ANWR Progress Report Number FY85-18

CALVING DISTRIBUTION, INITIAL PRODUCTIVITY, AND NEONATAL MORTALITY OF THE PORCUPINE CARIBOU HERD, 1984

Kenneth R. Whitten
Francis J. Mauer
Gerald W. Garner

Key words: Caribou, Porcupine herd, calving distribution, productivity, neonatal mortality, predation, post-calving movements, Arctic-Beaufort, north slope

Alaska Department of Fish and Game
1300 College Road
Fairbanks, Alaska 99701

and

Arctic National Wildlife Refuge
U.S. Fish and Wildlife Service
101 12th Avenue
Fairbanks, Alaska 99701

25 February 1985

Calving distribution, initial productivity, and neonatal mortality of the Porcupine caribou herd, 1984.

Kenneth R. Whitten, Francis J. Mauer, and Gerald W. Garner. Alaska Department of Fish and Game and U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.

Abstract: This report presents infomation collected during the second year of a three year study by the Alaska Department of Fish and Game and the U.S. Fish and Wildlife Service of the Porcupine caribou herd's calving distribution, initial productivity and neonatal mortality. Calving distribution and areas of concentrated calving activity were determined by relocation of 31 radio-collared adult (3+ years old) female caribou (Rangifer tarandus), and by aerial reconnaisance surveys during late spring migration and calving seasons. Distributions of calving caribou extended across the Arctic coastal plain and foothills from the Jago River in Alaska to approximately the Babbage River in Canada. Some calving caribou were also distributed along migration routes in the eastern portion of the Brooks Range in Alaska, the British Mountains in Canada, and as far south as the northern margin of the Old Crow Flats. Major concentrations of calving activity occurred on the coastal plain in the vicinity of the Niguanak River, between the Aichilik River, and the Turner River, and on the coastal plain south of Stokes Point in Canada. The peak of calving occurred on 4 June and did not appear to vary significantly from east to west. Twenty-three of 31 (74%) radio-collared females 3 years old or older produced calves, and initial productivity appeared to be similar to that of recent years. During 3-8 June, 77 calves were captured in the Niguanak River and Aichilik-Turner Rivers calving concentration areas, and fitted with mortality sensing radio-transmitters. Radio frequencies were monitored at least daily and visual checks were made every 48h during 4 June-6 July. Monitoring was less intense during the remainder of July and continued on a monthly basis through 1984. Twenty-three productive radio-collared females were monitored as a control group on 1-3 day intervals during 30 May-24 June. During 3 June-12 November, 33 study calves died. Seventeen calves died as a result of study-induced abandonment. The natural mortality rate of remaining calves was 26.7%. Categories of natural mortality included: Undetermined- predation/scavenging (56.25%), wolf (Canis lupus) predation (12.5%), brown bear (Ursus arctos) predation/scavenging (6.25%), golden eagle (Aquila chrysaetos) predation (6.25%), accident/drowning (6.25%), disease-pneumonia (6.25%), and human harvest (6.25%). The geographic distribution of mortality of study calves as well as that of unmarked adults and calves was primarily oriented towards the eastern and southern coastal plain/foothills areas in Alaska, and may be attributed to generally higher densities of predators in that region. Increased incidence of mortality among study calves was measured during fall migration in regions south of the Brooks Range and British Mountains.

Calving distribution, initial productivity, and neonatal mortality of the Porcupine caribou herd, 1984.

Much of the coastal plain portion of the Arctic National Wildlife Refuge (ANWR) was opened to a limited oil and gas exploration program by the Alaska National Interest Lands Conservation Act (ANILCA) of 1980. If significant potential for petroleum resources are indicated, Congress may pass additional legislation to open ANWR to further exploration, leasing and development. Caribou from both the Porcupine and Central Arctic Herds utilize portions of the coastal plain of the ANWR for calving, post-calving aggregations, and insect relief activities during the spring and summer (USFWS 1982). Parturient female caribou and post-parturient females with young calves are sensitive to disturbance associated with human activity (de Vos 1960, Lent 1964, Bergerud 1974, Cameron et al. 1979, Davis and Valkenburg 1979). Studies conducted annually since 1974 have shown that female caribou with young calves avoid the Prudhoe Bay oil field and adjacent Trans-Alaska Pipeline corridor (Cameron and Whitten 1976, 1980). It has been suggested that displacement of parturient female caribou and females with young from traditional areas may cause increased calf mortality which could ultimately contribute to population decline (Bergerud 1976, Calef and Lent 1976, Klein 1980).

Mortality factors and rates associated with potential displacement habitats need to be assessed to make predictions regarding calf survival and herd productivity if traditional calving habitats are further explored and developed for petroleum production. Consequences of displacement from traditional insect relief areas and preferred forage areas, and the overall impacts of human/industrial disturbances also need to be evaluated. ANILCA requires the evaluation of potential adverse effects that oil and gas exploration, production, and development on ANWR might have upon the Porcupine Caribou Herd. In addition, if petroleum development on ANWR is allowed, more information on caribou distribution and habitat use during the calving and post-calving periods is needed to formulate recommendations for leasing schedules, placement of facilities, and other mitigative measures. In particular, causes and patterns of calf mortality need to be examined with emphasis on differences among areas or habitat types, in order to assess the possible effects of displacement from development sites. This study focuses on determining annual calving distribution, initial productivity, and neonatal caribou calf mortality on the calving grounds and post-calving areas of the Porcupine Caribou Herd and was initiated in 1983 as a joint project between the Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game.

Objectives for this study are as follows:

A. Primary

1. Delineate distribution of the Porcupine Caribou Herd calving as part of a continuing effort to collect baseline information on wildlife resources in the portion of ANWR open to petroleum exploration;identify any annual consistencies in calving distribution and/or common characteristics among separate calving areas.

2. Determine initial calf production and extent, causes, and chronology of mortality among neonatal calves (i.e., 4-6 weeks postpartum).

3. Measure variation in calf mortality and calf mortality factors between core and peripheral areas and/or between different habitat types or localities.

B. Secondary

1. Provide productivity data for analysis of herd status.

2. Identify characteristics (i.e., habitat, snow ablation patterns, topography, etc.) of core and peripheral calving areas and/or calving areas in different habitat types or localities.

3. Provide additional collared caribou for concurrent studies of overwinter calf survival and seasonal movements.

4. Provide incidental observations of other species as part of the overall ANWR baseline studies, including casual or incidental locations of radio-collared muskoxen, brown bears, and wolves.

This study is being conducted concurrently with studies of the status (population size, and trend), overwinter calf mortality, and winter distribution of the Porcupine caribou herd. Adult caribou collared in conjunction with those studies aid in the conduct of this investigation. Collectively this study is a part of a comprehensive environmental inventory and assessment of the potential petroleum development area of ANWR. This report presents preliminary findings of the 1984 field season.

Methods and Materials

Study Area

The study area consists of the north slope of ANWR and may extend east to the Blow River in Canada and south to the southern slopes of the Brooks Range, depending on annual variations in caribou distributions. In 1984, the study area extended from the Jago River on the west, to the Babbage River in Canada on the east, and the Beaufort Sea coast on the north to the southern slopes of the Brooks Range.

Most study activities occurred on the coastal plain and foothills portions of the area described above. Descriptions of the physical environment, climate, geology, vegetation, and other wildlife resources of the study area are found in U.S. Fish and Wildlife Service (1982). Logistical operations were based at Kaktovik, Alaska.

Calving Distribution and Initial Productivity

General calving distribution was determined primarily by locating all

radio-collared adult female caribou in the Porcupine Herd during late May and early June. All radio-tracking was conducted from aircraft equipped with standard tracking equipment (Telonics, Mesa, AZ). Radio-tracking flights during calving distribution surveys were usually at altitudes greater than 1,000 m AGL. Low altitude (20-100 m AGL) aerial searches were also conducted to identify calving caribou.

A low-level transect extending across the calving grounds from Komakuk Beach to Barter Island was flown using fixed-wing aircraft on 2 June over the areas where collared cows were located. In areas of low caribou density, essentially all caribou within approximately 300 m of the flight line were counted and classified. In high density areas only partial counts of caribou could be obtained, and only newborn calves and adults were classified.

High altitude radio-tracking flights over the northern part of the winter range, and over the mountains and coastal plain east of the calving areas were conducted to determine the distribution of bulls and yearlings during calving.

Neonatal Mortality

Caribou calves were captured from two areas with high densities of calving females. The first capture area was located in the vicinity of Niguanak Ridge between the lower Jago River and the Niguanak River (Fig. 1), and coincided with the historic "core" calving region of the Porcupine herd. The second calf capture location was between the Turner River on the east and the Aichilik River on the west (Fig. 1), and is usually considered a peripheral calving location.

Caribou groups were approached by helicopter (Bell Jet Ranger 206B) with a capture crew of three persons aboard. The helicopter landed approximately 200 m from the caribou and one person took a sitting position on the right skid. The helicopter then proceeded towards the group and a calf was selected for capture. Selection from groups was standardized (calf on extreme left) to minimize sampling bias for slower, younger, and/or weaker calves.

The selected calf was pursued by flying approximately 1 m above the ground. When the helicopter was within 2-3 m of the running calf, the person on the skid stepped off to the side, ran, and grasped the calf. Sterile surgical gloves were worn by personnel handling captured calves and new gloves were used for each handling. When a calf was captured, the helicopter landed and the remaining members of the capture crew assisted in processing the calf.

Captured calves were sexed (Bergerud 1961), weighed, and measured for total body length, right hind foot length, and new hoof length (Haugen and Speake 1958). Characteristics of the umbilicus (moist, dry, absent) and hooves (degree of wear) were noted as described by Miller and Broughton (1974). Each calf was examined for abnormalities and fecal samples were collected from those calves with scours.

An expandable elastic collar supporting a mortality sensing transmitter (Telonics Inc., Mesa, AZ), weighing approximately 114 g was installed around the neck of each calf. Mortality mode for transmitter units was doubling of normal pulse rate following a 1 h motion free period. Estimated battery life

was 15 months. Each collar was constructed from a 3.75 cm wide elastic band. The initial collar size (25 cm circumference) was achieved by sewing the left and right ends of the elastic collar band together. Three separate expansion folds per collar were sewn with incremental amounts of cotton thread stitching. Each expansion fold provided an additional 7 cm of collar circumference. Maximum expansion circumference of each collar was 53 cm. Collars were constructed to breakaway after the last expansion fold was used. The color of the collars was changed from the white elastic used in 1983 to a dyed brown color in 1984. This change was made because it was believed that golden eagles might be attracted to the white collars due to their easy sightability (Garner et al. 1985).

Aircraft (PA-18) equipped with standard radio tracking equipment were used to monitor instrumented calves, locate mortalities, determine calf locations, and movements. In those cases in which the capture crew in the helicopter did not observe an immediate reunion of the calf with its dam, aerial relocation and visual checks were made at 1-3 h time intervals following release. All calf radio frequencies were monitored for mortality signals at least once daily and visual locations or locations to caribou group were made for each calf every other day from 3 June through 6 July 1984. Relocation surveys were conducted on a monthly basis from July through November 1984. Visual and group locations were plotted on 1:250,000 and 1:63,360 scale topographic maps.

All mortalities were investigated as soon as possible using a helicopter for access. Each carcass and mortality site was examined for information on the cause of death. Photographs were taken to document mortality sites. Evidence of predators/scavengers at the carcass site were noted and collected. Each carcass was placed in a plastic garbage bag, labeled, and transported to Barter Island. Necropsies were performed on carcasses when sufficient remains were present. In cases where only hair and bones remained, measurements of weight, right hind foot length, and new hoof length were recorded whenever possible. The location of retrieved carcasses was plotted on 1:63,360 scale topographic maps. Criteria for determining the category (Cook et al. 1971) and the cause of each mortality (Table 1) were developed from descriptions of predator kills and feeding characteristics in the literature (Murie 1948, Thompson 1949, Johnson 1951, Borg 1962, Atwell 1964, Mech 1970, Wiley and Bolen 1971, Alford and Bolen 1972, Cole 1972, White 1973, Miller and Broughton 1974, Bolen 1975, Henne 1975, Miller 1975, Mysterud 1975, Buskirk and Gipson 1978).

Carcasses of unmarked calves encountered during this and other field studies were also examined as opportunity allowed. The locations of predators observed on the calving grounds were noted and observations of interactions between caribou and predators were recorded. Concurrent field studies of brown bear, wolf, and golden eagle ecology on the coastal plain on ANWR also provided additional information relative to this study (Garner et al. 1985, Mauer 1985, Weiler et al. 1985).

Initial productivity and subsequent mortality of calves from 31 3+ year old cows and 29 2-year old radio-collared control cows were compared with data from the radio-collared study calves. The control females were radio-tracked in late May and early June 1984 as they arrived on the calving grounds and their locations were plotted on 1:250,000 scale topographic maps. Parturition

FIG.1 Porcupine Caribou Herd calving distribution and calf capture areas, 1984

Boundary enclosing light-scattered calving

Areas of major concentrations of calving activity

Niguanak calf capture area (3&5 June 1984)

Egaksrak-Kongakut calf capture area (5-8 June 1984)

SCALE

0 10 20 30 40 50 KM

0 10 20 30 40 50 MI

BEAUFORT SEA

Kaktovik (Barter Island)

ANNING RIVER

JAGO RIVER

NIGUANAK RIVER

AICHILIK RIVER

DEMARCATION BAY

Herschel Island

Stokes Point

SUNSET PASS

SADLEROCHIT RIVER

KIKITAK MTN

SCHRADER LAKE

JAGO FOOTHILLS

EGAKSRAK RIVER

KONGAKUT RIVER

BUCKLAND HILLS

FIRTH RIVER

BRITISH MTNS

CROW RIVER

OLD CROW FLATS

Arctic Village

Canada

United States

Northwest Territories

Yukon

1000

69°

146° 145° 144° 143° 142° 141° 140° 139° 138° 137°

533

Table 1. Criteria used for determining category of observed mortalities of neonatal caribou calves in northeast Alaska.

Criterion	Category
I. Carcass lacks sign of being bitten, chewed or disturbed by predators.	I. Predation-excluded
1. Milk curds absent in abomasum and intestinal tract. Lack of mesentary and subcutaneous fat. Rumen may be packed with vegetation.	1. Starvation
a. No reunion with dam observed following release and subsequently observed unattended by dam prior to death.	a. Probable study-induced abandonment
b. Reunion with dam observed following release, but later observed unattended by dam prior to death.	b. Probable natural abandonment
2. Milk curds present or absent from abomasum or intestinal tract. Mesentary and subcutaneous fat present. Absence of any signs of starvation.	2. Exposure/accident
a. Physical trauma present	
i. Broken bones, bruises, etc.	a. Accident
ii. Gun shot wounds	b. Hunter kill
b. No physical trauma present. Carcass in river or stream. Water in lungs, rumenoreticulum, or abomasum.	c. Drowning
c. No physical trauma or evidence of drowning.	d. Exposure
3. Disease syndrome present, or disease syndrome noted at capture.	3. Disease
4. None of the above.	4. Undetermined
II. Carcass bitten, chewed, and/or partially eaten.	II. Predation/scavenging involved.
A. Lack of blood in wounds, lack of frothy blood in nares and trachea, no bruises surrounding tooth marks, or no subcutaneous hemorrhages present.	1. Scavenging
1. Bones gnawed and chewed, feeding pattern generally not restricted to the upper portion of carcass.	a. Mammalian scavenger (return to I.1 to determine cause of death)
2. Bones not chewed, feeding limited to upper portions of carcass.	b. Avian scavenger (return to I.1 to determine cause of death)
3. Neither of the above, or some characteristics from both.	c. Undetermined
B. Blood in wounds, frothy blood in nares and trachea, bruises surrounding wounds and subcutaneous hemorrhages present.	B. Predation
1. Debilitating physical disorder, or disease syndrome present	1. Predator kill and other factors

Table 1. (Continued).

Criterion	Category
2. No debilitating physical disorder, or disease syndrome present.	2. Predator kill
a. Talon wounds on back and sides of body. Talon wounds on neck. Only upper portion of carcass fed upon. Ribs broken off at backbone. Leg bones usually intact.	a. Golden eagle kill
b. Teeth wounds on neck, sides or legs. Carcass fed upon extensively, bones chewed and carcass parts scattered.	b. Mammalian predator
i. Extensive trauma to carcass. Large portions of carcass missing. Bones broken or crushed. Skull crushed. In older calves, rumen not consumed. Carcass often covered with debris.	i. Brown bear
ii. Extensive trauma to carcass. Bones broken. Carcass not covered with debris. Skin at kill area often not punctured.	ii. Wolf
iii. Extensive trauma to carcass. Evidence not conclusive for any species or conflicting evidence.	iii. Undetermined mammal
c. None of the above.	d. Undetermined predator

status was determined by low-level aerial observations of the presence/absence of young, antler shedding (Lent 1965, Epsmark 1971), and udder distention (Bergerud 1964). Following parturition, productive members of the control group were monitored on a 24-72 hr basis until approximately 26 June.

Results and Discussion

Calving Distribution and Initial Productivity

Spring migration in 1984 followed traditional routes through the Richardson Mountains, across Old Crow Flats, and along the southern flank of the Brooks Range. Many caribou using the latter two routes converged along the international border and followed the Firth River valley through the British Mountains to the arctic coast. Deep snow delayed the onset of migration and most caribou were still on winter range on 1 May (Whitten et al. 1985). By mid-May, caribou were only just approaching the headwaters of the Firth River and the northern edge of Old Crow Flats. At that time it appeared most calving would occur east of the Firth River and in the British Mountains - northern Old Crow Flats region as occurred in 1982, when similar deep snow and late melt-off conditions prevailed on winter range (Whitten and Cameron 1983). However, in marked contrast to the nearly 100% snowcover on the coastal plain west of the Firth river throughout the calving period in 1982, snow conditions on the north slope of the eastern Brooks Range were relatively light during 1984. Once caribou crested the Brooks and British Mountains or reached the headwaters of the Firth River, they were able to proceed rapidly toward traditional calving areas in ANWR. Nevertheless, some cows lagged behind, and a few calves were born in the Brooks and British Mountains or along the northern fringe of Old Crow Flats.

At the onset of calving (i.e., 30 May to 2 June), many caribou were located in the Buckland Hills and on the coastal plain south of Stokes Point (Fig. 2). Numerous bands were also moving westward along the coastal plain and foothills from the Firth River Delta to Demarcation Bay. Highest densities were farther west, however, just north of the Brooks Range foothills from Demarcation Bay to the Aichilik River. Relatively high densities also occurred in the low, hilly country along both sides of the Niguanak River.

Caribou at the vanguard of the calving migration were predominantly pregnant cows, whereas barren cows and yearlings were distributed towards the rear; bulls remained south of the Brooks Range, British, and Barn Mountains (Fig. 2). Throughout the calving period, pregnant cows continued to move northward out of the mountains and westward across the coastal plain until they gave birth (Fig. 3). Ten cows which kept moving in this manner covered a mean distance of 15.5 km/day for 1-8 days immediately prior to calving. Three of these cows moved 20-25 km/day for 1-3 days. Once their calves had been born, parturient cows remained sedentary.

