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CALVING DISTRIBUTION, INITIAL PRODUCTIVITY, AND NEONATAL MORTALITY OF THE PORCUPINE CARIBOU HERD, 1985

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Abstract: This report presents information collected during the third year of a 3 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 57 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 Hulahula River in Alaska to approximately the Babbage River in Canada. A major concentration of calving activity occurred on the coastal plain and foothills from the Hulahula River to the Ekaluakat River. A second concentration area occurred on the coastal plain south of Stokes Point in Canada. The peak of calving occurred on 31 May - 1 June which was slightly earlier than previous years. Thirty-eight of 56 (68%) radio-collared females 3 years old or older produced calves, and initial productivity appeared to be similar to that of recent years. During 2-5 June, 66 calves were captured in the Jago River - Aichilik River calving concentration area, and fitted with mortality sensing radio-transmitters. Radio frequencies were monitored at least daily and visual checks were made every 48h during 2 June - 1 July. Monitoring was less intense during the remainder of July and continued on a monthly basis through 1984. Thirty-eight productive radio-collared females were monitored as a control group on 1-3 day intervals during 27 May-27 June. During 2 June-3 September, 14 study calves died. Four calves died as a result of study-induced abandonment. Two radio-transmitters apparently failed soon after installation. The natural mortality rate of the remaining calves was 16.8%. Categories of natural mortality included: mammalian predation (brown bear, Ursus arctos and wolf Canis lupus), 30%; avian predation (golden eagle, Aquila chrysaetos), 30%; undetermined predation, 10%; natural starvation, 10%; disease, 10%, and undetermined causes, 10%. 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/foothlls areas in Alaska, and may be attributed to generally higher concentrations 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, but were not investigated prior to this report.

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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 ANWR for calving, post-calving aggregations, and insect relief activities during the spring and summer (U.S. Fish and Wildife Service 1982). Parturient female caribou and post-parturient females with young calves are sensitive to disturbances 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, Whitten and Cameron 1985). 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 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 between areas or habitat types, in order to assess the 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 U.S. Fish and Wildlife Service (USFWS and the Alaska Department of Fish and Game (ADF&G).

Objectives for this study were:

A. Primary

1. Delineate calving distribution of the Porcupine caribou herd and identify 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 over-winter 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 was conducted concurrently with studies of the status (population size and trend), over-winter 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 part of a comprehensive environmental inventory and assessment of the potential petroleum development area of ANWR. This report presents preliminary findings of the 1985 field season.

Methods and Materials

Study Area

The study area was located on the north slope of ANWR extending east to the Blow River in Canada and south to the southern slopes of the Brooks Range, depending on annual variation in caribou distributions. In 1985, the study area extended from the Sadelrochit River on the west, to the Babbage River in Canada on the east, and from the Beaufort Sea coastline on the north, to the southern slopes of the Brooks Range on the south.

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.

Low-level transects across the calving grounds between the Aichilik River and Barter Island were flown using fixed-wing aircraft on 30 and 31 May. All caribou within approximately 300 m of the flight line were counted and classified as either newborn calves or adults.

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 2 areas with higher densities of calving females. The first capture area was located about 20 - 50 km inland from the coast on either side of the Jago River and coincided with the historic "core" calving region of the Porcupine herd. This area included flat, wet coastal plain in the north, and rolling hills and tussock tundra in the south. The second capture area was along both sides of the Aichilik River where it emerges from the Brooks Range mountains. Most of this area was rolling hills with tussock tundra, but it also included some riparian habitat within the higher mountains (Fig. 1). This capture area is sometimes considered a peripheral calving area for the Porcupine herd.

Caribou groups were approached by helicopter (Bell Jet Ranger 206B) with a capture crew of 3 persons aboard. The helicopter landed approximately 200 m from the caribou and 1 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, 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 break away after the last expansion fold was used. Collars were dyed brown as in 1984. All collars were stored in plastic bags with local soil and vegetation for 24 hours prior to placement on calves (Garner et. al 1985b).

Aircraft (PA-18) equipped with standard radio tracking equipment were used to monitor instrumented calves, locate mortalities, and determine calf locations and movements. The capture crew in the helicopter occasionally observed an immediate reunion of the calf with its dam, however, aerial relocation and visual checks of all marked calves were made at 1-3 h time intervals following release to determine if the dam rejected the calf. All calf radio frequencies were monitored for mortality signals at least once daily and visual locations or location to caribou group were made for each calf every other day from 2 June through 7 July 1985. Relocation surveys were conducted on a monthly basis from July through December 1985. 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 was noted and collected. Each carcass was placed in a plastic 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 locations of retrieved carcasses were 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. 1987, Weiler et al. 1987, Mauer 1987).

Initial productivity and subsequent mortality of calves from 57 3+ year-old cows and 8 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 1985 as they arrived on the calving grounds and their locations were plotted on 1:250,000 scale topographic maps. Parturition 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 h basis until approximately 27 June.

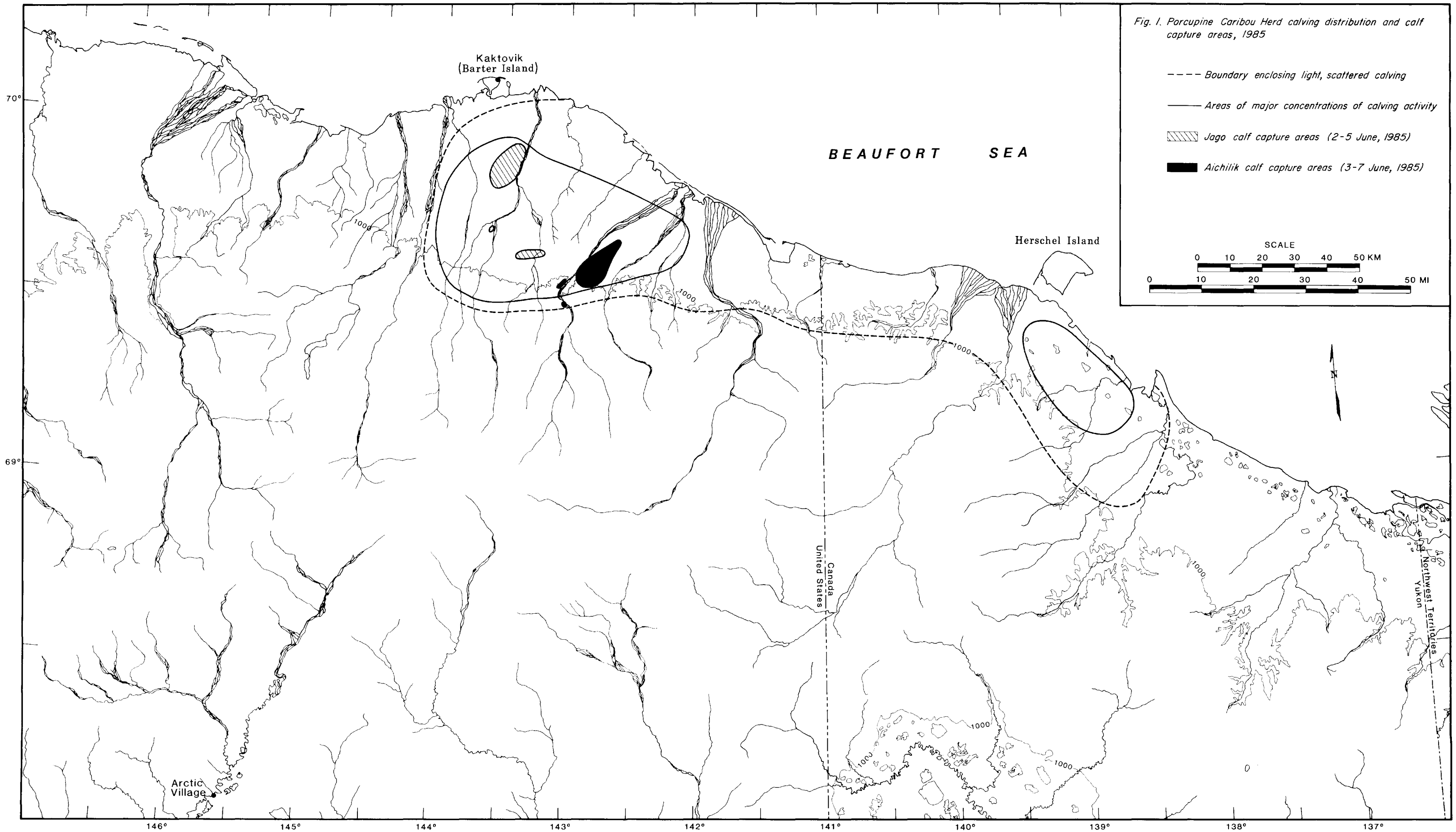

Fig. 1. Porcupine Caribou Herd calving distribution and calf capture areas, 1985

- - - - *Boundary enclosing light, scattered calving*

——— *Areas of major concentrations of calving activity*

Jago calf capture areas (2-5 June, 1985)

Aichilik calf capture areas (3-7 June, 1985)

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.	A. Scavenging
1. Bones gnawed and chewed, feeding pattern generally not restricted to the upper portion of carcass.	1. Mammalian scavenger (return to I.1 to determine cause of death)
2. Bones not chewed, feeding limited to upper portions of carcass.	2. Avian scavenger (return to I.1 to determine cause of death)
3. Neither of the above, or some characteristics from both.	3. Undetermined

Table 1. (Continued).

Criterion	Category
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
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.	c. Undetermined predator

Results and Discussion

Calving Distribution and Initial Productivity

In spite of deep snow on the Alaskan winter ranges and on the southern slope of the Brooks Range, spring migration of the Porcupine herd followed traditional routes with no noticeable delays. Caribou from the Chandalar wintering area moved north and east through the Sheenjek and Coleen drainages into the Firth River valley. Many first crossed the Continental Divide into the upper Kongakut River valley, but most of those left the Kongakut River where it turns north and crossed into the Firth River valley before heading toward the coastal plain. A few moved directly north from the Kongakut River and down the Aichilik River to the calving grounds. The latter movement is essentially the reverse of the mid-summer southward movement taken by as much as 1/3 of the herd in recent years. For most caribou, however, spring migration does not retrace the route taken in fall. Fall movements often entail abrupt reversals of direction followed by staging in various areas before finally heading toward winter range. The spring migration tends to be more directed, though there may be pauses, especially when deep snow areas temporarily inhibit travel. Thus, even though most sections of the spring routes may also be traveled in the fall, the routes used by caribou to reach the wintering areas and those followed north to the calving grounds are different.

Many caribou had reached the Continental Divide by about 20 April, while some radio-collared females remained far south on winter range until May. Once caribou reached the windswept valleys north of the crest of the Brooks Range and in the British Mountains, they had easy access to the coastal calving areas. Many cows were already on the traditional high-density calving area near the Jago River by 28 May, although others remained scattered eastwards across the coastal plain and foothills to the British Mountains. As in previous years (Whitten et al. 1984, 1985a), pregnant cows toward the rear of the migration kept moving north and westward during the first week of June. Thus the distribution of collared cow calving sites was skewed much farther west than the distribution of parturient cows at the onset of the calving period (Fig. 2 and 3).

Some cows did not follow the westward shift toward the Jago River during spring migration and calving, but instead moved toward the low, rolling hills south of Herschel Island and near Stokes Point in the Yukon Territory. Thus this region became an area of relatively high calving density that was isolated from the high density calving areas farther west (Fig. 1). A similar pattern occurred in 1984 (Whitten et al. 1985a) and in previous years (U.S. Fish and Wildlife Service 1982). Non-pregnant females and yearlings stayed mainly at the rear of the calving migration in the east and south; males were mostly on the south side of the British Mountains.

Peak of calving among radio-collared cows was between 30 May and 1 June (Fig. 4). Transects flown across the high density calving areas near the Jago River indicated 25% calves among 76 caribou on 30 May and 17% among a sample of 192 on 31 May. Surveys at the same time in earlier years found about 20 - 25 % calves, and the peak of calving in both 1983 and 1984 was between 2

and 6 June. The relatively advanced age of calves captured on 2 and 3 June 1985 compared with those captured on 3, 4, and 5 June in 1983 and 1984 (Whitten et al. 1984, 1985a) suggests that the peak of calving was earlier in 1985.

