

Central Selkirk Caribou Project

Annual Report

September 1997

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Slocan Forest Products
Ministry of Environment, Lands and Parks

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EXECUTIVE SUMMARY

A four-year Forest Renewal BC caribou habitat inventory project for the Central Selkirk caribou population was approved in November 1996. The project was initiated by Slocan Forest Products, Pope & Talbot Limited, and the Ministry of Environment, Lands and Parks and encompasses previous caribou telemetry work in the Central Selkirks.

Project monitoring of caribou previously fitted with VHF radio-collars commenced in November of 1996. The radio-collared caribou were located using a twin engine Cessna 337 aircraft and Lotek STR1000 scanning receiver. Depending on weather, flights were conducted on a weekly basis from November through January and biweekly thereafter. Field crews were sent out after each winter flight to “track” caribou and record stand level data on habitat type, selection and use. Despite inclement flying weather persisting for much of the winter, a total of fifteen different caribou locations, involving 14 different collared caribou, were sampled during the critical winter period from November 1996 to the end of January 1997. A total of 189 caribou telemetry point locations have been made since November of last year.

A population census conducted in April of 1997 resulted in the sighting of 222 caribou, including 22 out of 23 radio-collared caribou. Caribou group size ranged from 1 to 23 animals with a mean group size of 8.3 caribou. The Nakusp census area averaged 7.5 calves per 100 adults, and the Duncan census area averaged 10.3 calves per 100 adults. Corrected population estimates for the Central Selkirk project area is 232 caribou.

In March of 1997, seven additional caribou were captured and fitted with radio-collars. This brought the total number of active caribou radio-collars within the project area to twenty excluding eight mortalities of previously collared caribou.

Mapping and reporting on historic caribou distribution, population size, known migration routes and seasonal habitat use patterns was conducted based on review of historic information sources, interviews, incidental observations, hunter harvest records and telemetry information. The most dramatic population declines in the Central Selkirks appear to have been concentrated in two periods, the early 1900s and the late 1960s/early 1970s.

Other than incidental observations, no aerial monitoring or fieldwork was conducted from May through September of 1997 due to project funding termination.

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1.0 INTRODUCTION

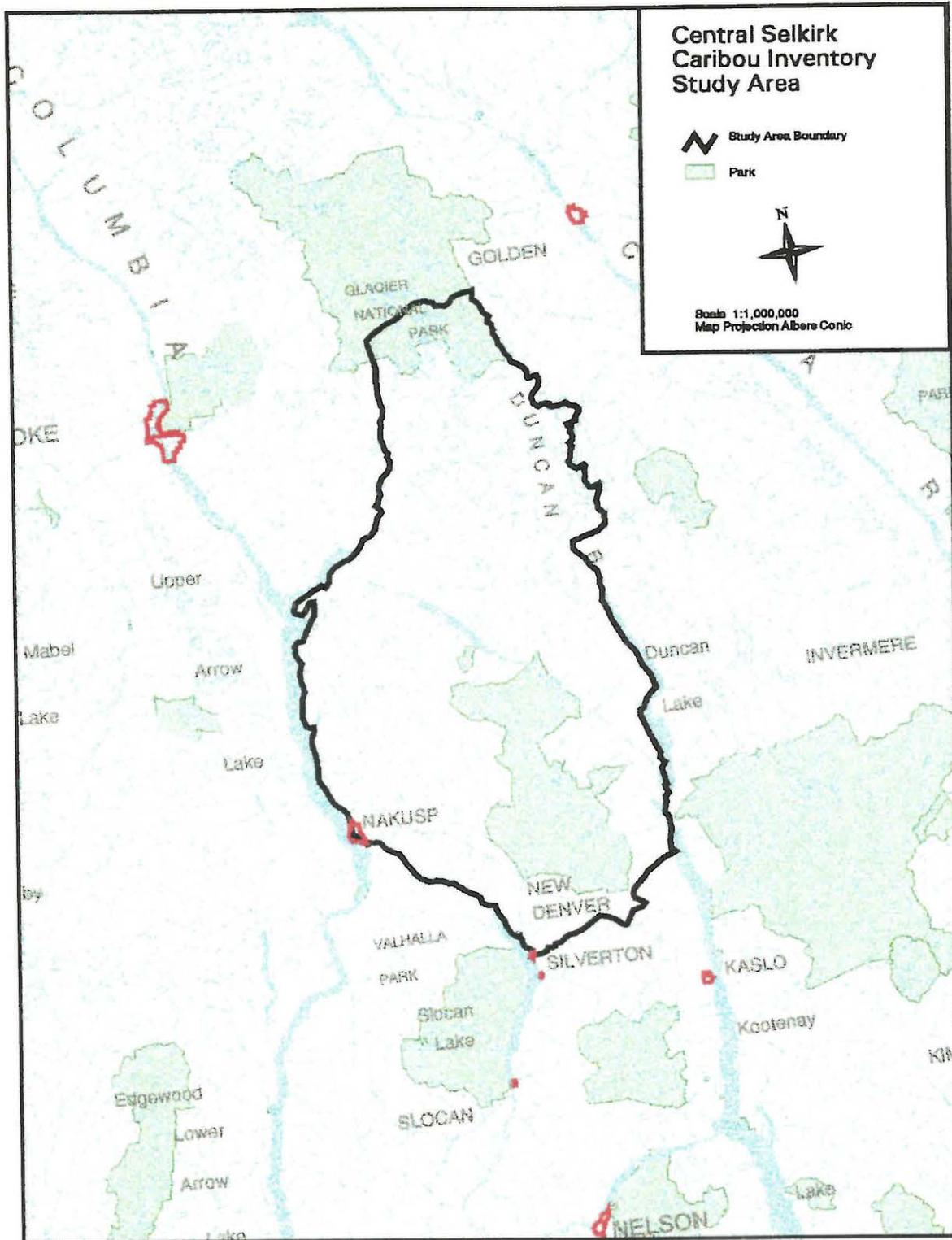
The Central Selkirk Caribou Project is a four-year Forest Renewal BC project involving BC Environment, Slocan Forest Products and Pope & Talbot Limited. The project was approved in November 1996, and aerial monitoring of radio equipped caribou, follow-up field tracking and baseline data collection was initiated thereafter. The goal of the project is to provide resource managers with information on caribou distribution, abundance, habitat selection, seasonal habitat use patterns, and forest habitat requirements in the Central Selkirks. The project is proposed to span four years, depending on available funding.

The Central Selkirk caribou inventory project area is approximately 610 square kilometers in size and is located within the Central Columbia Mountains and the southern portion of the North Columbia Mountains Ecoregions. It is characterized by steep mountainous terrain and dominated by three biogeoclimatic zones; the Interior Cedar-Hemlock (ICH) zone, the Engelmann spruce – Subalpine fir (ESSF) zone, and the Alpine Tundra (AT) zone. The largest biogeoclimatic variants include the ATp (196,029 ha), the ESSFwc4 (191,714 ha), and the ICHmw2 (157,685 ha). Other variants include the ESSFwm (6,891 ha), ICHdw (43 ha), ICHmw1 (30 ha), ICHmw3 (563 ha), and ICHwk1 (56,182 ha). Within the project area, caribou distribution and seasonal habitat use encompasses the full range of these zones. Figure 1 illustrates the Central Selkirk Caribou Project area.

Several individuals are acknowledged in terms of assisting with the development and implementation of this project. Firstly, Bruce McLellan, John Flaa, Brenda Herbison, Trevor Kinley, Garth Mowatt, Doug Lang, Cam Leitch and Bob Wright provided insight and assistance in developing overall project objectives and sampling design. Field crew staff endured long days to access caribou use sites to gather necessary field data. The crews included Doug and Glen Seaton, Neil Munro and Pierre Raymond. The aerial monitoring team of Dave Mair and Mike Super conducted the necessary flights to locate the caribou. Brenda Herbison directed field crews and Don Miller assisted with the population census. Rhiannon Daloise provided professional clerical services. Contract supervision was the responsibility of Michael Panian.

This is the first annual project report and covers the period from November 1996 to the end of August 1997. In addition, some reference is made to caribou observations made from May through August when no contractual agreement was in place; however, field notes were made by biologists conducting other work in the area. This report was prepared by Dennis Hamilton and Brenda Herbison.

FIGURE 1: CENTRAL SELKIRK PROJECT AREA



THE DATA AND DISCUSSION CONTAINED IN THIS REPORT ARE PRELIMINARY ONLY AND SHOULD NOT BE DISTRIBUTED WITHOUT CONSENT FROM THE AUTHORS.

