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MOUNTAIN CARIBOU MOVEMENTS IN RELATION TO THE PROPOSED GAS PIPELINE OF FOOTHILLS PIPELINES (SOUTH YUKON), KLUANE LAKE REGION

July 1979

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MOUNTAIN CARIBOU MOVEMENTS IN RELATION TO THE PROPOSED GAS PIPELINE OF FOOTHILLS PIPELINES (SOUTH YUKON) LTD., KLUANE LAKE REGION.

Contract study for the Yukon Wildlife Branch by

David A. Gauthier.

July, 1979

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INTRODUCTION

The objective of this study was to monitor the movement of mountain caribou (Rangifer tarandus caribou) of the Burwash Uplands and surrounding area in relation to the proposed gas pipeline route of Foothills Pipelines (South Yukon) Ltd. in the general area from Burwash Landing to the Donjek River bridge, Yukon Territory for a period from September, 1978 to July, 1979. This study was to provide information concerning three questions:

1. Did caribou of the Burwash Uplands area cross the proposed pipeline route and/or did they occupy habitat near that route for a relatively long period of time?
2. If caribou crossed the proposed pipeline route, at what times of the year did such crossings occur?
3. If caribou crossed the proposed pipeline route, where in relation to that route, did they cross?

STUDY AREA

The monitoring program was conducted within a study area of approximately 1292 km^2 bordering to the northwest of Kluane Lake, Yukon Territory (see Figure 1). Approximate boundaries to the study area are the Alaska Highway and a portion of the Ruby Range to the north; the Brooks Arm of Kluane Lake to the east; Halfbreed Creek and a portion of the Donjek Range to the south; and, the Donjek River to the west. These boundaries include the Burwash Uplands, a rolling plateau-like expanse of tundra about 100 km^2 in area (ranging from 1220 m - 1525 m in altitude), six mountain peaks rising to a maximum of 2350 m, large areas of lowland terrain covered by boreal forest, streams and ponds, and an upland tundra plateau of about 31 km^2 north and west of the Brooks Arm of Kluane Lake (ranging from 1220 m - 1525 m). Oosenbrug (1976)[1] has provided a detailed description of the geomorphology and physiography of the area.

Hoefs (1973)[2] has described three major vegetation types for the southwest Yukon: boreal forest; subalpine vegetation and arctic-alpine tundra.

1. *S.M. Oosenbrug. 1976. Range relationships and population dynamics of the Burwash Uplands caribou herd. M.Sc. Thesis, University of Waterloo, Ontario.*

2. *M. Hoefs. 1973. Ecological investigation in Kluane National Park, Yukon Territory. Can. Wildl. Serv. Rep. 37 p.*

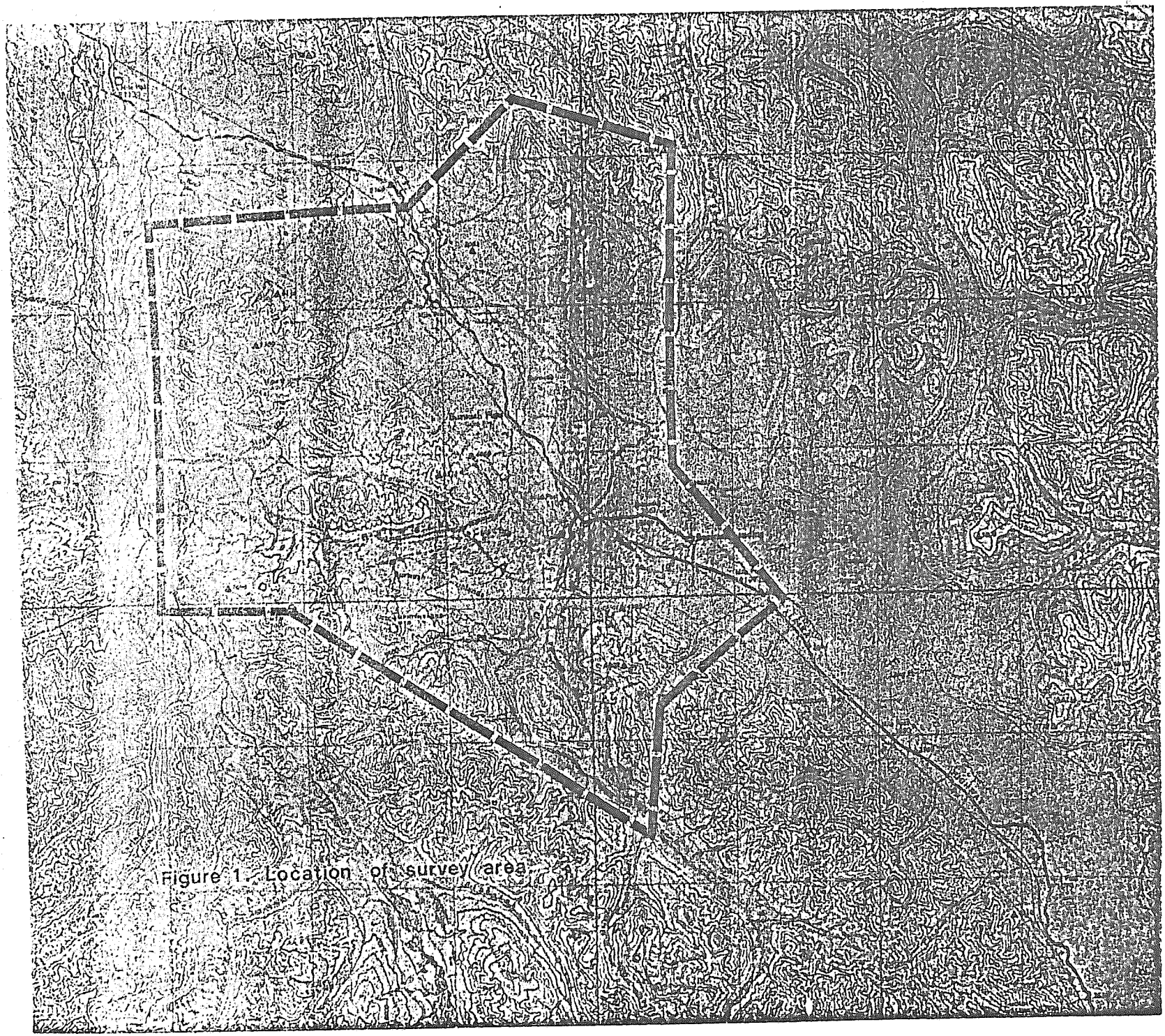


Figure 1. Location of survey area

The boreal forest zone is generally restricted to areas up to about 1200 m and is characterized by white spruce (Picea mariana) in climax stands and aspen (Populus tremuloides) in sub-climax stands. Birch (Betula glandulosa) and willows (Salix sp.) constitute the understorey. Within the study area forest cover occurs adjacent to the Alaska Highway, Kluane River and Brooks Arm, and in lowland valleys of the Donjek and Duke Rivers. Widely distributed throughout the study area in a zone between 1220 m to 1525 m erect shrubs are generally the dominant form of vegetation with an understorey of heaths and prostrate shrubs. Above 1525 m heaths, prostrate shrubs and herbs predominate.

Oosenbrug (1976) has recorded four ungulate species in addition to caribou found within the study area: Dall sheep (Ovis dallii); moose (Alces alces); mountain goat (Oreamnus americanus); and, black-tailed deer (Odocoileus hemionus). Predatory mammals include grizzly bear (Ursus arctos), wolf (Canis lupus), coyote (Canis latrans), red fox (Vulpes vulpes), wolverine (Gulo gulo), and lynx (Lynx canadensis).

The study area to the south and west of the Alaska Highway lies within the Kluane Game Sanctuary which is administered by the Yukon Territorial Government, and the southern edge of this segment lies within Kluane National Park. Placer-gold mining is conducted on Burwash Ck., and Tatamagouche Ck. and has been carried out in the past on Quill Ck., and Arch Ck. Vehicle access is possible via road systems up Burwash Ck., Quill Ck., Nickel Ck., and Tatamagouche Ck. The study area north and east of the Alaska Highway lies outside of the Kluane Game Sanctuary and National Park and wildlife are subject to trapping and sport and game hunting regulated by the Yukon Wildlife Branch. Vehicular access into this area is possible only by snowmobile in the winter.

METHODS

Capture and Tagging

Caribou were located by aerial search using a Hughes 5000 helicopter. Individual caribou were immobilized by a mixture of etorphine (M99) and acepromazine maleate administered by means of injection using Cap-Chur

equipment.* After administration of the drug, the caribou were kept under observation until they became immobile, at which time they were blindfolded and placed in sternal recumbancy (Photo 1). Each caribou was monitored for heart rate (Photo 2), respiration, body temperature and eructation. Mineral oil was applied to the eyes if needed. Wounds were treated by flushing with a mixture of bridine and ringer's solution and application of an antibiotic ointment. Animals were also treated with a long-acting penicillin (Photo 3). Body and antler measurements were taken (Photos 4 and 5) and color-coded ear-tags attached (Photo 6). A brightly colored collar containing a VHF radio-unit transmitting a specific signal in the 171.902-172.122 Mhz (electrical life 1-3 years) was attached to each animal (Photos 7 and 8). The blindfold was then removed and the antidote, diprenorphine, was administered intravenously. Animals were allowed to rise of their own accord as the field crew waited quietly at some distance away from the animal (Photos 9 and 10).

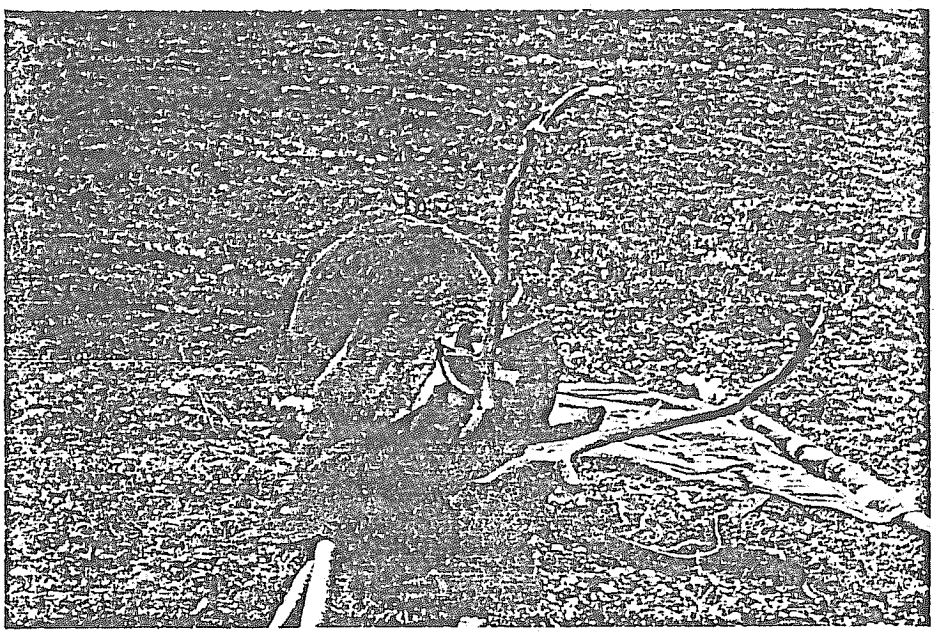
Relocation

Relocations of radiocollared caribou were conducted from both fixed-wing aircraft (Heliocourier; Cessna 185) and helicopter (Jet Ranger). Sufficient funding allowed a maximum of eleven flights, two of which were also used to census caribou in the study area. No monitoring flights were conducted in December or February.

For tracking radio-equipped caribou a directional yagi antenna was attached to the aircraft being used and connected inside to a portable receiver. On some flights two yagi antennas were used. Two observers were used on each flight in addition to the radio-receiver operator. The usual tracking technique was to fly at 305 m to 915 m elevation in a predetermined flight pattern throughout the study area until the study area had been covered or until all radio-collared animals had been located.

When a signal was received, the aircraft was directed in the

*For a detailed description of the veterinary aspects of the capture progran and drug performance, see "Veterinary aspects of a caribou capture project, September, 1978. A report to the Yukon Territorial Government Game Branch" by Dr. D.R. Flood-Brooke.



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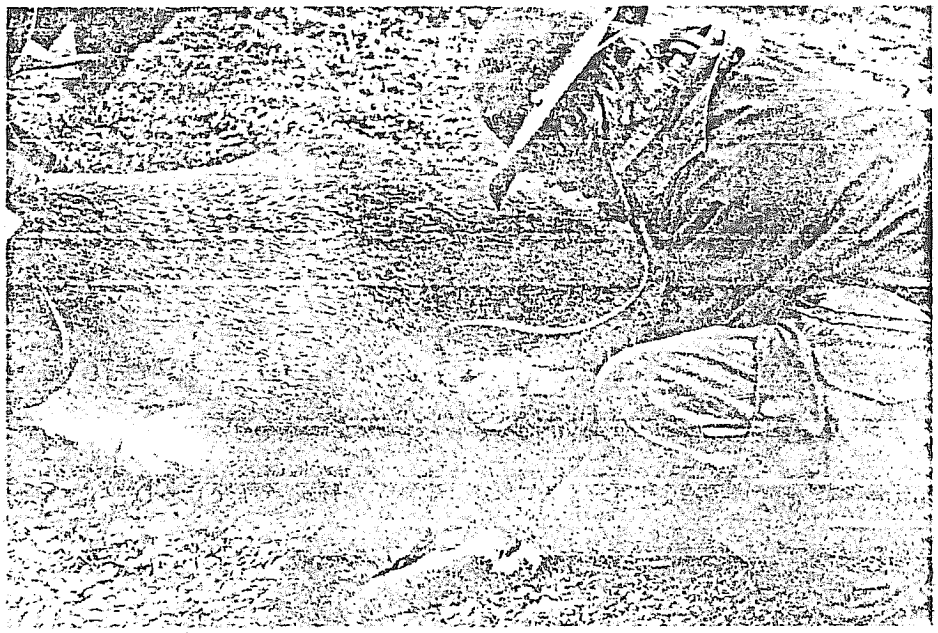

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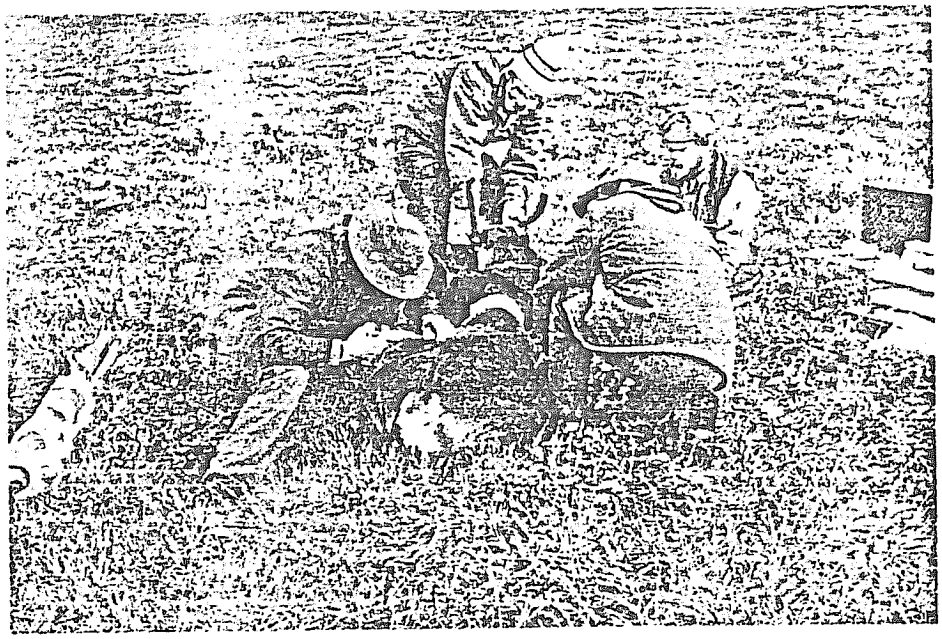

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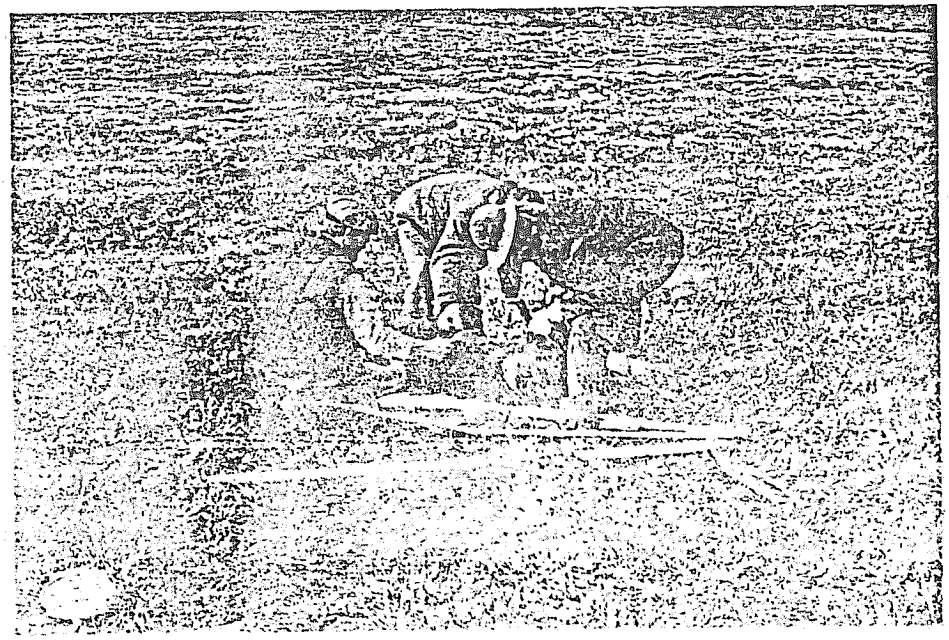

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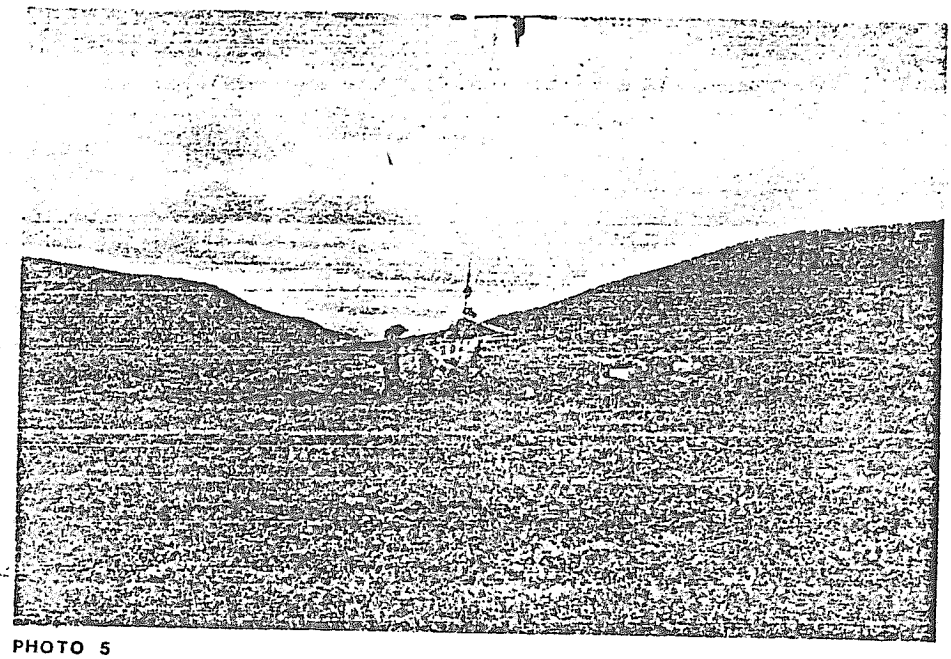