Thus the distribution of caribou changed markedly during the calving period. By the time most calves were actually born, distribution was skewed much farther westward than it had been at the onset of calving (Fig. 4). Ultimately, distribution was more similar to that in 1983 than in 1982. Major differences were that some cows remained in the Buckland Hills/Stokes Point

area throughout calving and that very few calved in the Jago River foothills area, which in 1983, and in 8 of the previous 11 years, supported high density calving (Whitten et al. 1984). High density calving did occur immediately east and north of the Jago River foothills, however. Essentially no calving occurred west of the Jago River.

Caribou which had wintered south and east of the Sadlerochit River, near Kikiktat Mountain and Schrader Lake, calved in the Niguanak area. Caribou wintering in the Sadlerochit Mountains from Sunset Pass west and those along the Canning River moved north or northwest, as expected, to Central Arctic Herd calving areas.

Peak of calving among radio-collared cows was between 2 and 6 June (Fig. 5). Very little tracking was done on 3-5 June as the entire study team was involved in calf capture. Many of the calves first detected on 6 June were probably born earlier. Thus it seems likely that the actual peak of calving was on or about 4 June, as it was in 1983 (Whitten et al. 1984). It also appeared during calf capture operations that some cows were still pregnant on 3 June, whereas nearly all had given birth by 5 June, further suggesting that the peak was on 4 June.

Peak of calving did not vary obviously across the calving grounds. A transect was flown over the calving grounds using fixed-wing aircraft on 2 June. Although this was before the peak of calving, some calves were present in all areas surveyed. Calf percentages were lower east of Demarcation Bay (Table 2), but this phenomenon can be explained by the relative abundance of nonpregnant and/or younger cows to the east. Nevertheless, observations of collared cows and of unmarked animals associated with them in 1982 (Whitten and Cameron 1983) indicate that delayed calving in the east or south does occasionally occur. Similar delays were also reported in 1980 (R. Farnell, YTG unpublished report).

Table 2. Calf percentages in various areas of the Porcupine Herd calving grounds, 2 June 1984.

Area	Number of caribou	% Calves
Komakuk Beach to Demarcation Bay	743	10.5
Demarcation Bay to Egaksrak River	255	24.3
Upper Niguanak River to Jago Delta	50	20.0

Surveys to determine initial productivity in the general caribou population were not conducted in 1984. Among collared females, 23 of 31 (74%) aged 3 years or older gave birth to calves. No collared 2-year-olds showed any signs of pregnancy; 28 of 29 with active collars were observed during the calving period, and all lacked hard antlers and/or were growing new, velvet antlers by 1 June. Thus, for the second year, no 2-year-olds were observed to give birth to calves in the Porcupine Herd. The same has been noted for Central Arctic

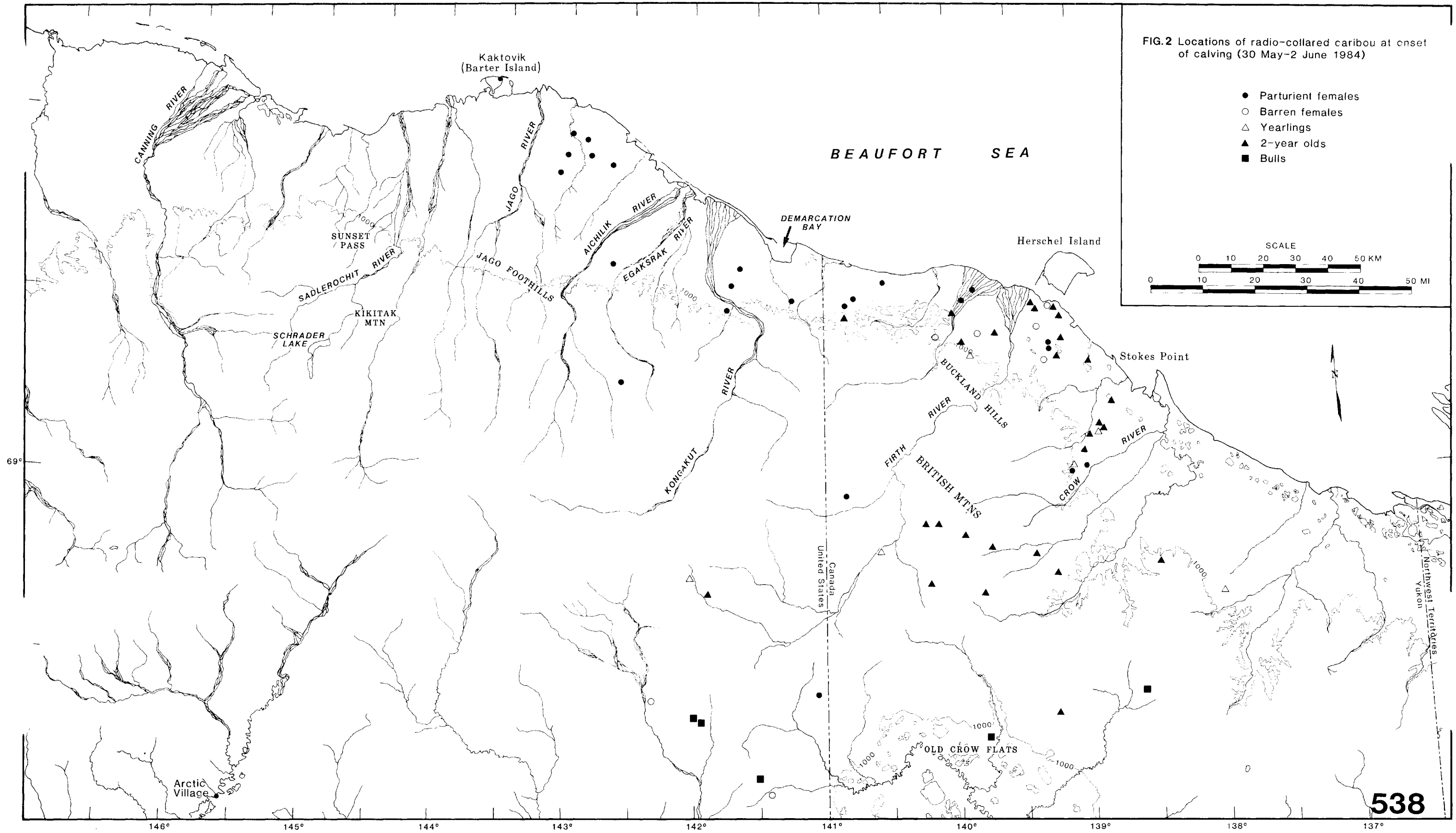

FIG. 2 Locations of radio-collared caribou at onset of calving (30 May–2 June 1984)

- ● Parturient females
- ○ Barren females
- △ Yearlings
- ▲ 2-year olds
- ■ Bulls

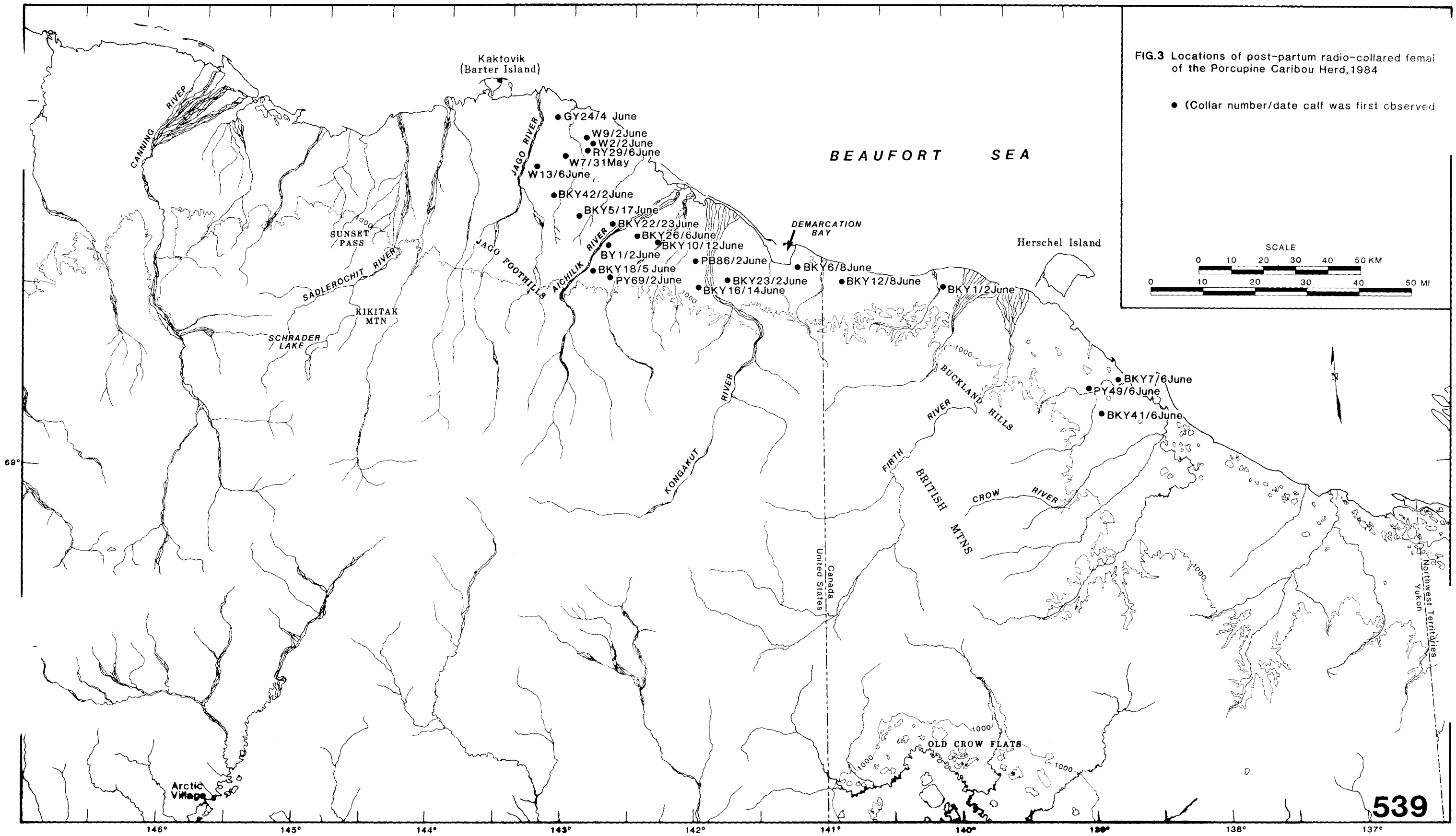

FIG.3 Locations of post-partum radio-collared femal of the Porcupine Caribou Herd, 1984

● (Collar number/date calf was first observed

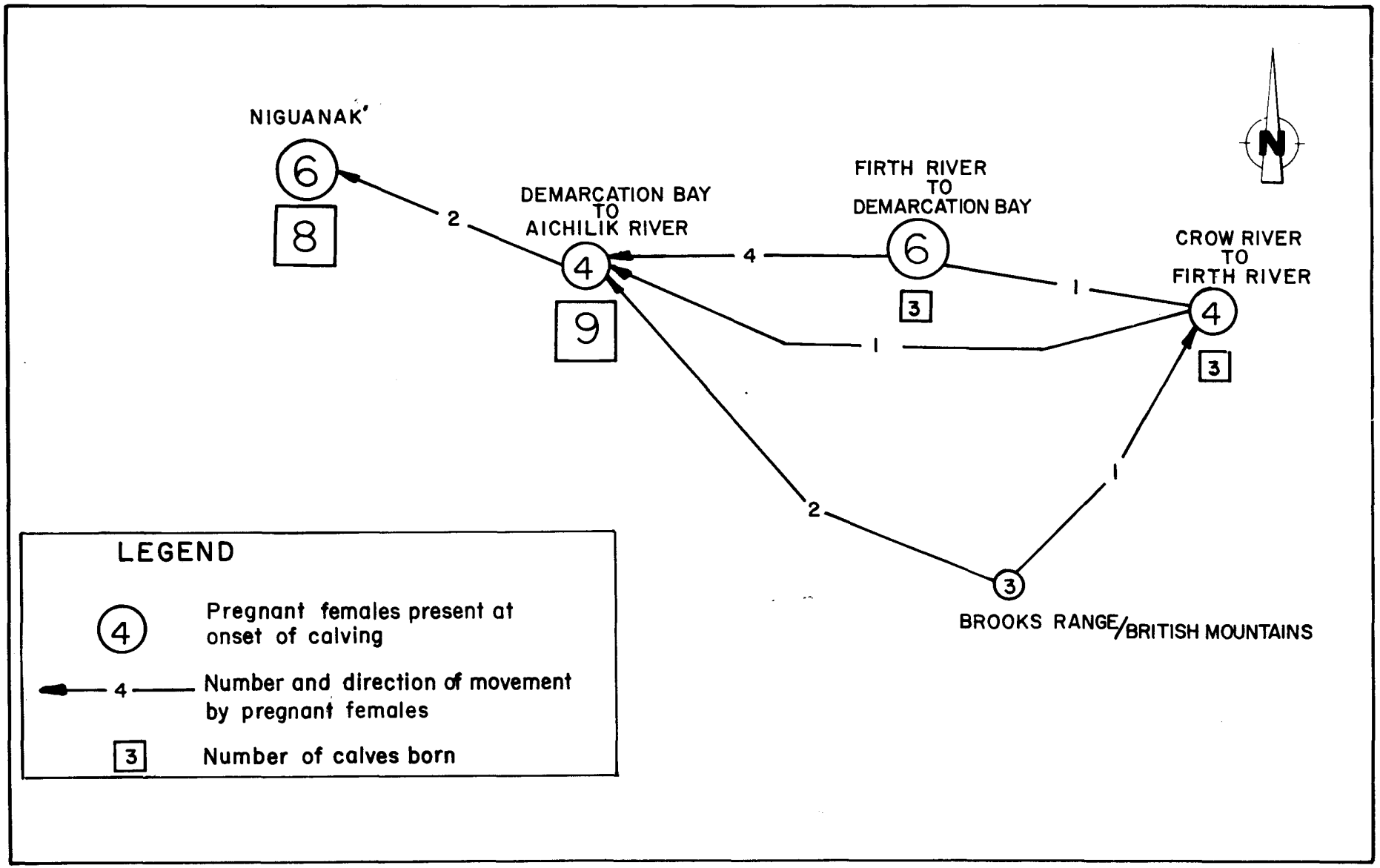

Fig. 4. SCHEMATIC REPRESENTATION OF MOVEMENTS BY PREGNANT RADIO-COLLARED FEMALE CARIBOU DURING THE 1984 CALVING PERIOD.

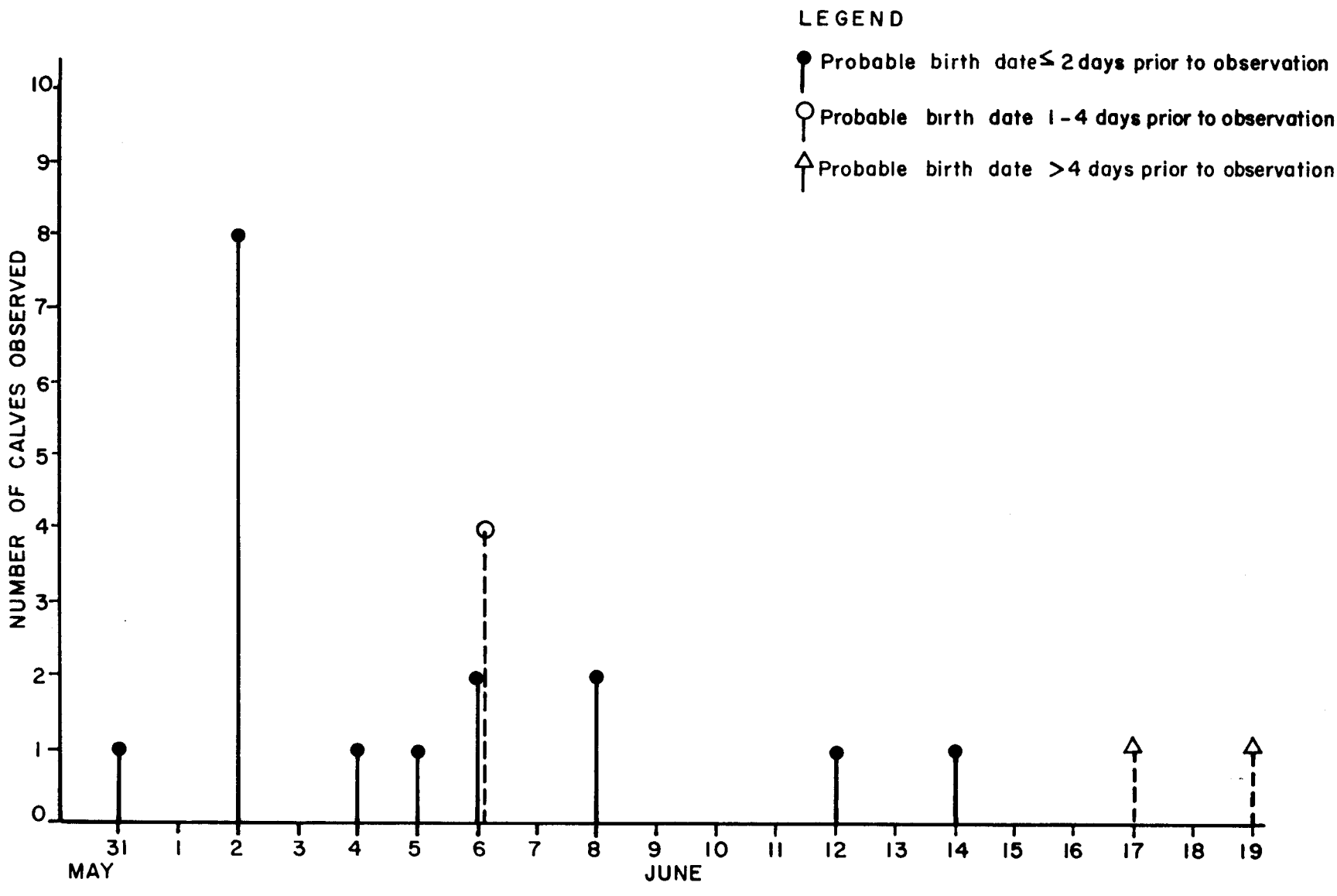

Fig. 5. Dates when newborn calves of 23 radio-collared cows were first observed, Porcupine caribou herd, 1984.

Herd caribou. If this pattern is normal, then population growth potential for the arctic caribou herds in Alaska is lower than for some caribou herds in interior Alaska, where 50% or more of the 2-year-olds may be pregnant (Davis and Valkenburg 1984), but is quite similar to Canadian barren ground caribou (Dauphine 1976).

Initial productivity among collared cows is difficult to compare to overall herd productivity. Collared cows are seldom a representative sample, and the 1984 collared cow cohort is clearly biased toward nonpregnant 2-year-olds. Nevertheless, initial productivity among collared cows aged 3 years or older was quite similar in 1982, 1983, and 1984 (67%, 78%, 74%, respectively) (Whitten et al. 1984, Whitten and Cameron 1983), and overall productivity was presumably similar in all 3 years.