2.0 ANNUAL REPORT

Module 1: Project Leader

The Project Leader coordinated and participated in meetings/discussions with other caribou researchers to ensure consistent experimental design and sampling procedures among caribou projects in addition to ensuring administrative, organizational, safety, training and contract requirements were met for the modules described below. The project leader also participated in field sampling, aerial monitoring flights and the population census. A presentation outlining project objectives and preliminary results was held with the Nakusp Public Advisory Committee. Discussions and meetings with forest licensees, government and interested public were conducted as requested.

Module 2: Historical Information

Historic information on the Central Selkirk caribou was gathered and reviewed and a report is provided in Appendix A. Maps on historic caribou distribution, population size, and seasonal habitat use patterns are provided in Appendices B and C respectively.

Module 3: Caribou Capture, Collaring, Collar Maintenance and Mortality Information

INTRODUCTION

Prior to commencement of this project in the winter of 1996, a total of 21 caribou had been previously captured and equipped with radio collars over the period from 1992 to 1996. Seven additional caribou were equipped with radio collars in March 1997, bringing the total number of active radio-collars to 20. The project objective will be maintaining radio-collars on roughly ten percent of the estimated total Central Selkirk caribou population. To date, irrespective of collared caribou mortalities over the years, no existing collars have failed or malfunctioned.

Site investigations and necropsy on caribou mortalities were conducted as soon as possible following death.

METHODS

Aerial net gunning was used to capture and equip seven additional caribou with radio collars on March 11, 1997. The capture process included use of a specially equipped Hughes 500 helicopter, experienced pilot, netgunner, and trained ground crew.

Since 1992, when caribou were first captured and equipped with radio transmitters, necropsy on collared caribou mortality was performed by Dr. Bruce McLellan and/or John Flaa. Through mutual agreement, this arrangement has been continued with respect to the current project. Additional laboratory analysis regarding fecal, teeth, jaw, femur, and rumen samples (where collection of such samples was feasible) is pending.

RESULTS

Table 1 provides a summary of caribou radio-collar frequency number, date and location of capture/collaring, animal sex, and existing collar status.

TABLE 1: CENTRAL SELKIRK RADIO COLLARED CARIBOU

Collar Frequency	Date Collared	Location	Status	Sex
150.115	Feb. 1992	Duncan		M
150.133	Feb. 1992	Duncan		F
150.150	Feb. 1992	Duncan	Dead (1993)	F
151.130	March 1995	Halfway	Dead (1995)	
151.060	March 1995	Fitzstubbs		M
151.070	March 1995	Wood	Dead (1997)	F
151.150	March 1995	Ione Falls		F
151.176	March 1995	Wood	Dead (1997)	F
151.015	March 1995	St. Leon	Dead (1997)	F
151.036	March 1995	Turner		F
151.090	March 1995	Cape Horn		M
151.099	March 1995	Cape Horn/Wilkie	Dead (1996)	F
151.045	March 1995	Hill		F
151.079	March 1995	Hill		M
151.119	March 1995	Halfway		F
151.184	March 1995	Wilkie		F
151.110	March 1995	Healy	Dead (1996)	F
151.025	March 1996	Lardeau		F
150.810	March 1996	Silvercup		F
151.006	March 1996	Humphries		F
151.434	March 1996	Payne Creek		F
151.260	March 1997	Mt. Goat Creek		F
151.110	March 1997	Swedish		F

151.206	March 1997	Swedish		F
151.142	March 1997	Mt. Johnson	Dead (1997)	F
151.195	March 1997	Mt. Johnson		M
151.330	March 1997	Gallo/Tenderfoot		F
151.412	March 1997	Gallo/Tenderfoot		F

Between 1992 and the end of August 1997, there was a total of eight mortalities of radio-collared caribou and three known mortalities of caribou not equipped with radio collars. Table 2 summarizes this information.

DISCUSSION

The capture and collaring of seven caribou in the spring of 1997 (replacing collared caribou mortality over the previous five-year period) has brought the total number of presently active radio collars for the Central Selkirk caribou population to 20 animals. The current distribution of radio-collared caribou appears to reflect a representative sample of the known distribution of caribou within the Central Selkirks. For project purposes and depending on funding, attempts will be made to ensure 10 percent of the caribou population is equipped with radio transmitters. In this context, additional caribou capture and collaring will be planned as required.

Five out of eight caribou mortalities (reported in Table 2) occurred within one year following capture and collaring. Probable causes of some deaths included wolverine predation, possible grizzly bear kill and suspected poaching. However, it was impossible to speculate on 3 collared-caribou mortalities which occurred in the summer because aerial project monitoring was suspended in April, due to funding cancellation, and little if any mortality evidence was left at the sites where the collars were finally retrieved in late summer.

The three mortalities of caribou that were not equipped with radio-collars were the result of highway vehicular collision in the Galena Bay area. All three caribou were males, in fair to poor condition with little mesenteric or kidney fat and no back fat. Their poor physical condition could perhaps be associated with the post-rut period.

TABLE 2: CENTRAL SELKIRK COLLARED CARIBOU MORTALITY INFORMATION

Frequency No.	Inspection Date (y/m/d)	Location	Sex	Cause	Condition	Collection	Comments
150.150	93/03/27	Houston Creek	F	Unknown		Jaw, femur	<ul style="list-style-type: none"> • Possible wolverine predation
151.130	95/08/03	Halfway River		Unknown	Unknown	Jaw	<ul style="list-style-type: none"> • Possibly older female • Wear on teeth • Possible grizzly bear kill
151.110	96/08/09	Healy Creek	F	Unknown	Unknown		<ul style="list-style-type: none"> • Eaten by bear
151.099	96/11/20	Wilkie Creek/ Trout Lake	F	Unknown	Fair (marrow cream with some pink)	Skull, femur, jaw	<ul style="list-style-type: none"> • Possible poaching
151.015	97/02/24	Halfway River	F	Unknown	Poor (little fat)	Femur, teeth, tissue	<ul style="list-style-type: none"> • Face chewed by wolverine • Buried beside avalanche under ≥ 1.5 m of snow
151.070	97/07/03	Wood Creek	F	Unknown			<ul style="list-style-type: none"> • 12 weeks between aerial locations • Carcass 99% consumed
151.176	97/07/04	Halfway River	F	Unknown			<ul style="list-style-type: none"> • Six weeks between locations • Only hair left on site
151.142	97/07/03	Lake Creek	F	Unknown		Jaw	<ul style="list-style-type: none"> • Six weeks between aerial locations • grizzly had consumed carcass
N/A	97/11/28	Galena Bay	M	Motor vehicle collision at approx. 1800 hours previous night	<ul style="list-style-type: none"> • Fair to poor • Little mysentary fat • No back fat • Little kidney fat 	Femur, teeth, foreleg muscle, brain, fecal samples, liver	
N/A	97/11/28	Galena Bay	M	Motor vehicle collision at approx. 1800 hours previous night	<ul style="list-style-type: none"> • Fair to poor • Little mysentary fat • No back fat • Little kidney fat 	Femur, teeth, foreleg muscle, brain, fecal samples, liver	
N/A	97/11/28	Galena Bay	M	Motor vehicle collision at approx. 1800 hours previous night	<ul style="list-style-type: none"> • Fair to poor • Little mysentary fat • No back fat • Little kidney fat 	Femur, teeth, foreleg muscle, brain, fecal samples, liver	

Module 4: Population Survey

INTRODUCTION

A caribou population census was conducted April 4 and 5, 1997, to estimate population size, distribution and any changes in overall population status. The only other caribou population census in the Central Selkirks was conducted the previous year.

METHODS

The population census was conducted using an Astar helicopter, pilot and three observers. One observer, who has not been directly involved with the project, acted as navigator and located, counted and classified the animals. The second observer worked the radio receiver and confirmed collar frequencies - but only after the animals were visually located, counted and classified. The third observer visually scanned a broader area looking for additional animals and/or tracks.

The Central Selkirk project area was divided into two distinct survey units for census purposes. The Silvercup unit encompasses the Silvercup Mountains (northeast of Trout Lake) and extends to the upper Duncan River. Unit size and shape was designed according to what could be censused in one day. Use of geographic features, where such features would reduce the probability of caribou movement across units between census days, was also considered. The Nakusp unit includes the area from Hamling Lakes north to Beaton. The census areas were flown over a period two days following a snowfall. Ridges were flown, following the timberline, and when caribou tracks were seen, the tracks were followed until the animals were observed. Where animal tracking did not result in visual identification, a note was made of the presence of tracks only. A visual check was made for radio collars - followed by collared caribou verification using a radio receiver.