Among radio-collared cows, 15 of 25 (60%) 3-year olds and 23 of 31 (74%) aged 4 years or older gave birth to calves in 1985. These rates did not differ significantly (x^2=0.89, df=1, P > 0.05). One of 8 (13%) 2-year olds gave birth, but lost its calf within 24 h. In previous years, no 2-year olds produced calves, (Whitten et al. 1984,1985a) and the present data also indicate that 2-year olds do not contribute significantly to herd productivity, at least under current and recent conditions. Initial productivity among collared cows 3-years old or older has not differed significantly over the past 4 years (67%, 78%, 74%, and 67% in 1982 -1985, respectively; X^2=1.52, df=3, P > 0.05).

Calf Capture

On 2 June, 30 calves were captured and fitted with radio-collars in the core calving concentration area along the Jago River, (15 on thaw-lake plains between the Jago and Okpilak Rivers, and 15 on uplands between the Jago and Okerokovik Rivers). An additional 29 calves were captured on the eastern periphery of the core calving concentration along the Aichilik River on 3 June (Fig.1). Seven calves were subsequently captured (2 on the Jago uplands, 5 on the Aichilik foothills) during 5 to 7 June to replace those lost to early mortality.

Cumulative time required for capture operations to search, capture, process and release 66 calves was 5 h 55 min. Average search/capture/procesing time was 5.38 min with processing time averaging 1.65 min. and search/capture averaging 3.73 min. Monitoring techniques using fixed-wing aircraft were used to document reunions and/or cases of study-induced mortality.

The average weight for all calves captured (Table 2) was 7.75 kg. Males were heavier, 7.89 kg vs. 7.59 kg for females. The average estimated age of captured calves was 2.47 days old. There were 36 males and 30 females (1.2 males:1 female).

Calf Mortality

A total of 14 study calf mortalities were detected and investigated between 4 June and 3 September 1985 (Table 3). An additional 8 mortality signals were detected from September 1985 through January 1986, however, investigations of their status was completed prior to this report. Case histories for each investigated mortality are included in Appendix I.

Four of 66 calves captured may have died due to abandonment after capture (Table 3). Study-induced mortality (abandonment by the dam or predisposition of calf to predation, etc.) is inherent using radio-transmitter study techniques. Transfer of foreign scent (human on calf) appears to increase study-induced

Fig. 2. Locations of post-partum radio-collared females of the Porcupine Caribou Herd, 1985.

● collar number/date calf was first observed

SCALE
0 10 20 30 40 50 KM
0 10 20 30 40 50 MI

Kaktovik
(Barter Island)

BEAUFORT SEA

Herschel Island

RY4/30 May
GY24/1 June
BKY42/8 June
BKY26B 2 June
PY59/3 June
BKY0/30 May
PY67/31 May
PB86/30 May
PB76/6 June
PB84/30 May
PB90/30 May
PY48/1 June
W2/7 June
S10/31 May
PY68/5 June
S15/7 June
PB83/30 May
BKY23/31 May
BKY16/4 June
W15/1 June
S9/6 June
PB72/31 May
S14/30 May
PY45/1 June
W24/7 June
PB74/30 May
PY62/28 May
PB81/28 May
BKY22/27 May
BKY41/31 May
PY64/9 June
BKY7/9 June
S11/29 May
S12/3 June
S13/9 June
PB71/1 June

100
1000

70°
69°
146° 145° 144° 143° 142° 141° 140° 139° 138° 137°

Canada
United States

Northwest Territories
Yukon

Arctic Village

N

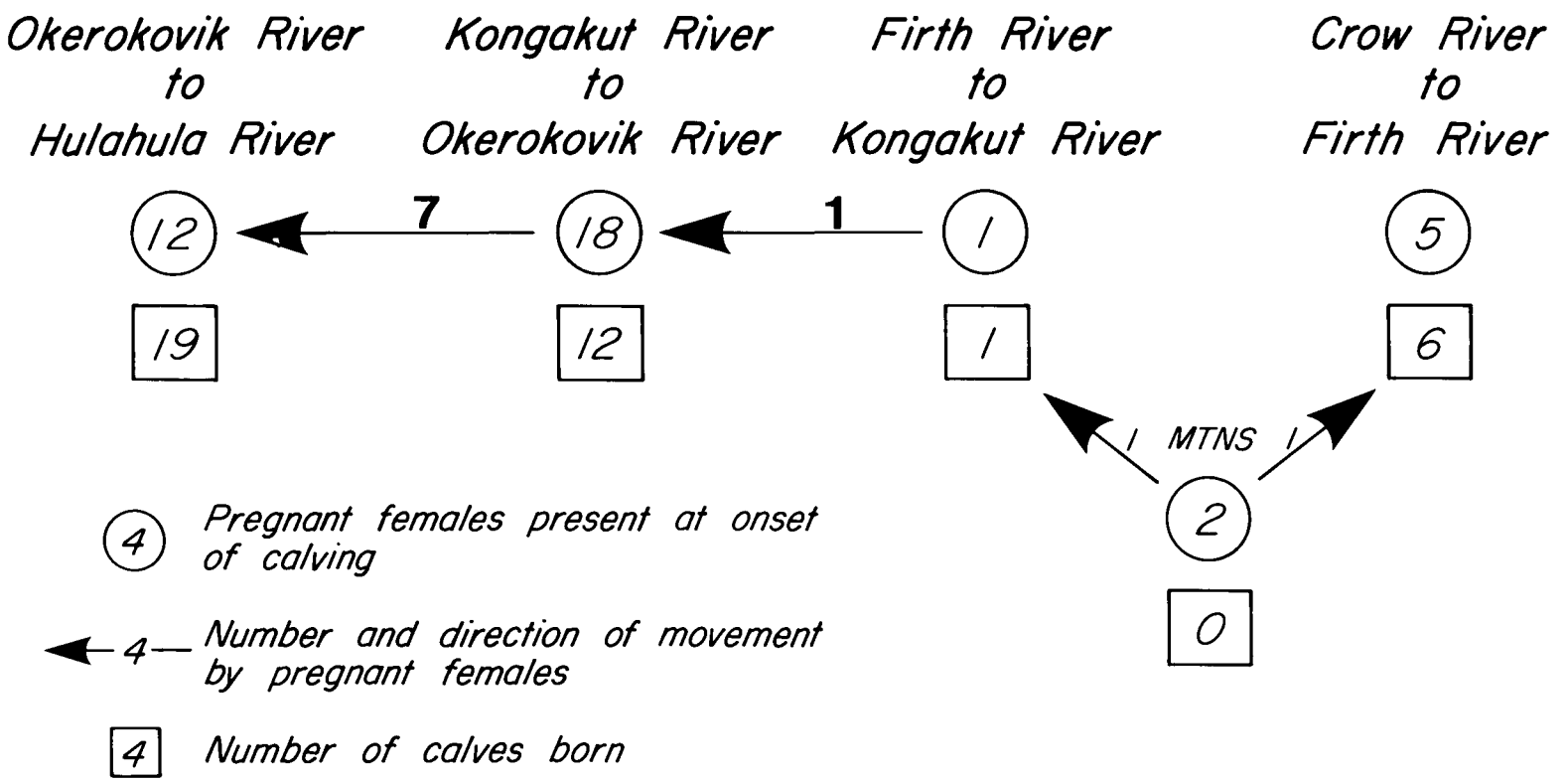

Fig. 3. Schematic representation of movements by pregnant radio-collared female caribou during the 1985 calving season.

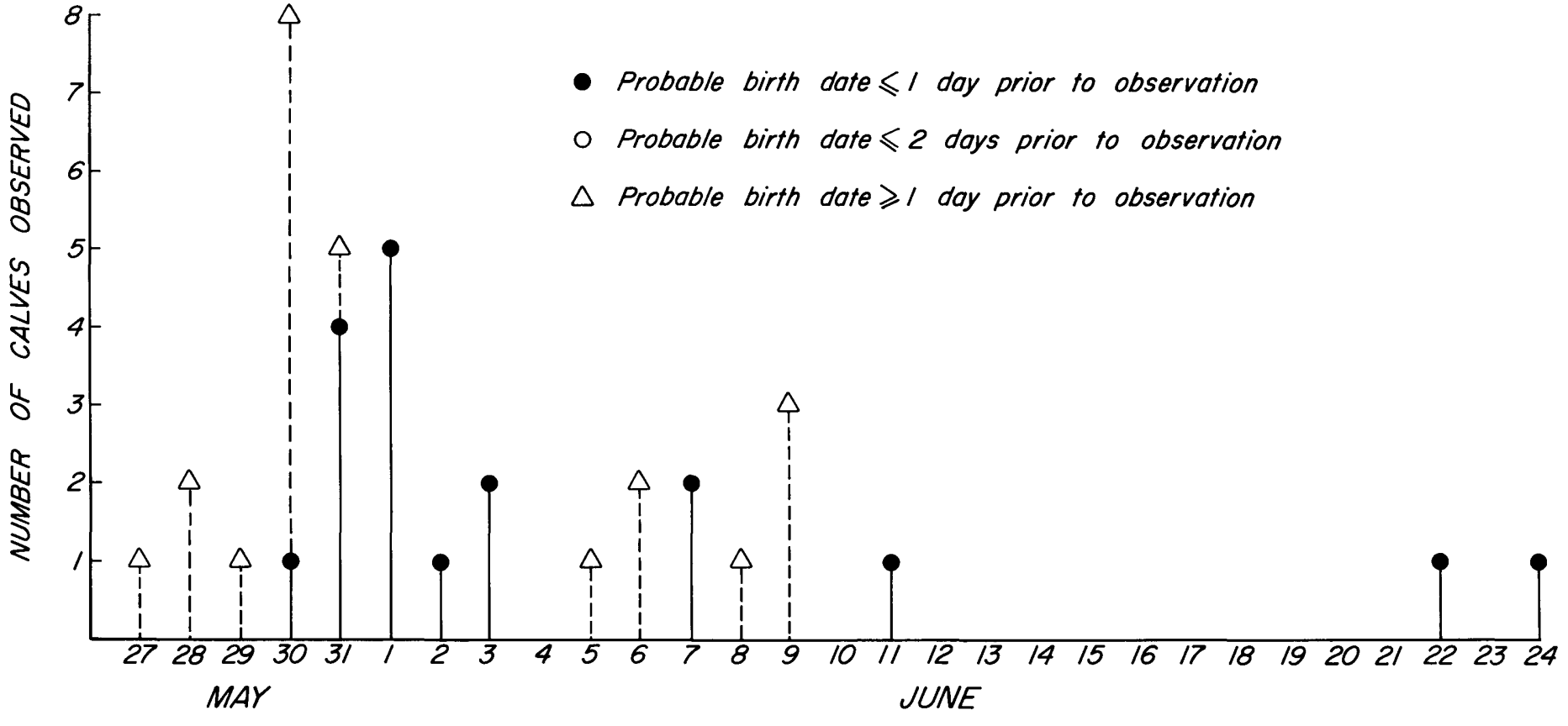

Fig. 4. Dates when newborn calves of 37 radio-collared cows were first observed, Porcupine caribou herd, 1985.

Table 2. Physical characteristics and survival related observations of radio-collared caribou calves, Arctic National Wildlife Refuge, 1985.