Calf Capture

On 3 June, 30 calves were captured and fitted with radio-collars in the high density calving area along the Niguanak River. Thirty calves were captured in another high density calving area located between the Aichilik and Turner Rivers on 5-6 June (Fig. 1). Eleven additional calves were captured in the high density Niguanak River area on 5 June. One additional calf was collared in this same area on 6 June. Four additional calves were collared on 7 June near the Kongakut River, and one more calf was collared in this same area on 8 June (Table 3). The 17 additional calves were collared due to study induced abandonment in the original 60 calves (see Results and Discussion section of this report).

Cumulative time required for capture operations to search, capture, process and release 77 calves was 7 h 41 min. Average search/capture/processing time was 6.7 min, with processing time averaging 2.9 min and search/capture averaging 3.7 min. Ground observers were not used to determine reunions. Fixed-wing aircraft monitoring techniques were successful in documenting reunions and/or cases of study-induced abandonment.

The average weight for all calves captured (Table 3) was 6.85 kg. Males were slightly heavier on the average, 7.09 kg vs. 6.74 kg for the females. The estimated age of captured calves was 1.92 days old, and was nearly 1 day less than that of calves captured in 1983 (2.8 days old). There were 44 males and 33 females in the captured sample (1.3 males:1 female).

Calf Mortality

During the period 3 June to 12 November, 1984, 33 study calf mortalities were detected and investigated. Mortality signals were recorded for two additional study calves, however, logistical problems have prevented investigation of their status prior to this progress report. Case histories for each mortality are included in the Appendix. Probable study-induced abandonment (17 cases) accounted for 51.5% of all detected mortality (Table 4).

Study-induced mortality (abandonment by the dams or predisposition to predators) is inherent with radio-transmitter techniques. Transfer of foreign scent, either from the capture crew members of from previously captured calves may influence study-induced abandonment. Care was taken to minimize transfer of human scent by wearing disposable, sterile latex gloves, and by holding

Table 3. Physical characteristics and survival related observations of radio-collared caribou calves, Arctic National Wildlife Refuge, 1984.

Calf no.	Capture date	Location	Sex	Weight (kg)	Length (cm)	Hind foot length(cm)	New hoof length(mm)	Umbilicus condition	Hoof condition[a]	Estimated age[b]	Handling time(min)	Status
1	3 June 84	Niguanak R.	F	8.2	85	34.0	9.1	Absent	H/W	3	6.0	Dead (21 Sept)
2	3 June 84	Niguanak R.	M	7.9	81	37.0	9.2	Absent	H	3	5.0	Dead (5 June)
3	3 June 84	Niguanak R.	M	8.0	86	32.0	7.2	Moist	H/W	1	4.0	Dead (4 June)
4	3 June 84	Niguanak R.	F	6.2	76	34.5	8.6	Moist	PH	2	3.0	Alive
5	3 June 84	Niguanak R.	M	6.7	80	32.5	8.4	Moist	PH/SHW	2	3.0	Alive
6	3 June 84	Niguanak R.	M	6.8	79	33.0	8.6	Bloody	PH/S	1	2.0	Alive
7	3 June 84	Niguanak R.	F	6.9	78	32.0	8.9	Moist	PH/W	3	3.0	Alive
8	3 June 84	Niguanak R.	M	7.1	77	32.5	8.6	Dry	H/W	3	3.0	Dead (5 June)
9	3 June 84	Niguanak R.	M	5.5	75	33.0	7.9	Dry	PH/W	2	3.0	Dead (28 August)
10	3 June 84	Niguanak R.	M	7.3	79	34.5	9.4	Moist	PH/W	3	3.0	Dead (5 June)
11	3 June 84	Niguanak R.	M	6.9	75	32.0	8.5	Bloody	PH/W	1	3.0	Alive
12	3 June 84	Niguanak R.	M	6.9	80	33.0	9.2	Moist	H/W	3	5.0	Alive
13	3 June 84	Niguanak R.	F	7.2	81	34.5	8.6	Moist	H/W	3	3.0	Dead (5 June)
14	3 June 84	Niguanak R.	M	7.5	86	33.0	7.8	Dry	PH/W	1	3.0	Alive
15	3 June 84	Niguanak R.	M	6.2	78	33.0	7.0	Moist	PH/W	1	3.0	Dead (5 June)
16	3 June 84	Niguanak R.	F	6.9	87	34.7	8.1	Dry	H/W	2	3.0	Dead (5 June)
17	3 June 84	Niguanak R.	M	7.8	89	34.5	9.8	Dry	PH/W	4	10.0	Alive
18	3 June 84	Niguanak R.	M	7.1	84	36.5	9.2	Moist	PH/W	3	6.0	Alive
19	3 June 84	Niguanak R.	F	6.6	82	31.5	7.8	Dry	H/W	1	3.0	Alive
20	3 June 84	Niguanak R.	F	6.0	78	33.0	7.8	Dry	H/W	1	3.0	Alive
21	3 June 84	Niguanak R.	F	7.8	84	35.5	8.9	Dry	H/W	3	3.0	Dead (5 June)
22	3 June 84	Niguanak R.	F	7.6	85	34.5	10.2	Dry	H/W	5	3.0	Alive
23	3 June 84	Niguanak R.	F	6.1	83	31.8	7.5	Moist	PH/W	1	3.0	Alive
24	3 June 84	Niguanak R.	F	6.1	82	32.0	7.1	Moist	H/W	1	4.0	Dead (4 June)
25	3 June 84	Niguanak R.	M	7.2	89	35.0	10.4	Moist	PH/W	3	3.0	Alive
26	3 June 84	Niguanak R.	F	7.5	91	34.0	8.1	Dry	PH/W	2	2.0	Dead (6 June)
27	3 June 84	Niguanak R.	F	5.4	72	31.0	6.9	Dry	PH/W	1	3.0	Dead (4 June)
28	3 June 84	Niguanak R.	M	8.0	84	33.5	7.7	Dry	H/W	1	3.0	Dead (5 June)
29	3 June 84	Niguanak R.	M	7.5	81	35.0	9.3	Dry	PH/W	3	2.0	Dead (28 August)
30	3 June 84	Niguanak R.	M	6.3	77	31.0	7.1	Dry	H/W	1	3.0	Alive
31	5 June 84	Egak/Kong R.	M	7.3	79	34.5	8.3	Dry	H/W	2	3.0	Alive
32	5 June 84	Egak/Kong R.	F	6.5	83	33.0	8.4	Dry	H/W	2	2.0	Dead (7 June)
33	5 June 84	Egak/Kong R.	M	7.6	86	33.5	9.2	Absent	H/W	3	3.0	Dead (21 Sept)
34	5 June 84	Egak/Kong R.	M	8.3	85	36.0	8.4	Dry	H/W	2	3.0	Alive

Table 3. (Continued).

Calf no.	Capture date	Location	Sex	Weight (kg)	Length (cm)	Hind foot length(cm)	New hoof length(mm)	Umbilicus condition	Hoof condition[a]	Estimated age[b]	Handling time(min)	Status
35	5 June 84	Egak/Kong R.	F	6.8	86	34.5	8.5	Dry	H/W	2	3.0	Alive
36	5 June 84	Egak/Kong R.	F	6.9	78	33.5	7.2	Moist	H/W	1	2.0	Alive
37	5 June 84	Egak/Kong R.	M	7.6	82	33.5	8.2	Dry	H/W	2	3.0	Dead (28 August)
38	5 June 84	Egak/Kong R.	F	-	73	33.5	7.6	Moist	H/W	1	3.0	Alive
39	5 June 84	Egak/Kong R.	M	6.3	81	33.5	8.7	Moist	PH/W	2	2.0	Dead (6 June)
40	5 June 84	Egak/Kong R.	F	6.8	87	34.5	8.7	Absent	H/W	3	3.0	Alive
41	5 June 84	Egak/Kong R.	M	4.1	71	30.0	7.3	Absent	PH/W	1	3.0	Dead (9 June)
42	5 June 84	Egak/Kong R.	F	6.4	82	35.5	8.4	Moist	PH/W	2	3.0	Alive
43	5 June 84	Egak/Kong R.	M	7.1	80	33.5	8.4	Dry	H/W	2	2.0	Dead (10 June)
44	5 June 84	Egak/Kong R.	F	8.2	84	34.5	9.0	Moist	H/W	3	2.0	Alive
45	5 June 84	Egak/Kong R.	M	4.9	70	32.5	7.0	Bloody	PH/W	1	3.0	Alive
46	5 June 84	Kongakut R.	F	6.7	75	33.0	8.3	Dry	H/W	2	2.0	Dead (22 August)
47	5 June 84	Kongakut R.	M	6.6	83	35.5	7.3	Absent	PH/W	1	2.0	Dead (6 June)
48	5 June 84	Kongakut R.	F	6.8	81	36.5	8.1	Bloody	PH/W	1	2.0	Alive
49	5 June 84	Kongakut R.	F	7.4	79	33.5	8.7	Dry	H/W	3	2.0	Alive
50	5 June 84	Kongakut R.	M	6.4	84	35.5	7.8	Bloody	H/W	1	3.0	Alive
51	5 June 84	E Kong. R.	F	5.6	77	32.5	8.2	Moist	PH/W	2	3.0	Dead (24 June)
52	5 June 84	E Kong. R.	M	8.0	89	35.0	8.7	Moist	H/W	3	3.0	Alive
53	5 June 84	E Kong. R.	M	5.1	73	32.5	7.8		S/SW	1	2.0	Dead (6 June)
54	6 June 84	E Kong. R.	M	6.4	84	35.5	9.2	Moist	H/W	3	2.0	Dead (21 Sept)
55	6 June 84	E Kong. R.	F	4.6	77	32.5	8.5	Dry	PH/W	2	2.0	Dead (22 August)
56	6 June 84	E Kong. R.	M	6.3	86	33.0	7.6	Dry		1	3.0	Dead (7 June)
57	6 June 84	E Kong. R.	F	7.5	85	34.5	7.9	Dry	H/W	1	2.0	Alive
58	6 June 84	E Kong. R.	M	7.1	88	35.0	7.6	Absent	H/W	1	3.0	Alive
59	6 June 84	E Kong. R.	M	7.2	84	37.5	7.3	Absent	H/W	1	2.0	Alive
60	6 June 84	E Kong. R.	M	7.7	87	35.0	9.2	Bloody	H/W	1	3.0	Alive
61	5 June 84	Niguanak R.	F	5.6	71	32.0	7.9	Moist	H/W	1	2.0	Dead (20 July)
62	5 June 84	Niguanak R.	M	6.6	86	34.0	8.0	Moist	H/W	2	2.0	Alive
63	5 June 84	Niguanak R.	M	12.0	92	37.0	10.4	Bloody	H/W	1	3.0	Alive
64	5 June 84	Niguanak R.	F	7.3	76	32.5	7.6	Dry	H/W	1	2.0	Alive
65	5 June 84	Niguanak R.	F	8.6	86	35.0	9.1	Dry	H/W	3	2.0	Alive
66	5 June 84	Niguanak R.	M	8.7	88	35.5	8.2			2	2.0	Dead (12 November)
67	5 June 84	Niguanak R.	M	7.2	78	33.0	9.2	Moist	H/W	3	2.0	Alive

Table 3. (Continued).

Calf no.	Capture date	Location	Sex	Weight (kg)	Length (cm)	Hind foot length(cm)	New hoof length(mm)	Umbilicus condition	Hoof condition[a]	Estimated age[b]	Handling time(min)	Status
68	5 June 84	Niguanak R.				No Data Sheet						
69	5 June 84	Niguanak R.	F	6.5	82	33.5	7.8			1	3.0	Alive
70	5 June 84	Niguanak R.	F	6.4	76	33.0	9.0	Dry	H/W	3	3.0	Alive
71	5 June 84	Niguanak R.	M	5.3	75	31.5	8.4	Moist	PH/W	2	3.0	Alive
72	6 June 84	Niguanak R.	M	6.1	81	34.0	6.8	Moist	PH/W	3	3.0	Alive
73	7 June 84	E Kong. R.	F	6.6		33.5	7.6	Moist	PH/W	1	3.0	Dead (13 June)
74	7 June 84	E Kong. R.	M	7.5		35.0	7.7	Dry	H/W	1	3.0	Dead (26 August)
75	7 June 84	E Kong. R.	F	6.0	83	34.5	8.1	Moist	PH/W	2	2.0	Alive
76	7 June 84	E Kong. R.	M	7.3	80	36.5	8.6	Bloody	PH/W	1	3.0	Dead (21 August)
77	8 June 84	Kongakut R.	M	7.6	83	33.5	8.2	Dry	H/W	2	3.0	Alive
		Male Averages		7.09	81.9	34.0	8.40			1.88		
		Female averages		6.74	78.3	33.0	8.25			1.97		
		Overall averages		6.85	81.4	33.8	8.33			1.92	2.93	

[a]AH=all hardened; PH=partially hardened; S=soft; W=hooves worn; SW=slightly worn.
[b]Age rounded to nearest whole day.

calves at arm's length or pressed to the ground. In 1982 and 1983, collars were retrieved from calves that died soon after capture and these collars were used again on newly captured calves. Some collars were reused more than once.

Table 4. Probable causes of mortality for 33 of 77 radio-collared caribou calves between 3 June and 12 November, 1984.

Category	Number of calves	% Total mortality
I. Predation-excluded deaths		
1. Starvation		
a. probable study-induced abandonment	14	42.4
b. probable natural abandonment		
2. Exposure/accident		
a. accident		
b. hunter kill	1	3.0
c. drowning	1	3.0
d. exposure		
3. Disease	1	3.0
4. Undetermined		
II. Predation and/or scavenging involved		
1. Scavenging		
a. mammalian scavenger		
b. avian scavenger/study-induced abandonment	3	9.1
c. undetermined scavenger	1	3.0
2. Predation		
a. Predator kill and other factors		
b. Predator kill		
1. Golden eagle kill	1	3.0
2. mammalian predator		
a. brown bear	1	3.0
b. wolf	2	6.0
c. undetermined mammal	8	27.2
3. Undetermined if predator		
Totals	33	100%

Reused collars were rinsed in cold water, but may have still had scent from a previous calf. Apparent abandonment was 7 out of 60 in the original collaring effort in 1983, but 4 out of 9 among recollars (Whitten et al. 1984). In 1984, 12 of 30 calves were abandoned after the first day of capture, possibly due to use of a large sling (a commercial canvas "log carrier") for weighing calves. It was difficult to keep a struggling calf in the sling and holes were eventually cut for the forelegs. The large surface area may have collected and transferred scent from one calf to another. In 1982, burlap sacks were used to wrap each calf and a scale was hooked through the ends of the sack for weighing. The process was awkward, but sacks were used once and discarded and abandonment was low. In 1983, attempts were made to use large sterile gauze pads to wrap around the calves, but these were too fragile (Whitten et al. 1984). A leather belt with the end run around the calf's chest and back through the buckle to form a tight noose was subsequently used

to weight calves in 1983. This method was fast and efficient and probably transferred minimal scent. After the sling proved unsatisfactory on the first day in 1984, the belt system was used thereafter.

In 1984, collars were again reused, but were first rubbed with moss and soil and stored in a large plastic bag with moss and soil in an attempt to mask human and other calf scents. Dickinson et al. (1980) first reported using vegetation to mask human and other neonate scents in a neonatal mortality study of desert native mule deer (Odocoileus hemionus) in southwest Texas. When caribou calf capture was resumed two days later in 1984, the abandonment rate dropped to 5 of 42. Those five collars were also descented and reused. None of the calves receiving descented and reused collars were abandoned. After these experiences, it is recommended that similar descenting be routine for all collars to remove scents from handling preparation as well as from previous calves. This descenting may reduce the approximate 10% abandonment rate that appears to be inherent under the best conditions.

Excluding study-induced mortality, the natural mortality rate for the remaining sample group of 60 calves was 26.8% (n=16) between 3 June and 12 November 1984 (Table 5). In 13 of 16 cases (81.25%) predation was either confirmed or identified as the most probable cause of mortality. Most of the predation-related mortality (9 cases, 76.9%) occurred during August to October when monitoring was conducted on a monthly rather than daily basis, due to logistical considerations (Fig 6). Because of frequently long time lapse between when mortalities occurred and when they were subsequently detected and investigated, in only two cases was there sufficient evidence remaining at the carcass sites to determine the predator species involved. During intensive monitoring (3 June to 6 July) only four mortalities occurred, however, investigation was timely and causes of mortality were established.

Table 5. Proportion of observed natural mortalities occurring radio-collared caribou calves during 3 June to 12 November 1984.

Mortality category	Number of calves	Proportion(%) of sample calves	Proportion(%) of natural mortality
Undetermined - predation/ scavenging involved	9	15.0	56.25
Wolf predation	2	3.3	12.50
Brown bear predation/ scavenging	1	1.7	6.25
Golden eagle predation	1	1.7	6.25
Accidental	1	1.7	6.25
Disease (pneumonia)	1	1.7	6.25
Human harvest	1	1.7	6.25
Totals	16	26.8	100.00

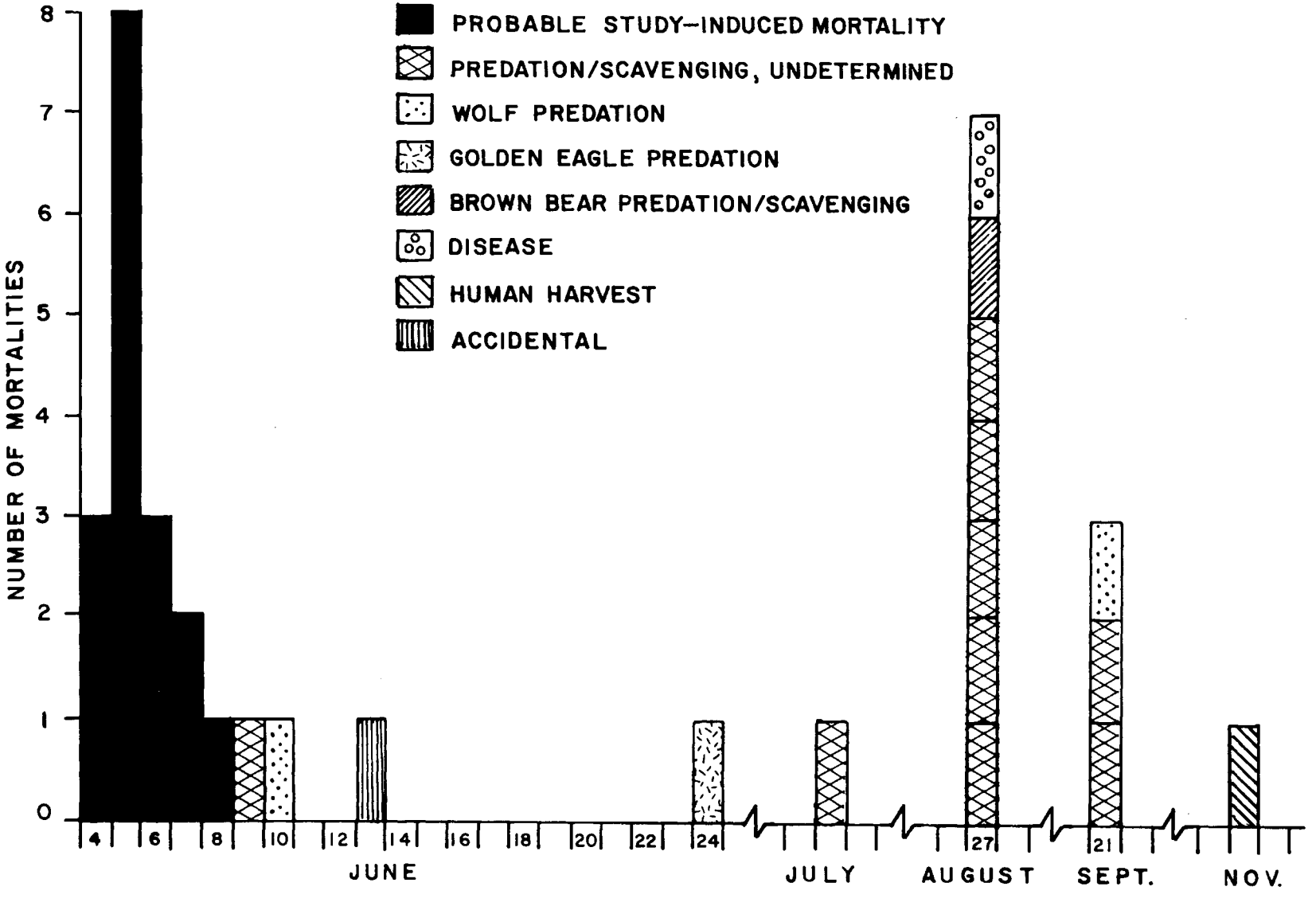

Fig. 6. Chronology of observed mortalities among 33 radio-collared calves, Porcupine caribou herd, 1984.

