

Woodland Caribou Studies In Central Yukon

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Woodland Caribou Studies
in Central Yukon
Yukon Fish and Wildlife Branch
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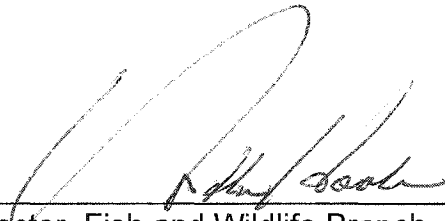
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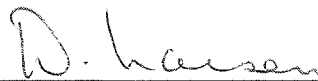
Woodland Caribou Studies in Central Yukon

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Abstract

From 1989 to 1996, the Tay River, Moose Lake and Ethel Lake woodland caribou herds of the central Yukon were inventoried. The inventory was done by radio-collaring 23 caribou from the Tay River herd, 12 from the Ethel Lake herd and 4 from the Moose Lake herd to determine each herd's range, seasonal movements and to derive population estimates. Population estimates for the herds are 3,758 caribou in the Tay River herd and 316 in the Ethel Lake herd. A 1991 rut composition count of the Moose Lake herd found 211 caribou. Because not all caribou are seen during composition counts, it is estimated that the Moose Lake herd may have 300 caribou. Food habits were analyzed and all three herds had over 70 per cent lichen in their diet, which is deemed adequate winter forage. Winter ranges were delineated through radio collar relocations. These ranges are deemed crucial to long-term survival of these caribou populations and should be protected. Reported harvest fell within the two to three per cent of the adult population set in the Yukon Woodland Caribou Guidelines.

Woodland Caribou Studies in Central Yukon

Table of Contents

Page		Page	
i	Abstract	7	Results
v	List of Figures		Tay River Herd
	List of Tables		• Capture and Radio collaring
	List of Appendices		• Distribution Surveys
1	Introduction	8	• Population Estimates and Composition
	• Other Studies	9	• Harvest
2	Study Area	12	Moose Lake Herd
3	Methods		• Capture and Radio collaring
	• How caribou are captured		• Distribution Surveys
	• How and why caribou are counted:		• Population Estimates and Composition
	1 Fall composition surveys		• Harvest
4	2 Late-winter population estimates	14	Ethel Lake Herd
5	• How caribou are followed		• Capture and Radio collaring
	• When seasonal movements are followed		• Distribution Surveys
	1 Calving		• Population Estimates and Composition
6	2 Post-calving	15	• Harvest
	3 Rut	15	Food Habits for All Herds
	4 Early winter	19	Conclusion and Recommendations
	5 Late winter	21	Literature Cited
	• Winter Food Habits	23	Appendices
7	• Harvest Regulations and Monitoring		

List of Figures

Page Figure

- vi 1. Range of caribou herds in and adjacent to study area.
- 10 2. Home range of the Tay River caribou herd.
- 11 3. Survey area used to estimate population size of the Tay River caribou herd.
- 13 4. Home range of the Moose Lake caribou herd.
- 16 5. Home range of the Ethel Lake caribou herd.
- 17 6. Survey area used to estimate population size of the Ethel Lake caribou herd.
- 18 7. Food habits of caribou on their winter range.

List of Tables

Page Table

- 8 1. Summary of caribou survey data and population estimate for the Tay River herd at 90 per cent confidence limit.
- 9 2. Licensed harvest of the Tay River herd.
- 12 3. Moose Lake herd rut count 1991.
- 12 4. Licensed harvest of the Moose Lake herd.
- 14 5. Summary of caribou survey data and population estimate for the Ethel Lake herd.
- 15 6. Ethel Lake herd rut counts 1993-1996.
- 15 7. Reported harvest of the Ethel Lake caribou herd 1990-1994.

List of Appendices

Page Appendix

- 25 A. Radio collaring data for the Tay River caribou herd.
- 26 B. Caribou survey data for the Tay River herd population estimate, March 23-27, 1997.
- 28 C. Radio collaring data for the Moose Lake Caribou Herd.
- 28 D. Radio collaring data for the Ethel Lake Caribou Herd.
- 29 E. Caribou surveys for the Ethel Lake herd population estimate March 12-14, 1993.

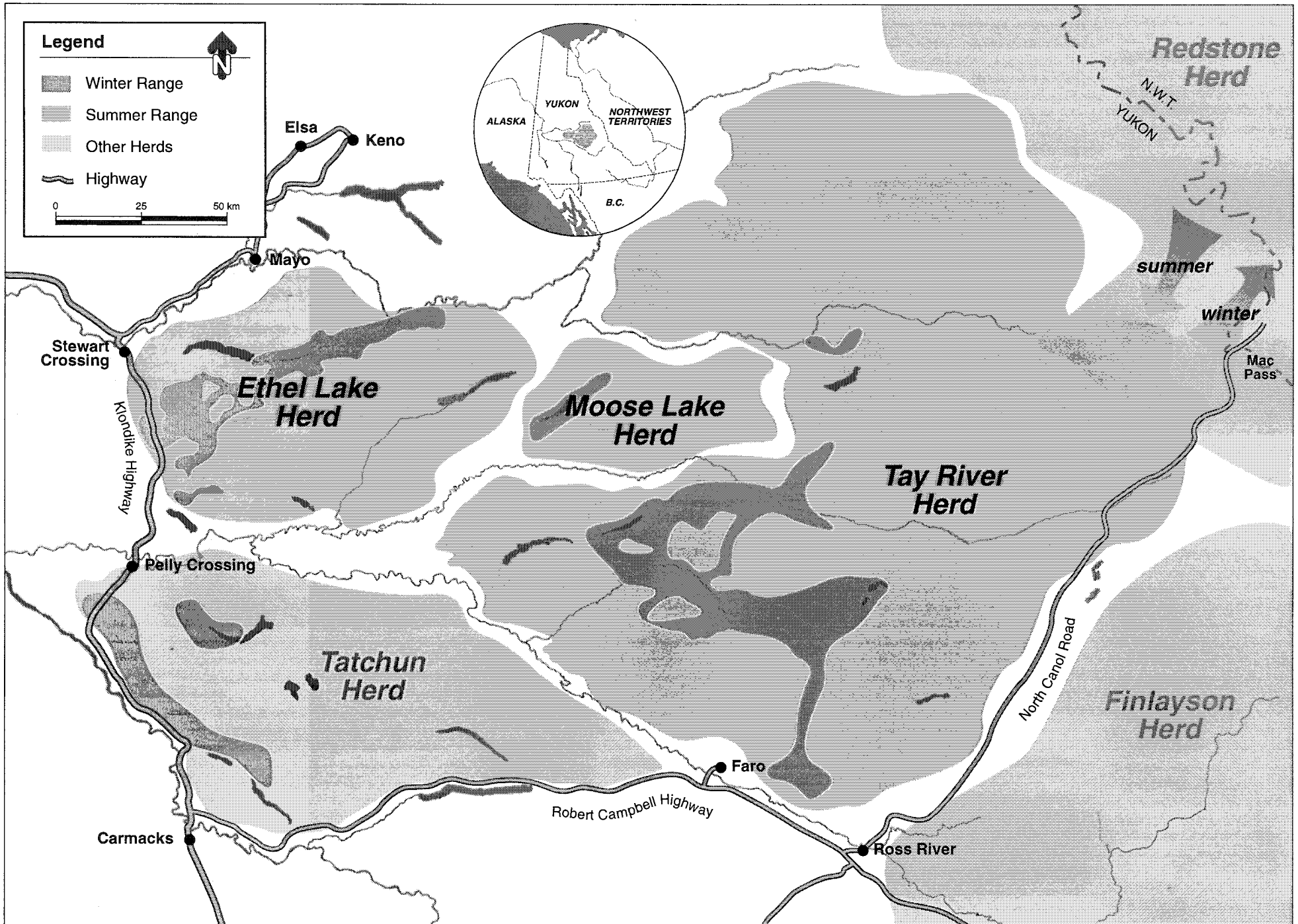


Figure 1. Range of caribou herds in and adjacent to study area.

Introduction

Yukon
Department of
Renewable
Resources
conducted a
study of three
woodland
caribou herds in
the central
Yukon from
March 1989 to
October 1996.

The Yukon Department of Renewable Resources conducted a study of three woodland caribou (*Rangifer tarandus caribou*) herds in central Yukon from March 1989 to October 1996. This study is part of the department's ongoing program to inventory all Yukon woodland caribou herds.

A woodland caribou herd is defined as a group of caribou that share a common winter range that is geographically distinct from neighboring herds (Edmonds 1988, Farnell et al. 1996). An inventory is a study of a caribou herd's size and composition, seasonal movements and distribution, and habitat use. We should inventory caribou herds to establish baseline data and monitor population so that we can set safe harvest limits and protect important habitats.

