

ALASKA DEPARTMENT OF FISH AND GAME

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# WESTERN ARCTIC CARIBOU HERD STUDIES

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Final Report  
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## FINAL REPORT (RESEARCH)

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(includes some information from September and October 1977 and spring 1978)

### SUMMARY

The Western Arctic Caribou Herd (WAH) declined from an estimated size of 242,000 in 1970 to a low of 64,000 (minimum) in 1976. Using different census methods we estimated herd size in July-October of 1975, 1976 and 1977 to be 100,000, 64,000 minimum and 75,000, respectively. We attempted an aerial photo-direct count-extrapolation (APDCE) census each year, but attained satisfactory results only in 1976. The 1975 estimate was extrapolated from a visual count/estimate of post-calving aggregations. The 1977 estimate was based upon a calving ground survey. The herd is probably stable in numbers or increasing. Another APDCE census is planned for 1978.

The bull:cow (older than yearlings) ratio in the population has probably been declining since the early 1960's, and the present bulls-only harvest strategy will probably continue to depress the bull:cow ratio.

For all years when data are available, initial calf production in the WAH has been high (about 70 to 80 calves:100 cows). We counted 73 calves:100 cows in early June 1976 and 68 calves:100 cows in early June 1977. Of 517 cows observed on the main calving area in early June 1977, 472 (91%) had distended udders, which are an indication of recent pregnancy.

Calf survival from spring 1976 to spring 1977 was high, probably about 60 percent. Survival of the 1977 cohort of calves was considerably poorer; the calf:100 cow ratio was down to 26 by mid-April 1978. It appears, however, that recruitment during the 2 years has been sufficient to sustain the lowered human harvest and possibly reduced level of predation.

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## BACKGROUND

Scott et al. (1950) reported on the first attempt to census Alaska's Arctic caribou (*Rangifer tarandus granti*) using aircraft. Flights conducted between October 1948 and December 1949 and reports from bush pilots, registered guides and local people led them to conclude that Brooks Range and Arctic Slope caribou consisted of five main herds totaling 139,000 caribou. However, they also stated that the upper Colville group, the Point Hope-Point Lay caribou and the large Kobuk-Noatak group (estimated to contain 100,000 animals) may have been segments of one large, loose herd. Skoog (1968) recognized the many biases and inaccuracies involved in Scott et al.'s method of estimation, and utilized subsequent knowledge (i.e. Watson and Scott 1956) to revise Scott et al.'s statewide estimate of 160,450 upward to 325,000. Based on Skoog's revision, the number of caribou in the present range of the Western Arctic Herd (WAH) in 1950 would have been 238,000.

Lent (1966) conducted the first intensive study of the WAH between 1959 and 1962. Using a method similar to the aerial photo-direct count-extrapolation (APDCE) technique developed in the late 1960's (Hemming and Glenn 1969, Hemming in Pegau and Hemming 1972), Lent estimated that the minimum pre-calving population in 1961 was 130,000 animals. He calculated the July population to be 156,000 animals but thought that the population actually numbered between 175,000 and 200,000 because he had probably missed some small calving segments of the herd.

Skoog (1968:250) estimated the population in 1964 to be 300,000 animals based on the magnitude of the village harvests. It was not until 1970 that another census was conducted. Hemming (1972) counted a total of 179,843 caribou from photographs of the 1970 post-calving aggregations, and visually counted an additional 10,380 in areas not photographed. They estimated the total population in 1970 to be 242,000 animals and calculated that the total number of cows older than yearlings was 97,394. Our later experience with the APDCE technique and

subsequent discussions with Hemming lead us to believe that the 1970 census was reliable; certainly it was the most reliable estimate of the population up to that time.

Lent made the first concerted attempts to estimate the sex and age composition and productivity of the WAH in 1960, 1961 and 1962 (Lent 1964, 1966, unpubl. field notes). These estimates and the counts of Skoog (1963), Lentfer (1965), Hemming and Glenn (1969), and others (ADF&G files) are summarized in Tables 1 and 2, and data collected after 1975 are presented in Table 3.

During the 1960's biologists believed that the size and productivity of the WAH were sufficient to sustain the average estimated annual human harvest of 25,000 caribou (c.f. Davis et al. 1978a). Indeed, the 1970 census suggested that the herd was maintaining itself and Hemming (1972) recommended that, "A four-year interval between censuses, supplemented by annual measurement of yearling survival and hunter harvest, should be adequate." Pegau (1973) recommended that a census be done in 1975. During the winters of 1973-1974 and 1974-1975 fewer caribou were observed in the "traditional" main wintering areas and some biologists speculated that the herd had diminished. Consequently a census in 1975 became a priority.

The calving grounds were not surveyed during calving between 1971 and 1975. In 1975 we found far fewer cows on the calving grounds than were present in prior years (Pegau pers. comm., Neiland pers. comm.) which suggested that the population had declined or a major change in calving distribution had occurred. Consequently, we began an intensive study of the WAH. This is one of four jobs concerning the herd that began in 1975 and 1976. The other three concerned movements and distribution, age structure and human harvest. In addition to these studies, the Department was contracted by the U.S. Fish and Wildlife Service to study the use of National Petroleum Reserve-Alaska (NPR-A) by caribou in view of the increased exploration for oil and minerals in the area. Data for all of these projects were often gathered concurrently. One annual report on the NPR-A project has been written (Davis and Valkenburg 1977) and a final report will be available in November 1978.

#### OBJECTIVES

To determine the population size, composition and productivity of the Western Arctic Caribou Herd.

Table 1. Fall composition counts of the WAH prior to 1975.

Date	Total Bulls per 100 Cows	Yrlg per 100 Cows	Calves per 100 Cows	Yrlg % in Herd	(Total Yrlgs)	Calf % in Herd	(Total Calves)	Cow % in Herd	(Total Cows)	Bull % in Herd	(Total Bulls)	Sample Size
10/18/52						26.0						320
10/18/52										10.0		614
10/16-19/53						24.0						164
9/20-24/54						28.0	(110)			19.0 <sup>1</sup>	(75) <sup>1</sup>	393
10/18-21/61	55	8.2	37.3	4.2	(42)	18.6	(187)	49.8	(501)	27.4	(276)	1006
10/26-28/68	62	23.0	34.0	10.6	(235)	15.6	(345)	45.6	(1010)	28.3	(627)	2217
Fall 1970	64	20.0	44.0	8.7	(543)	19.2	(1198)	43.8	(2732)	28.0	(1746)	6222

<sup>1</sup> Bulls older than yearlings.

Table 2. Productivity surveys of the WAH prior to 1975.

Date	Total Bulls per 100 Cows	Yrlg per 100 Cows	Calves per 100 Cows	Yrlg % in Herd	(Total Yrlgs)	Calf % in Herd	(Total Calves)	Cow % in Herd	(Total Cows)	Bull % in Herd	(Total Bulls)	Sample Size
6/60			73.0			42.2	(1680)	57.8	(2300)			3980
7/3-9/60	40.5	24.7	71.3	10.0	(197)	30.0	(568)	42.0	(797)	18.0	(323)	1885
7/61	81.0	37.0	42.0	14.0	(440)	16.1	(495)	38.0	(1179)	31.0	(959)	3073
6/7/63			75.0			32.7	(769)					2351
6/11/64			80.0			39.0	(1570)	49.2	(1971)			4009
6/10/65			69.0			41.0	(3431)	59.0	(4940)			8371
7/10-11/68	61.0	27.0	41.0	11.9	(485)	17.8	(725)	43.5	(1767)	26.7	(1085)	4066
6/69			56.0			36.5	(2187)	63.5	(3798)			5985
7/1-3/70	58.0	37.0	48.0	15.4	(4043)	19.7	(5171)	41.1	(10789)	23.8	(6247)	26250
6/15/71			78.0			44.1	(4085)	55.9	(5184)			9269

Table 3. Results of composition, productivity and calf survival surveys of the WAH 1975-1977.

Date	Total Bulls per 100 Cows	Yrlg per 100 Cows	Calves per 100 Cows	Yrlg % in Herd	(Total Yrlgs)	Calf % in Herd	(Total Calves)	Cow % in Herd	(Total Cows)	Bull % in Herd	(Total Bulls)	Sample Size
7/2-5/75	7.6	14.8	60.5	7.8	(396)	31.9	(1619)	52.7	(2673)	7.6	(383)	5069
10/18-19/75	31.0	13.0	48.0	7.0	(154)	25.0	(558)	52.0	(1171)	16.0	(360)	2231
6/9-14/76	0.5	14.7	73.3	7.8	(577)	38.9	(2884)	53.1	(3936)	0.3	(19)	7416
6/27-7/2/76	5.0	14.0	54.0	8.0	(766)	31.0	(3037)	58.0	(5636)	3.0	(309)	9748
10/16-18/76 <sup>1</sup>	58.0	26.0	48.0	11.3	--	20.6	--	43.1	--	25.0	--	7140
4/14-24/77 <sup>2</sup>	30.0	--	43.9	--	--	25.2	--	57.5	--	17.2	--	5636
6/14/77 <sup>3</sup>	0.4	18.0	68.0	9.1	--	36.7	--	54.0	--	0.2	--	8034
6/28-29/77 <sup>4</sup>	8.9	15.9	52.1	9.0	--	29.5	--	56.5	--	5.0	--	20615
10/19-21/77 <sup>5</sup>	43.2	28.5	41.7	13.4	--	19.5	--	46.8	--	20.3	--	6881
adjusted	48.0	43.0	46.0	--	--	--	--	--	--	--	--	--
4/6-13/78 <sup>6</sup>	19.3	--	24.6	--	--	16.8	--	69.9	--	13.3	--	9380

<sup>1</sup> Representative of 12,600 caribou

<sup>2</sup> Representative of 16,500 caribou

<sup>3</sup> Representative of 37,577 caribou

<sup>4</sup> Representative of 68,130 caribou

<sup>5</sup> Representative of 26,000 caribou

<sup>6</sup> Representative of 49,500 caribou

## PROCEDURES

### Population Size

#### 1975

In 1975 we attempted to conduct an aerial photo-direct count-extrapolation census of the WAH. Hemming (1972) and other Alaska Department of Fish and Game personnel developed the APDCE technique in the late 1960's, and with its successful application to the WAH in 1970 Hemming (1972) concluded that, "This technique appears to provide a useful tool for management.... It should not be necessary to conduct further research on techniques of caribou census." The technique has since been applied to the Porcupine Herd in 1972 (LeResche 1975) and 1977 (Bente and Roseneau 1978, Davis 1978); the Fortymile Herd in 1973, 1974 and 1975 (Davis et al. 1975, Davis et al. 1978); the Delta Herd in 1972 (ADF&G files); the Alaska Peninsula Herd in 1975 (Irvine 1976); and Glennallen Area Biologists have censused the Nelchina and Mentasta Herds frequently during the 1970's. The procedure has been described and discussed to various degrees in the above-mentioned reports and by Doerr (pers. comm.).

Because in 1975 the WAH did not form post-calving aggregations that were consolidated enough to allow photo coverage for an APDCE census, we visually enumerated or estimated the number of animals in the post-calving aggregation. We also estimated the minimum herd size by direct count/estimation of the herd in midsummer and during fall and winter. In the large aggregations it is impossible to enumerate animals individually, so some counting (i.e. estimating) by units of 5, 10, 50, 100, etc. is required.

#### 1976

In summer 1976 we counted animals older than calves on the calving grounds, and obtained sex and age composition data to extrapolate the "known minimum" number of adult cows in the herd. We used a Cessna 180 with two observers and two Piper Super Cubs to cover 100 percent of the "core" calving area. We monitored the calving aggregations continuously through June until post-calving aggregations were formed late in the month. By the first week in July aggregations suitable for photo coverage had still not developed so three direct count/estimates of animals older than calves in the "loose" aggregation were obtained. The herd was monitored through 16 July when dense aggregations suitable for photo coverage were formed. On 17 July a Bureau of Land Management aerial photo plane (Cessna 402) with a 9 x 9 inch negative aerial camera was used to photograph approximately one-half of the herd. The remaining animals in the aggregations were photographed from hand-held 35 mm cameras with color film. We counted the caribou from contact prints from the 9 x 9 inch negatives, and enlarged color prints 10 x 12 inches from the 35 mm color slides.

To analyze the 35 mm photos, we: 1) identified the caribou by using one lens of a pocket stereoscope as a magnifying glass, 2) marked a dot beside each animal, 3) laid out counting strips of arbitrary size directly on the photo, and 4) then counted the total dots while recording with a digital counter.

The scale on these photos varied from 1:500 to 1:1000 which meant that adult caribou were 1-3 mm long. In several instances we were able to identify the animal by first locating its shadow. Color prints greatly aided identification; in many cases we could locate caribou because they contrasted with surrounding vegetation. Black and white photos probably would not have shown contrast as well. The width of the counting strip was also important. It was difficult to count a strip wider than 3/4 inch if caribou were densely aggregated (e.g. 200+ caribou/strip). Caribou could often be counted in "clumps" rather than by following a straight line. However, in dense aggregations the individual members of clumps were practically indistinguishable. In these cases we slowly moved a piece of paper down the strip and counted the animals as they appeared from under the paper.

Sources of error included: 1) difficulty in distinguishing the actual number of animals on the photograph, 2) counting errors and 3) overlap between photos which missed or recounted animals that had moved between photos. We had problems distinguishing the actual number of animals if photographs had been taken under poor lighting conditions or from a poor camera angle, if the prints were not clear, if the animals were located on broken terrain, or any combination of these. Unfortunately, terrain features cannot be controlled, and light conditions are often not optimal when caribou are suitably aggregated to make photography feasible. Mornings or afternoons produce the best lighting conditions. Also, photos taken from vertical rather than oblique angles are clearer, and contain less pronounced edge distortions and more shadows. Print quality is an indirect function of the previous factors. A glossy rather than a matte finish might increase the contrast, although it is more difficult to write on a print with a glossy finish. By repetitive counting we found that about 5 percent of the caribou were missed when not using magnification. We also found it was possible to miss 4-8 percent of the caribou because of poor contrast. Precision error increased up to 12 percent when the images were small (ca. 1 mm), fuzzy, or if photographed in broken terrain. These factors seemed more important than the density of the animals in contributing to imprecision. In several instances we counted good quality prints of densely-aggregated animals more precisely than poor quality prints of scattered animals. On blurred photos it is possible to count the lighter mane and rump area of one animal as two smaller animals, especially when there are no shadows.

In winter 1976-1977 we visually counted (estimated) the number of animals located during fall migration and located in wintering concentrations. Most counts were made from Super Cub (PA-18-150), Helio Courier 250, or C-180 aircraft. A systematic survey was conducted on the North Slope between 3-14 January 1977 and is summarized in Appendix I in Davis and Valkenburg (1977).

## 1977

In summer 1977 we used two Super Cubs and a Cessna 180 to count adult caribou (i.e. older than calves) on the calving ground. We used the same procedure as in 1976 to estimate the number of animals present. We also visually counted (estimated) adults in the post-calving aggregation and conducted an APDCE census of the herd on 28-30 June. We used the same BLM photo plane and equipment as in 1976.

We conducted two other counts to estimate the number of caribou wintering north and south of the Brooks Range. North of the Brooks Range we conducted the count in April 1978, while the count south of the Brooks Range took place in October 1977 to determine the number of caribou wintering in the Kobuk River-Selawik Flats area. These caribou were counted separately by Area Biologist David Johnson in a Cessna 207 and by the investigators in a Bellanca Scout. Additional surveys of traditional south slope wintering areas were conducted in Super Cubs and a Helio Courier.

### Sex and Age Composition and Productivity

We classified caribou several times each year from 1975 through 1977 to obtain sex and age composition and productivity data. From 6-12 June 1975 we classified animals on the calving ground from Super Cubs to determine initial calf production (calves/100 older than calves) and the incidence of placenta retention (Neiland et al. 1968). Sex and age composition surveys were conducted using a Bell 206B helicopter from 2-5 July 1975. These counts provided a basis to extrapolate the number of adult females in the post-calving aggregation and calf survival rates from peak of calving. Fall sex and age composition data were obtained from migrating caribou near Cape Krusenstern. A Helio Courier was used to land an observer equipped with a spotting scope and five-digit mechanical counter (Lafayette Multi-Counter). Animals were classified as bulls, cows, calves or yearlings, and debilitated animals were also recorded. Limited funds precluded obtaining additional fall composition data or yearling survival data the following spring.

In 1976 we used a Super Cub for aerial composition counts of the calving grounds similar to those of 1975. We also used a Bell 206B helicopter to determine composition in early June, late June and October 1976, and in April 1977. As in 1975, the data were used to determine seasonal segregation of animals, to estimate the true composition of the herd and to measure production and survival of calves.

In 1977 we conducted Super Cub composition counts of the calving grounds, and used a helicopter (206B) for counts in early June, late June and October, and in April 1978.

Generally, for larger groups of more than 50 caribou and during all of the counts in early June the helicopter was used to place observers in strategic locations from which they could classify animals with a spotting scope. This technique was very successful on the groups that

were not densely aggregated, especially if the caribou were moving slowly. The technique can also be very difficult, however, especially if the post-calving aggregations occur on flat ground. In this situation the observer cannot view an entire large group. In large groups, composition counts may be biased because it is difficult to count the entire group, and members of certain age or sex classes may be concentrated on the periphery. We do not presently have satisfactory methods to classify dense aggregations. Using a helicopter to count small groups is very convenient and probably as accurate as attempting a ground count with a spotting scope. However, when classifying yearlings in the fall, we felt it advantageous to have a side view of animals to better view their relative size and length of their rostrum.

During the composition counts conducted from the helicopter the pilot sat in the right front seat with an observer in the front and a recorder in the left rear seat. The pilot pursued the groups of caribou closely, while the observer called out the sex or age of each caribou in the group and the recorder tallied the information with a five-place mechanical counter.

Observers based age determinations on body morphology and sex determinations on external genitalia. Because caribou generally run with their tails halfway down, it was usually possible to see the black, vertical line of the vulva on cows. Some cows did run with their vulva covered, however, and these were often difficult to distinguish from young bulls. An observer can be sure that a caribou showing the black vulva is a cow, but when it is not seen the animal cannot always be assumed to be a bull.

The early June 1976 and 1977 productivity counts were ground counts of the main calving concentration and aerial counts (Super Cub) in the peripheral areas where the density of caribou was lower (c.f. Job 3.21R this report). To assess pregnancy rates, we determined the proportion of cows with distended udders (Bergerud 1964) in some portions of the main calving area between 1 and 10 June.

Generally, we tried to sample 10 percent of the caribou in each area in the April and October counts and 20 percent in late June. We also tried to count animals in as many different areas as possible to determine whether our counts were representative. To then calculate the average herd composition at each season, we weighted the individual counts by the number of caribou which each count was thought to represent—rather than by the actual sample size.

## RESULTS

All censuses and resulting population estimates for the three years of this study are summarized in Table 4.

Table 4. Summary of population estimates of the Western Arctic Caribou Herd 1975-1977.

Time of Estimates	Estimate	Basis for Estimate	Authors' opinion of the best estimate of the population
1975 (late June)	66,981; 102,704; 121,412	Extrapolated by applying late June and fall 1975 composition data to observations of adults seen in post-calving aggregations (i.e. 45,000 adults involving <u>no</u> duplication, 66,981 adults involving <u>possible</u> duplication, and 81,569 involving <u>probable</u> duplication, respectively).	102,704 (1975)
1975 (mid-July)	65,000 adults minimum	Greatest number of adults counted/estimated in a single day during late post-calving aggregations.	
1975 (fall)	60,000-75,000 minimum	Number of caribou located during fall reconnaissance flights.	
1976 (early June)	16,957 adult cows minimum	Calving ground survey (later found to be a gross underestimate).	
1976 (late June)	60,789	Extrapolated by applying fall composition data to 26,200 adult cows observed in post-calving aggregation.	
1976 (mid-July)	65,000 minimum	Number of animals counted on photos and/or found in pre-photography reconnaissance (extrapolation not possible).	65,000 minimum (1976)
1976-77 (winter)	31,956-65,912	Estimated by transect extrapolation north of 70°N latitude and direct counts during fall reconnaissance south of 70°N latitude.	
1977 (early June)	32,464 adult cows	Calving ground survey.	
1977 (late June)	68,139	Counted on photographs and directly counted in late June (poor count).	
1977 (fall)	75,393	Extrapolated from early June cow base, using adjusted (see text) composition for bulls and April composition for yearlings. (1977)	75,393 (1977)
1977-78 (winter)	53,397-64,589	Based on late September count of migrating caribou and April 1978 transect extrapolation north of 70°N latitude.	

## Population Size in 1975

### Direct Count/Estimate Extrapolation Census

We attempted an APDCE census in June and early July but were unable to conduct the photo portion of the census because the caribou never formed condensed post-calving aggregations to make photo coverage feasible. We used three aircraft simultaneously and located a maximum of less than 45,000 adult caribou (i.e. older than calves) in any one day (28 June). We used two Super Cubs to cover most of the area south and west of the Utukok River and some areas north and east of the Utukok. A dense post-calving aggregation of about 30,000 was located near Mt. Kelly and about 15,000 additional animals were dispersed along a 120-mile route between Mt. Kelly and an area just northeast of Eskimo Hill. These animals were migrating toward Mt. Kelly. During the next few days the caribou on Mt. Kelly dispersed and moved primarily to the west, although some moved to the northwest and southwest. Although we extended our surveys to Meade River and Umiat, we sighted few additional caribou except one group (later determined to contain at least 24,000 adults) moving along a corridor which paralleled that used by the animals seen on 28 June. We believe these 24,000 animals did not include any duplication of the 45,000 seen on 28 June but we have no way of being sure. On 4 and 5 July we again tried to locate as many adults in one day as possible and counted about 45,000 each day.

We calculated an estimate of the "minimum" 1975 population by assuming that the 45,000 adults seen on 28 June comprised the total post-calving aggregation and hence all (or most) of the adult females in the herd. By applying the 2-5 July 1975 composition data (11.5% yearlings, 77.4% cows and 11.1% bulls) we extrapolate as follows:

$$\begin{array}{rcl} .774X & = & 34,830 \text{ cows} \\ .111X & = & 4,995 \text{ bulls} \\ .115X & = & \underline{5,175 \text{ yearlings}} \\ 1.000X & = & 45,000 \text{ Total} \end{array}$$

By applying our observed 1975 fall composition (Table 2) we extrapolate as follows:

$$\begin{array}{rcl} 34,830 \text{ cows} & = & .52X, \text{ therefore } X = 66,981 \\ 10,717 \text{ bulls} & = & .16X \\ 4,689 \text{ yr1s} & = & .07X \\ 16,745 \text{ calves} & = & \underline{.25X} \\ \text{Total } 66,981 & = & 1.00X \end{array}$$

To calculate our most likely 1975 population size we assumed that the 45,000 adults located on 28 June and the additional 24,000 located on 2 and 4 July included no duplication. By applying the 2-5 July composition data we extrapolated as follows:

$$\begin{array}{rcl} .774X & = & 53,406 \text{ cows} \\ .111X & = & 7,659 \text{ bulls} \\ .115X & = & \underline{7,935 \text{ yearlings}} \\ 1.000X & = & 69,000 \text{ Total} \end{array}$$

Applying our observed 1975 fall composition we obtained the following:

53,406 cows	=	.52X, therefore X = 102,704
7,189 bulls	=	.07X
16,433 yr1s	=	.16X
<u>25,676 calves</u>	=	<u>.25X</u>
Total 102,704	=	1.00X

We calculated the largest probable 1975 population using our census assumptions (and one which probably included duplication of 12,569 adults) by assuming there was no duplication of the 45,000 and 24,000 adults used in the calculations above. Further, if the 12,569 adults seen east of Mt. Kelly on 5 July which were probably included in the other counts are assumed not to involve duplication, then 81,569 adults were observed in post-calving aggregations. The resultant calculation follows:

.774X	=	63,134 cows
.111X	=	9,054 bulls
<u>.115X</u>	=	<u>9,381 yearlings</u>
1.00X	=	81,569 Total

Using the 1975 fall composition we calculated the following maximum population size:

63,134 cows	=	.52X, therefore X = 121,412
19,426 bulls	=	.16X
8,499 yr1s	=	.07X
<u>30,353 calves</u>	=	<u>.25X</u>
Total 121,412	=	1.00X

Thus our most liberal estimates were substantially less than the 1970 estimate of 242,000 (Hemming 1972). Even though the animals did not form optimum post-calving aggregations, and we may have missed part of the cow segment of the herd, our concern over this apparent decline was increased by the fact that for the preceding two winters numbers of caribou were observed on "traditional" winter ranges on the south side of the Brooks Range. Also, studies on the calving ground from 5-10 June 1975 were not encouraging; we obtained a crude estimate of only 30,000 cows. In general, we were convinced by our observations that the number of cows present could only account for the female segment of a herd that numbered substantially less than 240,000.

#### Post-Calving Direct Counts

Results of our direct count/extrapolation census combined with the observations on the calving grounds caused some alarm over a possible diminished population, and we attempted to locate animals throughout the summer. The greatest number was observed on 18-21 July when 65,000 caribou were located in eight groups in the area between Cape Lisburne

and the mouth of the Pitmegea River. Coverage in the Brooks Range during this period produced few additional caribou; for example, during a 9-hour C-180 flight on 21 July, only four caribou were located. Interviews with recreationists, guides, oil exploration crews, biologists from various agencies, pilots and bush residents did not produce information on any significant number of caribou in addition to the large numbers observed previously in the Cape Lisburne area.

#### Fall/Winter Direct Counts

Failure to account for any significant number of caribou during the summer stimulated a concerted survey effort during the fall migration. Between early September and the end of November fewer than 60,000 animals were observed directly, and the estimated total number in the areas surveyed was only 75,000 (including calves).

#### Discussion of the 1975 Census

We believe that the direct count/estimate-extrapolation census of late June/early July that resulted in the estimate of 102,704 caribou is the best estimate of the 1975 population. It could have been an underestimate of several thousand because the fall composition data used in the extrapolation suggested that the herd contained 31 bulls:100 cows. Fall 1976 and 1977 composition data revealed close to 60 bulls:100 cows, and we learned that approximately 40,000 animals from which the 1975 sex ratio was obtained received a harvest of many thousand animals (heavily weighted to adult bulls) prior to collecting the data. Thus, the 31 bulls:100 cows may not have been representative of the herd as a whole. Because the harvest following October was heavily weighted toward females the effect of human harvest on deflating the bull:cow ratio may have been neutralized prior to the next fall. We believed that the above may have caused an underestimate of 5,000-10,000 animals which would mean our three census efforts during the year would have been about 102,000-112,000, 65,000 adults minimum, and 75,000 plus. Unquestionably there were several thousand more animals in the herd than the last two of the above estimates suggest, but clearly the population was well reduced from the 1970 estimate of 242,000.