Predation of study calves by wolves was determined in two instances. The first case was detected on 10 June in the foothills near the Ekaluakat River, when a radio-collared wolf was in the vicinity; the second case was detected 21 September near Pine Creek, Yukon Territory. Wolves were observed on or near the calving grounds more frequently in 1984 than in preceding years. This could be partially related to increased observer effort associated with the initiation of wolf studies in the area at calving time (Weiler et al. 1985). Little information exists regarding wolf abundance on the remainder of the Porcupine Caribou Herd's range, but wolves are presumed to be at higher densities within and south of the Brooks Range. For the seven mortalities occurring during August and September for which predator species could not be determined, wolves were strongly suspected.

One case of predation by a golden eagle was detected among the study calves. This differs somewhat from 1983 results when three golden eagles kills were recorded. The relatively small samples involved, however, preclude complete evaluation of the hypothesis that visual factors such as the color of radio collars may influence rates of predation by golden eagles (See Methods). Golden eagles were frequently observed on the calving grounds and post-calving areas (Mauer 1985). During the calving period (30 May - 15 June), eagles were distributed in a scattered, diffuse manner over the calving grounds. Concentrations of golden eagles were observed in late June and were closely associated with post-calving aggregations of caribou.

Eagles often remained congregated for 3-4 days in areas recently vacated by post-calving caribou, presumably scavenging on carcasses (Mauer 1985). During July, golden eagles were frequently observed in association with caribou herds which had moved into the British Mountains of Canada. Predation of caribou calves by golden eagles were observed as late as 9 and 23 July (D. Russell per comm).

A brown bear was involved as a predator or scavenger in at least one study calf mortality case. The calf involved (No. 37) had been observed on 2 August east of Old John Lake, Alaska, unaccompanied by its dam. Its carcass was subsequently found in a bear's kill cache on 29 August, 4.8 km from the previous observation site. Due to its potentially orphaned status, this calf may have been predisposed to predation.

One study calf (No. 73) was found on 13 June lying in shallow water near the west side of the Kongakut River. Although no water was found in the calf's lungs to indicate drowning, death was apparently due to an accident while crossing the river.

One study calf found on 28 August apparently died as a result of severe fibral pneumonia infection of the lungs and pericardium. On 12 November a study calf was shot by a hunter approximately 51 km north of Aklavik, NWT (Kent Jingfors pers. comm.). A study calf captured in 1983 was also killed by a hunter from Aklavik during November. These cases are the only instances of study calf mortality due to hunting detected thus far, although several collared adults have been shot in the past.

Eleven of the 16 natural mortalities were males and only 5 were females, (2.2 males/female). The sex ratio of all captured calves was 1.3 males/female. Although this higher mortality rate for males was not statistically different

from the mortality rate of females, it is consistent with reports for other caribou populations (Kelsall 1968).

Four of 16 (25%) natural mortalities occurred during the calving and immediate post-calving period on the coastal plain in Alaska. The estimated ages of study calves that died on the calving/post-calving areas was 7 days(3 calves) and 21 days (1 calf)(Fig. 7). During the July post-calving movements only one mortality occurred. Mortalities increased sharply in August (n=7) and September (n=3), when the Porcupine herd was widely dispersed south of the continental divide in Alaska and Canada (Fig. 5). This pattern is similar to 1983 when initial mortality was also relatively high after birth, decreased in July and increased again during late summer and fall as caribou moved into areas with presumably higher predator densities (Whitten et al. 1984 and 1985). Evidence remaining at the carcass sites of August - September mortalities indicated that all but one case were probably predation-related. During August and September caribou were observed most often in shrub habitats and were perhaps more vulnerable to ambush by predators. Group sizes were smaller during this time and the herd was dispersed over a wide area, tending to make individual calves more vulnerable to attack by predators.

Nineteen carcasses of unmarked calves were collected from areas utilized by calving and post-calving caribou during 3 June to 6 July. Several additional carcasses were observed from fixed-wing aircraft, but could not be retrieved due to a lack of ground access. Necropsy examinations revealed that four of these calves (21.0%) were killed by golden eagles; two (10.5%) were killed by wolves; two (10.5%) were killed by brown bears; four (21.0%) were scavenged by birds/cause of death unknown; two (10.5%) died of starvation/pneumonia complications; one (5.25%) was stillborn, and one (5.25%) was subject to predation and/or scavenging by unknown species (Fig 8). Collection dates for the golden eagle kills ranged from 10 June to 6 July. The latter case involved a calf weighing 18 kg. The wolf kills were found associated with radio-collared wolves and documented by puncture wounds on the skull case matching wolf canine tooth dimensions. Interestingly there were no corresponding puncture wounds through the skin covering the skull, indicating a controlled squeeze of the calf's head rather than a bite or tear.

Two radio-collared adult females died on the calving/post-calving areas, however, it was not possible to determine causes of mortality. Four unmarked adult cow carcasses were also investigated. One appeared to have died or was predisposed to predation as a result of complications during birth. Another cow possibly died from parturition complications, however it was not possible to identify the exact cause of mortality. A brown bear apparently killed one cow and the fourth cow died of unknown causes.

Excluding study-related mortalities, calf survival on the calving and post-calving areas was generally good among radio-collared calves (93%) for 3 June to 6 July 1984. Calves born to radio-collared females (control calves) also survived well (95.6% during about the same period)(Appendix A-2). Slightly lower calf survival rates were reported in 1983 for study calves (82.5%) and control cows (72.2%)(Whitten et al. 1984).

The geographic distribution of caribou mortality sites (adults and calves) investigated on the calving and post-calving areas in Alaska was skewed towards the eastern coastal plain and foothills region (Aichilik River -

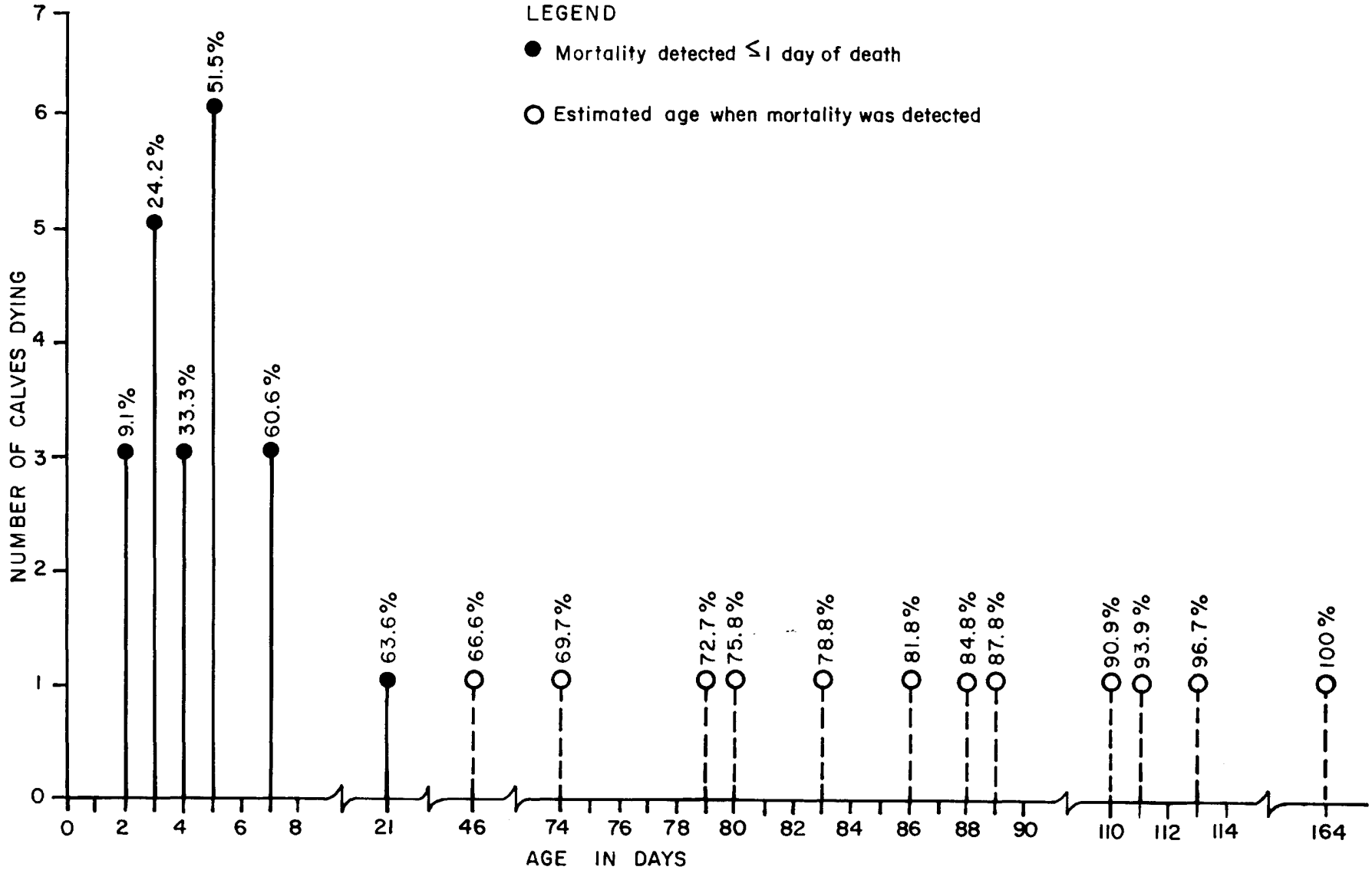

Fig. 7. Number of radio-collared caribou calves dying and cumulative proportions of mortality occurring within estimated age classes, Porcupine caribou herd, 1984.

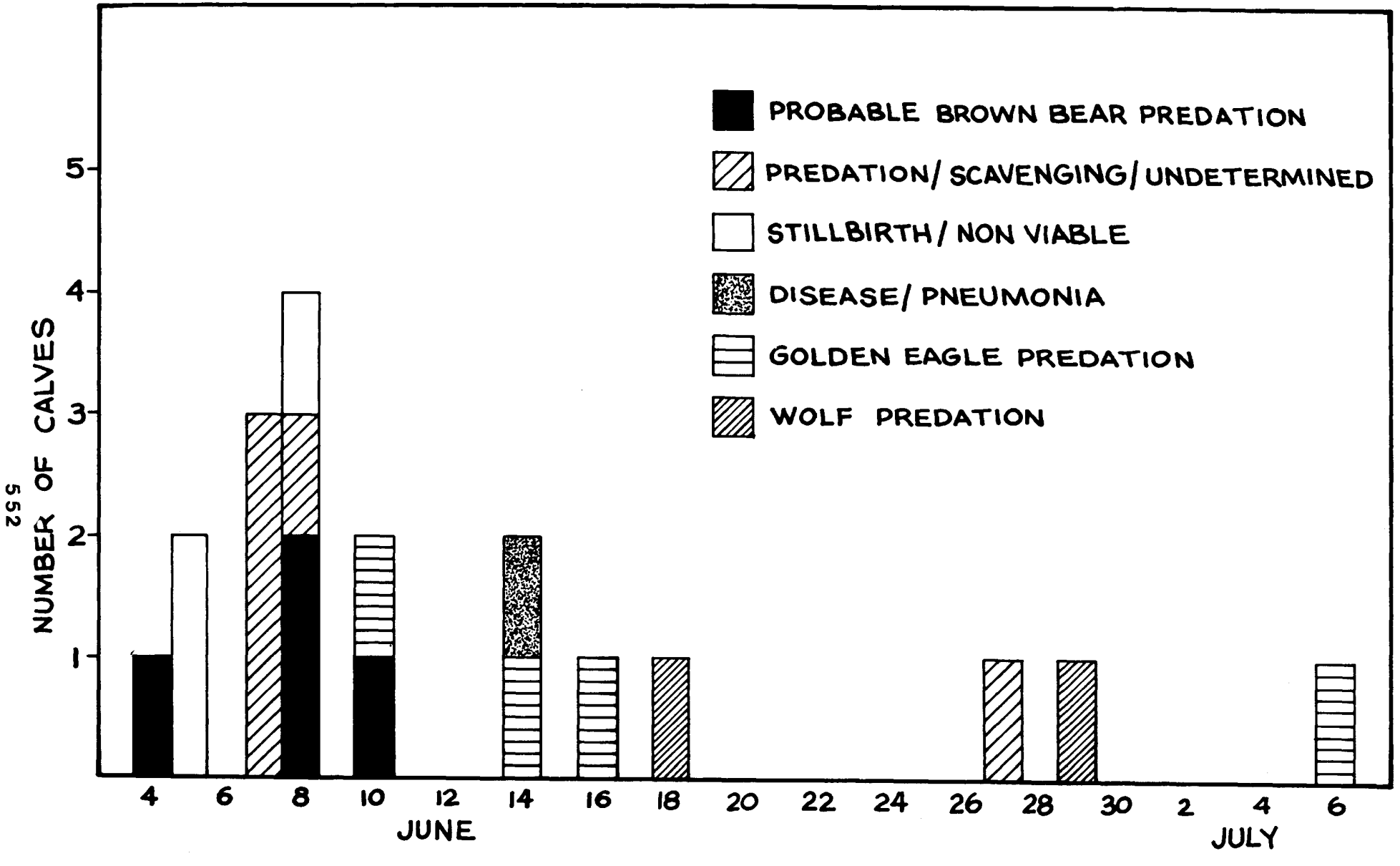

Fig. 8. Chronology of mortality detection by category for 19 unmarked calf carcasses, Porcupine caribou herd, 1984.

Canada border)(Fig 9). There was no natural mortality detected among study calves in the Niguanak River calving concentration area and only 2 of 17 mortality sites for unmarked calves were found there. All natural mortality of study calves detected during 3 June-6 July occurred in the Egaksrak-Kongakut calving area and involved only those calves that were originally captured there (Fig. 9). Thirteen of 17 unmarked calf carcasses for which the location of mortality was documented, were also found in the eastern area (Fig 9). Four unmarked adult females and one radio-collared adult female also died east of the Aichilik river. An additional radio-collared adult female died in the foothills approximately 13 km east of the international border. A majority (60%) of study calf mortality sites detected in 1983 also occurred in foothills terrain located to the south and east of coastal plain calving concentration areas (Whitten et al. 1984). These data suggest that mortality rates may be greater in eastern/southern "peripheral" calving areas adjacent to foothills and mountainous terrain than in the northern/western "core" calving areas of the coastal plain. Data regarding densities of reported observations of golden eagles (Mauer 1985), distribution and relative abundance of marked and unmarked brown bears (Garner et al. 1983, 1984, 1985) and the location of wolf dens and pack activity area (Weiler et al. 1985) tend to support this supposition. One note of caution in this hypothesis. Observer effort was higher in the eastern portion of the study area than the west, however, the disproportionate distribution of detected caribou mortalities in the eastern coastal plain would suggest that the hypothesis has some merit.

Movements

Calves captured and marked in the Niguanak River ("core") concentration area remained in the general area during the first two weeks post-capture. Their movement rates were low and non-directional (Fig 10). The movement rate for calves captured in the Egaksrak-Kongakut ("peripheral") calving area was also low during the same period, however, their movements were more directional on a west/northwest bearing (Fig 11). During this period, group size gradually increased in each area. By 18 June, the Niguanak study calves were in large groups and had established an east/southeastern direction of movement (Fig 10). The two groups merged on about 19-20 June on the coastal plains between the Niguanak and Aichikik Rivers (Fig 11). At this time, the west/northwest moving Egaksrak-Kongakut groups reversed it's direction in concert with the east/southeast movement of the Niguanak groups (Fig 10). During the first two weeks following calving the net movement rate/24h of the Egaksrak-Kongakut study calves increased from 2-3 km/day to 5 to 6 km/day (Fig 12). The direction of movement remained generally east-southeast and most caribou were now located in the foothills and northern flanks of the Brooks Range from the Kongakut River to the Aichilik River. During the period of 24-26 June the rate of movement continued to increase, reaching 18.5 km/day by 26 June.