Caribou studies in North America have found that any type of development on a caribou range that increases hunter access or alters important caribou habitats will lead to a herd's decline (Bergerud et al. 1984b, Farnell et al. 1998). Caribou winter range should therefore get special management considerations. Increased snow depths often restrict caribou to the winter range for extended periods making space and food availability important during this time. Lichen, the caribou's principal winter food source, may take up to 100 years to grow to be useable as forage (Thomas et al. 1996).

This report presents the results of fall composition surveys, population estimates, seasonal range use patterns, winter food habits and harvest patterns of the Tay River, Moose Lake and Ethel Lake herds and makes management recommendations for these herds.

Other studies:

Biologists have studied woodland caribou herds adjacent to the study area (Figure 1). The Finlayson caribou herd to the east of the study area is a large herd studied since 1982 using periodic population counts and fall composition trend surveys (Farnell and MacDonald 1988). The Redstone herd to the north is a large herd, which calves along the Yukon/Northwest Territories border and returns to the Northwest Territories to winter. There may be some herd overlap with the Tay River herd during calving (unpubl. data). The Tatchun caribou herd, to the west of the study area, is a small herd that has been under study since 1991 (unpubl. data).

Study Area

The area between Ross River and Mayo lies in the Pelly Mountain Ecoregion (Oswald and Senyk 1977). It is mainly mountainous terrain with large river drainages flowing in a westerly direction. Elevation ranges from 600 m in the valleys to over 1,000 m in the hills and mountains. The climate has characteristically long cold winters and short hot summers. The mean annual temperature ranges from -4°C to -7°C. Precipitation ranges from 250 mm in lower elevations to 300 mm in higher elevations. Black (*Picea mariana*) and white spruce (*P. glauca*) are the dominant tree species. Lodgepole pine (*Pinus contorta*) and aspen (*Populus tremuloides*) grow on the drier and recently burned sites while sub-alpine fir (*Abies lasiocarpa*) occurs intermittently at treeline.

Moose (*Alces alces*) studies in the North Canol area in November 1996 found moose occurring at 338 for every 1,000 km². (unpubl. data). This is above the Yukon average of 140 moose for every 1,000 km². There are about 1,000 Stone sheep (*Ovis dalli stonei*) in the study area (unpubl. data).

Wolf (*Canis lupus*) surveys found wolves to occur between nine and 10 wolves for every 1,000 km² (unpubl. data). Grizzly bears (*Ursus arctos*), black bears (*Ursus americanus*), wolverine (*Gulo gulo*) and golden eagles (*Aquila chrysaetos*) also occur in the area.

Access in the area is limited to major roads, rivers and lakes. The study area is bordered by the Robert Campbell Highway on the south and the North Klondike Highway to the west. Both roads are open all year. The eastern boundary of the study area is the North Canol Road and is only accessible to summer traffic. There is limited access for off road vehicles from the major highways. The Macmillan, Pelly and Stewart Rivers also provide access and drain the area in a westerly direction (Figure 2). There are numerous lakes used for fly-in recreation in the study area.

Methods

Woodland caribou inventories are generally carried out over a three-year period. In the first year, about 25 caribou are captured and radio-collared. The animals are then located five times a year for three years. This helps define the herd's seasonal ranges and determines if there is any range overlap between neighbouring herds. A fall composition survey is done annually using the radio-collared animals to help locate the groups that are gathered in the alpine for the breeding season. A population count is done near the end of the study and is used as a benchmark for management purposes.

How caribou are captured:

Most of the collared animals are females so that we learn more biological information such as pregnancy rates and calving sites. Wildlife staff capture caribou using a hand-held net gun fired from a helicopter (Barrett et al. 1982). All captures take place on the winter range where there is ample snow to slow the caribou and cushion their handling. Caribou become entangled in the net and are then physically restrained by the biologists. The age of each caribou is estimated by toothwear and body measurements are taken to compare with other herds. Each caribou is fitted with a radio-collar that has a unique signal (36 month life). The collars also have a highly visible band to help identify the animals from the air. A switch in the radio-collar changes the radio signal when the caribou has not moved for six hours or has died. This allows biologists to determine when and where the caribou died and investigate the mortality site.

How and why caribou are counted:

Caribou are counted twice a year. A fall composition survey or 'rut count' samples a portion of the population and is done annually during the fall breeding season. These surveys give trend information that is useful in following the proportion of calves and bulls in the population over time. A late-winter population estimate or 'count' to understand what the population size is doing over time is usually done every five years. Management recommendations are made using the combined information from the rut count trends and population size estimates.

1. Fall Composition Surveys

Caribou population trends are followed annually using rut counts that sample only a portion of the population. To make sure that enough caribou of each sex and age class are counted, biologists need to classify at least one third of the total population. These surveys are done every year to try to understand long-term population trends. A fall

population with 30 to 35 calves for every 100 cows and over 35 bulls for every 100 cows is thought to be stable (Woodland Caribou Guidelines 1996).

A rut composition survey begins with an airplane relocating the radio-collared caribou. A helicopter, also fixed with radio tracking equipment, then goes to the caribou locations found by the airplane. The groups are counted and classified according to age and sex. The helicopter gently moves the caribou so the biologist can classify the caribou as they are moving away from the aircraft. Additional rutting groups are counted while travelling between collared caribou. The caribou are classified as cows, female calves, male calves, mature bulls and immature bulls. Bulls and cows have antlers, but cows have a black vulva patch and bulls have a penis sheath. A few cows do not have antlers. These are called polled cows and it is not fully understood why they do not grow antlers. Both sexes of calves have similar sized small antlers, but the female calves have a distinctive black vulva patch. Mature bulls are distinguished by their large antlers and white manes while immature bulls have small antlers and manes ranging from brown to white

2. Late winter population estimates:

Biologists count caribou in late winter to get a population estimate. The method used in this study is called the *stratified random quadrat technique* (Gasaway et al. 1986, Farnell and Gauthier 1988). The survey area is divided into sample units of about 25 km². The first step of the survey involves finding all the radio-collared animals during a radio-tracking flight. Next, two airplanes, with two observers are used to divide or 'stratify' the survey area into blocks or strata with either high or low numbers of caribou. Stratifying involves systematically flying over the area at about 300m above the ground to locate groups of caribou or caribou tracking sign. Survey units containing more than 20 caribou are classed as high or primary strata and those containing less than 20 are classed in the low or secondary strata.

The 'census' or counting the caribou uses a crew of three observers in a helicopter. All the caribou in the surveyed units are counted and classified. The caribou are classified into the same groups as in the fall, except for the calves, which are grouped together, instead of being separated by sex.

All of the primary strata are counted but only a portion or about 30 per cent of the secondaries are randomly selected for counting. It is too expensive to count all the secondaries, so it is assumed that caribou density is the same in the uncounted units as in the counted units. Not all caribou are seen during the count. To account for missed caribou, a sightability correction factor is determined by resurveying a small area of some of the primary units at double the search intensity. This method produces a total population estimate that is statistically right 90 times out of 100.

How caribou are followed:

Biologists use airplanes to relocate collared caribou and track their movements. An airplane fixed with radio tracking antennas and receiver flies at about 3,000m above sea level, weather permitting, with the observer listening for radio signals. When a signal is heard, the airplane circles until the location is pinpointed to less than 10 square kilometers. The caribou are usually not seen; this would be time consuming and impractical with caribou in timbered areas. The caribou location is determined using a Global Positioning System (GPS).

When seasonal movements are followed:

Caribou are followed using aerial radio-tracking during five important stages of their annual life cycle.

1. Calving

Cow caribou move into isolated mountains for calving in late May and early June (Bergerud et al. 1984a). Most caribou calves in the Yukon are born around May 27, based on findings from the Finlayson caribou herd in 1995 (unpubl. data). To determine this, biologists flew daily in a helicopter to locate an adequate sample of caribou cows on the calving range. The peak of calving was then determined once 50 per cent of the cows were seen to have calves.

Most caribou calves in the Yukon are born around May 27...

There are a number of variables that affect calf survival including weather and predation. Fewer calves survive in years with cold springs when snow covers most of the alpine (Bergerud and Page 1987); this happened in the Yukon in 1992 (unpubl. data). Grizzly bears and wolves are the main predators of caribou calves (Adams et. al. 1995). Grizzly bear predation on calves lasts a short time during calving, as bears can only catch calves that are less than 10 days old. Wolves

prey on all caribou throughout the year. Wolverines, golden eagles, lynx (*Lynx canadensis*) and coyotes (*C. latrans*) also prey on caribou calves.