#### Population Size in 1976

##### Calving Ground Census

Between 12 and 14 June we counted 16,957 caribou older than calves in an attempted census of adults on the calving ground. The census was hampered by poor weather and was later considered to be a gross underestimate because calving was widely dispersed.

##### Early Post-Calving Direct Count/Estimate-Extrapolation Census

The herd was monitored periodically from peak of calving until the first week of July to determine when animals were optimally aggregated

for the photo portion of the APDCE census procedure. It did not appear that aggregations would become consolidated enough to make photo coverage possible so we attempted to visually count (estimate) the adults in the aggregations. On 27 and 28 June we counted 29,000 and 28,500, respectively.

We simultaneously conducted composition counts of the aggregations (Table 3) and determined that 84 percent of the adults were cows. This extrapolated to  $(28,500 \times 0.84) = 23,940$  adult cows "minimum." We estimated that about 50 percent of an additional 4,520 caribou previously located in peripheral areas were cows and that these animals may not have joined the larger aggregations which would make a probable adult cow cohort of 26,200. It is possible that from several hundred to two thousand caribou were not located. Thus we concluded that 23,940 cows was a conservative minimum and 26,200 was our best estimate, but one that could have been conservative.

By applying our observed 1976 fall composition (Table 3) we extrapolated as follows to calculate "minimum" and "best estimate" population figures, respectively:

	23,940 cows	=	.431X, therefore X = 55,545
	13,886 bulls	=	.250X
	6,277 yr1s	=	.113X
	<u>11,442 calves</u>	=	<u>.206X</u>
Total	55,545	=	1.000X

and

	26,200 cows	=	.431X, therefore X = 60,789
	15,197 bulls	=	.250X
	6,869 yr1s	=	.113X
	<u>12,523 calves</u>	=	<u>.206X</u>
Total	60,789	=	1.000X

#### Late Post-Calving Aerial Photography-Direct Count-Extrapolation Census

We continued to periodically monitor the caribou through July and on 17 July, the aggregations were found suitable to make photo coverage feasible.

After the APDCE census we counted between 54,557 and 55,528 animals from photographs. About 37,000 of these were counted on color prints from 35 mm film and between 17,476 and 18,447 were counted from the 9 x 9 inch contact prints of black and white negatives taken from the BLM photo plane. In addition to the animals that were photographed, we counted approximately 6,200 others directly from the aircraft for a total population of between 60,757 and 61,728 animals. At the time we photographed the herd, it was obvious that many more adult bulls were present than when the sex and age composition counts had been conducted (27 June through 2 July). We did not have a helicopter available to obtain composition data because of monetary constraints, and consequently we were unable to extrapolate the number of adult females photographed

and hence were unable to derive a final herd estimate using the fall 1976 composition data. Because some caribou were likely not present in the aggregations photographed, we believe that the total of 60,757 to 61,728 is a conservative known minimum and that it is highly probable that there were several thousand more animals in the herd. It is probable that one group visually estimated to contain 3-4,000 which was located during pre-photo reconnaissance was not relocated during the photo-coverage and so we believe the known minimum population in July 1976 was approximately 65,000.

#### Fall/Winter Direct Count/Estimates

We flew aerial surveys between 3 and 14 January 1977 to estimate the number of caribou wintering north of 70°N latitude (Appendix I in Davis and Valkenburg 1977). The estimated number of caribou present was 28,684 and the 80 percent confidence interval for the number of caribou present was 16,956-40,412. During previous reconnaissance of the winter range to the south we accounted for about 20,000 caribou wintering south of the Brooks Range. Several hundred caribou moved south across the Kobuk River in mid-September. Between 10,000 and 15,000 crossed between Shungnak and Ambler in mid-October and moved to the Selawik Flats where approximately 8,000 remained; the others traveled south and east to other areas. Between 1,000 and 1,500 were accounted for in small groups along the western coast from Noatak to Point Hope. From 3-7,000 migrated south between Anaktuvuk Pass and Howard Pass and then scattered widely throughout the Central Brooks Range, the southern foothills and flats. It is possible that half of these returned to the North Slope. About 1-2,000 wintered in the northern foothills of the Brooks Range from Anaktuvuk River east to the Trans-Alaska Pipeline. By adding the low and high range of estimates we accounted for 31,956-65,912 caribou during our fall and winter surveys.

#### Population Size in 1977

##### Calving Ground Census

We censused adults present on the calving grounds on 14 June and counted/estimated 37,577 caribou older than calves. We calculated that 32,464 were adult cows by extrapolating from the total using composition data (Table 2) obtained during or before the census. By using the figure of 32,464 cows as the female base of the population and by using herd composition data obtained in fall 1977, we extrapolated to a population estimate as follows:

females	=	32,464
43.2 bulls:100 cows	=	14,024
28.5 yearlings:100 cows	=	9,252
<u>41.7 calves:100 cows</u>	=	<u>13,537</u>
Total	=	69,277

However, after comparing our composition data from October 1976 and from April, late June and October 1977, we concluded that our population

estimate was probably low because of suspected bias in the October 1977 composition data. In April 1977 we counted 43.9 calves (short yearlings):100 cows, but in fall 1977 we observed only 28.5 yearlings. Similarly, in fall 1976 we counted 58 bulls:100 cows but only 43.2 bulls:100 cows in fall 1977. No evidence existed to suggest that the decline in the yearling ratios was due to summer mortality and known or suspected harvest by humans would not account for the observed decline in bulls. Therefore, we believe it is probable that we mistakenly classified a number of yearlings as adult females in the fall 1977 composition counts. We think the error resulted from poor counting conditions and inexperienced observers relying upon gross morphology rather than genitalia to distinguish the sexes. Because body size and antler conformation of yearling bulls can be similar to cows, most misidentification likely results in the yearlings being classified as cows. We estimated the error as follows:

1. We assumed 5 percent mortality of short yearlings and 2.5 percent mortality of cows from April 1977 to October 1977, so the expected October yearling:100 cows ratio would be:

$$43.9 - (43.9 \times .05); 100 - (100 \times .025) = 42.085y:97.5 c \\ \text{or } 42.7 y:100c \text{ or approximately } 43 y:100c$$

2. We assumed that the misidentified yearlings were added to the cows in the composition surveys of October 1977 and calculated that 10 yearlings must be subtracted from 100 cows and added to the observed yearling:100 cow ratio (28.5:100) to give the expected yearling:100 cow ratio calculated above (42.7:100) as illustrated below:

$$\frac{28.5 + 10 \text{ yearlings}}{100 - 10 \text{ cows}} = \text{approx. } 43 \text{ yearlings:100 cows}$$

Adjusting the calf:100 cow and bull:100 cow ratio proportionately (i.e. similarly) we calculated corrected ratios of 46.0 calves and 48 bulls:100 cows (Table 2).

Extrapolating with these data we derived a "corrected" population estimate as follows:

June 14, 1977 calving ground census, cow base =	32,464
48 bulls:100 cows	= 15,583
43 yearlings:100 cows	= 13,960
46 calves:100 cows	= <u>14,933</u>
Total	= 76,940

It is obvious from the above calculations that such misclassification in fall composition counts leads to an underestimate of population numbers. The actual fall population was possibly somewhat larger than the adjusted estimate of 76,940. We believe the adjusted estimate of 76,940 animals was a minimum estimate of the fall population. The actual population was probably somewhat larger. Some of the sources of error discussed by Hemming (1972) would also apply to our

estimate of the 1977 population. In addition to these, if we missed any significant groups of cows in early June 1977, our population estimates would be low. However, we believe that we did not miss any significantly large groups (thousands) because the weather during the calving period was excellent and extensive surveys were flown in the area adjacent to the main calving area. Even adding 500-4,000 caribou of the Teshekpuk Lake Herd (Job 3.21R this report), the total population of the caribou within the range of the WAH would not greatly exceed 80,000.

#### Aerial Photo-Direct Count-Extrapolation Census

Several large post-calving aggregations were successfully photographed on 28 June 1977. However, when a fog bank began moving into the area of the caribou aggregations, to finish the photo coverage the scale of the photographs was reduced from the normal 1:3,000 to 1:7,000. Photo resolution was poor and we had no confidence in the counts that we obtained from most photographs. On one photograph three different counters obtained totals ranging from 1,100 to 1,400. During the counting we expected that we would miss many calves, and the final total from the photographs was 54,936.

In addition to the caribou counted on the photographs, we counted another 13,203 visually from aircraft. The total number of caribou seen including those photographed and those counted visually was therefore 68,139. We calculated a population estimate from the observed caribou by extrapolating with our June and October composition data (Table 2) as follows:

June 28, 1977 cow base	=	(68,139) x (0.5651)	=	38,505
Fall composition = .468 cows	=		=	38,505
.203 bulls	=		=	16,702
.195 calves	=		=	16,044
.134 yrlds	=		=	<u>11,025</u>
Total				82,276

This figure agrees quite closely with the estimate based on the census of cows on the calving ground. But because of the problems that we encountered counting adults and calves on the photographs, and the low reliability of those figures, we feel that this agreement is as likely to be a coincidence as a confirmation of the accuracy of the photo-census.

If we consider that error is possible in the late June composition counts similar to that discussed above in fall composition, the bias would result in an inflated cow base and therefore an overestimate of the total population.

#### Fall/Winter Direct Count/Estimates

A count of caribou migrating south from the Noatak River during fall 1977 revealed that about half or slightly less than half of the

herd was involved in this movement. On 20 September Area Biologist David Johnson counted about 30,000 caribou between the Noatak River and the Kobuk River. A week later we counted and estimated the number of caribou in this aggregation to be 26,000 caribou.

Additional estimates of other wintering concentrations include an estimate of ca. 30,000 wintering on the North Slope north of 70°N latitude and west of the Colville River Delta (Davis and Valkenburg 1977).

### Sex and Age Composition

#### Pre-1975

Prior to our intensive study initiated in 1975, sex and age composition data were obtained from the WAH only sporadically (Table 1). Helicopters were generally unavailable in the past and hence samples were obtained when animals were available at access points. Consequently past samples were generally small and possibly not representative.

#### Post-1974

Data from composition counts are available for 1975, 1976 and 1977 (Table 3), but the sample size of the 1975 counts was rather small (2,231) and, as discussed above, almost certainly the bull:cow ratio was not representative of the population because of selective shooting of bulls just prior to the counts. In 1975 no helicopter was available and only a migrating segment of the population near Cape Krusenstern was sampled. The 1976 counts were probably the most representative of the three fall counts, but almost half of the WAH remained on the Arctic Slope where no counts were conducted. The same situation prevailed in 1977. Counts were planned for the Arctic Slope, but poor weather throughout September, October and much of November precluded conducting them. Also during the 1977 counts the caribou were in large groups that were difficult to count and classify, and both the helicopter pilot and several observers were inexperienced.

A discussion of the suspected bias in the 1977 composition counts appears in the previous section. The drop in the bulls:100 cows ratio from 1976 to 1977 was substantial, even more than could be expected with a 1976-1977 hunting season in which the harvest was restricted to bulls and 3,000 were taken (Job 3.20R this report). Using the correction factor discussed in the preceding section on population estimation, we obtained an adjusted 1977 bull:cow ratio of 48:100. However, again, the sources of bias are numerous and errors result from unrepresentative samples and samples of segregated groups. We have no objective way as yet to assess the reliability of our counts and must rely on our subjective feelings at the time the counts are done. This problem is compounded when comparing our counts to those of previous workers.

Doerr (pers. comm.) analyzed available composition data from the Nelchina Herd and the WAH. Using a statistical treatment of the data he concluded that the confidence intervals were so wide as to render the data statistically almost meaningless.

The only apparent trend in the composition data since 1961 is a decrease in the ratio of bulls:100 cows. The decrease appeared to begin before the first "bulls-only" season in 1976. This trend can be expected to continue with a bulls-only season.

#### Productivity, Age Structure and Survival

According to all available historical and recent data, initial production of calves in the WAH generally has been high (Table 3). Estimates of productivity have ranged between 70 and 80 calves:100 cows in all years except in 1969. No pregnancy or parturition rates had been determined for the herd before 1977. That year we counted distended udders on 472 out of 517 cows older than yearlings in the main calving area; indicating a pregnancy rate of 91.8 percent.

Although information on calf survival or yearling recruitment was not collected until 1977, some inferences can be made from comparisons of the age structure of harvested caribou collected in 1959-1961 and in 1975-1976 (Fig. 1). It appears that the 1959-1961 sample contained more caribou in the three youngest age classes than the 1975-1976 sample. It may be that calf survival during the early 1960's was higher than during the mid-1970's due to the apparently high wolf (*Canis lupus*) population in the 1970's, and perhaps the lingering effects of disease (Neiland et al. 1968). Detailed information on calf survival was collected in 1976-1977 and in 1977-1978.

#### Calf Survival 1976-1977

Initial calf production in the core calving area of the WAH was 76.9 calves:100 cows in mid-June 1976. Calf production in peripheral areas was lower, being approximately 60 calves:100 cows. The average between the two areas was 73. There was a 26.3 percent reduction in the calf:cow ratio from the peak of calving in mid-June to early July. This reduction was probably due, in part, to immigrating nonparturient cows and groups of cows with lower proportions of calves from the peripheral calving areas to the core area during this period. However, some loss of calves did occur, since instances of calf mortality were observed during this time. Also, many studies have demonstrated that neonate ungulates are most vulnerable to several mortality sources during the first days of life. Mortality rate of calves from early July to late October was proportional to mortality rate of cows. Findings from long-term life history studies of caribou in North America (Kelsall 1968, Skoog 1968, Bergerud 1971) suggest that the adult female segment of a population normally incurs 5 or 6 percent annual mortality from natural causes when wolf predation is not excessive. If this mortality occurred evenly through the year, less than 1.5 percent of the adult cows would be lost from July-October. Because ungulates in temperate regions usually sustain heaviest natural mortality of adult females during late winter and spring (during calving), it is likely that natural deaths (exclusive of predation) were very low during July-October.

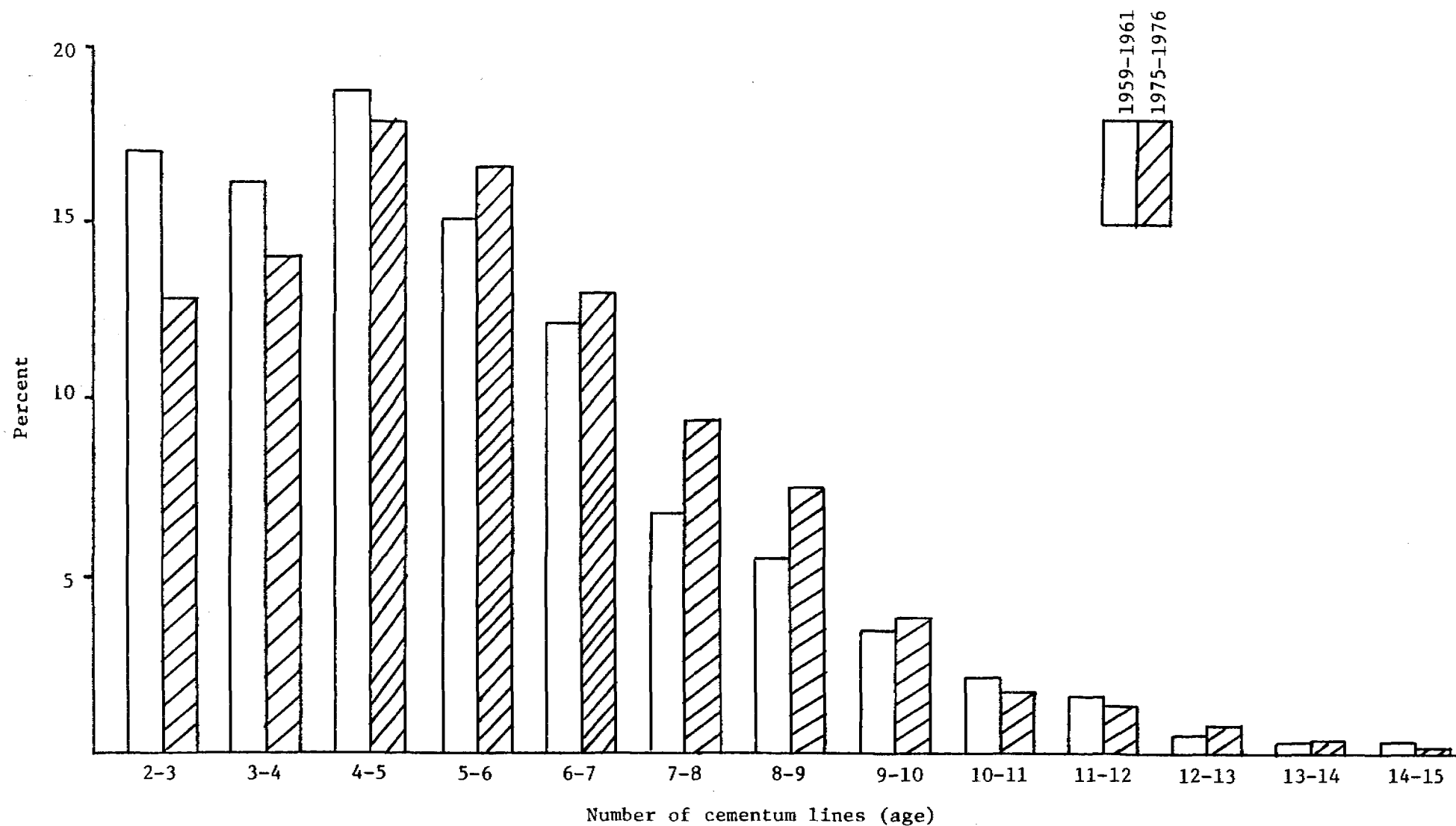


Figure 1. Age structure of hunter-killed caribou from the Western Arctic Herd (adopted from Davis 1978).

Further, little calf loss probably occurred during this period. We believe that wolf predation north of the Brooks Range is relatively low, particularly on the coastal plain.

Subsequent calf survival from late October 1976 to mid-April 1977 was 94.1 percent, based only on comparison of calf:cow ratios and assuming that: 1) no mortality of cows occurred during this period, and 2) one half of the yearlings classified in October were females. The second assumption requires that observed ratios be adjusted as follows:

Observed ratios in October 1976 were: 13.2 female yearlings and  
54.2 calves:100 cows

Observed ratios in April 1977 were: 43.9 calves:100 cows and  
female yearlings

Therefore, the April calf:cow plus female yearling ratio was corrected to calf:100 cows as follows:

$$\frac{43.9 \text{ calves}}{96.8 \text{ cows (+13.2 F yrlgs)}} = \frac{X \text{ calves}}{100 \text{ cows}}$$

$$X = \frac{100 (43.9)}{86.8}$$

$$X = 50.5 \text{ calves, or } 51$$

In October 1977 the yearling:cow ratio was estimated to be 26, but due to the suspected bias in composition counts already discussed, we believe that the actual figure was about 43. We feel that calf survival from 1976 to fall 1977 was in excess of 50 percent.

June and July calf:cow ratios were representative of the entire WAH whereas the October and April values represent about 50 percent of the herd, or those wintering south of 69°N latitude. The other 50 percent of the herd wintered on the Arctic Coastal Plain north of 69°N latitude and no October calf:cow ratios were obtained from this segment of the population. Calf:cow ratios were obtained from these animals in late April 1977, however. In April, 53.9 calves:100 cows (plus female yearlings) were observed in a sample of 1,245 animals classified between the Colville and Ikpiuk Rivers north of 70°N latitude. During a fixed-wing classification count southeast of Wainwright in April, 22 percent calves were identified in a sample of 1,195 animals. These observations suggest that overwinter calf survival in areas north of 69°N latitude equalled or surpassed that of areas south of 69°N latitude.

#### Identification of Calf Mortality Factors

Eight calf carcasses were examined during March and April 1977. Of these, four (50%) were probably killed by wolves, 3 (38%) by malnutrition and one (13%) by illegal hunting. Three of 12 "winter-killed" or moribund

caribou found were calves, and four of 26 (15%) wolf-killed caribou were calves.

#### Characteristics of Wolf-killed Caribou

Although sample sizes are not large, some inferences can be made about wolf predation on WAH caribou during late winter 1977. As noted above, calves were taken approximately proportional to their abundance in the population. In areas where snow was 45 to 90 cm deep (i.e. all locations except Selawik Flats vicinity), wolves seemed to take animals of any sex or age class in apparent good nutritional condition. Marrow fat averaged 64.6 percent (s.d. = 20.3, range = 96.9-27.2) for wolf-killed caribou. The degree of utilization of carcasses in these areas was less ( $\bar{X}$  = 62.7, range 5-100) than in the Selawik Flats vicinity. In the Selawik Flats vicinity snow depths ranged from 0-25 cm. All carcasses in this area received 90 percent or more utilization or wolves were still feeding on them when specimens were collected. Eighty-three percent (five of six) of the wolf-killed caribou from this area were in poor condition (femur marrow percent fat:  $\bar{X}$  = 18.3, s.d. = 19.8, range 58.5-7.8). For comparison, six hunter-killed animals from the Selawik Flats had the following values in percent marrow fat:  $\bar{X}$  = 84.4, s.d. = 4.5, range = 88.4-76.1.

#### Characteristics of Caribou Dying From Malnutrition

Femur marrow percent fat data were obtained from seven "winter-killed" animals. Five with lowest values apparently died from malnutrition during late winter. The two with highest values included a moribund yearling (16.0% marrow fat) that was shot. An autopsy revealed evidence of internal hemorrhaging. The other caribou (11.3% marrow fat) was a large adult bull with antlers, suggesting that it had died during early winter. The carcass was scavenged and no autopsy was possible. Because the five caribou apparently dying from malnutrition had a mean marrow fat of 6.5 percent (s.d. = 1.20 and a range of 7.8-5.0), marrow fat values considerably greater than 6.5 may indicate that death was due to factors other than malnutrition under the environmental conditions existing in 1976-1977. Although 12 probable "winter-killed" caribou were located, we feel that malnutrition contributed little to overall mortality in the herd during winter 1976-1977. All "winter-killed" caribou (except the moribund yearling) were found on the North Slope where carcasses probably remained visible for months. Further, over 90 percent of these were old bulls and calves, and most were found within a 15-mile strip on either side of the Colville River where snow was deeper than in any other area visited on the North Slope (about 60 cm). Fewer than 100 caribou were observed in this area and most were bulls in poor condition. The only other "winter-killed" caribou were found near Teshekpuk Lake where several carcasses and moribund animals were observed. Although this caused concern about possible heavy loss of "winter-killed" animals, the proportion of carcasses was very low when compared to total animals seen. Less than 20 weak and dead animals were observed in the Teshekpuk Lake area, and these were probably animals lagging behind several thousand caribou that had wintered in that vicinity but were

migrating west toward the calving area. More weak and dead animals were observed near Teshekpuk Lake than farther west. No weak or dead animals were seen west of the Ikpikpuk River, although several thousand live animals were observed.

#### Chronology of Calf Mortality 1977-1978

Ground counts were conducted in the "core" calving area in 1977 and aerial counts of adults and calves were flown in peripheral areas. The calves:100 cows ratio which we thought most representative of the population was 68.0:100. By the end of June the ratio was reduced to 52.1:100, a decline of 23 percent compared with 26 percent the previous year. The ratio in October had declined to 41.7:100, or a 20 percent decline compared to only 10 percent the previous year. About 30,000 caribou again remained on the Arctic Slope in fall, but we were unable to conduct composition counts there. We completed composition counts on both the Arctic Coastal Plain and in the southern wintering areas in mid-April 1978. The mean ratio (adjusted for yearlings as in 1977) from both the northern and southern areas was 28.7:100, a 31 percent decline from October. Calf survival on the Arctic Coast near Point Lay was particularly poor; the adjusted ratio here was 19.5:100. The ratio on the south side of the Brooks Range was 35.2:100. If we assume that the fall ratio was the same on the Arctic Slope as in the Kobuk River-Selawik Flats, the percent decline was 53.2 and 25.2, respectively. Possible biases in the composition counts have been discussed in the section on population size. If the fall ratio is adjusted for possible error in the composition counts the overwinter mortality is even higher.

A clue to the poor survival was our discovery of several dead and sick calves on the coastal plain near Point Lay, and a dead adult cow near the calving grounds in early June. All these animals had very heavy infestations of warble and/or nose bot larvae. The adult cow had about 100 nose bot larvae in the throat, and one of the dead calves had between 1,900 and 2,000 warble larvae on the back and upper legs. Temperature during the winter was probably about normal on both the coastal plain and on the Selawik Flats and snow depth was below normal.

No large predators were seen on the Arctic Coastal Plain and no wolves were seen by Department personnel in the major southern wintering areas. No wolves or wolf-killed caribou and only one set of wolf tracks were seen in the Selawik Flats, a very different situation from the previous year. However, Area Biologist Peter Shepherd conducted aerial surveys for wolves in the central Brooks Range, and saw almost 50 wolves and nearly 30 dead caribou in 3 days. Local residents of the Kobuk valley and Kotzebue who traditionally hunt wolves from aircraft took very few during the winter. Most were of the opinion that poor tracking conditions were responsible, and not a shortage of wolves.

Despite the poor survival in 1977-1978, recruitment may have been sufficient to sustain the herd, especially in view of the moderate harvest level and possibly reduced wolf population. We are currently working to refine the APDCE technique and we should obtain more precise estimates of population size in 1978.

## RECOMMENDATIONS

1. Because the WAH is now at a relatively low level, and because hunting pressure is high, especially on bulls, we recommend that a census of cows on the calving ground and a post-calving photo census be conducted each year.

2. Only bulls may be hunted at present, and therefore it is especially important to have good composition information. Future fall composition counts should be of adequate sample size, and as representative of the population as possible.

3. Due to the level of illegal hunting of cows and predation by wolves on the south side of the Brooks Range, a single recruitment failure could precipitate another decline. We should continue to conduct counts in April to determine the annual recruitment of yearlings into the herd.

4. Although census efforts from 1975-1977 have established a fairly good estimate of present herd size, the existing census technique produces a population estimate that is less accurate than current intensive management requires (Doerr pers. comm., Bente and Roseneau 1978). Most caribou biologists suggest that refining the existing aerial photo-direct count-extrapolation technique (APDCET) is preferable to using other existing techniques or attempting to develop entirely new techniques. Shortcomings in the present application of the APDCET stem from several assumptions. Of the four assumptions of the APDCET that follow, at least three may be contributing to considerable error in population estimates and improvement may be possible:

- a. Most or all of the adult females in the herd are counted in the post-calving areas.
- b. The adult females are randomly distributed throughout the post-calving aggregations.
- c. The age and sex cohorts are randomly distributed throughout the herd during the fall.
- d. Mortality of adult females from midsummer to fall is zero.