A major separation occurred during this time in which about 2/3 of the radio-collared caribou moved along the coastal plain and foothills on an easterly course into Canada (Fig 10). The other portion moved along a southern course into the mountains between the Kongakut and Aichilik Rivers (Fig 10). Unfavorable weather conditions as well as logistical problems posed by the widely separated groups prohibited continuation of daily monitoring of these movements. Periodic surveys after 27 June found that the eastern distribution had reached the Firth River-Spring Creek area by 3 July and the

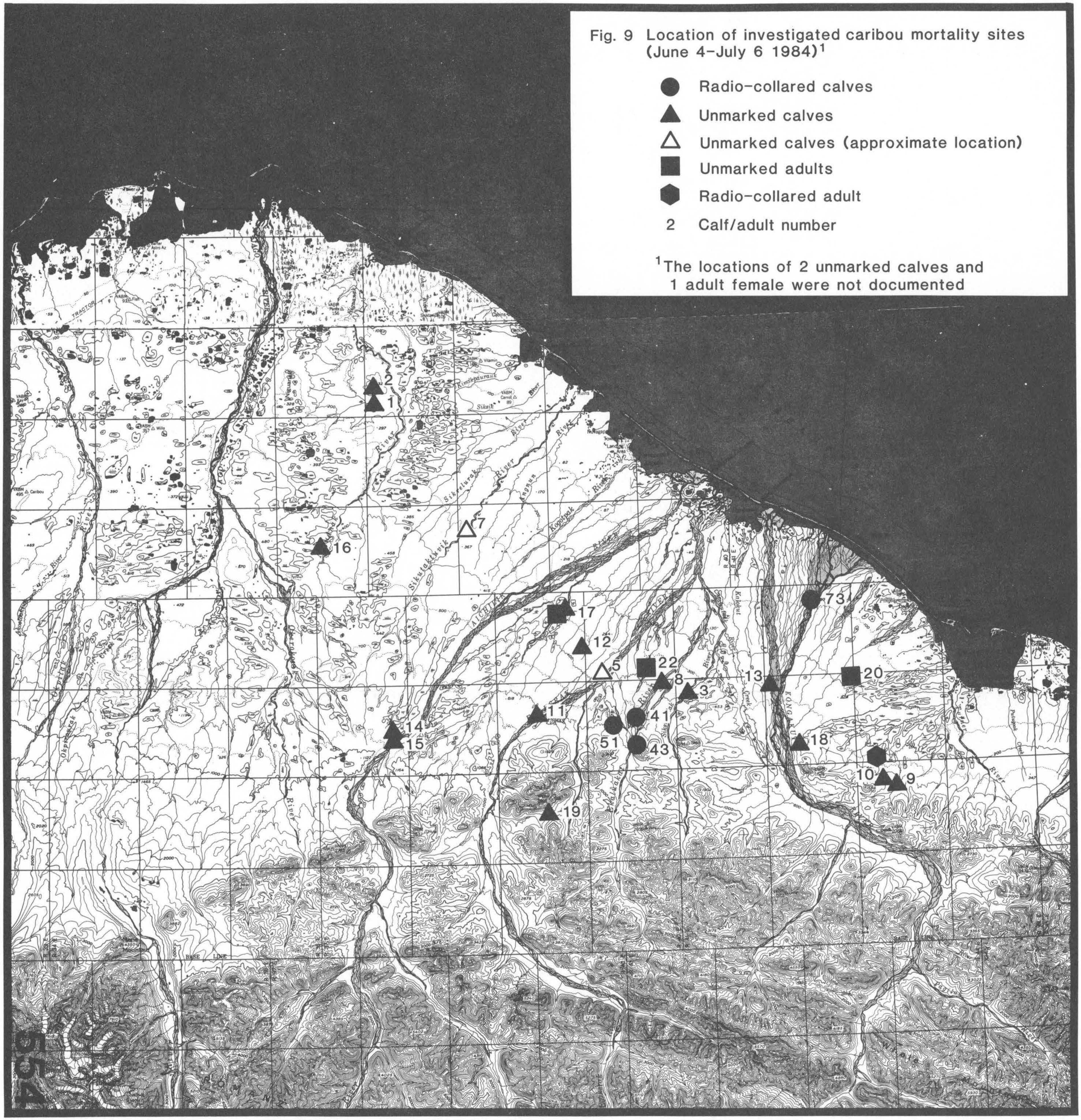

Fig. 9 Location of investigated caribou mortality sites (June 4-July 6 1984)[1]

[1] The locations of 2 unmarked calves and 1 adult female were not documented

Fig 10: Summary of movements and general distributions of calves radio-collared near the Niguanak River

(3-30 June, 1984)

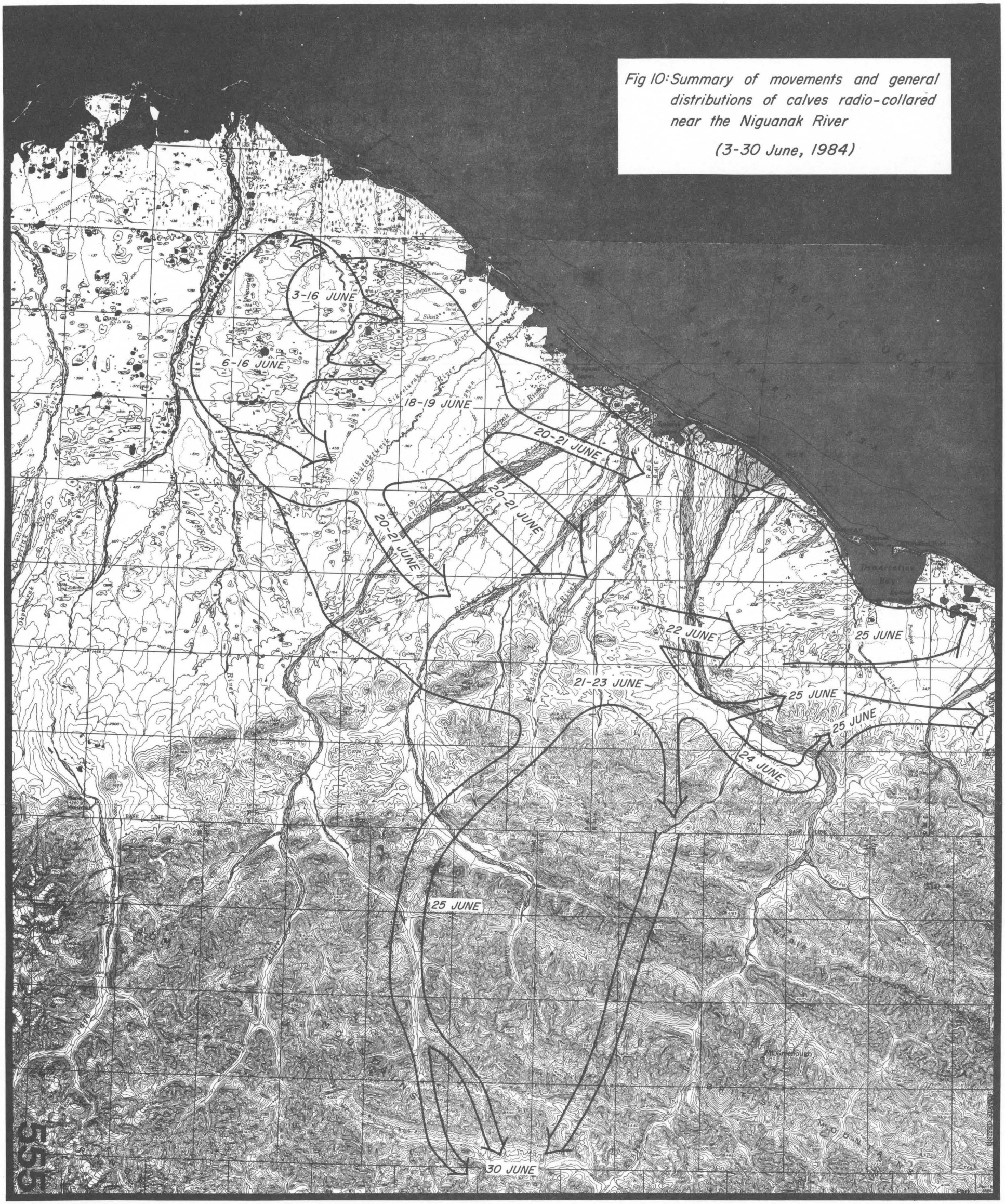

Fig 11: Summary of northwestward movement of calves radio-collared in the Egaksrak-Kongakut areas (5-16 June, 1984)

Rendezvous area with Niguanak group (see Fig 10 for 17-30 June 1984 movements)

16 JUNE

16 JUNE

16 JUNE

12 JUNE

10 JUNE

12-14 JUNE

12-14 JUNE

5-8 JUNE

5-14 JUNE

ARCTIC OCEAN

BEAUFORT SEA

Demarcation Point

Demarcation Bay

Mt. Greenough

BRITISH MOUNTAINS

ROMANZOF MOUNTAINS

BASE LINE

559

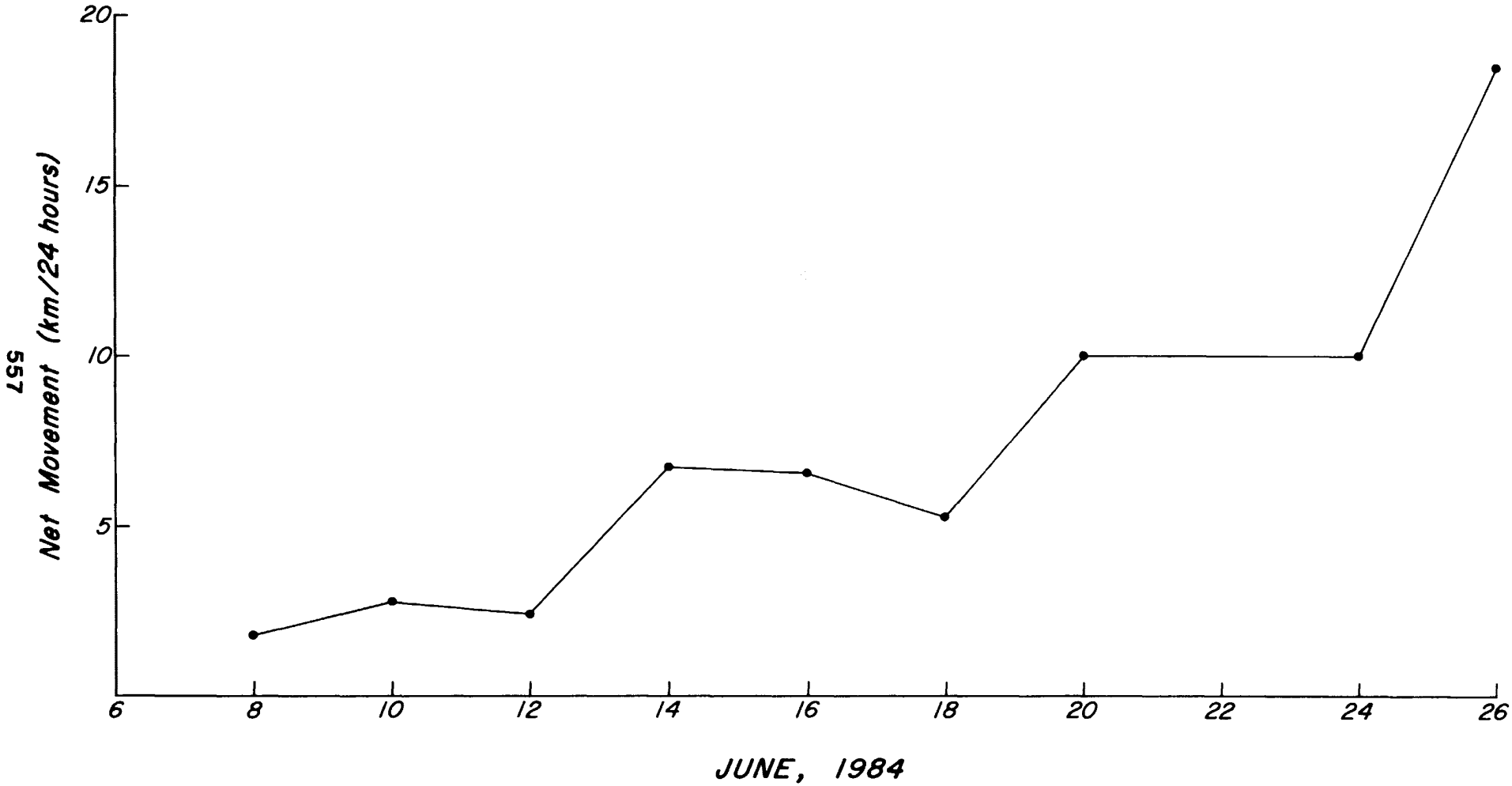

Fig. 12. Net movement rates for radio-collared caribou calves (8-26 June 1984).

southern distribution had crossed the continental divide between the Kongakut river drainage to the Sheenjek River and Coleen River drainages by 1 July. Movement by this group was especially rapid in the mountainous region and probably exceeded 25-30 km/day. During the same period (27 June-5 July), the eastern (coastal plains/foothills) group moved slower, spending 2-3 days in the Fish Creek basin before moving into mountainous terrain between the Malcolm and Firth Rivers.

Acknowledgements

Appreciation is extended fellow members of the Arctic National Wildlife Refuge staff and the Alaska Department of Fish and Game, Fairbanks Regional Office, who assisted this study in various ways. Pilots W. Audi, K. Butters, B. Carswell, K. Sibbetts, D. Miller, and G. Zemansky provided safe air support for the project and their efforts are greatly appreciated. D. Russell and W. Nixon, Canadian Wildlife Service, assisted by conducting radio-telemetry surveys in Canada. J. Wolf, Fish and Wildlife Protection (Alaska) assisted by testing evidence collected at mortality sites for the presence of blood.

Literature Cited

Alford, J.R., and E.G. Bolen. 1972. A note on golden eagle talon wounds. Wilson Bull. 84:487-489.

Atwell, G. 1964. Wolf predation on calf moose. J. Mammal. 45:313-314.

Ballard, W.B., T.H. Spraker, and K.P. Taylor. 1981. Causes of neonatal moose calf mortality in south central Alaska. J. Wildl. Manage. 45:335-342

Bergerud, A.T., 1961. Sex determinations of caribou calves. J. Wildl. Manage. 25:205.

Bergerud, A.T., 1964. A field method to determine annual parturition rates for Newfoundland caribou. J. Wildl. Manage. 28:477-480.

Bergerud, A.T., 1974. The role of the environment in the aggregation, movement and distribution behavior of caribou. Pages 552-584 in V. Geist and F. Walther, eds. The behavior of ungulates and its relations to management. IUNC News Series No. 24.

Bergerud, A.T., 1976. Impact on the living environment. Transcripts of the Mackenzie Valley Pipeline Inquiry. Vol. 106.

Bolen, E.G. 1975. Eagles and sheep: a view pont. J. Range Manage. 28:11-17.

Borg, K. 1962. Predation on roe deer in Sweden. J. Wildl. Manage. 26:133-136.

Buskirk, S.W., and P.S. Gipson. 1978. Characteristics of wolf attacks on moose in Mount McKinley National Park, Alaska. Arctic 31:499-502.

Calef, G.W., and P.C. Lent. 1976. Impact on living environment. Transcripts of the Mackenzie Valley Pipeline Inquiry. Vo. 106.

Cameron, R.D., and K.R. Whitten. 1976. First interim report of the effects of the Trans-Alaska Pipeline on caribou movements. Joint State/Federal Fish and Wildlife Advisory Team, Special Report No. 2. 39pp.

Cameron, R.D., and K.R. Whitten. 1980. Influence of the Trans-Alaska Pipeline corridor on the local distribution of caribou. Pages 475-484. in E. Reimers, E. Gaare and S. Skjenneberg, eds. Proc. 2nd Int. Reindeer/Caribou Symp. Roros, Norway. 799pp.

Cameron, R.D., K.R. Whitten, W.T. Smith, and D.D. Roby. 1979. Caribou distribution and group composition associated with construction of the Trans-Alaska Pipeline. Can. Field-Natur. 93:155-162.

Cole, G.F. 1972. Grizzly bear-elk relationships in Yellowstone National Park. J. Wildl. Manage. 36:556-561.

Cook, R.S., M. White, D.O. Trainer, and W.C. Glazener. 1971. Mortality of young white-tailed deer fawns in south Texas. J. Wildl. Manage. 35:47-56.

Dauphine, T.C., and R.L. McClure. 1974. Synchronous mating in Canadian barren-ground caribou. J. Wildl. Manage. 38:54-66.

Davis, J.L., and P. Valkenburg. 1979. Caribou distribution, population characteristics, mortality and responses to disturbance in Northwest Alaska. in Studies of selected wildlife and fish and their use of habitats on and adjacent to the National Petroleum Reserve in Alaska, 1977-1978. 105(c) Land Use Study, USDI, Anchorage.

Davis, J.L., and P. Valkenburg. 1984. Demography of the Delta caribou herd under varying rates of natural mortality and harvest by humans. Alaska Dept. Fish and Game. Fed Aid and Wildl. Rest. Prog. Rept. Proj. W-22-2. Juneau, Ak. 55pp.

de Vos, A. 1960. Behavior of barren-ground caribou on their calving grounds. J. Wildl. Manage. 24:250-258.

Dickinson, T.G., G.E. Wampler, G.W. Garner, and C.D. Simpson. 1980. Mortality of desert mule deer fawns in Pecos County, Texas. Proc. West Assoc. State Fish and Wildl. Agencies 60:581-592.

Epsmark, V. 1971. Antler shedding in relation to parturition in female reindeer. J. Wildl. Manage. 35:175-177.

Garner, G.W., K.R. Whitten, and F.J. Mauer. 1985. Methodology for studying neonatal mortality of caribou in remote areas. Proc. 2nd No. Am. Caribou Workshop, McGill University, Montreal. In press.

Garner, G.W., H.V. Reynolds, L.D. Martin, G.J. Weiler, J.M. Morton, and J.M. Noll. 1985. Ecology of brown bears inhabiting the coastal plain and adjacent foothills and mountains of the northeastern portion of the Arctic National Wildlife Refuge. Pages __-__ in G.W. Garner and P.E. Reynolds, eds. 1984 update report baseline study of the fish, wildlife and their habitats. U.S. Fish and Wildl. Serv., Anchorage, Ak. ___pp.

Haugen, A.O., and D.W. Speake. 1958. Determining age of young white-tailed deer. J. Wildl. Manage. 22:319-321.

Henne, D.R. 1975. Domestic sheep mortality on a western Montana ranch. Pages 133-146 in R.L. Phillips and C.J. Jonkel, eds. Proc. 1975 Predator Symp. 268pp.

Johnson, D.E. 1951. Biology of the elk calf, Cervus canadensis Nelsoni. J. Wildl. Manage. 15:396-410.

Kelsall, J.P. 1968. The migratory barren-ground caribou of Canada. Canadian Wildl. Serv. Monograph No. 3, Queen's Printer, Ottawa. 364pp.

Klein, D.R. 1980. Reaction of caribou and reindeer to obstructions - a reassessment. Pages 519-527 in E. Reimers, E. Gaare and S. Skjenneberg, eds. Proc. 2nd Int. Reindeer/Caribou Symp., Roros, Norway. 799pp.

Lent, P.C. 1964. Calving and related social behavior in the barren-ground caribou. Ph. D. Thesis, Univ. of Alberta, Edmonton. 220pp.

Lent. P.C. 1965. Observations on antler-shedding by female barren-ground caribou. Can. J. Zool. 3:553-558.

Mauer, F.J. 1985. Distribution and relative abundance of golden eagles in relation to the Porcupine caribou herd during calving and post-calving periods, 1984. Pages ___-___ in G.W. Garner and P.E. Reynolds, eds. 1984 update report baseline study of the fish, wildlife and their habitats. U.S. Fish and Wildl. Serv., Anchorage, Ak. ___pp.

Mech, L.D. 1970. The wolf: the ecology and behavior of an endangered species. The Natural History Press, Doubleday. New York. 384pp.

Miller, D.R. 1975. Observations of wolf predation on barren-ground caribou in winter. Pages 209-220 in J.R. Luick, P.C. Lent, D.R. Klein, and R.G. White, eds. Proc. First Int. Reindeer and Caribou Symp., Biol. Papers, Univ. Alaska, Spec. Rep. No. 1. 551pp.

Miller, F.L., and E. Broughton. 1974. Calf mortality on the calving ground of Kaminuriak caribou, during 1970. Canadian Wildl. Serv. Rept. Ser. No. 26. 25pp.

Murie, A. 1948. Cattle on grizzly bear range. J. Wildl. Manage. 12:57-72.

Mysterud, I. 1975. Sheep killing and feeding behavior of the brown bear (Ursus arctos) in Trysil, south Norway 1973. Norw. J. Zool. 23:243-260.

Thompson, W.K. 1949. Predation on antelope. J. Wildl. Manage. 13:313-314.