2. Post-Calving

Following calving, the cows and calves spend the summer or post-calving season (June to August) together in the alpine, feeding and resting on snow patches to avoid the heat and insects (Ion and Kershaw 1989). Mature bulls band together and spend the summer in the same habitats, but do not associate with the cow-calf groups. During this season, immature bulls may be found with either the large bulls or the cows and calves.

3. Rut

Rut, or fall breeding, takes place from mid-September to mid-October. During this period bulls, cows and calves are mixed together in the alpine areas. The bulls spend most of their time tending the receptive cows and sparring with other males.

4. Early Winter

Caribou move out of the alpine and into timbered valleys in the early winter. In mid-December, caribou may be found anywhere from alpine areas in light snow years to timbered valleys in years of heavy snow. Caribou start to socially segregate at this time. Mature bulls form bachelor groups and are often found on the periphery of the herd's range. Cows with calves band together and usually reach the core of the winter range first. Cows without calves may or may not be with other cow-calf groups. Immature bulls can be found with any group of caribou.

5. Late Winter

A winter range is usually in a snow shadow region between mountain ranges where ample food is available and there are small lakes for resting and watching for predators. During late winter (January to early April), increased snow depths confine the caribou to a restricted area until the snow melts in spring and it is possible to move back to the alpine. Caribou are still segregated at this time and spend their time foraging for lichen and resting on nearby lakes.

Winter Food Habits:

Because snow depths confine caribou during late winter it is important to determine the quality of late winter range available to them at this time. Lichen is the most important winter food for caribou and most Yukon herds have about 70% lichen in the diet (Farnell et al. 1991). Winter food habits are studied by collecting fecal pellets from three different sites

to get proper assessment of the winter range. The pellets are sent to a laboratory where they are analyzed for the per cent of each food item present in the diet (Thomas and Barry 1989).

**Harvest
Regulations
and Monitoring:**

Management experiences throughout North America have found that harvest should not exceed two to three per cent of adults (Yukon Woodland Caribou Management Guidelines 1996). Caribou harvest for licensed hunters in the Yukon has been gathered by hunter questionnaire since 1979. In 1986, licensed harvest was restricted to bulls only except in the isolated northern areas. In 1993, the Yukon government made it mandatory for residents to report all caribou harvests. Non-residents must complete a report of their hunting activities shortly after the hunt. Quotas for the number of caribou taken by clients of each registered outfitter are presently being implemented throughout the Yukon. Native harvest is managed by First Nations according to First Nation Final and Self Government Agreements.

Results

Tay River Herd:

***Capture and
Radio-collaring***

In March 1989, 22 adult female and one immature male caribou were captured on the winter range (Figure 2) (Appendix A). Three caribou died during the study but the causes of death are unknown because the mortality sites could not be visited. Four other collars stopped transmitting during the first two years of the study.

***Distribution
Surveys***

All calving locations for the herd were south of the upper Stewart River and north of the Pelly River.

Cows in the Tay River herd calve over an extensive area. All calving locations for the herd were south of the upper Stewart River and north of the Pelly River (Figure 2). Female caribou were generally found alone in alpine habitats during calving surveys.

During post-calving surveys, caribou were found in the same general areas as during calving (Figure 2). Caribou were found mostly in alpine areas where they use snow patches and ridges for relief from heat and insects (Ion and Kershaw 1989). Nine collared caribou returned to the same mountain over two post-calving seasons.

Caribou were more widely distributed in the rut than during the summer. A number of collared caribou crossed valleys and moved to adjacent mountain blocks between the summer and rut surveys.

Early winter surveys found the caribou moving out of the alpine and into the lowlands. There was a general movement out of the mountains towards the wooded creek and river drainages north of Faro (Figure 2). A small group of caribou that spent the summer and fall north of the Hess River was found to move back to winter near the Hess River. It appears that they are somewhat independent of the larger winter concentration of caribou that winter north of Faro. During late winter, the collar locations were more confined to the valley bottoms than during early winter (Figure 2). The valleys between the Macmillan and Pelly Rivers were the most heavily used. More winter distribution information was learned during the 1991 census when helicopters intensively searching for caribou found a concentration of caribou within 10 kilometers of Faro (Figure 3).

**Population
Estimates and
Composition**

The Tay River herd was censused from March 23 to 27, 1991 (Table 1). The total area surveyed was 1,265 km² (Figure 3). The caribou were found mostly along the Tay and South Macmillan Rivers. There were 3,091 caribou in the primary survey units and 185 caribou in the secondary units. A sightability correction factor of 1.14 brought the population estimate to 3,758 +/- 571 caribou (Appendix B).

Table 1. Summary of caribou survey data and population estimate for the Tay River caribou herd at 90 per cent confidence limit.

Strata	Units Surveyed	Total Survey Units	Area Surveyed (km ²)	Total Area (km ²)	Total Caribou	Expanded Population Estimate	Population Estimated With SCF
Primary	31	31	845	845	3,091	3,091	
Secondary	15	53	421	1,469	53	185	
Totals	46	84	1,266	2,314	3,144	3,276	3,758

* population estimate from Gasaway et al. (1986) with a sightability correction factor of 1.14.

Harvest

The harvest over five years is considered sustainable at about one per cent of the population and ranging from 35 to 43 caribou harvested annually by licensed hunters (Table 2). Harvest of the Tay River herd is limited by access in the fall. The North Canal Road, on the eastern edge of the herd's range, has a few spur roads that allow ATV hunting. Fly-in hunts based out of Ross River and Faro are also common and contribute to the overall harvest (Table 2). Moose hunters use the Macmillan River and may incidentally take caribou. There is presently limited access to the herd's winter range, which keeps winter harvest by First Nation people light.

Table 2. Licensed Harvest of the Tay River herd.

	1990	1991	1992	1993	1994
Resident	16	25	21	22	19
Non-resident	21	18	14	17	17
Total	37	43	35	39	36

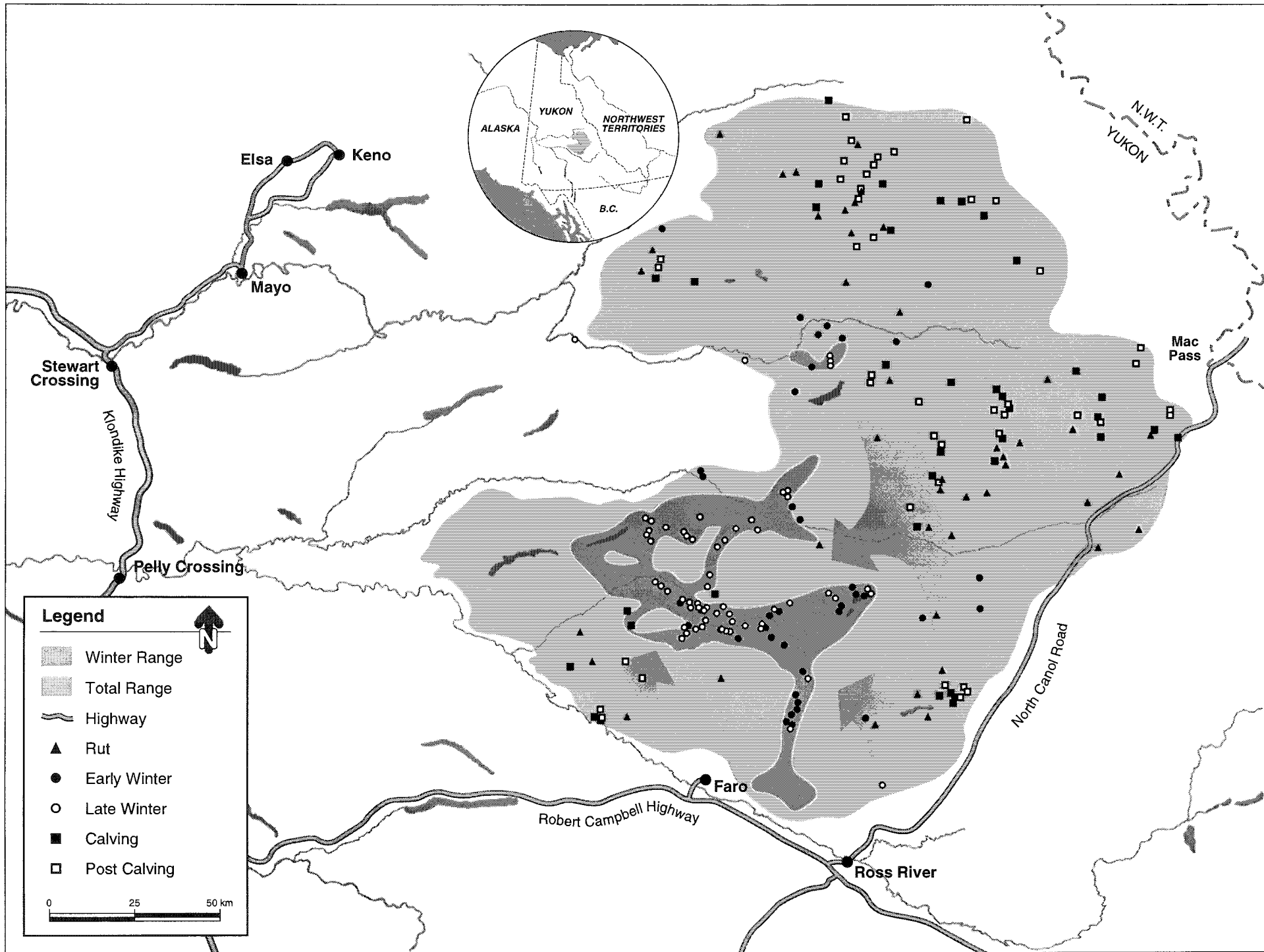


Figure 2. Home range of the Tay River caribou herd.