RESULTS

Figure 2 illustrates the flight path/observation routes taken and identifies sighting numbers used in Table 3. Tables 3 and 4 summarize caribou census data for the two areas. In total, 222 caribou were observed during the 1997 census, including 22 out of 23 marked or collared animals. Nine additional groups of tracks from an unknown number of caribou were also seen but the animals were not observed. The 1997 Nakusp census area averaged 7.5 calves per 100 adults, and the Duncan census averaged 10.3 calves per 100 adults. Caribou group size ranged from 1 to 23 animals with a mean group size of 8.3 caribou. The total population estimate for the Central Selkirk project area is 232 caribou (Chapman, 1951).

FIGURE 2: CENTRAL SELKIRK CARIBOU INVENTORY 1997 AERIAL CENSUS

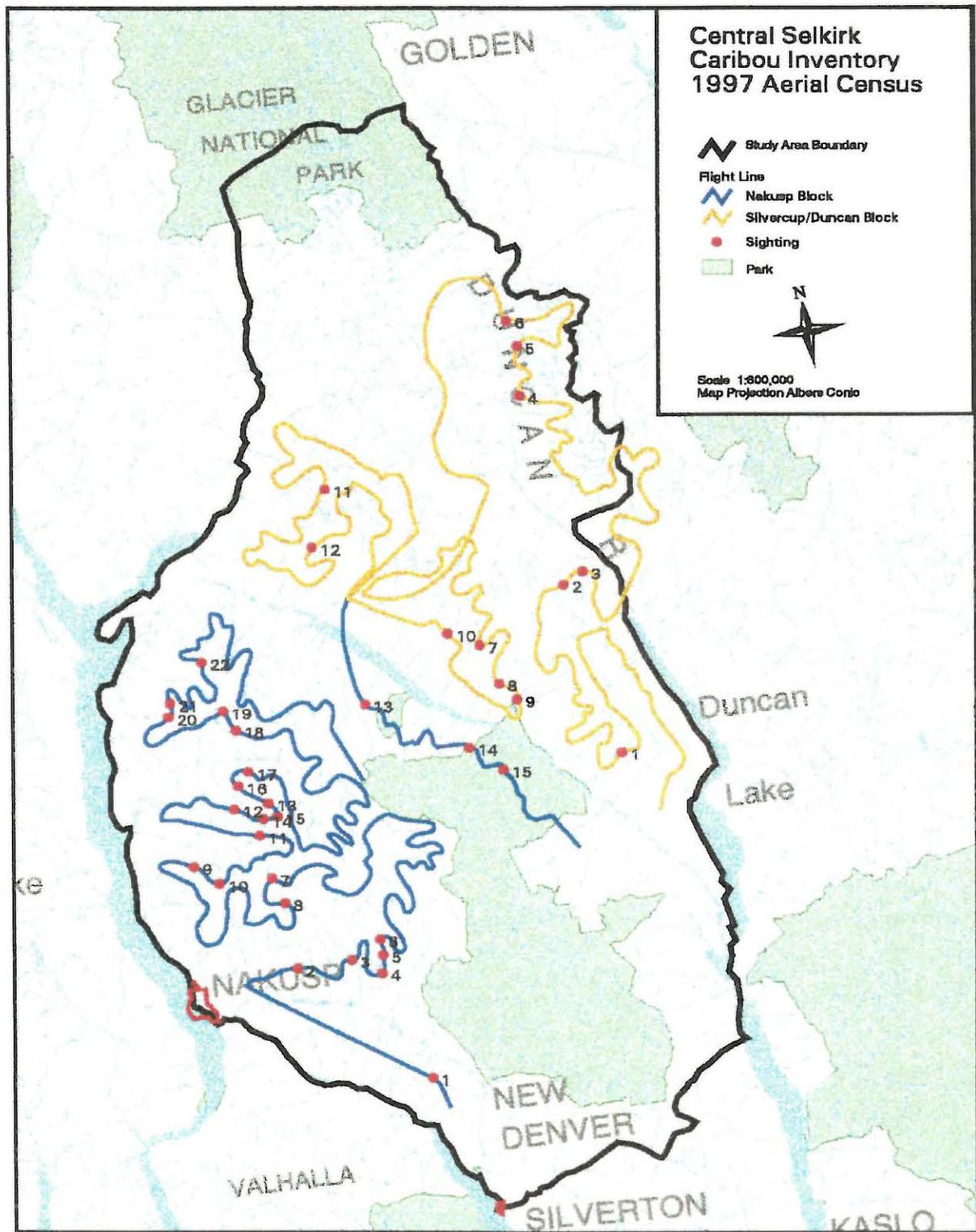


TABLE 3: CARIBOU CENSUS 1997 FOR NAKUSP

Date	Drainage	Sighting No.	Zone	Easting	Northing	Adults	Calf	Total	Male	Female	Unclass	Collar
97/04/04	Nakusp Region	1	MF	675	543	4		4	4	1		1C
97/04/04	Fitzstubbs	2	MF	538	690	11		11		1	11	
97/04/04	Kuskanax	3	MF	585	676	1		1	1			
97/04/04	Hamling	4	MF	643	667	5		5	5			
97/04/04	Hamling	5	MF	640	692	5	1	6	1	4		1C
97/04/04	Wood	6	MF	643	707	5		5	1	4		1C
97/04/04	St. Leon	7	MF	529	805	9	2	11	4	5		1C
97/04/04	Raven	8	MF	530	772	4		4	4			
97/04/04	St. Leon	9	MF	438	988	3		3	3			1C
97/04/04	Cape Horn	10	MF	460	795	21	2	23	5	16		1C
97/04/04	St. Leon	11	MF	517	860	9	2	11		9		
97/04/04	Halfway	12	MF	492	896	1		1	1			
97/04/04	Halfway	13	MF	530	887	8		8	1	7		
97/04/04	Halfway	14	MF	534	880	6		6	6			
97/04/04	Halfway	15	MF	541	875	8		8	1	7		
97/04/04	Halfway	16	MF	506	920	1		1		1		
97/04/04	Halfway	17	MF	510	925	2	1	3		2		1C
97/04/04	Halfway	18	MF	988	510	3		3	2	1		1C
97/04/04	Payne	19	MG	492	10	4	2	6		4		1C
97/04/04	Nacillewaet	20	MG	438	12	7		7	7			
97/04/04	Payne	21	MG	440	25	4		4	3	1		
97/04/04	Mackenzie	22	MG	480	75	5		5	2	3		1C
97/04/05	Bigger	13	MF	660	5	12		12		12		1C
97/04/05	Mobbs	14	MF	761	925	4		4	2	2		
97/04/05	Tenderfoot	15	MF	805	895	5	1	6		5		2C
TOTALS						147	11	158	53	83		13/13C

Calves/100 Adults: 7.5

Calves/100 Cows: 13.3

NOTE: Three other caribou tracks were observed at sighting 12 (Halfway River). Six other caribou tracks were observed at sighting 15 (Tenderfoot Creek).

TABLE 4: CARIBOU CENSUS 1997 FOR DUNCAN

NAKUSP

Date	Drainage	Sighting No.	Zone	Easting	Northing	Adults	Calf	Total	Male	Female	Unclass	Collar
97/04/05	Lake	1	MG	940	910	2		2	1	1		2C
97/04/05	Hume	2	MG	900	125	1	1	2		1		
97/04/05	Hall	3	MG	925	120	9	1	10	2	7		
97/04/05	Hall	4	MG	875	345	3	1	4	1	2		2C
97/04/05	Hatteras	5	MG	888	407	5		5	1	4		1C
97/04/05	Alicia	6	MG	875	440	2	1	3	2			
97/04/05	Ottawa	7	MG	795	50	3		3		3		
97/04/05	Haskins	8	MG	807	5	13		13		13		2C
97/04/05	Healy	9	MG	823	988	2		2	2			
97/04/05	Ottawa	10	MG	763	70	5		5	5			
97/04/05	Pool	11	MG	640	267	10	2	12	1	9		2C
97/04/05	Mt. Goat	12	MG	613	193	3		3	3			
TOTALS						58	6	64	16	42		9C/10C

Calves/100 Adults: 10.3

Calves/100 Cows: 14.3

NOTE: The area north of Hall Creek to Marsh Adams Creek was not flown due to fuel and time constraints.