U.S. Fish and Wildlife Service. 1982. Arctic National Wildlife Refuge coastal plain resource assessment -- initial report baseline study of the fish, wildlife and their habitats. Anchorage, Ak. 507pp.

Weiler, G.J., G.W. Garner, L.D. Martin, and W. Reglin. 1985. Wolves of the Arctic National Wildlife Refuge:their seasonal movements and prey relationships. Pages __-__ in G.W. Garner and P.E. Reynolds, eds. 1984 update report baseline study of the fish, wildlife and their habitats. U.S. Fish and Wildl. Serv., Anchorage, Ak. ___pp.

White, M. 1973. Description of remains of deer fawns killed by coyotes. J. Mammal. 54:291-293.

Whitten, K.R., and R.D. Cameron. 1983. Calving distribution and initial productivity in the Porcupine caribou herd, 1982. Alaska Depart. Fish and Game Interim Report. 8pp.

Whitten, K.R., G.W. Garner, and F.J. Mauer. 1984. Calving distribution, initial productivity and neonatal mortality of the Porcupine caribou herd, 1983. Pages 359-420 in G.W. Garner and P.E. Reynolds, eds. 1983 update report baseline study of the fish, wildlife and their habitats. U.S. Fish and Wildl. Serv., Anchorage, Ak. 614pp.

Whitten, K.R., F.J. Mauer, and G.W. Garner. 1985. Fall and winter movements and distribution and annual mortality patterns of the Porcupine caribou herd, 1983-1984. Pages ___-___ in G.W. Garner and P.E. Reynolds, eds. 1984 update report baseline study of the fish, wildlife and their habitats. U.S. Fish and Wildl. Serv., Anchorage, Ak. ___pp.

Wiley, R.W., and E.G. Bolen. 1971. Eagle-livestock relationship: livestock carcass census and wound characteristics. The Southw. Natur. 16:151-169.

Prepared by: Francis J. Mauer Date: 26 March 1985

Kenneth R. Whitten, Francis J. Mauer, and Gerald W. Garner
Game Biologist, Alaska Department of Fish and Game; and Wildlife Biologists, Arctic National Wildlife Refuge.

Approved by: Gerald W. Garner Date: 26 March 1985

Gerald W. Garner
Supervisory Wildlife Biologist, Arctic National Wildlife Refuge

APPENDIX
ANWR Progress Report Number FY85-18

Mortality Case History

Calf No: 1
Captured: 3 June 1984

Sex: Female
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 8.4 kg
Umbilicus condition: absent
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 6 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 85 cm
Right hind foot length: 34 cm
New hoof length: 9.1 mm

Estimated age at capture: 3 days old
Observed with dam the following day.

Signal Monitored: 29 times/ 110 day period
Mortality detected: 21 September 1984
Carcass collected: 22 September 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations: 3
Location: Thomas Creek, Yukon Territory
Distance from capture site: 185 km
Response time: 24 hours

Carcass condition and disposition: Partially covered by snow. Bones, hair and rumen present. Bones chewed/crushed, rumen contents scattered. Collar broken and stained with blood. No scats found.

Necropsy findings:

Mortality category: Predation/scavenging involved. Predator/scavenger undetermined (wolf probable).

Mortality Case History

Calf No: 2
Captured: 3 June 1984

Sex: Male
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 8.1 kg
Umbilicus condition: absent
Hoof condition: hard
Health Status: appeared healthy at capture
Processing time: 5 min.

Total Length: 81 cm
Right hind foot length: 37 cm
New hoof length: 9.2 mm

Estimated age at capture: 3 days old

Cow-calf reunion: Capture crew observed reunion 1 min after release. Observed unattended by dam following day.

Signal Monitored: 3 times/ 2 day period
Mortality detected: 1109 5 June 1984
Carcass collected: 1415 5 June 1984
Carcass weight: 7.3 kg
Total length: 90 cm
Right hind foot length: 36 cm
New hoof length: 8.3 mm

Number of visual relocations: 3
Location: Niguanak Ridge
Distance from capture site:
Response time: 3 hours

Carcass condition and disposition: No indication of trauma. No caribou in immediate area.

Necropsy findings: Vegetation in abomasum and rumen, milk absent. All other internal organs normal. No indication of wounds or trauma associated with carcass.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 3
Captured: 3 June 1984

Sex: Male
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 8.2 kg
Umbilicus condition: moist
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 4 min.
Cow-calf reunion: Capture crew did not observe reunion. Observed unattended by dam 1.5 hours after release.

Total Length: 86 cm
Right hind foot length: 32 cm
New hoof length: 7.2 mm

Estimated age at capture: 1 day old

Signal Monitored: 2 times/ 2 day period
Mortality detected: 4 June 1984
Carcass collected: 1956 4 June 1984
Carcass weight: 7.0 kg
Total length: 91 cm
Right hind foot length: 35 cm
New hoof length: 8.5 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time:

Carcass condition and disposition: Lying on right side. No indication of trauma. No caribou in immediate area. No sign of predators.

Necropsy findings: Vegetation in abomasum, milk absent. All other internal organs normal.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 8
Captured: 3 June 1984

Sex: Male
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 7.3 kg
Umbilicus condition: dry
Hoof condition: hard/partially worn
Health Status: appeared healthy at capture
Processing time: 3 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 77 cm
Right hind foot length: 32.5 cm
New hoof length: 8.6 mm

Estimated age at capture: 3 days old
Observed with dam 1.5 hours after release.

Signal Monitored: 3 times/ 2 day period
Mortality detected: 1114 5 June 1984
Carcass collected: 1406 5 June 1984
Carcass weight: 6.4 kg
Total length: 81 cm
Right hind foot length: 34 cm
New hoof length: 7.1 mm

Number of visual relocations: 3
Location:
Distance from capture site:
Response time: 3 hours

Carcass condition and disposition: No indication of trauma. No caribou in immediate area. No sign of predators.

Necropsy findings: Vegetation fragments in abomasum, milk absent. All other internal organs normal. No indication of wounds or trauma associated with carcass.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 9
Captured: 3 June 1984

Sex: Male
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 5.7 kg
Umbilicus condition: dry
Hoof condition: partially hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.

Total Length: 75 cm
Right hind foot length: 33 cm
New hoof length: 7.9 mm

Estimated age at capture: 2 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed without dam 1.5 hrs after release. Observed with dam following day.

Signal Monitored: 28 times/ 27 day period
Mortality detected: 28 August 1984
Carcass collected: 29 August 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations: 4
Location: Marten Creek, Alaska
Distance from capture site: 225 km
Response time: 24 hours

Carcass condition and disposition: No carcass found. Collar under snow. Collar torn and blood stained (blood test positive).

Necropsy findings:

Mortality category: Predation/scavenging involved. Predator/scavenger undetermined.

Mortality Case History

Calf No: 10
Captured: 3 June 1984

Sex: Male
Location:

Weight: 7.5 kg
Umbilicus condition: moist
Hoof condition: partially hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.

Total Length: 79 cm
Right hind foot length: 34.5 cm
New hoof length: 9.4 mm

Estimated age at capture: 3 days old

Cow-calf reunion: Capture crew did not observe reunion. Calf followed crew to helicopter. Unattended by dam 1.5 hours and 24 hours after release.

Signal Monitored: 2 times/ 2 day period
Mortality detected: 1234 5 June 1984
Carcass collected: 1234 5 June 1984
Carcass weight: 5.9 kg
Total length: 86 cm
Right hind foot length: 35.5 cm
New hoof length: 6.9 mm

Number of visual relocations:
Location:
Distance from capture site:
Response time:

Carcass condition and disposition: Dispatched by project investigators when abandonment was apparent and starvation imminent. No caribou or predators observed in immediate area.

Necropsy findings: Vegetation in abomasum, milk absent. Lungs appeared slightly bloody. All other internal organs normal.

Mortality category: Predation excluded, euthenized, starvation imminent. Probable study-induced abandonment.

Mortality Case History

Calf No: 13
Captured: 3 June 1984

Sex: Female
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 7.4 kg
Umbilicus condition: moist
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.
Cow-calf reunion: Capture crew did not observe reunion. Unattended by dam 1.5 hours and 24 hours after release.

Total Length: 81 cm
Right hind foot length: 34.5 cm
New hoof length: 8.6 mm

Estimated age at capture: 3 days old

Signal Monitored: 3 times/ 2 day period
Mortality detected: 1143 5 June 1984
Carcass collected: 1236 5 June 1984
Carcass weight: 6.1 kg
Total length: 81 cm
Right hind foot length: 32.4 cm
New hoof length: 6.7 mm

Number of visual relocations:
Location:
Distance from capture site:
Response time: 1 hour

Carcass condition and disposition: Hole (42.6 mm diameter) on right rump, hemorrhage at wound (appears to be made by an avian scavenger). No other indication of trauma. No caribou in the immediate area. No other sign of predators.

Necropsy findings: Vegetation in abomasum, milk absent. All other internal organs normal. No other indication of trauma.

Mortality category: Predation/scavenging involved (avain sp.) - predisposed due to probable starvation/study-induced abandonment.

Mortality Case History

Calf No: 15
Captured: 3 June 1984

Sex: Male
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 6.4 kg
Umbilicus condition: moist
Hoof condition: partially hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 78 cm
Right hind foot length: 33 cm
New hoof length: 7.0 mm

Estimated age at capture: 1 day old
Unattended 24 hours after release.

Signal Monitored: 3 times/ 2 day period
Mortality detected: 1116 5 June 1984
Carcass collected: 1245 5 June 1984
Carcass weight: 5.2 kg
Total length: 80 cm
Right hind foot length: 33 cm
New hoof length: 6.0 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time: 1.5 hours

Carcass condition and disposition: No indication of trauma. No caribou in immediate area. No sign of predators at carcass site.

Necropsy findings: Trace of vegetation in abomasum, milk absent. All other internal organs normal.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 16
Captured: 3 June 1984

Sex: Female
Location: coastal plain, east side of Niguanak River.

Weight: 7.1 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health Status: slight mucous on muzzle - moved slow
Processing time: 3 min.
Cow-calf reunion: Capture crew did not observe reunion. Unattended day after release.

Total Length: 87 cm
Right hind foot length: 34.7 cm
New hoof length: 8.1 mm
Estimated age at capture: 2 days old

Signal Monitored: 3 times/ 2 day period
Mortality detected: 1344 5 June 1984
Carcass collected: 1349 5 June 1984
Carcass weight: 5.4 kg
Total length: 78 cm
Right hind foot length: 33 cm
New hoof length: 6.9 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time: 5 min.

Carcass condition and disposition: Dispatched by project investigators when abandonment was apparent and starvation imminent. No caribou or predators in immediate area.

Necropsy findings: Vegetation in abomasum, milk absent. All other internal organs normal.

Mortality category: Predation excluded, euthenized, starvation imminent, probable study-induced abandonment.

Mortality Case History

Calf No: 21
Captured: 3 June 1984

Sex: Female
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 8.0 cm
Umbilicus condition: dry
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 84 cm
Right hind foot length: 35.5 cm
New hoof length: 8.9 mm
Estimated age at capture: 3 days old
Attended by dam following day.

Signal Monitored: 2 times/ 2 day period
Mortality detected: 1116 5 June 1984
Carcass collected: 1309 5 June 1984
Carcass weight: 6.4 kg
Total length: 88.9 cm
Right hind foot length: 35 cm
New hoof length: 11.0 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time:

Carcass condition and disposition: No indication of trauma. No caribou in immediate area. No sign of predators at carcass site.

Necropsy findings: Vegetation in abomasum, milk absent. All other internal organs normal.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 24
Captured: 3 June 1984

Sex: Female
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 6.3 kg
Umbilicus condition: moist
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 4 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 82 cm
Right hind foot length: 32 cm
New hoof length: 7.1 mm

Estimated age at capture: 1 day old
Unattended by dam following day.

Signal Monitored: 2 times/2 day period
Mortality detected: 1818 4 June 1984
Carcass collected: 1253 5 June 1984
Carcass weight: 5.3 kg
Total length: 75 cm
Right hind foot length: 30 cm
New hoof length: 7.1 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time: 19 hours

Carcass condition and disposition: No indication of trauma. Slight scouring at anus. No caribou in immediate area. No sign of predators at carcass sight.

Necropsy findings: Vegetation in abomasum, milk absent. All other internal organs normal.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 26
Captured: 3 June 1984

Sex: Female
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 7.7 kg
Umbilicus condition: dry
Hoof condition: partially hard/worn
Health Status:
Processing time: 2 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 91 cm
Right hind foot length: 34 cm
New hoof length: 8.1 mm
Estimated age at capture: 2 days old
Unattended by dam following day.

Signal Monitored: 3 times/ 2 day period
Mortality detected: 6 June 1984
Carcass collected: 1553 6 June 1984
Carcass weight: 5.9 kg
Total length: 69 cm
Right hind foot length: 34 cm
New hoof length: 7.1 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time:

Carcass condition and disposition: Intact, no indication of trauma. No caribou in immediate area. No sign of predators at carcass site.

Necropsy findings: Dried blood in throat; puncture wound (4.1 mm diameter). Hemorrhage on left side of larynx. Vegetation in abomasum, milk absent. All other internal organs normal.

Mortality category: Predation/scavenging involved, avian scavengers. Starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 27
Captured: 3 June 1984

Sex: Female
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 5.6 kg
Umbilicus condition: dry
Hoof condition: partially hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 72 cm
Right hind foot length: 31 cm
New hoof length: 6.9 mm

Estimated age at capture: 1 day old
Unattended by dam following day.

Signal Monitored: 2 times/ 1 day period
Mortality detected: 4 June 1984
Carcass collected: 2020 4 June 1984
Carcass weight: 4.6 kg
Total length: 72 cm
Right hind foot length: 31.5 cm
New hoof length: 6.9 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time:

Carcass condition and disposition: Lying on left side. Intact, no indication of trauma. No caribou in immediate area. No sign of predators.

Necropsy findings: Scouring at anus. Abomasum empty, milk absent. All other internal organs normal.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 28
Captured: 3 June 1984

Sex: Male
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 8.2 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 84 cm
Right hind foot length: 33.5 cm
New hoof length: 7.7 mm

Estimated age at capture: 1 day old
Unattended by dam following day.

Signal Monitored: 2 times/ 2 day period
Mortality detected: 5 June 1984
Carcass collected: 1315 5 June 1984
Carcass weight: 6.6 kg
Total length: 82 cm
Right hind foot length: 35 cm
New hoof length: 8.5 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time:

Carcass condition and disposition: Intact, no indication of trauma. No caribou in immediate area. No sign of predators at carcass site.

Necropsy findings: Vegetation in abomasum, milk absent. All other internal organs normal.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 29
Captured: 3 June 1984

Sex: Male
Location: coastal plain between Jago and Niguanak Rivers.

Weight: 7.7 kg
Umbilicus condition: dry
Hoof condition: partially hard/worn
Health Status: appeared healthy at capture
Processing time: 2 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 81 cm
Right hind foot length: 35 cm
New hoof length: 9.3 mm

Estimated age at capture: 3 days old
Observed with dam the following day.

Signal Monitored: 25 times/ 33 day period
Mortality detected: 28 August 1984
Carcass collected: 29 August 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations: 2
Location: Upper Christian River
Distance from capture site: 270 km
Response time: 24 hours

Carcass condition and disposition: Bones and hair present. Long bones and ribs broken. Collar torn, blood stained, transmitter cannister chewed.

Necropsy findings:

Mortality category: Predation/scavenging involved, predator/scavenger undetermined.

Mortality Case History

Calf No: 32
Captured: 5 June 1984

Sex: Female
Location: coastal plain between Egaksrak and Kongakut Rivers.

Weight: 6.8 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 2 min.

Total Length: 83 cm
Right hind foot length: 33 cm
New hoof length: 8.4 mm
Estimated age at capture: 2 days old

Cow-calf reunion: Capture crew did not observe reunion. Attended by dam 3 hrs after release. Observed unattended by dam 24 hours after release.

Signal Monitored: 3 times/ 2 day period
Mortality detected: 1653 7 June 1984
Carcass collected: 1711 7 June 1984
Carcass weight: 5.5 kg
Total length: 76 cm
Right hind foot length: 33.5 cm
New hoof length: 7.6 mm

Number of visual relocations: 3
Location:
Distance from capture site:
Response time: 2 hours

Carcass condition and disposition: Lying on right side, intact. No indication of trauma. No caribou in immediate area. No sign of predators at carcass site.

Necropsy findings: Vegetation in abomasum, milk absent. Lungs cloudy, heart enlarged. All other internal organs normal.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 33
Captured: 5 June 1984

Sex: Male
Location: coastal plain between Aichilik and Kongakut Rivers.

Weight: 7.9 kg
Umbilicus condition: absent
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 85.5 cm
Right hind foot length: 33.5 cm
New hoof length: 9.2 mm

Estimated age at capture: 3 days old
Observed with dam 3 hours after release.

Signal Monitored: 28 times/ 108 day period
Mortality detected: 21 September 1984
Carcass collected: 22 September 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations: 4
Location: Caribou Bar Creek, Yukon Territory
Distance from capture site: 250 km
Response time: 24 hours

Carcass condition and disposition: Bones crushed, rumen contents scattered/uneaten, appears death was recent to date of collection. Collar intact, tested positive for presence of blood.

Necropsy findings:

Mortality category: Predation/scavenging involved. Predator/scavenger undetermined.

Mortality Case History

Calf No: 37
Captured: 5 June 1984

Sex: Male
Location: coastal plain between Aichilik and Kongakut Rivers.

Weight: 7.9 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.

Total Length: 82 cm
Right hind foot length: 33.5 cm
New hoof length: 8.2 mm

Estimated age at capture: 2 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed with dam the following day. Observed unattended by dam 2 August 1984 - probable orphan.

Signal Monitored: 28 times/ 84 day period
Mortality detected: 28 August 1984
Carcass collected: 29 August 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations: 2
Location: north side of Old John Lake
Distance from capture site: 220 km
Response time:

Carcass condition and disposition: Bones and hair partially covered by soil and moss by brown bear. Bear scats containing coribou hair were present. Collar stained with blood, cannister attachment bent.

Necropsy findings:

Mortality category: Predation/scavenging involved. Predator/scavenger probable brown bear.

Mortality Case History

Calf No: 39
Captured: 5 June 1984

Sex: Male
Location: coastal plain between Egaksrak and Kongakut Rivers.

Weight: 6.6 kg
Umbilicus condition: moist
Hoof condition: partially hard/worn
Health Status: appeared to be healthy at capture
Processing time: 2 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 80.5 cm
Right hind foot length: 33.5 cm
New hoof length: 8.7 mm
Estimated age at capture: 2 days old
Unattended by dam 2.5 hours after release.

Signal Monitored: 2 times/ 1 day period
Mortality detected: 2049 6 June 1984
Carcass collected: 1718 7 June 1984
Carcass weight: 5.7 kg
Total length: 81 cm
Right hind foot length: 34.5 cm
New hoof length: 8.4 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time: 21 hours

Carcass condition and disposition: Tongue partially removed, right eye removed, hair removed from right rump. Remainder of carcass intact. No caribou in immediate area.

Necropsy findings: Stomach empty, milk absent. Lungs cloudy/bloody, heart appears to be enlarged. All other internal organs normal.