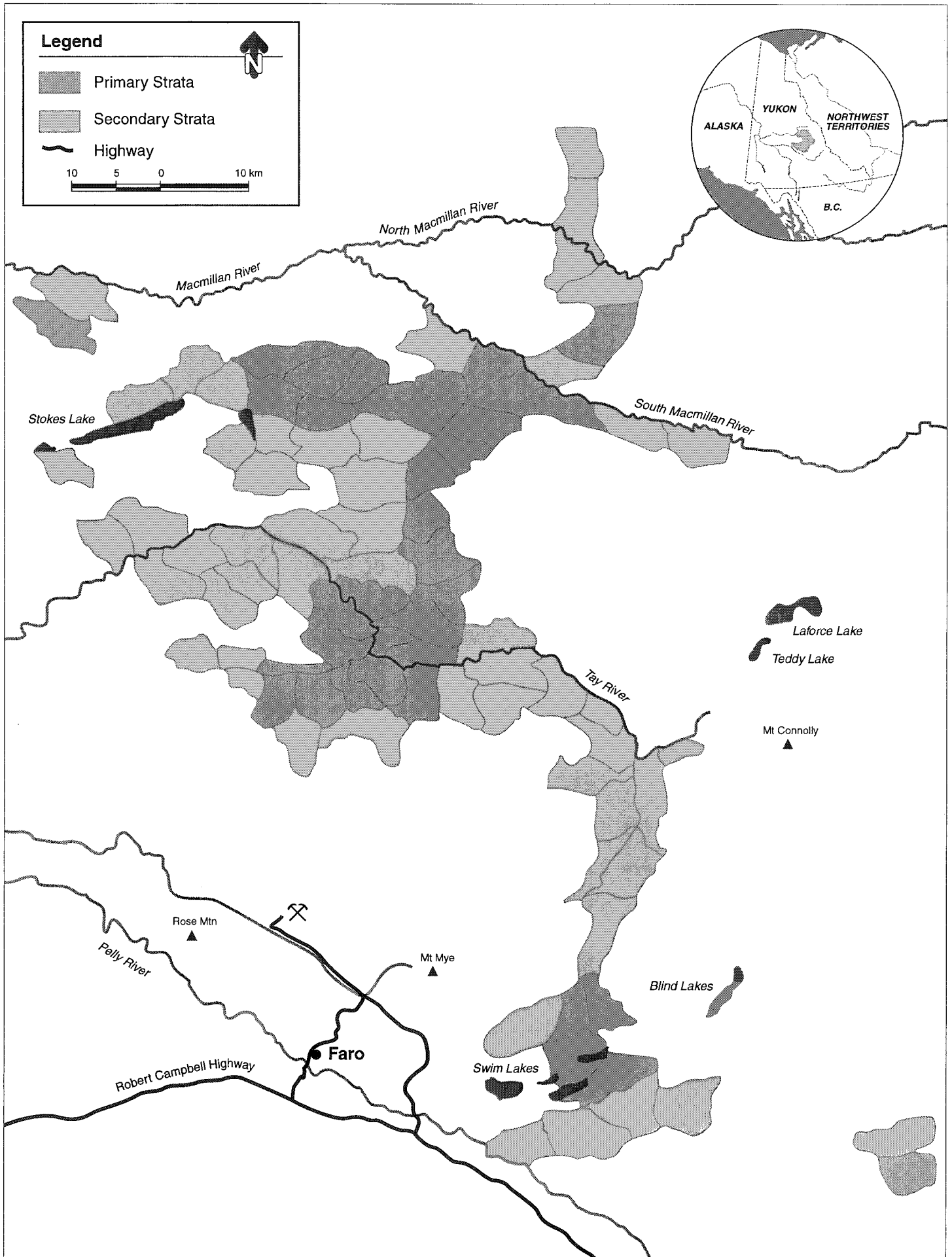


Figure 3. Survey area used to estimate population size of the Tay River caribou herd.

Moose Lake Herd:

Capture and Radio Collaring

There were four adult female caribou collared in late winter, 1989 from the Moose Lake herd. Two of the caribou died during the study due to unknown causes and two radios failed after 18 and 36 months (Appendix D).

Distribution Surveys

During calving, post-calving and rut these caribou were commonly found in the mountains and plateaus to the east of Moose Lake (Figure 4).

During calving, post-calving and rut these caribou were commonly found in the mountains and plateaus to the east of Moose Lake.

Radio-tracking results showed that this caribou population is a separate herd from the larger Tay River herd. The caribou make a distinct pattern of short movements from a wintering area near Moose Lake to a summer range in the neighbouring mountains to the east.

Population Estimate and Composition

No population census was done for the Moose Lake herd. In 1991 there were 211 caribou seen during a rut count (Table 3). Because of low search intensity used during a rut count, not all caribou are seen. We estimate that this herd could number up to 300 caribou.

With this population information, the Moose Lake Herd is classed as a small herd as outlined in the Yukon Caribou Management Guidelines. Any access that enters the herd's range should be closely monitored.

Table 3. Moose Lake herd rut count, 1991.

Date	Cow	Calf	Immature Bul	Mature Bull	Total	Calf/Cow	Bull/Cow
October 1991	145	21	27	18	211	14	31

Harvest

From 1991 to 1994, the only harvest was 2-5 caribou per year by the outfitter (Table 4). At about one to two percent of the herd, this rate is considered sustainable. Access to the herd's range is presently limited which is keeping harvest light.

Table 4. Licensed harvest of the Moose Lake herd.