DISCUSSION

It is premature to draw conclusions based on only two censuses; however, the following is provided:

- The 1996 caribou population census (Miller) classified 207 caribou with 20 caribou tracks observed, but animals not located. The same census for the Nakusp and Duncan census classified 222 caribou.
- Although a total of 15 more animals were observed during the 1997 census (probably due to excellent visibility and new snowfall) a significantly greater number of males were observed than the previous year. In 1996 a total of 20 males, 165 females and 22 calves were classified; in 1997 a total of 69 males, 125 females and 17 calves were classified (with 11 animals remaining unclassified).
- An alternate population estimate to that derived using Chapman and data from both census could be calculated, which may suggest a total caribou population of around 265 animals. For example, 22 calves from the 1996 survey + 69 males from the 1997 survey + 165 females from the 1996 survey + 11 unclassified from the 1997 survey equals ± 265 animals (G. Woods, personal communication). However, in terms of assumptions around overall population trends, it would be inappropriate to draw speculative conclusions from only two years of censuses – especially considering the differences in male/female ratios resulting from the two censuses. The number of calves (22 in 1996, and 17 in 1997) does not really support an indication of drastic differences in the female/male ratio as suggested by the censuses. Oddly enough, similar differences were noted with respect to the Purcell Caribou population censuses. (Kinley, personal communications).

Module 5: Aerial Monitoring of Radio-collared Caribou

INTRODUCTION

An observer and pilot out of Revelstoke conducted fixed wing aerial monitoring of radio-collared caribou until April of 1997. Weather permitting, the aerial surveys were conducted in order to locate radio-equipped caribou and to provide point source location data on population distribution and habitat use.

METHODS

Radio-collared caribou were located using a twin engine Cessna 337 fixed-wing aircraft and a Lotek STR1000 scanning receiver. Weather permitting, monitoring flights were undertaken weekly from the beginning of November to the end of January and bimonthly thereafter. Following each flight, the observer-recorder provided the field crew coordinator with grid coordinates for each point location to facilitate next-day habitat

sampling of caribou use sites by field crews. The observer-recorder was also responsible for plotting the aerial point locations on TRIM/forest cover maps and for recording observations made during the flight pertaining to habitat selection and caribou behavior. This information was entered into a Microsoft Access database (Appendix D).

RESULTS

Between November 1996 and April of 1997 there were a total of eleven telemetry flights resulting in a total of 189 caribou point locations. This brings the total for the Central Selkirk caribou, including telemetry dating back to 1992, to 913 caribou telemetry locations. A map depicting caribou point locations is provided in Appendix E.

DISCUSSION

In some instances, flights could not be conducted as planned due to inclement weather. This was a significant problem in the November-December period, when typically more than one flight was usually required to locate collared animals. Not once during this period were all the collared caribou located during one flight only. There were also 2 or 3 cases in which flights in the Central Selkirks were not conducted as planned due to other telemetry project priorities in the Revelstoke area.

In general, when winter weather was conducive to flying, the system used for aerial monitoring of radio-collared caribou and transfer of aerial point location data to field crews operated smoothly and efficiently. The field crews found aerial telemetry point locations to be accurate in terms of ground verification for field sampling.

The Central Selkirk caribou appear to exhibit traditional seasonal movements and habitat use patterns similar to the Revelstoke and South Selkirks populations. That is, use of low elevation ICH and ICH/ESSF transition habitats during the early winter period and movement to higher elevation alpine habitats in the late winter. However, a preliminary observation by field staff is that the period of time spent in “ecotone” habitats during the transition period between early winter and late winter habitats appears to be slightly longer than that of other populations.

Module 6: Habitat Measurements and Mapping

INTRODUCTION

Between November 1996 and January 1997 habitat field measurements and observations of caribou use sites were conducted within one to two days following each telemetry

flight – weather and safety factors considered. Caribou habitat field sampling concluded when “late winter” conditions prevailed. In this context, habitat attributes and caribou requirements during this traditional late winter use of high elevation alpine habitats is fairly well documented.

METHODS

Caribou use sites were sampled using methods almost identical to those used in Revelstoke (McLellan and Flaa, 1992). Locations were selected and sampled based on direction to sample each caribou collar frequency an equal number of times – access to use sites permitting. Six transects (2m x 50m) were established at each site, three along caribou foraging paths and three randomly located in straight lines (Figure 3). Information recorded on each transect included ski pole and basket penetration depth, caribou hoof sinking depth, tree species, tree diameter, tree vigour class (including down trees), lichen genus and abundance below and above 1.8 meters, shrub cover (when visible), caribou feeding intensity and field observation notes on caribou behaviour.

Measurements of additional variables believed to be important to caribou habitat selection were also attempted, on a somewhat experimental basis. This included estimation of sight distance (understory density), estimates of lichen abundance in the crowns of the trees, (important to stand value as early winter habitat), and estimates of the occurrence of tree blowdown. The method used for rating sight distance was designed to accommodate the short time available at sampling locations - a standard-sized pack was placed at the P.O.C. and the distance at which it was hidden from sight by degrees of 50 % and 100 % was recorded. The estimation of lichen abundance in the crowns of trees was simply a “ High Medium and Low “ ranking. The field crews calibrated rankings together at the beginning of the project to ensure consistency in rankings. Whenever time permitted, “long trailing” of caribou use sites was also undertaken. This involved following caribou tracks and trails to record qualitative information on behavior and habitat selection.

Following site sampling of caribou use areas, field crews entered the data into a Microsoft Access database (Appendix D).

RESULTS

A total of 15 different caribou use sites were sampled during the November 1996 to January 1997 project period. The field sampling involved 14 different caribou radio collar frequencies. Dates, caribou collar frequency numbers and site locations are listed in Table 5. To date, there has not been a detailed analysis of the field data as the data is limited and only constitutes the later portion of one winter season. Furthermore, proposed summer field sampling to compliment winter sampling was not conducted due to project funding termination in April.

DISCUSSION

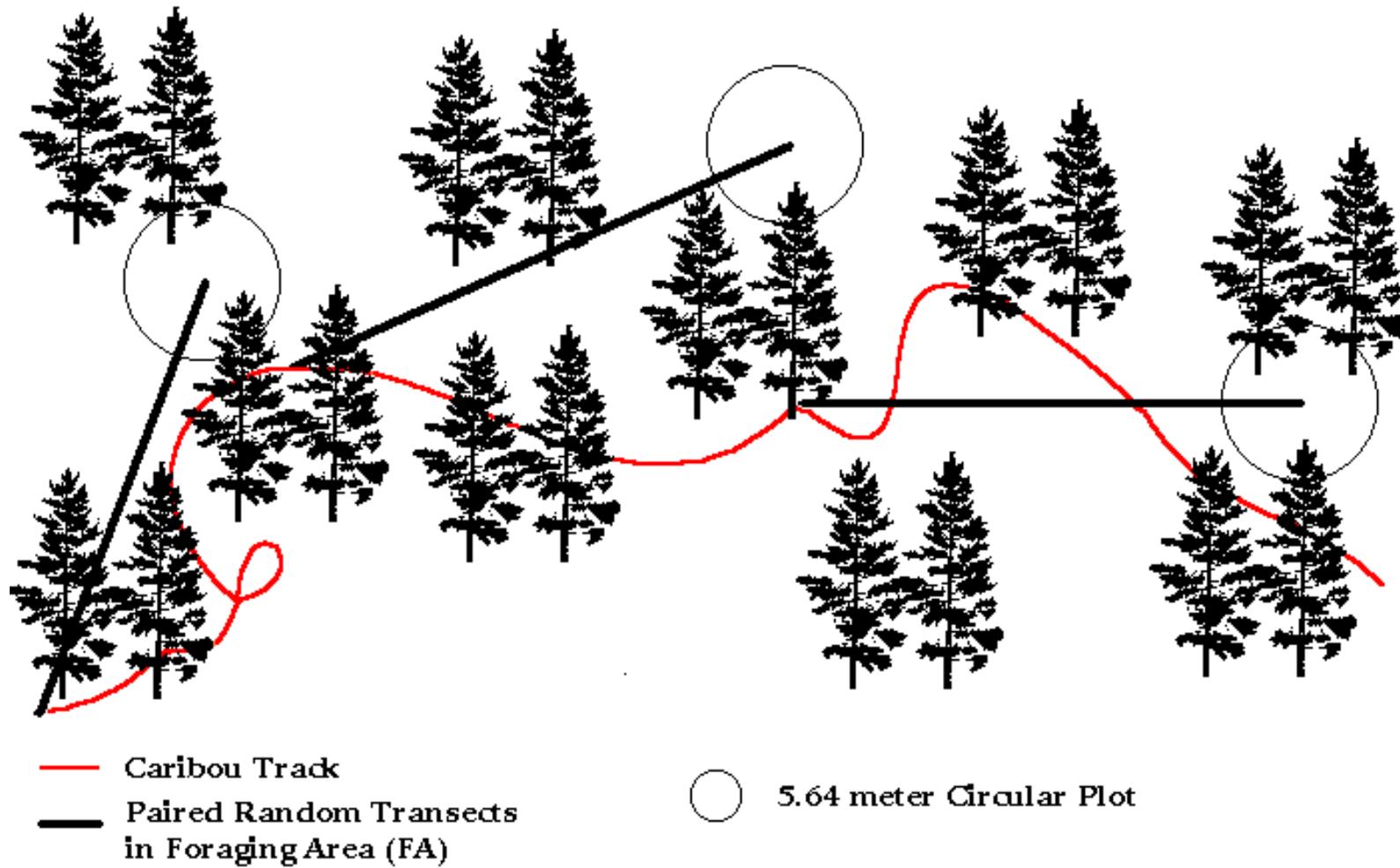
Caribou use sites sampled from December to early January were primarily in “ecotone” stand types. Snow conditions were typical. In the caribou use areas sampled, caribou were found feeding primarily on lichens obtained from blowdown - with some use of lichens from tree trunks and branches. At one site sampled (Harlow Creek), available lichen in the caribou use area was scarce. By the late winter period, the caribou were generally found in alpine habitats feeding primarily on lichens directly from tree branches.