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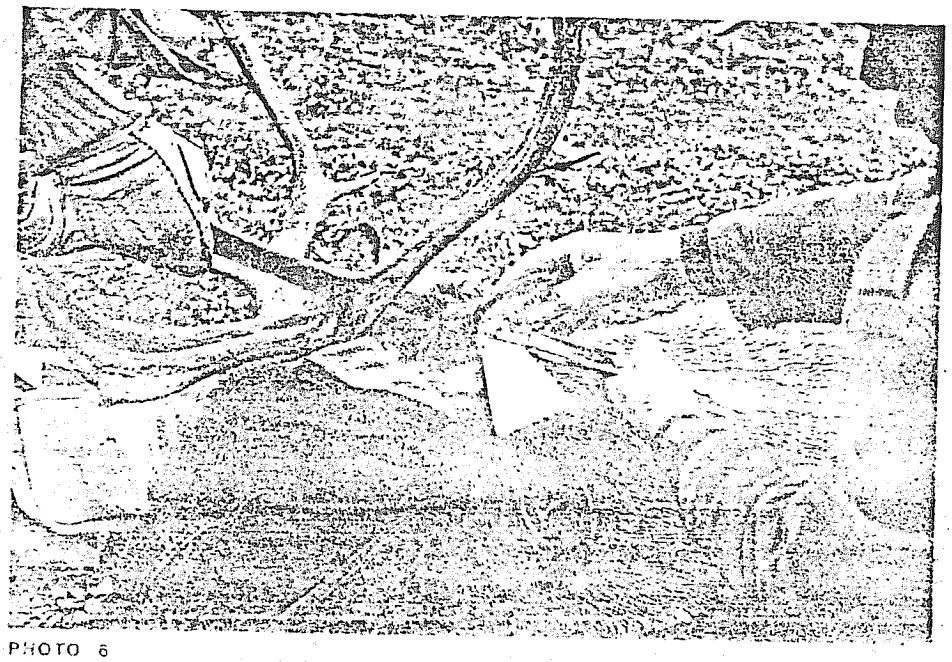

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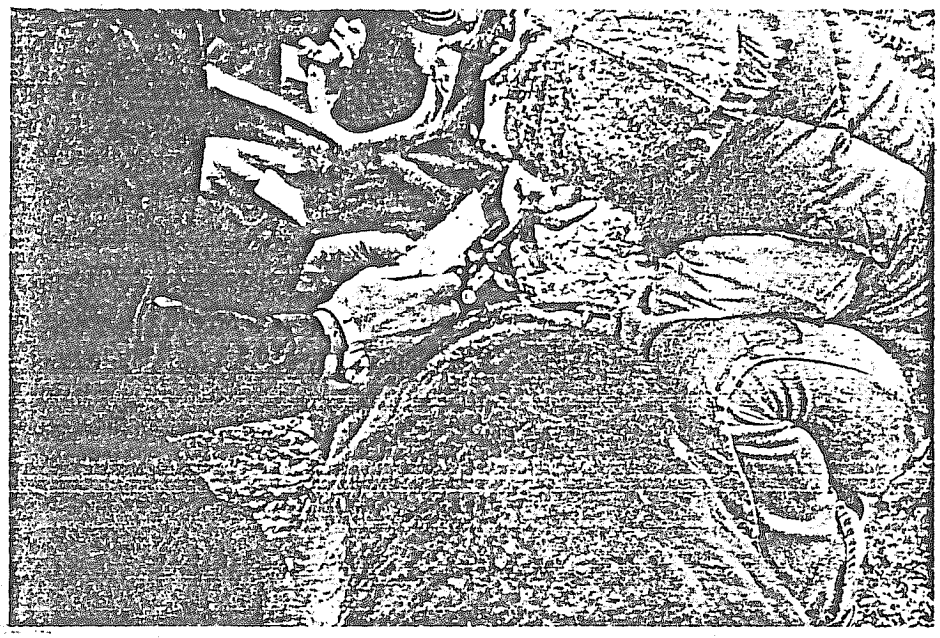

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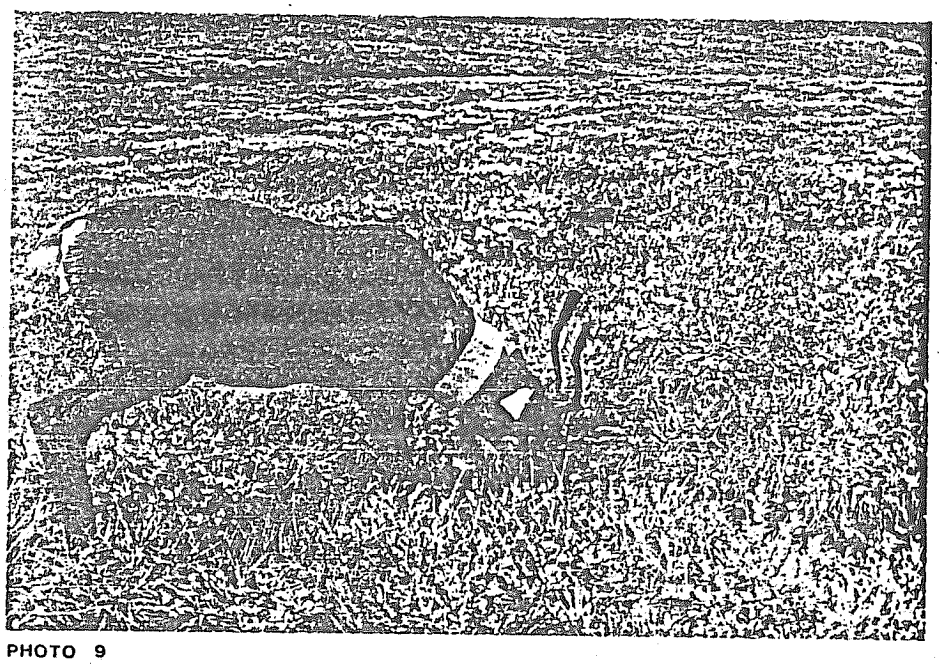

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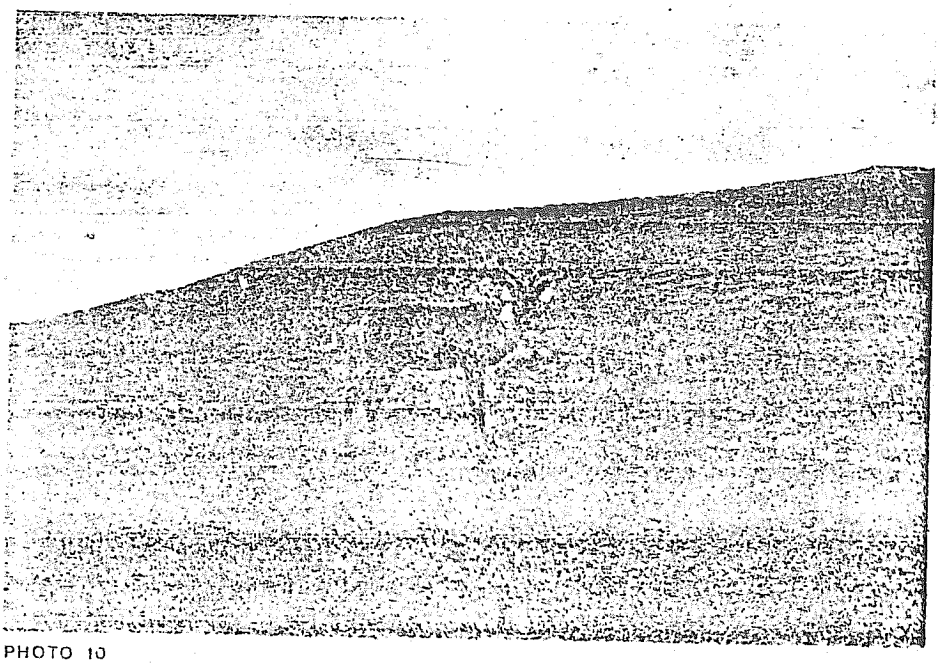

PHOTO 10

approximate direction of the source until the signal strength reached a peak. A 90° turn was then made in the direction the signal seemed strongest. These maneuvers were repeated until a visual confirmation of the radio-collared animal was achieved or the search area was confined to as narrow an area as possible. Data on caribou numbers, activity, sex and age classes (when possible), time of day, topography and miscellaneous information were collected. Locations were plotted on topographic map "Kluane Lake 115G and 115F (E½)" (1:250,000) and universal trans-mercator (UTM) grid coordinates used to describe locations. Incidental observations of unmarked caribou were also recorded in a similar manner.

Ground Reconnaissance

Ground reconnaissance of caribou in the areas of the Burwash Uplands, Tatamagouche Creek, Quill Creek and Maple Creek were conducted at intervals over the period of September, 1978 to July, 1979. Data were recorded on caribou observed as described above.

Census

Helicopter surveys were conducted in March and June, 1979 by the Yukon Wildlife Branch. Three observers were used. Due to the topographic variability in the study area, ridge and mountainous terrain were surveyed by flying at a constant elevation following contours, while plateau areas were surveyed in line transects approximately 1.2-1.6 km apart at an elevation of 305 m. All caribou observed were recorded for the data described above.

RESULTS

Number of Caribou Radio-collared

Over the three day period of September 6, 7 and 8, 1978, 10 mountain caribou (3 adult bulls, 7 adult does) were captured in the study area. One adult doe died as a result of the capture procedure. The remaining 9 radio-collared animals were aerially relocated 78 times from September, 1978 through July, 1979. Visual contact was more frequent during November to March (72%) than during the periods of October and April to July (19%). We attribute the generally low overall percentage of visual contacts to

the great difficulty of spotting mountain caribou (particularly when stationary or among tall vegetation) from fixed-wing aircraft, and the seasonal variation in visual contacts to the white background provided by snowcover during November to March. All nine radio-collars remained active over the period of this study and are still transmitting as of the date of this report.

Locations of Caribou Observed During the Study

Tables 1 through 21 provide summaries of locational information for all observations recorded during the study periods and Figures 2 through 11 show the locations of all collared caribou according to each survey flight. Figures 12 through 20 show the location of each radio-collared caribou according to all survey flights. The straight-line shortest distance to the proposed pipeline route for each caribou observation was calculated.

Table 22 provided an analysis of that data for all survey and census flights. The closest distance of caribou to the proposed pipeline route measured during aerial surveys was 4 km (May and June) while the farthest distance was 21 km (November and April). The mean minimum distance of caribou varied from a high of approximately 14 km (November-April) to a low of approximately 10 km (May and June). These mean valves show that caribou were on the average located 12 km from the proposed pipeline route during September and part of October; distances then increased to an average of approximately 14 km after the rut and throughout the winter months until the beginning of May; the caribou then moved, on the average, closer to the pipeline route (10 km) during the calving period and then began to move further away (12-14 km) during the latter part of June and into July.

Coefficients of variation of the distance of caribou from the proposed pipeline route were calculated for each survey flight. These coefficients provide a measure of the degree of dispersal of caribou both in relation to the pipeline and, when coefficients are compared, between individual groups of caribou. Low coefficients of variation suggest that caribou groups are distributed at similar distances from

the proposed pipeline route and our direct observations of caribou groups indicate that when that occurs caribou are also closely grouped. High coefficients of variation suggest that caribou groups widely vary in their distances from the proposed pipeline route, and, again, direct observations of caribou groups indicate that they are then widely dispersed in relation to one another.

The coefficients of variation listed in Table 21 show an increase in the variability of distances of caribou from the pipeline route during the fall, which leveled off in late fall and then declined sharply between November and January. The low coefficient for January suggests that the caribou observed during the January flight were at similar distances from the pipeline, i.e. were more closely grouped than during previous flights. After January, the coefficients indicate a dispersal of caribou to a fluctuating level (17.4-22.5) which reached a peak in the calving period of late May (49.5%) and early June (42.1%). By mid-June variations in distances of caribou from the proposed pipeline route decreased indicating a re-grouping of animals.

Period of Crossing of Caribou through the Proposed Pipeline Route

During the course of this study, 5 out of 9 caribou radio-collared on the Burwash Uplands and in its vicinity were recorded to have crossed the proposed pipeline corridor to the Brooks Arm plateau and to have returned again to the Burwash Uplands. We have no evidence to suggest that multiple crossings by any of the radio-collared caribou occurred. Table 23 provides a record of the periods in which crossings of radio-collared caribou occurred.

The data from this table show that radio-collared caribou commenced crossing to the Brooks Arm plateau no earlier than September 8, 1978 (the last date of the collaring operation) and no later than January 27, 1979 (after this date no new radio-collared caribou were found on the Brooks Arm plateau). 3 of the 5 caribou to cross made the journey in the period between November 22, 1978 and January 27, 1979. Between January 27, 1979 and March 3, 1979, 2 of these 3 radio-collared caribou returned to the Burwash Uplands. Between March 3, 1979 and April 29, 1979, one more radio-

collared animal made the recrossing. Interestingly these first 3 out of 5 caribou to make the recrossing were adult does. Between June 9, 1979 and July 10, 1979 the last two radio-collared caribou (both adult bulls) made the recrossing to the Burwash Uplands.

Location of Crossing of Caribou through the Proposed Pipeline Route

Despite extensive ground searching no visual sighting of caribou crossing the proposed pipeline route or finding of tracks was recorded in the fall of 1978. Multiple caribou tracks crossing the Alaska Highway were observed on March 21, 1979 less than 1 km southeast of the Hudsons Bay Mining and Smelting Company (approximate kilometer 1777 on the Alaska Highway). These tracks were observed to have originated from the Brooks Arm plateau. They crossed the Alaska Highway at the point indicated and fanned out into the area of Quill Creek and the lower slopes between Quill Creek and Burwash Creek. On March 30, 1979 caribou tracks indicating 2 - 3 animals were observed crossing the Alaska Highway near kilometer post 1792 (less than 2 km west of Swede Johnson Creek). Two observations by local residents of caribou crossing the Alaska Highway were reported: an observation of one adult caribou approximately 2 km northwest of Burwash Landing on April 24, 1979; and, one observation of one adult caribou approximately 2 km southeast of Quill Creek on May 6, 1979.

Population Numbers and Density of Caribou Within the Study Area

Two census flights were conducted during this study by the Yukon Wildlife Branch. 82% of the study area or 1060 km^2 was surveyed on the flight of March 3, 1979. 242 caribou were counted, yielding a density in the census area of 1 caribou per 4.4 km^2. The majority of these animals were distributed basically in 2 ranges within the census area: 1) 114 animals were found in the region of Arch Creek and Maple Creek, i.e. 5.3% of the census area, and 2) 122 animals were found in the area of the Brooks Arm plateau, i.e. 3.5% of the census area. On the census flight of June 17, 1979, 70.5% of the study area or 911 km^2 was surveyed. 197 caribou were counted, yielding a density in the census area of 1 caribou per 4.6 km^2. Unlike the highly aggregated distribution of caribou found on March 3, caribou groups on the June flight were found to be widely distributed in smaller groups.

CONCLUSIONS AND DISCUSSION

1. Mountain caribou of the Burwash Uplands region cross the proposed gas pipeline route.
2. The movement of caribou through the proposed pipeline route occurs over a broad period of time, although the actual crossing may be of short duration.
3. The majority of movement from the Burwash area to the Brooks Arm area may occur in a period from mid-October into January, although much more detailed substantiation of this is required.
4. The return crossing of caribou may occur as early as late-January and continue to as late as early-July.
5. In crossing the proposed pipeline route and approaching either the Brooks Arm area or Burwash area, caribou groups may fan out from their point of departure and cross the proposed pipeline route along a wide front.
6. Within this front the Quill Creek drainage may be a major and recurrent area of crossing for caribou (this is supported by a report of a local resident who saw 25 caribou cross the Alaska Highway near Quill Creek on October 10, 1977).
7. Very few, if any, caribou occupy habitat for any lengthy period of time within a distance of less than 4 kilometers from the proposed pipeline route. Further substantiation of this is required.
8. The majority of caribou within the study area occupy habitat, on a seasonal basis, within a radius of 4 to 21 km from the proposed pipeline route.
9. Caribou groups were more greatly dispersed in relation to the proposed pipeline route in the fall (October-November) and late spring (late May-June) than at other times during the study period.
10. Caribou groups were at their closest to the proposed pipeline route in late spring (calving period), and that these groups tended to be adult does with newborn calves.
11. A number of calving sites were within 5 kilometers of the proposed pipeline route.

12. Many rutting groups gather in the vicinity of Tatamagouche Creek during the rut (October-November).

13. Caribou which do not cross to the Brooks Arm area winter in the area of Arch Creek, Wade Creek and Maple Creek.

14. Caribou which do cross to the Brooks Arm area winter on the Brooks Arm plateau.

It should be clear that these conclusions must be considered preliminary to the consideration of the potential impacts of the proposed gas pipeline upon the caribou within the study area. We are still beset by quite a number of unknowns.

1. We do not know the number or composition of caribou from the Burwash herd that cross to the Brooks Arm plateau. We do not know what factors determine their route selection, or why some animals stay on the Burwash side and some move to the Brooks Arm plateau. We do not know if all animals that cross from the Burwash Uplands return. We do not know if there is reproductive exchange between the Burwash herd and the suspected Brooks Arm herd.
2. We suspect a resident population of mountain caribou in the area of the Brooks Arm plateau but we do not know its number and composition, nor do we have any information about recruitment or factors regulating its numbers. We do not know if individuals of this suspected resident population move onto the Uplands or whether they move into other areas on a seasonal basis.
3. We do not know the qualities of winter range occupied by these caribou.
4. We do not know if the nonexistent recruitment reported for the Burwash herd from 1974-1975 by Oosenbrug (1976) is continuing. In this regard it should be of concern to Foothills Pipelines Ltd. that calving sites for the Burwash herd have been reported within 5 km of the proposed pipeline route.
5. We do not know the extent and importance of mortality factors operating on these herds.

It is of paramount importance in the consideration of the potential impacts of the proposed pipeline that research efforts be directed to the effects of pipeline construction and maintenance activities on reproductive

success and survivorship within the population. Mountain caribou exhibit low reproductive rates. Females are monoparous. It has been shown from studies in other areas that mountain caribou show very little phenotypic plasticity (particularly in relation to other cervids) in relation to their reproductive strategies that might vary and affect populations and population growth. Given these factors and the realization that we know very little about the extent and importance of natural mortality factors operating on these herds, we must be concerned about the potential additional impact resulting from pipeline construction and maintenance activities. It is essential that key mortality factors to the population be assessed if accurate predictions of impact disturbances are to be made. To this end research efforts should be directed toward the following areas:

- accurate estimates of population numbers on a seasonal basis.
- reproductive rates of populations.
- occurrence and extent of inter-population breeding.
- distribution of individuals by age and sex within each population.
- mortality factors and their importance.
- survivorship by age and sex classes.
- timing and duration of calving and location of calving sites.
- distribution of local populations in the vicinity of the proposed pipeline corridor.
- seasonal movement behaviour.
- movement routes through the pipeline corridor.
- numbers and composition of caribou moving through the pipeline corridor.
- factors initiating and controlling movement.
- timing of movements.

I have briefly described the limited information we have available in a few of the above areas. It is inadequate at this time in meeting the predictive needs of Foothills Pipelines Ltd., and that agency would be in error to proceed as if it were. Further research is required in the areas I have outlined. Since construction is not planned in this area until 1982, the time frame exists in which to continue gathering the required information.

ACKNOWLEDGEMENTS

I extend my sincere appreciation to Dr. John Theberge for his continued advice and support.

I thank the staff of the Technical Section of the Yukon Wildlife Branch for their help, particularly Dr. Manfred Hoefs and Mr. Doug Larsen who were instrumental in the success of the caribou capture and collaring operation.

Andy Williams, Wynn Muss, George McKias, Ron Eland and Barry Watson performed the piloting duties over the course of the study. Their skill added immeasurably to the study.

I also thank the many individuals who assisted as very able observers in both aerial and ground reconnaissance. My debt of gratitude to my wife, Rita, for her unfailing encouragement and support grows every day.

Table 1 - Selected information on collared caribou from the mountain caribou capture project in the Burwash Uplands and surrounding area, September 6 and 7, 1978.

(Also see Figure 2 and Appendix 1)

Caribou Number	Capture Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Sex	Comments
1	UTM7VET8397	18	1678;northeast	Female	In a group of 2 does and 2 calves. Other doe is Caribou #2.
2	UTM7VET8499	16	1678;northeast	Female	In a group of 2 does and 2 calves. Other doe is Caribou #1.
3	UTM7VEU8705	10	1678;south	Male	In a group of 2 males, 4 does and 2 calves.
4	UTM7VEU9101	10	1678;east	Female	In a group of 2 does and 2 calves. Other doe is Caribou #5.
5	UTM7VEU9102	8	1525;open terrain	Female	In a group of 2 does and 2 calves. Other doe is Caribou #4.
6	UTM7VEU8901	10	1678;north	Female	Observed alone.
7	UTM7VEU8207	13	1678;west	Male	In a group of 2 males, 3 females and 1 calf. Caribou #8 also in group.
8	UTM7VEU8207	13	1678;west	Female	In a group of 2 males, 3 females and 1 calf. Caribou #7 also in group.
9	UTM7VEU8306	13	1830;north	Male	Observed alone.