	1990	1991	1992	1993	1994
Resident	0	0	0	0	0
Non-resident	5	3	2	3	3

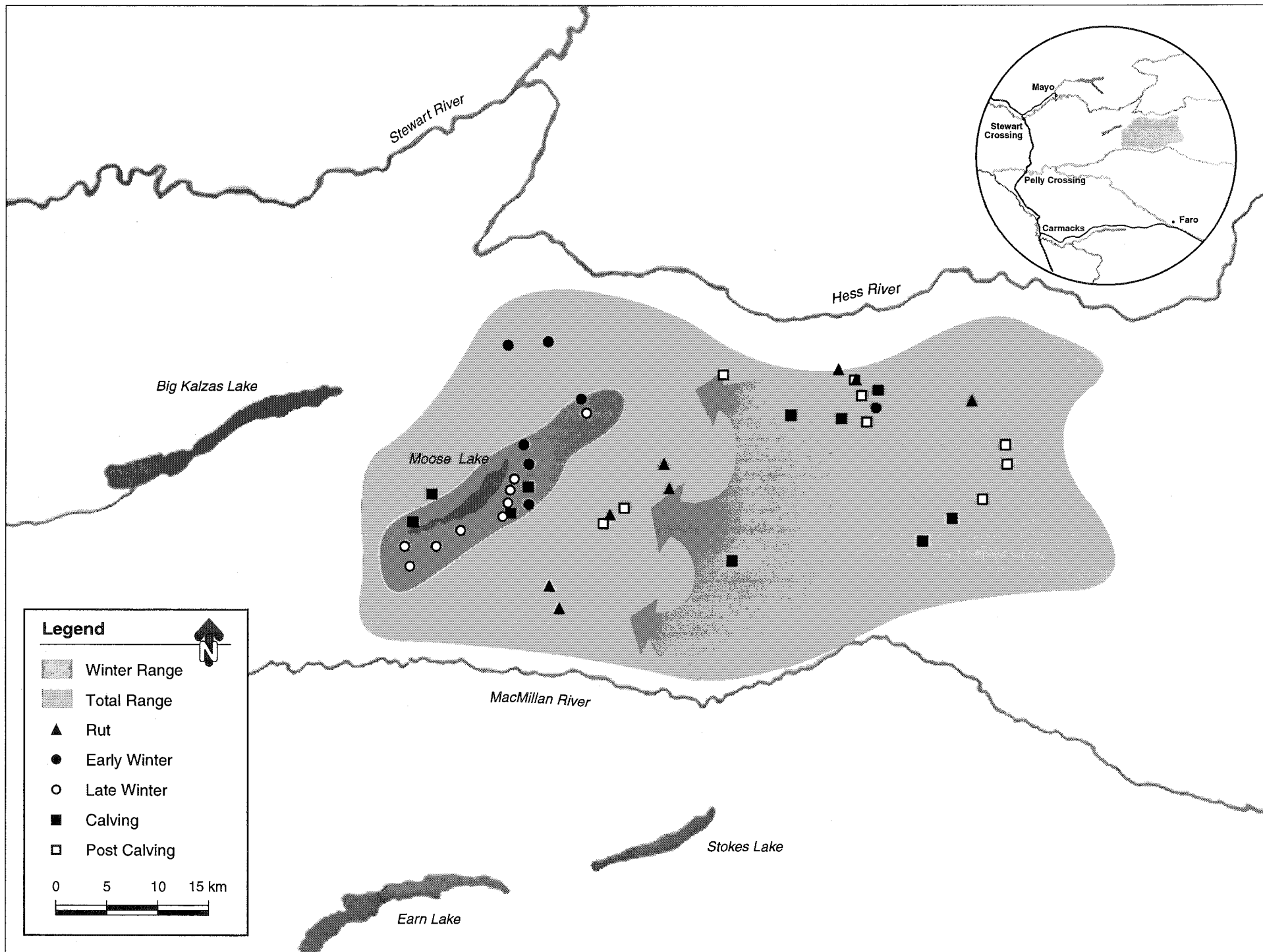


Figure 4. Home range of the Moose Lake caribou herd.

Ethel Lake Herd:

Capture and Radio-collaring

There were eight adult female and four immature male caribou collared from the Ethel Lake herd in the late winters of 1989 and 1990 (Appendix E). There were five radio failures, two mortalities that were not investigated and five caribou alive at the end of the study in March 1993

Distribution Surveys

The Ethel Lake caribou herd, like the Moose Lake herd, has short movements from the surrounding mountains in summer and fall to a common winter range. Caribou locations during calving, post-calving and rut were found on the plateaus and mountains between Ethel Lake and Big Kalzas Lake (Figure 5). During early-winter distribution flights the caribou were found in the subalpine and timber from Ethel Lake to the confluence of the Stewart River. The caribou then moved to timbered valleys east of Ethel Lake later in the winter.

Population Estimates and Composition

Intensive search found tracking sign west of the North Klondike Highway...

The Ethel Lake caribou herd was censused in 1993 and annual fall rut counts were done from 1993 to 1996 (Tables 5 and 6). The census was conducted from March 9 to 14, 1993. This distribution was similar to other years but a more intensive search found tracking sign west of the North Klondike Highway (Figure 6). This is an important finding as winter harvest from the North Klondike Highway could impact the herd. There were 263 caribou counted in the primary survey units and 53 caribou in the secondary units for a total of 316 caribou (Table 5). There is no extrapolation for more caribou being missed in this survey for two reasons. First, caribou were confined by snow to a small area (778 km²) and it was efficient to survey all units. Second, three primary survey units were resurveyed with no extra caribou found, giving a sightability correction factor of 1.0. We therefore assume all caribou were counted on the census survey. (Appendix B).

Table 5. Summary of caribou survey data and population estimate for the Ethel Lake caribou herd.

Strata	Units Surveyed	Total Survey Units	Area surveyed (km²)	Total Caribou Observed
Primary	13	13	393	263
Secondary	13	13	385	53
Totals	26	26	778	316

Table 6. Ethel Lake herd rut counts 1993-1996.

Date	Cow	Calf	Immature Bull	Mature Bull	Unclassified	Total	Calf/Cow	Bull/Cow
October 1993	120	47	48	24	0	239	39	60
October 1994	47	26	11	12	4	100	55	49
October 1995	64	14	11	22	0	111	22	52
October 1996	63	22	19	14	0	118	35	52

Harvest

Harvest on the Ethel Lake herd is light (Table 7). There is no outfitter in the herd's range and road access is limited. Caribou occasionally cross the North Klondike Highway in winter making them more accessible, but little harvest near the road has been documented.

Table 7. Licensed harvest of the Ethel Lake herd.

	1990	1991	1992	1993	1994
Resident	11	0	1	2	1

Food Habits for all herds:

The results from winter diet analysis show that there is adequate lichen available on these three caribou winter ranges. The proportion of lichen in the winter diet was 70 per cent for the Moose Lake herd, 74 per cent for the Ethel Lake herd and 76 per cent for the Tay River herd (Figure 7). This amount of lichen in the winter diet is typical of other Yukon woodland caribou herds that live in forested environments (Farnell et al 1991). Evergreen shrubs were the next most predominant food item in the diet analysis. It is not as easily digested so it may be over represented in the diet. Small amounts of horsetails and grasses were also found in the diet. Moss was found at less than 3 per cent for all herds. The moss is probably ingested during normal feeding and a low incidence of moss (less than 5 per cent) in the diet indicates good range quality (Russell and Martell 1984).

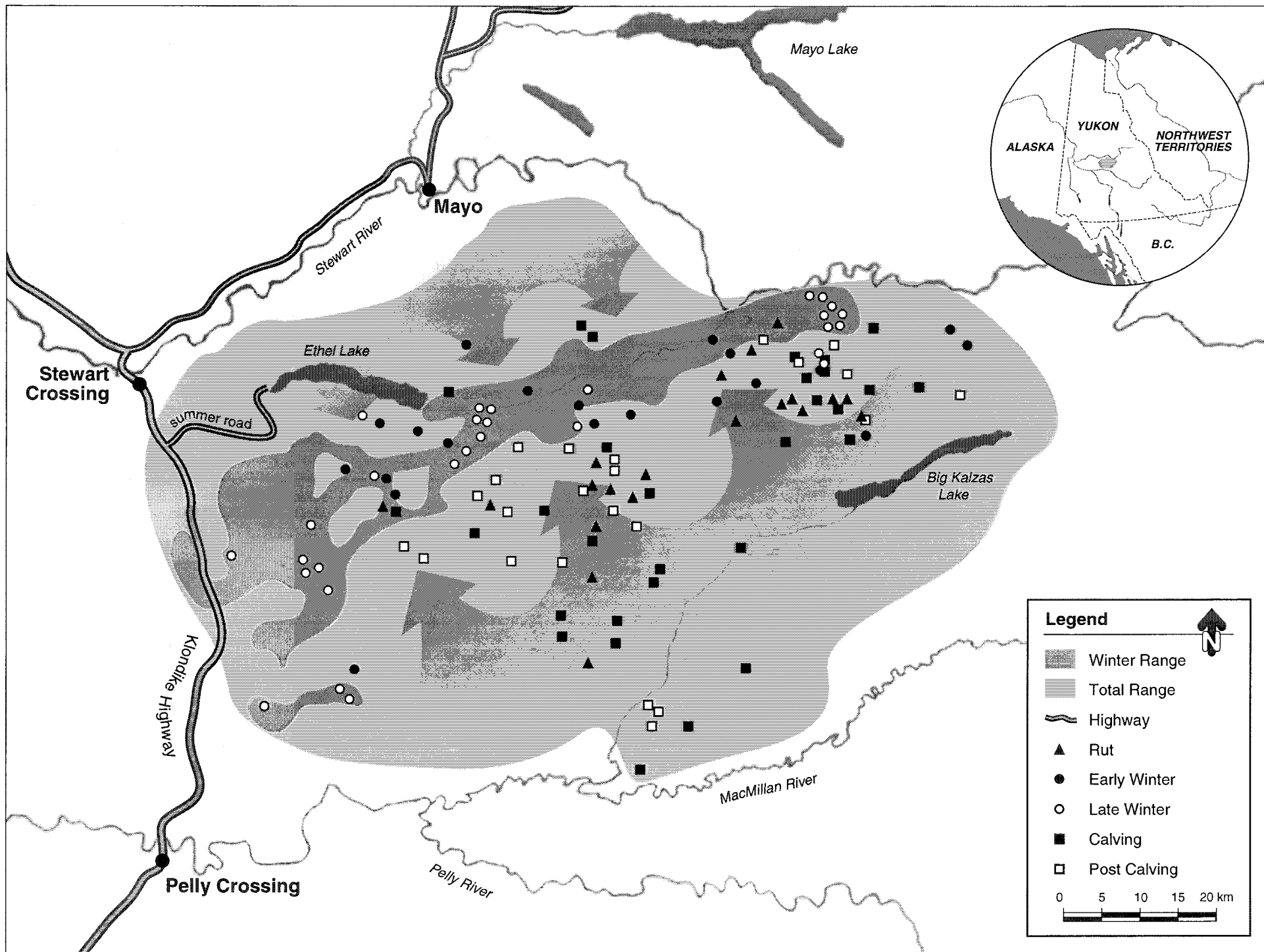


Figure 5. Home range of the Ethel Lake caribou herd.