Short daylight periods were limiting relative to the amount of data that could be collected at caribou use sites. Typically, a good portion of the day was spent reaching the sampling location and returning. Site inaccessibility and avalanche hazards also limited sampling opportunities.

TABLE 5: CENTRAL SELKIRKS CARIBOU PROJECT – 1996/1997 WINTER FIELD SAMPLING RECORD

Caribou Collar Frequency	Date Sampled	Location
151.025	Nov. 21	Gainer
151.070	Nov. 24	Kuskanax
151.060	Nov. 24	Box Lake
151.090	Nov. 25	Kuskanax Second Northfork
151.119 and .015	Dec. 14	Halfway
150.133	Dec. 14	Alicia (Duncan)
151.006	Dec. 17	Asher
150.810	Dec. 17	Horsefly/Gerrard
151.060	Dec. 18	Box Lake
151.184	Dec. 18	Wilkie
151.036	Jan. 12	Cape Horn
151.045	Jan. 13	Nacilliwaet
150.810	Jan. 13	Silvercup
151.079	Jan. 14	Payne
151.060	Jan. 27	Harlow

FIGURE 3: SCHEMATIC DIAGRAM OF CARIBOU USE AND RANDOM TRANSECTS USED TO ASSESS FORAGING SELECTION



Module 7: Habitat Selection Analysis

No detailed habitat selection analysis or mapping has been conducted to date due to only one winter season of field data collection. In addition, no funding was available in 1997 to conduct summer field sampling to compliment the telemetry and winter field data collection.

Module 8: Geographic Information Systems (GIS) Support

The caribou radio telemetry results were recorded on a Geographic Information System (GIS) using an Arcinfo platform. Telemetry point locations and data on forest cover and TRIM base maps were used to generate caribou distribution maps showing seasonal habitat use and movement patterns. A map of individual radio-collared caribou point locations, coded by season of use, is provided in Appendix E.

3.0 LITERATURE

Apps, C. D., and T. A. Kinley. In prep. A multivariate stand-level habitat model for mountain caribou in the Southern Purcell Mountains of British Columbia.

Apps, C. D., and T. A. Kinley. 1995. Preliminary habitat suitability assessment for mountain caribou in the Southern Purcell Mountains of British Columbia. MELP.

Chapman, D. G., 1951. Some properties of the hypergeometric distribution with applications to 200 logical sample censuses. University of California Berkeley.

Kinley, Trevor. Sylvan Consulting. Invermere, British Columbia, pers. comm.

McLellan, B., J. Flaa and J. Woods. 1994. Mountain caribou censuses in the North Columbia Mountains. Canadian Parks Service, Ministry of Forests, BC Hydro Mica Compensation Program, and the Ministry of Environment, Lands and Parks.

Woods, Guy. Ministry of Environment, Lands & Parks, Nelson, British Columbia, pers. comm.

4.0 APPENDICES

Appendix A
Central Selkirks Caribou, Historic to Present Times:
Apparent Trends and Emerging Priorities

Module 2
Central Selkirks Caribou Inventory Project
1996

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ABSTRACT

A review of historic information, early caribou studies, and telemetry information, this report indicates the most marked caribou population declines in the Central Selkirks were concentrated in the early 1900s and the late 1960s/early 1970s. In both periods, the declines were attributable to multiple, interrelated factors which included large-scale habitat loss and direct mortality from hunting and poaching. In the ranges that were still occupied by caribou in the mid-1970s, it appears that caribou may have maintained a consistent or recurring presence into the 1990s. Today's population of approximately 250 caribou is evidently composed of small groups, between which there appears to be frequent exchange of individuals. Present information indicates that caribou use a complexity of elevations and habitats within 'core' habitat areas, often ranging widely between elevations within a given 'season'. The extent to which low elevation ICH is used appears roughly intermediate between Revelstoke and the southern Selkirks. However, it is noted that telemetry information is disproportionately scarce for the early winter season as yet, so these conclusions may be premature. "Special habitats" used by the Central Selkirks caribou include hot springs, a mineral source, (used apparently at any time of year), and subalpine snowpatches, used in the mid-summer insect peak. One emerging priority appears to be the need to maintain landscape and stand conditions that facilitate travel between subpopulations/groups. There is a need to improve systems for managing caribou core ranges "as a unit" in consideration of complex habitat needs and the numerous, interacting direct and indirect mortality factors.

1.0 INTRODUCTION

The present range of the Central Selkirks caribou population covers approximately 600km² between the Nakusp area and the upper Duncan River, in the Central Columbia Mountains and Northern Columbia Mountains ecosections. Biogeoclimatic subzones include the ESSF wc4, ICH mw2, ICH wk1, and minor areas of ICH dw. The west half lies in the Arrow Forest District, and the east half in the Kootenay Lake Forest District.

This report reviews existing information on the Central Selkirks population from the early 1900s to 1996, as general background for Caribou Inventory Project No. KB96172IN. The objective has been to identify apparent trends and unanswered questions relevant to future priorities.

2.0 METHODS

After collating the data from the sources described below, caribou locations from nontelemetry sources were mapped on two overlays, one covering the time period from 1930 to 1975, the other from 1976 to 1996. A digital database was established for each location, through which further details are available (MELP files). Locations were colour-coded by season. A brief review of human activities and land use was undertaken as part of reviewing apparent historic caribou population trends. Maps produced for the present telemetry study which show individual collared caribou numbers and seasonal colour theming were also used in interpretations, as were maps themed for forest age class, species, and topography.

Information from non-telemetry locations was interpreted in a general, qualitative manner in making the statements in this report. There were no statistical analyses attempted, due to the nature of the data. It was recognized that locations of all “incidental” reports reflect patterns of human use (i.e., that the location and timing of human access/activities has determined human opportunities to see and report caribou). The locations of “deliberate”, non-telemetry reports reflect the expectations of the investigators (i.e., the search path taken). To compensate for this as much as possible, the source of each report was considered, in the context of concurrent access and human activity patterns. Data sources are described further below.

2.1 *Incidental or ‘anecdotal’ observations*

Ground-based

People engaged in backcountry activities such as trapping logging, prospecting, forestry, and hiking since the 1940s-50s have reported incidental observations of caribou. These were documented through interviews by the present FRBC project and by earlier reports [Herbison (1995); Harling, Snyder and Herbison (1974-1975); Russell, Demarchi and Jamieson (1975); and Herbison (1973)]. Approximately 400 incidental records from reliable sources were used in interpretations in this report.

Incidental Aerial

Heli-ski operators and other helicopter pilots have made incidental aerial observations of caribou during non-project related flights during the 1990s. This information was obtained from interviews in 1995 (Herbison), in the Central Selkirk Caribou Project report, and through written reports obtained directly from Kootenay Heli-skiing and Canadian Mountain Holidays in 1995.

2.2 Deliberate observations without the use of telemetry

Prior to the present telemetry study there were intermittent efforts made to obtain information on the Central Selkirks caribou through tracking and direct observations. Caribou were located simply by searching locations when and where history and/or recent incidental reports indicated they might be present.

Deliberate Ground-based

- Harling, Snyder, Herbison 1974-1975 (unpublished reports, field notes, field maps, photographs, film footage). This study based out of the Notre Dame University (Nelson, BC) was funded by the National Research Council. It involved tracking and observing caribou in the spring, summer, and fall primarily in Poplar Creek, Bremner Creek, and the upper Kuskanax. The daily behaviour of a group of 17 caribou was observed and recorded in detail for a month in July 1974, in the Poplar 'north fork'. The vegetation of the meadow in which the caribou grazed was described. Herd composition was detailed (individuals identified by antlers, etc.). There were also several fixed-wing flights by this project, resulting in aerial records of tracks and animals, mainly in May and June. There were no radio collars involved.
- Herbison (unpublished notes and maps) 1973 and 1987-1990. Direct observations and tracking were undertaken by the author in December and January 1973 in the Craig-Benson Creek area, and from 1987 to 1990 (November, December, and January) in the Rusty Creek to Craig-Benson areas, west side of Lardeau River and Trout Lake. Snow depth, caribou sinking depth, caribou behaviour, and habitat were noted and recorded on 1:20,000 maps.
- There have been other deliberate observations of caribou and tracks made in a variety of locations without the use of telemetry, prior to and during the course of the present telemetry project (D. and P. Seaton, pers. comm., personal observations). These have been used in interpretations in the present report though kept separate from the telemetry data.