Mortality category: Predation/scavenging involved (avian), starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 41
Captured: 5 June 1984

Sex: Male
Location: coastal plain between Egaksrak and Kongakut Rivers.

Weight: 4.4 kg
Umbilicus condition: absent
Hoof condition: partially hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 70.5 cm
Right hind foot length: 30 cm
New hoof length: 7.3 mm

Estimated age at capture: 3 days old
Observed with dam the following day.

Signal Monitored: 5 times/ 3 day period
Mortality detected: 1847 9 June 1984
Carcass collected: 2240 9 June 1984
Carcass weight: 1.8 kg
Total length:
Right hind foot length: 33.7 cm
New hoof length: 7.95 mm

Number of visual relocations: 4
Location: coastal plain west of Ekaluakat River.
Distance from capture site: 10.4 km
Response time: 4 hours

Carcass condition and disposition: Approximately 60% consumed, all internal organs and flesh removed, remainder of carcass held together by remnants of torn skin and connective tissue. Fragment of jaw bone chewed, remainder of skeletal bones not chewed. Skull cap intact, palate removed, puncture wound above right eye (4 mm diameter). Golden eagle perched approx. 0.1 km from carcass. Feathers and scats of Golden eagle at carcass site.

Necropsy findings: Wounds on anterior scalp (9.4, 9.4 mm diameter parallel; 3.6, 3.6 mm diameter parallel; 17.2 mm separates pairs of parallel wounds).

Mortality category: Predation/scavenging involved, mammalian predator undetermined, avian scavenger/Golden eagle.

Mortality Case History

Calf No: 43
Captured: 5 June 1984

Sex: Male
Location: coastal plain between Egaksrak and Kongakut Rivers.

Weight: 7.4 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 2 min.

Total Length: 79.5 cm
Right hind foot length: 33.5 cm
New hoof length: 8.4 mm

Estimated age at capture: 2 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed with dam 2.25 hrs. after release.

Signal Monitored: 6 times/ 5 day period
Mortality detected: 10 June 1984
Carcass collected: 1250 10 June 1984
Carcass weight: 6.1 kg
Total length: NA
Right hind foot length: 34.5 cm
New hoof length: 7.95 mm

Number of visual relocations: 2
Location: Mountain slope east side of Ekaluakat River.
Distance from capture site: 9.6 km
Response time: 3 hrs.

Carcass condition and disposition: Lying on left side, approximately 35% consumed, internal organs consumed, legs intact, mid-section of vertebrae missing, hemorrhage around mouth. Puncture wounds on left thigh (33 mm apart, 1.5 and .7 cm deep). Skin peeled away from back. No predator sign noted at carcass site.

Necropsy findings: Skull punctured anterior to orbital arches approx. 13 mm diameter, 38.2 mm apart, skin covering skull trauma not punctured, hemorrhage only on internal surface of skin. Partially digested vegetation found in remnant of intestine.

Mortality category: Predation included, probable wolf kill.

Mortality Case History

Calf No: 46
Captured: 5 June 1984

Sex: Female
Location: coastal plain between the Aichilik and Kongakut Rivers.

Weight: 7.0 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 2 min.

Total Length: 74.5 cm
Right hind foot length: 33 cm
New hoof length: 8.3 mm

Estimated age at capture: 2 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed with dam the following day.

Signal Monitored: 25 times/ 78 day period
Mortality detected: 22 August 1984
Carcass collected: 22 September 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations: 4
Location: Muskeg Creek, Yukon Territory
Distance from capture site: 140 km
Response time: 30 days

Carcass condition and disposition: No carcass found. Collar was intact (unlikely that it was shed from a live animal).

Necropsy findings:

Mortality category: Predation/scavenging probable. Predator/scavenger undetermined.

Mortality Case History

Calf No: 47
Captured: 5 June 1984

Sex: Male
Location: coastal plain between Egaksrak and Kongakut Rivers.

Weight: 6.9 kg
Umbilicus condition: absent
Hoof condition: partially hard/worn
Health Status: appeared healthy at capture
Processing time: 2 min.

Total Length: 82.5 cm
Right hind foot length: 35.5 cm
New hoof length: 7.3 mm

Estimated age at capture: 1 day old

Cow-calf reunion: Capture crew did not observe reunion. Attended by cow 2.75 hours after release. Unattended by dam following day.

Signal Monitored: 4 times/ 3 day period
Mortality detected: 1628 8 June 1984
Carcass collected: 8 June 1984
Carcass weight: 5.8 kg
Total length: 82.5 cm
Right hind foot length: 35.5 cm
New hoof length: 8.6 mm

Number of visual relocations: 4
Location:
Distance from capture site:
Response time:

Carcass condition and disposition: Intact, no indication of trauma. No caribou in immediate area. No sign of predators at carcass site.

Necropsy findings: Vegetation in abomasum, milk absent. Lungs cloudy/dark, heart enlarged. All other internal organs normal.

Mortality category: Predation excluded, starvation. Probable study-induced abandonment.

Mortality Case History

Calf No: 51
Captured: 5 June 1984

Sex: Female
Location: coastal plain between Egaksrak and Kongakut Rivers.

Weight: 5.9 kg
Umbilicus condition: moist
Hoof condition: partially hardened/worn
Health Status: appeared healthy at capture
Processing time: 3 min.

Total Length: 76.5 cm
Right hind foot length: 32.5 cm
New hoof length: 8.2 mm

Estimated age at capture: 2 days old

Cow-calf reunion: Capture crew did not see reunion. Observed with dam 1.75 hours after release.

Signal Monitored: 20 times/ 19 day period
Mortality detected: 1219 24 June 1984

Number of visual relocations: 3
Location: Foothills west side of Ekaluakat River aufeis field.

Carcass collected: 1524 24 June 1984
Carcass weight: 8.6 kg
Total length: 98 cm
Right hind foot length: 32 cm
New hoof length: 11.2 mm

Distance from capture site: 21.7 km
Response time: 3 hours

Carcass condition and disposition: Lying on right side, carcass intact and no external indication of trauma. Cow observed standing near carcass when helicopter approached. Golden eagle perched approximately 1.1 km to the west of carcass.

Necropsy findings: Six round puncture wounds on upper thorax and shoulder (3.3-14.3 mm diameter) with internal hemorrhage at each wound site. Hemorrhage of lung cavity, lungs bloody and clouded. All other organs and body structures normal.

Mortality category: Predation/scavenging involved, Golden eagle kill.

Mortality Case History

Calf No: 53
Captured: 5 June 1984

Sex: Male
Location: coastal plain east of the Kongakut River.

Weight: 5.4 kg
Umbilicus condition: NA
Hoof condition: soft/slight wear
Health Status: appeared healthy at capture
Processing time: 2 min.

Total Length: 72.5 cm
Right hind foot length: 32.5 cm
New hoof length: 7.8 mm

Estimated age at capture: 1 day old

Cow-calf reunion: Capture crew observed reunion. Unattended by dam 1.75 hours after release.

Signal Monitored: 2 times/ 1 day period
Mortality detected: 1525 6 June 1984
Carcass collected: 1912 7 June 1984
Carcass weight: 4.9 kg
Total length: 80.5 cm
Right hind foot length: 34.5 cm
New hoof length: 7.6 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time: 28 hours

Carcass condition and disposition: Intact, no indication of trauma. No caribou in the immediate area. No sign or predators at carcass site.

Necropsy findings: Stomach empty, milk absent. Lungs cloudy/bloody, all other internal organs normal.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 54
Captured: 6 June 1984

Sex: Male
Location: coastal plain east of Kongakut River.

Weight: 6.7 kg
Umbilicus condition: moist
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 2 min.

Total Length: 84 cm
Right hind foot length: 35.5 cm
New hoof length: 9.2 mm

Estimated age at capture: 3 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed with dam 12 hours after release.

Signal Monitored: 23 times/ 107 day period
Mortality detected: 21 September 1984
Carcass collected: 22 September 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations: 2
Location: Pine Creek, Yukon Territory
Distance from capture site: approx. 325 km
Response time: 24 hours

Carcass condition and disposition: Scattered bones, bones broken, rumen contents present, wolf scats present. Collar intact, blood stained, retrieved from spruce tree.

Necropsy findings:

Mortality category: Predation/scavenging involved. Probable wolf kill.

Mortality Case History

Calf No: 55
Captured: 6 June 1984

Sex: Female
Location: Coastal plain east of the Kongakut River.

Weight: 4.9 kg
Umbilicus condition: dry
Hoof condition: partially hardened/worn
Health Status: scouring - otherwise appeared normal
Processing time: 2 min.
Cow-calf reunion: Capture crew did not observe reunion. Observed with dam approximately 12 hours after release.

Total Length: 76.5 cm
Right hind foot length: 32.5 cm
New hoof length: 8.5 mm
Estimated age at capture: 2 days old

Signal Monitored: 25 times/ 77 day period
Mortality detected: 22 August 1984
Carcass collected: 22 September 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations: 2
Location: Old Crow Range, Yukon Territory
Distance from capture site: 245 km
Response time: 30 days

Carcass condition and disposition: No carcass found. Collar broken and tested positive for presence of blood.

Necropsy findings:

Mortality category: Predation/scavenging involved. Predator/scavenger undetermined.

Mortality Case History

Calf No: 56
Captured: 6 June 1984

Sex: Male
Location: coastal plain east of Kongakut River.

Weight: 6.6 kg
Umbilicus condition: dry
Hoof condition: NA
Health Status: diarrhea present at capture
Processing time: 3 min.

Total Length: 85.5 cm
Right hind foot length: 33 cm
New hoof length: 7.6 mm
Estimated age at capture: 1 day old

Cow-calf reunion: Capture crew observed reunion 1 min. after release. Unattended by dam following day.

Signal Monitored: 2 times/ 2 day period
Mortality detected: 1525 7 June 1984
Carcass collected: 1718 7 June 1984
Carcass weight: 5.7 kg
Total length: 85 cm
Right hind foot length: 34 cm
New hoof length: 7.8 mm

Number of visual relocations: 2
Location:
Distance from capture site:
Response time: 2 hours

Carcass condition and disposition: Intact, no indication of trauma. No caribou in immediate area, no sign of predators at carcass site.

Necropsy findings: Vegetation in rumen, milk absent. Lungs cloudy, all other internal organs normal.

Mortality category: Predation excluded, starvation, probable study-induced abandonment.

Mortality Case History

Calf No: 61
Captured: 5 June 1984

Sex: Female
Location: coastal plain between the Jago and Okerokovik Rivers.

Weight: 5.9 kg
Umbilicus condition: moist
Hoof condition: hard/worn
Health Status: appeared healthy at capture
Processing time: 2 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total Length: 71 cm
Right hind foot length: 32 cm
New hoof length: 7.9 mm
Estimated age at capture: 1 day old
Observed with dam 9.75 hours after release.

Signal Monitored: 24 times/ 25 day period
Mortality detected: 20 July 1984

Number of visual relocations: 4
Location: British Mountains west of Firth River, Yukon Territory

Carcass collected: 20 July 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Distance from capture site: 142km
Response time:

Carcass condition and disposition: Approximately 85% consumed. Flesh removed from skeleton, bones partially attached by remnants of skin and connective tissue, interval organs removed. Bones not broken or gnawed. No sign of predators found at carcass site.

Necropsy findings:

Mortality category: Predation/scavenging involved, avian scavengers, cause of mortality undetermined.

Mortality Case History

Calf No: 66
Captured: 5 June 1984

Sex: Male
Location: coastal plain between the Jago and Niguanak Rivers.

Weight: 9.0 kg
Umbilicus condition: NA
Hoof condition: NA
Health Status: appeared healthy at capture
Processing time: 2 min.

Total Length: 88 cm
Right hind foot length: 35.5 cm
New hoof length: 8.2 mm
Estimated age at capture: 2 days old

Cow-calf reunion: Capture crew observed reunion after release.

Signal Monitored: 29 times/ 66 day period Number of visual relocations: 1
Mortality detected: 12 November 1984 Location: W. channel MacKenzie River, 52 km north of Aklavik, NorthWest Territories.
Carcass collected:
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Distance from capture site: 330 km
Response time: NA

Carcass condition and disposition: Shot by hunter.

Necropsy findings:

Mortality category: Predation excluded, hunter kill.

Mortality Case History

Calf No: 73
Captured: 7 June 1984

Sex: Female
Location:

Weight: 6.9 kg
Umbilicus condition: moist
Hoof condition: partially hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min.

Total Length: NA
Right hind foot length: 33.5 cm
New hoof length: 7.6 mm

Estimated age at capture: 1 day old

Cow-calf reunion: Capture crew observed reunion 1 min. after release.

Signal Monitored:_____ times/_____day period Number of visual relocations:
Mortality detected:
Carcass collected: 1815 13 June 1984
Carcass weight: 7.2 kg
Total length: 83 cm
Right hind foot length: 35.5 cm
New hoof length:

Location: West channel of lower Kongakut River.
Distance from capture site: 10 km
Response time:

Carcass condition and disposition: Intact, lying in approximately 10 cm of water (west channel of Kongakut River). No indication of trauma. No caribou or predators observed in the immediate area.

Necropsy findings: Slight bruise and hemorrhage on brisket and at base of neck and shoulders. No puncture holes in the skin. No water in trachea, esophagus, stomach or intestines. Trachea clear of obstructions. Lungs appeared normal (aerated). Vegetation and milk present in stomach. All other organs were normal.

Mortality category: Predation excluded, probable accidental injury and/or drowning.

Mortality Case History

Calf No: 76
Captured: 7 June 1984

Sex: Male
Location: coastal plain east of Kongakut River.

Weight: 7.6 kg
Umbilicus condition: bloody
Hoof condition: partially hard/worn
Health Status: appeared healthy at capture
Processing time: 3 min
Cow-calf reunion: Capture crew observed reunion 2 minutes after release.

Total Length: 79.5 cm
Right hind foot length: 36.5 cm
New hoof length: 8.6 mm

Estimated age at capture: 1 day old

Signal Monitored: 24 times/ 75 day period
Mortality detected: 21 August 1984
Carcass collected: 22 September 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations: 0
Location: Upper Bell River, Yukon Territory
Distance from capture site: 275 km
Response time: 30 days

Carcass condition and disposition: No carcass found. Collar intact (unlikely that it was shed while animal was alive). Tested negative for presence of blood.

Necropsy findings:

Mortality category: Predation/scavenging involved. Predator/scavenger undetermined.

Mortality Case History

Calf No: Unmarked 01
Captured:

Sex: Male
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 4 June 1984
Carcass weight: 2.9 kg
Total length:
Right hind foot length: 35 cm
New hoof length: 9.1 mm

Number of visual relocations:
Location: coastal plain between Jago and Niguanak River
Distance from capture site:
Response time:

Carcass condition and disposition: Carcass remains spread out on snow bank in creek draw. 75% consumed, flesh and vicera removed, skin and bones attached. Skull crushed, bones broken and chewed. Brown bear tracks and hair present. Glaucous gull tracks present.

Necropsy findings:

Mortality category: Predation/scavenging involved. Brown bear, Glaucous gull.

Mortality Case History

Calf No: Unmarked 02
Captured:

Sex: Male
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 5 June 1984
Carcass weight: 3.5 kg
Total length: 67.5 cm
Right hind foot length: 28.5 cm
New hoof length: 6.6 mm

Number of visual relocations:
Location: coastal plain between Jago and Niguanak Rivers
Distance from capture site:
Response time:

Carcass condition and disposition: Found lying in tussock meadow. Intact - no external indication of trauma. Appears to be very young (less than 1 day old). No cow observed in the area.

Necropsy findings: No indication of wounds or trauma. Stomach and rumen empty. No internal fat deposits, organs fetal in appearance. Lungs dark/clouded.

Mortality category: Predation excluded, still birth or not viable birth.

Mortality Case History

Calf No: Unmarked 03
Captured:

Sex: Male
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period Number of visual relocations:
Mortality detected:
Carcass collected: 5 June 1984
Carcass weight: 6.5 kg
Total length: 84 cm
Right hind foot length: 33.5 cm
New hoof length: 8.2 mm

Location:
Distance from capture site:
Response time:

Carcass condition and disposition: Found on dryas terrace with cow standing near carcass. Intact, no external indication of trauma. Hooves soft/unworn, umbilicus moist, pelage dry. Cow with 2 hard antlers, placenta protruding from vagina.

Necropsy findings: Stomach empty, lungs clouded, fat present on kidneys, all other internal organs normal.

Mortality category: Predation excluded, probable stillbirth.

Mortality Case History

Calf No: Unmarked 04
Captured:

Sex: Female
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 7 June 1984
Carcass weight: 3.6 kg
Total length: 78.5 cm
Right hind foot length: 33.0 cm
New hoof length: 8.7 mm

Number of visual relocations:
Location: foothills Ekaluakat River
Distance from capture site:
Response time:

Carcass condition and disposition: Found lying on right side in wet sedge area. No cow present. About 30% consumed. Tongue partially consumed. Fed on from left side through rib cage, heart and lungs gone, left hip/upper thigh removed, flesh removed from anus and pubic area. Jaegers observed at carcass.

Necropsy findings: No puncture wounds or indicaton of trauma found. All internal organs except a portion of liver consumed.

Mortality category: Predation/scavenging involved, scavenging, avian scavenger, cause of death undetermined.

Mortality Case History

Calf No: Unmarked 05
Captured:

Sex: Female
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 7 June 1984
Carcass weight: 4.8 kg
Total length: 82 cm
Right hind foot length: 34.5 cm
New hoof length: 7.2 mm

Number of visual relocations:
Location: coastal plain west side of Egaksrak River
Distance from capture site:
Response time:

Carcass condition and disposition: 95% intact, lying on left side. Right eye and tongue removed. Skin opened on right shoulder and right rear thigh. Lungs and intestines partially fed on. Hooves partially hard and worn. Umbilicus dried. No cow present. Jaegers present at the carcass when collected.

Necropsy findings: Right lung gone, left lung dark and clouded, heart partially eaten, stomach with green colored mucous, yellow material in intestines. All other internal organs normal. No indication of wounds or trauma except for areas of avian feeding.

Mortality category: Predation/scavenging involved, scavenging, avian scavenger, cause of death undetermined.

Mortality Case History

Calf No: Unmarked 06
Captured:

Sex: Male
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/____day period
Mortality detected:
Carcass collected: 7 June 1984
Carcass weight: 6.8 kg
Total length: 86 cm
Right hind foot length: 36 cm
New hoof length: 8.6 mm

Number of visual relocations:
Location:
Distance from capture site:
Response time:

600

Carcass condition and disposition: Mostly intact, right eye removed, bruise on right rear rib area - no other indication of trauma. Hooves hard/worn, umbilicus dry. Antlered cow standing at the carcass.

Necropsy findings: Lungs cloudy, vegetation and milk curds present in stomach, all other internal organs appear normal.

Mortality category: Predation/scavenging involved, scavenging, avian scavenger, cause of death undetermined.

Mortality Case History

Calf No: Unmarked 07
Captured:

Sex: Female
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 8 June 1984
Carcass weight: 5.1 kg
Total length: 79.5 cm
Right hind foot length: 32.5 cm
New hoof length: 7.6 mm

Number of visual relocations:
Location: coastal plain near Angun River
Distance from capture site:
Response time:

Carcass condition and disposition: Lying on right side on gravel bar. Left eye removed, right eye and nose chewed, skin around tail opened. No cow present at carcass.