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 Jan 1986
1	3 June 85	Aichilik Fths.	M	7.4	93	33.0	7.2	Dry	H/W	2	1.75	Dead (19 June)
2	3 June 85	Aichilik Fths.	M	8.4	79	34.0	7.7	Absent	H/W	3	1.52	Alive
3	3 June 85	Aichilik Fths.	M	7.6	83	33.0	7.2	Dry	H/W	2	1.30	Dead*(October)
4	3 June 85	Aichilik Fths.	M	7.6	92	34.5	7.2	Absent	H/W	3	1.17	Alive
5	3 June 85	Aichilik Fths.	F	7.0	90	33.0	7.3	Dry	H/W	2	1.26	Alive
6	3 June 85	Aichilik Fths.	M	8.9	97	36.5	7.5	Dry	H/W	2	1.32	Dead*(October)
7	3 June 85	Aichilik Fths.	F	7.6	89	34.0	7.4	Absent	H/W	3	N/A	Dead*(September)
8	3 June 85	Aichilik Fths.	F	9.1	97	36.0	7.6	Dry	H/W	2	5.10	Alive
9	3 June 85	Aichilik Fths.	M	8.0	85	34.5	7.6	Absent	H/W	3	2.10	Alive
10	3 June 85	Aichilik Fths.	F	10.1	102	37.5	8.7	Dry	H/W	4	1.42	Alive
11	3 June 85	Aichilik Fths.	M	6.8	79	34.0	7.9	Moist	PH/W	2	1.18	Alive
12	5 June 85	Aichilik Fths.	M	6.2	78	32.0	8.3	Moist	PH/W	2	N/A	Dead (8 June)
13	3 June 85	Aichilik Fths.	F	5.9	79	32.0	6.0	Dry	PH/W	2	1.32	Alive
14	3 June 85	Aichilik Fths.	F	7.6	84	34.0	7.3	Dry	H/W	2	2.35	Alive
15	3 June 85	Aichilik Fths.	M	8.8	92	36.0	8.0	Absent	H/W	4	N/A	Alive
16	3 June 85	Aichilik Fths.	M	7.6	89	35.0	7.3	Absent	H/W	3	1.57	Alive
17	3 June 85	Aichilik Fths.	M	6.5	78	33.0	8.1	Moist	PH/W	2		1.05Alive
18	3 June 85	Aichilik Fths.	F	7.5	86	35.5	8.6	Dry	PH/W	3	1.15	Alive
19	3 June 85	Aichilik Fths.	M	6.8	87	34.5	7.4	Moist	PH/W	1	1.34	Alive
20	3 June 85	Aichilik Fths.	M	9.4	91	37.0	8.0	Dry	H/W	2	1.56	Dead (5 June)
21	3 June 85	Aichilik Fths.	M	8.6	87	36.0	8.2	Dry	H/W	3	1.15	Alive
22	3 June 85	Aichilik Fths.	F	6.9	85	33.0	7.4	Absent	PH/W	2	1.09	Dead*(January)
23	3 June 85	Aichilik Mtns.	F	8.5	89	34.0	9.1	Dry	H/W	4	1.36	Dead (5 June)
24	3 June 85	Aichilik Mtns.	F	9.2	92	34.5	8.0	Dry	H/W	3	1.18	Dead (5 June)
25	3 June 85	Aichilik Fths.	F	8.9	90	37.0	7.2	Dry	H/W	2	N/A	Alive
26	3 June 85	Aichilik Fths.	M	11.9	101	36.0	9.1	Absent	H/W	4	1.40	Alive
27	3 June 85	Aichilik Fths.	M	9.0	94	35.5	8.3	Dry	H/W	3	1.20	Dead (5 June)
28	3 June 85	Aichilik Fths.	F	7.5	87	32.0	7.7	Dry	H/W	2	1.45	Alive
29	3 June 85	Aichilik Fths.	F	6.8	83	35.0	8.6	Bloody	PH/SW	1	N/A	Alive
30	3 June 85	Aichilik Fths.	M	8.0	88	36.0	7.8	Dry	H/W	2	N/A	Alive
31	2 June 85	Jago C.P.	F	7.4	82	31.0	7.7	Absent	H/W	3	5.00	Alive
32	2 June 85	Jago C.P.	M	7.5	84	34.0	7.8	Moist	PH/W	2	2.02	Alive
33	2 June 85	Jago C.P.	M	6.9	82	32.0	8.2	Dry	PH/W	3	2.09	Dead (5 June)
34	2 June 85	Jago C.P.	M	7.9	84	34.5	8.4	Moist	PH/W	2	1.50	Alive
35	2 June 85	Jago C.P.	F	8.2	88	34.5	8.7	Dry	H/W	4	1.46	Alive
36	2 June 85	Jago C.P.	F	7.5	79	34.0	7.4	Dry	PH/W	2	1.32	Dead (24 June)
37	2 June 85	Jago C.P.	F	7.7	84	34.0	7.5	Dry	H/W	2	1.49	Dead*(October)
38	2 June 85	Jago C.P.	F	8.4	88	35.5	8.4	Dry	H/W	3	1.27	Alive

Table 2. (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 Jan. 1986
39	2 June 85	Jago C.P.	M	7.6	88	34.5	8.0	Dry	PH/W	2	1.35	Alive
40	2 June 85	Jago C.P.	M	7.4	82	34.5	7.4	Dry	PH/W	2	1.41	Dead (20 June)
41	2 June 85	Jago C.P.	M	7.1	76	33.5	8.5	Bloody	PH/W	1	1.35	Alive
42	2 June 85	Jago C.P.	M	7.7	82	35.0	8.5	Dry	H/W	3	N/A	Alive
43	2 June 85	Jago C.P.	F	6.7	80	32.5	8.2	Dry	H/W	3	1.31	Alive
44	2 June 85	Jago C.P.	M	8.0	84	36.0	7.6	Moist	H/W	2	1.35	Alive
45	2 June 85	Jago C.P.	F	6.9	82	34.0	9.0	Dry	H/W	4	2.10	Alive
46	2 June 85	Jago Fths.	F	8.1	92	35.5	7.4	Absent	H/W	3	1.48	Alive
47	2 June 85	Jago Fths.	M	6.6	81	33.5	7.1	Moist	PH/W	1	2.22	Alive
48	2 June 85	Jago Fths.	F	6.6	85	33.5	7.3	Absent	PH/W	3	1.30	Alive
49	2 June 85	Jago Fths.	F	9.1	91	37.0	7.7	Absent	PH/W	3	1.54	Alive
50	2 June 85	Jago Fths.	M	8.3	90	35.0	7.8	Absent	H/W	3	1.57	Dead (5 June)
51	2 June 85	Jago Fths.	F	5.5	77	32.0	6.8	Dry	PH/W	2	1.36	Alive
52	2 June 85	Jago Fths.	M	8.4	87	37.0	7.6	Absent	H/W	3	1.45	Alive
53	2 June 85	Jago Fths.	F	6.9	81	33.0	7.2	Dry	H/W	2	2.06	Alive
54	2 June 85	Jago Fths.	M	7.6	87	34.5	8.2	Moist	PH/W	2	1.49	Alive
55	2 June 85	Jago Fths.	F	8.2	98	35.0	7.3	Dry	H/W	2	2.11	Dead*(December)
56	2 June 85	Jago Fths.	M	6.4	87	33.0	6.7	Bloody	PH/W	1	1.42	Dead (24 June)
57	2 June 85	Jago Fths.	M	7.8	88	34.5	7.7	Absent	H/W	3	1.43	Alive
58	2 June 85	Jago Fths.	M	7.4	89	33.5	8.3	Moist	N/A	2	2.45	Dead*(December)
59	2 June 85	Jago Fths.	F	8.0	84	33.5	7.9	Moist	PH/SW	2	2.50	Alive
60	2 June 85	Jago Fths.	M	7.6	78	34.0	7.1	Absent	H/W	3	N/A	Dead (24 June)
61	5 June 85	Jago Fths.	M	8.4	83	34.0	7.7	Absent	H/W	3	N/A	Alive
62	5 June 85	Jago Fths.	M	7.6	84	36.0	7.4	Dry	H/W	2	1.40	Alive
63	5 June 85	Aichilik Fths.	M	10.5	94	35.5	8.0	Absent	H/W	3	1.55	Alive
64	5 June 85	Aichilik Fths.	F	7.1	84	34.0	7.5	Absent	PH/W	3	1.45	Dead*(October)
65	6 June 85	Aichilik Fths.	F	6.8	79	34.0	7.4	Dry	H/W	2	1.35	Dead (31 August)
66	7 June 85	Aichilik Fths.	F	6.1	83	33.0	7.3	Dry	H/W	2	2.15	Dead (15 June)
		Male Averages		7.89	86.2	34.6	7.80			2.39		
		Female averages		7.59	86.	34.1	7.72			2.57		
		Overall averages		7.75	86.25	34.4	7.76			2.47	1.65	

[a] H=hardened; PH=partially hardened; S=soft; W=hooves worn; SW=slightly worn.

[b] Age rounded to nearest whole day.

*Mortality detected but not confirmed by ground investigation.

mortality rates (Whitten et al. 1984). The use of sterile latex gloves, holding captured calves away from contact with the capture crew, and scenting the collars with natural moss and soil (Dickinson et al. 1980) and dying collars brown prior to deployment or redeployment on calves helped to minimize foreign sight and scents. Study-induced mortalities in 1985 were low compared to earlier years of this study (Whitten et al. 1984 and 1985a). Any further studies of caribou calf mortality using radio-collaring techniques should also employ the same capture and handling procedures to minimize study-induced mortality.

Table 3. Probable causes of mortality for 14 of 66 radio-collared caribou calves between 4 June and 3 September 1985.

Category	Number or Calves	% Total Mortality
I. Predation - excluded mortality		
1. Starvation		
a. probable study-induced abandonment	2	14.3
b. probable natural starvation	1	7.1
2. Disease (congenital)	1	7.1
3. Undetermined cause	1	7.1
II. Predation and/or scavenging involved		
1. Predation		
a. Predator kill and other factors		
1. Mammal predator/study-induced abandonment	2	14.3
b. Predator kill		
1. Golden eagle kill	3	21.4
2. Mammalian predator, probable wolf	2	14.3
3. Mammalian predator, undetermined	1	7.1
4. Undetermined predator (brown bear/golden eagle)	1	7.1
TOTALS	14	99.8%

Two calf transmitters failed during June, leaving 60 calves for which natural mortality rate could be calculated; 10 (16.8%) died between 3 June and 3 September, 1985 (Table 4). Nine calves (15%) died on the calving and post-calving areas, and 1 died during late summer south of the continental divide. Previous levels of natural mortality among radio-collared neonates on the calving and post-calving habitats were 15.4% in 1983 and 6.6% in 1984 (Whitten et al. 1984, 1985a).

Predation was the cause for 70% of the natural mortality in 1985. Other natural causes (starvation and disease) each accounted for 10% of mortality and the probable cause of mortality could not be determined 10%. Predation by mammalian

Table 4. Proportions of observed natural mortalities occurring among radio-collared caribou calves during 4 June to 3 September 1985.

Mortality category	Number of calves	Proportion (%) of sample calves	Proportion of natural mortality
Mammalian predation	3	5.0	30.0
Golden eagle predation	3	5.0	30.0
Undetermined predation	1	1.7	10.0
Natural starvation	1	1.7	10.0
Disease (congenital)	1	1.7	10.0
Undetermined	1	1.7	10.0
TOTALS	10	16	100%

predators (brown bears and wolves) accounted for 3 of 7 predation - related mortalities. In 2 of these, wolves were suspected as the probable cause. The remaining case of mammalian predation could not be differentiated between brown bear or wolf. There was also one case in which differientiation between brown bear and golden eagle as primary predator could not be established. Brown bears were relatively common on the calving grounds during the calving season. The movements of radio-collared brown bears to the calving grounds generally coincided with arrival of the cows at calving time (Garner et al. 1987). In spite of 12 known wolf mortalities from a minimum 1984 fall population of 34 adult wolves associated with the northern portion of ANWR, the incidence of wolf observations on the calving/post-calving habitats of the PCH did not decline sharply over those of 1984 (Weiler et al. 1987). Three radio-collared calves were killed by golden eagles. The abundance of golden eagles appeared to be similar to that recorded in previous years (Whitten et al. 1984, Mauer 1985, 1987).

Natural starvation was the probable cause of death of 1 radio-collared calf. This calf apparently became temporarily separated from the dam, was unable to suckle or was not allowed to suckle. One radio-collared calf apparently died because of congenital defects (abnormal heart) and pneumonia complications. This is the first such case documented in 235 radio-collared calves over the past 4 years. In one case the mortality could not be determined, but was due to natural causes.

The chronology of natural mortality of radio-collared calves followed a pattern similar to that of the 2 previous years (Fig 5.) (Whitten et al. 1984, 1985a). Natural mortality was high during the first month of life (n=9), then decreased sharply during summer (n=1) and increased during fall (n=8).