We recommend that assumptions a through c be tested in the next fiscal year. Assumption d should be tested as soon as in-depth studies to quantify the magnitude and chronology of adult mortality become feasible.

Another aspect to improving the technique will consist of testing the feasibility of the Department conducting the aerial photography of the Western Arctic Herd. The photo mission has been contracted to BLM or private industry in the past. This should be explored during the 1978 census.

5. Because of the high demand for human harvest of the herd, it is imperative to better evaluate causes and magnitude of natural mortality to insure that collective mortality does not allow the herd to increase.

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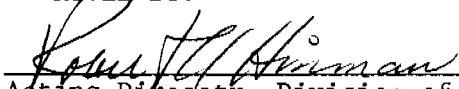
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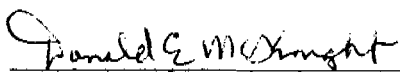
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## FINAL REPORT (RESEARCH)

State: Alaska

Cooperators: James L. Davis, Carl Grauvogel, Harry Reynolds and Patrick Valkenburg

Project No.: W-17-8 and W-17-9 Project Title: Big Game Investigations

Job No.: 3.20R Job Title: Human Utilization of the Western Arctic Caribou Herd

Period Covered: July 1, 1975 to June 30, 1978

### SUMMARY

From 1963 to regulatory year 1976-1977 there was no closed season and no bag limit for hunting caribou north of the Yukon River. During this time humans harvested about 20,000-30,000 caribou annually from the Western Arctic Caribou Herd (WAH). Over 95 percent of this harvest was estimated to be taken by residents of northwestern Alaska. We made an intensive effort, the first since 1968, to ascertain the nature and extent of human harvest of the WAH in regulatory year 1975-1976. We determined that humans likely killed and retrieved well over 20,000 caribou during the year; several thousand more were lost to wounding and waste. Although no major effort was made to quantify waste of caribou, we observed 996-1,067 carcasses (this range is because of various degrees of decomposition and unexact counts of animals in piles) that we judged had been killed by humans and wasted. We concluded that actual total waste was likely several times the number we observed, and that the waste could not be justified either biologically or morally/socially/ethically. Patterns of human use varied greatly depending upon availability of caribou. The range of caribou harvested per successful hunter was 1-85 for hunters for which we received harvest logs. Several verbal reports were received of individual hunters who took 200 or more caribou but these were not verified.

Findings of this study and other research initiated in 1975 necessitated major restrictions of human harvest in regulatory year 1976-1977.

A summary of the regulations for the 1976-1977 and 1977-1978 hunting seasons is presented. Of 3,000 permits that were available for issuance in 1976-1977, 2,334 (77.8%) were issued. Permits returned (1,600) equalled 68.5 percent of those issued. About 69 percent of the returned permits were by successful hunters. The extrapolated harvest from the permits was 1,687. Adding known and suspected harvests before the permit season began (i.e. 15 July to 13 August), during the closure (14 August to 24 September) and unreported harvests, we estimated that the human harvest of caribou was between 2,700 and 3,500 from 1 July 1976 to 1 July 1977. The administration of the 1976-1977 hunt was such that essentially all of the permits went to residents of northwestern Alaska.

Legal decisions mandated that the 1977-1978 hunt be administered differently. Although a 3,000 bulls quota was in effect and permits were issued to all applicants only 2,883 hunters obtained them. Persons residing south of the Yukon River obtained 5.9 percent of the permits and residents of northwestern Alaska obtained 94.1 percent of the permits. Only 1,010 permit harvest reports were returned and 67 percent of these (672) were successful. Extrapolating what the total harvest for the year may have been from the reported harvest data is confounded by not having an index of the biases involved in successful versus unsuccessful hunters who reply. Although a liberal extrapolation of the total harvest would be 1,932, we believe that the actual harvest may have been considerably larger because of apparently widespread noncompliance with regulations. However, few cases of blatant violation of the regulations were noted.

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## BACKGROUND

The long dependence of northern people, both Natives and more recent immigrants, on caribou (*Rangifer tarandus*) is common knowledge. Northern people have been so closely tied to caribou that existing literature is replete with references documenting the use of caribou and of widespread starvation or hardship when they became unavailable (Gubser 1965, Kelsall 1968, Stefansson 1913, Jackson 1894).

People in northwest Alaska have a long history of using caribou (Skoog 1968, Lent 1964, Anderson et al. 1977, Gubser 1975). Anderson et al. (1977) summarized the extensive pre-history evidence that illustrates the dependence of early Kobuk Valley residents upon caribou. This evidence suggests that even 10,000 years ago, just after Alaska's land connection to Asia across the Bering Land Bridge had been severed, residents of northwest Alaska hunted and were largely dependent upon caribou. Other recent fauna and perhaps native American horses (*Equus* spp.) and bison (*Bison* spp.) (Anderson et al. 1977) were also used. By 6,500 to 6,000 B.C. all Pleistocene ungulates, except for those extant today, were extinct in the region so residents of inland northwest Alaska (Kobuk Valley) had to rely primarily on caribou for sustenance. They were

not yet dependent upon fish resources (Anderson et al. 1977). In reviewing the artifact record from the Onion Portage site on the Kobuk River, Anderson et al. summarized the apparent periods of occupancy of the Kobuk River. Although this record is incomplete, it appears that when people resided in the region they were heavily dependent upon caribou.

The Kobuk River peoples flourished in the valley until between 500 and 600 A.D. when a regional decline in caribou forced them and their more northerly inland tundra relatives to concentrate their activities on the seacoast where their livelihood depended on the harvesting of fish and sea mammals. Around 1,000 A.D. the Eskimos, in all likelihood Kuuvanmiit, again began to occupy the valley year round.

As a result of several factors, the period following 1,000 A.D. was one of population growth for the Kuuvanmiit, as well as for the Kotzebue Sound Eskimos. Caribou were once again abundant in northwestern Alaska including the downriver Kobuk area, and the Kuuvanmiit developed a new fishing technology that enabled them to make full use of the river's resources.

Between 1,000 and 1,400 A.D. the Kuuvanmiit developed a wide range of fishing techniques and began a seasonal scheme of subsistence activities that is basically the same as that today. In the middle reaches of the river, settlements sprang up that centered around winter caribou hunting in the Kobuk River Valley, spring seal hunting at the coast and summer salmon fishing along the main river.

Because Ahteut, Onion Portage and Qalukruitichiaq are located at the main river crossings for southward migrating caribou, the hunters also had easy access to caribou in the fall. These animals may, in fact, have remained in the vicinity of the settlements throughout the winters. Life on the Kobuk River remained quite bountiful during the 15th to 17th centuries.

As far as can be determined, the 18th century Kuuvanmiit subsistence cycle continued throughout the early 19th century (Hickey 1977 cited in Anderson et al. 1977). Sometime during the latter half of the 19th century, caribou populations began to decline as they had periodically during the previous ten millennia, and the Kuuvanmiit again had to rely heavily on the seacoast for their economic pursuits. This time, however, the growing influx of foreign goods tempered the effects of the caribou decline, and the upriver peoples were able to maintain themselves in the Interior despite the decline in caribou.

Various written records pertaining to the relative abundance of caribou in northwestern Alaska date to the mid-1800's and were reviewed and summarized by Lent (1964) and Skoog (1968). Dease and Simpson (1838 cited in Skoog 1968) reported that large numbers of caribou were frequenting the Arctic Coastal Plain east of Point Barrow in 1837. To

the south, caribou were abundant in the area embracing the Seward Peninsula and the hills east of Norton Sound to the Yukon River until the early 1870's (Skoog 1968). According to Lent (1964), starting in the mid-19th century there was a rapid decrease in the number of caribou in western Alaska. The decrease was first noted in the lower Yukon River drainage. Caribou were still plentiful in 1867 as evidenced in a report by Dall (1870 cited in Lent 1964) where he reported seeing over 4,000 "reindeer" calf skins at Anvik on the Yukon River. Caribou were scarce in the area by 1878 according to Nelson (1887 cited in Lent 1964). Nelson reported that in 1866-1867, when the American telegraph explorers visited Alaska, caribou were found everywhere and herds containing thousands were not uncommon. They were abundant in the area adjacent to Norton Sound. Nelson spent the years 1878-1881 at Saint Michaels without seeing a caribou. However, he stated that they were then still abundant at the head of the Kobuk River.

By 1878 caribou had greatly declined in numbers along Alaska's northwest coast and Eskimos began making market hunting trips to Nunivak Island and soon exterminated the caribou there (Murie 1935). By the late 1890's, caribou were scarce all along the northwest coast as far as Barrow (Jackson 1897 cited in Lent 1964), a reason given by Jackson (1894) for the introduction of reindeer. This is contradictory to Skoog's (1968) comments that during the late 1800's caribou continued to be numerous on the Arctic Slope east of Cape Lisburne, but scarce throughout the Bering Sea coast and along the Kobuk and upper Koyukuk Rivers. The Chandler Lake area was particularly well populated with caribou during this time.

Skoog also stated that Ray (1885) had noted an absence of inland Eskimos along the Meade River in 1883 at a time when caribou were numerous there. By the turn of the century caribou had retreated inland from the Arctic Coast and perhaps moved eastward; most caribou were found along the upper Colville River and in the De Long and Endicott Mountains. This center had shifted farther eastward by the 1920's, mainly east of Chandler Lake, and regular movements of caribou occurred in the fall and winter from the north and northeast into the Wiseman area of the upper Koyukuk River and southwestward to the Ray Mountains (Skoog 1968).

The caribou population in northwestern Alaska was considerably reduced because of the apparent eastward shift, which caused caribou to remain in the De Long and western Endicott Mountains throughout the year, extending into the foothills north of the upper Colville River, but not onto the coastal plain. The Baird Mountains and the Kobuk River drainage were not frequented.

An increase in caribou numbers in the area was first noted in the early 1920's (Bailey and Hendee 1926, Murie 1935 cited in Lent 1964). During the late 1920's and later, the population in northwestern Alaska continued to grow, perhaps being augmented by shifts of animals from the east and by a general movement northward from the south (Skoog 1968). In the mid-1930's caribou once again were being sighted along the Bering Sea coast north of the Seward Peninsula, and the reindeer

herders for the first time began to have serious losses of reindeer due to wandering bands of caribou (Rood 1942). By the late 1940's north-western Alaska contained the bulk of the Arctic caribou population in Alaska, and major portions of the herd began to winter along the Kobuk River drainages. Prior to that time the animals had wintered north of the Baird and Schwatka Mountains, frequently on the Arctic foothills and coastal plains. The large population size caused the herd to split into numerous groups seasonally, with the utilization of several wintering areas (Skoog 1968).

Lent (1964) commented about historical occupancy of the traditional (and current) calving area as follows:

One region which appeared to be only partially affected during the drop in caribou numbers lay just north of the Brooks Range on the upper Colville River, and from the Killik River to the Utukok River. Schrader (1904) reported caribou to be plentiful in this region even though they were apparently scarce along the adjacent coast in the same years (ca. 1901).

Samuel Agnassaga of Point Lay (pers. comm. 1961) reports that caribou calved in the general region of the upper Utukok River when he was a boy (ca. 1910-1915). The Utukokmiut (people of the Utukok River) were perhaps the largest group of inland Eskimos north of the Brooks Range before the arrival of the European (Spencer 1959, Agnassaga pers. comm.). These people came down to the coast in the summer to trade caribou calf skins, among other things. Murie (1935:65) describes how in more recent times, '...natives from Point Lay, Icy Cape and Wainwright came up the Utukok and also portaged over the Kuk to get caribou on the upper Utukok.' The observations summarized by Murie indicate that even when the caribou population of the Arctic Slope was at its lowest point, the Utukok River drainage and the upper Colville River area continued to be a center of relative abundance.

Few data are available about the magnitude of human harvest of the Western Arctic Herd prior to the early 1950's. Pertinent data describing the patterns of human use of the WAH caribou from the early 1950's through 1974 are summarized in Tables 1, 2 and 3.

## OBJECTIVES

To ascertain the nature and extent of human use of Western Arctic Herd caribou.

## PROCEDURES

Regulatory Year 1975-1976

### Harvest

To determine the number of caribou harvested from the WAH in 1975-76, we hired village data collectors in Anaktuvuk Pass, Point Hope,

Table 1. Estimated human harvest of the Western Arctic Caribou Herd and hunting seasons and bag limits from 1952 to 1974.

Year	Season and Limit	*Approximate Harvest (Entire Region)	Source
1974	No closed season <sup>1</sup> No limit	"Below normal"	Grauvogel & Pegau, 1974 S&I Report
1973	No closed season <sup>1</sup> No limit	"Above normal" ("normal"=25,000)	Pegau, 1973 S&I Report (1975) <sup>3</sup>
1972	No closed season <sup>1</sup> No limit	"The overall harvest in 1972 was higher than normal"	Pegau, 1972 S&I Report (1974) <sup>3</sup>
1971	No closed season <sup>1</sup> No limit	"About normal, or a little less..."	Pegau, 1971 S&I Report (1973) <sup>3</sup>
1970	No closed season <sup>1</sup> No limit	"About normal"	Pegau, 1970 S&I Report (1971) <sup>3</sup>
1969	No closed season <sup>1</sup> No limit	"Less than the average of 25,000"	Pegau, 1969 S&I Report (1970) <sup>3</sup>
1968	No closed season <sup>1</sup> No limit	27,000	Hemming & Glenn, 1968 Caribou Report (1969) <sup>3</sup>
1967	No closed season <sup>1</sup> No limit	26,000	Hemming & Glenn, 1968 Caribou Report
1966	No closed season <sup>1</sup> No limit	24,000	Hemming & Glenn, 1968 Caribou Report
1965	No closed season <sup>1</sup> No limit	29,000	Hemming & Glenn, 1968 Caribou Report
1964	No closed season <sup>1</sup> No limit	25,000	Hemming & Glenn, 1968 Caribou Report
1963	No closed season <sup>1</sup> No limit	20,000	Hemming & Glenn, 1968 Caribou Report
1962 to 1959	No closed season <sup>2</sup>	n/a	
1958	Aug. 20-Dec. 31 <sup>2</sup> 3 caribou (either sex)	n/a	
1957	No closed season <sup>2</sup> No limit	n/a	
1956	Aug. 20-Feb. 28 <sup>2</sup> No limit	n/a	
1955	Aug. 20-Feb. 28 <sup>2</sup> 5 caribou (either sex, no calves)	n/a	
1954	Aug. 20-Feb. 28 <sup>2</sup> 5 caribou (either sex, no calves)	n/a	
1953	Aug. 20-Feb. 28 <sup>2</sup> 3 caribou (either sex, no calves)	n/a	
1952	Aug. 20-Feb. 28 <sup>2</sup> 3 caribou (bulls only, forked horn or larger)	n/a	

\* NANA Corporation estimated approximately 14,000 yearly subsistence harvest  
in their region.

<sup>1</sup> North of the Yukon River

<sup>2</sup> North of Arctic Circle

<sup>3</sup> Publishing date

Table 2. Chronology of caribou harvest by selected northwestern Alaska villages between 1959 and 1967.

Month	Kivalina <sup>1</sup> 1959-60	Kivalina <sup>1</sup> 1960-61	Noatak <sup>2</sup> 1960-61	Pt. Hope <sup>2,3</sup> 1960-61	Ambler <sup>4</sup> 1965-66	Selawik <sup>4</sup> 1965-66	Selawik <sup>5</sup> 1966-67	Ambler <sup>5</sup> 1966-67	Noatak <sup>5</sup> 1966-67	Pt. Hope <sup>5</sup> 1966-67
Sept	0	130	-	5	200	-	-	-	-	-
Oct	30	98	462	106	237	200	0	97(25F) <sup>6</sup>	0	0
Nov	100	44	210	225	10	200	0	4(3F)	27(18F) <sup>6</sup>	15(13F) <sup>6</sup>
Dec	29	37	20	28	0	300	34(27F) <sup>6</sup>	6(4F)	1(1F)	36(29F)
Jan	41	85	182	48	0	500	67(43F)	18(5F)	77(65F)	35(27F)
Feb	53	80	268	26	20	150	57(35F)	40(26F)	31(28F)	58(49F)
Mar	117	69	153	161	30	505	241(181F)	17(14F)	36(33F)	36(32F)
Apr	37	76	213	35	226	665	108(81F)	114(99F)	17(13F)	12(11F)
May	0	0	33	11	50	-	0	154(124F)	0	0
June	0	0	0	17	-	-	0	45(1F)	0	0
July	0	0	-	39	-	-	0	0	0	0
Aug	0	0	-	41	-	-	0	0	0	0
% Total	51	36	43	44	42	52	80	75	44	55 $\bar{x} = 52$
after January										
Total	407	619	1541	742	773	2520	507(367F)	495(301F)	189(158F)	192(161F)

<sup>1</sup> Saario and Kessel. 1966. Human ecological investigations at Kivalina. In Environment of the Cape Thompson Region, Alaska. USAEC.

<sup>2</sup> Foote and Williamson. 1966. A human geographic study. In Environment of the Cape Thompson Region, Alaska. USAEC.

<sup>3</sup> Time period: June 1960-May 1961.

<sup>4</sup> ADF&G files, village harvest survey.

<sup>5</sup> Hemming and Glenn. 1968. Caribou Report. Based on village caribou jaw collections.

<sup>6</sup> (#) = number of females in harvest.

Table 3. Estimated average annual harvest of caribou from ca: 1969-1973 for villages within the range of the Western Arctic Caribou Herd.<sup>1</sup>

Village	1970 Population	1973		Average number of caribou/year	Average number caribou/person
		Native Enrollment			
Anaktuvuk Pass	97	124		1000	10.3
Barrow	1904	1912		3500	1.8
Point Hope	369	386		750	2.0
Wainwright	307	320		1500	4.9
Total - Arctic Slope Native Region <sup>2</sup>	2677	2742		6750	$\bar{x}$ 2.5
Ambler	195	173 <sup>3</sup>		2500	12.8
Buckland	104	146 <sup>3</sup>		150	1.4
Deering	60	54 <sup>3</sup>		6	0.1
Kiana	300	315 <sup>3</sup>		863	2.9
Kivalina	190	185 <sup>3</sup>		513	2.7
Kobuk	60	65 <sup>3</sup>		180	3.0
Kotzebue	1696	1819 <sup>3</sup>		5000	3.0
Noatak	293	282 <sup>3</sup>		1214	4.1
Noorvik	462	444 <sup>3</sup>		1381	3.0
Selawik	450	433 <sup>3</sup>		1887	4.2
Shungnak	165	165 <sup>3</sup>		525	3.2
Total - NANA Region	3975	4081		14,219	$\bar{x}$ 3.6
Elim	168	--		20	0.1
Koyuk	121	--		125	1.0
Shaktolik	144	--		138	1.0
Unalakleet	403	--		130	0.3
White Mountain	84	--		10	0.1
Total - Bering Straits Native Corporation <sup>4</sup>	920	--		423	$\bar{x}$ 0.5
Alatna/ Allakaket	168	155		300	1.8
Bettles/ Evansville	26	20		50	1.9
Galena	265	315		60	0.2
Hughes	73	85		218	3.0
Huslia	151	171		500	3.3
Koyukuk	121	107		3	less than 0.1
Ruby	134	131		30	0.2
Tanana	350	359		100	0.3
Total - Doyon Limited Galena Subregion <sup>4</sup>	1288	1343		1261	$\bar{x}$ 1.0
Aggregated total	8860	--		22,653	$\bar{x}$ 2.56

<sup>1</sup> These data were primarily obtained from Patterson (1974). Inventory: subsistence harvests in five native regions. Resources planning team, Joint Federal-State Land Use Planning Commission. 48pp.

<sup>2</sup> Point Lay and Nuiqsut were not occupied when these data were collected.

<sup>3</sup> These data from Mauneluk Association, Inc. 1973. The NANA Region its resource development potential. Report No. 221. 289pp.

<sup>4</sup> The only villages listed here are those that indicate some harvest of caribou.

Kivalina, Noatak, Selawik, Noorvik, Kiana, Shungnak and Ambler. Each village recorder was paid \$50 per month. Harvest recording forms and verbal instructions were given to each data collector.

Department biologists obtained estimates from Wainwright, Point Lay, Barrow, Nuiqsuit, Meade River (Atkasook), Bettles, Kobuk, Allakaket-Alatna, Hughes and Huslia by personal observations, interviews and information supplied by village councils.

This system worked reasonably well until about January 1976, when the Department believed some emergency reduction in the caribou harvest was necessary and initiated village meetings to determine how such restrictions would be accepted and whether people would comply with restrictions. These restrictions were never implemented but proposing them caused a great deal of alarm and most villages became uncooperative in assessing the harvest. NANA Corporation leaders in Kotzebue offered to provide harvest data for the villages in their region after January 1976, but these estimates were never made available to us. Harvest data after January 1976 are largely based on the few village returns where cooperation continued and on estimates made by local residents, pilots and Area Biologists. The most meaningful estimates by local residents were believed to be those in which we obtained known minimum kills for a portion of the year. In such instances, if several reliable persons were consistent in estimating the portion of the total kill that occurred within given time periods in their respective villages, we could prorate the total kill for the village.

Harvest by persons not residing in villages or within the herd's range (i.e. "recreational" hunters) was estimated by Area Biologists and from interviews with pilots and Fish and Wildlife Protection officers.

#### Use of Caribou

During 1975-1976 the commercial use of caribou was estimated by interviewing the known major buyers of caribou. Crippling loss and waste of caribou were evaluated by personal observation, aerial and ground surveys, interviews, pilot reports, complaints from villagers and through public meetings.

#### Regulatory Year 1976-1977

#### Harvest

Village harvests were determined by village residents employed by contract to issue permits and collect mandatory harvest reports stipulated by the permit. Requirements and details of the permit hunt appear in Appendix I. Persons transporting caribou south of the Yukon River were required to submit a transport permit, and these permits were initially used to assess the harvest by hunters residing outside the range of the herd. After the emergency regulations were passed, all hunters were required to complete a harvest report card.

## Use of Caribou

We located and examined carcasses by use of fixed-wing aircraft and a helicopter, incidental to classifying caribou in April to determine overwinter calf survival. We also flew surveys to look for dead animals in areas where caribou were wintering.

### Regulatory Year 1977-1978

## Harvest

Harvest was determined by mandatory postcard-type harvest report cards that were required under provisions of the permit hunt (Appendix II).

## Use of Caribou

As in the previous year, we examined carcasses using a helicopter and fixed-wing aircraft during overwinter calf survival surveys conducted in April. We flew periodic aerial surveys around caribou wintering adjacent to villages.

## FINDINGS AND DISCUSSION

### Harvest During Regulatory Year 1975-1976

When the results of the 1975 summer census of the WAH suggested the herd had likely declined to about 100,000 animals, we made a concerted effort in fall 1975 to document human harvest. Human harvest had averaged about 25,000 per year from 1952-1973 (see Table 1) and if it were still anywhere near that we believed the herd would continue to rapidly decline. Retrieved village harvests were documented or estimated to have totaled 6,384 for September and October 1975 (Table 4, excerpted from Davis et al. 1976) and we estimated that a 20 percent crippling loss and nonretrieval of carcasses had occurred during the period. Available harvest data were summarized in January 1976 (Table 5, excerpted from Davis et al. 1976) and we concluded that human-induced caribou mortality from September 1975 through January 1976 likely totaled a minimum of 15,000 animals (see footnote 7 Table 5). Estimates for the period from February 1976 to June 1976 were based on the following.

Area Biologist C. Grauvogel estimated the harvest in Unit 23 as follows:

With only three collectors remaining on the payroll and as I did not spend much time in Unit 23 after February, our factual harvest information was sparse. However, compiling past hunting trends, recent spot checks, and the "known" harvest from Ambler, Shungnak, and Kobuk, we made the following educated guesses as to the number of caribou killed. The harvest as tabulated by the village collectors was as follows:

Table 4. Village harvest of Western Arctic Herd caribou during September and October 1975.

<u>Village</u>	<u>Animals Harvested</u>		
Ambler	460		
Anaktuvuk Pass	63		
Allakaket	0		
Barrow	700		
Bettles	5		
Buckland	200		
Hughes	12		
Huslia	0		
Kiana	412		
Kivalina	808		
Kobuk	100		
Kotzebue	350		
Noatak	200		
Noorvik	400		
Nuiqsuit	150		
Point Lay	300		
Point Hope	900		
Selawik	400		
Shungnak	274		
Wainwright	300		
Meade River	<u>100</u>		
	6,384	Total	
20% crippling loss	<u>1,277</u>	estimated	
	7,661	Total	

Table 5. Village harvests of caribou from the Western Arctic Caribou Herd for September 1975 through January 1976.

Village	Number Harvested	Basis for estimate
<u>Unit 23</u>		
Ambler	603	paid village data collector
Buckland	169	paid village data collector
Kiana	644	paid village data collector
Kivalina	925	paid village data collector (includes thru Feb. 20)
Kobuk	40	determined from village meeting
Kotzebue	1,000	estimate by Area Biologist <sup>1</sup>
Noatak	750-1,000	estimate by Area Biologist <sup>2</sup>
Noorvik	942	paid village data collector
Point Hope	1,400	estimate by Area Biologist <sup>3</sup>
Selawik	500	estimate by Area Biologist <sup>4</sup>
Shungnak	338	
Total	7,311 to 7,561	
<u>Unit 24</u>		
Allakaket	ca. 10	determined from village meeting
Bettles	ca. 10	determined from village meeting
Hughes	100+	determined from village meeting
Huslia	ca. 10	determined from village meeting
Total	ca. 130+	
<u>Unit 26</u>		
Anaktuvuk Pass	200-300	paid village data collector <sup>5</sup>
Barrow	ca. 1000+	estimate by Area Biologist <sup>6</sup>
Nuiqsuit	ca. 300-450	estimate by Area Biologist
Point Lay	ca. 300	estimate by Area Biologist
Wainwright	ca. 800	estimate by Area Biologist
Meade River	ca. 100	estimate by Area Biologist
Total	2,700 to 2,950	

Total Units 23, 24 and 26 = 10,141 to 10,641<sup>7</sup>

<sup>1</sup> ADF&G paid NANA \$200 to make a survey of harvest in Kotzebue but the data are not yet available.

<sup>2</sup> This estimate is based on a combination of partial reports by a paid reporter, estimates by local residents and the Area Biologist's observations.

<sup>3</sup> Estimate based on a known minimum harvest of over 800 through October.

<sup>4</sup> This estimate is likely low. A report by a paid data collector is due.

<sup>5</sup> From September-December 135 were reported by a paid data collector; pilots report increasing harvest since.

<sup>6</sup> When this report was drafted the Area Biologist was out in the villages conducting meetings and updating harvest estimates. These estimates could be revised after these village contacts are made.