Necropsy findings: Lungs aerated/dark, milk curds present in stomach, all other internal organs appear normal.

Mortality category: Predation/scavenging involved, scavenging, avian scavenger, cause of death undetermined.

Mortality Case History

Calf No: Unmarked 08
Captured:

Sex: Female
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 8 June 1984
Carcass weight: 4.1 kg
Total length: 70.5 cm
Right hind foot length: 31 cm
New hoof length: 8.1 mm

Number of visual relocations:
Location: coastal plain near Ekaluakat River
Distance from capture site:
Response time:

Carcass condition and disposition: Found lying in tussock tundra area, antlered cow standing at carcass site. No external indication of trauma - carcass intact. Hooves hardened/worn. Umbilicus dry.

Necropsy findings: Lungs dark. Stomach and rumen empty, milk curds absent. All other internal organs normal. Lacks internal fat deposits.

Mortality category: Predation excluded, starvation - not related to abandonment.

Mortality Case History

Calf No: Unmarked 09
Captured:

Sex: Undetermined
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 8 June 1984
Carcass weight: 2.2 kg
Total length:
Right hind foot length: 34 cm
New hoof length: 7.2 mm

Number of visual relocations:
Location:
Distance from capture site:
Response time:

Carcass condition and disposition: 65% consumed. Carcass chewed up, partially scattered, leg disarticulated, bones intact/attached by skin. Skull crushed, brain removed, neck and abdomen gone.

Necropsy findings: Ears and right eye removed. No internal organs present. Bird feces and black feathers present.

Mortality category: Predation/scavenging involved, mammalian and avian scavengers, probable brown bear kill.

Mortality Case History

Calf No: Unmarked 10
Captured:

Sex: Female
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 8 June 1984
Carcass weight: 3.8 kg
Total length: 72 cm
Right hind foot length: 31 cm
New hoof length: 8.0 mm

Number of visual relocations:
Location: coastal plain east of Kongakut River
Distance from capture site:
Response time:

Carcass condition and disposition: Lying on right side on snow bank. Chest cavity opened, heart and lungs gone. Puncture wounds: (1) left jugular 6.3 mm diameter, (1) below right ear 3.8 mm diameter Subcutaneous hemorrhage at wounds and on skull. Skull broken. Hooves partially hard/worn. Umbilicus dry. No cow present. Collared brown bear #1234 0.4 km to west.

Necropsy findings: Bruises on left and right shoulder and right loin area. Lower ramus broken. No internal organs present.

Mortality category: Predation/scavenging involved, predation, brown bear kill.

Mortality Case History

Calf No: Unmarked 11
Captured:

Sex: Undetermined
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period Number of visual relocations:
Mortality detected:
Carcass collected: 10 June 1984
Carcass weight: 3.6 kg
Total length:
Right hind foot length: 34.7 cm
New hoof length: 7.6 mm

Location:
Distance from capture site:
Response time:

Carcass condition and disposition: 70% consumed, flesh removed from carcass, internal organs gone. Bones not chewed, connected by skin. Hemorrhage in mouth cavity. Compound fracture of left hind foot. Head unharmed externally. Two golden eagles feeding on carcass when collected.

Necropsy findings: Head skinned - skull fractured posterior to right eye above right ear, and above left eye. Hemorrhage associated with skull fractures. Puncture wound in skin (2.4 mm diameter) above right eye. Dried blood, tissue and soil on wound of broken leg indicates injury occurred prior to death.

Mortality category: Predation/scavenging involved, predation, Golden Eagle kill, probable predisposed to predation (broken leg).

Mortality Case History

Calf No: Unmarked 12
Captured:

Sex: Undetermined
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 10 June 1984
Carcass weight: 3.6 kg
Total length:
Right hind foot length: 35 cm
New hoof length: 7.3 mm

Number of visual relocations:
Location:
Distance from capture site:
Response time:

909

Carcass condition and disposition: 65% consumed, majority of flesh removed from skeleton, internal organs gone, limbs attached by skin, disarticulated from vertebrae. Skull partially crushed. Collected from brown bear. 2 Golden eagles near carcass.

Necropsy findings: Hemorrhage above right eye and inside braincase.

Mortality category: Predation/scavenging involved, predation, brown bear kill.

Mortality Case History

Calf No: Unmarked 13
Captured:

Sex: Male
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 14 June 1984
Carcass weight: 5.0 kg
Total length: 84 cm
Right hind foot length: 31.6 cm
New hoof length: 6.7 mm

Number of visual relocations:
Location: coastal plain west of Kongakut River
Distance from capture site:
Response time:

607

Carcass condition and disposition: Intact lying on left side on a dryas terrace area. No external indication of trauma. Antlerless cow standing by carcass.

Necropsy findings: No internal indication of wounds or trauma, lungs mottled dark red, stomach contained vegetation, milk curds absent. Internal fat lacking, liver dark.

Mortality category: Predation excluded, starvation/pneumonia, not related to abandonment.

Mortality Case History

Calf No: Unmarked 14
Captured:

Sex: Undetermined
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 14 June 1984
Carcass weight: 8.9 kg
Total length:
Right hind foot length: 35.9 cm
New hoof length: 10.45 mm

Number of visual relocations:
Location: foothills west of Aichilik River
Distance from capture site:
Response time:

Carcass condition and disposition: Lying on left side in tussock/shrub tundra. Skin removed from right rib cage - flesh removed. Internal organs partially removed. 2 Golden eagles feeding on carcass when collected. Cow caribou nearby.

Necropsy findings: Extensive hemorrhage associated with round puncture wounds - dorsal surface of left shoulder (4.8 mm diameter); left flank (4.2 mm diameter); left neck (4.8 mm and 2.8 mm diameter). Oval punctures of left shoulder (33 mm and 35 mm across). Vegetation in stomach, fat on kidneys and mesentery.

Mortality category: Predation/scavenging included; predation, Golden eagle kill.

Mortality Case History

Calf No: Unmarked 15
Captured:

Sex: Female
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 16 June 1984
Carcass weight: 5.5 kg
Total length:
Right hind foot length: 35.6 cm
New hoof length: 9.25 mm

Number of visual relocations:
Location: foothills west of Aichilik River
Distance from capture site:
Response time:

Carcass condition and disposition: Lying on left side near willow and wet sedge hummocks. 40% consumed. Tongue, right ear and eyes removed. Chest cavity opened, heart and lungs and intestines gone. Flesh removed from right flank and thigh. Right ribs broken and removed. 3 Glaucous gulls feeding on carcass when collected.

Necropsy findings: Carcass skinned: hemorrhage associated with round puncture wounds on lower left dorsal surface (4.1 mm and 3.0 mm in diameter). Right mandible disarticulated from skull, right maxillae gone, left maxillae disarticulated, palate removed, remainder of braincase intact.

Mortality category: Predation/scavenging involved, predation, Golden eagle kill.

Mortality Case History

Calf No: Unmarked 16
Captured:

Sex: Female
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 18 June 1984
Carcass weight: 7.0 kg
Total length: 80 cm
Right hind foot length: 36 cm
New hoof length: 10.1 mm

Number of visual relocations:
Location: coastal plain west of Niguanak River
Distance from capture site:
Response time:

Carcass condition and disposition: Lying on right side in tussock/hummock tundra. Adult cow standing at carcass site. Flesh removed from left shoulder and rib area.

Necropsy findings: Bruise and slight hemorrhage above right eye. No wounds in skin, no broken bones or skull. Heart and right lung removed. Massive hemorrhage in abdominal cavity and around small intestines. Stomach contained vegetation and milk curds.

Mortality category: Predation/scavenging involved, predator/scavenger undetermined.

Mortality Case History

Calf No: Unmarked 17
Captured:

Sex: Male
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 27 June 1984
Carcass weight: 10.7 kg
Total length: 91 cm
Right hind foot length: 32.5 cm
New hoof length: 11.9 mm

Number of visual relocations:
Location: coastal plain east of Aichilik River
Distance from capture site:
Response time:

Carcass condition and disposition: Intact with blood stain lower left neck. Wolf observed near carcass site.

Necropsy findings: Carcass skinned - multiple tear wounds (4.6-14.5 mm diameter) on lower rib cage and neck. Extensive hemorrhage associated with wounds. Vegetation and milk curds present in stomach. Internal organs appear normal

Mortality category: Predation/scavenging involved, predation, wolf kill.

Mortality Case History

Calf No: Unmarked 18
Captured:

Sex: Male
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 29 June 1984
Carcass weight: 10.0 kg
Total length: 86 cm
Right hind foot length: 31.6 cm
New hoof length:

Number of visual relocations:
Location: coastal plain of north VABM Dar
Distance from capture site:
Response time:

Carcass condition and disposition: Intact near to location of radio-collared wolf. Tear wounds (2) on back (20 mm diameter). Blood stains around wounds.

Necropsy findings: Massive hemorrhage associated with tear wounds on back. Flesh wounds on underside of chest but no holes in skin. Elongate puncture of skull case behind left ear (4 x 12 mm). No corresponding puncture of skin over wound. Extensive hemorrhage in abdominal cavity. Milk curds in stomach, internal organs appear normal.

Mortality category: Predation/scavenging involved, predation, wolf kill.

Mortality Case History

Calf No: Unmarked 19
Captured:

Sex: Male
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 6 July 1984
Carcass weight: 18.1 kg
Total length: 104 cm
Right hind foot length: 40 cm
New hoof length: 13.1 mm

Number of visual relocations:
Location: foothills east of Egaksrak River
Distance from capture site:
Response time:

Carcass condition and disposition: Intact except for small holes torn on right rump (16.9 mm and 18.1 mm diameter). Carcass still warm, bleeding from wounds in skin. Golden eagle feeding on carcass when found.

Necropsy findings: Multiple round puncture wounds on right neck, rib cage and top of back (2.5-18.4 mm diameter). Massive hemorrhage associated with puncture wounds. Vegetation and milk curds in stomach, internal organs normal.

Mortality category: Predation/scavenging involved, predation, Golden eagle kill.

Mortality Case History

Animal No: Unmarked 20
Captured:

Sex: Adult cow and fetus
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 13 June 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations:
Location: coastal plain near Kongakut River
Distance from capture site:
Response time:

Carcass condition and disposition: Fetus partially extending (legs first) from vagina of dead cow, remainder of fetus in birth canal. Brown bear #1188 feeding on carcass. Cow observed alive previous day - did not stand up when aircraft passed overhead.

Necropsy findings: Not conducted

Mortality category: Predation/scavenging involved, brown bear predator/scavenger. Cause of death - complication during birth process - probable predisposition to brown bear predation.

Mortality Case History

Animal No: Unmarked 21
Captured:

Sex: Adult cow (antlerless)
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period

Number of visual relocations:

Mortality detected:
Carcass collected: 8 June 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Location:
Distance from capture site:
Response time:

Carcass condition and disposition: Lying on right side, 10% consumed. Brown bear feeding on right leg. Throat and left mandible chewed. Intestines extending out of hole in rear of carcass. No calf or fetus present.

Necropsy findings: NA

Mortality category: Predation/scavenging involved, brown bear kill, no indication of predisposition to predation.

Mortality Case History

Animal No: Unmarked 22
Captured:

Sex: Adult female
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 14 June 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations:
Location: coastal plain west of Ekaluakat River
Distance from capture site:
Response time:

Carcass condition and disposition: Found lying on left side, antlers present, udder not distended, hemorrhage from mouth and vagina. Right abdominal wall torn, avian feeding - right eye gone. One immature Golden eagle feeding on carcass when found. No calf or fetus present.

Necropsy findings:

Mortality category: Predation/scavenging involved, avian scavenger (Golden eagle), cause of death undetermined.

Mortality Case History

Animal No: Unmarked 23
Captured:

Sex: Adult cow
Location:

Weight:
Umbilicus condition:
Hoof condition:
Health Status:
Processing time:
Cow-calf reunion:

Total Length:
Right hind foot length:
New hoof length:

Estimated age at capture:

Signal Monitored:_____ times/_____day period
Mortality detected:
Carcass collected: 15 June 1984
Carcass weight:
Total length:
Right hind foot length:
New hoof length:

Number of visual relocations:
Location: coastal plain east of Aichilik River
Distance from capture site:
Response time:

Carcass condition and disposition: Lying on left side, 2 antlers, udder not distended, tongue and left eye gone. Hole in left rib cage, part of lungs and intestines consumed. Five Glaucous gulls feeding on carcass when found. No other indication of trauma. No calf or fetus present.
Necropsy findings:

Mortality category: Predation/scavenging involved, avian scavenging (Glaucous gulls), cause of death undetermined.

Appendix Table 1. Chronology of calving, calf mortality, udder distention, and antler retention of 31 radio-collared control cows in the Porcupine caribou herd, 1984[a]

Cow # and Status	May 30	May 31	June 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
BKY-0:																																
calf			N					N																								
udder			U					N																								
antlers (#)			0					0																								
BKY-1:																																
calf	N		N	Y				Y		Y		Y		Y		Y	Y								Y							
udder	U		Y	U				U		U		U		U		U	U								U							
antlers (#)	2		2	2				2		1		0		0		0	0								0							
BKY-5:																																
calf	N		N	N				N											Y													
udder	N		N	N				N											U													
antlers (#)	0		0	0				0											0													
BKY-6:																																
calf			N	N			N	N		Y		Y		Y		Y	Y							Y								
udder			U	U			Y	Y		U		U		U		U	U							U								
antlers (#)			2	2			2	2		2		1		0		0	0							0								
BKY-7:																																
calf	N		N					Y		Y																						
udder	U		U					U		U																						
antlers (#)	2		2					2		1																						
BKY-10:																																
calf	N		N	N		N		N		N		N		Y		Y	Y						Y		Y							
udder	U		U	U		U		U		U		U		U		U	U						U		U							
antlers (#)	2		2	2		1		1		1		0		0		0	0						0		0							
BKY-12:																																
calf	N			N				N		Y		Y		Y		Y	Y							Y		Y						
udder	U			Y				Y		U		U		U		U	U							U		U						
antlers (#)	2			2				2		0		0		0		0	0							0		0						
BKY-16:																																
calf	N							N		N		N		N		Y	Y															
udder	U							Y		Y		U		U		U	U															
antlers (#)	2							2		2		2		1		0	0															
BKY-18:																																
calf	N		N	N			Y		Y								Y	Y	Y				Y									
udder	U		U	Y			U		U								U	U	U				U									
antlers (#)	1		1	1			1		1								0	0	0				0									

Appendix Table 1. (Continued).

Cow # and	May		June																												
Status	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
BKY-19:																																
calf	N																		Died													
udder	U																														
antlers (#)	0																														
BKY-22:																																
calf																					Y											
udder																					U											
antlers (#)																					0											
BKY-23:																																
calf		N		Y	Y		Y	Y		Y		Y		Y		Y	Y							Y								
udder		U		U	U		U	U		U		U		U		U	U							U								
antlers (#)		2		2	2		2	0		0		0		0		0	0							0								
BKY-26:																																
calf			N	N				Y	Y			Y		Y		Y	N				Y	Y										
udder			U	U				U	U			U		U		U	U				U	U										
antlers (#)			2	2				2	0			0		0		0	0				0	0										
BKY-41:																																
calf	N							Y		Y											Y											
udder	Y							U		U											U											
antlers (#)	2							2		0											0											
BKY-42:																																
calf	N			Y		Y			Y		Y		Y		Y		Y		Y				Y	Y								
udder	U			U		U			U		U		U		U		U		U				U	U								
antlers (#)	2			2		2			0		0		0		0		0		0				0	0								
BY-1:																																
calf	N	N		Y	Y		Y			Y		Y		Y		Y	Y															
udder	U	U		U	U		U			U		U		U		U	U															
antlers (#)	2	2		2	2		2			0		0		0		0	0															
RY-4:																																
calf		N		N			N	N											N													
udder		Y		Y			U	U											U													
antlers (#)		0		0			0	0											0													
RY-29:																																
calf				N		N		Y				Y	Y		Y		Y		Y													Died
udder				U		U		U				U	U		U		U		U													
antlers (#)				2		2		2				1	0		0		0		0													

Appendix Table 1. (Continued).

Cow # and Status	May 30	May 31	June 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
GY-24:																																
calf		N	N	N		Y			Y		Y		N		N		N		N													
udder		U	U	U		U			U		U		U		U		U		U													
antlers (#)		2	2	2		2			0		0		0		0		0		0													
GY-25:																																
calf	N																				N											
udder	U																				U											
antlers (#)	0																				0											
GY-27:																																
calf			N					N													N											
udder			U					U													U											
antlers (#)			0					0													0											
PY-49:																																
calf		N	N					Y		Y									Y		Y				Y							
udder		U	U					U		U									U		U				U							
antlers (#)		2	1					1		1									0		0				0							
PY-67:																																
calf			N	N													N	N														
udder			N	U													U	U														
antlers (#)			0	0													0	0														
PY-69:																																
calf				Y			Y		Y			Y		Y		Y	Y							Y								
udder				U			U		U			U		U		U	U							U								
antlers (#)				2			2		1			1		0		0	0							0								
PB-86:																																
calf	N	N		Y	Y		Y	Y		Y		Y		Y		Y							Y									
udder	U	U		U	U		U	U		U		U		U		U							U									
antlers (#)	2	2		2	2		2	2		0		0		0		0							0									
PB-87:																																
calf		N		N				N										N														
udder		U		U				U										U														
antlers (#)		0		0				0										0														
W2:																																
calf		N		Y			Y		Y				Y		Y		Y		Y				Y		Y							
udder		U		U			U		U				U		U		U		U				U		U							
antlers (#)		2		0			0		0				0		0		0		0				0		0							

Appendix Table 1. (Continued).

Cow # and Status	May 30	May 31	June 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
W7:																																
calf		Y		Y			Y		Y				Y		Y		Y		Y					Y		Y						
udder		U		U			U		U				U		U		U		U					U		U						
antlers (#)		2		0			0		0				0		0		0		0					0		0						
W9																																
calf		N		Y			Y						Y		Y		Y		Y				Y			Y						
udder		U		U			U						U		U		U		U				U			U						
antlers (#)		0		0			0						0		0		0		0				0			0						
W13:																																
calf			N	N			N	Y	Y				Y		Y		Y		Y					Y								
udder			U	U			Y	U	U				U		U		U		U					U								
antlers (#)			2	2			2	2	2				0		0		0		0					0								
W15:																																
calf			N	N			N	N		N		N		N		N		N						N								
udder			U	U			N	U		Y		Y		N		N		U						U								
antlers (#)			2	2			2	2		2		2		0		0		0						0								

[a]N=no; Y=yes; U=undetermined.

ARCTIC NATIONAL WILDLIFE REFUGE COASTAL PLAIN
RESOURCE ASSESSMENT

1984 UPDATE REPORT BASELINE STUDY OF THE FISH, WILDLIFE, AND THEIR HABITATS

Section 1002C
Alaska National Interest Lands Conservation Act

Edited by
Gerald W. Garner and Patricia E. Reynolds

U.S. Department of the Interior
U.S. Fish and Wildlife Service
Region 7
Anchorage, Alaska
March 1985