Twenty-five carcasses of unmarked calves were collected from areas utilized by calving and post-calving caribou between 30 May and 30 June 1985. 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 10 (40%) were killed by golden eagles; 6 (24%) died of starvation/pneumonia; 3 (12%) died of undetermined disease; 1 (4%) died of exposure; 2 (8%) were probably killed by wolves; 1 (4%) was apparently trampled by an adult caribou; 1 (4%) had

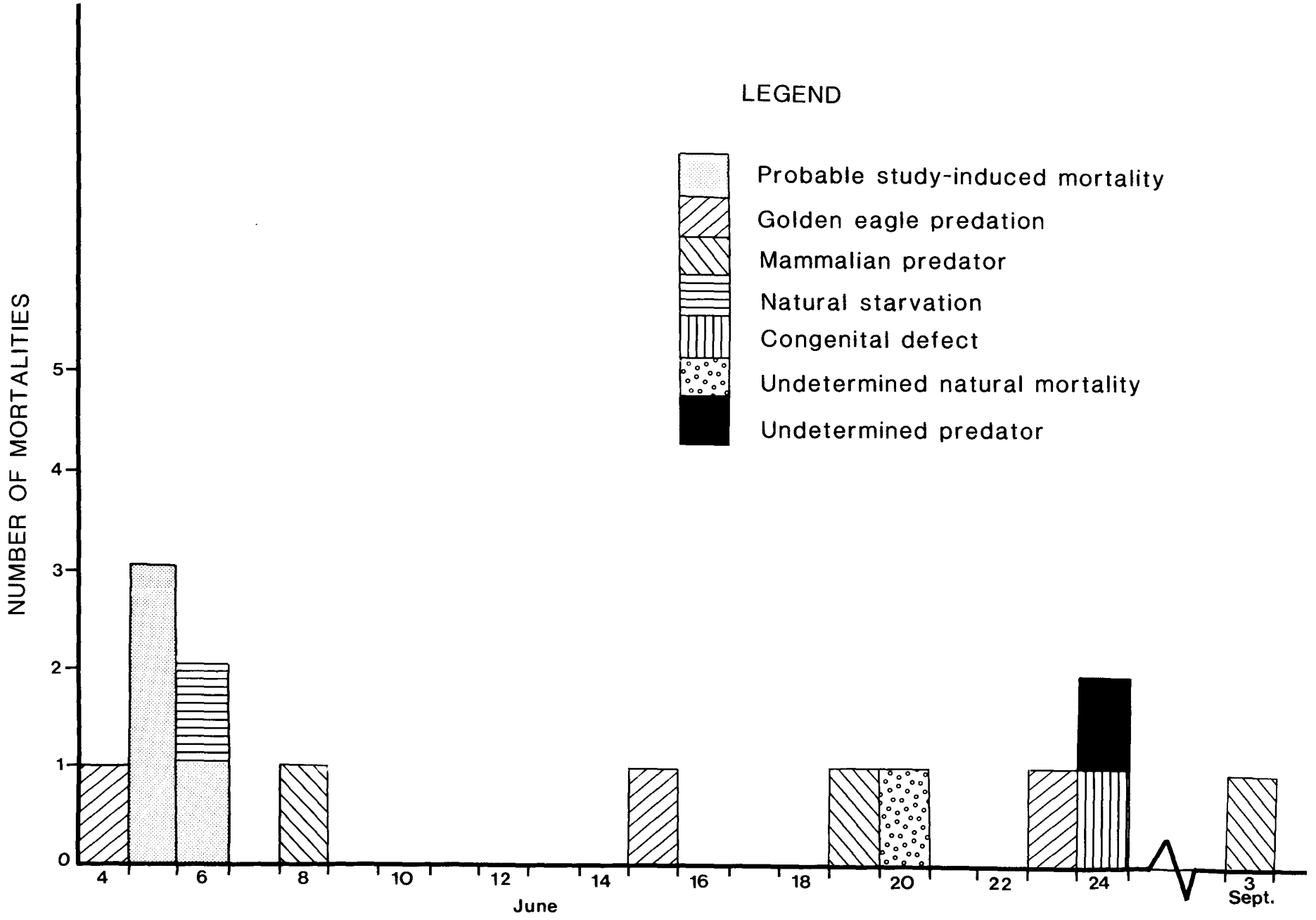

Fig. 5. Chronology of observed mortalities among 14 radio-collared calves, Porcupine caribou herd, 1985.

an abnormally low birth weight (weak/non-viable); and the cause of 1 mortality could not be determined.

Eighty percent of the natural mortality among radio-collared calves occurred in foothills and mountainous terrain located in the eastern and southern portions of the calving/post-calving habitats during the intensive study period (Fig 6). The distribution of mortality sites of unmarked calves and adults found during field operations was also greater in these areas (Fig 6). This geographic relationship is consistent with results from the previous 2 years (Whitten et al. 1984, 1985a), which also indicated a preponderance of mortality occurring in the southern and eastern foothills/mountains. Field studies of brown bears (Garner et al. 1984, 1985, 1987), wolves (Weiler et al. 1985, 1987), and golden eagles (Mauer 1985, 1987) indicate a greater abundance of these predators in the foothill/mountain zone.

Natural mortality of radio-collared calves during the calving/post-calving period (2 June - 1 July) was 15.0%. Calves born to radio-collared females aged 3 years or older had a higher mortality rate, (24.3%) for the same period. The calf mortality rate measured by control cows includes still-born calves, a factor of mortality not measured using the radio-collared calf technique. Excluding still-born mortality, the control rate (17.1%) did not differ significantly from the mortality rate among collared calves (X^2=0.07, df=1, P > 0.05). A similar pattern for radio-collared calves and control calves (17.5% vs, 27.8%), respectively, was recorded in 1983 when calving distribution (Jago River foothills) was similar to that of 1985 (Whitten et al. 1984). In 1984, mortality of both radio-collared calves (7%) and control calves (4.4%) was lower (Whitten et al. 1985a). Calving distributions in 1984 differed in that a major concentration occurred along the Niguanak River (approximately 10-15 km north of foothills calving areas), and in the Aichilik River foothills. Movement of nursery groups following calving in 1983 and 1985 during the immediate post-calving period (10 - 20 June) was southward towards the foothills and mountains (Whitten et al. 1984). In contrast, the 1984 Aichilik calving distribution shifted northwesterly onto the coastal plain and merged there with the Niguanak distribution (Whitten et al. 1985a). These observations further support the observation that habitats more distant or northerly from the southern/southeastern foothills and mountains zone may afford greater advantages to calf survival.

Movements

Marked calves in both the Jago and Aichilik capture areas, remained near capture sites during the first 48-72 hours after capture. Both upland tussock meadows and riverine habitats were used by radio-collared calves and their dams. Calves of the Jago area gradually moved in southerly, westerly and northwesterly directions, while the Aichilik calves moved primarily southwest and west. A unified movement to higher elevations to the south and southwest by the Jago group occurred during and immediately following a snowfall on 10 June. The Aichilik group also shifted more toward the southwest. By 18 June members of the Jago group extended as far west as the Sadlerochit River and the Aichilik group extended west to the Okpilak River Riparian areas along the Salderochit River were used extensively at this time. On 19 June nearly all members of both

Fig. 6 Locations of investigated caribou mortality sites[1] (27 May - 1 July, 1985)

- ● *Radio-collared calves*
- ▲ *Unmarked calves*
- ■ *Unmarked adults*
- *2 Calf number*

[1]The location of 1 unmarked calf was not documented.

groups reversed direction and increased their movement rate several fold (Figs. 7, 8, 9). Scattered caribou groups near the coastline also demonstrated a similar directional movement towards the east. This synchronous shift by essentially the entire Porcupine calving group in Alaska coincided with emmergence of mosquitos reported at several locations within the study area.

The eastward movement occurred in a broad band across the central and southern coastal plain region and in concentrated corridors within east-west valleys of the foothills and mountains (Fig. 8). Movements through the foothills shifted northeastward prior to reaching the Kongakut River on 24 June. Calving caribou located east of the Firth River in Canada initiated a swift, nearly simultaneous, westward movement during 20-22 June. These caribou merged with juvenile, barren female and bull groups in the foothills west of the Firth River that were also moving west. Essentially all segments of the Porcupine caribou herd converged on the coastal plain and foothills south of Demarcation Bay on 26 June.

A large scattered distribution of caribou extended from the Kongakut River on the west to Fish Creek in Canada. By 28 June, 2 major movements had developed from this loose aggregation. Approximately 60% of the herd moved southeastward into Canada, while about 40% moved southward up the Kongakut River to Whale Mountain before turning west. Scattered residual groups numbering perhaps a few thousand persisted on the Alaska coastal plain and foothills near Schrader Lake through August. By 30 June the west moving group had reached the Aichilik River where most of them moved rapidly southeast into the valley of the Leffingwell Fork of the Aichilik River. The group splintered several times during southern movements across the continental divide of the Brooks Range. By 4 July, many caribou had arrived in the upper Kongakut and upper Coleen River drainages. Most of these groups moved southwesterly and reunited in the vicinity of Table Mountain by 12 July. These groups continued southwesterly to the vicinity of Old John Lake before breaking into smaller groups and dispersing eastward during late summer.

The southward movement of large portions of the Porcupine caribou herd through the mountain valleys of the Aichilik, Egaksrak, and Kongakut Rivers during late June - early July has been observed each year since 1982. This movement pattern was not observed during earlier intensive caribou studies in the mid-1970's (Roseneau per. comm.). The presence of numerous old trail systems visible in moist soil areas and on talus/scree slopes of this area, suggest similar movements have occurred in the past.

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Fig. 7. Summary of movements and general distributions of radio-collared caribou calves, Porcupine Caribou Herd.

(2-18 June, 1985)

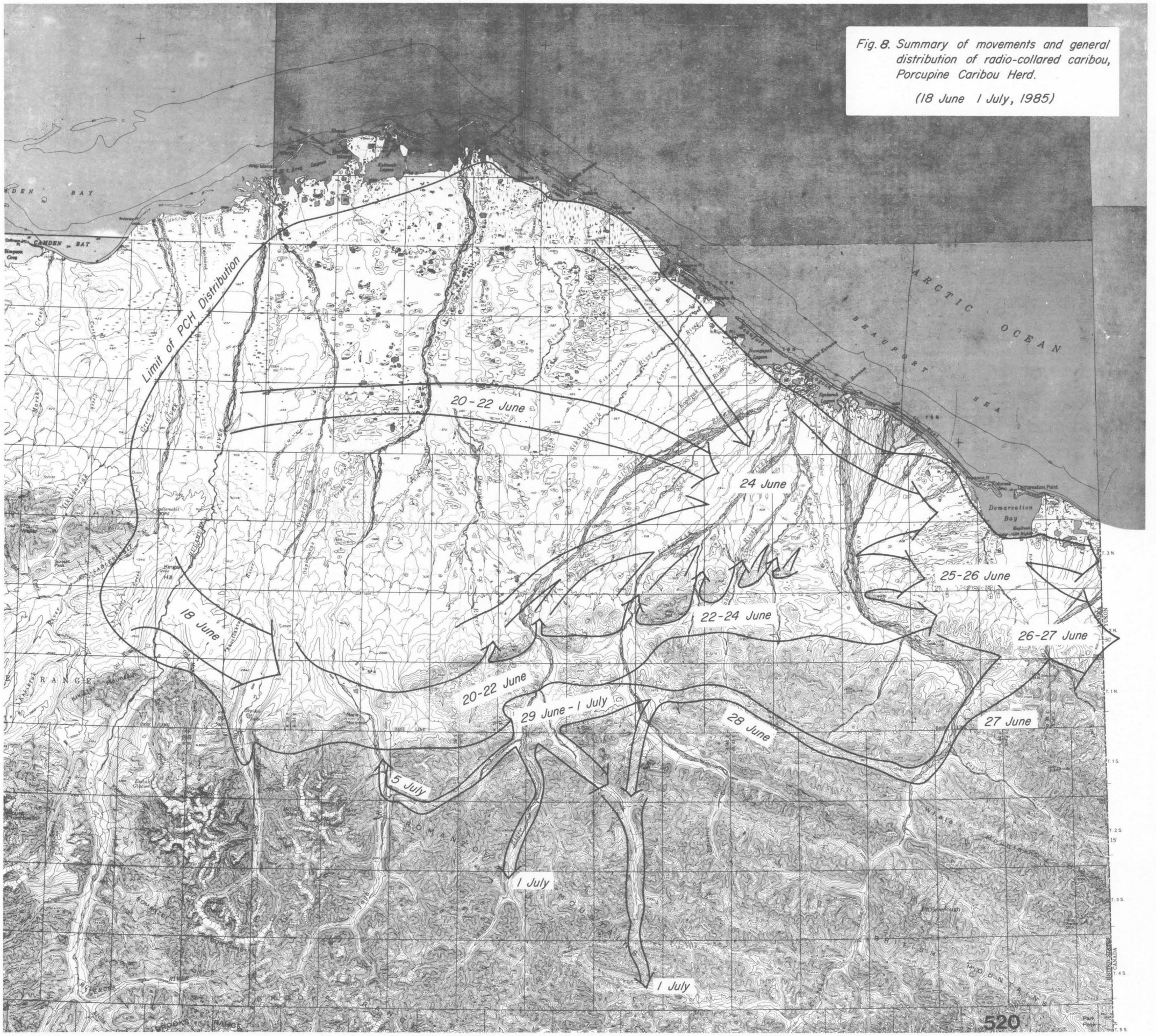

Fig. 8. Summary of movements and general distribution of radio-collared caribou, Porcupine Caribou Herd.