Table 5. Continued.

<sup>7</sup> These estimates should be considered as "known" minimum estimates of the harvest. The actual retrieved harvest likely exceeds most of these estimates. In addition, hundreds of caribou were likely taken by the combined sources of 1) individuals from other villages (e.g. Nome, Galena, Tanana, etc.); 2) sport hunters from south of the Yukon; 3) bush residents including trappers, miners, etc.; 4) the harvest for February having been substantial (partially because of rumors of a possible emergency closure) and it is not improbable that over 1,000 animals total were taken at Noorvik, Kiana, Selawik and Kotzebue during the month (possibly many more); and 5) wanton waste has accounted for hundreds if not thousands of additional animals. I think human-induced caribou mortality to date is likely in the order of a minimum of 15,000.

	<u>Ambler</u>	<u>Shungnak</u>	<u>Kiana</u>
February	94	110	133
March	29	107	Unk
April	76	121	Unk
Total	<u>199</u>	<u>338</u>	<u>133</u>

The above figures, of course, only reflect minimums but it appears most villages were averaging about 100 caribou a month. Since several thousand caribou wintered in the Kiana Hills, it is not unreasonable to assume villages in the immediate vicinity experienced good hunting. I suspect Kiana, Noorvik and Kotzebue averaged more than 100 a month. Pulling together all factors, I would estimate the harvest from February through April for villages in Unit 23 was as follows (I believe all estimates are minimums):

Ambler	300	Kotzebue	800
Kiana	500	Noatak	600
Shungnak	400	Kivalina	300
Kobuk	100	Pt. Hope	300
Noorvik	500	Buckland	200
Selawik	400		
		Total	<u>4,400</u>

We believe that the above estimates are probably fairly accurate (at least not excessively liberal) since during early May when J. Davis visited Kotzebue and Noatak several residents of each community told him that of the total harvest from September through April well over 50 percent of the total, and possibly 70 percent, at Kotzebue was taken after January. Also, the estimates for Kiana and Noorvik are considerably lower than estimates given to Davis by people present in the two communities during this period.

In addition, the communities in Unit 22 harvested an estimated 500 animals during the January-April period, the Unit 24 harvest may have been close to 1,000 caribou during the period, and communities in Unit 26 likely harvested at least 1,000 additional caribou during the period. There is also some indication that the estimated harvest for Barrow through January may have been quite conservative.

Adding the above estimates to the estimated harvest through January we come up with the following:

Harvest from September through January from	
Table 5 footnote #7 =	15,000
Harvest since January, Unit 22 =	500
Harvest since January, Unit 23 =	4,400
Harvest since January, Unit 24 =	1,000
Harvest since January, Unit 26 =	1,000
Total	<u>21,900</u>

This figure of 21,900 does not include any crippling loss for the period from January through May and the harvest from May through September is not included. Considering these two factors it seems unlikely that the total human kill that year was less than 25,000 animals. Implications of this level of harvest were spelled out in the Department staff report on the Western Arctic Herd that was presented to the State Game Board in March 1976 (Davis et al. 1976).

In the following section harvest estimates for 1975-1976 are discussed based upon analysis of monthly village harvest logs. Because 1975-1976 was the last regulatory year when there was no closed season and no bag limit on the WAH (see Appendix III) those harvest statistics warrant discussion in detail. Human use of caribou was not documented between 1970 and 1976 and therefore the 1975-1976 data are the best approximation of the hunting patterns during those years. These patterns are of value not only to wildlife managers but to anthropologists and other social scientists. Also, greatly reduced opportunities for human use of caribou are likely for the foreseeable future.

Monthly reports prepared by village harvest recorders provided data of variable quality, and for several villages they represented a fairly accurate record of year-long harvests. A discussion of harvest by village follows.

#### Game Management Unit 23

Village data recorders in Ambler, Buckland, Kiana, Kivalina, Noatak, Noorvik, Selawik and Shungnak reported a combined harvest of 4,965 caribou for variable periods ranging from less than 3 months for Buckland and Noatak to 11 months for Ambler (Table 6). All reported harvests (even for the periods covered) are minimum estimates of retrieved harvest. Many additional animals were left in the field (see Waste section). Reported harvests were adjusted to total estimates by prorating the harvest during known periods to the rest of the year making allowances for caribou availability and different harvest patterns between villages (Table 7). Total retrieved harvest for GMU 23 was estimated to be in excess of 13,540-17,540. A discussion of harvest statistics by village follows:

Ambler - Harvest statistics for Ambler during the 1975-1976 regulatory year are available for July through May. The reported harvest constitutes a minimum retrieved harvest. Harvest magnitude, chronology, sex of harvest and number of animals taken per hunter are summarized in Table 8 and Figs. 1 and 2. Total reported harvest was 824 caribou and consisted of 371 (45%) males, 321 (39%) females and 132 (16%) animals of unknown sex. Forty of 44 total hunters interviewed (91%) were successful and they took an average of 20.6 caribou each (s.d. = 16.25) with a range of 1-65. More males than females were taken during August, September, October and May.

Buckland - Harvest statistics for Buckland are available only for October and November 1975. They are summarized in Table 9 and Figs. 1 and 2. Total reported harvest for the period was 169 caribou

Table 6. Summary of harvest statistics for GMU 23 villages during regulatory year 1975-1976 for villages where data collectors responded.

	July			Aug			Sept			Oct			Nov			Dec		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
<b>Unit 23</b>																		
Ambler	0	0	0	26	10	36	203	63	266	87	71	158	2	11	13	3	8	11
Buckland	No Data			No Data			No Data			1	0	1	41	127	168	No Data		
Kiana	No Data			222 <sup>1</sup>				0 <sup>1</sup>				403 <sup>1</sup>	27	17	132	5	2	23
Kivalina	No Data			No Data			No Data			254	534	798	20	31	51	0	13	13
Noatak	No Data			No Data			168 <sup>2</sup>				84 <sup>2</sup>			252 <sup>2</sup>		No Data		
Noorvik	No Data			421 <sup>1</sup>				246 <sup>1</sup>				752 <sup>1</sup>	No Data			No Data		
Selawik	No Data			90 <sup>1</sup>				81 <sup>1</sup>				171 <sup>1</sup>	61 <sup>4</sup>				151 <sup>4</sup>	226 <sup>4</sup>
Shungnak	203 <sup>3</sup>				71 <sup>3</sup>		No Data					274 <sup>3</sup>	3	15	18	1	6	7
Total*	0	0	0	26	10	36	203	63	266	342	605	957	93	201	382	9	29	54
<b>Unit 26</b>																		
Anaktuvuk																		
Pass	No Data			No Data			31	0	31	31	1	32	0	11	13	0	55	55
Total*	0	0	0	26	10	36	234	63	297	373	606	989	93	212	395	9	84	109
	Jan			Feb			Mar			Apr			May			Total		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
<b>Unit 23</b>																		
Ambler	9	69	119	17	48	94	5	7	29	6	25	76	13	9	22	371	321	824
Buckland	No Data			No Data			No Data			No Data			No Data			42	127	169
Kiana	63	12	75	88	50	138	No Data			No Data			No Data			405	81	771
Kivalina	3	10	13	7	24	31	No Data			No Data			No Data			284	612	906
Noatak	No Data			No Data			No Data			No Data			No Data			168	84	252
Noorvik	79	111	190	No Data			No Data			No Data			No Data			500	357	942
Selawik	9	16	25	No Data			No Data			No Data			No Data			160	248	422
Shungnak	15	16	39	52	42	113	2	105	107	0	121	121	No Data			276	376	679
Total*	178	234	461	164	164	376	7	112	136	6	126	197	13	9	22	2206/2206/4965		
<b>Unit 26</b>																		
Anaktuvuk																		
Pass	No Data			No Data			No Data			No Data			No Data			62	67	130
Total*	178	234	461	164	164	376	7	112	136	6	126	197	13	9	22	2268/2273/4995		

<sup>1</sup> August, September and October are lumped together.

<sup>2</sup> September, October and November are lumped together.

<sup>3</sup> July, August, and October are lumped together.

<sup>4</sup> November and December are lumped together.

\* Figures with superscripts are not included in column totals. Animals of unknown sex are included in monthly totals.

Table 7. Extrapolated caribou harvest for GMU 23 villages during regulatory year 1975-1976 based on partial reported harvests (see Fig. 1).

Village	Reported Harvest	Period included in reported harvest	Reported harvest & include non-reported harvest	Estimated retrieved harvest July 1975-June 1976
Ambler	824	July through May	916-1030	1000+
Buckland	169	part Oct. & Nov.	188-211	400+
Kiana	769	August-February	854-961	1500+
Kivalina	896	October-February	996-1120	1500+
Noatak	252	partial for Sept.-Nov.	280-315	1000-2000
Noorvik	942	Aug. Sept. Oct. & Jan.	1047-1178	2000-3000
Selawik	422	Aug.-Jan. (partial)	469-528	1000+
Shungnak	679	July-April	754-849	1000+
Candle	*3	---	---	---
Deering	*3	---	---	---
Kobuk	*3	---	---	140
Kotzebue	*3	---	---	2000-3000+
Point Hope	*3	---	---	2000-3000
			Total	13,540-17,540+

<sup>1</sup> All reported harvest figures are assumed to include 80-90 percent of the total retrieved harvest during the reporting period. This is because not all hunters were included on the master list of village residents to be interviewed monthly, and some on the lists were not interviewed each month if they did not happen to be available when the interviews were conducted. Also, not all hunters volunteered how many animals they took or could remember how many for sure.

<sup>2</sup> These estimates are best guesses based largely on extrapolating from the known harvest for given periods and interviewing as many people possible to determine a consensus of what percent of the annual harvest occurred after January. In most villages the opinion was unanimous that 50-70 percent of the harvest occurred after January.

<sup>3</sup> No paid village data recorders reported for these villages.

Table 8. Caribou harvest patterns by residents of Ambler during the 1975-1976 regulatory year.

	August			September			October			November			December		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
No. hunters			41			41			41			35			35
caribou taken	26	10	36	203	63	266	87	71	158	2	11	13	3	8	11
caribou/hunter	.63	.24	.88	4.95	1.54	6.49	2.10	1.73	3.85	.06	.31	.37			
range	0-13	0-10	0-22	0-25	0-8	0-28	0-21	0-20	0-40	0-1	0-6	0-6	0-3	0-8	0-8
s.d.	2.73	1.56	3.94	6.72	2.54	8.21	4.80	4.40	8.13	.24	1.16	1.17			
No. successful hunters	3	1	3	20	15	21	13	10	13	2	3	5	1	1	2
caribou taken	26	10	36	203	63	266	87	71	158	2	11	13	3	8	11
caribou/hunter	8.67	10	12.0	10.15	4.20	12.67	6.69	7.00	12.15	40	2.20	2.60	1.5	4	5.5
range	0-13	0-10	1-22	0-25	0-8	1-28	1-21	0-20	2-40	0-1	0-6	1-6	0-3	0-8	3-8
s.d.	6.66	-	10.54	6.12	2.45	7.08	6.59	6.73	11.80	0	-	2.07			
	January			February			March			April			May		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
No. hunters			36			35			27			30			31
caribou taken	9	69	119	17	48	94	5	7	29	6	25	76	13	9	22
caribou/hunter	.25	1.92	3.31	.48	1.33	2.61	.19	.26	1.07	.20	.92	.91	.42	.29	.71
range	0-7	0-15	0-40	0-5	0-11	0-11	0-3	0-3	0-10	0-5	0-8	0-17	0-3	0-5	0-5
s.d.	1.20	3.72	7.54	1.13	2.88	3.80	.68	.76	2.38	.92	2.13	4.73	.85	.94	1.32
No. successful hunters	2	10	12	8	10	16	2	3	6	2	5	9	7	5	9
caribou taken	9	69	119	17	48	94	5	7	29	6	25	76	13	9	22
caribou/hunter	4.50	6.90	9.92	2.13	4.80	5.88	2.50	2.33	4.83	3.00	5.0	8.44	1.86	1.8	2.44
range	0-7	0-15	1-40	0-5	0-11	1-11	0-3	2-3	2-10	0-5	1-8	2-17	0-3	0-5	1-5
s.d.	3.54	3.96	10.47	1.46	3.52	3.50	.71	.58	2.79	2.83	2.65	4.98	.69	1.79	1.33
No. hunters			44	No. successful hunters			36	37	40						
caribou taken	371	321	824				371	321	824						
caribou/hunter	8.43	7.27	18.75				9.28	8.03	20.63						
range	0-23	0-32	0-65				0-23	0-32	1-65						
s.d.	8.14	7.25	16.60				8.07	7.19	16.25						

Table 9. Caribou harvest patterns by residents of Buckland during the 1975-1976 regulatory year.

	October			November			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
No. hunters			2			20			20
caribou taken	1	0	1	41	127	168	42	127	169
caribou/hunter	.5	0	.5						
range				0-10	0-21	0-26	0-10	0-21	0-26
x				2.05	6.35	8.40	2.10	6.35	8.45
s.d.				2.78	6.26	8.17	2.79	6.26	8.17
No. successful									
hunters	1	0	1	12	16	16	12	16	16
caribou taken	1	0	1	41	127	168	42	127	169
range				0-10	1-21	2-26	0-10	1-21	2-26
x				2.56	7.94	10.50	2.63	7.94	10.56
s.d.				2.87	6.02	7.81	2.90	6.02	7.80

Number of  
successful hunters  
reported

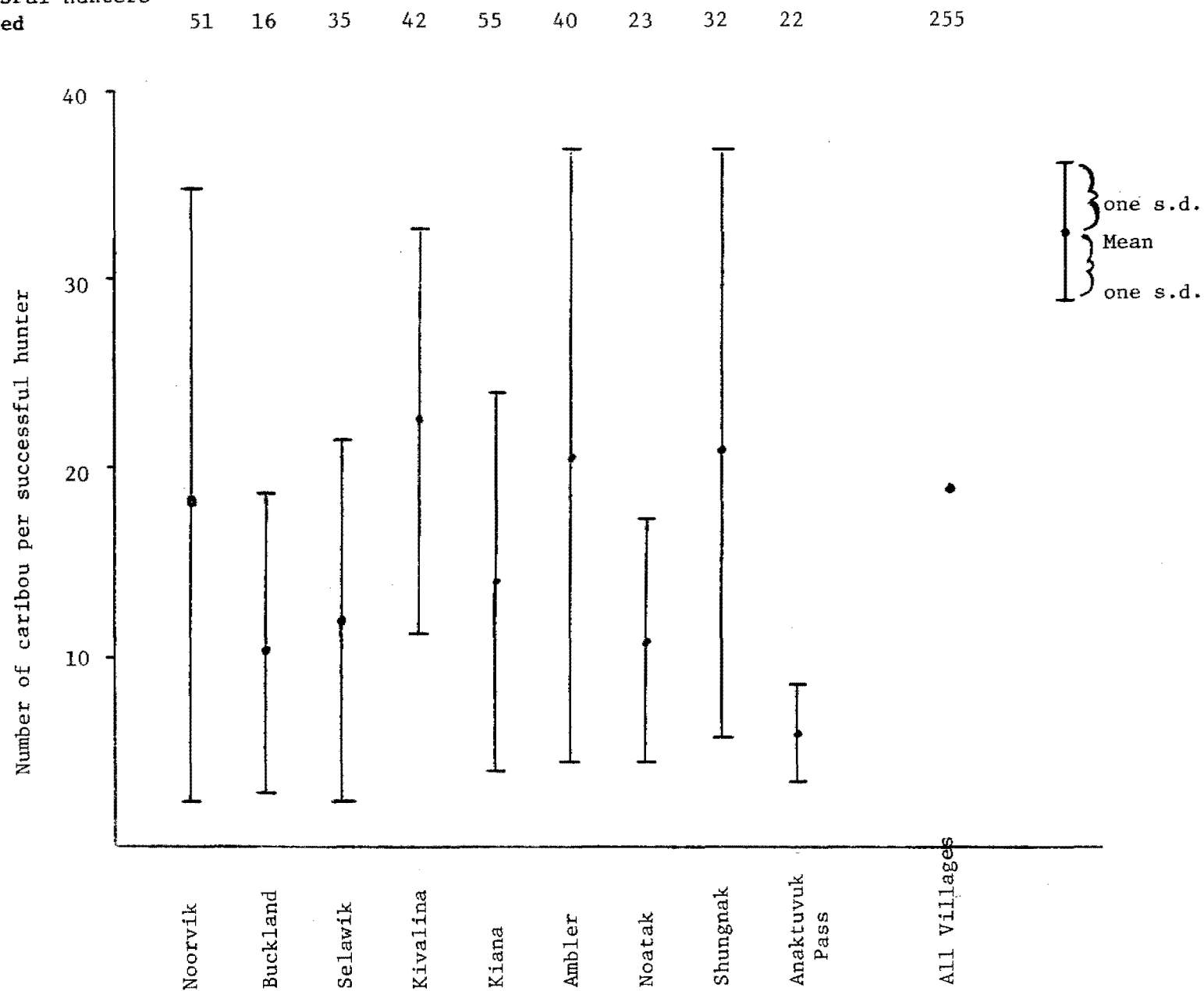


Fig. 1. Mean number of caribou taken per successful hunter from villages in GMU 23 and Anaktuvuk Pass.

Village

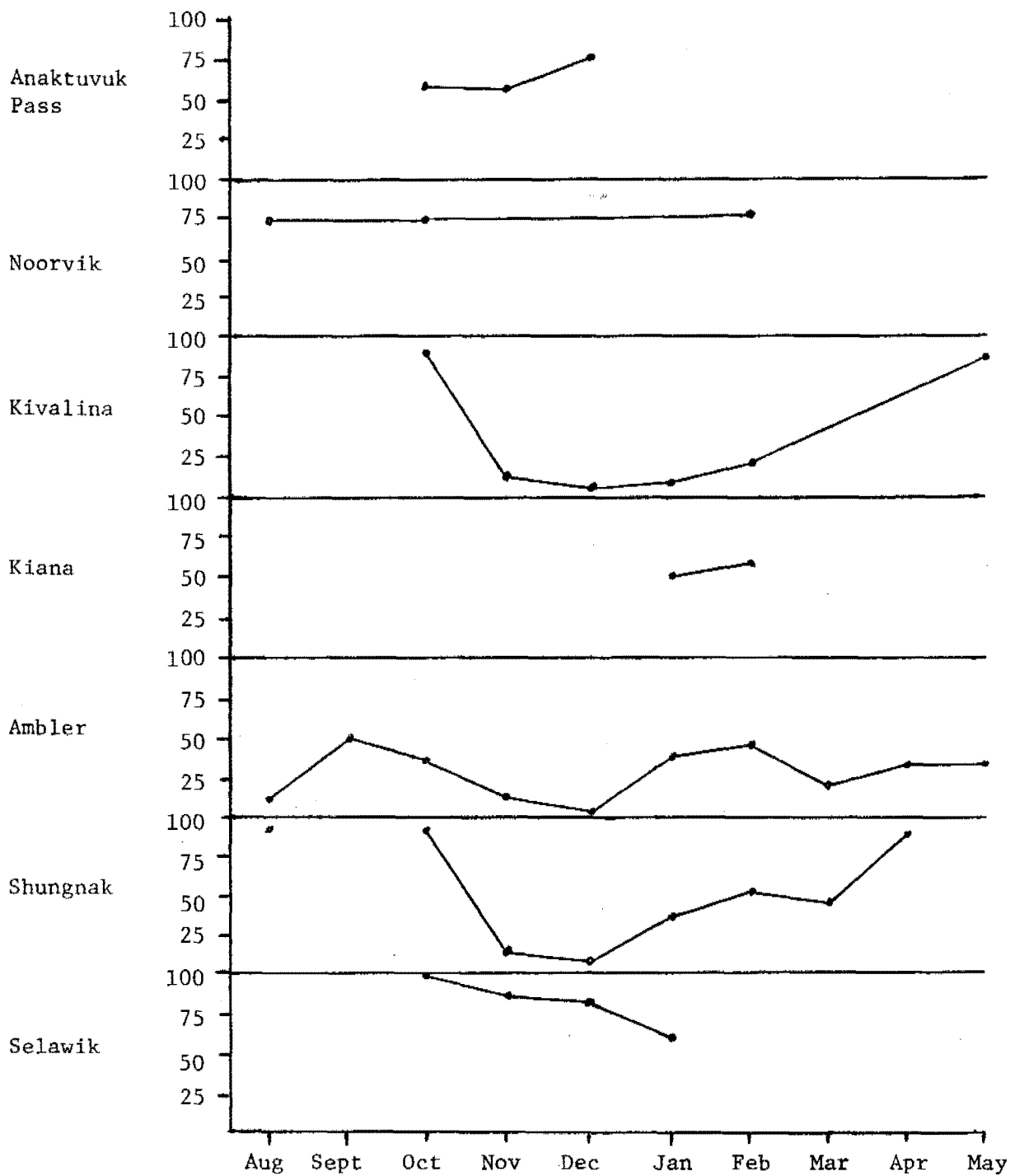


Fig. 2. Percent hunter success by month for six villages in Unit 23 and Anaktuvuk Pass.

consisting of 42 (25%) males and 127 (75%) females. Sixteen (80%) of 20 hunters interviewed were successful, they took an average of 10.6 caribou each (s.d. = 7.8) and the range of harvest was 2-26. All reported harvest was for the month of November, except one bull taken in October.

Candle - Candle was not occupied during the harvest period.

Deering - No harvest data are available from Deering, and only a few, if any, caribou were estimated to have been taken.

Kiana - Partial harvest statistics for Kiana are available for August 1975 through February 1976 (Table 10 and Figs. 1 and 2). Total reported harvest for the period was 769 caribou and consisted of 405 (53%) males, 81 (11%) females and 283 (37%) animals of unknown sex. All of the 55 hunters interviewed were successful and they took an average of 14.0 caribou (s.d. = 9.85) and the harvest range was 1-46. From August through December the data were recorded in a manner that made determining the exact number of males and females taken impossible. However, more males were taken during August through October than were females. More males than females were also taken in January and February.

Kivalina - Harvest statistics for Kivalina are available for October 1975 through February 1976. They are summarized in Table 11 and Figs. 1 and 2. Reported harvest was 896 caribou and consisted of 284 (32%) males and 612 (68%) females. Forty-two (84%) of 50 hunters interviewed were successful and they took an average of 21.6 caribou (s.d. = 10.06) with a range of 4-40. More females than males were taken in all months (October-February).

Kobuk - The only harvest data available for Kobuk are estimates that Nome Area Biologist C. Grauvogel made based largely on conversations with Kobuk residents.

Kotzebue - Because the human population in Kotzebue was too large to make monthly interviews of all hunters feasible, we do not have detailed harvest statistics available. Harvest estimates are based upon Area Biologist estimates emanating from personal observations and interviews of local people, a household interview survey conducted by NANA in January for which the Department paid, and by impressions of graduate student J. Doerr when he went from door to door in March and April to obtain jaw samples from caribou. Also, J. Davis interviewed a number of Kotzebue residents in May to determine what percent of the total harvest for the year occurred after January.

Noatak - Harvest statistics for Noatak are incomplete (Table 12). Only one village report was received which was initiated November 11, 1975 and was supposed to have covered September to mid-November. Discussions with local people indicated that the reported harvest for the above period was only a fraction of the actual harvest. The reported harvest showed that all of 23 hunters interviewed were successful and took 252 caribou for an average of 11.0 per hunter (s.d. = 6.68) and the range of the harvest was 2-24. Twice as many males as females were reported taken.

Table 10. Caribou harvest patterns by residents of Kiana during the 1975-1976 regulatory year.

	Aug/Sept/Oct*			November*			December*			January*			February		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
No. hunters									46			45			44
caribou taken	NO			NO			NO		22	63	12	75	77	45	122
range	DATA			DATA			DATA		0-11	0-8	0-4	0-8	0-10	0-12	0-12
x									.50	1.40	.27	1.67	2.00	.82	3.02
s.d.									1.75	1.72	.84	2.17	2.44	2.12	3.64
No. successful hunters			39			25			7	23	5	23	25	10	26
caribou taken	NO		412	NO		134	NO		22	63	12	75	77	45	122
range	DATA		1-20	DATA		1-23	DATA		1-11	1-8	1-4	0-8	1-10	0-12	1-12
x			10.56			5.36			3.29	2.74	.52	3.26	3.52	1.38	5.12
s.d.			4.20			5.00			3.50	1.45	1.12	2.00	2.26	2.62	3.42

	Total		
	Male	Female	Total
No. successful hunters	48	17	55
caribou taken	405	81	769
range	0-25*	0-14*	1-46
x	7.36*	1.45*	14.04
s.d.	.580*	2.94*	9.85

\*August through January reports did not have the number taken by sex. Only animals included in these figures are from reports of one sex only taken by a hunter.

Table 11. Caribou harvest patterns by residents of Kivalina during the 1975-1976 regulatory year.

	October			November			December			January			February		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
No. hunters			48			44			44			44			44
caribou taken	264	544	808	15	20	35	0	13	13	3	3	16	7	30	37
range	0-15	0-32	0-40	0-7	0-12	0-12	0	0-5	0-5	0-2	0-6	0-6	0-4	0-6	0-6
x	5.50	11.33	16.83	.34	.45	.11	0	.30	.30	.07	.28	.36	.16	.68	.84
s.d.	3.83	8.70	11.58	1.44	2.24		0	1.11	1.11	.33	1.07	1.12	.64	1.75	1.85
No. successful hunters	40	40	40	6	7	8	0	3	3	2	4	5	4	7	10
caribou taken	264	544	808	15	20	35	0	13	13	3	3	16	7	30	37
range	2-15	2-32	5-40	0-7	0-12	1-8	0	4-5	4-5	0-2	0-6	2-6	0-4	0-6	1-6
x	6.60	13.60	20.20	1.88	2.5	4.38	0	4.33	4.33	.60	2.60	3.20	.70	3.00	3.70
s.d.	3.19	7.72	9.58				0	.58	.58	.89	2.30	1.64	1.25	2.62	2.16
	Total						Total								
	Male	Female	Total				Male	Female	Total						
No. hunters			50	No. successful hunters			42	42	42						
caribou taken	284	612	896				284	612	896						
range	0-15	0-32	0-40				2-15	2-32	4-40						
x	5.78	12.24					6.88	14.57	21.57						
s.d.	4.05	9.15					3.44	8.08	10.06						

Table 12. Caribou harvest patterns by residents of Noatak during the 1975-1976 regulatory year.