Deliberate Aerial Population census flights

Aerial census flights were infrequent and inconsistent prior to the 1990s, and the records do not appear to be available. However, since 1992 the MELP has conducted fairly regular census flights using consistent methods (McLellan and Flaa 1994). Flights are always conducted in late winter (i.e., March or April). The reliability of population census using this technique appears to be very high within the area covered. It is recognized, however, that the habitat types and areas where caribou are observed on these flights do reflect the expectations of the census biologists. It is noted that subsequent radio collars have been fitted on caribou in these same locations.

2.3 Previous Ministry of Environment Reports

- BC Game Commission reports 1915 to 1956: This six page paper (full citation unknown) consists of very general notes on each year/group of years based on caribou hunter harvest records and general impressions.
- Russell, Jamieson and Demarchi (1975): A discussion of caribou status in the East and West Kootenays, this report is based on available early historical information, hunter harvest records from 1960 to 1973, the HHS/NDU information above, interviews, and biologists' opinions.
- Stevenson and Hatler (1985): This review of the caribou and habitat status throughout southeastern BC uses essentially the same database as the above reports for the Central Selkirks section.

2.4 Telemetry Data from the present project

There have been 913 telemetry point locations since the first three radio collars were fitted in 1992 in the upper Duncan valley. The point locations and associated data are recorded in an 'Access' database (MELP files). The total number of live collared caribou as of March 30, 1997 was 20 which is estimated to be just under 10% of the population (discussed later).

The telemetry data has been interpreted by the present report in only a general manner, consistent with methods used in interpreting non-telemetry data. No formal graphic or statistical analyses were attempted. These will be produced when more point locations and more ground sampling data has accumulated (i.e., possibly by 1998-1999).

3.0 RESULTS

3.1 Caribou Distribution and Numbers - 1900 to 1997

Historic information on the Central Selkirks caribou is extremely scarce, particularly prior to the 1960s. Such information as exists yields the following general results. Time periods are divided (below) according to characteristic trends in land use and human activities. It appears these periods coincide with apparent trends in caribou numbers and distribution.

Late 1800s to 1930s

It appears that caribou populations in Southeastern BC were larger and more continuous in the late 1800s than any time since then. The available information suggests a period of major decline began in the late 1800s and continued into the first part of the 1900s.

Bailey-Grohman (1900) reported that “Caribou were shot for the pot when encountered on the trail” (referring to the shores of Kootenay Lake) where there were “deep trails” from heavy caribou use “15 years ago”. Russell (1975) had evidence for believing the South Selkirks herd may have been isolated from northern populations in the late 1800s.

In the Central Selkirks, land use changes occurred at an accelerated pace at the turn of the century in comparison to former decades. Accompanying a “mining boom”, there were large, man-induced fires in main lake and river valleys, railway systems following most major rivers in the study area, as well as towns and mining camps in many areas now considered ‘backcountry’¹. There was well-developed boat access on all the lakes and on parts of the larger rivers.

1930s to 1960

The BC Game Commission and incidental reports from this period suggest a relatively stable, though not large, or widespread, population of caribou in the Central Selkirks in this era.

The BCGC reports indicate caribou sustained a regular short fall hunting season in these years. They state that caribou were difficult to access, associated with higher elevations and remote areas, but that they were “not hard to take by the few enthusiasts that pursued them”. In a discussion of “why caribou do not increase” in spite of “ample pasturage”, the BCGC reports considered predators to be responsible; however, no specific examples or numbers are provided.

¹ Beaton and Ferguson, as examples

It appears caribou may have experienced heavy illegal hunting pressure in the Depression years (i.e., the late 1930s and 1940s). “Caribou were easy to shoot” said Norm Haslem of the Lardeau River near Rusty Creek, “We would just fell one of those big cedar trees covered with lichen and wait `til they came in to feed”. Jim Macnicol spoke of living up the Duncan “when times were hard” where caribou were “a handy source of food”. Russel et al report an anonymous letter to R. Demarchi which states “...I owe caribou...for supporting my large family in the Depression”. The extent to which, and where, this affected caribou numbers is not clear.

This was a time period of relatively slow-paced, small-scale land use change in the Central Selkirks. Depressions and wars did not involve major resource extraction here.

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1960s to 1976

Major declines in caribou numbers and shrinkage in distribution are indicated by all sources in the Central Selkirks during this period, especially during the late 1960s and early 1970s. In retrospect, however, the population in the early 70s was not likely as diminished as implied by Bergerud in his (mis)interpretation of the Harling/Snyder/Herbison data, in which he referred to the Poplar-Kuskanax creek ‘herd’ as a ‘relic’, rapidly shrinking, isolated group (Bergerud 1978).

Locations in which caribou essentially disappeared in this time period ([based on the fact that previously regular reports of caribou ceased, while sighting opportunities/human use continued) included the following:

- Grohman Creek-Kokanee Park;
- low elevations in Fry-Carney-Hamill Creeks;
- river crossing on the Lardeau River at “28 mile”;
- Meadow Mountain/Deception Creek/Cascade Creek ‘face’ areas; and
- Duncan flats/Howser area (flooded).
-

Caribou disappearance in the Akolkolex and Fosthall/Mosquito Creek area may have occurred in the 1950s (NDU study interviews).

Russell et al estimated 12 caribou in the Kokanee Park herd in 1975; however, this appears to have been based on reports from the 1960s.

In the following locations, numbers appeared to decline but caribou remained present in low numbers in the 1960s–1970s (based on the fact that caribou were reported less frequently, while opportunities for sightings/human use continued):

- Duncan River valley north of reservoir;
- Trout Lake road/low elevations around lake;
- Odin Creek area;
- Harlow Creek/Box Lake area;
- Poplar Creek;
- Bremner Creek; and
- Crawford Creek.

Habitat loss and human disturbance in the Central Selkirks was accelerated in this time period, particularly from 1967 into the early 1970s. Impacts within both ‘core’ drainages (backvallleys), and in the main river valleys which were historically “new” included

- valley bottom habitat loss from hydroelectric flooding,
- accelerated rates of timber harvesting valley in core ranges,
- proliferation of new road access in core ranges, and
- extreme levels of overhunting and poaching as a result of new access and liberal seasons.

Caribou hunting seasons were “increasingly liberalized” after 1964, apparently “in keeping with the fashion in wildlife management of the day” (Russell 1975). The increase in season length was apparently not connected to any perceived increase in caribou numbers. From 1964 to 1972 there were 110 caribou legally shot in the Halfway and Kuskanax drainages, 27 of these in 1967. In 1973 caribou open seasons were closed in the Central Selkirks due to low numbers reflected by zero hunter success in 1969 and 1970 (Russell et al 1975).

Significant illegal hunting events are also reported from the 1960s and 1970s. “25 - 30 caribou were killed in 1971 on a new fire road up the first north fork of the Kuskanax in December or January” (L. Hascharl, pers. comm. 1975). “Three caribou were killed at the Nakusp Hot Springs (P. Ewart, pers. comm. 1974). Caribou were “often poached” in the Rusty-Mobbs area in the early 1970s (Isaacs, Bowles, Fenger, pers. comm. 1973).

A report by Ed Varney (pers. comm.) sheds light on the Kokanee Park declines. Ed says that “about thirty years ago” (i.e., ~ 1966) he remembers his father coming home saying he had found the “whole herd (± 20) shot and lying there” at Six Mile Lakes. Ed said his father had been familiar with this herd over the previous 10-20 years and that the numbers were “always between 19 and 21”.

In 1975, the total population size for the Central Selkirks was estimated at 150 by Russell et al. However, the authors questioned the accuracy of this estimate. It was based on Canada Land Inventory flights and very rough “guesstimates” by biologists and other individuals, and not based on any systematic censuses.

1976 to 1997

Incidental reports of caribou have continued, either consistently or recurrently, from the following drainage groups/areas over the past twenty years. Most of the same areas are currently being used by radio collared caribou.