(18 June - 1 July, 1985)

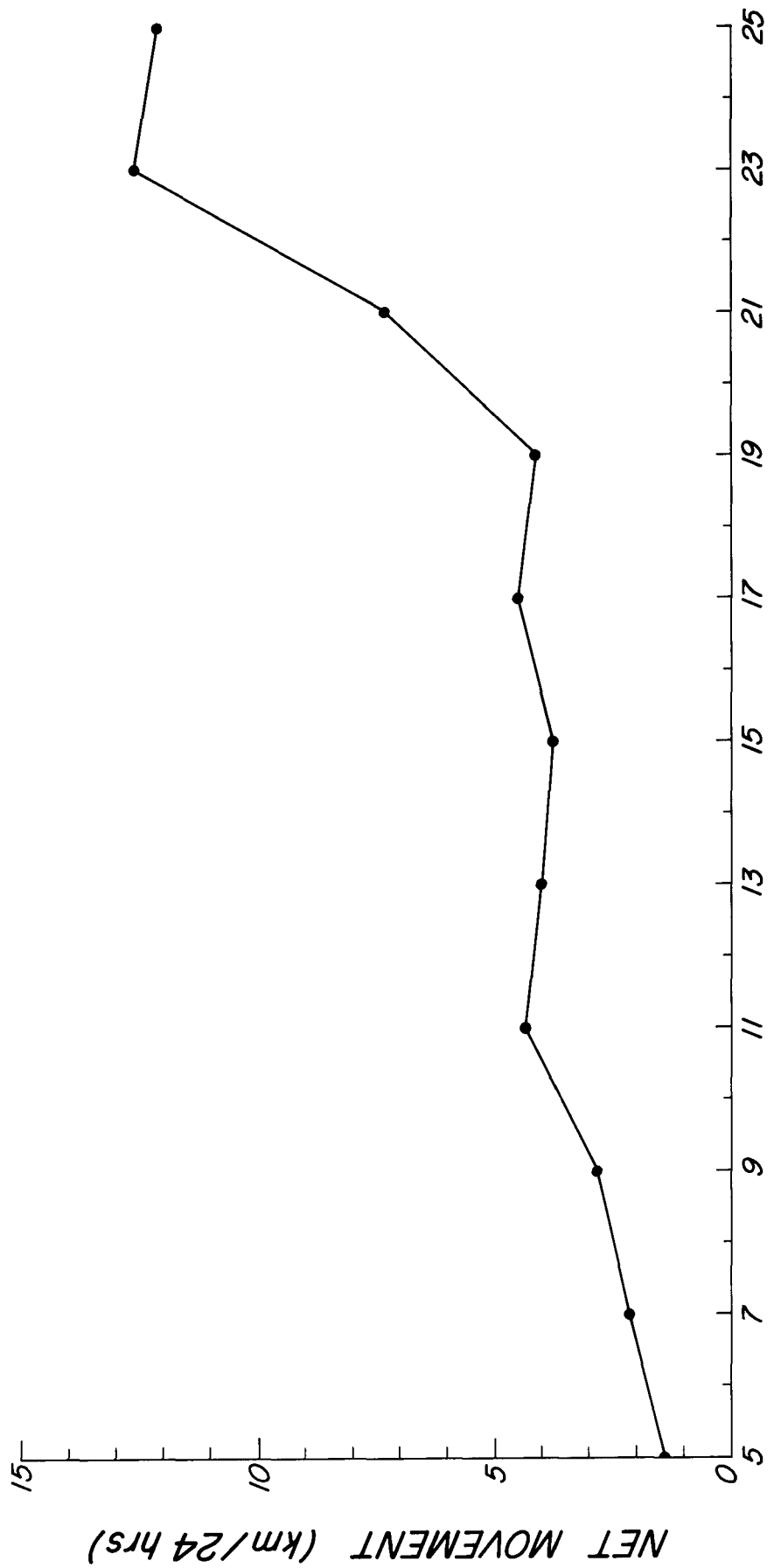

Fig. 9. Net movement rates for radio-collared caribou calves (5-25 June, 1985).

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APPENDIX
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Appendix Table 1. Chronology of calving, calf mortality, udder distension, and antler retention of radio-collared cows in the Porcupine caribou herd, 1985a

Cow # and Status	May					June																								
	27	28	29	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
4+ years old																																
S8:																																
calf				N	N	N		N						N							N									N	
udder				N	N	N		N						U							U									U	
antlers (#)				0	0	0		0						0							0									0	
S9:																																
calf				N	N	N	N	N			Y		Y		Y		Y			N	N				Y	Y		N		N	
udder				U	Y	Y	Y	Y			U		U		U		U			U	Y				U	U		U		U	
antlers (#)				2	2	2	2	2			2		2		2		2			0	0				0	0		0		0	
BKY26B:																																
calf				N	N	N	N	N		N		N			N	Y	Y				Y		Y		Y		Y		Y		Y
udder				Y	Y	Y	Y	Y		Y		Y			Y	U	U				U		U		U		U		U		U
antlers (#)				0	0	0	0	0		0		0			0	0	0				0		0		0		0		0		0
S10:																																
calf			N	N	Y	Y	Y	Y				Y		Y		Y				Y		Y		Y		Y		Y		Y	
udder			U	U	U	U	U	U				U		U		U				U		U		U		U		U		U	
antlers (#)			2	2	2	2	2	2				0		0		0				0		0		0		0		0		0	
S11:																																
calf			Y		N	N		N						N			N								N			N			
udder			U		U	Y		Y						N			N								U			U			
antlers (#)			2		2	2		0						0			0								0			0			
BKY41:																																
calf			N		Y		Y	Y				Y		Y		Y		Y														
udder			U		U		U	U				U		U		U		U		DIED											
antlers (#)			2		2		2	2				0		0		0		0														
BKY42:																																
calf			N	N		N	N	N		N			Y			Y		Y		Y		Y			Y		Y		Y			
udder			U	Y		Y	Y	Y		Y			U			U		U		U		U			U		U		U			
antlers (#)			2	2		2	2	2		2			2			0		0		0		0			0		0		0			

Appendix Table 1.Continued.

Cow # and Status	May 27	28	29	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
BKY16:																																
calf				N		N	Y		Y			Y		Y		Y				Y		Y			Y		Y		Y		Y	
udder				U		Y	U		U			U		U		U				U		U			U		U		U		U	
antlers (#)				2		2	2		2			0		0		0				0		0			0		0		0		0	
S12:																																
calf					N	N		Y						N							N				N			N				
udder					N	U		U						Y							U				N			U				
antlers (#)					2	2		2						2							1				0			0				
BKY22:																																
calf	Y			Y		Y	Y			Y		Y				Y		Y				Y		Y		Y		Y		Y		
udder	U			U		U	U			U		U				U		U				U		U		U		U		U		
antlers (#)	2			2		0	0			0		0				0		0				0		0		0		0				
BKY7:																																
calf												Y					Y				Y				Y			Y				Y
udder												U					U				U				U			U				U
antlers (#)												0					0				0				0			0				0
BKY23:																																
calf			N	N	Y		Y				Y		Y		Y		Y			Y		Y		Y		Y		Y		Y		Y
udder			U	U	U		U				U		U		U		U			U		U		U		U		U		U		U
antlers (#)			2	2	2		2				0		0		0		0			0		0		0		0		0		0		0
S13:																																
calf					N	N		N						Y			Y								Y			Y				Y
udder					N	N		N						U			U								U			U				U
antlers (#)					2	2		2						0			0								0			0				0
S14:																																
calf				Y	Y		Y	Y		Y		Y		Y		Y		Y		Y		Y			Y			Y		Y		Y
udder				U	U		U	U		U		U		U		U		U		U		U			U			U		U		U
antlers (#)				2	2		2	2		2		0		0		0		0		0		0			0			0		0		0
GY24:																																
calf			N	N		Y	Y			Y		Y		Y		Y		Y			Y		Y			Y			Y		Y	
udder			U	Y		U	U			U		U		U		U		U			U		U			U			U		U	
antlers (#)			2	2		2	2			0		0		0		0		0			0		0			0			0		0	

Appendix Table 1.Continued.

Cow # and Status	May 27	28	29	30	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
GY25:																																
calf			N																													
udder			U																													
antlers (#)			0																													
BKY0:																																
calf				Y	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				O						0		0			0		0		0	
BKY1:																																
calf					N																											
udder					U																											
antlers (#)					0																											
BKY5:																																
calf				N	N					N		N								N												
udder				N	N					N		N								N												
antlers (#)				0	0					0		0								0												
RY4:																																
calf			N	Y														N		DIED												
udder			U	U														N														
antlers (#)			2	2														0														
W2:																																
calf					N	N	N	N	N			Y	Y			Y					Y					Y			Y			Y	
udder					U	U	Y	Y	Y			Y	U			U					U					U			U			U	
antlers (#)					2	2	2	2	2			2	2			2					2					0			0			0	
W7:																																
calf		N		N		N		N			N						N			N				N	N	N	N		N		N	
udder		Y		Y		Y		Y			Y						Y			Y				Y	Y	Y	Y		U		U	
antlers (#)		0		0		0		0			0						0			0				0	0	0	0		0		0	
W9:																																
calf					N																			N								
udder					N																			N								
antlers (#)					0																			0								

Appendix Table 1.Continued.

Cow # and Status	May 27	28	29	30	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
W11:																																
calf						N																										
udder						N																										
antlers (#)						0																										
W13:																																
calf					N																											
udder					N																											
antlers (#)					0																											
S15:																																
calf				N	N	N	N	N		N	N	Y			Y																	
udder				Y	Y	Y	Y	Y		Y	Y	Y			U			DIED													
antlers (#)				2	2	2	2	2		2	2	2			2																
W15:																																
calf				N	N	Y	N																									
udder				U	N	U	U																									
antlers (#)				2	2	2	2																									
PY49:																																
4 years old																																
calf													N								N										N	
udder													Y								U										U	
antlers (#)													2								2										2	
RY67:																																
calf			N	N	Y	Y	N	N																								
udder			U	U	U	U	U	U																								
antlers (#)			2	2	2	2	2	2																								
PB86:																																
calf				Y		Y	Y			Y		Y		Y		Y		Y	Y			Y		Y		Y		Y				
udder				U		U	U			U		U		U		U		U	U			U		U		U		U				
antlers (#)				2		2	1			0		0		O		0		0	0			0		0		0		0				
PB87:																																
calf				N	N	N	N	N		N		N			N				N			N				N						
udder				U	Y	Y	Y	Y		U		Y			Y				Y			U				U						
antlers (#)				0	0	0	0	0		0		0			0				0			0				0						

Appendix Table 1.Continued.

Cow # and Status	May 27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	June 15	16	17	18	19	20	21	22	23	24	25	26	27
3 years old																																
PY45:																																
calf				N	N	Y	Y	Y	Y			Y		Y		N																
udder				U	Y	U	U	U	U			U		U		U																
antlers (#)				2	2	2	2	2	2			0		0		0																
PY47:																																
calf					N																											
udder					N																											
antlers (#)					0																											
PY48:																																
calf				N		Y	Y					Y				Y	Y				Y		Y		Y				Y			Y
udder				Y		U	U					U				U	U				U		U		U				U			U
antlers (#)				2		2	2					2				U	1				0		0		0				0			0
PY51:																																
calf			N																											N		
udder			U																											U		
antlers (#)			0																											0		
PY52:																																
calf			N	N	N	N	N	N			N	N		N		N	N	N				N	N		N		N		Y	N		N
udder			U	U	Y	Y	Y	Y			Y	Y		Y		Y	Y	U				Y	Y		U		U		U	U		U
antlers (#)			1	1	1	1	1	1			1	1		1		1	1	1				1	1		1		1		U	U		0
PY53:																																
calf					N	N		N						N																N		
udder					Y	Y		Y						Y																U		
antlers (#)					2	2		1						0																0		
PY56:																																
calf			N		N																									N		
udder			U		N																									U		
antlers (#)			0		0																									0		
PY57:																																
calf			N		N																									N		
udder			U		N																									U		
antlers (#)			0		0																									0		

Appendix Table 1.Continued.