	Sept/Oct/Nov		
	Male	Female	Total
No. successful			
hunters	23	13	23
caribou taken	168	84	252
caribou/hunter	7.30	3.65	10.96
range	2-20	0-18	2-24
s.d.	5.16	5.15	6.68

Noorvik - Noorvik caribou harvest statistics are available for August, September, October and January (Table 13 and Figs. 1 and 2). Reported harvest for these months was 942 which consisted of 500 (53%) males, 357 females (38%) and 85 (9%) animals of unknown sex. Fifty-one (84%) of 61 hunters interviewed were successful and they took an average of 18.5 caribou (s.d. = 16.38) per hunter with a range from 2-85. From August through October, 63 percent (421) of the known sex animals taken were males and 37 percent (246) were females. During January 42 percent (79) of 190 animals taken were males and 58 percent (111) were females.

Point Hope - No monthly village harvest reports were received from Point Hope during the year but a number of trips were made to the village by Area Biologists to estimate harvest.

Selawik - Partial harvest statistics are available for Selawik for August through January (Table 14 and Figs. 1 and 2). Reported harvest for the period was 422, and 408 of these were reported by sex. Of these, 39 percent were males and 61 percent were females. Thirty-five (97%) of the 36 hunters interviewed were successful and they took an average of 12.1 caribou (s.d. = 9.70) with a range of 1-30. More males than females were taken during August, September and October and more females were taken during November, December and January.

Shungnak - Shungnak harvest records are available for all months from July 1975 through April 1976 (Table 15 and Figs. 1 and 2). Total reported harvest was 679 caribou and consisted of 274 (40%) males, 376 (55%) females and 29 (5%) animals of unknown sex. All of 32 hunters interviewed were successful and they took an average of 21.2 caribou each (s.d. = 15.41) with a harvest range of 1-65. More males than females were taken during July through October and February and less males than females were taken during November, December, January, March and April.

#### Game Management Unit 24

Anaktuvuk Pass was the only GMU 24 village (although Anaktuvuk Pass is located in GMU 24, village residents hunt in GMU's 24 and 26) where a village data collector was employed. He worked September through December, when he was accidentally injured. No data were collected after December. All harvest estimates for other villages were determined by interviews with Fish and Wildlife Protection officers in the area, pilot reports, by our personal observations and conversations with village residents and by input through public meetings with the village councils. Harvest estimates for GMU 24 are summarized in Table 5. An elaboration of Anaktuvuk Pass harvest statistics is presented below.

Anaktuvuk Pass - Harvest statistics are available for September through December 1975 (Table 16). During this period 22 hunters were interviewed and all were successful in taking one or more caribou. The average number of caribou taken per hunter was 5.9 (s.d. = 4.17) and the harvest range was 1-19. After December the number of caribou available to Anaktuvuk Pass hunters increased as did the harvest. Minimum harvest

Table 13. Caribou harvest patterns by residents of Noorvik during the 1975-1976 regulatory year.

	Aug-Sept-Oct			January			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
No. hunters			60			40			61
caribou taken	421	246	752	79	111	190	500	357	942
range	0-20	0-19	0-85	0-8	0-9	0-16	0-47	0-21	0-85
x	7.02	4.10	12.53	1.98	2.78	4.75	8.20	5.85	15.44
s.d.	8.17	5.09	15.17	2.39	2.79	4.36	9.15	6.10	16.46
No. successful hunters	42	34	45	24	29	31	49	45	51
caribou taken	421	246	752	79	111	190	500	357	942
range	0-20	0-19	1-85	0-8	0-9	2-16	0-35	0-21	2-85
x	10.02	7.24	16.71	3.29	3.83	5.94	9.80	7.00	18.47
s.d.	8.07	4.79	15.40	2.27	2.58	4.08	9.19	6.04	16.38

Table 14. Caribou harvest patterns by residents of Selawik during the 1975-1976 regulatory year.

	Aug-Oct			Nov-Dec			January			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
No. hunters			23			18			10			36
caribou taken				61	151	226	9	16	25	160	248	422
range				0-14	0-20	0-30	0-3	0-4	0-7	0-14	0-19	0-30
x				3.39	8.39	12.56	.90	1.60	2.50	4.44	6.89	11.72
s.d.				4.38	6.40	9.77	1.20	1.90	2.51	3.75	6.86	9.76
s <sup>1</sup>				4.26	6.22	9.49	1.14	1.80	2.38	3.69	6.77	9.63
No. successful												
hunters			23	10	15	15	4	5	6	31	30	35
caribou taken	90	81	171	61	151	226	9	16	25	160	248	422
range	0-11	0-19	1-29	0-14	2-20	3-20	0-3	0-4	2-7	0-14	0-19	1-30
x	3.91	3.52	7.43	4.07	10.07	15.07	1.50	2.67	4.17	5.16	8.27	12.06
s.d.	3.09	4.41	7.11	4.51	5.62	8.68	1.22	1.75	1.72	3.54	6.71	9.70
s <sup>1</sup>	3.02	4.31	6.95	4.36	5.43	8.39	1.12	1.60	1.57	3.48	6.60	9.56

Table 15. Caribou harvest patterns by residents of Shungnak during the 1975-1976 regulatory year.

	July-Oct			November			December			January		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
No. hunters			31			30			29			27
caribou taken	203	71	274	3	15	18	1	6	7	15	16	39
range	0-17	0-11	0-25	0-2	0-11	0-11	0-1	0-5	0-5	0-7	0-8	0-15
x	6.55	2.29	8.84	.10	.50	.60	.03	.21	.24	.56	.59	1.44
s.d.	4.82	3.19	6.29	.40	2.06	2.09	.19	.94	1.12	1.42	1.76	3.29
No. successful hunters	26	15	29	2	2	4			2	7	4	9
caribou taken	203	71	274	3	15	18	1	6	7	15	16	39
range	0-17	0-11	1-25	0-2	0-11	2-11	0-1	1-5	1-6	0-7	0-8	1-15
x	7.00	2.45	9.45	.75	3.75	4.50	.50	3.0	3.5	1.67	1.78	4.33
s.d.	4.65	3.24	6.03	.96	4.99	4.36	.71	2.83	3.54	2.12	2.77	4.58
	February			March			April			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
No. hunters			29			28			24			32
caribou taken	52	42	113	2	105	107	0	22	22	274	376	679
range	0-9	0-10	0-13	0-2	0-20	0-20	0	0-11	0-11	0-26	0-34	0-65
x	1.79	1.45	3.90	4.90	3.75	3.82	0	5.50	5.50	8.56	11.75	21.22
s.d.	2.64	2.40	4.26	.37	5.37	5.05	0	3.57	3.57	6.75	9.78	15.41
No. successful hunters	12	11	15	1	13	13	0	19	19	27	28	32
caribou taken	52	42	113	2	105	107	0	22	22	274	376	679
range	0-9	0-10	1-13	0-2	2-20	2-20	0	1-11	0-11	0-26	0-34	1-65
x	3.47	2.80	7.06	.15	8.08	8.23		6.37	6.37	8.56	11.75	21.22
s.d.	2.77	2.40	3.17	.55	5.19	5.05	0	3.00	3.00	6.75	9.78	15.41

Table 16. Caribou harvest patterns by residents of Anaktuvuk Pass during the 1975-1976 regulatory year.

	September			October			November			December			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
No. hunters									10						
caribou taken	29	0	29	33	1	34	2	11	13	0	59	59			
range				0-7	0-1	0-7	0-4	0-1	0-4	0	0-11	0-11			
x				1.83		1.83	1.10		1.3		2.46	2.46			
s.d.				2.46		2.46	1.45		1.64		1.62	1.62			
No. successful															
hunters	8	0	8	11	1	11	5	1	5	0	12	12	15	16	22
caribou taken	29	0	29	33	1	34	2	11	13	0	59	59	64	71	135
range	1-9	0	1-9	1-7	1	1-7	0-4	0-1	1-4	0	1-11	1-11	1-15	1-11	1-19
x	7.9		7.9	3.0		3.09	2.2		2.6	0	3.11	3.11	4.27	4.19	5.91
s.d.	3.54		3.54	2.53		2.5	1.3		1.34		1.10	1.10	3.51	2.94	4.17

for the year was an estimated 300-400, but quite possibly a couple hundred more could have been taken.

#### Game Management Unit 26

No data collectors were employed in any villages within GMU 26. All estimates of village harvests were obtained by project personnel's personal observations and conversations with village residents. In Table 5 we estimated that 2,700-2,950 caribou were taken prior to February 1976. We estimated that no less than 1,000 additional animals were taken after January in the unit, making a total of 3,700-3,950 for the year. However, our Barrow harvest estimate in Table 5 may have been a gross underestimate as J. Doerr (pers. comm.), estimated that the harvest at Barrow must have been much larger than at Noorvik or Kotzebue. His estimates were based on the human population and the amount of dead caribou he found in meat cellars and sheds in the respective villages while collecting jaws in late winter 1976. It is not unlikely that the Barrow harvest totaled 4,000 or more.

#### Game Management Units 21 and 22

No rigorous accounting of harvest for these Units was accomplished but residents of Unit 22 were estimated to have taken 500 caribou between January and April.

The harvest of WAH caribou by residents of GMU 21 was not well documented but likely numbered several hundred.

#### Harvest by Persons Not Residing in GMU's 21-24 and 26

Hunters residing outside these units likely harvested 200 to 400 caribou in 1975-1976. Most harvest occurred along the middle portion of the Noatak River during September and on the Kanuti Flats near Bettles.

#### Waste of Caribou During 1975-1976

Quantifying waste of caribou is very difficult. However, limited quantification and subjective impressions of the extent of waste this year revealed that it was of such magnitude that it could not be justified or tolerated biologically, socially, morally or ethically.

Most waste occurred in the following forms:

1. Crippling loss - This sort of loss has been documented for most species of hunted big game animals, but has probably caused more concern in caribou than in any other land mammal. Crippling loss results from many causes such as:

- a. legitimate non-realization that the animal fired at was hit
- b. shooting at long range
- c. flock shooting
- d. shooting with small caliber rifles and improper sights
- e. chasing with snow machines

Canadian biologists have reported that a 20 percent loss is a conservative minimum wounding loss for native hunting of caribou (Kelsall 1968).

Estimates of the wounding loss from sport hunting for the Fortymile Herd in Alaska have ranged from 10-20 percent during years when migrations were such that large numbers of caribou were available to large numbers of hunters.

2. Mistakenly killed animals - During the rut, many hunters kill bulls by flock shooting or by being unable to differentiate between sexes. At this time the males are losing fat and are strong smelling and tasting. Likewise in mid and late winter bulls and calves are often in poor condition (not fat) and are often killed but not utilized if caribou are abundant.

3. Poor or abnormal animals - Animals have traditionally not been utilized when suspected of being abnormal. However, many animals left for this excuse are gut shot or shot up and messy to handle so, if caribou are abundant, they are not used.

4. Un-retrieved animals - Many animals are killed and properly cared for in the field but never retrieved. Some have been partially scavenged and fouled before a hunter returns, so are left. Others are left in the field because additional animals have been killed closer to home. It has been a traditional practice to kill as many animals as possible in the fall "because they are fatter then" and because of the migratory nature of caribou ("If and when we find them we try to get as many as possible knowing that it may be our only chance to get them for a long time"). When there is a great abundance of caribou many are killed for choice parts only, e.g. the tongues and heads.

5. Animals killed for trapping bait or attractant baits - It is a common practice to leave caribou carcasses for trapping bait. If traps are not set the carcasses are left to attract furbearers so they can be pursued by snow machines until they can be shot.

6. Animals killed or not properly used because of eroded or underdeveloped ethics - This is a poorly defined category but can be used to include animals killed primarily for fun, out of boredom, to spite someone or something and by illegal use of mechanized conveyances. Allegedly, caribou are run down by snow machines and stabbed on occasion, or pursued by snow machine and shot with pistols or .22 automatic rimfire rifles.

7. Waste occurs after animals are brought home - This occurs particularly in years of great abundance.

Department personnel witnessed or received reports of instances of each of the above types of waste during the year.

Fig. 3 summarizes the best documented instance of waste occurring during 1975-1976. It should be emphasized that this was not an isolated case and that the communities involved were not singled out for any particular reason. It just happened to occur in an area where the timing and logistics were such that documentation was possible.

The objective of documenting this waste was not to establish the number of animals wasted, but to show that waste was unacceptably extensive. The only area where an attempt was made to see as many carcasses as possible from the air was Area B in Fig. 3. However, there were likely considerably more carcasses in this area than the 214 counted, as evidenced by the facts that: 1) we took pictures from the air of several piles of caribou before we began flying transects in the area. One pile of about eight carcasses that we photographed was not seen when we were flying the transects and I was sure we were missing others; 2) there were still some patches of snow where drifting had occurred, and several legs, heads and small patches of hide barely showing through the snow suggested that additional carcasses were still buried; and 3) it is my subjective impression that most of the carcasses seen were not more than several months old, i.e. ones left in October or November had likely been scavenged and therefore were likely much easier to miss. I marked four carcasses that were left in mid-October in an area near Cape Krusenstern and on this trip no sign of them could be detected (scavengers had likely scattered or consumed the remains). They had received no human use when marked and there was no evidence that humans had "cleaned the area up" later.

Several other observations of interest were made on the flight. A high percentage of the carcasses were in groups of piles often containing as many as five caribou and in one case there were apparently eight in one pile and five more within 50 yards. Of the 214 seen in Area B, 109 were single carcasses and 105 were in groups as follows: 12 groups of 2, 13 groups of 3, 2 groups of 4, 3 groups of 5, 1 group of 6, and the groups mentioned above of 8 + 5. At least three piles of caribou were at camp sites with many tin cans and tent poles present and several caribou had spruce poles through them.

We have some direct observations and numerous reports that suggest hundreds of caribou were wasted at several other locations. Combined, they constitute a biological threat to the resource.

Additional documentation of waste occurring in other communities in the past several years is available in Department files in Fairbanks.

The wasted caribou between the Kobuk River and the Kiana Hills were first observed by Department personnel on 20 February 1976. The following summary quote was extracted from J. Davis' field notes:

Along this transect line (i.e. part of straight line from Noorvik to Kiana) we counted 24 caribou left whole--there was a snow machine track up to each one. Often a gut pile was next to the carcass. Most had been there a considerable time. We saw 3 or 4 times as many gut piles. The same situation seemed to prevail almost all the way across the



flat to the Kobuk River. It is probable that there are hundreds of wasted carcasses on this flat. There are hundreds of gut piles in addition.

Although the most concerted effort to quantify waste was made on the above area in May 1976, several additional partial counts of wasted caribou were made incidental to other surveys to determine if the above was an isolated situation.

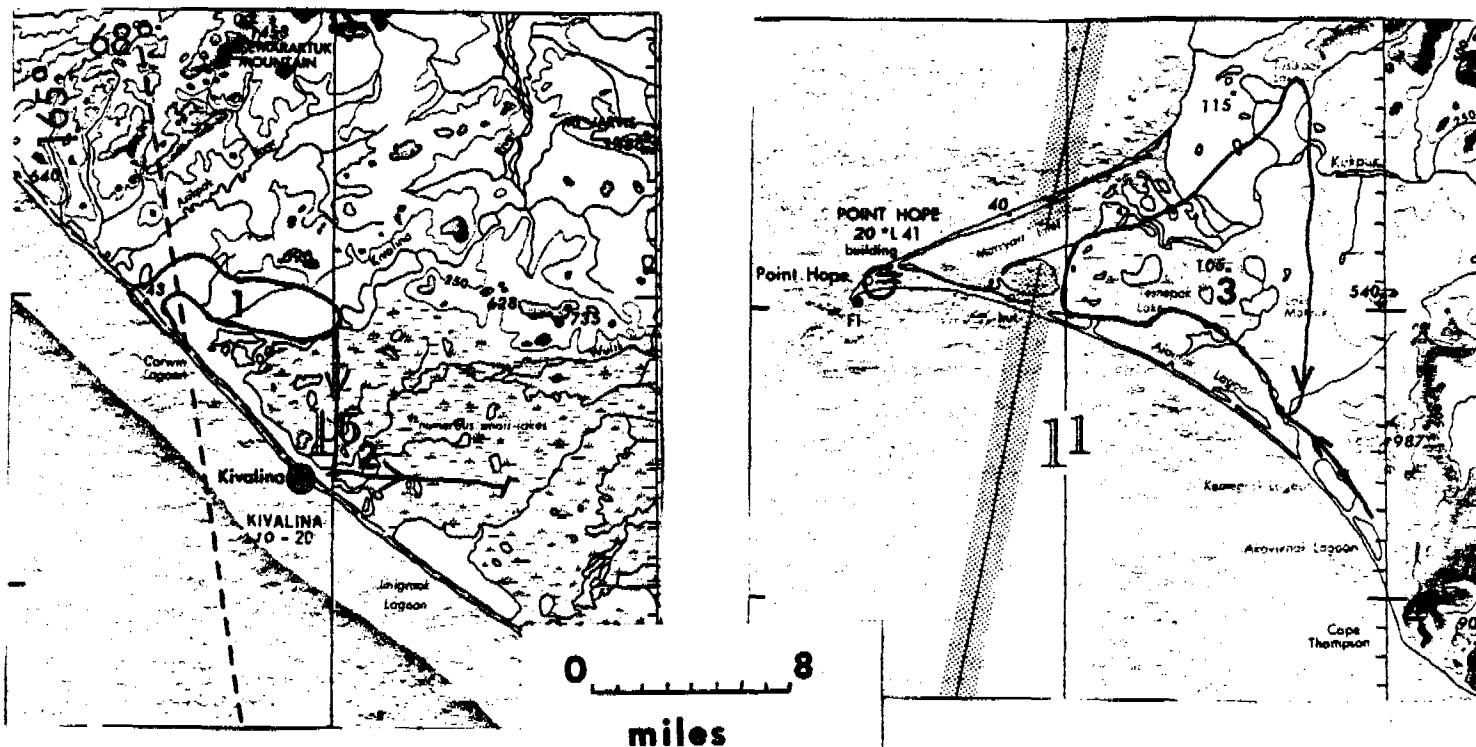
On 25 June 1976, while flying reconnaissance surveys to locate caribou concentrations for a population census, we attempted to count apparently wasted caribou near Point Hope and Kivalina.

At Point Hope we flew for 68 minutes in a Super Cub counting and photographing carcasses. During this time we covered the area delineated in Fig. 4 and observed 174 apparently wasted entire carcasses and a number of additional hides and parts of carcasses. From experience with ground observations in other areas, we judged that practically all of the animals had been killed by humans based on their proximity to hides and gut piles, proximity to the village and the fact that many were piled together. Of the 174 carcasses counted, 65 were single carcasses and the others were piled in groups as follows: 18 groups of 2, 6 groups of 3, 1 group of 4, 4 groups of 5, 2 groups of 6 and 1 group of 7.

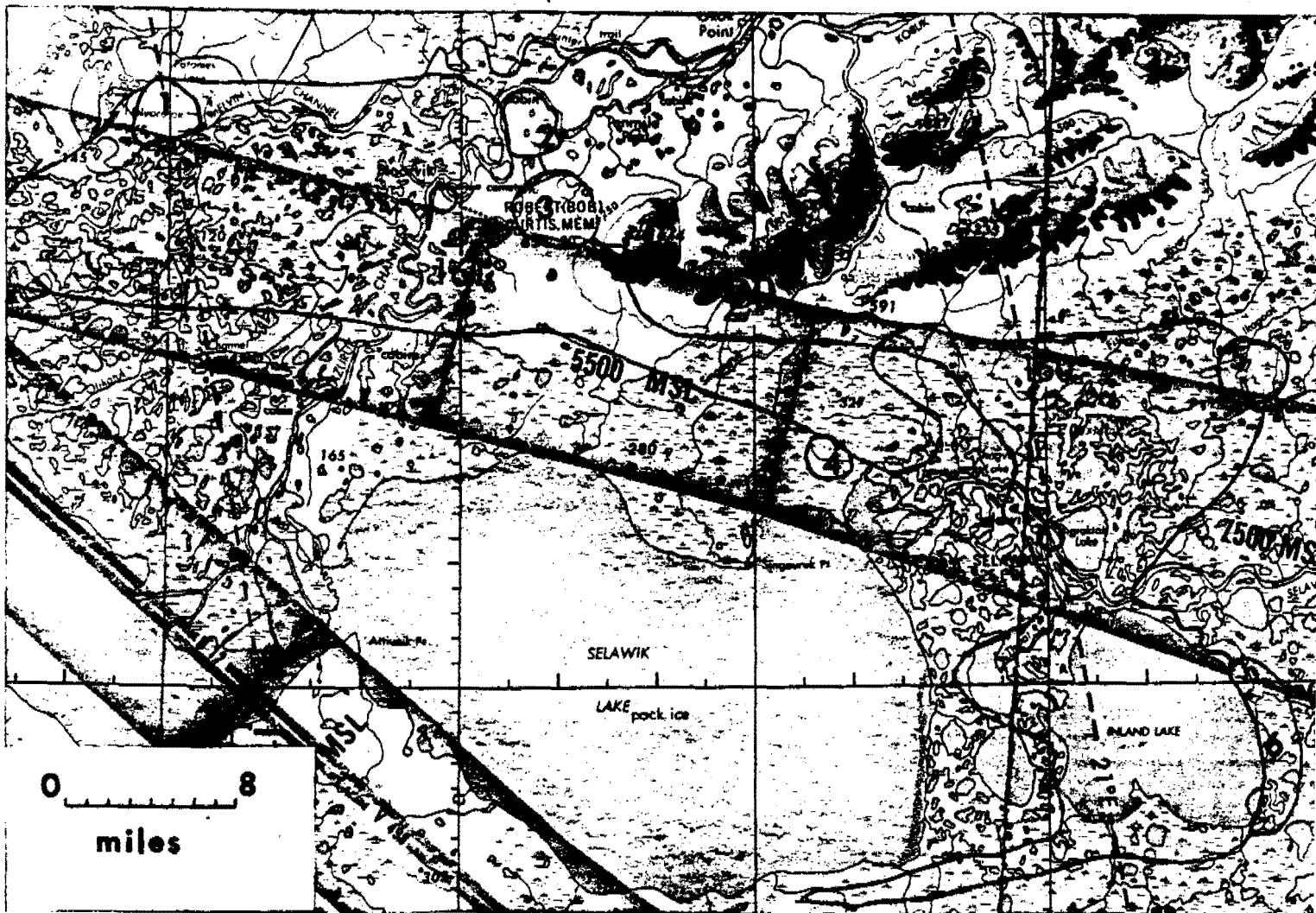
At Kivalina, enroute to Kotzebue, we flew by an area where carcasses were readily apparent, and in a relatively small area (see Fig. 4) we counted 106 carcasses during 28 minutes of flying that were judged to have been wasted by humans based on the criteria mentioned above. Thirty of the 106 carcasses consisted of solitary carcasses and the others were observed in piles or groups as follows: 10 groups of 2, 1 group of 3, 1 group of 4, 3 groups of 5, and 1 group each of 6, 7, 8, 9 and 14.

It should be stressed that in the searches for carcasses in each of the areas mentioned, only a portion (unlikely more than 50 percent in any of the locations) of the area where considerable numbers of carcasses were present was covered in the carcass enumerations. In the three areas discussed above (i.e. Kiana Hills, Point Hope vicinity and Kivalina vicinity) brief reconnaissance flights away from the areas covered in the enumeration counts detected considerable numbers of additional carcasses in surrounding areas. Additional superficial searching in the area between Kotzebue and Noorvik (Fig. 5) and in the vicinity of Selawik revealed between 109 and 168 (piles of carcasses at several sites were decayed enough to preclude accurate counting) unused carcasses of caribou believed to have been killed by humans.

It is our belief that most areas that had substantial numbers of caribou present for harvest experienced considerable wounding and waste loss of caribou. Near every community we searched, where caribou were wintering or had recently migrated past, evidence of human-killed and nonutilized caribou carcasses was found. The number of carcasses found



- 1 - The area enclosed in the black line was intensively searched and 76 unused carcasses were found.
- 2 - Thirty unused carcasses were located along the flight line shown.
- 3 - One hundred and seventy-four unused carcasses were found along this flight line east of Point Hope.



The area shown was searched on 28 June 1976 along the flight line and carcasses were located within the numbered circles.

- 1 - Unused carcasses of at least 50 and more likely 100 caribou were located in this general area.
- 2 - Nine unused caribou carcasses were located here.
- 3 - Unused carcasses of 20-23 caribou were located here.
- 4 - Unused carcasses of 6-9 caribou.
- 5 - Unused carcasses of 2 caribou.
- 6 - A minimum of 22 and probably 36 carcasses were located including 4 piles of 2-5 each. Between 3-5 other places were found where just a gut pile or hide remained.

Fig. 5 Area searched near Selawik to locate wasted caribou carcasses in June 1976.

was largely a function of our search effort. Total loss to the herd was undoubtedly several to many times the number we documented (Table 17).

#### Harvest During 1976-1977

The apparent dramatic population decline of the WAH from 242,000 animals in 1970 to about 100,000 (Davis et al. 1978) in 1975 was verified during regulatory year 1976-1977 when the July 1976 census estimated about 65,000 animals remaining in the herd. Subsequently, hunting seasons, bag limits and other regulations adopted by the Alaska Board of Game in spring 1976 were made more restrictive by emergency regulations necessitated by the census results. The ensuing management plan for the herd resulted in a caribou harvest quota system outlined in Appendix I. The results of the 1976-1977 harvest are summarized in Table 18.

Of the 3,000 permits allocated, 2,334 (77.8%) were issued. Permits returned (1,600) equalled 68.5 percent of those issued. About 68.8 percent of the returns were successful. The summation of extrapolated harvests from the individual (i.e. weighted extrapolation) village harvests was 1,687.

Adding known and suspected harvests before the permit season began (i.e. 15 July-13 August), during the closure (14 August-24 September) and unreported harvests, we estimate that the human-induced kill was between 2,700 and 3,500 from 1 July 1976-30 June 1977.

#### Waste and Illegal Kills During 1976-1977

Although several instances of waste and illegal (all females illegal) kills of caribou were located this year, the waste problem, although still present, was insignificant relative to the waste observed during 1975-1976. We saw five whole carcasses of caribou that were shot by hunters and left to rot in the Selawik Flats and evidence that at least five cows (illegal kills) were taken. Northeast of Shungnak and Ambler we visited a number of kill sites and found the following:

- Site #1 - Of five caribou killed at least three were females and probably all five were females.
- Site #2 - A calf and adult bull were killed. The bull was salvaged and the calf was left.
- Site #3 - Of seven kills in the area, four were females, one was a male and two were of unknown sex.
- Site #4 - Three animals were cached under a tarp but the weather was warm and the snow and carcasses were thawing rapidly. All three carcasses may have gone to waste. Of the three, one was a female. Within 50 feet radius of the three cached carcasses, six offal piles were located; two of these contained fetal bones (i.e. they were females). Also the tarp at the cache was weighted down by 11 sets of antlers judged to be females.