- Box Lake-Harlow/Bremner/Kuskanax/Hamling Lakes-Upper Poplar
- St. Leon/Cape Horn/Halfway
- Asher/Wilkie/Trout Lake flats/Trout Lake slopes
- Great Northern/Poole/Ferguson/Gainer
- Silvercup ridge/Haskins/Healy/Lake Creek
- Hall - Morgan - Stephens - Marsh Adams - Westfall - Upper Duncan
- Craig - Benson - Mobbs-Tenderfoot-Rusty Creek; slopes west side of Lardeau River -upper Poplar

The present population for the Central Selkirks population is estimated at 232 caribou based on the April 1997 census (Annual Report FRBC 1996).

Hunting for caribou has been closed in the Central Selkirks since 1973, except for Limited Entry Hunting (LEH) in 1991 when two bulls were shot in upper St. Leon, and two in upper Halfway River.

Further details relevant to present-decade population dynamics are discussed in Section 4.1

3.2 Caribou Habitat Use - 1950s to 1997

Available information on habitat and caribou behavior associated with specific seasons, or with special functions, in the Central Selkirks is summarized below (no reliable habitat information was available from years prior to 1950). Reference is made to both collared and non-collared caribou. Any concepts regarding habitat selection arising from these observations are merely hypothetical at this time. Statistically valid statements about habitat selection may be available after the measurements undertaken at caribou telemetry use sites have been matched with/compared to random locations and/or analysis of availability, and after the overall data base has grown in size.

Spring [May-June]

Characteristic conditions: first 'green-up' after snowmelt

Tracking studies of caribou in Poplar-Bremner-Kuskanax in May to July 1974 found that in the first part of spring, when greens were still scarce (May), the caribou appeared to move a lot, ranging widely between elevations and between drainages. Low passes between drainages were of obvious importance at this time. Later in the spring (June) when food became plentiful in concentrated locations such as avalanche runouts, caribou appeared to 'settle down', remaining for several days or weeks on end in a single subdrainage (June) (Harling, Snyder, Herbison 1975). Low passes have been common locations of early spring incidental reports (Miller pers. comm., pers. obs.). There have been several incidental reports of caribou feeding in or near slide paths in May and June, for apparently continuous days in 'predicable' locations in successive years (Bremner, Healy, Westfall, Asher, Ferguson and Poplar Creeks, by Stuart, Miller, Scherm, Shreiber, Carmen, Mattes, and NDU study). Elevations of spring incidental reports range from 1200m to 1700m.

Spring elevations of telemetry locations range from 1000 to 2000m+, but appear to be most frequent between 1500m and 1800m. Wilkie Creek appears to be an important drainage in spring for radio-collared caribou, where there were few incidental records from this drainage (no road access).

Summer [mid July-August]:

Characteristic conditions: hottest period of the summer, insect peak

Most mid-summer incidental reports of caribou and tracks have been reported from near and above timberline (2000 +), where caribou have been highly visible to people recreating or prospecting (Remple, Greenlaw, Sherm, Mowat pers comm.). They have been reported frequently from snowpatches or icefields (Lawrence, Wyles, Toporowski, pers.obs). However, tracks and caribou have also been observed from much lower elevations in summer (August), from the ICH at 1500 m (approx.) elevations, where both travelling and 'residing' was indicated in old growth hemlock-cedar stands (Healy and Skinner-Madden Creeks; pers. obs., and Westfall River, Mattes pers. comm.)

Deliberate observations in 1974 in Poplar Creek found that during the hot, insect-peak season, which lasted roughly one month in mid July, caribou concentrated in a single subalpine basin at 1750-1850m elevation. Seventeen caribou (including three calves) were observed spending most of daylight hours on snowpatches, feeding for brief periods in immediately adjacent herbaceous meadows, and sheltering in alder patches in inclement weather and at night (Harling Snyder Herbison 1975). In late August when the weather changed, caribou left for lower elevations. The NDU study tracked these caribou, by then in small groups, to approximately 1600m but beyond that were not followed.

Telemetry locations indicate use of a wide range in elevations in summer, but locations appear most frequent between 1200 and 1800m.

Fall and “pre-deep snow early winter” [October, very early November]

Characteristic conditions: cool, changeable weather

Fall incidental observations and telemetry locations have occurred at a wide range in elevations. It appears that the lowest elevations used annually by the Central Selkirks caribou have been reported from October and early November, often apparently associated with caribou ‘travelling’ (see later discussion).

Prior to snow accumulations in early November, caribou tracked in the Rusty-Tenderfoot area were found to be feeding on False Box while it was reachable above the snow. They were found digging (cratering) through 40-60cm of snow to reach plants *in springs and seepage areas* prior to switching to a lichen diet (Rusty-Tenderfoot-Craig-Benson Creeks, pers. obs., 1996-1990).

Fall feeding habits/behaviour have not yet been documented by the present telemetry project.

There is no solid information yet on dates of the rut, for the Central Selkirks caribou, on locations of rutting areas, or on preferred rut habitats.

Early winter [November-December]

Characteristic conditions: deep, soft/wet snow conditions; difficult mobility for caribou

Hunters, trappers and loggers from the 1950s to early 1970s reported caribou from November and December in “decadent” hemlock-cedar stands, and “heavy timber” at 1100-1500m elevation, in the upper ICH. These reports were from the west side of the Duncan River (benches between Hall and Stephens Creeks), from the west side of the Lardeau River (benches between Rusty and Craig-Benson Creeks), and from Healy, Skinner-Madden, and Lake Creeks (Wyles, Carson, Macnicol, Bowles, Fenger, Sawczuk, Eimer and others).

Deliberate tracking and observations by the author in 1973, and in 1986 to 1990 in November-December west of the Lardeau River between Rusty Creek and Craig-Benson Creeks, also found caribou using the same “decadent” hemlock-cedar stand types (i.e., age class 9 and older age class 8) at elevations 1000 to 1500m. Unusually heavy lichen loads were visibly apparent on trees in these stands. Based on tracks, caribou were evidently confined to these stand types in the deep soft snow conditions, where they were feeding entirely on lichen obtained from treefall and branchfall. Before the snow was deep, and after it had consolidated, openings of 200m+ - were crossed and a wider range of habitats were used.

The telemetry data is inconclusive, to date, with regard to early winter caribou behaviour and habitat use. Weather is typically poor for flying in “classic” early winter conditions, so point locations from this season are disproportionately scarce. None of the field measurements by the FRBC project have yet sampled caribou use in classic early winter conditions.

Miscellaneous notes re: early winter and other habitat use interpretations:

It appears that in some years the “classic” deep wet snow, early winter condition does not occur. There are wide variations in dates of given conditions between years.

Caution should be used in interpreting BEC or forest type from elevation, forest cover maps or BEC maps without field verification. Forest cover labels are commonly inaccurate for tree species and age. BEC maps for some caribou drainages do not show the “perched” ICH zone on mid to upper slopes with ESSF in the valley bottoms, a situation that occurs in many caribou drainages due to temperature inversions.

“Transition” season [January/February]

Characteristic conditions: snow variable, beginning to consolidate, mobility generally easier for caribou than in EW; snowdepth not yet sufficient for caribou to reach lichens directly from trees at higher elevations

[Note: not all caribou researchers separate transition from early winter (e.g., Oldemeyer/Rominger 1987) in the south Selkirks]

There is no information from incidental reports that sheds light on the transition season. Trapping seasonal normally ended by late December, so there were few opportunities for humans to see caribou from January on, historically.

Telemetry locations from 1992-1997 indicate that the transition season may be relatively prolonged, in the Central Selkirks, relative to either early winter or late winter. Most of the caribou feeding sites sampled in 1996-97 in November - December by the FRBC project typified transition conditions. These habitats were generally above 1500 m, in mixed ecotone ICH/ESSF, BS (HC) stands to ESSF stands. Caribou were found to be feeding on lichens from treefall and branchfall; in some stands there were lichens available on tree trunks. In several locations sampled (e.g., upper Harlow Creek) available lichens appeared very scarce; caribou appeared to be “waiting” (‘yarding’ almost suggested), for the snowpack to deepen adequately for the use of high elevation parkland.

Late winter [end of February to end of April]

Characteristic conditions: snow firmly packed, settled, and deep

All late winter records of the Central Selkirks caribou have been from elevations near 2000m approximately in the upper ESSF and “parkland” habitat types. This is typical of caribou throughout southeastern BC. Caribou are highly visible in these locations. The primary data sources for this season have been recent MELP censuses, and heliskiers/helipilots.

There were very few historic reports from late winter, as human access to high elevation ‘back country’ was limited prior to the 1970s. However, it is noted that historic records of low elevation “special uses – ‘crossings’ or ‘hot spring visits’ - apparently included late winter observations (see later discussion).

There are indications from tracking and telemetry that caribou may, on occasion, descend from parkland habitats into closely adjacent denser crown closure ESSF and ecotone stands, in certain weather conditions, in late winter (Seaton pers. comm., and pers. obs.).