Table 2 - Summary of caribou observations by aerial reconnaissance, September 6, 7 and 8, 1978.

Number of Caribou in Each Group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Comments
4	UTM7VET8397	18	1678;northeast	2 adult female caribou with 2 calves. The 2 adults were collared as Caribou #1 and #2.
8	UTM7VEU8705	10	1678;south	2 bulls with 4 does and 2 calves. One of the bulls was collared as Caribou #3.
4	UTM7VET9199	11	1372;creek bottom	4 adult female caribou.
4	UTM7VEU9101	10	1678;east	2 does with 2 calves. The 2 does were collared as Caribou #4 and #5.
1	UTM7VEU8901	10	1678;north	1 doe; collared as Caribou #6.
6	UTM7VEU8207	13	1678;west	2 bulls with 3 does and 1 calf. 1 bull and 1 doe collared as Caribou #7 and #8 respectively.
5	UTM7VEU8307	12	1754;northwest	5 bull caribou. One was collared as Caribou #9.
13	UTM7VFU0322	12	1449;upland plateau	4 bull caribou with 5 does and 4 calves.

Table 3 - Summary of locations of collared caribou monitored by aerial reconnaissance, October 14, 1978. (Also see Figure 3).

Caribou Number	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Approximate Minimum Distance Moved Since Original Capture (km)	Altitude (meters) and Aspect	Comments
1	UTM7VEU8306	13	11	1678;southwest	In a group of 9 caribou.
2	UTM7VEU7802	19	6	1525;open terrain	In a group of 2 does and 2 calves.
3	UTM7VEU8406	13	5	1678;south	No visual confirmation.
4	UTM7VEU8512	8	13	1830;south	No visual confirmation.
5	UTM7VEU8606	12	4	1830;upland plateau	In a group of 33-35 caribou.
6	UTM7VEU8203	16	4	1372;flat terrain	No visual confirmation.
7	UTM7VEU0414	8	23	1144;south	Caribou #7 was found at this location on October 9, 1978.
8	UTM7VEU8106	15	2	1525;southwest	No visual confirmation.
9	UTM7VEU8712	7	6	1830;south	No visual confirmation.

Table 4 - Summary of caribou observations by aerial reconnaissance, October 14, 1978.

Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and Aspect	Comments
9	UTM7VEU8306	13	1830;southwest	Caribou #1 present.
4	UTM7VEU7802	19	1525;open terrain	2 does with calves; caribou #2 present.
33-35	UTM7VEU8606	12	1830;upland plateau	Mixed group of bulls, does, calves, yearlings. Caribou #5 present.
1	UTM7VEU8909	6	1678;northwest	Lone uncollared bull.
25	UTM7VEU7907	16	1525;southwest	Mixed group of bulls, does, calves, yearlings. No collared caribou present.

Table 5 - Summary of locations of collared caribou monitored by aerial reconnaissance, November 22, 1978. (Also see Figure 4).

Caribou Number	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Approximate Minimum Distance Moved Since Last Sighting (km)	Cumulative Total of Distance Moved Since Original Capture (km)	Altitude (meters) and Aspect	Comments
1	UTM7VEU7505	20	7	18	1525;flat terrain	Caribou #1 and #2 were together; each with one calf
2	UTM7VEU7505	20	2	8	1525;flat terrain	See above.
3	UTM7VEU7308	21	12	17	1068;flat terrain	No visual confirmation.
4	UTM7VFU0224	13	21	34	1449;upland plateau	Found together with Caribou #7 in a mixed group of 40 caribou.
5	Not located	-	-	-	-	-
6	UTM7VFT0397	7	20	24	1449;west facing	Found in a mixed group of 28 caribou
7	UTM7VFU0224	13	10	33	1449;upland plateau	See comments for Caribou #4.
8	UTM7VEU8509	10	5	7	1525;south	No visual confirmation.
9	UTM7VEU8104	15	8	14	1372;flat terrain	No visual confirmation.

Table 6 - Summary of caribou observations by aerial reconnaissance, November 22, 1978.

Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and Aspect	Comments
7	UTM7VFU0223	12	1525;upland plateau	Group of bulls. No collared caribou present.
40	UTM7VFU0224	13	1449;upland plateau	Mixed group of bulls, does, calves, yearlings. Caribou #4 and #7 present.
25	UTM7VEU7708	16	1220;northwest	Mixed group of bulls, does, calves, yearlings. No collared caribou present.
8	UTM7VEU7508	18	1068;north	Group of bulls. No collared caribou present.
10	UTM7VEU7807	16	1372;west	Mixed group of bulls, does, yearlings. No collared caribou present.
4	UTM7VEU7505	20	1525;north	2 does (Caribou #1 and #2) and 2 calves.
6	UTM7VFT0298	5	1372;west	Does and calves. No collared caribou present.
28	UTM7VFT0397	7	1449;northwest	Mixed group of bulls, does, calves, yearlings. Caribou #6 present.

Table 7 - Summary of locations of collared caribou monitored by aerial reconnaissance, January 27, 1979. (Also see Figure 5).

Caribou Number	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Approximate Minimum Distance Moved Since Last Sighting (km)	Cumulative Total of Distance Moved Since Original Capture (km)	Altitude (meters) and Aspect	Comments
1	UTM7VFU0224	13	32	50	1372;upland plateau	In a group of 31 caribou with Caribou #3, #4, and #7.
2*	-	-	-	-	-	-
3	UTM7VFU0224	13	34	51	1372;upland plateau	See Comments for Caribou #1.
4	UTM7VFU0224	13	0	34	1372;upland plateau	See Comments for Caribou #1.
5	UTM7VEU8013	13	Unknown	Unknown	1220;valley bottom	In a group of 28 caribou.
6	UTM7VEU7614	15	30	54	1525;south	In a group of 9 caribou.
7	UTM7VFU0224	13	0	33	1372;upland plateau	See Comments for Caribou #1.
8*	-	-	-	-	-	-
9	UTM7VEU8104	15	0	14	1372;flat terrain	No visual confirmation.

* A signal was received at UTM7VFU0124 (1449 m;flat terrain) not corresponding to any expected signal. It must belong to either Caribou #2 or #8. This location is 11 km from the proposed pipeline route.

Table 8 - Summary of caribou observations by aerial reconnaissance, January 27, 1979.

Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and Aspect	Comments
10	UTM7VFU0323	13	1220;upland plateau	No collared caribou present. Mostly adult female.
31	UTM7VEU0224	13	1372;upland plateau	On approach by plane this herd broke up into one herd of 16 and one of 15. Caribou #1 and #3 were in the former herd; Caribou #4 and #7 were in the latter.
6	UTM7VEU9829	12	1525;northeast	No collared caribou present. All antlered females.
28	UTM7VEU8013	13	1220;valley bottom	When first seen 28 were out on a small lake; 7 were in the trees. Caribou #5 was visually confirmed among the group on the lake.
20	UTM7VEU7412	17	1525;south	No collared caribou present.
7	UTM7VEU7612	16	1372;northeast	No collared caribou present.
9	UTM7VEU7614	15	1525;northwest	Caribou #6 visually confirmed.

Table 9 - Summary of locations of collared caribou monitored by aerial reconnaissance, March 3, 1979. (Also see Figure 6).

Caribou Number	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Approximate Minimum Distance Moved Since Last Sighting (km)	Cumulative Total of Distance Moved since Original Capture (km)	Altitude (meters) and Aspect	Comments
1	UTM7VEU7806	18	31	81	1372;flat terrain	No visual confirmation
2	UTM7VEU7614	15	Unknown	Unknown	1525;northwest	In a mixed grou of 29 caribou with Caribou #6
3	UTM7VFU0224	13	0	51	1372;upland plateau	In a mixed grou of 16 caribou/
4	UTM7VFU0224	13	0	34	1372;upland plateau	In a mixed grou of 6 caribou.
5	UTM7VEU7613	15	Unknown	Unknown	1372;south	In a mixed grou of 8 caribou.
6	UTM7VEU7614	15	0	54	1525;northwest	See Comments fo Caribou #2.
7	UTM7VFU0224	13	0	33	1372;upland plateau	In a mixed grou of 16 caribou.
8	UTM7VEU7711	15	Unknown	Unknown	1220;valley bottom	In a mixed grou of 8 caribou.
9	UTM7VEU8104	15	0	14	1372;flat terrain	No visual confirmation.

Table 10 - Summary of caribou observations by aerial reconnaissance, March 3, 1979.

Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and Aspect	Comments
7	UTM7VEU7319	15	1678;southwest	5 females, 2 calves. No collared caribou present.
9	UTM7VEU7315	18	1372;south	1 bull, 8 females and yearlings. No collared caribou present.
15	UTM7VEU7314	17	1525;west	12 females and yearlings, 3 calves. No collared caribou present.
36	UTM7VEU7614	15	1525;northwest	29 adults, 7 calves. Caribou #6 and #2 present.
25	UTM7VEU7714	14	1525;northeast	24 females and yearlings, 1 calf. No collared caribou present.
6	UTM7VEU7711	15	1220;valley bottom	5 females and yearlings, 1 calf. Caribou #8 present.
5	UTM7VEU7216	18	1525;north	4 females and yearlings, 1 calf. No collared caribou present.
8	UTM7VEU7613	15	1372;south	6 females and yearlings, 2 calves. Caribou #5 present.
3	UTM7VFU0220	11	1220;upland plateau	3 bulls. No collared caribou present.
16	UTM7VFU0224	13	1372;upland plateau	12 females and yearlings, 4 calves. Collared caribou #3 present.
2	UTM7VFU0224	13	1372;upland plateau	1 female, 1 calf. No collared caribou present.

Table 10 continued....

Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and Aspect	Comments
6	UTM7VFU0224	13	1372;upland plateau	4 females and yearlings, 2 calves. Caribou #4 present.
2	UTM7VFU0224	13	1372;upland plateau	1 female, 1 calf. No collared caribou present.
5	UTM7VFU0224	13	1372;upland plateau	All adults. No collared caribou present.
6	UTM7VFU0224	13	1372;upland plateau	5 females, 1 calf. No collared caribou present.
6	UTM7VFU0224	13	1372;upland plateau	5 females, 1 calf. No collared caribou present.
16	UTM7VFU0224	13	1372;upland plateau	13 adults, 3 calves. Caribou #7 present.
16	UTM7VFU0224	13	1372;upland plateau	13 adults, 3 calves. No collared caribou present.
37	UTM7VEU9731	12	1525;northeast	30 adults, 7 calves. No collared caribou present.
10	UTM7VFU0727	19	1525;east	7 adults, 3 calves. No collared caribou present.
4	UTM7VEU7821	8	1372;north	3 adults, 1 calf. No collared caribou present.
2	UTM7VEU7806	17	1220;valley bottom	2 adults. No collared caribou present.

Table 11 - Summary of locations of collared caribou monitored by aerial reconnaisance, April 29, 1979. (Also see Figure 7).

Caribou Number	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Approximate Minimum Distance Moved Since Last Sighting (km)	Cumulative Total of Distance Moved Since Original Capture (km)	Altitude (meters) and Aspect	Comments
1	UTM7VET9297	12	17	98	1220;flat terrain	No visual confirmation.
2	UTM7VEU8702	12	16	Unknown	1372;flat terrain	No visual confirmation.
3	UTM7VFU0125	12	0	52.5	1525;upland plateau	No visual confirmation.
4	UTM7VET8899	13	26	60	1449;upland plateau	No visual confirmation.
5	UTM7VEU8802	12	17	Unknown	1372;upland plateau	No visual confirmation.
6	UTM7VEU7702	21	13	67	1830;north	No visual confirmation.
7	UTM7VFU0224	13	0	33	1449;upland plateau	No visual confirmation.
8	UTM7VET8003	18	11	Unknown	1525;north	No visual confirmation.
9	UTM7VEU8104	15	0	14	1372;upland plateau	No visual confirmation.

Table 12 - Summary of locations of collared caribou monitored by aerial reconnaissance, May 15, 1979. (Also see Figure 8).

Caribou Number	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Approximate Minimum Distance Moved Since Last Sighting (km)	Cumulative Total of Distance Moved Since Original Capture (km)	Altitude (meters) and Aspect	Comments
1	UTM7VEU8211	12	18	116	1372;northeast	No visual confirmation.
2	UTM7VEU8108	15	9	Unknown	1525;northeast	No visual confirmation.
3	UTM7VFU0125	12	0	52.5	1525;upland plateau	No visual confirmation.
4	UTM7VEU9104	8	6	64	1220;upland plateau	In a group of 3 female adult caribou.
5	UTM7VEU8705	10	5	Unknown	1525;southeast	No visual confirmation.
6	UTM7VEU8706	10	13	80	1600;northeast	No visual confirmation.
7	UTM7VFU0224	13	0	33	1449;upland plateau	No visual confirmation.
8	UTM7VEU8904	10	10	Unknown	1220;upland plateau	In a group of 2 adult caribou.
9	UTM7VEU8104	15	0	14	1372;upland plateau	No visual confirmation.

Table 13 - Summary of caribou observations by aerial reconnaissance, May 15, 1979.

Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and Aspect	Comments
4	UTM7VET9299	11	1678;upland plateau	No collared caribou sighted.
2	UTM7VEU8400	16	1525;north	No collared caribou sighted.
7	UTM7VEU8502	14	1525;upland plateau	Adults and yearlings. No collared caribou sighted.
8	UTM7VEU8702	12	1525;upland plateau	No collared caribou sighted.
1	UTM7VEU8803	11	1525;upland plateau	A bull. No collared caribou sighted.
2	UTM7VEU8904	10	1525;upland plateau	Adults. No collared caribou sighted.
6	UTM7VEU8701	13	1525;upland plateau	Adults and yearlings. No collared caribou sighted.
3	UTM7VET9104	8	1220;upland plateau	Adult females with antlers. Caribou #4 present.
5	UTM7VEU8703	12	1220;upland plateau	3 adult females (all antlered) and 2 yearlings. No collared caribou present.

Table 14 - Summary of locations of collared caribou monitored by aerial reconnaissance, May 31, 1979. (Also see Figure 9).

Caribou Number	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Approximate Minimum Distance Moved Since Last Sighting (km)	Cumulative Total of Distance Moved Since Original Capture (km)	Altitude (meters) and Aspect	Comments
1	UTM7VEU9307	5	12	128	1449;east	No visual confirmation.
2	UTM7VEU8304	14	5	Unknown	1372;south	No visual confirmation.
3	UTM7VFU0125	12	0	52.5	1525;upland plateau	No visual confirmation.
4	UTM7VEU8912	5	8	72	1449;northeast	No visual confirmation.
5	UTM7VEU8707	9	1	Unknown	1678;upland plateau	In a mixed group of 10 caribou.
6	UTM7VEU8909	6	3	83	1678;west	No visual confirmation.
7	UTM7VFU0224	13	0	33	1449;upland plateau	No visual confirmation.
8	UTM7VEU7604	19	12	Unknown	1525;north	No visual confirmation.
9	UTM7VEU8104	15	0	14	1372;upland plateau	No visual confirmation.

Table 15 - Summary of caribou observations by aerial reconnaissance, May 31, 1979.

Number of caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and Aspect	Comments
2	UTM7VET9999	5	1220;upland plateau	1 adult female with calf.
8	UTM7VET9299	10	1372;upland plateau	6 adult caribou with 2 calves.
3	UTM7VEU9605	4	1220;upland plateau	2 adult female caribou with 1 calf.
4	UTM7VEU9406	4	1220;upland plateau	4 adults and yearlings.
2	UTM7VEU8804	11	1372;upland plateau	2 adult caribou.
1	UTM7VEU7802	19	1525;north	1 bull caribou.
11	UTM7VEU8306	13	1678;southwest	8 adult and yearling caribou with 3 calves.
10	UTM7VEU8707	9	1678;upland plateau	6 adult and yearling caribou with 4 calves. Caribou #5 present in this group.
2	UTM7VEU8808	8	1372;southwest	2 adult caribou.
2	UTM7VEU8603	13	1372;upland plateau	2 adult caribou.
3	UTM7VEU8815	4	1068;northeast	2 adult female caribou with 1 calf.

Table 16 - Summary of locations of collared caribou monitored by aerial reconnaissance, June 9, 1979. (Also see Figure 10).

Caribou Number	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Approximate Minimum Distance Moved Since Last Sighting (km)	Cumulative Total of Distance Moved Since Original Capture (km)	Altitude (meters) and Aspect	Comments
1	UTM7VEU9500	8	7	135	1220;upland plateau	In a group of 8 caribou with Caribou #8.
2	UTM7VEU7706	18	9	Unknown	1220;upland plateau	No visual confirmation.
3	UTM7VFU0125	12	0	52.5	1525;upland plateau	No visual confirmation.
4	UTM7VEU8809	6	3	75	1525;west	No visual confirmation.
5	UTM7VEU7606	19	12	Unknown	1372;upland plateau	No visual confirmation.
6	UTM7VEU9801	5	13	96	1068;upland plateau	No visual confirmation.
7	UTM7VFU0224	13	0	33	1449;upland plateau	No visual confirmation.
8	UTM7VEU9500	8	20	Unknown	1220;upland plateau	See Comments for Caribou #1.
9	UTM7VEU8104	15	0	14	1372;upland plateau	No visual confirmation.

Table 17 - Summary of caribou observations by aerial reconnaissance, June 9, 1979.

Number of caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Comments
2	UTMFT0199	5	1220;upland plateau	1 adult female caribou with yearling.
1	UTM7VET9895	10	1068;valley bottom	1 adult caribou.
2	UTM7VET9397	12	1372;valley bottom	1 adult female caribou with calf.
6	UTM7VET9598	9	1144;upland plateau	6 adult and yearling caribou.
8	UTM7VEU9500	8	1068;upland plateau	5 adult and yearling caribou with 3 calves. Caribou #1 was present.
13	UTM7VEU8702	12	1372;upland plateau	13 adult and yearling caribou with 1 calf.
5	UTM7VEU8503	13	1372;upland plateau	5 adult and yearling caribou.
11	UTM7VEU8105	15	1372;southwest	8 adult and yearling caribou with 3 calves.
6	UTM7VEU8302	16	1449;upland plateau	6 adult and yearling caribou.
16	UTM7VEU8407	12	1830;upland ridge	11 adult and yearling caribou with 5 calves.
6	UTM7VEU8513	8	1830;upland ridge	4 adult and yearling caribou with 2 calves.
2	UTM7VEU9209	4	1220;northeast	1 adult female caribou with calf.
30	UTM7VEU9902	4	1068;upland plateau	25 adult and yearling caribou with 5 calves.

Table 18 - Summary of caribou observations by aerial reconnaissance, June 17, 1979.

Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Comments
2	UTM7VEU9901	5	1220;upland plateau	1 adult female caribou with calf.
9	UTM7VET9098	13	1449;east	9 adult and yearling caribou.
5	UTM7VET9298	12	1372;upland plateau	5 adult and yearling caribou.
2	UTM7VET8999	12	1372;upland plateau	1 adult female caribou with yearling.
5	UTM7VET9399	10	1372;upland plateau	5 adult and yearling caribou.
3	UTM7VEU7505	20	1449;upland plateau	3 adult caribou.
71	UTM7VEU8803	11	1372;upland plateau	58 adult and yearling caribou with 13 calves.
10	UTM7VEU8007	15	1525;upland plateau	8 adult and yearling caribou with 2 calves.
3	UTM7VEU8408	11	1525;northeast	3 adult and yearling caribou.
22	UTM7VEU8208	13	1678;northeast	16 adult and yearling caribou with 6 calves.
2	UTM7VEU8706	9	1525;northeast	1 adult female caribou with calf.
4	UTM7VEU8610	8	1678;west	2 adult female caribou with 2 calves.

Table 18 continued....

Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Comments
2	UTM7VEU8109	13	1525;upland plateau	2 adult caribou.
9	UTM7VEU8415	9	1678;upland ridge	5 adult and yearling caribou with 4 calves.
1	UTM7VEU7416	16	1525;north	1 adult female caribou.
6	UTM7VEU9918	7	1068;upland plateau	6 bull caribou.
1	UTM7VEU9921	9	1220;upland plateau	1 adult female caribou.
8	UTM7VEU9524	7	1220;upland plateau	8 bull caribou.
31	UTM7VFU0131	15	1830;south	21 adult and yearling caribou with 10 calves.
1	UTM7VFU0728	19	1525;southeast	1 bull caribou.