The best data we obtained to determine rates of illegal kills came from Anaktuvuk Pass when we determined that of the first 106 animals

Table 17. Western Arctic Herd caribou carcasses observed by project personnel during regulatory year 1975-1976 that were judged to have been wasted by humans.

Date	Number of carcasses observed	Location
late Sept 1975	8	near Sheshalik
September 1975	4	Nimiuktuk River
10/16/75	ca. 20 (some may have been retrieved later?)	north of Noatak River mouth
10/17/75	ca. 20 (some may have been retrieved later?)	south of Noatak River mouth
10/19/75	4	Krusenstern Lagoon
10/30/75	ca. 6	south of Barrow
10/31/75	17	Point Hope vicinity
2/20/76	24	straight line between Noorvik & Kiana
late March 1976	8-10	Kobuk River near Ambler
late March 1976	20	Eli River near Noatak
5/6/76	423	Kiana Hills & Etichuk Lake
6/15/76	9	mouth of Noatak River
6/25/76	174	Point Hope vicinity
6/25/76	106	Kivalina vicinity
6/28/76	32-47	Selawik & Inland Lake Area
6/28/76	31	near Noorvik
6/28/76	40-44 counted (50-100 seen at high altitude)	Nulvorotok Lake
Total	996-1067	

Table 18. Summary of the 1976-1977 WAH permit hunt.

Town	Permit Quota	Permits Issued	Permits Returned	Number of Permits Successful	Percent		Extrapolated Harvest
					of Quota Issued	Permits Issued Returned Successful	
Anaktuvuk							
Pass	340	330	192	192	97.1	58.2	330 <sup>a</sup>
Atkasook	10	-	-	-	-	-	10 <sup>b</sup>
Barrow	320	320	122	109	100.0	38.1	286
Nuiqsuit	200	200	104	104	100.0	52.0	200 <sup>c</sup>
Pt. Lay	40	8	-	-	-	-	-
Wainwright	150	147	128	119	98.0	87.1	137
Unit 26							
Subtotal	1,060	1,005	546	524	94.8	54.3	963
Ambler	104	90	65	44	86.5	72.2	61
Kiana	167	123	53	6	73.6	43.1	14
Kivalina	115	80	37	30	69.6	46.3	65
Kobuk	27	16	16	12	59.3	100.0	12
Kotzebue	696	435	376	201	62.5	86.4	233 <sup>d</sup>
Noatak	114	113	73	58	99.1	64.6	90
Noorvik	260	192	188	78	73.8	97.9	80
Pt. Hope	150	20	20	6	13.3	100.0	6
Selawik	217	170	144	94	78.3	84.7	111
Shungnak	90	99	82	47	100.0	91.1	52
Unit 23							
Subtotal	1,940	1,329	1,054	576	64.8	83.8	724
Total	3,000	2,334	1,600	1,100	77.9	68.5	1,687

<sup>a</sup> It is probable that Anaktuvuk took 330 caribou because sufficient caribou were available to allow that. However, it is possible that an extrapolated figure would overestimate the true harvest (i.e. perhaps only successful permits returned).

<sup>b</sup> No data available as Atkasook was just being reinhabited. Evidence of apparent hunter killed caribou seen in June 1977 suggests that the quota of 10 was likely taken and exceeded.

<sup>c</sup> The same possibilities as in footnote a exist here for data interpretation.

<sup>d</sup> Buckland was subsequently allocated 85 permits from Kotzebue's quota. The data are combined with Kotzebue.

taken by the village, six animals were killed illegally (i.e. two calves and two cows taken and two stinky bulls not salvaged).

Because the people at Anaktuvuk Pass have been on the whole quite conscientious regarding caribou hunting, we believe that the observed 5 to 6 percent illegal kill rate may likely have been doubled or exceeded many fold in many areas. We did observe several dozen carcasses lying on the tundra near Atkasook and Wainwright that were judged to have been left by people.

One noteworthy case where legal prosecution was initiated, involved three Noorvik residents who shot and cached 14 caribou (including a number of females) and made no effort to salvage any of them.

#### Harvest During 1977-1978

Hunting regulations for the 1977-1978 regulatory year are summarized in Appendix II. A summary of data pertaining to the season is presented in Table 19.

Extrapolation to what the total harvest for the year may have been from the reported harvest data is confounded by not having an index of the biases involved in successful versus unsuccessful hunters replying. No reminder letters were sent to individuals not returning harvest reports but a concerted effort was made through the radio and written media to remind holders of the report cards to send them in. The hunt statistics reveal that although a 3,000 bull quota was in effect, only 2,883 hunters obtained permits and hence the greatest possible legal harvest was below the quota level of 3,000 bulls. The distribution of permits issued by location was 39 (1.4%) in GMU 22, 1,214 (42.1%) in GMU 23, 298 (10.3%) in GMU 24, 1,162 (40.3%) in GMU 26, 119 (4.1%) in Fairbanks and 51 (1.8%) for all other locations south of the Yukon River. Persons residing outside the WAH range obtained 5.9 percent of all permits and residents of the area obtained 94.1 percent.

Of the 672 caribou reported as harvested, 1 (0.2%) was reported from GMU 22, 413 (61.5%) from GMU 23, 78 (11.6%) from GMU 24, 133 (19.8%) from GMU 26 and 47 (7.0%) from south of the Yukon River.

The proportion of permits returned varied greatly between GMU's and between villages within GMU's. Of the five villages in GMU 22 that received permits, only a total of 5 percent of the harvest reports were returned. Rates of return between villages varied from 0-17 percent. Of the 12 villages in GMU 23 that received permits, a total of 51 percent of the harvest reports were returned. Rates of return between villages varied from 10-78 percent. Of the six villages in GMU 24 that received permits, a total of 33 percent of the harvest reports were returned. Rates of return between village varied from 0-59 percent.

#### Waste and Illegal Kills During 1977-1978

Waste of caribou remained at an acceptably low level in 1977-78, although general compliance with the bag limit and restriction against

Table 19. Summary of the 1977-1978 WAH permit hunt.

Village	# permits issued	No. & (%)		No. returned and (%) <sup>1</sup>		Did not hunt	No comment
		permits returned		successful	unsuccessful		
<u>GMU 22</u>							
Elim	1	0		0	0	0	0
Koyuk	17	0		0	0	0	0
Nome	13	1(8)		0	1	0	0
Shakttoolik	6	1(17)		1(100)	0	0	0
Unalakleet	2	0		0	0	0	0
Subtotal	39	2(5)		1(50)	1(50)	0	0
<u>GMU 23</u>							
Ambler	128	73(57)		69(95)	1(1)	2(3)	1(1)
Buckland	32	12(38)		6(50)	2(17)	2(17)	2(17)
Deering	7	4(57)		0	0	4(100)	0
Kiana	165	129(78)		92(71)	3(2)	29(22)	5(4)
Kivalina	29	9(31)		9(100)	0	0	0
Kobuk	39	30(77)		20(67)	2(7)	8(27)	0
Kotzebue	392	208(53)		116(56)	37(18)	52(25)	3(1)
Noatak	50	14(28)		11(79)	0	3(21)	0
Pt. Hope	89	9(10)		1(11)	4(44)	4(44)	0
Noorvik	71	44(62)		30(68)	0	11(25)	3(7)
Selawik	103	20(19)		14(70)	2(10)	4(20)	0
Shungnak	109	72(66)		45(63)	1(1)	24(33)	2(3)
Subtotal	1,214	624(51)		413(66)	52(8)	143(23)	16(3)
<u>GMU 24</u>							
Alatna	8	0		0	0	0	0
Allakaket	60	6(10)		4(67)	1(17)	1(17)	0
Anaktuvuk Pass	115	68(59)		66(97)	1(1)	1(1)	0
Bettles	52	24(46)		8(33)	5(21)	11(46)	0
Hughes	28	0		0	0	0	0
Huslia	35	0		0	0	0	0
Subtotal	298	98(33)		78(80)	7(7)	13(13)	0
<u>GMU 26</u>							
Atkasook	27	0		0	0	0	0
Barrow	764	99(13)		80(81)	6(6)	13(13)	0
Colville Delta	6	0		0	0	0	0
Nuiqsuit	111	19(17)		19(100)	0	0	0
Pt. Lay	25	5(20)		1(20)	1(20)	3(60)	0
Wainwright	229	34(15)		33(94)	0	1(3)	1(3)
Subtotal	1,162	158(14)		133(84)	7(4)	17(11)	1(1)
<u>Areas south of Yukon River</u>							
Fairbanks	119	92		28	18	45	1
All others in Alaska	40	25		11	14	0	0
Out of state	11	11		8	3	0	0
Subtotal	170	128(75)		47(37)	35(27)	45(35)	1(1)
Total	2,883	1,010(35)		672(67)	102(10)	218(22)	18(2)

shooting females seemed to be poorer than during the preceding year as determined through conversations. While conducting April calf survival counts, we used a helicopter to investigate dead caribou encountered. In the Selawik Flats area we observed three caribou that had been shot by humans--all were females. In the middle Kobuk River area we investigated the kill sites of 10 females, 1 bull and 5 of unknown sex. Four of the females had been left whole in the field. One legal case was investigated in which several Barrow residents who flew to Karupa Lake and allegedly killed caribou out of season, exceeded bag limits, shot animals of the wrong sex and allowed meat to waste.

#### ACKNOWLEDGMENTS

We wish to thank the many residents of northwestern Alaska who cooperated in this study by reporting their harvests and especially those villagers who worked as data collectors. We particularly thank J. Doerr for making his unpublished data available. We thank Department Area Biologists D. A. Johnson and H. Melchior for their aid in harvest determinations. R. Shideler and Marilyn Sigman aided in various facets of the project. NANA Region Native leaders, John Schaeffer and Robert Newlin are commended for their realistic and helpful attitudes in helping make their constituents realize the need to greatly lower their caribou harvest to allow the herd to rebuild. Dale Stotts was an effective liaison between the Department and the North Slope Borough administration during the difficult period of reduced opportunity to harvest caribou. J. Coady and D. McKnight edited the report.

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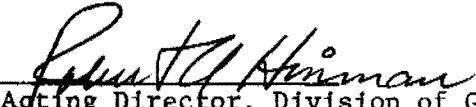
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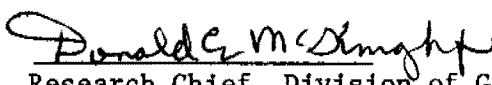
James L. Davis and P. Valkenburg  
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Research Chief, Division of Game

APPENDIX I. Information describing the regulations for the 1976-77  
Western Arctic Caribou Herd Hunting Seasons.

1976-77

CONDITIONS OF THE CARIBOU  
PERMIT HUNT

1. Permits in the form of a metal locking tag are valid for the taking of one bull caribou between September 25, 1976 and March 31, 1977 within the Game Management Unit where the permit was issued.
2. The hunter must carry his metal locking tag permit with him while hunting and immediately upon taking caribou, the permit must be validated by securely locking it to the right hindquarter of the animal.
3. The harvest report shall be completed and returned to the Village Agent who issued the permit within 5 days after the caribou is taken. If UNSUCCESSFUL or DID NOT HUNT, this permit still must be completed and returned to the Village Agent within 5 days of the close of the season.

I have read the above listed conditions and understand that violation of these conditions is a misdemeanor (5 AAC 81.055) and that violators will be prosecuted. My signature appears on the Issuing Agent's Record of Caribou Hunting Tags Issued.

## Instructions for Agents Issuing Caribou Hunting Tags (= Permits)

1. For each tag issued, fill out the form entitled "Record of Caribou Tags Issued." Information required for each tag includes: Date, Tag Number, Name of Hunter, License Number and Signature of Hunter. The hunter to whom a tag (or tags) is being issued should first read or be informed of the conditions of the caribou permit hunt. Copies of these conditions are attached.
2. Each hunter is required to have a valid hunting license.
3. The number of each tag received by a hunter is to be written on the back of his hunting license.
4. Hunters are to be instructed that the caribou tag must be attached (and locked) around the bone of the right hindquarter above the hock joint of each caribou taken.
5. Hunters are required to report the taking of each caribou, and the number of the tag used to account for each caribou, on the form provided with each tag.
6. The agent issuing tags is required to keep a record of the number of caribou taken in his village. Forms entitled "Record of Caribou Harvested" are provided in this booklet.
7. Only those persons who have been issued caribou hunting tags can hunt during the open season.
8. The issuing agent is to collect all unused tags by 5 April 1977.

Note: It is the Department's intent to obtain as large a series of caribou jaws (lower front teeth) as possible in order to study changes in age structure of the herd. Hunters can greatly assist in this effort by turning the jaws over to the village agent who issued caribou tags.

APPENDIX II. Information describing the regulations for the 1977-1978  
Western Arctic Caribou Herd permit hunt and its administration.

NOTICE OF ADOPTION OF EMERGENCY REGULATION

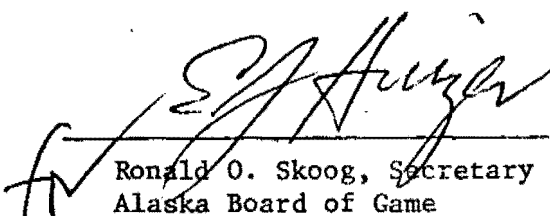
As required by AS 44.62.250, notice is given that the Alaska Board of Game adopted on this date, as emergency regulation, 5 AAC 81.055(20) and 5 AAC 81.320(5) relating to a permit hunt for caribou in Game Management Units 23, 24, subunits 26(A), 26(B) and portions of Units 22 and 25.

Copies of these regulations may be obtained by writing to Alaska Department of Fish and Game, Subport Building, Juneau, Alaska 99801. Notice is also given that the Board of Game intends to consider adoption of this regulation as a permanent regulation at their next meeting beginning November 29, 1977 at Sitka. At a later date, the Board will announce specific times and dates for public comment.

Date

8/19/77

Juneau, Alaska

  
\_\_\_\_\_  
Ronald O. Skoog, Secretary  
Alaska Board of Game

## ALASKA BOARD OF GAME

## REGULATIONS AUTHORIZING PERMIT HUNT FOR WESTERN ARCTIC CARIBOU

5 AAC 81.055 is amended by adding a new paragraph to read:

(20) The following provisions apply to the taking of caribou in that portion of Unit 22 draining into Norton Sound and the Bering Sea north of Cape Denbigh, Units 23, 24 and that portion of Unit 25 draining into the Yukon River from and including the drainage of the Tozitna River to and including the drainage of the Hodzana River, and subunits 26(A) and 26(B).

(A) Permits will be available from employees of the Department of Fish and Game by applying in person at the locations and during the times specified in subparagraph (C) of this paragraph. Persons unable to apply in person at these locations may obtain permits by mail or in person from the Alaska Department of Fish and Game, 1300 College Road, Fairbanks, Alaska 99701. All permit applicants must supply their name, address, and current hunting license number (if over 15 years of age).

(B) Hunting seasons for caribou in the area described in paragraph (20) are: August 26 - October 5 and March 15 - April 15 with a bag limit of one (1) bull by permit only. The season will be closed by field announcement if the total harvest exceeds 3,000 bulls. Permit holders must confine hunting to said areas and seasons. Permits are not effective except during the seasons and in the areas described in paragraph (20) and subparagraph (B).

(C) Permits will be issued from August 20 through September 7, 1977. Specific dates for issuance at each locality will be announced through local news media. However, permits issued by the Fairbanks office pursuant to subparagraph (A) will be available from August 20 through March 31. Permits issued before or during the fall season are valid for both the fall and spring season. Permits expire on April 15 following the date of issuance. Localities at which permits will be available are as follows:

Unit 26

Barrow  
Wainwright  
Pt. Lay  
Anaktuvuk Pass  
Nuiqsut  
Atkasook

Unit 24

Bettles  
Allakaket/Alatna  
Hughes  
Huslia

Unit 23

Kivalina  
Pt. Hope  
Noatak  
Kotzebue  
Noorvik  
Ambler  
Shungnak  
Kobuk  
Selawik  
Buckland

Unit 23 Cont'd:

Candle  
Deering  
Kiana

(D) A metal locking tag and a harvest report form will be issued with the permit. The permit number will be recorded on the hunter's current license. A successful hunter will lock the metal tag to the animal immediately after taking and will complete and mail the harvest report form within ten days after taking to Department at the address listed in (A) of this paragraph.

(E) Unsuccessful hunters will complete and mail their harvest report forms within 15 days after the end of the season.

(F) Hunters participating in both the fall and spring seasons must complete a harvest report form for each season. The number of animals which may be taken per permit as specified in subparagraph (B) constitutes the total number of animals which may be taken by one person for the period August 20 through the following April 15. A person may not apply for more than one permit during the period August 20 through April 15.

(G) An unlimited number of permits will be issued.

(H) The hunter harvest report will serve as the Arctic caribou harvest report required by 5 AAC 81.010(a) and .015(a) for the area of this hunt.

(I) Paragraphs (1), (2), (3), (11), (12), (13), (15), (18), and (19) of this section are not applicable to permit hunts conducted under this paragraph.

(J) The Commissioner may impose any other terms and conditions with respect to permits issued under this paragraph as he believes are necessary and proper to carry out the intent, purposes, and provisions of this paragraph.

Authority: AS 16.05.255(2), (3), (4), (7), and (10)

5 AAC 81.320(5) is amended to read:

(5) Caribou

[Provisions for Units not specifically listed below remain the same]

<u>Units</u>	<u>Open Season</u>	<u>Bag Limits</u>
Unit 22, that portion draining into Norton Sound and the Bering Sea north of Cape Denbigh, Units 23, 24 and that portion of Unit 25 draining into the Yukon River from and including the drainage of the Tozitna River to and including the drainage of the Hodzana River, and subunits 26(A) and 26(B).	Aug. 20 - Oct. 5 Mar. 15 - Apr. 15	1 bull by permit only. The season will be closed by field announcement if the total harvest exceeds 3,000 bulls.

Authority: AS 16.05.255(2), (4), (7), and (10)

END OF REGULATION

# Permittee Must Read This Before Signing For Permit

## CONDITIONS OF THE 1977/78 WESTERN ARCTIC CARIBOU PERMIT HUNT

1. Permits in the form of a metal locking tag and a written harvest report are valid for the taking of one bull caribou during the open season from August 26 through October 5 and March 15 through April 15. The season will be closed if total harvest exceeds 3000 bulls. Bag limit is one bull per legal permit hunter.
2. Permits are valid for Units 23, 24, 26A, 26B and that portion of Unit 22 draining into Norton Sound and the Bering Sea north of Cape Denbigh and that portion of Unit 25 draining into the Yukon River from and including the drainage of the Tozitna River to and including the drainage of the Hodzana River.
3. Permits will be available from Department personnel by applying in person at the locations and during the times listed in (4) below. For people unable to apply in person under these conditions, permits may be obtained any time prior to March 31, 1978 by mail or in person by supplying name, address and hunting license number (or by specifying age if under 16) to: Alaska Department of Fish and Game, 1300 College Road, Fairbanks, AK 99701.
4. Permits will be issued sometime during the period August 20 to September 7, 1977 at the following locations. Specific dates for issuance at each locality will be announced through local news media. Department employees will be issuing permits at the following locations and times in Game Management Units 24 and 26:

### Unit 26

### Dates

Barrow	August 23-26
Anaktuvuk Pass	" 22
Wainwright	" 23
Point Lay	" 23
Nuiqsut	" 24
Atkasook	" 24

### Unit 24

### Dates

Bettles	August 23
Allakaket	" 23
Hughes	" 24
Huslia	" 24

Department employees will issue permits in the communities in Unit 23 sometime between August 20 and September 7. Specific dates of issuance in each village will be announced on the Kotzebue radio station.

Also, for people unable to apply in person under the above conditions, permits may be obtained during the period August 20-March 31 by mail or in person by supplying name, address and hunting license number (or by stating age if under 16) to: Alaska Department of Fish and Game, 1300 College Road, Fairbanks, AK 99701.

5. The usual requirements for permit hunts are waived. But the following conditions will be required:

- (A) An unlimited number of permits will be issued.
- (B) A metal locking tag and a hunter harvest report will be issued as the permit. The permit number will be recorded on the hunter's current license. The successful hunter will lock the metal tag to the animal upon taking and will complete and mail the hunter report within 10 days of taking the animal. Unsuccessful hunters will complete and mail their permits within 15 days of the end of the season.
- (C) The hunter harvest report will serve as the Arctic caribou harvest report for the area of this hunt.

6. The permittee will acknowledge that he is aware of the conditions of the hunt and understands them by signing his signature on a record of caribou tags issued form.

# # # #

APPENDIX III. Hunting seasons and bag limits for the Western Arctic Caribou Herd during regulatory years (July 1-June 30) 1975-1976, 1976-1977 and 1977-1978.

Regulatory Year 1975-1976

<u>Unit</u>	<u>Open Season</u>	<u>Bag Limits</u>
Units 18 and 21 (only those portions north of the Yukon River), and Units 22 through 25	No closed season	No limit
Unit 26, that portion of the drainage of the Anaktuvuk River upstream from its confluence with Anayaknauruk Creek and the drainage of Natvakruak Creek	July 1-Aug. 9 Sept. 16-June 30	No limit
Remainder of Unit 26	No closed season	No limit

Regulatory Year 1976-1977

Regulations adopted for 1976-1977 at the annual spring Board of Game regulation meeting in 1976 follow:

<u>Unit</u>	<u>Open Season</u>	<u>Bag Limits</u>
Units 18 and 21 (only those portions north of the Yukon River) and Units 22, 23, 24 and 26(A)	July 15-Dec. 20 Jan. 6-May 31	15 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 south of the Yukon River per regulatory year.
Unit 26(B), that portion of the drainage of the Anaktuvuk River upstream from its confluence with Anayaknauruk Creek and the drainage of Natvakruak Creek	Sept. 16-Dec. 20 Jan. 6-May 31	15 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 south of the Yukon River per regulatory year.

The above was superseded by a Department of Fish and Game Emergency Order from the Commissioner as follows:

Emergency Order No. V-1-76

Issued at Juneau, August 13, 1976

Effective Date, August 14, 1976

Expiration date October 1, 1976  
or when superseded by emergency  
regulations promulgated by the  
Board of Game

REGULATION:

5 AAC 81.320(5) Caribou is amended to read: Units 23, 24, 26(A) and 26(B), no open season

The Board of Game held an emergency Board meeting on September 1976 and adopted the following regulations:

5 AAC 81.320. BIG GAME HUNTING. Following are the seasons and bag limits on big game, and the units or portions of units to which they apply:

(5) Caribou

Units 18, 21 and 22	Aug. 10-Mar. 31	Three caribou
Units 23, 24, 26A & 26B	Sept. 25-Mar. 31	Bull caribou by permit only. One caribou per permit.
Unit 25	Aug. 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
Unit 26C	July 1-Mar. 31	

Authority: AS 16.05.255(2)(4)

Regulatory Year 1977-1978

Regulations for seasons and bag limits adopted for 1977-1978 at the annual spring Board of Game regulation meeting in 1977 follow:

<u>Units</u>	<u>Open Seasons</u>	<u>Bag Limits</u>
Unit 22, that portion draining into Norton Sound and the Bering Sea north of Cape Denbigh, Units 23, 24 and that portion of Unit 25 draining into the Yukon River from and including the drainage of the Tozitna River to and including the drainage of the Hodzana River, 26(A) and 26(B)	No open season	

The Board of Game passed an emergency regulation on 18 August 1977 as follows:

<u>Units</u>	<u>Open Season</u>	<u>Bag Limits</u>
Unit 22, that portion draining into Norton Sound and the Bering Sea north of Cape Denbigh, Units 23, 24 and that portion of Unit 25 draining into the Yukon River from and including the drainage of the Tozitna River to and including the drainage of the Hodzana River, 26(A) and 26(B)	Sept. 1-Oct. 5 Mar. 15-Apr. 15	One bull by permit registration. The season will be closed by field announcement if total harvest exceeds 3,000 bulls

The above emergency regulations were adopted as permanent regulations at a subsequent scheduled Board of Game meeting in April 1977.

## FINAL REPORT (RESEARCH)

State: Alaska

Cooperators: James L. Davis, Patrick Valkenburg, Harry V. Reynolds, Carl Grauvogel, Richard T. Shideler, and David A. Johnson

Project No.: W-17-8 & W-17-9      Project Title: Big Game Investigations

Job No.: 3.21 R      Job Title: Herd Identity, Movements, Distribution and Seasonal Patterns of Habitat Use of the Western Arctic Caribou Herd

Period Covered: July 1, 1975 to June 30, 1977

### SUMMARY

At least two small semimigratory or nonmigratory caribou herds exist within the range of the large, migratory Western Arctic herd: the Central Arctic Herd, which resides on the Arctic Slope in the vicinity of the Trans-Alaska Pipeline, and the Teshekpuk Lake Herd, which ranges the Arctic Slope between Barrow and the Colville River delta and is centered around Teshekpuk Lake. The former contains about 5,000-6,000 caribou and the latter between several hundred and 4,000. Some evidence suggests that two additional herds, the Andreafsky Herd and the Ray Mountains Herd, exist. The existence of a reported Wainwright-Point Lay Herd has not been confirmed.

Movements of the Western Arctic Herd from 1975 through 1977 generally followed patterns previously described with some important exceptions. In fall 1975 well over 30,000 caribou migrated, a few miles inland from the coast, south from Point Hope to the Kiana Hills. This movement resulted in a very large harvest. In winter 1976-77 about one-half of the herd wintered on the Arctic coastal plain, and many others moved as far south as the northern Andreafsky Mountains before turning north to a traditional major wintering area adjacent to the Selawik Flats. Winter use of the Koyukuk drainage was very light during the period of study and Anaktuvuk Pass has not been a major passageway since fall 1973.

The examination of the rumen contents of caribou killed by wolves, hunters and other causes, indicated that sedges comprised almost the entire winter diet of caribou on the arctic coastal plain. South of the Brooks Range caribou also used large amounts of sedges but lichens were the major food around Walker Lake and perhaps in the Selawik-Buckland area. Caribou were observed feeding heavily on the flowering heads of *Eriophorum* in late May and early June. Use of willow (*Salix* spp.) and dwarf birch (*Betula* spp.) leaves began in early June.

The traditional calving area, the middle portion of the Utukok River drainage, was the center of calving in all three years of study. Densities of caribou on the calving area during 1976 and 1977 are presented.

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## BACKGROUND

Lent (1964), Skoog (1968), and Hemming (1971) reviewed the historical movements and distribution of the Western Arctic caribou (*Rangifer tarandus granti*) Herd (WAH) and discussed the expansion and contraction of the inhabited range in relation to herd size. The WAH was small in the late 1800s and its range was restricted to a relatively small part of the Arctic Slope including the present calving grounds (Utukok, upper Colville and Ketik Rivers) and part of the Noatak drainage. As numbers increased the herd's range also expanded, and by 1945 caribou were wintering in the Kobuk Valley.