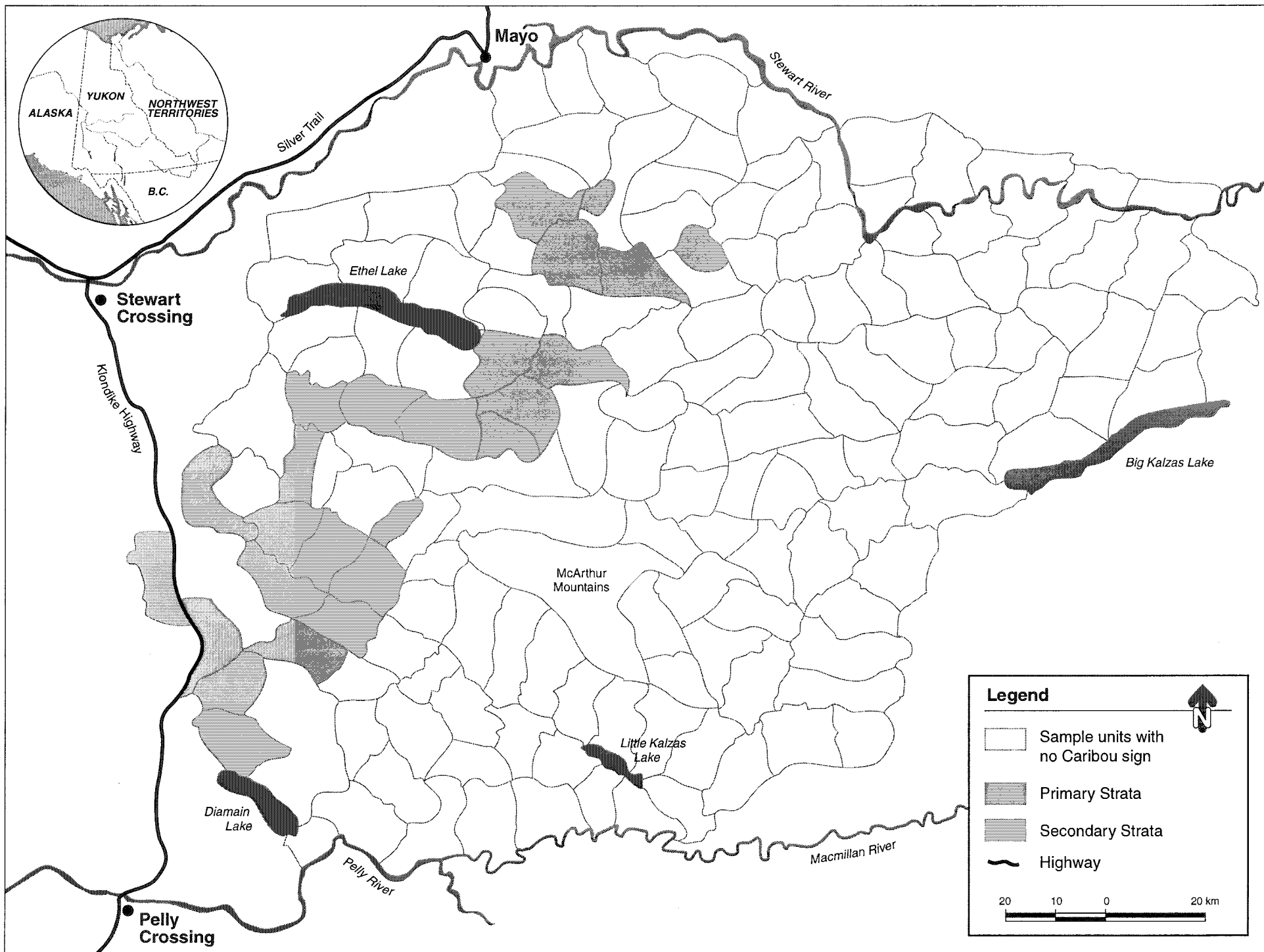


Figure 6. Survey area used to estimate population size of the Ethel Lake caribou herd.