Table 19 - Summary of locations of collared caribou monitored by aerial reconnaissance, July 10, 1979. (Also see Figure 11).

Caribou Number	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Approximate Minimum Distance Moved Since Last Sighting (km)	Cumulative Total of Distance Moved Since Original Capture (km)	Altitude (meters) and aspect	Comments
1	UTM7VEU7910	14	19	154	1372;west	No visual confirmation.
2	UTM7VEU8306	16	6	Unknown	1525;south	No visual confirmation.
3	UTM7VET9498	9	24	76.5	1220;upland plateau	No visual confirmation.
4	UTM7VET8497	18	13	88	1678;north	In a group of 60 caribou with Caribou #7.
5	UTM7VEU8702	12	12	Unknown	1372;upland plateau	No visual confirmation.
6	Not Located	-	-	-	-	-
7	UTM7VET8497	18	32	65	1678;north	See Comments for Caribou #4.
8	UTM7VEU8505	11	11	Unknown	1678;south	No visual confirmation.
9	UTM7VEU8104	15	0	14	1372;upland plateau	No visual confirmation.

Table 20 - Summary of caribou observations by aerial reconnaissance, July 10, 1979.

Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Comments
60	UTM7VET8497	18	1678;northeast	47 adults and yearlings, 13 calves. Caribou #4 present.
35	UTM7VEU9926	12	1525;east	24 adult and yearling caribou with 2 calves.

Table 21 - Summary of caribou observations by aerial and ground reconnaissance; September, 1978 - July, 1979.

Date	Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Comments
September 6, 7, 8, 1978	See Tables				
September 14, 1978	3	UTM7VEU9002	10	1372;upland plateau	3 does with Caribou #6 present.
September 14, 1978	5	UTM7VEU9000	11	1525;south	1 bull with 2 does, 1 yearling and 1 calf.
September 15, 1978	10	UTM7VEU8501	17	1830;northeast	1 bull with 5 does and 1 calf.
September 16, 1978	3	UTM7VEU8507	15	1678;south	3 does.
September 16, 1978	2	UTM7VEU8608	10	1525;north	2 bulls.
September 16, 1978	3	UTM7VEU8306	13	1830;south	3 does with Caribou #5 present.
September 17, 1978	3	UTM7VEU8807	9	1373;northeast	1 bull with 2 does.
September 17, 1978	5	UTM7VEU8508	10	1373;north	3 does and 2 yearlings.
October 3, 1978	2	UTM7VEU8406	12	1830;south	1 doe and 1 calf.
October 3, 1978	11	UTM7VEU8305	14	1520;south	1 bull with 5 does, 1 calf and 4 yearlings.
October 4, 1978	5	UTM7VEU8307	13	1830;north	1 bull with 2 does and 2 yearlings.
October 4, 1978	1	UTM7VEU8306	13	1678;southwest	1 doe.
October 4, 1978	11	UTM7VEU8305	14	1520;south	1 bull with 5 does, 4 calves and 1 yearling.

Table 21 continued....

Date	Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Comments
October 5, 1978	8	UTM7VEU8509	14	1375;southwest	4 does with 1 calf and 3 yearlings.
October 5, 1978	15	UTM7VEU8410	14	1220;west	1 bull with 8 does and 6 yearlings.
October 9, 1978	1	UTM7VFU0414	8	915;upland plateau	1 bull which was Caribou #7.
October 14, 1978	See Tables 3 and 4.				
October 26, 1978	1	UTM7VFU0322	17	1520;southwest	1 bull which was Caribou #7.
October 26, 1978	2	UTM7VEU7803	19	1520;northeast	1 bull with 1 doe. Bull was Caribou #3.
November 2-5, 1978	Surveyed by ground reconnaissance Quill Creek and Tatamagouche Creek and headwaters of Maple Creek. No caribou were sighted. However, tracks showed 6 caribou along the slope of the ridge (altitude 1525 meters) north of Tatamagouche Creek. Two sets of caribou tracks were seen along Quill Creek.				
November 22, 1978	See Tables 5 and 6.				
January 27, 1979	See Tables 7 and 8.				
February 24, 1979	7	UTM7VEU7714	14	1525;north	Adults and yearlings.
March 3, 1979	See Tables 9 and 10.				
March 20, 1979	10	UTM7VFU0322	12	1372;upland plateau	Adults and yearlings.

Table 21 continued....

Date	Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Comments
March 21, 1979	43	UTM7VFU0125	12	1525;upland plateau	Mixed group of adults and yearlings with Caribou #3 present.
March 21, 1979	Multiple caribou tracks crossing the Alaska Highway at approximate km 1776.				
March 21, 1979	-	UTM7VFU0224	13	1449;upland plateau	Caribou #7 received by radio signal; no visual confirmation.
March 30, 1979	26	UTM7VEU9826	10	1525;upland plateau	Adults and yearlings.
March 30, 1979	Caribou tracks observed 30 meters south of Kilometer Post 1792 on the Alaska Highway.				
April 24, 1979	One caribou observed crossing the Alaska Highway at Kilometer Post 1752 (approximately 2 kilometers northwest of Burwash Landing).				
April 29, 1979	See Table 11.				
May 6, 1979	One caribou observed crossing the Alaska Highway at Kilometer Post 1776 (approximately 2 kilometers southeast of Quill Creek).				
May 15, 1979	See Tables 12 and 13.				
May 16, 1979	7	UTM7VEU8603	10	1373;north	Adults and yearlings.
May 16, 1979	3	UTM7VEU8104	16	1373;south	Adults and yearlings.
May 16, 1979	6	UTM7VEU8903	10	1373;upland plateau	Adults and yearlings.
May 16, 1979	3	UTM7VEU8702	12	1373;upland plateau	Adults and yearlings.
May 17, 1979	4	UTM7VEU8104	16	1373;south	Adults and yearlings.

Table 21 continued....

Date	Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Comments
May 17, 1979	1	UTM7VEU8504	13	1220;upland plateau	Adult.
May 17, 1979	1	UTM7VEU8704	11	1220;upland plateau	Adult.
May 17, 1979	6	UTM7VEU8903	10	1296;upland plateau	Adults and yearlings.
May 17, 1979	4	UTM7VEU8803	10	1296;upland plateau	Adults and yearlings.
May 24, 1979	1	UTM7VEU8802	11	1373;upland plateau	Adult caribou.
May 24, 1979	1	UTM7VEU8804	10	1373;upland plateau	Adult caribou.
May 24, 1979	1	UTM7VEU8806	9	1525;southeast	Bull caribou.
May 25, 1979	5	UTM7VEU8902	11	1400;upland plateau	3 does with 2 yearlings.
May 26, 1979	1	UTM7VEU9502	6	1220;upland plateau	Bull caribou.
May 31, 1979	See Tables 14 and 15.				
June 9, 1979	See Tables 16 and 17.				
June 17, 1979	See Table 18.				
July 2, 1979	2	UTM7VEU8303	14	1373;upland plateau	1 doe with yearling.
July 2, 1979	115	UTM7VEU8302	15	1440;upland plateau	Adults, yearlings and calves.

Table 21 continued....

Date	Number of Caribou in each group	Location	Approximate Minimum Distance from Proposed Pipeline (km)	Altitude (meters) and aspect	Comments
July 3, 1979	127	UTM7VET9596	12	1090;upland plateau	Adults and yearlings with 9-16 calves. Caribou #5 present in group.
July 4, 1979	2	UTM7VEU8203	15	1373;upland plateau	Doe with calf. Doe is Caribou #6.
July 5, 1979	1	UTM7VEU8303	15	1296;upland plateau	Adult female.
July 10, 1979	See Tables 19 and 20.				

Table 22 - Analysis of data on the minimum distance of caribou from the proposed pipeline, (data taken from Tables 1-20).

Date	Mean Minimum Distance (km) of Caribou From Proposed Pipeline (± standard deviation)		Range of Distances (km)	Sample Size (Number of Observations)	Coefficient of Variation (%)
September 6 and 7, 1978	12.2	± 2.9	8-18	11	23.8
October 14, 1978	12.1	± 4.3	6-19	11	35.5
November 22, 1978	14.3	± 5.0	5-21	13	35.0
January 27, 1979	14.0	± 1.5	12-17	12	10.7
March 3, 1979	14.4	± 2.5	8-19	25	17.4
April 29, 1979	14.2	± 3.2	12-21	9	22.5
May 15, 1979	12.0	± 2.2	8-16	17	18.3
May 31, 1979	9.9	± 4.9	4-19	19	49.5
June 9, 1979	10.7	± 4.5	4-19	21	42.1
June 17, 1979	11.7	± 3.9	5-20	20	33.3
July 10, 1979	13.9	± 3.1	9-18	9	22.3

Table 23 - Record of radio-collared caribou crossing the proposed pipeline route.

Caribou Number	Period of First Crossing	Period of Return Crossing
7 (adult bull)	Sept. 8, 1978 - Oct. 14, 1978	June 9, 1979 - July 10, 1979
4 (adult doe)	Oct. 14, 1978 - Nov. 22, 1978	March 3, 1979 - April 29, 1979
1 (adult doe)	Nov. 22, 1978 - Jan. 27, 1979	Jan. 27, 1979 - March 3, 1979
3 (adult bull)	Nov. 22, 1978 - Jan. 27, 1979	June 9, 1979 - July 10, 1979
2 (adult doe) or 8 (adult doe)	Nov. 22, 1978 - Jan. 27, 1979	Jan. 27, 1979 - March 3, 1979

F I G U R E S

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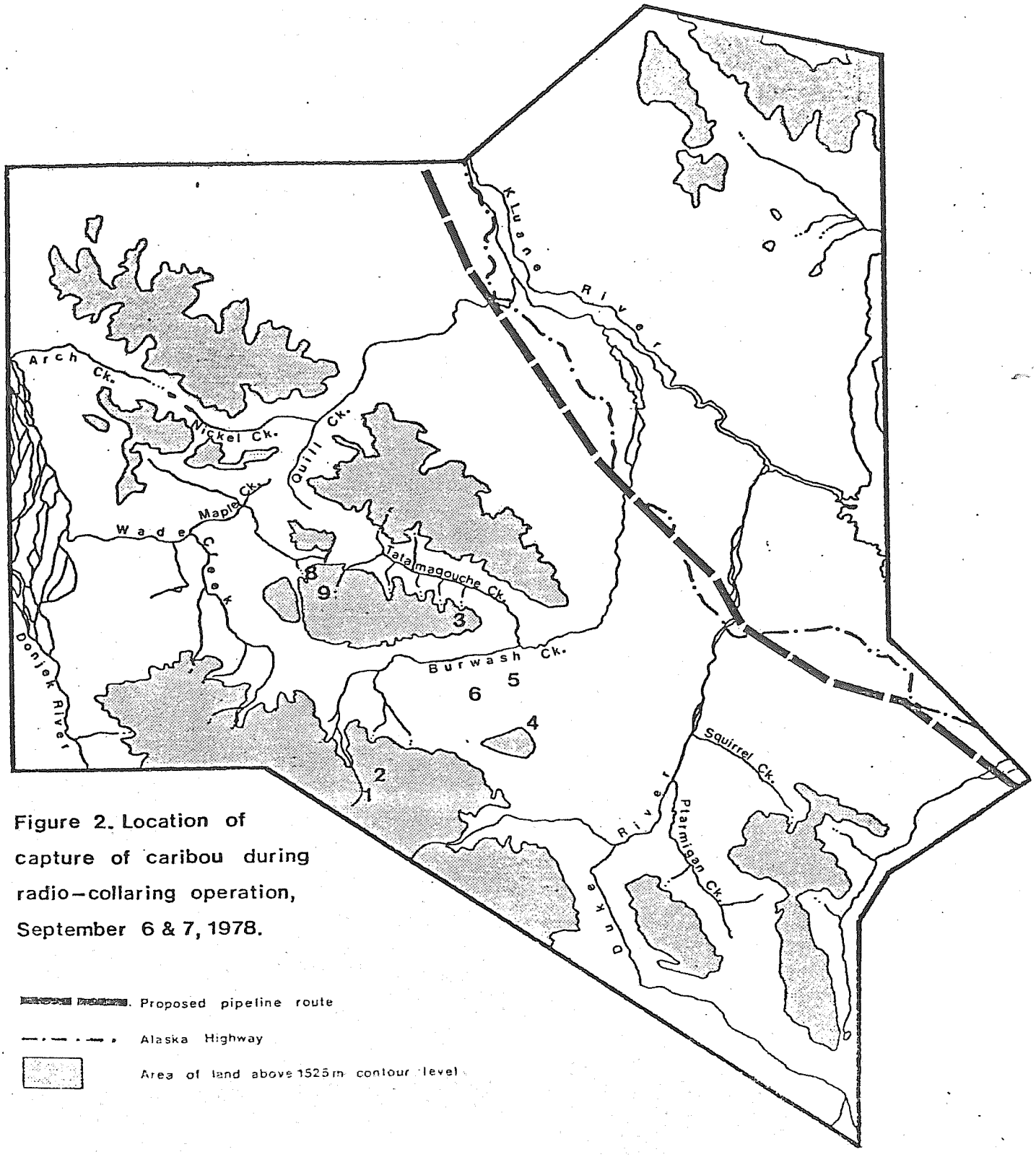

Figure 2. Location of capture of caribou during radio-collaring operation, September 6 & 7, 1978.

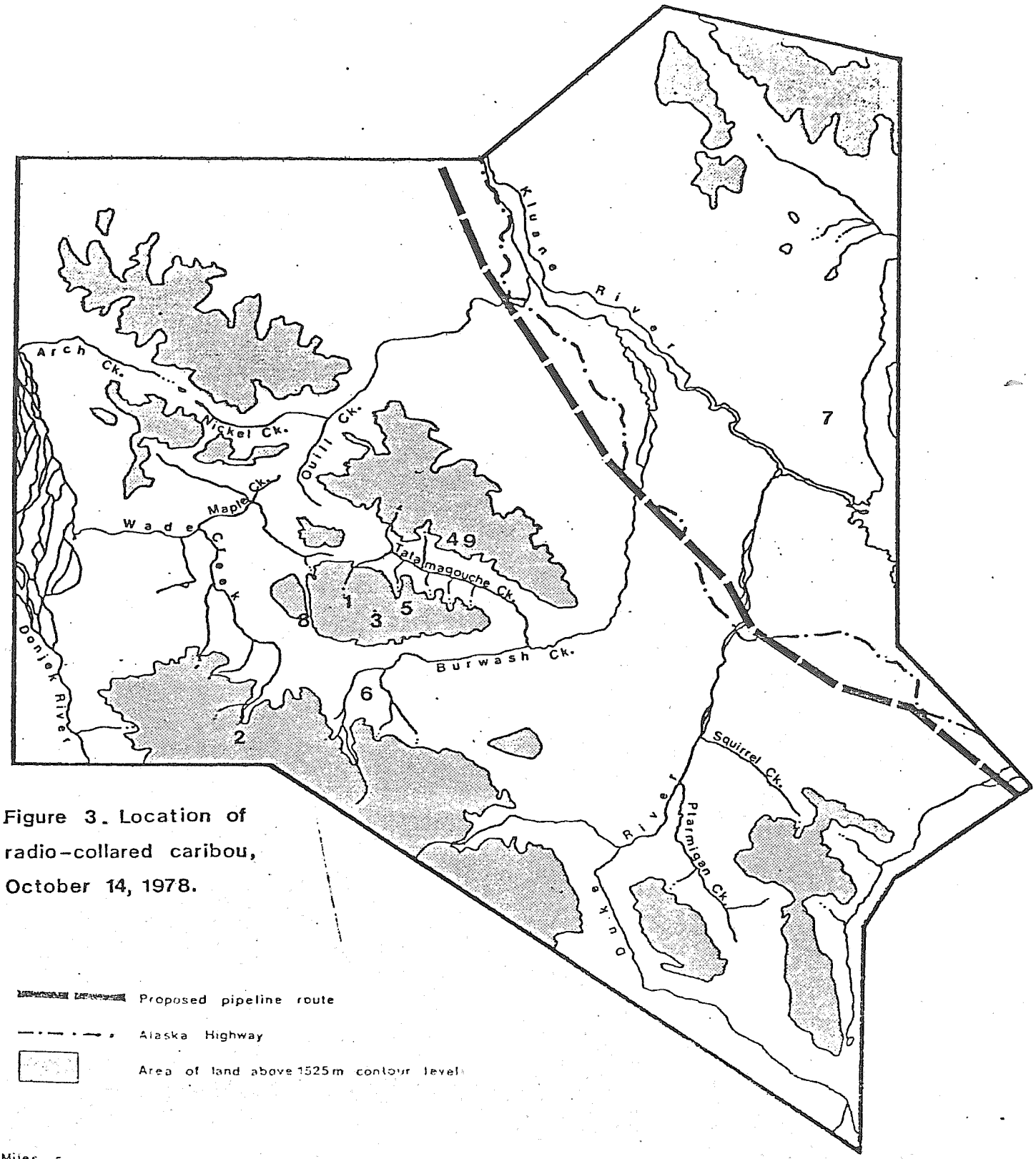

Figure 3. Location of radio-collared caribou, October 14, 1978.

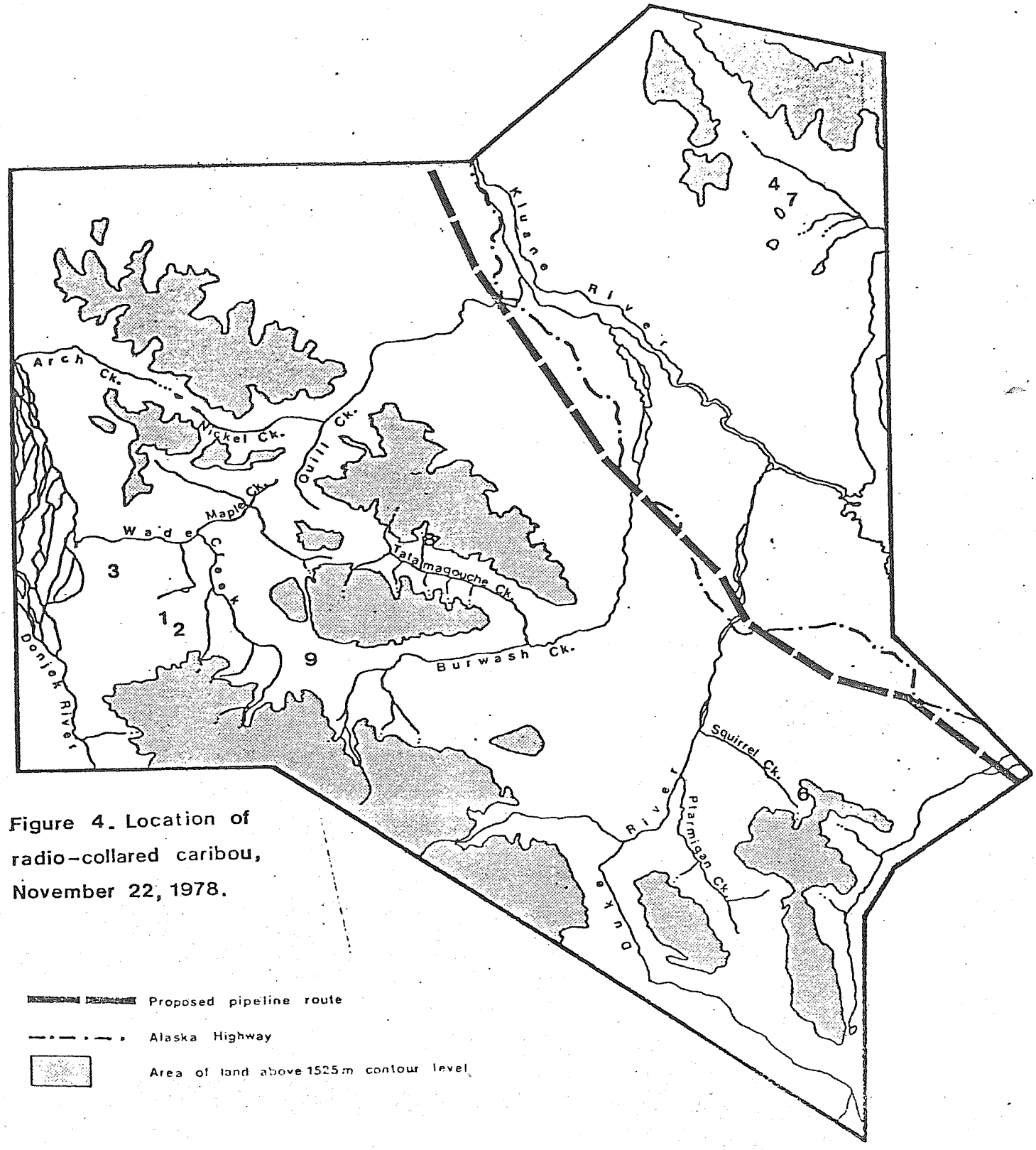

Figure 4. Location of radio-collared caribou, November 22, 1978.