Cow # and Status	May 27	28	29	30	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
PY59:																																
calf				N	N	N	N	Y				Y		Y		Y		Y				Y		Y	Y		Y		Y		Y	
udder				U	Y	Y	Y	U				Y		U		U		U				U		U	U		U		U		U	
antlers (#)				2	2	2	2	2				2		2		1		0				0		0	0		0		0		0	
PY62:																																
calf		Y		Y		Y	Y				Y		Y		Y				Y			Y		Y		Y				Y		Y	
udder		U		U		U	U				U		U		U				U			U		U		U				U		U	
antlers (#)		0		0		0	0				0		0		0				0			0		0		0				0		0	
PY64:																																
calf						N		N						Y							Y				Y			Y				Y	
udder						N		N						U							U				U			U				U	
antlers (#)						2		2						2							0				0			0				0	
PY68:																																
calf		N		N	N	N	N	N		Y		Y											Y		Y		Y		Y		Y	
udder		U		U	N	Y	Y	Y		U		U											U		U		U		U		U	
antlers (#)		2		2	2	2	2	2		2		2											0		0		0		0		0	
PY71:																																
calf					N	Y		Y						Y			Y								Y		Y					Y	
udder					Y	U		U						U			U								U		U					U	
antlers (#)					1	1		0						0			0								0		0					0	
PB72:																																
calf					Y								Y		Y				Y			Y			Y		Y		Y			Y	
udder					U								U		U				U			U			U		U		U			U	
antlers (#)					2								0		0				0			0			0		0		0			0	
PB74:																																
calf				Y		Y	Y	Y					Y											Y		Y		Y		Y			
udder				U		U	U	U					U											U		U		U		U			
antlers (#)				2		2	2	1					0											0		0		0		0			
PB76:																																
calf				N	N	N	N	N			Y		N			Y		Y								Y		Y		Y			
udder				U	Y	Y	Y	Y			U		Y			U		U								U		U		U			
antlers (#)				2	2	2	2	1			2		0			0		0								0		0		0			

Appendix Table 1.Continued.

Cow # and Status	May 27	28	29	30	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
PB78:																																
calf					N	N	N	N	N			N	N			N	N	N							N			N				
udder					N	N	N	N	N			N	N			Y	U	Y							U			U				
antlers (#)					0	0	0	0	0			0	0			0	0	0							0			0				
PB81:																																
calf		Y		Y		Y	Y	Y				Y		Y					Y			Y		Y			Y		Y		Y
udder		U		U		U	U	U				U		U					U			U		U			U		U		U
antlers (#)		2		2		2	2	2				0		0					0			0		0			0		0		0
PB82:																																
calf				N		N	N	N		N		N	N	N	N	N		N	N			N			N							
udder				Y		Y	Y	Y		Y		Y	Y	Y	Y	Y		Y	Y			Y			U							
antlers (#)				1		1	1	1		1		1	1	1	1	1		1	1			1			U							
PB83:																																
calf				Y		Y	Y				Y		Y		Y						Y		Y		Y		Y		Y		Y	
udder				U		U	U				U		Y		Y						U		U		U		U		U		U	
antlers (#)				2		2	2				0		0		0						0		0		0		0		0		0	
PB84:																																
calf				Y		Y	Y			Y		Y		Y		Y		Y			Y		Y		Y		Y		Y			
udder				U		U	U			U		U		U		U		U			U		U		U		U		U			
antlers (#)				2		2	2			2		0		0		0		0			0		0		0		0		0			
PB89:																																
calf			N		N																											
udder			U		N																											
antlers (#)			0		0																											
PB90:																																
calf				Y		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	1	1			0		0		0									0			0			0	0
PB91:																																
calf			N																						N							
udder			U																						U							
antlers (#)			0																						0							

Appendix Table 1.Continued.

Cow # and Status	May 27	28	29	30	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
2 years old																																
W18:																																
calf			N		N																											
udder			U		N																											
antlers (#)			0		0																											
W6:																																
calf				N																												
udder				U																												
antlers (#)				0																												
W21:																																
calf					N																				N							
udder					N																				U							
antlers (#)					0																				0							
W22:																																
calf			N		N																											
udder			U		N																											
antlers (#)			0		0																											
W23:																																
calf					N																											
udder					N																											
antlers (#)					0																											
W16:																																
calf					N																											
udder					N																											
antlers (#)					0																											
W24:																																
calf				N	N	N	N	N	N			Y		N		N																
udder				U	Y	Y	Y	Y	Y			U		Y		Y																
antlers (#)				2	2	2	2	2	2			2		2		2																
W17:																																
calf																																
udder																																
antlers (#)																																

[a] N=no, Y=yes, U=undertermined

Mortality Case History

Calf No: 1
Captured: 3 June 1985

Sex: Male
Location: Aichilik River foothills

Weight: 7.4 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health status: appeared healthy at capture
Processing time: 1.44 min.

Total length: 93 cm
Right hind foot length: 33.0 cm
New hoof length: 7.2 mm

Estimated age at capture: 2 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed with dam 9 hrs. after release.

Signal monitored: 14 times/ 16 day period
Mortality detected: 19 June 1985
Carcass collected: 19 June 1985
Carcass weight: 0.8 kg
Total length: N/A cm
Right hind foot length: N/A cm
New hoof length: N/A mm

Number of visual relocations: 5
Location: Jago River foothills
Distance from capture site: 33 km
Response time:

Carcass condition and disposition: Bone fragments chewed and scattered: partial vertebrae, skull fragments, distal portion of forelimb, skin and hair fragments. Golden eagle perched approximately 200 m from carcass, radio-collared wolf approximately 1.5 km from carcass.

Necropsy findings: N/A

Mortality category: Predation/scavenging involved, mammalian predator, probable golden eagle scavenging.

Mortality Case History

Calf No: 12
Captured: 5 June 1985

Sex: Male
Location: Aichilik River foothills

Weight: 6.2 kg
Umbilicus condition: moist
Hoof condition: partially hard/worn
Health status: appeared healthy at capture
Processing time: 2 min.
Cow-calf reunion: Capture crew did not observe reunions. Observed with dam 48 hrs. after capture.

Total length: 78 cm
Right hind foot length: 32 cm
New hoof length: 8.3 mm

Estimated age at capture: 2 days old

Signal monitored: 2 times/ 3 day period
Mortality detected: 1354 8 June 1985
Carcass collected: 1225 9 June 1985
Carcass weight: N/A kg
Total length: N/A cm
Right hind foot length: N/A cm
New hoof length: N/A mm

Number of visual relocations: 2
Location: Aichilik River foothills
Distance from capture site: 2 km
Response time: 22.5 hrs.

Carcass condition and disposition: Cow with two antlers, distended udder within 50 m of carcass on 8 June 1985. Scattered bone fragments, skull cap, lower jaw bone and lower portions of hind legs and one front leg present at site of retrieved radio-collar. No skin/hide present. Radio-collar torn, multiple punctures in transmitter cannister, antennae chewed.

Necropsy findings: N/A

Mortality category: Predation included, mammalian predator (probable wolf).

Mortality Case History

Calf No: 20
Sex: Male
Captured: 3 June 1985
Location: Aichilik River foothills

Weight: 9.4 kg
Total length: 91 cm
Umbilicus condition: dry
Right hind foot length: 37 cm
Hoof condition: hard/worn
New hoof length: 8.0 mm
Health status: appeared healthy at capture
Processing time: 1.5 min.
Estimated age at capture: 2 days old
Cow-calf reunion: Capture crew did not observe reunion. Unattended by dam approximately 3.0 hrs. after capture.

Signal monitored: 4 times/ 4 day period
Number of visual relocations: 2
Mortality detected: 6 June 1985
Location: Aichilik River foothills
Carcass collected: 6 June 1985
Distance from capture site: 3.4 km
Carcass weight: 5.0 kg
Response time:
Total length: N/A cm
Right hind foot length: 36 cm
New hoof length: 7.8 mm

Carcass condition and disposition: Found in two portions separated at the sacrum. Flesh removed from right foreleg, neck, vertebrae, right hip area, abdominal cavity opened, internal organs not present. Skull cap broken, bone fragment pushed into brain, left and right zygomatic arches broken. No puncture of scalp adjacent to skull fractures. No other puncture wounds found in remainder of skin. Golden eagle observed at carcass prior to collection.

Necropsy findings:

Mortality category: Predation involved, mammalian predator, probable wolf, golden eagle and gull scavenging, possible predisposition due to study-induced abandonment.

Mortality Case History

Calf No: 23
Captured: 3 June 1985

Sex: Female
Location: Aichilik River foothills

Weight: 8.5 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health status: appeared healthy at capture
Processing time: 1.5 min.

Total length: 89 cm
Right hind foot length: 34 cm
New hoof length: 9.1 mm

Estimated age at capture: 4 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed with dam approximately 4 hrs. after capture.

Signal monitored: 3 times/ 2 day period
Mortality detected: 1637 4 June 1985
Carcass collected: 5 June 1985
Carcass weight: 8.1 kg
Total length: 89 cm
Right hind foot length: 32.5 cm
New hoof length: 7.6 mm

Number of visual relocations: 3
Location: Aichilik River foothills
Distance from capture site: 2.3 km
Response time: N/A

Carcass condition and disposition: Intact, no external indication of trauma. Female caribou observed near carcass when mortality was detected. Golden eagle flushed approximately 50 m from carcass when collected.

Necropsy findings: Multiple round puncture wounds (3-6 mm.diameter) on skin of right thorax and abdomen with corresponding massive hemorrhage. Liver punctured at several locations, extensive internal hemorrhage. Stomach full with milk curds.

Mortality category: Predation included, golden eagle kill.

Mortality Case History

Calf No: 24
Captured: 3 June 1985

Sex: Female
Location: Aichilik River foothills

Weight: 9.2 kg
Umbilicus condition: partially intact
Hoof condition: hard/worn
Health status: appeared healthy at capture
Processing time: 1 min.

Total length: 92 cm
Right hind foot length: 34.5 cm
New hoof length: 8.0 mm

Estimated age at capture: 3 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed with dam approximately 4 hrs. after capture. Observed unattended approximately 20 hrs. after capture.

Signal monitored: 3 times/ 2 day period
Mortality detected: 5 June 1985
Carcass collected: 5 June 1985
Carcass weight: 5.9 kg
Total length: N/A cm
Right hind foot length: 34.5 cm
New hoof length: 7.6 mm

Number of visual relocations: 3
Location: Aichilik River foothills
Distance from capture site: less than 1.0 km
Response time: N/A

Carcass condition and disposition: Carcass partially fed upon, flesh removed from right shoulder, thorax and hip areas. Right side of skull fractured, right zygomatic arch and right orbit removed. Skin torn on left ear, round puncture wound posterior to left ear.

Necropsy findings: Portions of heart, left lung intestines and stomach remain. Stomach packed with vegetation, green solution in intestines.

Mortality category: Predation involved, mammalian predator/scavenger, probable predisposed due to study-induced abandonment.

Mortality Case History

Calf No: 27
Captured: 3 June 1985

Sex: Male
Location: Aichilik River foothills

Weight: 9.0 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health status: appeared healthy at capture
Processing time: 1.3 min.
Cow-calf reunion: Capture crew observed reunion within 0.5 min. after release. Observed with dam approximately 4 hrs. after capture.

Total length: 94 cm
Right hind foot length: 35.5 cm
New hoof length: 8.3 mm

Estimated age at capture: 3 days old

Signal monitored: 3 times/ 3 day period
Mortality detected: 1306 6 June 1985
Carcass collected: 6 June 1985
Carcass weight: 8.3 kg
Total length: 87 cm
Right hind foot length: 35.5 cm
New hoof length: 7.7 mm

Number of visual relocations: 2
Location: Aichilik River foothills
Distance from capture site: 1.6 km
Response time: N/A

Carcass condition and disposition: Female caribou at carcass when mortality was detected and when carcass was collected. Intact, left eye removed, tongue partially removed. No external indications of trauma.

Necropsy findings: Carcass skinned - no wounds, hemorrhage or indication of trauma. Stomach packed with soil and vegetation, absent of milk.

Mortality category: Predation excluded, avian scavenging, probable natural starvation.

Mortality Case History

Calf No: 33
Captured: 2 June 1985

Sex: Male
Location: coastal plain west of Jago River

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

Total length: 82 cm
Right hind foot length: 32 cm
New hoof length: 8.2 mm

Estimated age at capture: 3 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed with female caribou displaying agonistic behavior towards calf approximately 3 hrs. after release by capture crew. Observed unattended approximately 24, and 48 hrs. after capture.