With few exceptions, between 1950 and 1970 annual movements of the herd were similar, and somewhat predictable, but Skoog (1968) and Hemming (1971) both mention some erratic movements and a continuing southward shift in wintering areas at least until the early 1960s. Lent (1964) described calving in the traditional calving area and typical post-calving movements in a southwesterly direction to the Kukpowruk and Wulik Rivers, and then eastward along the north side of the Brooks Range. In August the large aggregations broke up; most caribou dispersed north onto the coastal plain, but many remained in the Brooks Range and Noatak Valley all summer.

Two major fall migration routes were documented between 1950 and 1970 (Hemming 1971). These were via the Anaktuvuk, Killik, and John

Rivers in the central Brooks Range and the Aniuk, Nimiuktuk, Hunt, and Redstone Rivers to the west. However, most of the major drainages of the north and south slopes of the Brooks Range were used by some migrating animals.

Caribou using the western migration routes wintered along the lower and middle Kobuk River valley and in the Selawik Flats and Buckland Hills. Those using the central Brooks Range routes generally wintered in the Koyukuk drainage as far south as Huslia. Hemming (1971) mentioned that large numbers wintered on the Arctic Slope in 1957-58, and that some caribou wintered there every year, especially along the coastal plain. After Lent's (1966) work in the early 1960s, biologists conducted few winter surveys north of the Brooks Range, and it is possible that significant numbers of caribou stayed there during the winter in other years. Undoubtedly, since 1950 the Selawik Flats and surrounding hills have provided more sustenance for wintering caribou than any other area.

Compared to the fall migrations from the North Slope to wintering areas, spring movements north to the calving area tend to be more direct (Hemming 1971). Deep snow has retarded migration in some springs, notably in 1962, when caribou calved as far south as the Kobuk River (Lent 1966). Pegau (1972) also reported delayed migration in 1972 with some calving occurring south of the traditional calving area.

From 1971 through 1974 few data were collected from the herd. Only limited winter distribution and harvest data are available (Pegau 1971, 1972, 1973, Pegau et al. 1974, Grauvogel and Pegau 1974).

We reviewed and summarized the winter distribution data from the above reports as well as from Lent (1964), Pegau (1968, 1970a,b,c), Skoog (1968), Hemming (1971), and Pegau et al. (1973) (Table 1). In comparing 1970 data to 1960 data it appears that from 1970 through 1974 migration patterns and herd distribution generally followed the trend of previous years. However, in winter 1970-71 some caribou were observed south of the Yukon River in the vicinity of Galena, as far south as caribou from the Western Arctic herd have ever been reported since the early 1870s (Skoog 1968:242).

Available literature on caribou generally suggests that as the number of caribou in a herd decreases, the area ranged by that herd also tends to get smaller, and marginal ranges are abandoned. Also, as a herd increases, its movements become erratic and these erratic movements are a mechanism by which caribou become reestablished in areas which they have not used for long periods (Kelsall 1968, Skoog 1968, Hemming 1971). The WAH increased its size and range after about 1925 (Skoog 1968) and probably reached a peak in the mid- to late 1960s (Skoog 1968, Hemming 1971). The decline of the herd since 1970 has presented an opportunity to study the changes in movements, distribution and habitat use of a declining herd.

A better understanding of how caribou occupy and use potential range is particularly necessary because the calving ground and a significant

Table 1. Reported location of major wintering areas of Western Arctic caribou between 1959 and 1975.

Winter	lower Kobuk lower Noatak	Baird Mtns Squirrel R	Delong Mtns Mulgrave Hills	Arctic Coastal Plain*	upper Koyukuk	middle Koyukuk	Dolbi Flats Huslia Area	Selawik Flats Buckland Hills	Ray Mountains	Remarks
1959-60		X			X			X		
1960-61	X			X				X		
1961-62	X		X		X			X		
1962-63	X	X								
1963-64			X		X			X	X	widespread distribution
1964-65										no data
1965-66								X		few obs.
1966-67	X		X		X	X		X		
1967-68			X	X		X		X		
1968-69										no data
1969-70			X					X		few obs.
1970-71						X	X	a few		few obs.
1971-72							X	X		
1972-73		X		X				X		
1973-74		X						X	X	
1974-75			X					X		

\* Few reliable observations. It is likely that some caribou wintered on the coastal plain in most years.

portion of the range of the WAH lie within National Petroleum Reserve-A (NPR-A). Increasing northern development and exploration for oil and gas have focused worldwide attention on the status of northern wildlife species, particularly caribou. Presently, intensive studies are underway to determine the effectiveness of construction methods and design features of the Trans-Alaska oil pipeline in providing "free passage and movement" of caribou (Cameron and Whitten 1976, 1977). Findings of this study will add greatly to our general knowledge of caribou reaction to disturbance factors and barriers. However, because variables determining caribou behavior are frequently specific to an area and herd, extrapolating findings from one area to another may not be valid. For instance, caribou encountering the Trans-Alaska pipeline project in northern Alaska are members of a "local" population of about 5-6,000 animals that occupy a fairly narrow area longitudinally (Cameron and Whitten 1976). Seasonal movements of these animals are generally in a north-south direction. No groups larger than 2,000 animals have been observed, and groups usually number less than a few hundred caribou. The large, migratory Western Arctic Herd, in contrast, has extensive seasonal movements which can occur in any direction, and seasonal aggregations of tens of thousands of caribou are normal. The angle at which migrating caribou encounter seismic lines, roads, and barriers is just one of the many variables determining their response to human activities (Calef 1974), and one which warrants further study.

Knowledge of seasonal patterns of range use will provide the basis for intelligent recommendations for land use and for the design and implementation of exploration and development activities in NPR-A. Although some knowledge of caribou use of the area exists, better baseline information is necessary. Hemming (1971) summarized most of the past studies of caribou in the area. The information was again summarized by the Alaska Department of Fish and Game (1973). Several other noteworthy studies include those by Hanson et al. (1975), Henshaw (1968), Lent (1964), and White et al. (1975).

Determination of the winter distribution of caribou and the optimum carrying capacity of the range for caribou is presently required. Because most of the herd has wintered south of the Brooks Range in recent years, knowledge of winter distribution of caribou in NPR-A is not adequate, and further data must be obtained. This information will complement data obtained from other studies, and will ultimately be used in computer modeling to help make management decisions regarding the herd and its habitat.

#### OBJECTIVES

To determine herd identity, movements, distribution, traditional migration routes, critical habitats, and seasonal patterns of habitat use of the Western Arctic herd.

## PROCEDURES

We concentrated most of our effort into three times of the year: early June (calving), late June (post-calving aggregation), and October (rutting). We collected the most detailed information about movements and distribution from these periods, concurrent to obtaining information for Job 3.19R (Size, Composition and Productivity of the Western Arctic Herd). Surveys at other times of the year, except in April 1977, were specifically designed to collect information on movements and distribution of the herd. Area Biologists Reynolds (Barrow), Johnson (Kotzebue), and Grauvogel (Nome) provided much information on winter distribution of the herd from surveys which they flew specifically for caribou, and from their observations incidental to other surveys. Air taxi pilots, particularly from Bettles, Kobuk, and Kotzebue, and members of the general public also contributed information on winter distribution. We also obtained a few reports of caribou distribution from business-reply postcards distributed at various locations in northwest Alaska. The postcard system was of limited utility, however, because of the effort required to make the cards available and to encourage their use. Also, we had hoped that the cards would supply information on caribou distribution in late summer, but this is the time of year when they are hardest to find.

Incidental resightings of caribou tagged near the Trans-Alaska Pipeline corridor and near Bettles by Cameron and Whitten (1976, 1977) provided some interesting information on the relationship between WAH and Central Arctic Herd caribou.

## FINDINGS

### Herd Identity

Hemming (1971) considered all caribou north of the Yukon and west of the Sagavanirktok River to be members of the WAH. During the 1970s reports became common of small, apparently resident, groups of caribou in areas ranged or formerly ranged by the WAH. Of five reported resident groups, two (Teshekpuk Lake and Central Arctic) certainly exist, two (Andreafsky and Ray Mountains-Kokrines Hills) have been neither documented nor discounted, and one (Wainwright-Point Lay) probably does not exist. For this discussion we define a herd after Skoog (1968) as a group of caribou that use a discrete calving area regularly.

Cameron and Whitten (1976, 1977) studied the Central Arctic herd and documented its existence. It ranges the central Arctic Slope between the Brooks Range and the Arctic Ocean. They placed 30 radio collars and 120 numbered vinyl collars on caribou near the Trans-Alaska Pipeline between 1975 and 1977, and the majority of these animals have never left the area between the Canning River and the Itkillik River. A few marked animals have been resighted in the ranges of the WAH (Table 2) and the Porcupine herd. These sightings do not contradict the definition of Central Arctic animals as a herd because the animals were tagged prior to calving when overlap of herds is allowed by the definition.

Table 2. Resightings of caribou tagged near the Trans-Alaska pipeline and near Bettles in 1975.

<u>Collar</u>		<u>Tagged</u>		<u>Recovered or Resighted</u>		Remarks
Color	Number	Date	Location	Date	Location	
BY*	25	2/6/75	Wild River	10/15/75	near Kivalina	shot
BY	1	2/5/75	Wild River	5/28/77	Happy Valley	could be mistaken id
BY	2	2/5/75	Wild River	4/8/77 5/28/77	Wild River Happy Valley	doubtful sighting
BY	3	2/7/75	Wild River	5/26/77	Galbraith-Toolik	
BY	42	4/24/75	65km S Happy Valley	6/9/77	Utukok River	
BY	63	10/22/75	Happy Valley	4/23/77	between Nuiqsut and Teshekpuk	
BY	71	10/21/75	Happy Valley	4/23/77	between Nuiqsut and Teshekpuk	

\* BY = Blue with yellow numbers.

The Teshekpuk Lake Herd apparently occupies the area around Teshekpuk Lake (from Barrow eastward to the Colville River) during the entire year. In recent years, during calving, it has been separated from the Central Arctic herd by an area essentially devoid of caribou about 10-20 miles on either side of the Colville River, but during winter its range has been continuous with that of the Central Arctic herd.

No good estimate of herd numbers exists. Animals from the WAH and possibly from the Central Arctic Herd are present in the general area in highly variable numbers in all seasons of the year except during calving. A cursory partial survey during the calving period in 1976 produced an estimate of about 500 calving animals and a reconnaissance survey during calving in 1977 discovered about 200 caribou. However, a long-term resident of the Colville River delta, Harmon "Bud" Helmericks (pers. comm.), reported that the general area has had a calving population for at least the past two decades and that prior to the resettlement of Nuiqsuit in 1974 the "resident herd" contained about 4,000 caribou. It seems improbable that there are many more than 1,000 at present.

During the mid-1970's some caribou have been present near Wainwright in all or most months of the year. This fact, combined with reports of caribou being seen with newborn calves in late June and early July by Wainwright residents, caused speculation that a small resident herd discrete from the WAH occupied the area from Wainwright to Point Lay. Although a limited number of calving cows were noted in 1976 south of Point Lay, the distribution of the calving animals was continuous with the main WAH calving aggregation. Moreover no calving was observed in 1975 or 1977 and the area in question was devoid of caribou. Because of the close proximity of Wainwright to the WAH calving area, it is probable that animals moving to and from the WAH calving area would be sighted near calving time. It should be noted that many of these reports have come from hunters traveling south on the Kuk River in late June or early July (which is well after the peak of calving) and they are actually approaching the northern extent of the traditional WAH calving area. Aberrations in the migration patterns of caribou occur occasionally, and they sometimes calve in unexpected places. The delayed spring migrations in 1962 and 1972 have already been mentioned. In 1965 McGowan (1966) observed calving between Walker Lake and the Ambler River. Thus, the presence of a group of calving animals in an area during one or two seasons should not necessarily be considered evidence for the existence of a separate herd, particularly without further supporting evidence.

The range of the two questionable herds, Andreafsky and Ray Mountains-Kokrines Hills, has never been totally surveyed during calving, nor has a herd been seen in the summer by ADF&G personnel. Department personnel found about 70 caribou in the southern Ray Mountains in March 1977 but only five were found in the hills east of Unalakleet on a survey in mid-June 1977. Residents of Unalakleet told Grauvogel that they thought caribou were resident in the hills to the east but on further questioning they admitted that they had never actually seen caribou there in summer. The existence of a resident group in the Ray Mountains and Kokrines

Hills is likewise based on hearsay. People from Tanana have traditionally hunted caribou in the mountains and say there are always some there. Pilots also report sightings from all times of the year. Skoog (1968) referred to Eakin (1918) who found caribou abundant in the Ray Mountains at a time when the Western Arctic herd was small, but this appears to be the only historical reference to caribou in the area. We do not discount the possibility that a small calving group exists in either the Ray Mountains or the Andreafsky Mountains.

Alaska's reindeer population was very large in the 1930s and has since declined (Skoog 1968); in some cases entire herds escaped or were neglected, and eventually became feral. The wild *Rangifer* in the Andreafsky Mountains from 1900 to around 1940 probably came from the Unalakleet reindeer herd which was introduced in the 1890s (Skoog 1968) and numbered about 50,000 at its peak. There were few caribou in the area at the time, and it was at least partly for this reason that the reindeer were introduced (Jackson 1892). Since the 1940s, many caribou from the WAH have wintered south of the Kobuk River, and since the early 1960s they have been observed in the Andreafsky Mountains in winter (J. Burns, pers. comm.) It is possible, and perhaps even likely, that a separate group of *Rangifer*, likely feral reindeer, existed here until the 1960s and perhaps still persists. The Seward Peninsula presently supports a population of reindeer in excess of 15,000 (Bureau of Land Management, unpubl. data), and many are probably never or seldom rounded up by the herders. Any *Rangifer* found west of the Kiwalik River are likely to be feral or domestic reindeer.

#### Movements and Distribution of the Western Arctic Herd Since 1975

Winter - 1974-75. The major winter concentrations of caribou during 1975 (January to April) were located in the Selawik Flats along the Selawik and Kugarak Rivers, and southwest to the vicinity of Buckland. We cannot estimate the total number of caribou that wintered in this area but probably the majority of the herd was there. Caribou were scattered farther to the east along the south slope of the Brooks Range but we made no extensive flights to determine total numbers (see Table 3 and Fig. 1).

Spring - 1975. Spring migration in 1975 was not well documented. John Coady saw 1,500-2,500 caribou apparently moving north along the Hunt River in April. Animals that wintered in the Selawik Flats usually: 1) cross the Kobuk River between Ambler and Kiana and continue north, or 2) cross Selawik Lake and travel north nearer the coast. They probably used both of these routes in 1975.

In late May caribou were still migrating along the Colville, Itkillik and Etivluk Rivers, moving northwest (Ray Cameron, pers. comm.).

Summer - 1975. The herd calved near the "traditional" area between Noluck Lake, the upper Kukpowruk River and the Utukok River and the core calving area was identical to that reported by Lent (1964)(Fig. 2).

Table 3. Location of groups of wintering caribou in 1974-75.

Location	Number seen	Date	Observer
Selawik drainage	2-3,000	winter 1974-75	J. Jacobson
Kugarak River	large number	winter 1974-75	J. Coady
Mulgrave Hills	some	winter 1974-75	J. Jacobson
N of Stevens Village	184	21-23 Jan 1975	R. Cameron/ J. Davis
N of Stevens Village	craters of 50	6-8 Mar 1975	R. Cameron/ J. Davis
Lower Wild River	123	21-23 Jan 1975	R. Cameron/ J. Davis
Lower Wild River	59	6-8 Mar 1975	R. Cameron/ J. Davis
Alatna Hills	81	21-23 Jan 1975	R. Cameron/ J. Davis
Ridges W of Crevice Cr	115	6-8 Mar 1975	R. Cameron/ J. Davis
Hunt River (near Ambler)	1500-2500	Mar 1975	J. Coady
Old Dummy Lake (Kanuti Flats)	craters	6-8 Mar 1975	J. Davis

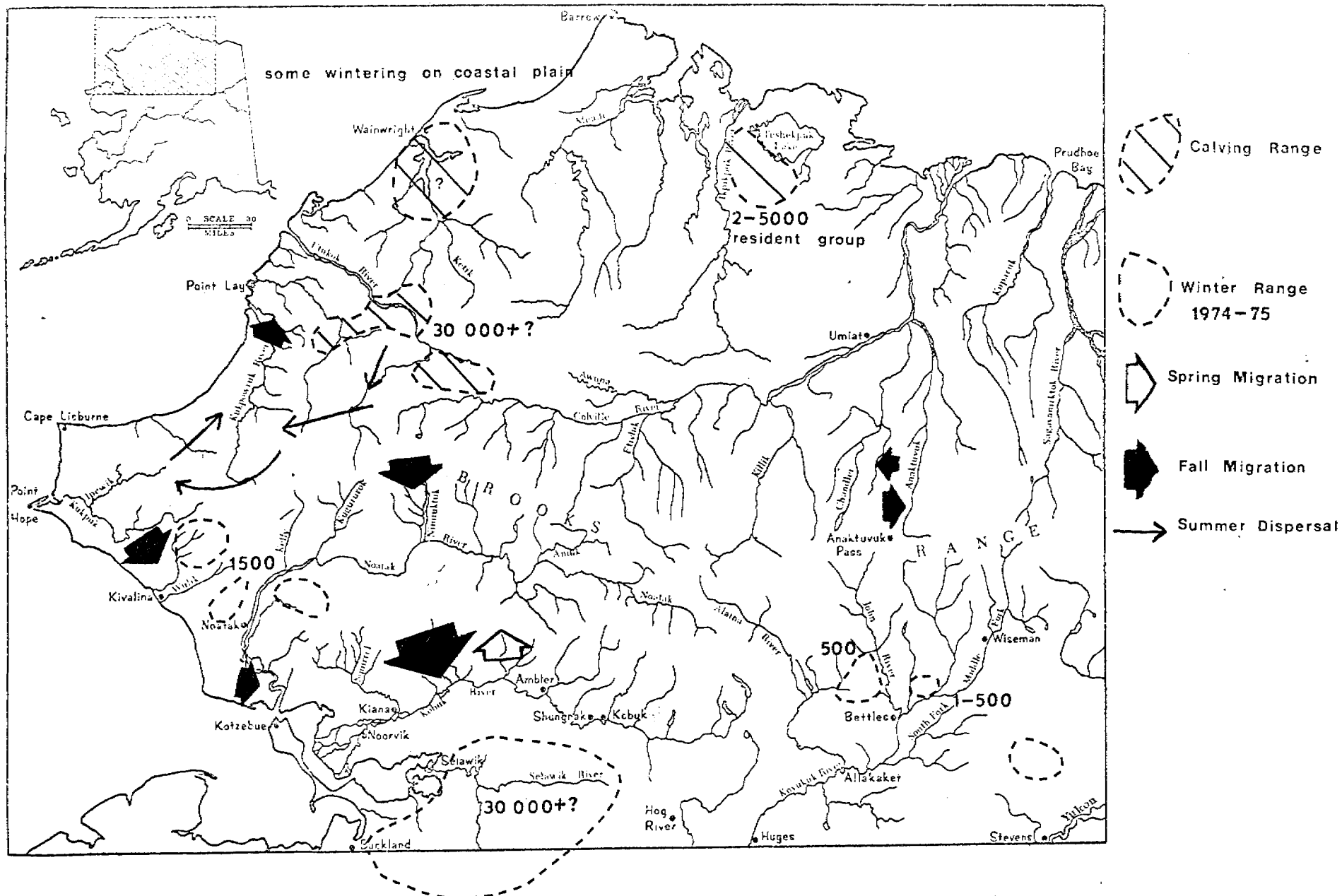


Figure 1. Movements and distribution of the Western Arctic Herd in 1975.

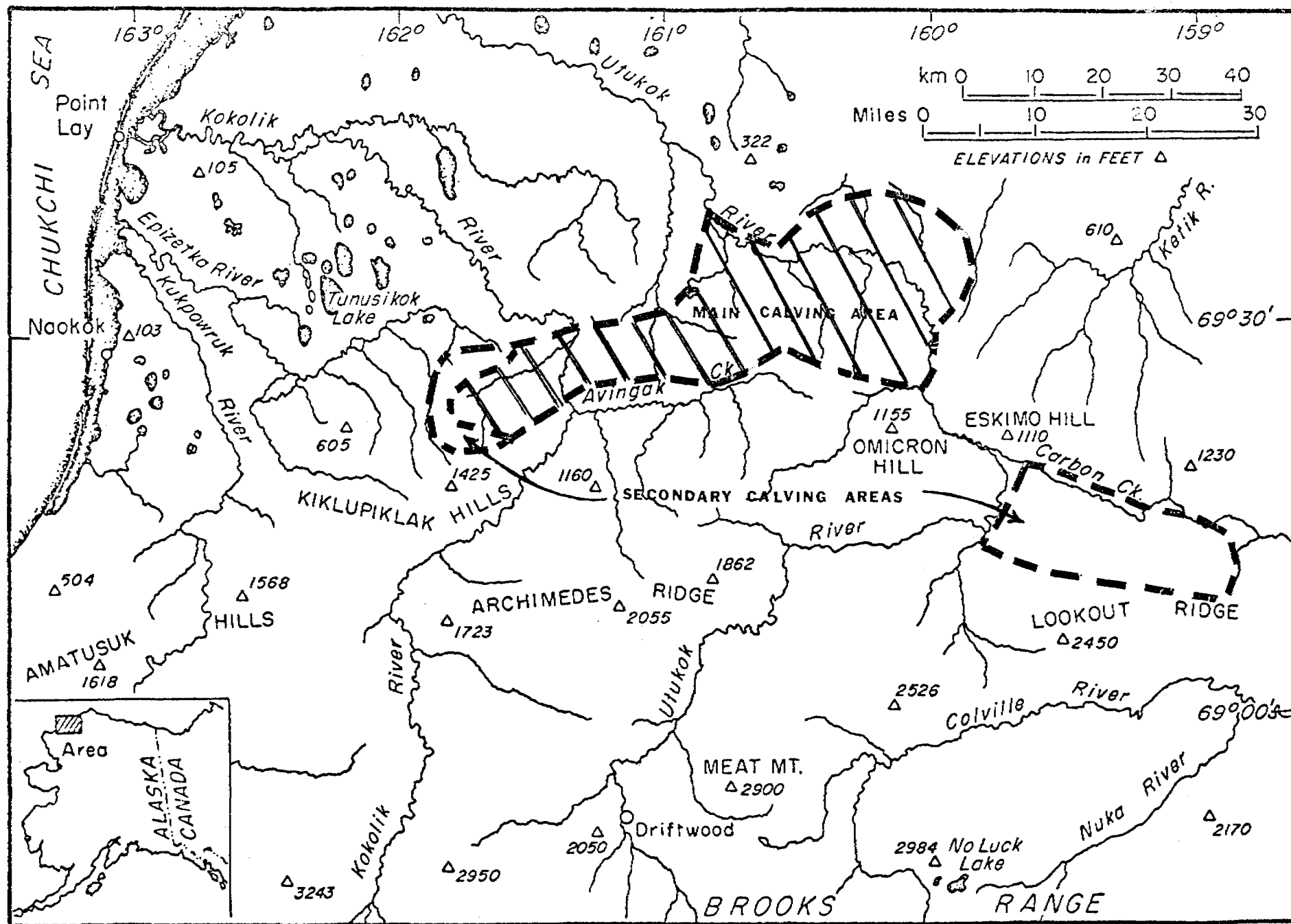


Figure. 2. Calving areas of the Western Arctic Herd in 1975, identical to that reported by Lent (1964).

Immediately after calving, about 14 June, caribou started moving slowly west but turned south and east, and remained in the southern edge of the calving area. Toward the end of June they began a definite westward movement which resulted in an estimated 45,000 animals being in the Ipewik, Kukpuk, upper Pitmegea, and upper Kukpowruk drainages. During the second week of July this definite movement ceased and the caribou became more concentrated. Reynolds estimated that 64,500 were present between the Ipewik River, the Pitmegea River, and Cape Lisburne. During this time Davis searched the crest of the Brooks Range during an 8.3-hour flight and saw only four caribou. These two observations, plus the fact that observers on the Meade and Colville Rivers saw very few caribou, indicated that nearly the entire population was in the Cape Lisburne area in middle to late July.

This large concentration of animals dispersed to the northeast of Cape Lisburne in August. We made few observations in August because the weather was poor for flying.

Fall - 1975. Although the bulk of the herd apparently moved south, some caribou remained near the coast in the vicinity of Point Lay and Wainwright. The southward migration was principally along two paths. Grauvogel observed 15-20,000 animals moving down the Nimiuktuk River to the Noatak River. He thought these caribou probably crossed the Baird Mountains, and went down the Salmon River and Hunt River. This movement started in early September, and reached the Kobuk River around mid-month, when Nelson Walker of Kotzebue reported "lots" of caribou crossing upriver from Kiana. After they crossed the Kobuk River, the caribou presumably continued to the Selawik Flats-Buckland Hills area. Farther to the west about 30,000 caribou traveled south along the coast and reached Cape Krusenstern by mid-October. These animals crossed the mouth of the Noatak River and many remained all winter in the Kiana Hills, where Dr. David Klein of the Alaska Cooperative Wildlife Research Unit reported several thousand in late 1975.

Some caribou remained on the North Slope. Reynolds estimated that 5,000 animals were within 40-50 miles of Barrow in October. Reynolds also reported that 1,000 or 2,000 remained near Wainwright all year long. Several thousand caribou were present in the Teshekpuk Lake area.

Winter - 1975-76. Most caribou again wintered in the Selawik Flats. We did not obtain winter counts but Klein estimated the group wintering in the Kiana Hills at 10,000 animals.

Again this year only scattered groups used the eastern part of the winter range in the Koyukuk drainage; the largest group being 3-4,000 that remained on the Tinayguk River. Table 4 and Fig. 3 summarize reported locations of wintering groups, and movements of the herd.

Spring - 1976. Two main routes were used on the spring migration. Enoch Sherman of Noatak reported many thousands traveling up the Noatak River in late April and May. These were probably caribou that had wintered in the Kiana Hills. They traveled up the Noatak River past the

Table 4. Locations of wintering caribou during 1975-76.