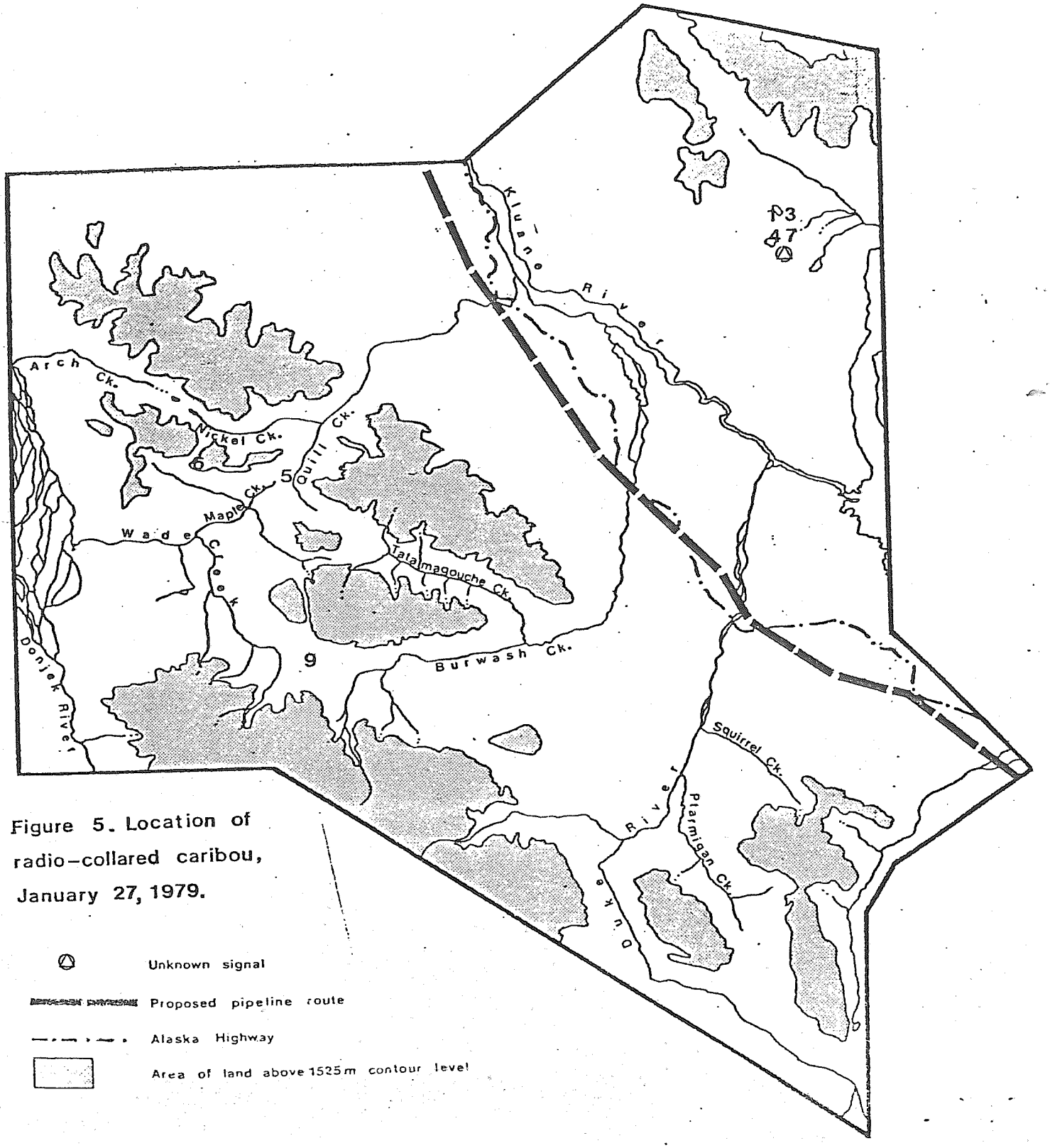

Figure 5. Location of radio-collared caribou, January 27, 1979.

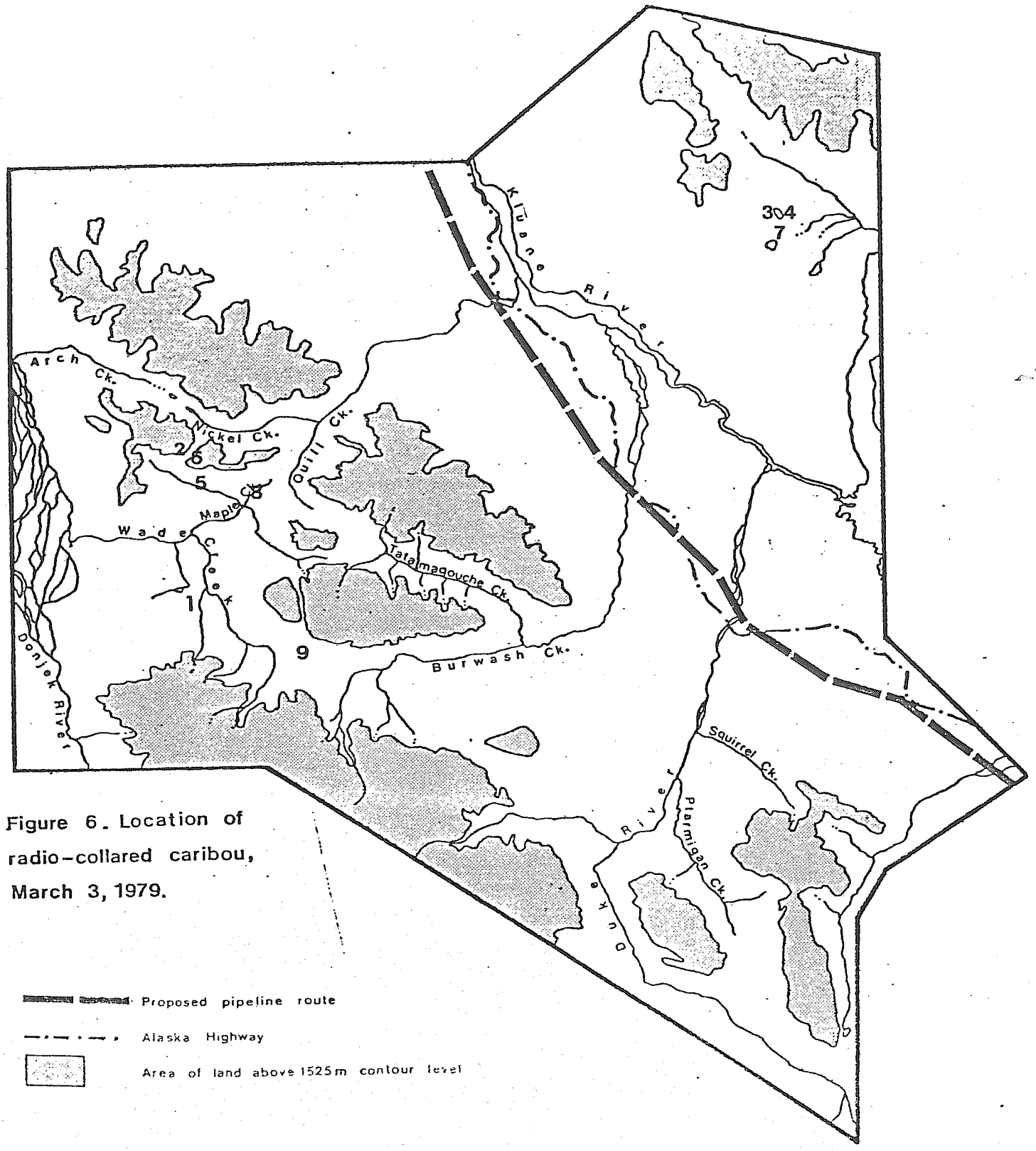

Figure 6. Location of radio-collared caribou, March 3, 1979.

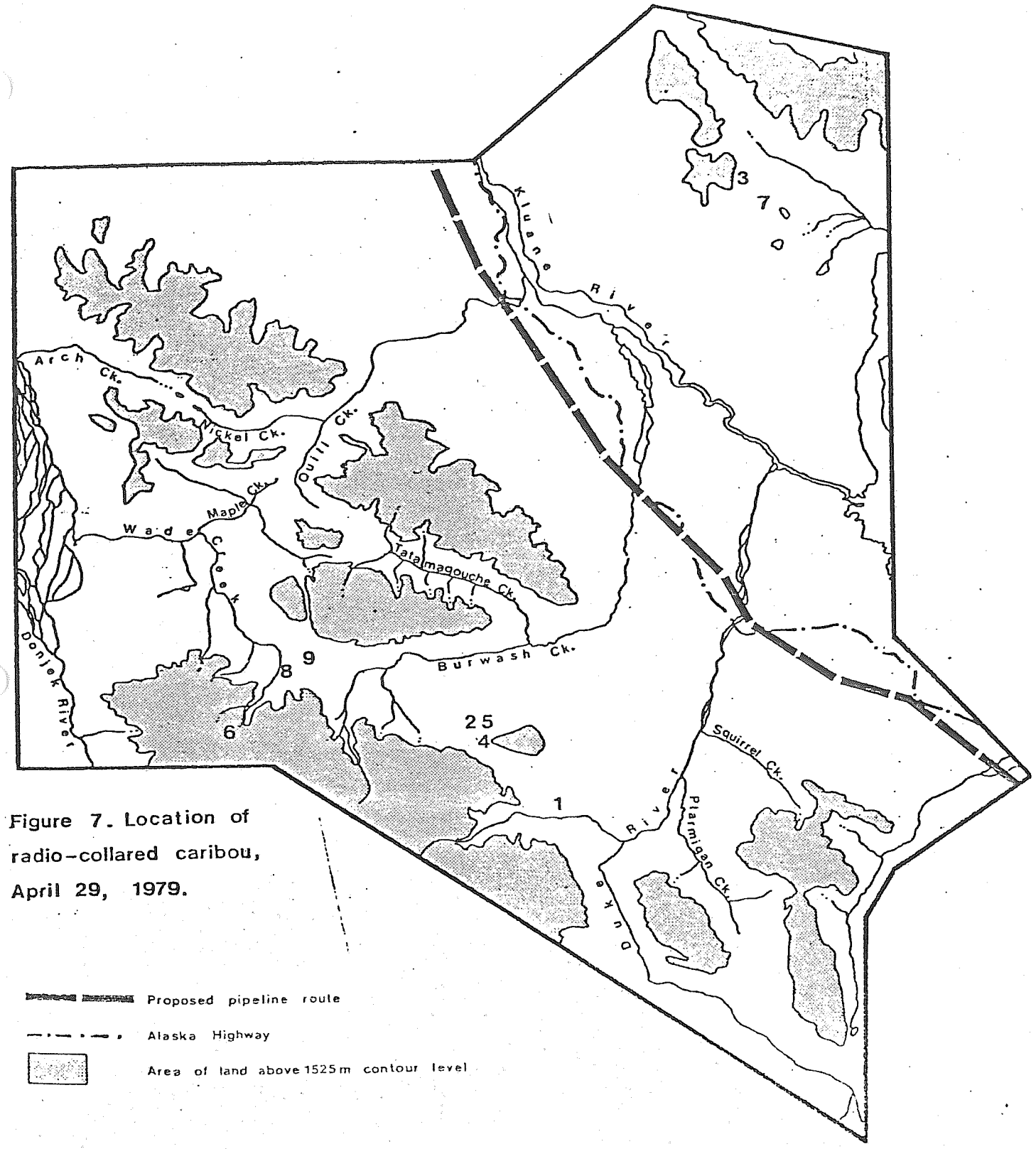

Figure 7. Location of radio-collared caribou, April 29, 1979.

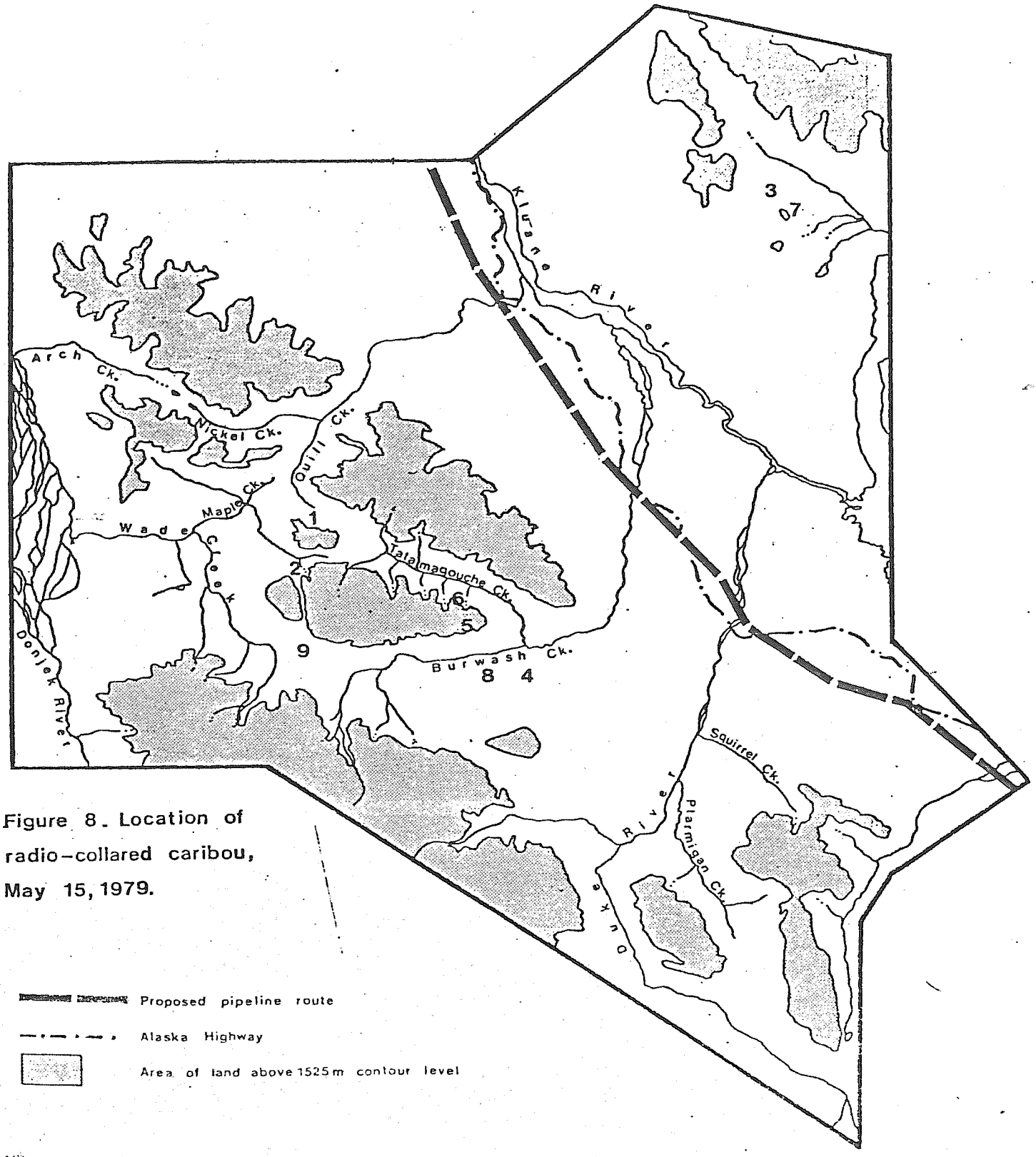

Figure 8. Location of radio-collared caribou, May 15, 1979.

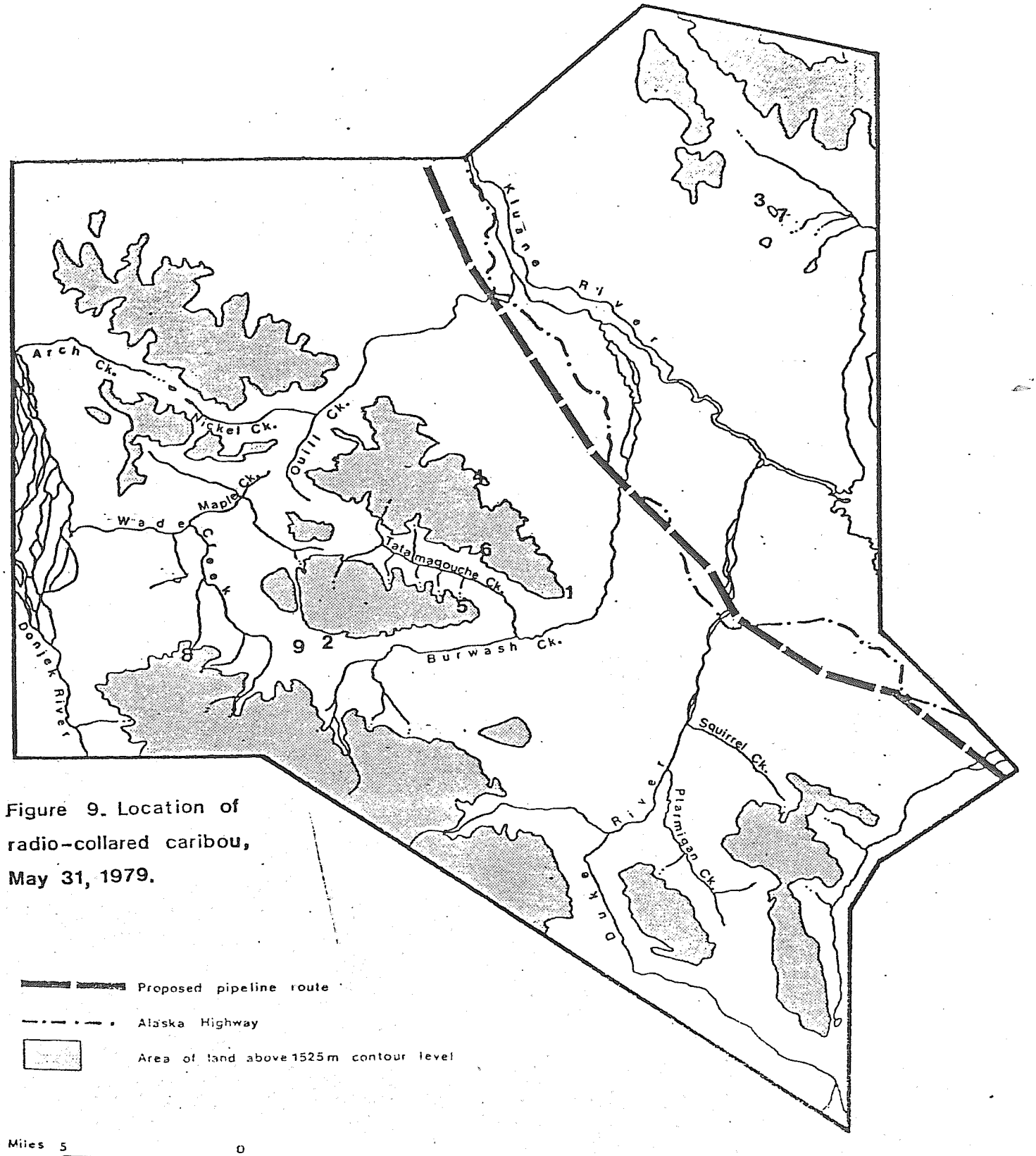

Figure 9. Location of radio-collared caribou, May 31, 1979.