Signal monitored: 4 times/ 3 day period
Mortality detected: 5 June 1985
Carcass collected: 5 June 1985
Carcass weight: 5.3 kg
Total length: 82 cm
Right hind foot length: 7.2 mm
New hoof length:

Number of visual relocations: 3
Location: coastal plain west of Jago River
Distance from capture site: 1.2 km
Response time: N/A

Carcass condition and disposition: Intact, no evidence of trauma.

Necropsy findings: Stomach packed with vegetation, absence of milk.

Mortality category: Predation excluded, starvation/study induced abandonment.

Mortality Case History

Calf No: 36
Captured: 2 June 1985

Sex: Female
Location: Jago River coastal plain

Weight: 7.5 kg
Umbilicus condition: dry
Hoof condition: partially hard/worn
Health status: appeared healthy at capture
Processing time: 1.32 min.

Total length: 79 cm
Right hind foot length: 34.0 cm
New hoof length: 7.4 mm

Estimated age at capture: 2 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed with dam approximately 5 hrs. after release.

Signal monitored: 19 times/ 22 day period
Mortality detected: 2000 23 June 1985
Carcass collected: 1220 24 June 1985
Carcass weight: 6.4 kg
Total length: N/A cm
Right hind foot length: N/A cm
New hoof length: N/A mm

Number of visual relocations: 8
Location: Hulahula River coastal plain
Distance from capture site: 19 km
Response time: 16.3 hrs.

Carcass condition and disposition: Lying on left side, approximately 70% consumed. Golden eagle observed at carcass at 2000 h on 23 June 1985. Two golden eagles and one glaucous gull observed at carcass when collected.

Necropsy findings: Round puncture wounds with subcutaneous hemorrhage on right shoulder and rib cage. Left zygomatic arch broken. Flesh removed from right side of carcass. Viscera removed.

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

Mortality Case History

Calf No: 40
Sex: Male
Captured: 2 June 1985
Location: Jago River coastal plain

Weight: 7.4 kg
Total length: 82 cm
Umbilicus condition: dry
Right hind foot length: 34.5 cm
Hoof condition: partially hard/worn
New hoof length: 7.4 mm
Health status: appeared healthy at capture
Processing time: 1.41 min.
Estimated age at capture: 2 days old
Cow-calf reunion: Capture crew did not observe reunion. Observed with dam approximately 5 hrs. after release.

Signal monitored: 17 times/ 18 day period
Number of visual relocations: 6
Mortality detected: 1435 20 June 1985
Location: Jago River foothills
Carcass collected: 20 June 1985
Distance from capture site: 52 km
Carcass weight: 9.8 kg
Response time: N/A
Total length: 93 cm
Right hind foot length: 38.5 cm
New hoof length: 22.8 mm

Carcass condition and disposition: Intact, no indication of injury or trauma, carcass found near river.

Necropsy findings: No internal wounds or hemorrhage, vegetation in rumen, milk curds absent, internal body fat absent.

Mortality category: Predation excluded, natural mortality, cause undetermined.

Mortality Case History

Calf No: 50
Captured: 2 June 1985

Sex: Male
Location: coastal plain east of Jago River

Weight: 8.3 kg
Umbilicus condition: absent
Hoof condition: hard/worn
Health status: appeared healthy at capture
Processing time: 1.5 min.

Total length: 90 cm
Right hind foot length: 35 cm
New hoof length: 7.8 mm

Estimated age at capture: 3 days old

Cow-calf reunion: Capture crew did not observe reunion. Observed with female caribou exhibiting agonistic behavior towards calf approximately 4 hrs. and 20 hrs. after release by capture crew.

Signal monitored: 4 times/ 3 day period
Mortality detected: 5 June 1985
Carcass collected: 5 June 1985
Carcass weight: 6.5 kg
Total length: 91 cm
Right hind foot length: 36 cm
New hoof length: 7.6 mm

Number of visual relocations: 3
Location: coastal plain east of Jago River
Distance from capture site: 0.2 km
Response time: N/A

Carcass condition and disposition: Intact, no evidence of trauma.

Necropsy findings: Stomach packed with vegetation, absence of milk.

Mortality category: Predation excluded, starvation/study induced abandonment.

Mortality Case History

Calf No: 56
Captured: 2 June 1985

Sex: Male
Location: Jago River foothills

Weight: 6.4 kg
Umbilicus condition: bloody
Hoof condition: partially hard/worn
Health status: appeared healthy at capture
Processing time: 1.42 min.

Total length: 87 cm
Right hind foot length: 33.0 cm
New hoof length: 6.7 mm

Estimated age at capture: 1 day old

Cow-calf reunion: Capture crew did not observe reunion. Observed with dam approximately 3 hrs. after release.

Signal monitored: 19 times/ 22 day period
Mortality detected: 1900 24 June 1985
Carcass collected: 2215 24 June 1985
Carcass weight: N/A kg
Total length: N/A cm
Right hind foot length: N/A cm
New hoof length: N/A mm

Number of visual relocations: 4
Location: Egaksrak River foothills
Distance from capture site:29 km
Response time: 3.25 hrs.

Carcass condition and disposition: Small scattered, chewed bone fragments and hair. Tooth marks on transmitter cannister. Adult female brown bear with two yearling cubs present at carcass when collected. Golden eagle feathers also at carcass site.

Necropsy findings: N/A

Mortality category: Predation/scavenging involved - brown bear and golden eagle.

Mortality Case History

Calf No: 60
Captured: 2 June 1985

Sex: Male
Location: Jago River foothills

Weight: 7.6 kg
Umbilicus condition: absent
Hoof condition: hard/worn
Health status: appeared healthy at capture
Processing time: N/A min.

Total length: 78 cm
Right hind foot length: 34.0 cm
New hoof length: 7.1 mm

Estimated age at capture: 3 days old
Cow-calf reunion: Capture crew did not observe reunion. Observed with dam approximately 2 hrs. after release.

Signal monitored: 20 times/ 22 day period
Mortality detected: 1240 24 June 1985
Carcass collected: 1245 24 June 1985
Carcass weight: 22 kg
Total length: N/A cm
Right hind foot length: N/A cm
New hoof length: N/A mm

Number of visual relocations: 55
Location: Hulahula River coastal plain
Distance from capture site: 23 km
Response time: 5 min.

Carcass condition and disposition: Intact, cow with distended udder standing near calf. No external evidence of injury or trauma.

Necropsy findings: No internal injury or trauma. Lungs appeared cloudy and were partially fused to the pericardium, right lung was hard-rubbery. Heart abnormally shaped. Internal fat deposits absent. Milk curds and vegetative material present in abomasum, vegetative material in rumen and reticulum.

Mortality category: Predation excluded, natural mortality, congenital defects/pneumonia.

Mortality Case History

Calf No: 65
Captured: 6 June 1985

Sex: Female
Location: Aichilik River foothills

Weight: 6.8 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health status: appeared healthy at capture
Processing time: 1.35 min.

Total length: 79 cm
Right hind foot length: 34.0 cm
New hoof length: 7.4 mm

Estimated age at capture: 2 days old

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

Signal monitored: 27 times/ 85 day period
Mortality detected: 31 August 1985
Carcass collected: 3 September 1985
Carcass weight: N/A kg
Total length: N/A cm
Right hind foot length: N/A cm
New hoof length: N/A mm

Number of visual relocations: 3
Location: Coleen River
Distance from capture site: 225 km
Response time: 3 days

Carcass condition and disposition: Fractured skull bones, mandibles, and hair found near retrieved collar. Site was located along a game trail in dense willow shrubs. Fresh bear scats containing blueberries nearby.

Necropsy findings:

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

Mortality Case History

Calf No: 66
Captured: 7 June 1985

Sex: Female
Location: Aichilik River foothills

Weight: 6.1 kg
Umbilicus condition: dry
Hoof condition: hard/worn
Health status: appeared healthy at capture
Processing time: 2.15 min.
Cow-calf reunion: Capture crew did not observe reunion.

Total length: 83 cm
Right hind foot length: 33 cm
New hoof length: 7.3 mm

Estimated age at capture: 2 days old
Observed with dam the following day.

Signal monitored: 6 times/ 7 day period
Mortality detected: 1137 15 June 1985
Carcass collected: 1530 15 June 1985
Carcass weight: 3.6 kg
Total length: N/A cm
Right hind foot length: 35.7 cm
New hoof length: N/A mm

Number of visual relocations: 3
Location: Aichilak River foothills
Distance from capture site: 5.2 km
Response time: 4 hrs.

Carcass condition and disposition: Sixty percent consumed, internal organs removed/consumed, flesh removed from legs, shoulders and back, ribs removed, remainder of skeleton attached by skin and tendons. Neck and head intact, eyes, ears and tongue present. Dead cow lying 30 m away. golden eagle observed feeding on calf. Neck and left jaw of cow fed upon, left rear leg disarticulated, fed upon left shoulder and ribs also fed upon.

Necropsy findings: No evidence of trauma to head and neck.

Mortality category: Predation/scavenging involved, probable golden eagle kill, predisposed to predation by death of cow.

Mortality Case History

Calf No: Unmarked 01

Sex: Female
Location: Aichilik River aufeis field

Carcass collected: 5 June 1985
Carcass weight: 4.8 kg
Total length: N/A cm
Right hind foot length: N/A cm
New hoof length: 7.9 mm

Carcass condition and disposition: Forty percent consumed, eyes and tongue removed, flesh removed from right shoulder and hip, internal organs removed. Skull crushed, rostrum fractured from skull, right mandible and right foreleg broken off. Wolf observed in area of carcass.

Necropsy findings:

Mortality category: Predation/scavenging involved - probable wolf, avian scavenging.

Mortality Case History

Calf No: Unmarked 02

Sex: Male
Location: Aichilik River aufeis field

Carcass collected: 5 June 1985
Carcass weight: 4.0 kg
Total length: 88.5 cm
Right hind foot length: 34.0 cm
New hoof length: 7.4 mm

Carcass condition and disposition: Fifty-five percent consumed, right eye, and ear removed, flesh removed from rear quarters and ribs, six right ribs severed (snapped), internal organs removed. Posterior of skull crushed with corresponding subcutaneous hemorrhage. Wolf observed in area of carcass.

Necropsy findings:

Mortality category: Predation/scavenging involved probable wolf kill, avian scavenger.

Mortality Case History

Calf No: Unmarked 03

Sex: Female
Location: coastal plain east of Jago River

Carcass collected: 30 May 1985
Carcass weight: 8.3 kg
Total length: 92 cm
Right hind foot length: 35.5 cm
New hoof length: 8.4 mm

Carcass condition and disposition: Calf of radio-collared adult female (#RY4) which was observed standing near carcass. Found in water (flooded tundra), hooves soft and not worn, placenta still attached to calf. Intact, no evidence of external injuries or trauma.

Necropsy findings: Lungs inflated/normal, all other internal organs appeared normal, stomach and intestines empty.

Mortality category: Predation excluded, exposure.

Mortality Case History

Calf No: Unmarked 04

Sex: Male
Location: Okerokovik River foothills

Carcass collected: 2 June 1985
Carcass weight: 4.6 kg
Total length: 83.5 cm
Right hind foot length: 32.0 cm
New hoof length: 7.3 mm

Carcass condition and disposition: Intact, radio-collared adult female (#W15) observed at carcass. Umbilicus bloody, hooves partially hardened and worn. Cow observed previous day without calf. No evidence of external injury/trauma. Appeared thin.

Necropsy findings: Lungs spotted/cloudy, internal fat absent, organs otherwise normal. Small amount of vegetative material in abomasum, milk absent, intestines empty.

Mortality category: Predation excluded, starvation/pneumonia.

Mortality Case History

Calf No: Unmarked 05

Sex: Female
Location: Okerokovik River foothills

Carcass collected: 2 June 1985
Carcass weight: 4.9 kg
Total length: 86 cm
Right hind foot length: 31 cm
New hoof length: 6.8 mm

Carcass condition and disposition: Right eye removed, no other evidence of external injury or trauma.

Necropsy findings: Lungs clouded, absence of internal fat deposits, abomasum empty, absent of milk.

Mortality category: Scavenging involved, avian scavenger, starvation/pneumonia.

Mortality Case History

Calf No: Unmarked 06

Sex: Male
Location: Jago River coastal plain

Carcass collected: 4 June 1985
Carcass weight: 6.5 kg
Total length: 92 cm
Right hind foot length: 35 cm
New hoof length: 7.4 mm

Carcass condition and disposition: Intact, no evidence of external injury/trauma. Umbilicus dry, hooves partially hard/worn. Carcass appeared thin.