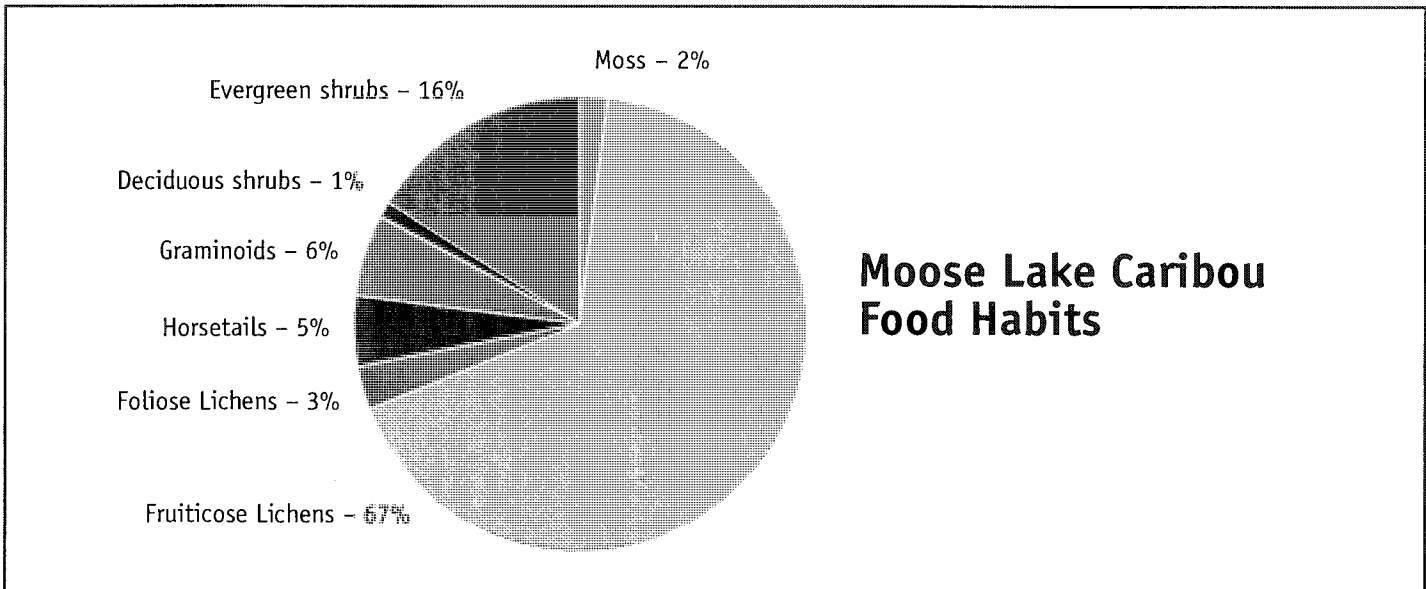
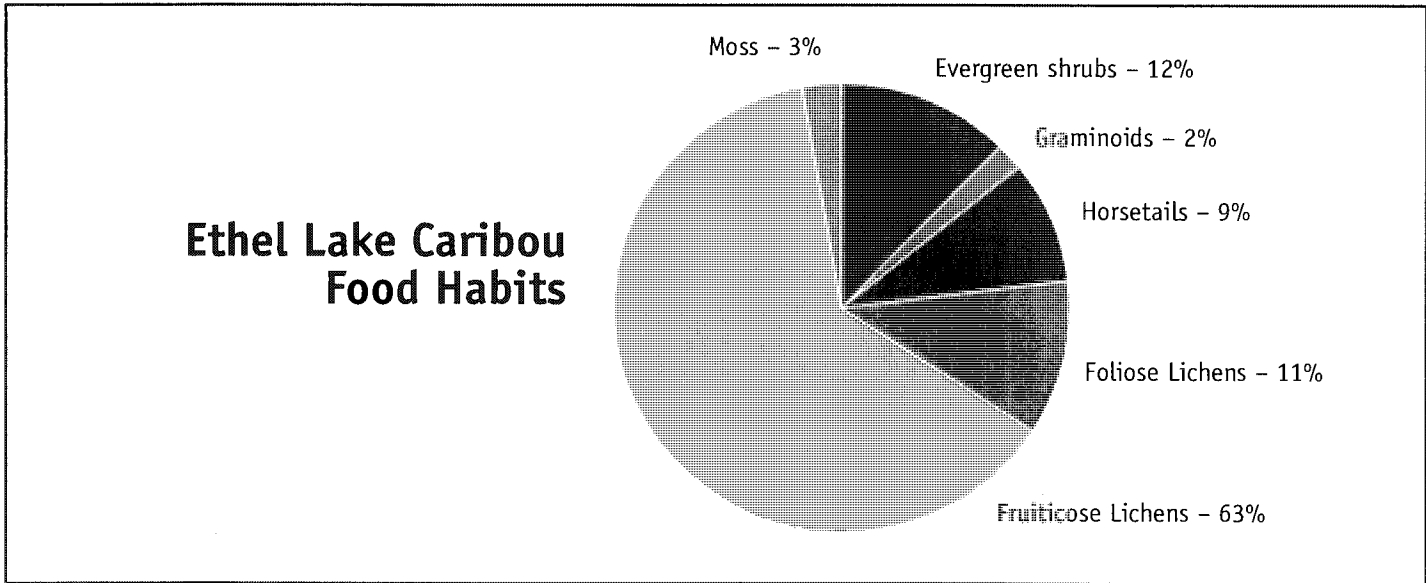
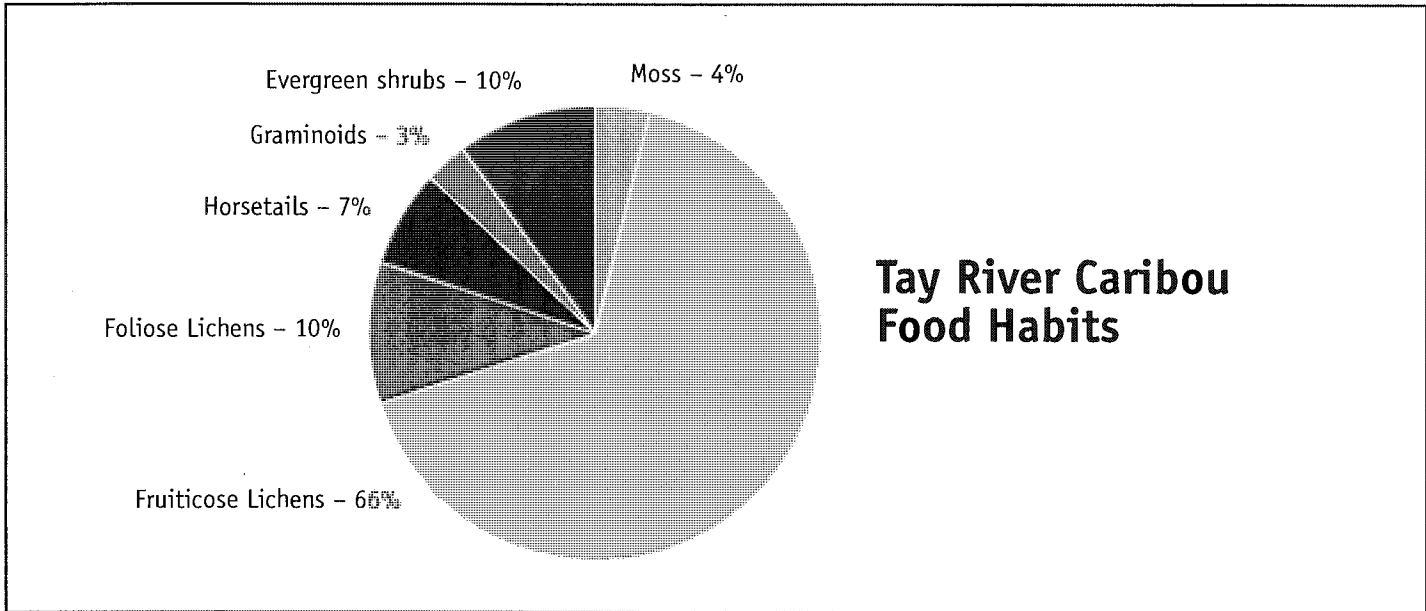


Figure 7. Food habits of caribou on their winter range.

Conclusion and Recommendations

1. First time population estimates were done for the Tay River, Moose Lake and Ethel Lake herds. These numbers should be treated as benchmark estimates for management purposes. All herds had near the 30 calves for every 100 cows and over 35 bulls for every 100 cows, which indicate stable populations (Yukon Woodland Caribou Guidelines 1996). Annual fall composition surveys and population estimates every 5 years are recommended to monitor the population status of these herds.
2. Average harvest on these three herds is near three per cent of the adult population, which is considered sustainable. The population information gained in this study should be used in implementing harvest restrictions when deemed necessary.
3. Important caribou habitats have been delineated. Any development that enters the herd ranges, especially winter ranges, should be closely regulated and attempts made to mitigate increased hunter access. The proximity of the Tay River herd winter range to Faro should be noted. Any attempt to gain access to this area should be closely monitored to prevent the chance of overharvest in the winter.
4. Moose Lake and Ethel Lake caribou herds are small herds of less than 400 caribou. These small populations are especially vulnerable to human disturbance through land use developments and hunting and should therefore be given special management considerations.
5. Forest cutting practices and forest fire management should complement the three caribou winter ranges in terms of amount of habitat needed for the number of caribou. Lichen availability should also be taken into account as an important part of the forest and a crucial winter food for caribou.
6. Mining activities should consider that caribou are sensitive to disturbance during calving and rut. The caribou spatial information presented in this report should be used when considering the effects of future mineral development in the area.

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**Woodland Caribou Studies
In Central Yukon**

Appendices



Appendix A Radio-collaring data for the Tay River caribou herd.

Date	Collar	Sex	Age	Location	End Status	No. of Relocations
89/02/09	BB-14	F	Adult	Laforce Lake	alive	10
89/02/09	BB-37	F	Adult	Laforce Lake	fail	8
89/02/10	BB-42	F	Adult	Gillis Lake	alive	3
89/02/10	BB-08	F	Adult	Orchay Lake	alive	10
89/02/11	BB-10	F	Adult	Teddy Creek	alive	10
89/02/11	BA-09	F	Adult	Laforce Lake	alive	10
89/02/11	BB-07	F	Adult	Tay River	dead	1
89/02/11	BB-12	F	Adult	Tay River	alive	10
89/02/11	BB-15	F	Adult	Gillis Lake	alive	9
89/02/11	BB-03	M	Immature	Gillis Lake	dead	8
89/02/12	BB-02	F	Adult	Teddy Creek	alive	10
89/02/12	BB-13	F	Adult	Teddy Creek	alive	10
89/02/12	BB-41	F	Adult	Teddy Creek	alive	9
89/02/12	BB-09	F	Adult	Tay River	alive	10
89/02/12	BB-87	F	Adult	Barwell Lake	alive	10
89/02/12	BB-01	F	Adult	Tay River	alive	10
89/02/12	BB-44	F	Adult	Tay River	fail	8
89/02/15	BB-06	F	Adult	Mt. Selous	alive	9
89/02/15	BB-40	F	Adult	Mt. Selous	fail	9
89/02/15	BB-89	F	Adult	Fairweather Lake	dead	7
89/02/15	BB-64	F	Adult	Fairweather Lake	fail	8
89/02/15	BA-07	F	Adult	Fairweather Lake	alive	9
89/02/15	BB-11	F	Adult	Mt. Selous	alive	9

Appendix B Caribou survey data for the Tay River herd population estimate,
March 23-27, 1991

Low Intensity Search (1.8 min/km)