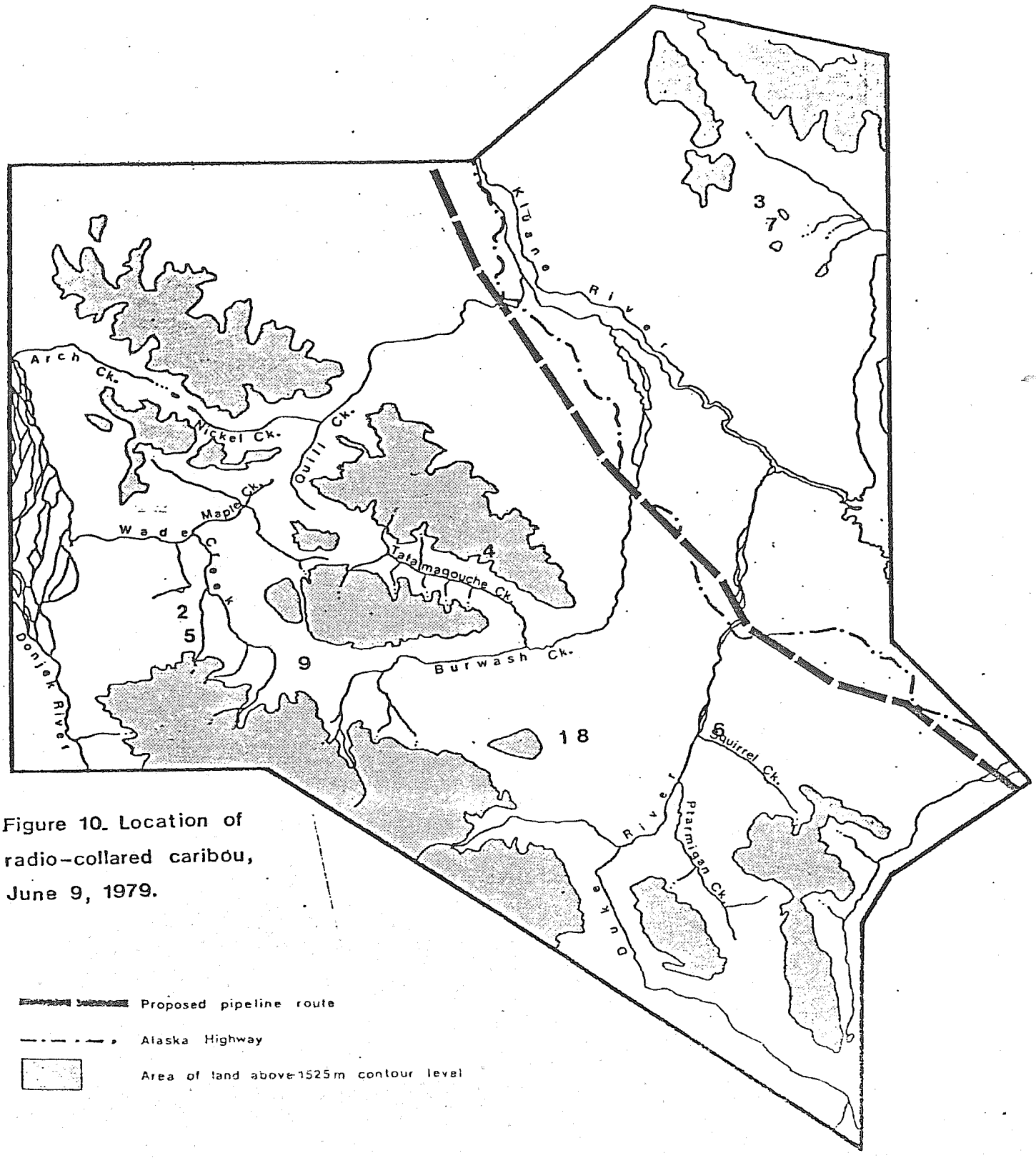

Figure 10. Location of radio-collared caribou, June 9, 1979.

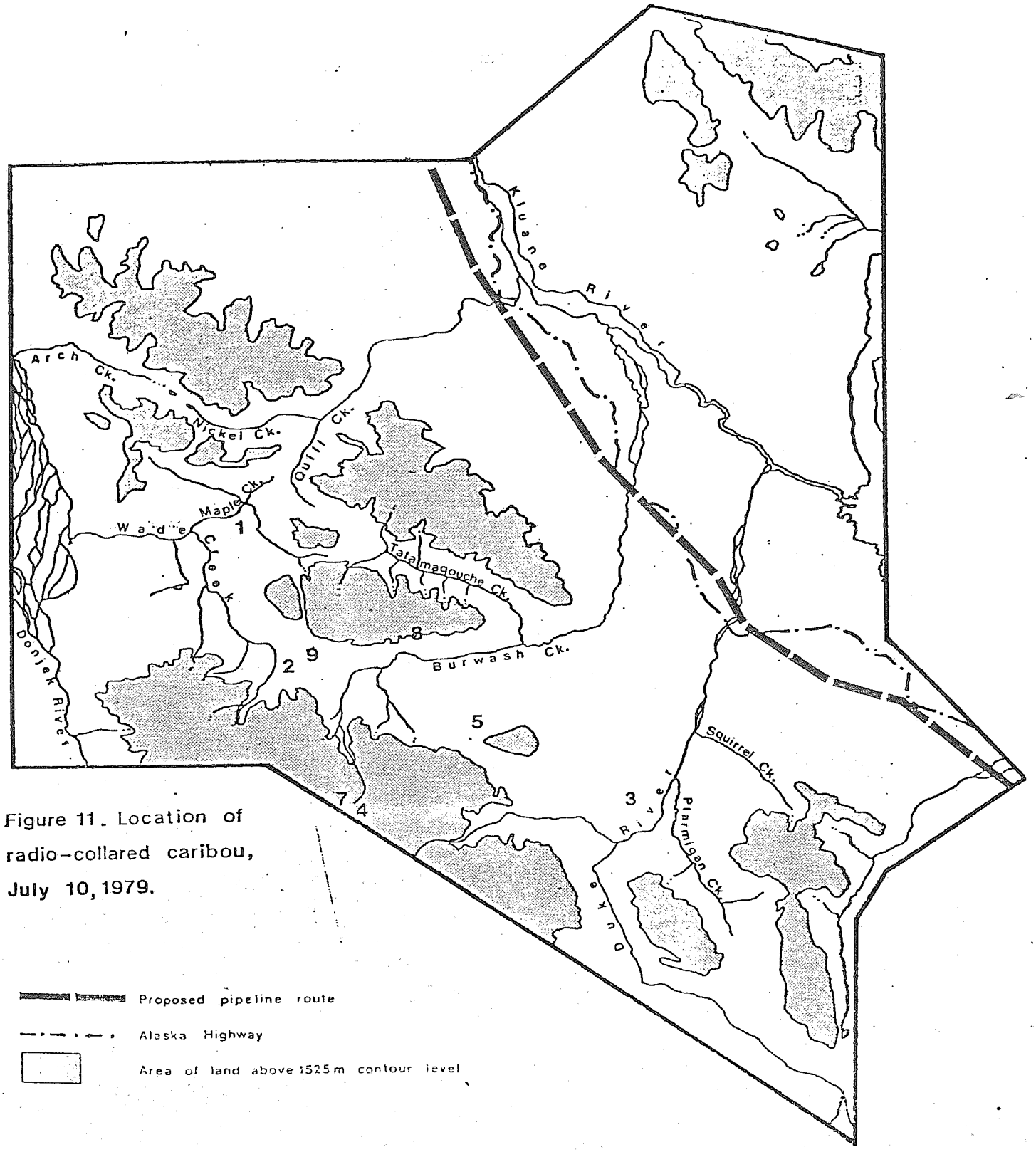

Figure 11. Location of radio-collared caribou, July 10, 1979.

Figures 12-20: The following figures show locations of individual collared caribou according to the following flight dates:

1 - September 6 and 7, 1978
2 - October 14, 1978
3 - November 22, 1978
4 - January 27, 1979
5 - March 3, 1979
6 - April 29, 1979
7 - May 15, 1979
8 - May 31, 1979
9 - June 9, 1979
10 - July 10, 1979

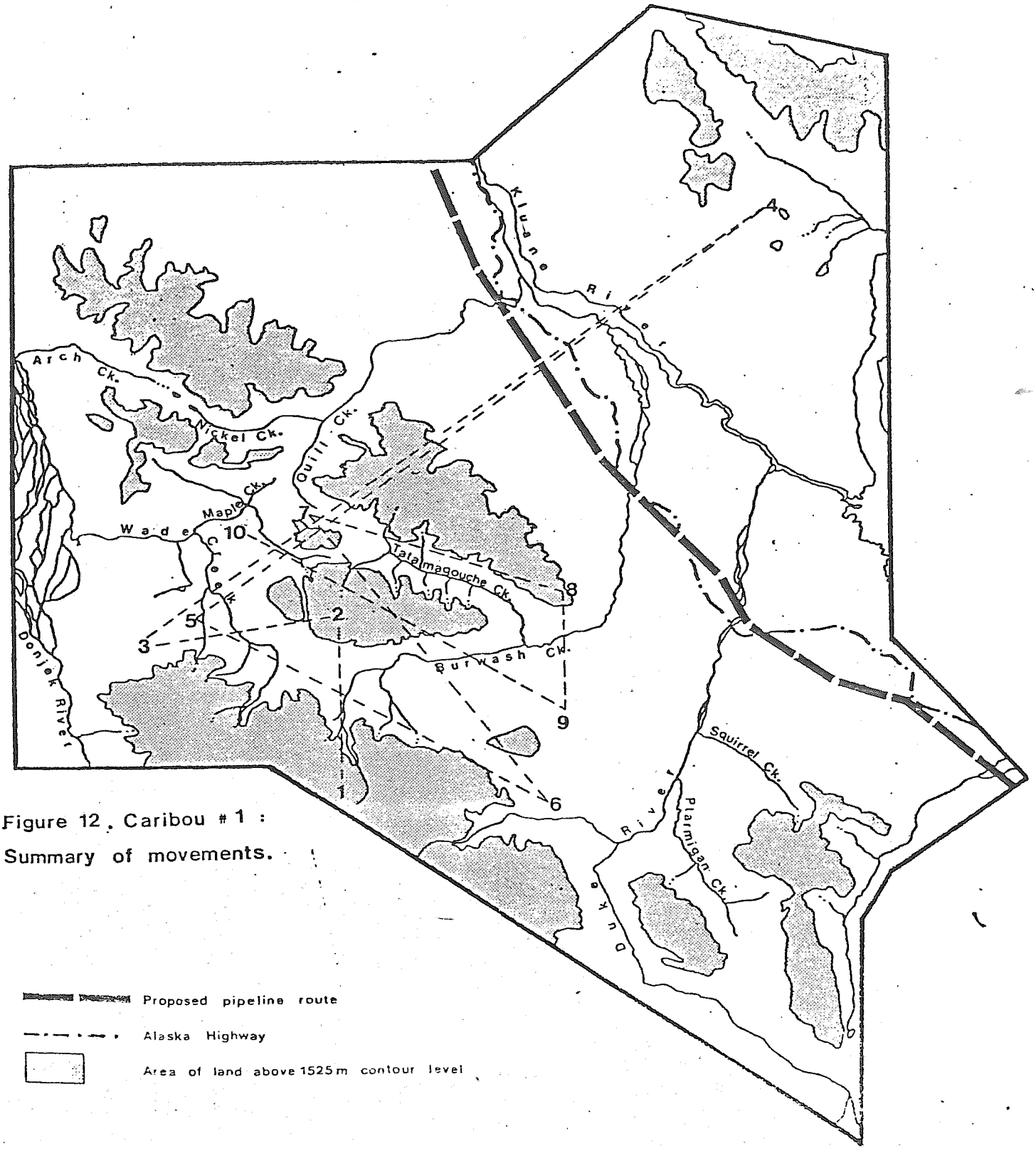

Figure 12. Caribou # 1 : Summary of movements.

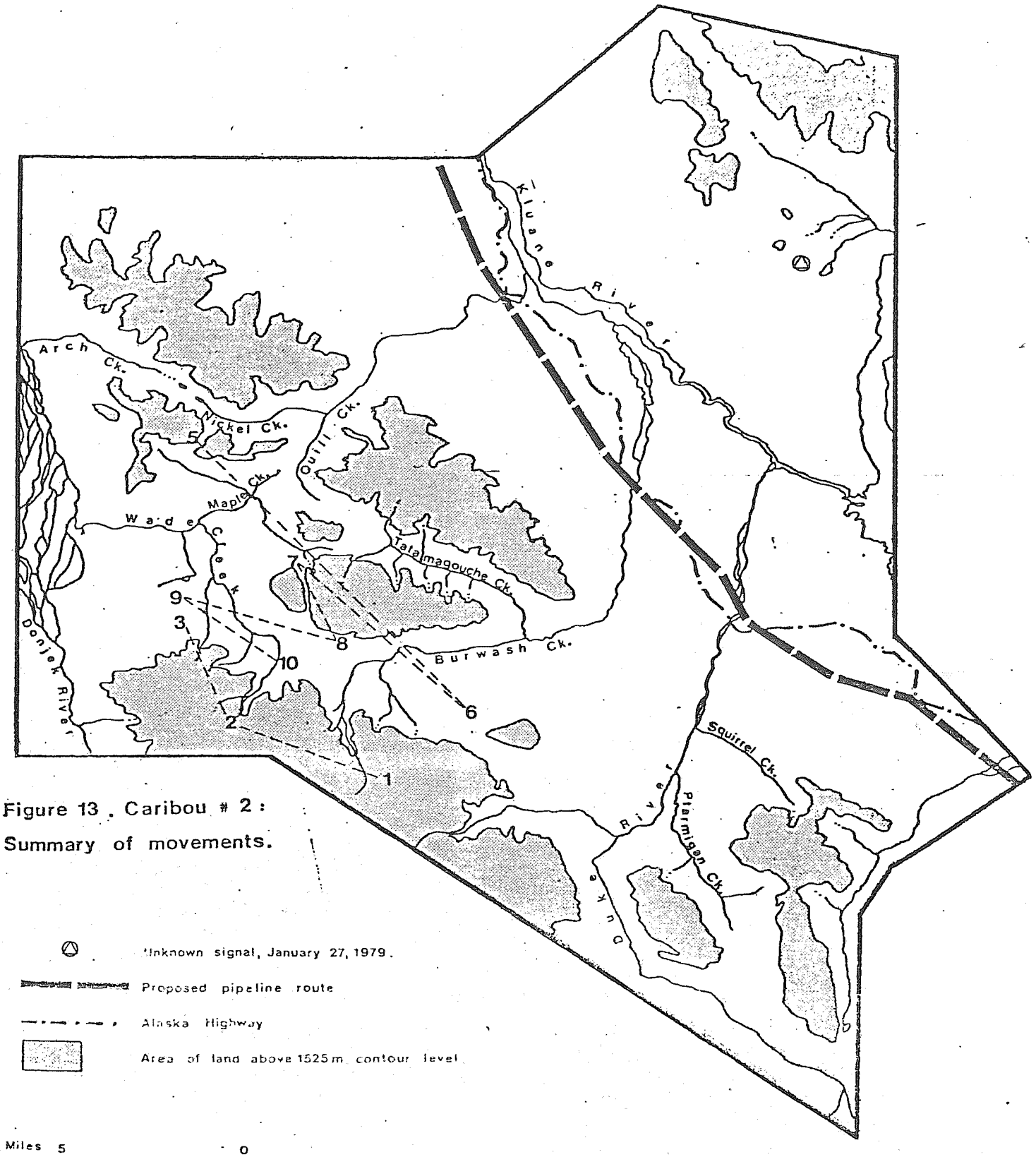

Figure 13. Caribou # 2: Summary of movements.

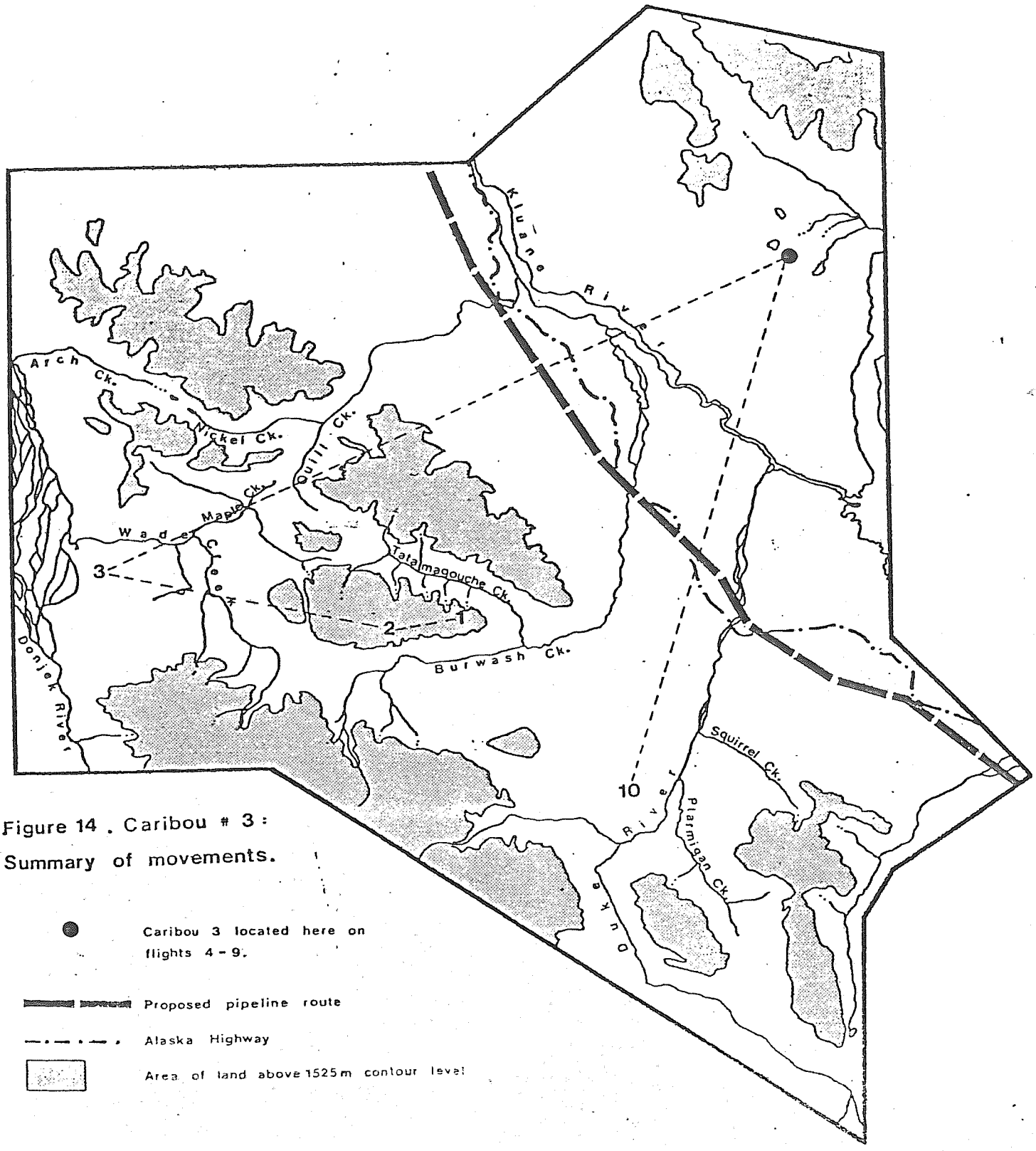

Figure 14 . Caribou # 3 : Summary of movements.