Necropsy findings: Lungs spotted and cloudy, absence of internal fat deposits, hair and vegetative material in abomasum, absence of milk curds.

Mortality category: Predation excluded, starvation/pneumonia.

Mortality Case History

Calf No: Unmarked 07

Sex: N/A
Location: Jago River foothills

Carcass collected: 5 June 1985
Carcass weight: 7.5 kg
Total length: 95 cm
Right hind foot length: 35 cm
New hoof length: 8.1 mm

Carcass condition and disposition: Carcass lying on right side, flesh removed from left side, rib cage intact, left eye and tongue removed, heart, stomach and lungs consumed, liver partially consumed.

Necropsy findings: No evidence of injury or trauma on head and neck.

Mortality category: Predation/scavenging involved, avian scavenger.

Mortality Case History

Calf No: Unmarked 08

Sex: Male
Location: coastal plain west of Jago River

Carcass collected: 5 June 1985
Carcass weight: 5.8 kg
Total length: 85 cm
Right hind foot length: 35 cm
New hoof length: 7.2 mm

Carcass condition and disposition: Carcass lying on left side, gulls were feeding on it at time of collection. Right eye and tongue removed, flesh removed from right abdominal area, intestines and stomach consumed. Hooves soft, little wear.

Necropsy findings: No evidence of wounds, lungs red and bloody.

Mortality category: Predation/scavenging involved, avian scavengers - gulls, probable pneumonia.

Mortality Case History

Calf No: Unmarked 09

Sex: Female
Location: coastal plain east of Jago River

Carcass collected: 5 June 1985
Carcass weight: 6.5 kg
Total length: 83 cm
Right hind foot length: 33.5 cm
New hoof length: 8.1 mm

Carcass condition and disposition: Intact, hemorrhage at mouth, scours around anus.

Necropsy findings: Bruise on right rib cage with corresponding gelatinous hemorrhage, abdominal hemorrhage, ruptured liver. No corresponding puncture of skin adjacent to bruise. Heart, lungs and spleen normal, milk curds present in stomach.

Mortality category: Predation excluded, probable trampling accident.

Mortality Case History

Calf No: Unmarked 10

Sex: N/A
Location: Aichilik River mountains

Carcass collected: 5 June 1985
Carcass weight: 3.1 kg
Total length: N/A cm
Right hind foot length: N/A cm
New hoof length: 7.5 mm

Distance from capture site:

Carcass condition and disposition: Sixty percent consumed, only anterior portion remaining. Right eye removed, flesh partially removed from neck. No evidence of injury to the head. Golden eagle at carcass site when collected.

Necropsy findings: N/A

Mortality category: Predation/scavenging involved, golden eagle.

Mortality Case History

Calf No: Unmarked 11

Sex: Female
Location: Jago River coastal plain

Carcass collected: 7 June 1985
Carcass weight: 5.5 kg
Total length: 87 cm
Right hind foot length: 34 cm
New hoof length: 7.5 mm

Carcass condition and disposition: Intact, cow standing at carcass. Appears thin. Umbilicus dry, hooves hard/worn.

Necropsy findings: No evidence of wounds/trauma. Internal organs normal. Internal fat deposits absent, small amount of milk in abomasum. Muscle behind left eye soft, gelatinous.

Mortality category: Predation excluded, disease related, natural mortality.

Mortality Case History

Calf No: Unmarked 12

Sex: Female
Location: Okerokovik River foothills

Carcass collected: 9 June 198
Carcass weight: 4.6 kg
Total length: 71 cm
Right hind foot length: 32 cm
New hoof length: 7.6 mm

Carcass condition and disposition: Partially consumed, jaegers observed feeding on carcass. Tongue and right eye removed, flesh removed from left abdomen. Hooves partially hard, slight wear. Cow with distended udder standing near carcass site.

Necropsy findings: Liver, kidneys and stomach removed, heart normal, internal fat absent, lungs dark and gelatinous.

Mortality category: Scavenging involved, jaegers, disease related natural mortality, probable weak calf at birth (non-viable).

Mortality Case History

Calf No: Unmarked 13

Sex: Male
Location: Okerokovik River foothills

Carcass collected: 9 June 1985
Carcass weight: 5.1 kg
Total length: N/A cm
Right hind foot length: 36 cm
New hoof length: 8.9 mm

Carcass condition and disposition: Thirty percent consumed, right eye removed, all internal organs removed, puncture wounds on head, broken skull. Flesh from left femur removed. Several ribs severed at base. Three gulls feeding at carcass when collected.

Necropsy findings: Puncture wounds on dorsal surface of skull 30.4 mm apart (5.5 mm and 8.1 mm diameter). Puncture of skull above left ear 13.2 mm diameter.

Mortality category: Predation/scavenging involved, golden eagle - predator, glaucous gull - scavenger.

Mortality Case History

Calf No: Unmarked 14

Sex: Female
Location: Aichilik River foothills

Carcass collected: 9 June 1985
Carcass weight: 5.5 kg
Total length: N/A cm
Right hind foot length: 35.1 cm
New hoof length: 8.4 mm

Carcass condition and disposition: Lying on right side, immature golden eagle at carcass site. Flesh removed from exposed ribs and hip area, eyes, ears and tongue removed. Zygomatic arches fractured, lower jaw broken off.

Necropsy findings: Heart, lungs normal.

Mortality category: Predation/scavenging involved, golden eagle-predator.

Mortality Case History

Calf No: Unmarked 15

Sex: Female
Location: Okerokovik River foothills

Carcass collected: 11 June 1985
Carcass weight: 5.3 kg
Total length: 82 cm
Right hind foot length: 33 cm
New hoof length: 7.4 mm

Carcass condition and disposition: Intact, lying on left side. Radio-collared adult female (#PY45) standing at carcass site. No evidence of external wounds/trauma.

Necropsy findings: Internal organs normal, lack internal fat deposits. Vegetation and milk curds in abomasum and rumen.

Mortality category: Predation excluded, disease related natural mortality.

Mortality Case History

Calf No: Unmarked 16

Sex: N/A
Location: Okerokovik River foothills

Carcass collected: 11 June 1985
Carcass weight: 4.8 kg
Total length: 85 cm
Right hind foot length: 35 cm
New hoof length: 8.4 mm

Carcass condition and disposition: Fifty percent consumed, gulls observed feeding at carcass, eagle feathers present. Tongue partially removed, no broken or chewed bones, legs, shoulders intact, puncture wounds dorsal surface of neck, hemorrhage associated with wounds.

Necropsy findings: Internal organs removed. Talon punctures left and right side of skull and neck with corresponding hemorrhage.

Mortality category: Predation/scavenging involved, golden eagle - predator, glaucous gulls - scavengers.

Mortality Case History

Calf No: Unmarked 17

Sex: Male
Location: Okerokovik River coastal plain

Carcass collected: 12 June 1985
Carcass weight: 5.0 kg
Total length: 76.5 cm
Right hind foot length: 33.5 cm
New hoof length: 6.5 mm

Carcass condition and disposition: Lying on right side, gulls feeding on carcass. Tongue and left eye removed. Flesh removed from left side, internal organs consumed. Skin punctured above right ear, with blood stain.

Necropsy findings: Skull punctured (5.3 mm and 9.3 mm diameter) approximately 10 mm apart.

Mortality category: Predation involved, golden eagle.

Mortality Case History

Calf No: Unmarked 18

Sex: N/A
Location: Okerokovik River coastal plain

Carcass collected: 13 June 1985
Carcass weight: 2.5 kg
Total length: N/A cm
Right hind foot length: 35 cm
New hoof length: 12.2 mm

Carcass condition and disposition: Sixty percent consumed, brown bear observed feeding on carcass. Carcass of collared adult female (#S15) nearby. Eyes and tongue removed, wounds appear old and dried relative to fresh evidence of bear feeding. Internal organs removed, flesh removed from upper hind legs, shoulder and under neck.

Necropsy findings: Skull punctured on right (7.0 mm diameter), with corresponding hemorrhage and on the left (above the eye) 15.4 mm diameter puncture wound with no associated hemorrhage.

Mortality category: Predation/scavenging involved. Golden eagle - predator, brown bear - scavenger.

Mortality Case History

Calf No: Unmarked 19

Sex: N/A
Location: Okerokovik River mountains

Carcass collected: 21 June 1985
Carcass weight: 8.7 kg
Total length: 92 cm
Right hind foot length: 37 cm
New hoof length: N/A mm

Carcass condition and disposition: Intact, lying on right side. Bird peck hole on left hip. No other external evidence of injury or trauma.

Necropsy findings: No internal evidence of injury or trauma. Internal organs normal, no internal fat deposits, vegetation packed in stomach, milk curds absent.

Mortality category: Scavenging involved, avian scavenger, starvation.

Mortality Case History

Calf No: Unmarked 20

Sex: N/A
Location: Egaksrak River foothills

Carcass collected: 24 June 1985
Carcass weight: N/A kg
Total length: N/A cm
Right hind foot length: N/A cm
New hoof length: N/A mm

Carcass condition and disposition: Eighty-five percent consumed, two immature golden eagles were feeding at the carcass. Skin stained with blood, numerous talon puncture wounds. Flesh and internal organs consumed.

Necropsy findings:

Mortality category: Predation involved, golden eagle.

Mortality Case History

Calf No: Unmarked 21

Sex: Female
Location:

Carcass collected: 24 June 1985
Carcass weight: 15 kg
Total length: 37.5 cm
Right hind foot length: N/A cm
New hoof length: 12.1 mm

Carcass condition and disposition: Found live, seriously disabled by wounds and hemorrhage on right rear of abdomen and hip area. Adult female was standing near disabled calf. Calf was dispatched and carcass collected for necropsy investigations. Wolf observed approximately 3.2 km from injured calf.

Necropsy findings: Puncture wounds (12.4 mm) and (20.6 mm) diameter, 10.2 mm deep on upper right hip with extensive hemorrhage. Puncture wound on left flank and left shoulder. Internal organs normal, fat deposits present, vegetation preset in rumen, milk curds present in abomasum.

Mortality category: Predation involved, probable golden eagle.

Mortality Case History

Calf No: Unmarked 22

Sex:
Location:

Carcass collected: 29 June 1985
Carcass weight: kg
Total length: cm
Right hind foot length: cm
New hoof length: mm

Carcass condition and disposition:

Necropsy findings:

Mortality category:

Mortality Case History

Calf No: Unmarked 23

Sex: Female
Location: Ekaluakat River foothills

Carcass collected: 29 June 1985
Carcass weight: 5.4 kg
Total length: cm
Right hind foot length: 31.5 cm
New hoof length: 8.5 mm

Carcass condition and disposition: Carcass was intact. Adult female standing at carcass, immature golden eagle approximately 30 m from carcass, brown bear approximately 200 m from carcass. Hooves partially hard and worn, dried umbilicus. Hemorrhage from mouth and puncture wounds on right rib cage (50.4 mm diameter).

Necropsy findings: Extensive hemorrhage. Small puncture wounds in right abdominal area. Milk curds present in abomasum.

Mortality category: Predation involved, probable golden eagle.

Mortality Case History

Calf No: Unmarked 24

Sex: Male
Location:

Carcass collected: 1985
Carcass weight: 10.9 kg
Total length: cm
Right hind foot length: 37.5 cm
New hoof length: 9.5 mm

Carcass condition and disposition: Carcass was intact with dried umbilicus. Adult female without antlers standing at carcass site.

Necropsy findings: Lungs clouded, internal fat deposits absent, milk curds absent in abomasum and intestinal tract, moss and soil material in rumen.

Mortality category: Predation excluded, starvation/pneumonia.

Mortality Case History

Calf No: Unmarked 25

Sex: Male
Location: Aichilik River mountains

Carcass Collected: 30 June 1985
Carcass weight: 13.8 kg
Total length: cm
Right hind foot length: 42. cm
New hoof length: mm

Carcass condition and disposition: Carcass was 50% consumed. Radio-collared wolf observed at carcass, immature golden eagle near carcass. Internal organs removed/consumed, ribs partially removed, skull fractured into four parts, brain partially consumed, mandibles broken, flesh removed, ears, tongue and eyes consumed, left foreleg broken/chewed at joint.

Necropsy findings: Puncture wounds in mid back (4.9 mm and 6.5 mm) with corresponding hemorrhage.

Mortality category: Predation involved, golden eagle - predator, wolf - scavenger.

ARCTIC NATIONAL WILDLIFE REFUGE COASTAL PLAIN
RESOURCE ASSESSMENT

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