was derived as follows:

1. Number of caribou (including calves) counted on aerial photographs of post-calving concentration:

   82,680

2. Number of caribou (including calves) counted in peripheral (unphotographed) groups and estimated by interpolation to be present between non-overlapping photographs:

   10,080

3. Total caribou in post-calving concentration group:

   (1)+(2) = 92,760

4. Composition of post-calving group:

	No. Counted	Percent of Total
a) cows	6,157	52.5
b) calves	3,052	26.0
c) bulls	1,433	12.2
d) yearlings	1,079	9.2
	11,721	99.9

5. Number of cows in post-calving group (and therefore minimum number of cows in entire subpopulation):

   (4a)x(3) = 48,727

6. Composition of entire herd, as determined by Lortie during rut (assuming random mixing at that time) (Calef and Lortie 1973):

	No. Counted	Percent of Total
a) cows	1,461	48.7
b) calves	443	14.8
c) bulls	836	27.9
d) yearlings	257	8.6
	2,997	100.0

7. Minimum size of entire herd, assuming 48,726 cows (step 5) represents 48.7 percent (step 6) of the herd:

   $\frac{(5)}{(6a)}$ = 99,959 (or 100,000 to the nearest 100)

APPENDIX III. Weighted post-calving migration caribou sex and age composition, July 1977.

Composition count area	Cows (%)	Calves (%)	Bulls (%)	Yrlgs. (%)	Total
5	4,618(61.0)	1,359(18.0)	212 (3.8)	1,378(18.2)	7,567
8	1,810(64.0)	725(25.6)	55 (2.0)	237(8.4)	2,827
9	2,098(64.3)	946(29.0)	83 (2.6)	134(4.1)	3,261
wt $\bar{x}$ of 5, 8, 9 =	8,526(62.4)	3,030(22.2)	350 (2.6)	1,749(12.8)	13,655
6	1,609(64.3)	809(32.4)	38 (1.5)	44(1.8)	2,500
7	514(59.8)	267(31.1)	13 (1.5)	65(7.6)	859
wt $\bar{x}$ of 6, 7	2,123(63.3)	1,076(32.0)	51 (1.5)	109(3.2)	3,359
10	1,113(56.9)	627(32.0)	132 (6.7)	87(4.4)	1,959
11	363(54.8)	178(26.8)	80 (12.1)	42(6.3)	663
wt $\bar{x}$ of 10 and 11	1,476(56.3)	805(30.7)	212 (8.1)	129(4.9)	2,622
Total	12,125(61.7)	4,911(25.0)	613 (3.1)	1,987(10.1)	19,636

APPENDIX IV. Seasons and bag limits for the Porcupine caribou herd in 1976-77 and 1977-78.

Game Management Units 25 and 26C - Porcupine Herd

Period Covered: January 1, 1975 - June 30, 1977

Seasons and Bag Limits

Units 25 and 26C	1976-77 No Closed Season	No limit, provided that no more than 5 caribou may by taken in any one day; and provided further that no more than 2 caribou may be transported south of the Yukon River per regulatory year

By Emergency Regulation the following was effective on September 25, 1976 for the remainder of the regulatory year, ending June 30, 1977.

Unit 25 Unit 26C	Aug. 1 - Mar. 31 July 1 - Mar. 31	10 caribou provided that not more than 5 caribou may be taken on any one day; and provided further that no more than 2 caribou may be transported from these units per regulatory year
Remainder of Unit 25*, and Unit 26(C)*	1977-78 Aug. 1 - Mar. 31	Five caribou provided that not more than 2 caribou may be transported from these units per regulatory year

*Arctic Caribou Harvest Ticket required before transporting caribou from Units 25 and 26(C).