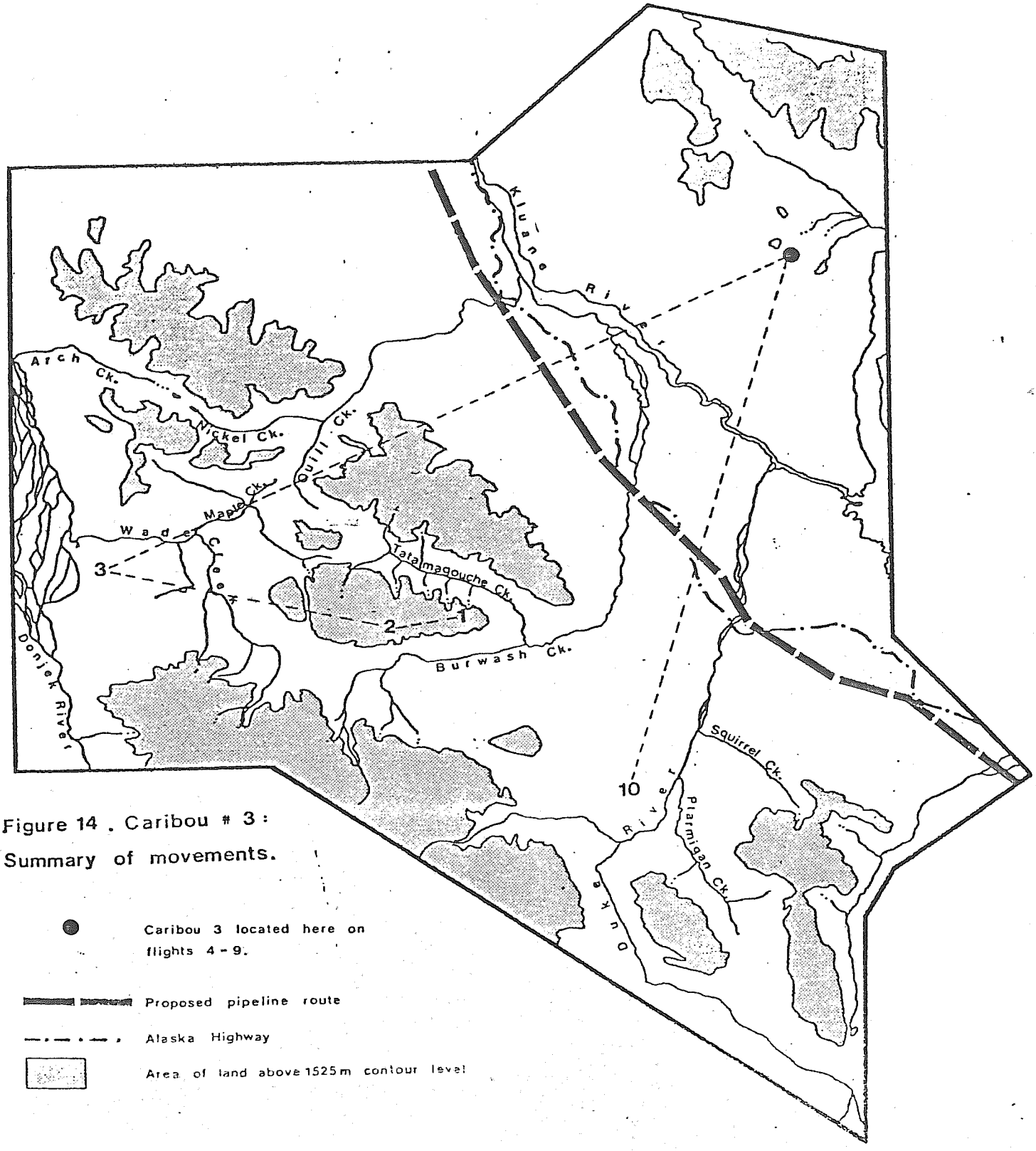

Figure 14 . Caribou # 3 :
Summary of movements.

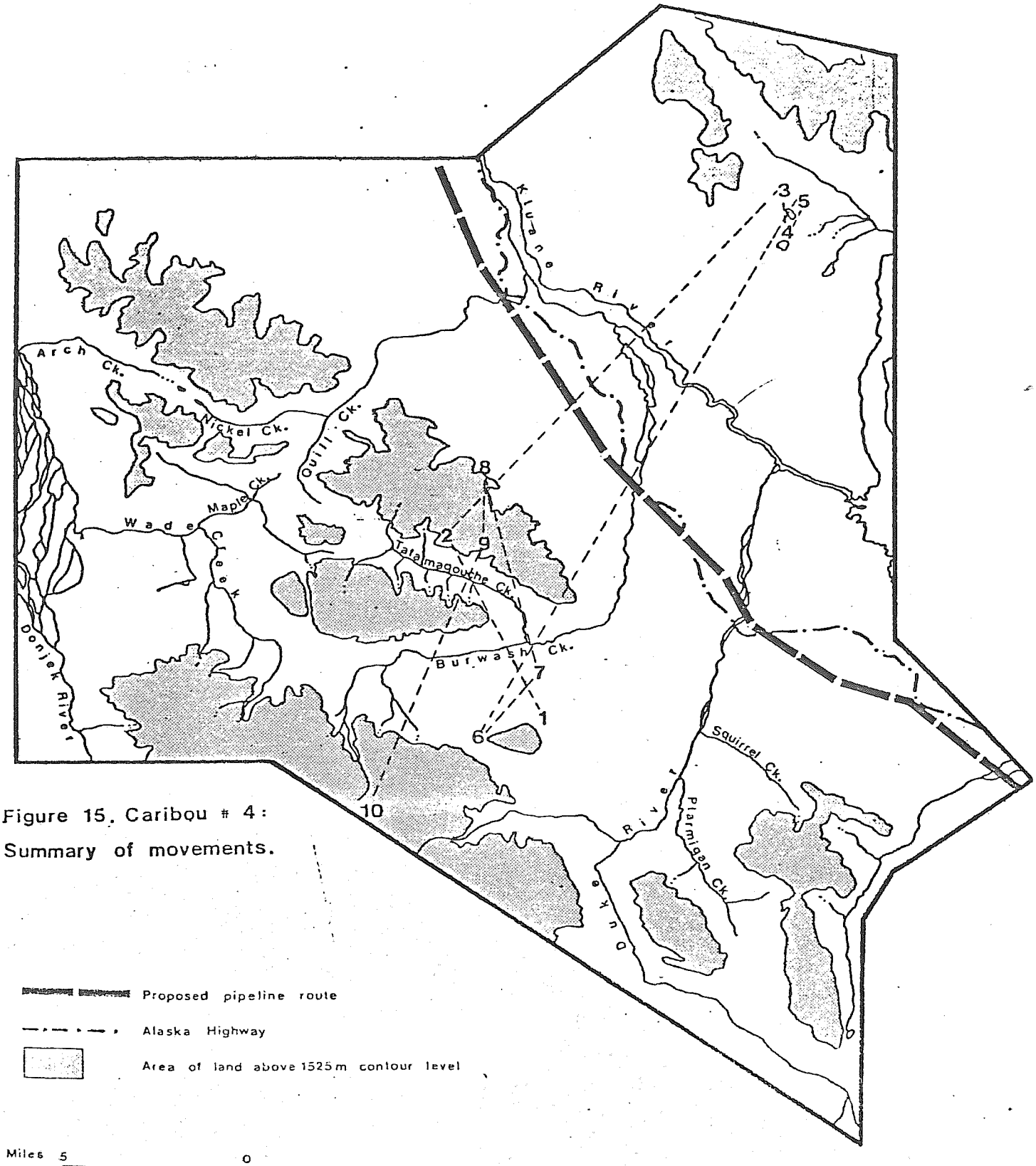

Figure 15. Caribou # 4:
Summary of movements.

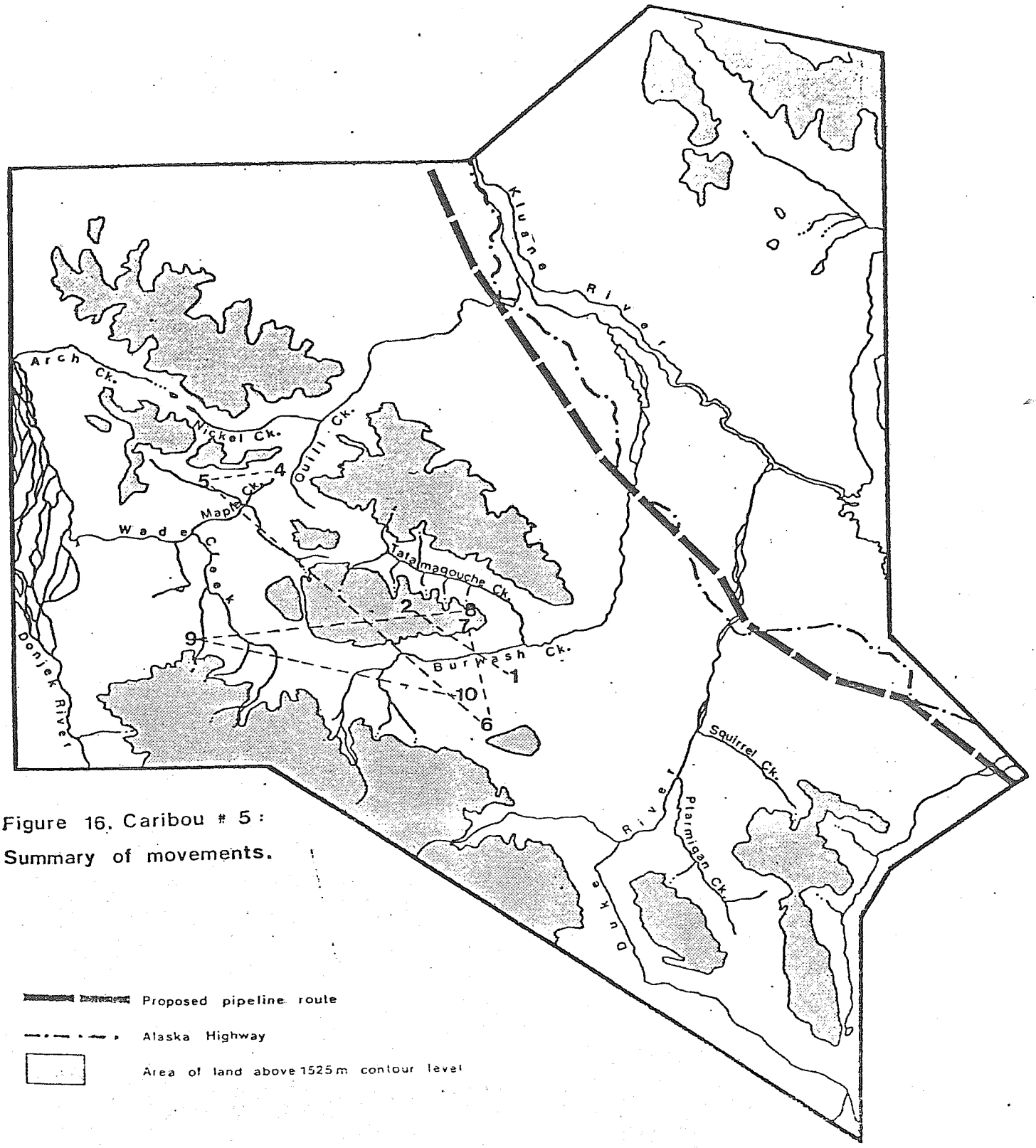

Figure 16. Caribou # 5 : Summary of movements.

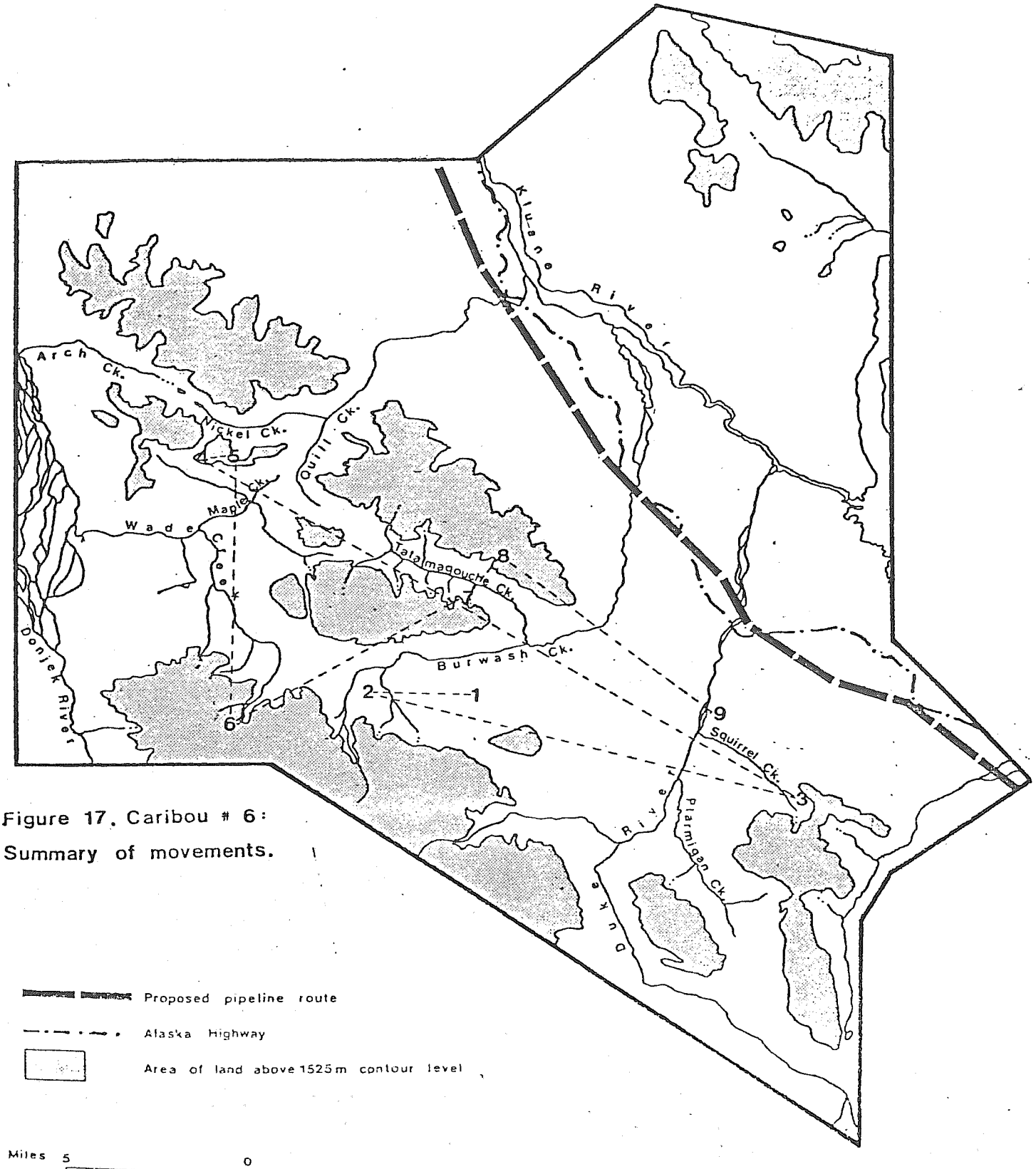

Figure 17. Caribou # 6:
Summary of movements.

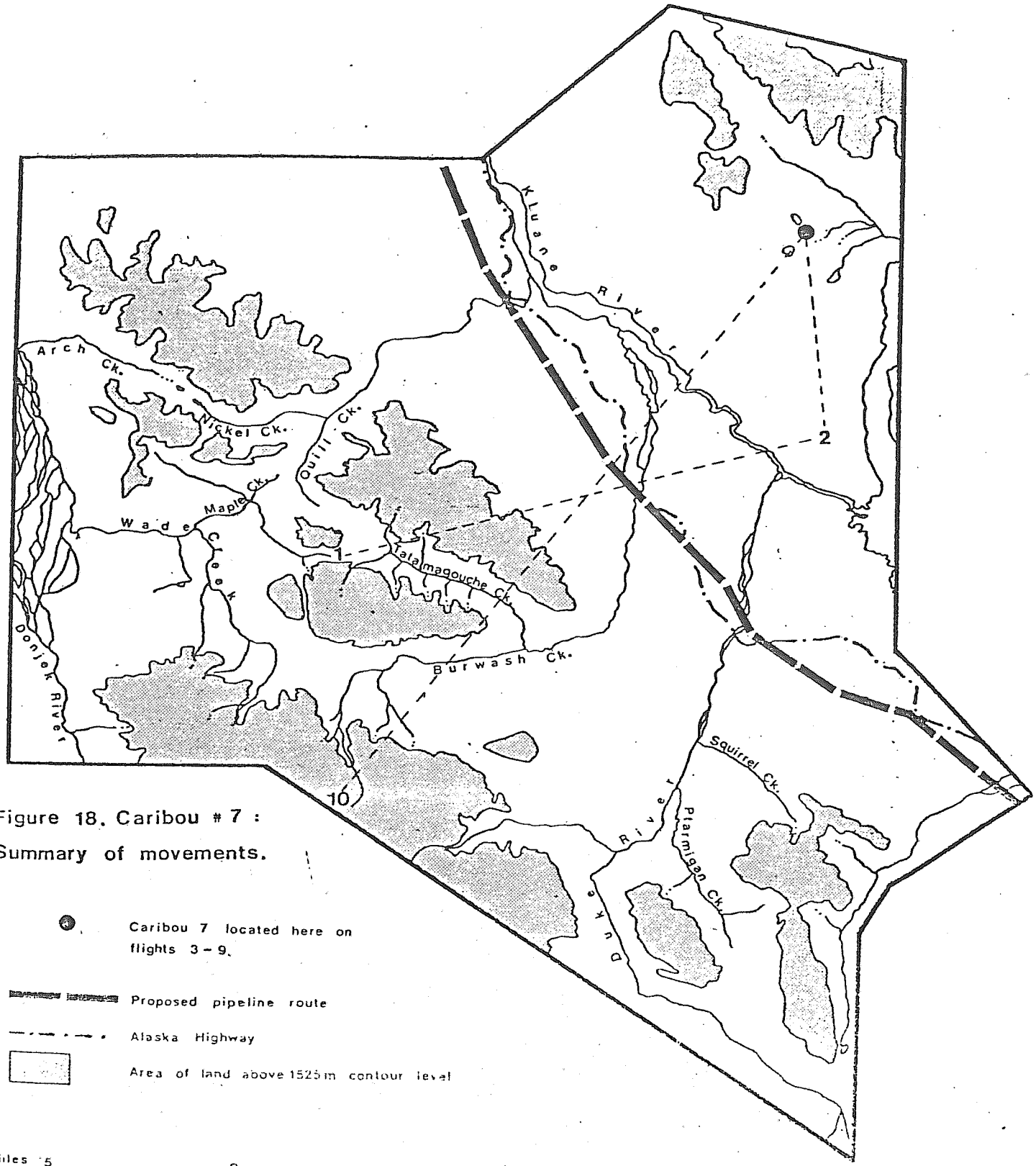

Figure 18. Caribou # 7 : Summary of movements.

Caribou 7 located here on flights 3 – 9.

Proposed pipeline route

Alaska Highway

Area of land above 1525m contour level

Miles 5 0

Kilometers 5 0

Scale 1:250,000

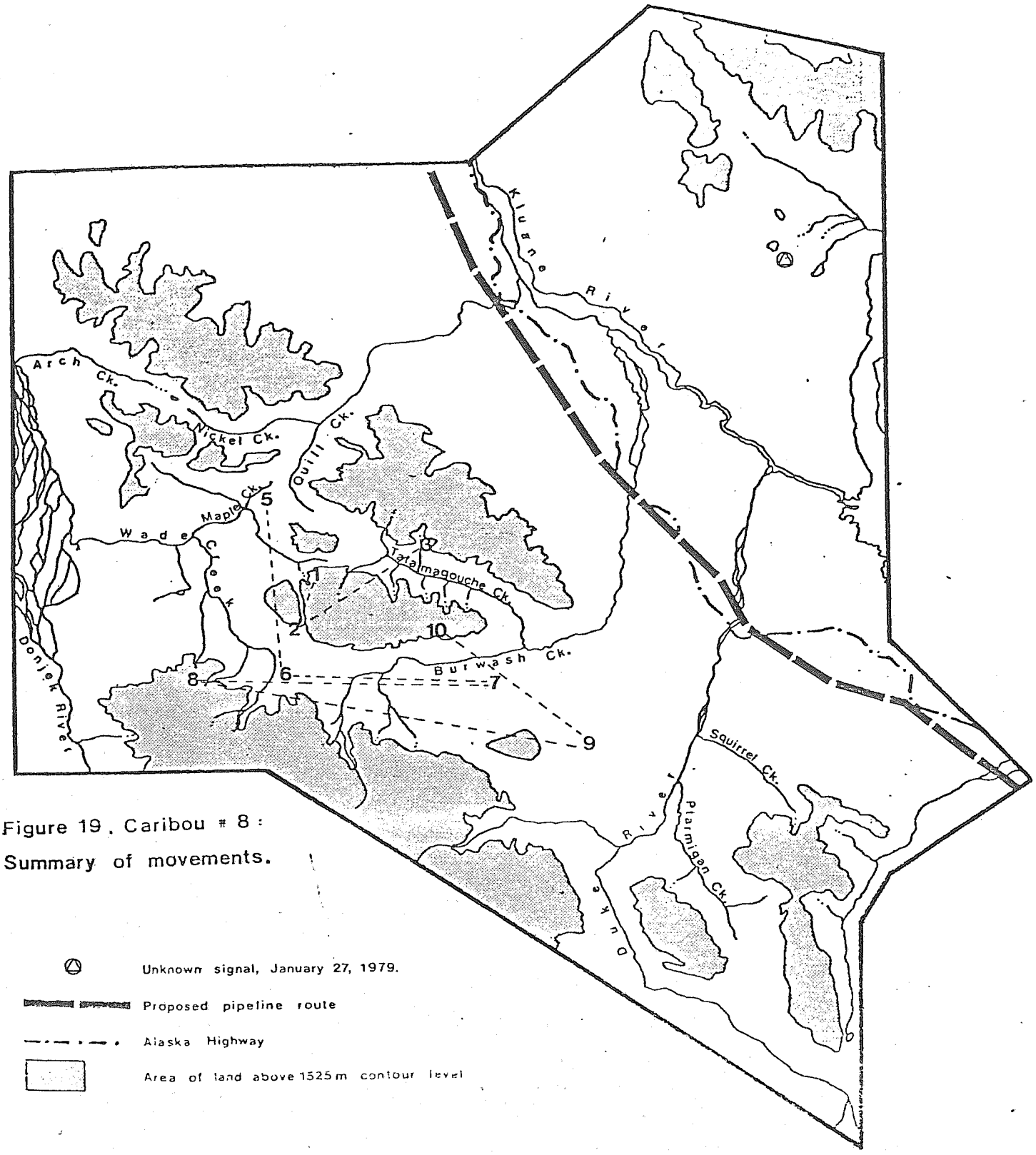

Figure 19. Caribou # 8 : Summary of movements.