Obs.	Date	Sample Unit	Adult Cow	Calf	Imm. Bull	Mat. Bull	Unclass	Total	Area (km)	Time (min)	Collars
Primary Stratum											
1	Mar/23/91	P1	29	19	8	1	–	57	28.9	60	
2	Mar/23/91	P2	163	82	58	20	–	323	46.9	95	BB-12
3	Mar/23/91	P3	–	–	2	27	–	29	27.4	55	
5	Mar/23/91	P5	–	–	4	17	–	21	28.3	52	
6	Mar/23/91	P6	35	18	32	25	9	119	27.3	80	BB-13
7	Mar/23/91	P7	82	36	21	7	–	146	43.1	81	
8	Mar/24/91	P8	35	15	5	–	–	55	28.8	54	
9	Mar/24/91	P9	36	10	4	5	–	55	26.5	64	
10	Mar/24/91	P10	17	5	5	5	–	32	24.4	60	BA-09
11	Mar/24/91	P11	65	22	9	4	–	100	22.2	66	
12	Mar/24/91	P12	13	11	3	2	–	29	24.1	32	
13	Mar/24/91	P13	87	28	30	17	–	162	18.5	59	BB-42
14	Mar/24/91	P14	140	49	29	21	–	239	26.1	71	
15	Mar/24/91	P15	68	24	15	13	–	120	33.5	64	BB-02
16	Mar/25/91	P16	54	32	15	8	–	109	25.6	58	BB-41
17	Mar/25/91	P17	78	47	21	3	3	152	27.5	74	BB-11/10/14
18	Mar/25/91	P18	27	22	8	3	–	60	18.4	37	
19	Mar/25/91	P19	47	11	2	5	–	65	26.2	54	
20	Mar/25/91	P20	26	16	6	–	2	50	32.8	58	BB-87
21	Mar/25/91	P21	55	20	10	1	–	86	21.4	42	
22	Mar/25/91	P22	18	3	7	1	–	29	22.1	53	
23	Mar/25/91	P23	86	28	3	–	10	127	18	52	BA-07
24	Mar/26/91	P24	73	23	19	13	4	132	25.3	50	
25	Mar/26/91	P25	85	32	27	11	11	166	23.6	55	
26	Mar/26/91	P26	85	44	32	6	1	168	21	50	
27	Mar/26/91	P27	22	10	2	4	–	38	34.7	59	
28	Mar/26/91	P28	11	5	6	2	3	27	30.7	70	BB-15
29	Mar/26/91	P29	65	22	8	5	4	104	22.5	46	
30	Mar/26/91	P30	97	39	38	40	–	214	29.5	83	BB-40
31	Mar/26/91	P31	–	–	1	46	–	47	23.1	28	
32	Mar/26/91	P32	9	18	1	2	–	30	36.4	45	
		Total	1608	691	431	314	47	3091	845	1807	

(cont'd next page)

Appendix B (continued)

Obs.	Date	Sample Unit	Adult Cow	Calf	Imm. Bull	Mat. Bull	Unclass	Total	Area (km)	Time (min)	Collars
Secondary Stratum											
33	Mar/22/91	S1	2	2	-	-	-	4	21.2	48	
34	Mar/24/91	S2	-	-	-	-	-	0	25.4	24	
35	Mar/26/91	S3	9	3	3	-	-	15	29.6	43	
36	Mar/27/91	S4	-	-	-	-	-	0	33.9	48	
37	Mar/27/91	S5	-	-	-	-	-	0	34.2	44	
38	Mar/27/91	S6	-	-	-	3	-	3	28.4	28	
39	Mar/27/91	S7	-	-	-	-	-	0	24.3	23	
40	Mar/27/91	S8	-	-	-	-	-	0	18.5	20	
41	Mar/27/91	S9	-	-	-	-	-	0	22.9	20	
42	Mar/27/91	S10	-	-	-	10	-	10	35.9	44	
43	Mar/27/91	S11	-	-	-	-	-	0	45.5	55	
44	Mar/27/91	S12	9	4	2	-	6	21	31.7	43	
45	Mar/27/91	S13	-	-	-	-	-	0	22.9	31	
46	Mar/27/91	S14	-	-	-	-	-	0	21.6	27	BB-09
47	Mar/27/91	S15	-	-	-	-	-	0	24.6	28	
		Total	20	9	5	13	6	53	421	526	
		Grand Total	1628	700	436	327	53	3144	1266	2333	

High Intensity Search (6.8 min/km)

Survey Unit	Area (km)	Time (min)	Intensity Over Survey Count
P1	2.3	31	42/42
P3	8	20	24/24
P13	2.8	17	42/42
P16	6.6	39	29/29
P31	6.4	38	47/47
P29	2.5	16	70/45
P19	2	18	82/65

Appendix C Radio-collaring data for the Moose Lake caribou herd.

Date	Collar	Sex	Age	Location	End Status	No. of Relocations
89/02/15	BB-05	F	Adult	Moose Lake	dead	6
89/02/16	BB-04	F	Adult	Moose Lake	dead	13
89/02/16	BA-08	F	Adult	Moose Lake	fail	16
89/02/16	BA-04	F	Adult	Moose Lake	fail	7

Appendix D Radio-collaring data for the Ethel Lake caribou herd.

Date	Collar	Sex	Age	Location	End Status	No. of Relocations
89/02/13	BB-92	F	Adult	Crooked Creek	fail	14
89/02/13	BB-35	F	Adult	Nogold Creek	fail	11
90/02/24	CC-59	F	Adult	Kalzas Plateau	alive	14
90/02/24	CC-67	F	Adult	Kalzas Plateau	alive	14
90/02/24	CC-45	F	Adult	Kalzas Plateau	alive	14
90/02/25	CC-30	M	Immature	Kalzas Plateau	alive	14
90/02/25	CC-65	M	Immature	Kalzas Plateau	dead	13
90/02/25	CC-85	F	Adult	Kalzas Plateau	dead	2
90/02/26	CC-80	M	Immature	Meadowhead Cr.	fail	11
90/02/26	CC-77	F	Adult	Kalzas Plateau	alive	14
90/02/26	CC-69	M	Immature	Kalzas Plateau	fail	3
90/02/26	CC-26	F	Adult	Kalzas Plateau	fail	5

Appendix E Caribou surveys for the Ethel Lake herd population estimate, March 12-14, 1993.

Low Intensity Search (1.8 min/km)

Obs.	Date	Sample Unit	Adult	Calf	Imm.	Mat. Bull	Unclass Bull	Total	Area	Time (km)	Collars (min)	
Primary Stratum												
1	Mar/12/93	P1	20	2	1	-	-	-	23	39.3	95	CC-45
2	Mar/12/93	P2	46	7	5	1	-	-	59	33	57	BB-92
3	Mar/12/93	P3	18	3	3	-	-	-	24	26.7	58	
4	Mar/12/93	P4	2	-	-	-	-	-	2	24.4	43	
5	Mar/12/93	P5	12	3	5	-	-	3	23	29.4	64	CC-67
6	Mar/12/93	P6	36	4	12	-	-	1	53	34.3	86	CC-59
7	Mar/12/93	P7	46	8	7	-	-	1	62	33.7	77	BB-35
8	Mar/13/93	P8	-	-	-	-	-	-	-	28.4	55	
9	Mar/13/93	P9	-	-	-	-	-	-	-	31.8	69	
10	Mar/13/93	P10	-	-	-	-	2	-	2	38.1	98	
11	Mar/13/93	P11	-	-	-	5	5	-	10	39.1	69	CC-30
12	Mar/13/93	P12	-	-	-	-	-	-	-	34.6	66	
13	Mar/13/93	P5	4	-	1	-	-	-	5	-	-	CC-77
Total			184	27	39	8	5	5	263	393	837	
Secondary Stratum												
14	Mar/12/93	S12	-	-	-	-	-	-	0	17.5	20	
15	Mar/13/93	S6	4	-	1	11	-	-	16	35.4	65	
16	Mar/13/93	S9	-	-	-	-	-	-	0	36.4	69	
17	Mar/13/93	S10	-	-	-	-	-	-	0	31.8	58	
18	Mar/13/93	S11	-	-	-	-	-	-	0	29.1	26	
19	Mar/14/93	S1	-	-	-	-	-	-	0	24.8	21	
20	Mar/14/93	S2	-	-	-	-	-	-	0	32.8	42	
21	Mar/14/93	S3	-	-	-	-	-	-	0	40.5	42	
22	Mar/14/93	S4	-	-	-	-	-	-	0	36.1	51	
23	Mar/14/93	S5	13	-	2	-	-	-	15	40	79	
24	Mar/14/93	S7	12	-	1	-	-	-	13	33	61	
25	Mar/14/93	S8	-	-	-	-	-	-	0	22.4	26	
26	Mar/14/93	S13	3	-	-	6	-	-	9	5.1	24	
Total			32	-	4	17	-	-	53	385	584	
Grand Total			216	27	43	25	5	5	316	778	1421	

High Intensity Search (6.8 min/km)

Survey Unit	Area (km)	Time (min)	Intensity Over Survey Count
P3	3.8	44	17/17
P6	7.9	37	15/15
P10	3.8	25	2/2