Location	Number	Date	Observer
North of Hughes	20	late Nov 1975	T. McBirney
Indian Mountain	200	late Nov 1975	T. McBirney
E side John River	20-30	late Nov 1975	T. McBirney
Chandler Lake	?	late Nov 1975	T. McBirney
Eli River (Noatak)	800	December 1975	C. Grauvogel
Tinayguk Creek	3000-4000	Winter 1975-76	D. Rodey
Alatna Hills-Norutak Lake	2038	19 Feb 1976	J. Davis
Kiana Hills	10,000	20 Feb 1976	D. Klein
Upper Kobuk	69	19 Feb 1976	J. Davis
Selawik Flats	lge. no.	1 May 1976	K. Woodworth
Kobuk River	fair no.	1 May 1976	K. Woodworth
Wainwright area	up to 1000	winter	H. Reynolds



mouth of the Kelly River and it is likely that they continued up the Kugururok or Nimiuktuk Rivers to the calving area. Caribou that wintered in the Selawik Flats crossed the Kobuk River between Ambler and Kiana and proceeded up the Hunt River, Salmon River and other rivers draining into the Kobuk River. Caribou from the Norutak Lake-Alatna Hills area were moving west by late March, and these animals probably traveled north via Walker Lake or the Reed River.

Summer - 1976. The area where the herd calved was larger than what they have usually used since the early 1960s. While most calving took place in nearly the same area as 1975, there were many caribou calving as far east as Liberator Lake. Most calves were born west of the Eskimo Hill area on the Utukok River (Fig. 4) in the traditional core calving area.

Although most animals were within the calving area, some small groups of less than 100 were seen near Kivalina, Selawik and Noorvik in mid-June. Sappington (1976) reported very few caribou outside the calving area in Naval Petroleum Reserve-A during June and July. Those seen were in groups of 5 or less except for about 2,000 near Teshekpuk Lake. The latter are considered by Helmericks to be a resident, sedentary group.

Post-calving movements were predictable and followed nearly the same pattern as those of 1975. The caribou milled about the calving area in June, moved to the Cape Lisburne area in July, and then dispersed northeastward beginning in early August. Sappington reported that caribou were widely spread in NPR-A during August. Six thousand had apparently traveled east along the Colville, turning north near the Killik River. Reynolds saw about 1,000 animals west of Chandler Lake in August, and these may have remained there to winter. Some caribou also dispersed south toward the Brooks Range, and some crossed the mountains and remained along the upper Noatak River in late summer.

Fall - 1976. There was no mass fall migration in 1976; an estimated 25-35,000 caribou remained on the North Slope, mostly north of 70°N latitude. Three to 10 thousand migrated south from the Chandler River toward Anaktuvuk Pass and Chandler Lake in early October and some moved as far as the Tinayguk River. Farther west, Davis observed trails which indicated that another few thousand caribou had traveled south through Howard and Nigu Passes.

The migration was later than usual, and virtually no caribou were south of the Kobuk River by mid-October. Caribou did begin crossing the Kobuk River then, but only about 3,000 migrated south across the middle Kobuk River. Warren Thompson of Kotzebue estimated that 1,000 caribou crossed the mouth of the Noatak in mid-November. About 12,000 animals were seen in migration to the Selawik Flats, and counts in April 1977 showed about 14,000 to be in that area. These caribou must have arrived via one of the two routes mentioned.

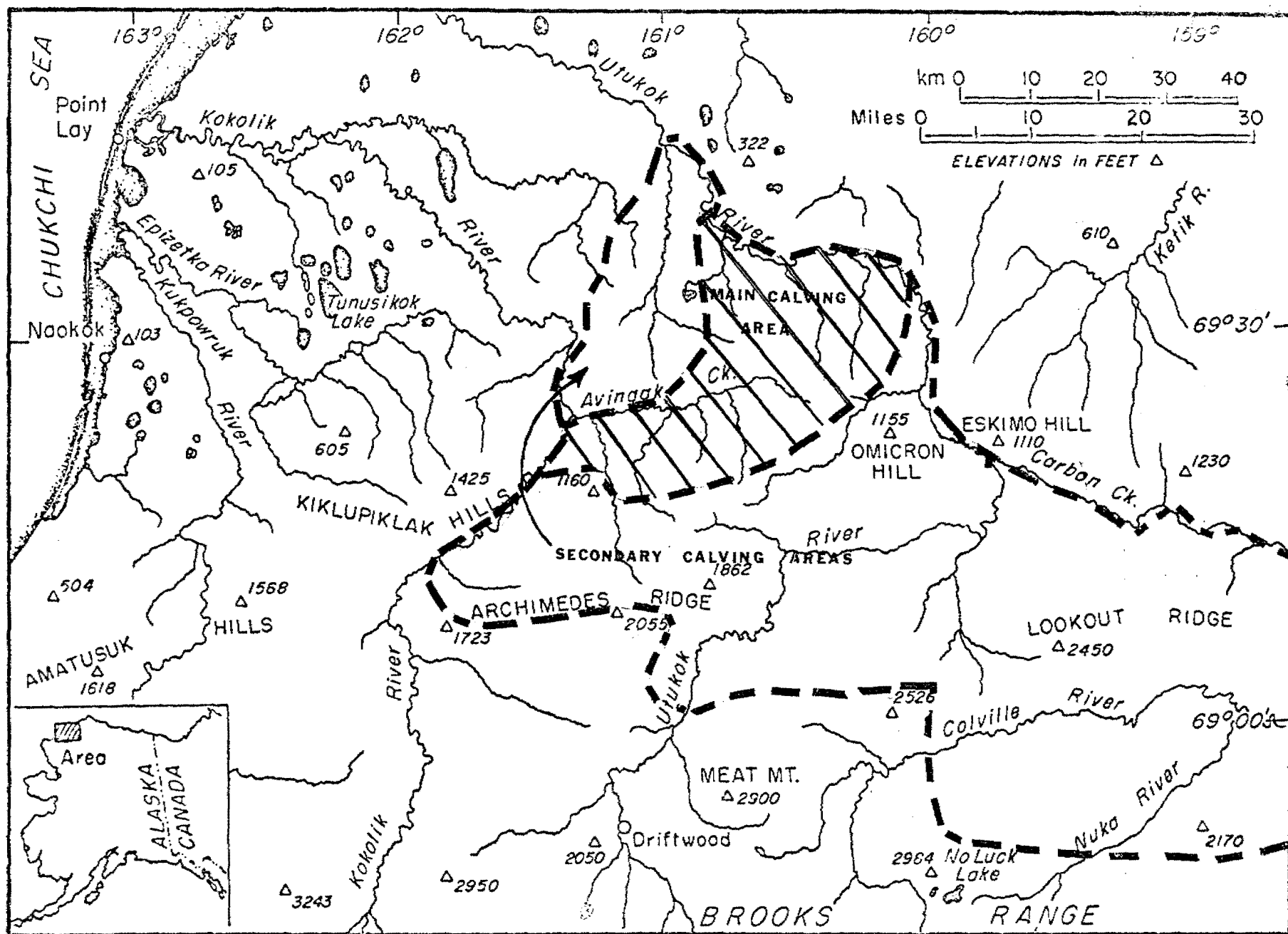


Figure 4. Calving areas of the Western Arctic Herd in 1976.

The 1976 fall migration was not only unusually late but some animals (estimated by Johnson to be thousands) went much farther south than in recent years. Many thousands reached the upper Buckland River and some went as far south as the middle Koyuk River before turning north to the southern Selawik Flats.

Winter - 1976-77. From January through April 1977 caribou from the WAH were distributed in two main areas (Table 5 and Fig. 5). The largest group, consisting of 20-35,000 animals, wintered between the Colville River delta and Wainwright north of 70°N latitude. A second large group consisting of 14,000 caribou wintered on the southern and eastern portion of the Selawik Flats and adjacent uplands and the Buckland River drainage. Other smaller groups totaling about 5,000 animals were scattered over the south slope of the central Brooks Range.

Some caribou that wintered on the south side of the Brooks Range began to move northwest by early March. Trails of several hundred migrating caribou were seen in several areas: 1) from Easter Creek westward to the Nigu River, 2) north across Walker Lake from areas to the south, and 3) north across Selby Lake from areas to the south near the Kobuk River. The latter migrations were observed about 10 April by residents of Walker and Selby Lakes. Caribou in the Selawik Flats were beginning northward migrations as late as 15 April and were probably heading toward the Kobuk River near Ambler. Migrating caribou were observed on 3 May crossing the Kobuk River between Ambler and Shungnak, and trails indicated that several thousand had already crossed the river. Trails of these caribou observed by Area Biologist Pete Shepherd, McGrath, on 12 May indicated that the caribou had moved down the Cutler River, across the Noatak River, and up the Anisak River where the vanguard of the groups was located at the crest of the DeLong Mountains. These caribou probably reached Noluck Lake by 17 May because on that date an air taxi operator observed 500 caribou there.

Smaller wintering groups in the central Brooks Range migrated north along two routes. Shepherd observed trails that indicated several hundred caribou moved from the upper Nigu River to the upper Etivluk River and then to Desperation Lake where they joined caribou migrating from the south in early May. Other caribou moved through Howard and Nigu Passes and west along the northern foothills of the Brooks Range. Shepherd believed that caribou taking this route would join those from the south shortly after 12 May.

On the Arctic Slope, caribou north of 70°N latitude did not make lengthy movements between January and late April. The largest concentrations observed in April were southeast of Wainwright and southwest of Teshekpuk Lake. In April large numbers of caribou probably occurred throughout most of the area north of 70°N between the Colville River delta and Kuk River, but poor weather precluded searching. From January through early May an area from the crest of the Brooks Range north to 70°N, and from the Driftwood airstrip narrowing eastward along the Colville River to Umiat was nearly devoid of caribou. We were unable to locate the routes that the caribou wintering south of Wainwright and Teshekpuk Lake used to migrate to the calving area.

Table 5. Observations of wintering caribou seen during January through April 1977.

Date	Area	No. of caribou	Observer	Habitat type	Snow conditions
2/9/77	Pt. Hope to Kotzebue	several hundred	K. Laughton	Unknown	probably shallow & windblown
2/11/77	SW side Kiana Hills	73	C. Youngren	probably <u>Eriophorum</u> tussocks	probably shallow & windblown
2/14/77	Mulgrave Hills	32	D. A. Johnson	probably <u>Eriophorum</u> tussocks	probably shallow & windblown
2/14/77	Upper Noatak	640	D. A. Johnson	Unknown	probably shallow & windblown
2/14/77	Upper Ambler	250	D. A. Johnson	sparse black spruce woodland and <u>Eriophorum</u> tussocks	probably shallow & windblown
2/26/77	Area W of Noatak Lake	tracks of 50	D. A. Johnson	Unknown	Unknown
2/26/77	Kelly River	15	D. A. Johnson	probably black spruce woodland	Unknown
2/28/77	S Fork Squirrel River	beds of 3	D. A. Johnson	Unknown	Unknown
2/28/77	Tututsuk River hills SW Chandler Lake	2000	J. Coady	<u>Dryas</u> tundra and <u>Eriophorum</u> tussocks	Windblown
3/8/77	Ambler & Shungnak Rivers	644	J. Coady	Unknown	Unknown
3/8/77	Selby Lake	300	D. Rue	<u>Dryas</u> tundra on S facing hillside	Windblown
3/8/77	Kobuk River east Manuneluk	275	D. A. Johnson	sparse black spruce woodland	Windblown
3/28/77	Area around Kotzebue	219	D. A. Johnson	Unknown	Unknown
4/13/77	Hills N Agashashok River	300-400	J. Rood		
4/14/77	Kevuk Creek	15	P. Valkenburg	<u>Dryas</u> tundra mountain tops	windblown; about 10-20cm
4/14/77	Head of Alatna River	17	P. Valkenburg	probably <u>Dryas</u> tundra	windblown; about 10-20cm
4/14/77	Upper Nigu River	660	P. Valkenburg	mountain slopes	windblown; about 10-20cm

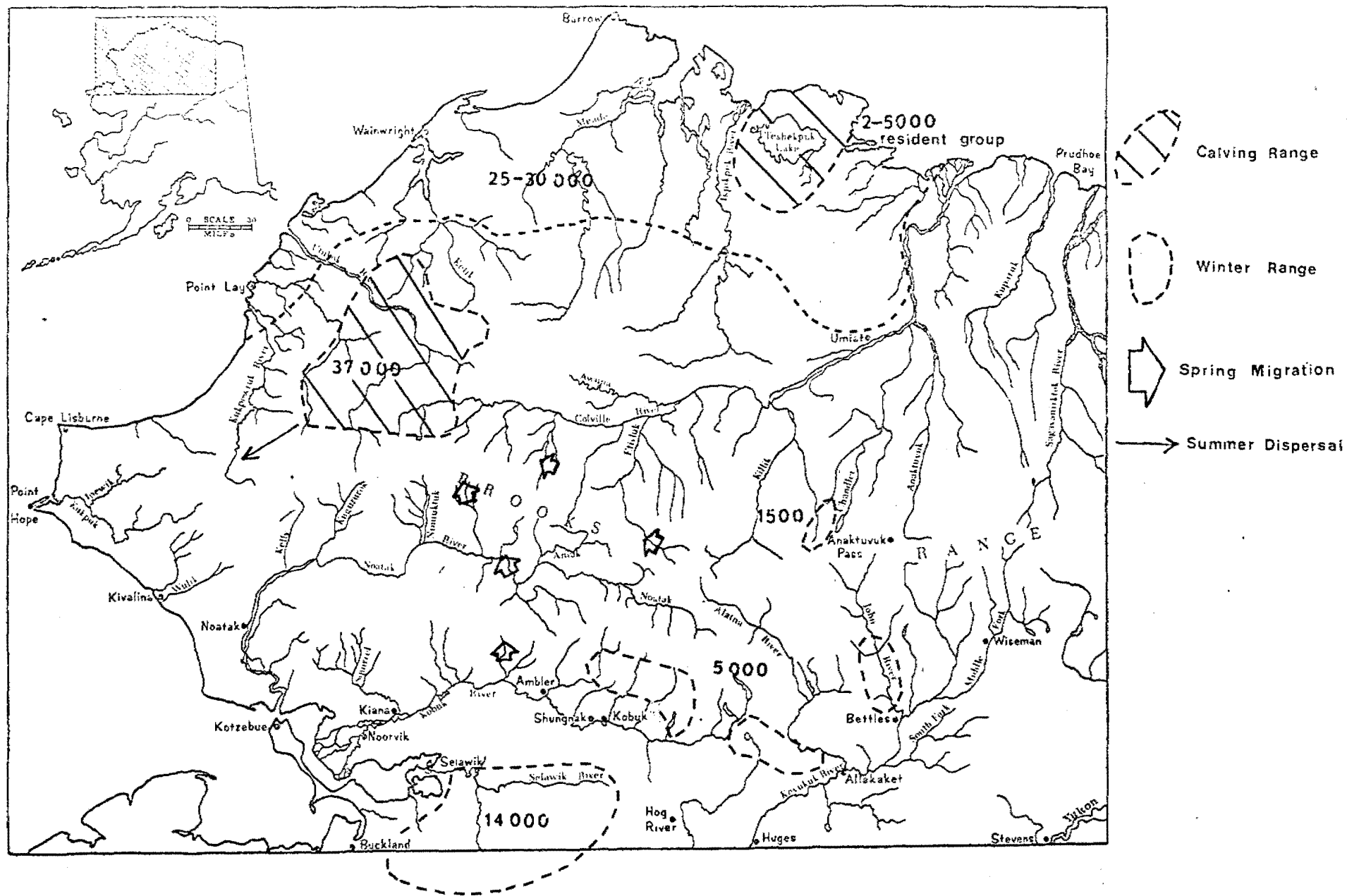


Figure 5. Movements and distribution of the Western Arctic Herd in 1977.

Arrival on the calving grounds, 1977. Caribou began passing Driftwood airstrip on the upper Utukok River about 20 May. Trails in the snow indicated that many caribou moved north through the Brooks Range along three western tributaries of the Anisak River. From there most caribou proceeded northwest to the vicinity of Noluck Lake. From Noluck Lake the trails spread out, and continued in a more northerly direction.

Apparently most of the cows and yearlings segregated during the last week of May, and the yearlings remained behind in the foothills. On 31 May, 85 percent of 2,000 caribou seen on the main calving area were antlered cows. The following day we saw many yearlings in the foothills near Noluck Lake, and they were traveling along trails previously made by the cows. We saw one group of 30 yearlings and several other smaller groups composed entirely of yearlings. Many yearlings were separated from the females on 14 June when we attempted to count caribou on the calving area. We saw 46.3 yearlings per 100 cows on the southern part of the calving area closest to the foothills, and an average of 9.1 per 100 in the central portion of the calving area.

At Driftwood airstrip, movement of cows and yearlings stopped on 2 June, and most cows were probably in their calving area (Fig. 6). Some groups of cows were still traveling northwest on 2 June east of Driftwood where a heavier snow cover persisted.

Definite directional movements and formation of larger groups began around 10 June; the peak of calving. At this time caribou in the main calving area began moving southwest. After 14 June we did not document the post-calving movement closely. Most of the caribou, including some bulls, were located between Mount Kelly, Windy Lake and Cape Sabine on 28 June when we initiated composition counts and a photocensus. Other caribou were located between Tupikchak Mountain and the Kukpowruk River.

Seasonal patterns of habitat use. We collected some detailed information on habitat use and snow conditions incidental to other research jobs during April and June 1977. Table 6 summarizes the results of analysis of samples from 43 rumens collected from wintering areas.

About half the herd wintered north of 70°N. The area is generally very windblown and *Eriophorum* tussocks are the dominant vegetation type. Lichens were noticeably lacking from the 11 rumen samples collected on the North Slope; only three rumens contained lichens (*Cladonia* in two, *Stereocaulon* in one).

We collected rumens from 30 dead caribou on the Wild River Flats and Norutak, Walker, and Selby Lake areas where about 4,000 caribou wintered and the snow was deep. The dominant vegetation type in these areas is spruce woodland and of all wintering areas snow was deepest here. Caribou had used the lake margins and *Eriophorum* and *Carex* meadows within the area intensively. Twenty-two of 23 rumen samples from the Norutak Lake, the Wild River, and Selby Lake area contained primarily sedges and the seven from Walker Lake primarily contained lichens of the genus *Cladonia*.

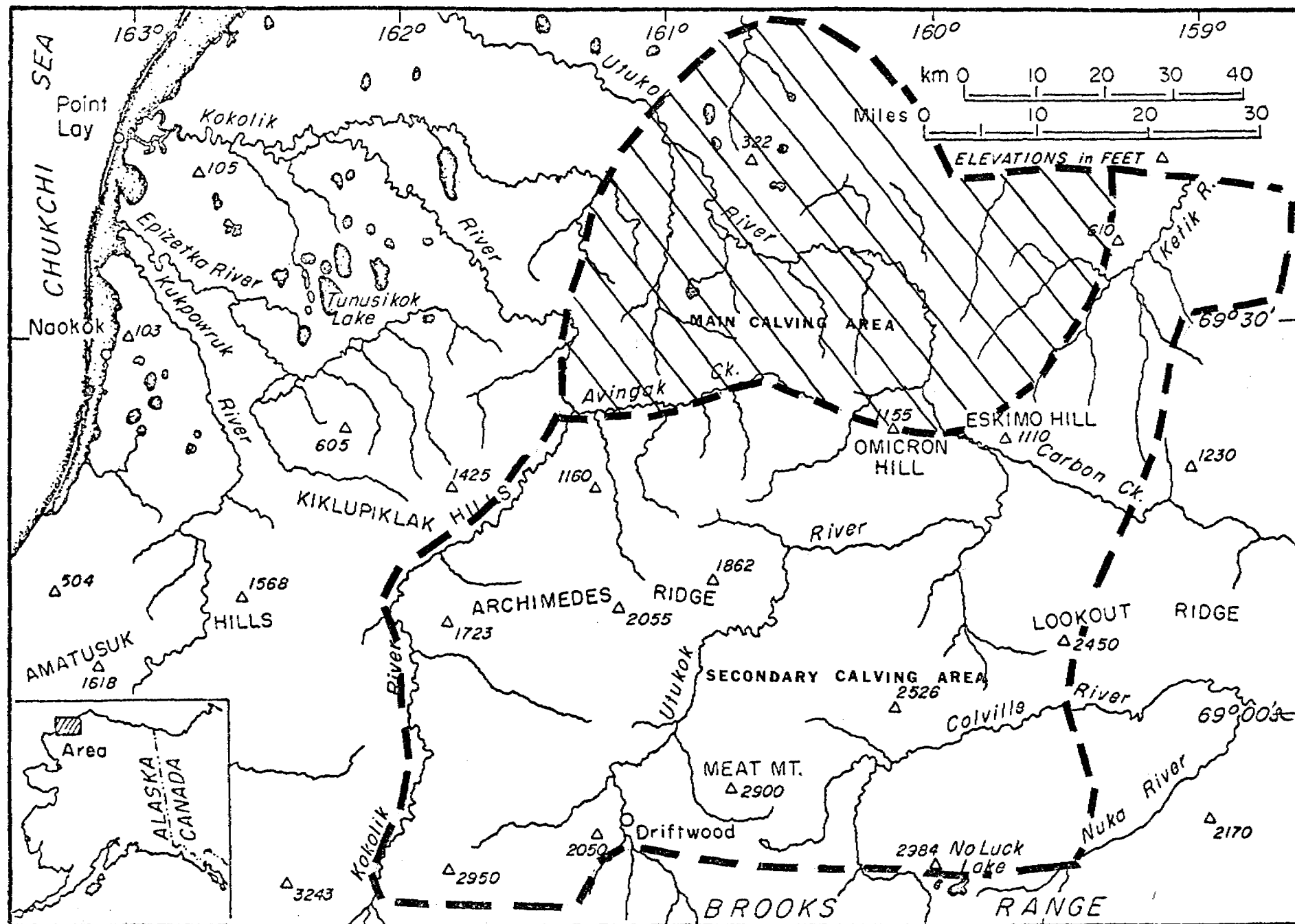


Figure 6. Calving areas of the Western Arctic Herd in 1977.

Table 6. Analysis of 41 rumen samples collected during April 1977 from the range of the Western Arctic herd.

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Number of rumen samples in which the largest sorted percentage was:			
<u>Area</u>	<u>Sedges/grasses</u>	<u>Lichen</u>	<u>Total Rumen Samples</u>
Walker Lake		7	7
Wild River, Norutak Lake, Selby Lake	22		23*
Teshekpuk Lake/ Arctic Slope	11		11**

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\*Lichens and sedges/grasses equally abundant in one sample.

\*\*The presence of lichens was noted in only 3 of the 11 samples.

Summer habitat use. From late May through the end of the first week of June caribou were observed feeding on the flowers of *Eriophorum*. They seemed to select forage near frost boils and exposed soil where the sun warmed the soil and probably promoted earlier growth. After 7 June many caribou stripped new leaves from willow (*Salix planifolia* and *S. spp.*) and dwarf birch (*Betula glandulosa*).

Calving areas of the WAH. Calving occurs on the Arctic Slope in two areas. A resident group of between 200 and 4,000 animals uses the area around Teshekpuk Lake. The Utukok River and its associated drainages are the areas of major importance to the WAH. This area has been used off and on, if not continuously, by some caribou since the 1830s (Skoog 1968). Hemming (1971) indicated that more of Ketik drainage was used during calving than we observed in 1975 through 1977. The herd was larger in 1970, and Hemming may have included more low density calving areas than we have. Drawing lines around the calving area is a subjective and somewhat arbitrary process because even on the calving ground the caribou are constantly moving. We chose to outline the calving area during the week when most calves are born (8-14 June). Before 8 June some cows may still be en route, and after 14 June many large cow/calf groups are moving in a southwesterly direction, away from the area where the calves were born. In other words, it is likely that not all calving took place in the areas shown in Figs. 2, 4 and 6. Scattered calving occurs in surrounding areas and the number of cows using the outlying area may vary from year to year.

In 1975 the main calving area was 1,040 km<sup>2</sup> (406 mi<sup>2</sup>) in extent, and the secondary calving areas included 385 km<sup>2</sup> (150 mi<sup>2</sup>). We did not census calving caribou during 1975 and therefore cannot calculate a density. We do not believe that the density was lower in 1975 than in 1976 or 1977. In fact, it was probably higher because the herd was probably larger.

In 1976 we censused the calving area on 13 June. The main calving area encompassed 1,152 km<sup>2</sup> (450 mi<sup>2</sup>) and secondary areas 4,889 km<sup>2</sup> (1,910 mi<sup>2</sup>). Density of caribou in the main area was 7.85/km<sup>2</sup> (20.1/mi<sup>2</sup>) and 1.62/km<sup>2</sup> (4.1/mi<sup>2</sup>). We saw a total of 16,957 caribou older than calves.

In 1977 we censused on 14 June. The greatest calving density (main calving area) occurred on 3,580 km<sup>2</sup> (1,400 mi<sup>2</sup>). Secondary areas comprised 15,920 km<sup>2</sup> (6,200 mi<sup>2</sup>). The density of caribou older than adults was 5.4/km<sup>2</sup> (14.3/mi<sup>2</sup>) on the main calving area and 1.1/km<sup>2</sup> (2.9/mi<sup>2</sup>). The total number of caribou older than calves counted was 37,600. Of the three years, the best weather occurred in 1977, and a thorough search was possible, therefore the 1977 figures are probably more accurate than those of 1976.

The calving area as a critical habitat. Of all the areas used by caribou from the WAH, the Utukok calving area has been used most consistently. No reports of large numbers of caribou calving in other areas in the range of the WAH exist.

No published information is available from situations where a caribou herd has been displaced from a calving area. The effect of development on the calving grounds of the Central Arctic herd is still being assessed, but it appears that Central Arctic herd cows are avoiding the areas where development is greatest (Cameron and Whitten 1977). Until we know more about the effect of development and disturbance of caribou on calving areas, and in view of Cameron and Whitten's findings in the Central Arctic herd, it seems wise to discourage human activity on and/or adjacent to calving areas.

#### RECOMMENDATIONS

Because of the management implications of selectively harvesting members of more sedentary populations within the range of the WAH, it is essential to document the size, seasonal distribution and discreteness of these populations. Available data suggest two priorities: 1) an intensive study of the Teshekpuk Lake herd and 2) a reconsideration of certain assumptions about the management of the WAH based on the use of an area by a single herd. These assumptions include the beliefs: a) that use of a communal calving ground is the only social characteristic shared by a large majority of the animals in the WAH, b) that no additional persistent social units are formed, and c) that caribou are not faithful to particular seasonal ranges, or if fidelity exists it occurs for the entire herd and not for subunits of the herd. Management programs have considered all caribou in a herd to be equally susceptible to hunting by assigning only one season and bag limit throughout the range of the herd even though hunting is localized. The management implications of these concepts may not be entirely accurate, and need to be tested.

The prospect of imminent developments (including but not limited to construction of transportation corridors, petrochemical projects, mining and reindeer herding) in northwest Alaska requires the thoughtful incorporation of data about the movements and distribution of the WAH and associated herds to ensure the perpetuation and enhancement of caribou populations.

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