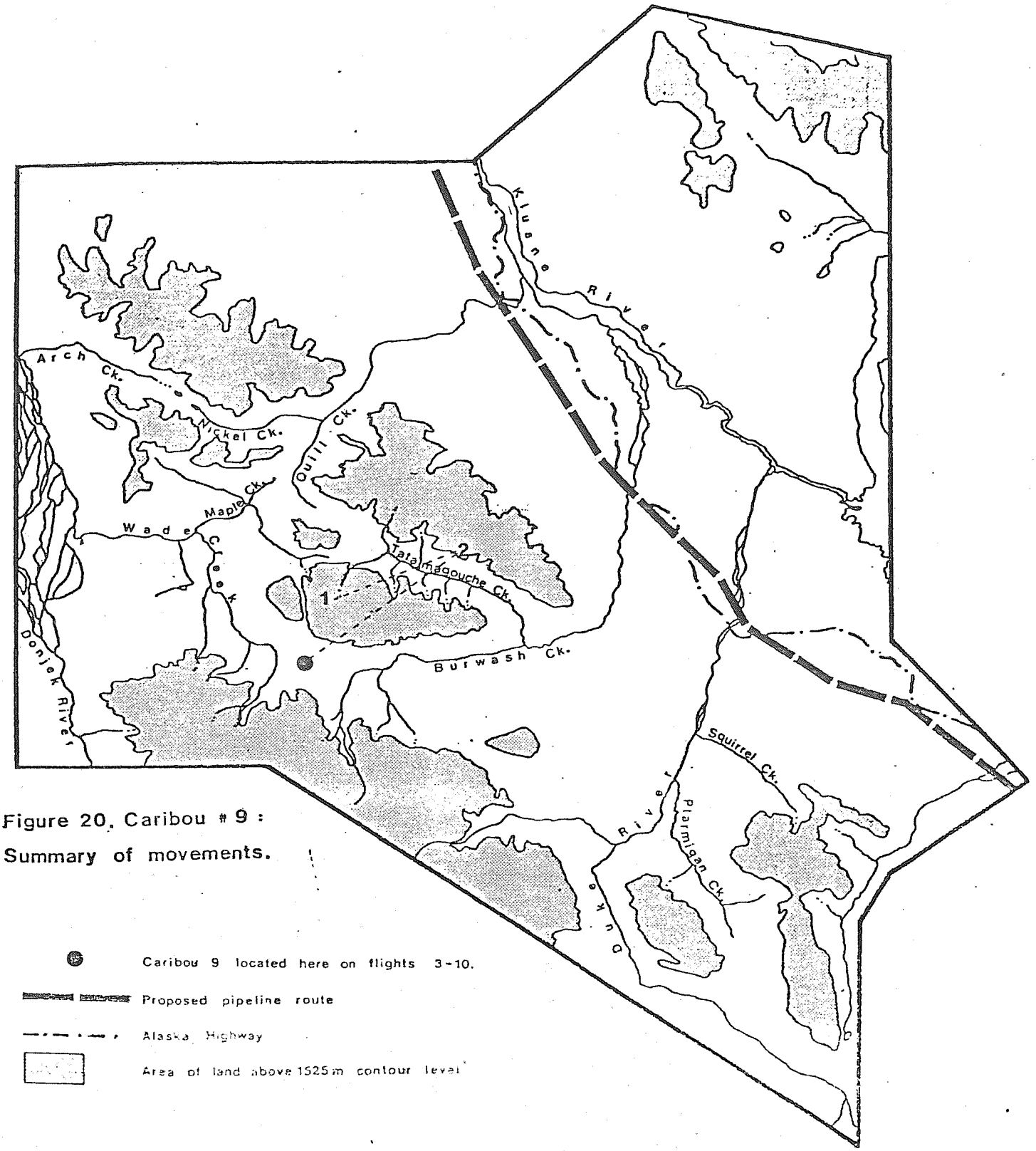

Figure 20. Caribou # 9 : Summary of movements.

A P P E N D I X

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CARIBOU IMMOBILIZATION PROGRAM - BURWASH

Date: September 6, 1978

Aircraft: Shirley Helicopters - Gazelle

Pilot: W. Eng

Crew: M. Hoefs
D. Larsen
D. Pitt-Brooke
D. Gauthier

Weather: 60% overcast, cool, calm

Observations: The following groups of animals were observed between Amphitheatre Mtn. and Tatamagouche Creek: 2♀♀, 2 calves - ♀ #243, ♀ #252; 2♂♂, 4♀♀, 2 calves - ♂ #245; 4♀♀; ~~1♂~~ 2♀♀, 2 calves, - ♀ #248, ♀ #250

Five animals (4♀♀, 1♂) were collared

D.L.

YUKON CAME BRANCH CARIBOU INVESTIGATION [illegible]

Location of investigation (population): Burwash Uplands

Type of investigation: September 6, 1978

Capture location: West side of Amphitheatre Mt.

Type of animal (species, sex, age): ♀ caribou and calf (young cow)

Weight of animal: 104.42 kg

Heart girth: 114.30 cm

Total length: 193.04 cm

Ear length: 13.02 cm

Tail length: 17.78 cm

Hindfoot length: 52.07 cm

Shoulder height: 106.68 cm

Chest height: 68.58 cm

Antlers: length of main beam: left: 39.37cm right: 38.10 cm
number of points: left: 2 right: 2

If female (young at heel, or lactating)?: calf - lactating

Amount of tranquilizer given (M-99)?: 3mg (2 darts - first probably didn't take)

Time between administration of tranquilizer and animal down? (reaction time): 60 minutes (2nd probably took time unknown)

Amount of antidote (M-50/50) administered?: 4mg + 4.8mg
Reaction time?: 10 minutes (estimate)

Numbers of ear tags and colour combinations: orange - orange

right ear ?: #14

left ear ?: #13

Frequency of transmitter?: Opt. Setting Band 1 Ch. 2 Freq. 1

Colour and type of collar attached?:

Additional information: Total 2♀ - ? calves

wide collar #243

Temp. - 41.4° C

Heart Rate - 56

YUKON GAME BRANCH CARIBOU INVESTIGATION

Location of investigation (population): Burwash Uplands

Date of investigation: September 6, 1978

Capture location: Amphitheatre Mt.

Type of animal (species, sex, age): ♀ caribou and calf

Weight of animal: 118.04 kg

Heart girth: 124.46 cm

Total length: 207.01 cm

Ear length: 13.65 cm

Tail length: 15.24 cm

Hindfoot length: 52.07 cm

Shoulder height: 114.30 cm

Chest height: 63.50 cm

Antlers: length of main beam: left: 30.48cm right: 32.17 cm
number of points: left: spike right: 2

If female (young at heel, or lactating)?: yes

Amount of tranquilizer given (M-99)?: 3mg

Time between administration of tranquilizer and animal down? (reaction time): 11 minutes

Amount of antidote (M-50/50) administered?: 4mg
Reaction time?: 1 minute, 45 seconds

Numbers of ear tags and colour combinations: blue - blue

right ear ?: #17

left ear ?: #15

Frequency of transmitter?: Opt. Setting Band 1 Ch 9 Freq 1

Colour and type of collar attached?: #252 narrow collar

Additional information: old ♀ - light in colour. NOTE this was the other female with #1

Heart Rate: 88 (loud and pounding)

Temp. 40.9°C

YUKON GAME BRANCH CARIBOU INVESTIGATION DATA SHEET

Location of investigation (population): Burwash Uplands

Date of investigation: September 6, 1978

Capture location: On ridge south of Tatamagouche Creek

Type of animal (species, sex, age): ♂

Weight of animal: 136.20 kg

Heart girth: 127.00 cm

Total length: 224.79 cm

Ear length: 14.29 cm

Tail length: 21.59 cm

Hindfoot length: 59.69 cm

Shoulder height: 127.00 cm

Chest height: 71.12 cm

Antlers: length of main beam: left: 73.66 cm right: 72.39 cm
number of points: left: 6 right: 8

If female (young at heel, or lactating)?:

Amount of tranquilizer given (M-99)?: 4mg

Time between administration of tranquilizer and animal down? (reaction time): 16 minutes (estimate)

Amount of antidote (M-50/50) administered?: 6mg
Reaction time?: 22 minutes

Numbers of ear tags and colour combinations: yellow - yellow

right ear ?: #26

left ear ?: #27

Frequency of transmitter?: Opt. Setting Band 1 Ch 3 Freq. 3.5

Colour and type of collar attached?: Collar #245

Additional information: with group of one other ♂, 4♀, ? calves, 4♀

Heart rate: 80

Temp.: 42.1°C

YUKON GAME BRANCH CARIBOU INVESTIGATION DATA SHEET

Location of investigation (population): Burwash Uplands

Date of investigation: September 6, 1978

Capture location: flats east of Burwash Creek

Type of animal (species, sex, age): ♀ (it had calf)

Weight of animal: 131.66 kg

Heart girth: 124.46 cm

Total length: 198.12 cm

Ear length: 13.97 cm

Tail length: 18.10 cm

Hindfoot length: 54.61 cm

Shoulder height: 106.68 cm

Chest height: 60.96 cm

Antlers: length of main beam: left: 52.07 cm right: 48.26 cm
number of points: left: 5 right: 5

If female (young at heel, or lactating)?: calf

Amount of tranquilizer given (M-99)?: 3mg

Time between administration of tranquilizer and animal down? (reaction time): 17 minutes

Amount of antidote (M-50/50) administered?: 4mg
Reaction time?: 1 minute, 15 seconds

Numbers of ear tags and colour combinations: white - white

right ear ?: #18

left ear ?: #19

Frequency of transmitter?: Opt. Setting Band 1 Ch. 6 Freq. 0.25

Colour and type of collar attached?: Collar #248

Additional information: Old scar on left ribs

♀♀ and 2 calves total

Heart rate: 88

Temp.: 42.4°C

CARIBOU IMMOBILIZATION PROGRAM - BURWASH

Date: September 7, 1978

Aircraft: Shirley Helicopters - Gazelle

Pilot: W. Eng

Crew: M. Hoefs
D. Larsen
D. Pitt-Brooke
D. Gauthier

Weather: overcast, rainy, cool

Observations: The following groups were observed between Amphitheatre Mtn. and Tatamagouche Creek:

2♀♀, 2 calves - ♀ accidentally killed

1♀ - ♀ #244

2♂♂, 3♀♀, 1 calf - ♂ #246, ♀ #249

4♀♀

5♂♂

5♀♀, 1 calf

1♀

5♀♀

Four animals were collared (2♂♂, 2♀♀)

One old ♀ was paralized from the dart puncturing the spinal column and was later destroyed.

D.L.

YUKON GAME BRANCH CARIBOU INVESTIGATION DATA SHEET

Location of investigation (population): Burwash Uplands

Date of investigation: September 6, 1978

Capture location: Between Amphitheatre and Burwash Creek

Type of animal (species, sex, age): ♀ with calf

Weight of animal: 133.93 kg

Heart girth: 124.46 cm

Total length: 213.36 cm

Ear length: 14.29 cm

Tail length: 18.41 cm

Hindfoot length: 57.15 cm

Shoulder height: 111.76 cm

Chest height: 60.96 cm

Antlers: length of main beam: left: 54.61cm right: 54.61cm
number of points: left: 5 right: 3

If female (young at heel, or lactating)?: with one calf

Amount of tranquilizer given (M-99)?: 3mg 2 darts (first may not have taken)

Time between administration of tranquilizer and animal down? (reaction time): 2nd dart - 9 minutes

Amount of antidote (M-50/50) administered?: 5mg and 4mg - Total 9mg
Reaction time?: 10 minutes until 2nd shot. 1½ min. from 2nd shot

Numbers of ear tags and colour combinations: red on red only

right ear ?: #16

left ear ?:

Frequency of transmitter?: 250 Opt. Setting Band 1 Ch. 7 Freq. 3

Colour and type of collar attached?: Collar #250

Additional information: 2nd ♀ from same group as #1

YUKON GAME BRANCH CARIBOU INVESTIGATION DATA SHEET

Location of investigation (population): Burwash Uplands

Date of investigation: September 7, 1978

Capture location: Flats east of Burwash Creek

Type of animal (species, sex, age): ♀ (no calf) very old, teeth down to gum line

Weight of animal: 115.77 kg

Heart girth: 115.57 cm

Total length: 193.04 cm

Ear length: 12.70 cm

Tail length: 20.32 cm

Hindfoot length: 49.53 cm

Shoulder height: 106.68 cm

Chest height: 63.50 cm

Antlers: length of main beam: left: 43.18cm right: 44.45cm
number of points: left: 1 (spike) right: 3 (growth at base)

If female (young at heel, or lactating)?: no

Amount of tranquilizer given (M-99)?: 3mg

Time between administration of tranquilizer and animal down? (reaction time): 37 minutes after 1st. shot, 1 second after second shot

Amount of antidote (M-50/50) administered?:
Reaction time?:

Numbers of ear tags and colour combinations:

right ear ?: yellow
left ear ?: orange
(no numbered metal tags used)

Frequency of transmitter?: Opt. Setting Band Ch. Freq.

Colour and type of collar attached?: No collar - old ♀

Additional information: incisors worn down to gum

- animal destroyed

- [illegible]

heart rate - 82 body temp. 42

YUKON GAME BRANCH CARIBOU INVESTIGATION DATA SHEET

Location of investigation (population): Burwash Uplands

Date of investigation: September 7, 1978

Capture location: Flats east of Burwash Creek

Type of animal (species, sex, age): ?

Weight of animal: 113.50 kg

Heart girth: 121.92 cm

Total length: 176.53 cm

Ear length: 12.38 cm

Tail length: 20.32 cm

Hindfoot length: 53.97 cm

Shoulder height: 101.60 cm

Chest height: 60.96 cm

Antlers: length of main beam: left: 39.37cm right: 36.83cm

number of points: left: 4 right: 4

If female (young at heel, or lactating)?: no calf - not lactating

Amount of tranquilizer given (M-99)?: 3mg

Time between administration of tranquilizer and animal down? (reaction time): 11 min. from 2nd shot - 20 min. from 1st shot to 2nd shot

Amount of antidote (M-50/50) administered?: 4mg
Reaction time?: 1 minute, 20 seconds

Numbers of ear tags and colour combinations: no numbered tags

right ear ?: blue

left ear ?: red

Frequency of transmitter?: Opt. Setting Band Ch. Freq.

Colour and type of collar attached?: #244

Additional information: Hit twice. Shot #1 - back. Shot #2 - left hindquarter

- from teeth wear appears of medium age

- showing velvet wear heart rate - 80

Temp. - 41.9

YUKON GAME BRANCH CARIBOU INVESTIGATION

Location of investigation (population): Burwash Uplands

Date of investigation: September 7, 1978

Capture location: head of Tatamogouche Creek

Type of animal (species, sex, age): ♂ (middle age)

Weight of animal: 181.60 kg

Heart girth: 134.62 cm

Total length: 160.02 cm

Ear length: 13.97 cm

Tail length: 19.05 cm

Hindfoot length: 55.88 cm

Shoulder height: 124.46 cm

Chest height: 71.12 cm

Antlers: length of main beam: left: 111.76cm right: 104.14cm
number of points: left: 11 right: 12

If female (young at heel, or lactating)?: -

Amount of tranquilizer given (M-99)?: 5mg

Time between administration of tranquilizer and animal down? (reaction time) 18 minutes after last dart (3 darts)

Amount of antidote (M-50/50) administered?: 6mg
Reaction time?: 1 minute, 30 seconds

Numbers of ear tags and colour combinations: yellow - white

right ear ?: 44 - yellow

left ear ?: 42 - white

Frequency of transmitter?: #246 Opt. Setting Band 1 Ch 5 Freq 0.5

Colour and type of collar attached?: #246 - wide band

Additional information: heart - 52
temp - 42

YUKON GAME BRANCH CARIBOU INVESTIGATION DATA SHEET

Location of investigation (population): Burwash

Date of investigation: September 7, 1978

Capture location: Head of Tatamagouche Creek

Type of animal (species, sex, age): ♀ with calf - fairly old

Weight of animal: nil

Heart girth: 121.92 kg

Total length: 149.86 cm

Ear length: 12.70 cm

Tail length: 17.46 cm

Hindfoot length: 53.34 cm

Shoulder height: 109.22 cm

Chest height: 60.96 cm

Antlers: length of main beam: left: 39.37 cm right: 40.64 cm
number of points: left: 5 right: 4

If female (young at heel, or lactating)?: yes, calf at heel

Amount of tranquilizer given (M-99)?: 3mg

Time between administration of tranquilizer and animal down? (reaction time): 14 minutes

Amount of antidote (M-50/50) administered?: 6mg
Reaction time?: 1 minute

Numbers of ear tags and colour combinations:

right ear ?: #20 - yellow

left ear ?: #21 - red

Frequency of transmitter?: Opt. Setting Band 1 Ch.7, Freq. 0.5

Colour and type of collar attached?: #249 - narrow collar

Additional information: Heart rate: 140+

Temp: 0°

Mid - old

YUK... GAME BIOLOGY...

Location of investigation (population): Burwash

Date of investigation: September 7, 1978

Capture location: Head of Tatamagouche Creek

Type of animal (species, sex, age): ♂ (old)

Weight of animal: 213.38 kg

Heart girth: 152.40 cm

Total length: 238.76 cm

Ear length: 13.97 cm

Tail length: 17.78 cm

Hindfoot length: 58.42 cm

Shoulder height: 119.38 cm

Chest height: 60.96 cm

Antlers: length of main beam: left: 115.57cm right: 111.76cm
number of points: left: 18 right: 12

If female (young at heel, or lactating)?:

Amount of tranquilizer given (M-99)?: 4mg

Time between administration of tranquilizer and animal down? (reaction time): 8 minutes

Amount of antidote (M-50/50) administered?: 6 + 6 (up with 6 I.V.)
Reaction time?: 2 minutes

Numbers of ear tags and colour combinations: orange - orange

right ear ?: #22 - orange

left ear ?: #39 - orange

Frequency of transmitter?: Opt. Setting Band Ch. Freq.

Colour and type of collar attached?: #265 - collar on fairly loose

Additional information: animal light in colour

Heart rate: 74

Body Temperature: 41.2°C

CARIBOU IMMOBILIZATION PROGRAM - BURWASH

Date: September 8, 1978

Aircraft: Shirley Helicopters - Gazelle

Pilot: W. Eng

Crew: M. Hoefs
D. Larsen
D. Pitt-brooke
D. Gauthier

Weather: overcast

Observations: Two groups were observed on Flats N.W. of Brooks Arm (5♀♀, 2 calves, 8♀♀ and calves, 4♂♂)

Two attempts were made to immobilize a ♂ and a ♀. Both attempts failed.

D.L.