Telemetry data, to date, suggests that the Central Selkirks caribou move to high elevations late winter habitats later, and more gradually, than the Revelstoke caribou.

3.3 Travel

Historic reports commonly referred to caribou traveling through predictable routes (e.g., specific passes, or river crossings) sometimes in predictable seasons, in successive years within given time periods. “Deeply worn” caribou trails were often mentioned.

During the 1940s to late 1960s there was a river crossing reported at “28 Mile” on the Lardeau River (Hope-Rusty Creek area), where caribou apparently crossed “back and forth at all times of year” (N. Haslem pers. comm. 1973). Haslem lived at Hope Creek during most of this time period. Other people also reported caribou from the 28 Mile location (road or river) during a period when it appeared sightings were uncommon elsewhere along the main Lardeau.

Several Duncan-Lardeau residents believed caribou “migrated” down the Duncan valley every fall during the 1940s-60s, “towards the west side of the Lardeau River” (Macnicol, Sawczuk, Bowles, Eimer, Wyles and others). It is of interest that the following reports also support this general notion:

- S. Triggs, a trapper and prospector in Lake Creek and area in the 1950s-60s, stated “Caribou migrate through Lake Creek every fall”.

- Locations and dates of several 1960s-70s incidental reports in the East Creek-Howser ridge area suggest east to west movement (Eimer, Wagenin, pers. comm.).
- Caribou were reported at the mouth of Hall Creek on the Duncan River every year in early November during the first decade of access/development north of the Duncan reservoir, 1975- 1985 (Carmen, Scherm, pers. comm., and pers. obs.)
- Caribou were observed crossing the Duncan River “frequently” near the bottom of East Creek in November and December 1967 (K. Wyles, pers. comm.).

Throughout the 1950s to 1970s, in the Kuskanax valley, trapline owner Emil Newbrand believed caribou made a regular “circle route” on which they “...visited the hot springs every two weeks for minerals” (Newbrand, pers. comm. 1975).

Current telemetry and incidental information indicates there is a travel zone or crossing near the bottom of Wilkie Creek, south of Staubert Lake. The main Duncan river valley is travelled (parallel to, and crossed by) collared and noncollared caribou. As mentioned in Section 3.1, there is occasional travel across the Lardeau River north of Healy Creek, and across Trout Lake. Observations by project personnel have indicated that there are regularly used, well-worn routes used by caribou through low passes between the Kuskanax-St Leon-Halfway and Cape Horn drainages (D. and P. Seaton pers. comm.)

“Migration”, as such, is not suggested by recent incidental reports of caribou, or by the telemetry data to date. Further details on apparent present-day travel/movement patterns are discussed in Section 4.0.

Hot Springs - Mineral Springs

Reports of caribou at or near the hot springs in Kuskanax, St Leon, and Halfway drainages have been common since the 1950s and continue into the present. Emil Newbrand, trapline owner in the Kuskanax drainage 1950s-1970s, believed caribou made regular use of the hot springs for minerals, as mentioned above. The current manager of the Kuskanax Hot Springs regularly sees caribou and tracks at the source springs upstream from the developed pool (pers. comm. via P. Seaton). Caribou and tracks are frequently seen at the springs in the upper Halfway River (Seaton, pers. comm.). In 1996 there was a caribou seen near the Halcyon Hot Springs. None of the radio-collared animals have yet been located at these springs.

There are 1950s reports of caribou around mineral springs at Hume Creek on the Duncan River, and at “11 Mile” on Fry Creek (J. Macnicol, K. Bowles pers. comm. 1973).

4.0 DISCUSSION

4.1 *Population Dynamics, Mortality Factors*

Population Dynamics

It appears that in the late 1800s the now separate populations of the South Selkirks, South Purcells, and Central Selkirks may have been one large interbreeding population which included several additional herds now extinct. In the only case of local extinction for which records clearly exist - Kokanee Park - it appears that the isolation of this herd from the larger population to the north, through habitat fragmentation, may have played a role in the apparent permanency of caribou disappearance.

There were evidently two time periods of most marked decline in caribou numbers, the early 1900s, and the 1960s/early 1970s. Both periods were characterized by multiple, interrelated, relatively extreme, influences on caribou, both direct and indirect. In the early 1900s there was widespread habitat loss from fires and human settlement, with associated hunting pressure. In the late 1960s/early 1970s, there was accelerated habitat loss from reservoirs and timber harvesting, a proliferation of new road access networks, and accelerated rates of hunting and poaching. Legal and illegal hunting appears to have been a significant mortality factor for the Central Selkirks caribou, throughout history, up until season closure in 1973.

In most of the core ranges where caribou were present in the mid to late 1970s, they are evidently still present today based on telemetry and census reports. There are indications that present-day group sizes may be smaller, but this is not clear.

Results from telemetry, censuses, incidental, and deliberate observations indicate that today's population of 230-250 is composed of small groups (<10), that essentially 'reside' in certain favored core areas. It appears that none of the groups or sub-populations are genetically isolated; however, telemetry shows that travel by individuals or <5 caribou between core areas occasionally involves widely separated distances (e.g., between the west side of Trout Lake and Poole Creek). Mixing between groups may occur on late winter ranges, when larger numbers of 20-30 congregate, and on mid-summer snow patches. Incidental reports suggest long distance travel may be more common in the late fall, and by bulls.

No *radio-collared* caribou have been located moving between the Healy Lake/Silvercup area and the Duncan, nor have any collared caribou been yet located crossing the Lardeau River south of Trout Lake. However, in 1989 three non-collared caribou were seen on the Lardeau River near the mouth of Tenderfoot creek (on the west side of the Lardeau); they appear to have crossed the river from the east side (Von Koughnett, pers. comm. and author, pers. obs.). In 1988 a caribou was tracked down Healy Creek and is believed to have swum the Lardeau

to the west side (Greenlaw, pers. comm.). In May 1997, two non-collared caribou were seen swimming Trout Lake from the west, near Benson Creek, to the east side (R. Gates, pers. comm.).

Mortality Factors

There were very few direct historic references to natural (non-human) causes of caribou mortality. Emil Newbrand (Kuskanax valley trapper 1950s-70s) believed “maggots in their heads” were significant. He also believed calves suffered in winter if “they were not tall enough to reach lichens”. This is of interest with regard to definitions of snow pack conditions defining a “hard” or “easy” winter for caribou.

A few miscellaneous reports of predators in association with caribou include

- May 1974: cougar tracks following caribou tracks for roughly 1 km, in Wood Creek, upper Kuskanax (pers. obs.),
- Winter 1976: one caribou observed being “chased by two wolves on (frozen) Trout Lake” (R. Brenton, pers. comm.),
- July 1974: a grizzly was observed (off and on), using the same subalpine basin as 17 caribou (including three calves) for several weeks in upper Poplar Creek. It is of interest that one calf in the group was lame, yet remained present/alive for the whole month of records. No caribou mortality was obvious. One incident of caribou “panicking” from the grizzly was observed; the caribou “banded together and ran for a snowpatch at the back of the valley” (Harling, Snyder, Herbison 1975).

As yet, telemetry data indicates nothing clear with regard to caribou mortality factors or rates. Out of a total of 28 caribou radio-collared to date, eight had died by the end of March 1997. In all except one case (wolverine predation in the upper Duncan) the cause of mortality was undetermined.

Legal hunting is no longer a factor today. However, there are an ever-increasing number of indirect impacts on caribou and habitat, affecting an increasingly greater area. Known and potential direct and indirect causes of mortality related to human activities in the 1990s include:

- habitat fragmentation/area loss,
- shifts in species balance towards other ungulates, from shifts in seral stage proportions,
- predator increases due to prey increase from above,
- possibility of increased predation on caribou due to above and to fragmentation of habitat causing “traps”,
- vehicle collisions,
- accidental shooting,
- stress from radio-collaring and/or from censuses,

- stress [increased after collaring] from helicopters associated with other activities, and
- stress from snowmobile activities.

Natural causes of mortality documented in other caribou populations have been associated with avalanches, predation, and critical season stress (Woods and Simpson 1987, Siep 1990, McLellan and Flaa, 1992)

1990's reports of direct caribou mortality include

- Three caribou were hit by a chip truck on the Highway near Galena Bay, November 1996 (Flaa, pers. comm.)
- "Caribou are often shot up the Duncan, mistaken for deer or elk, and the carcasses buried to avoid penalties" (Ed Varney, pers.comm.). Ed is the trapline owner in the Duncan.

Predator numbers - especially cougars - appear generally high in the study area at present (1996). Wolves are present in the lower Lardeau River and the Incommapleaux River valley based on occasional incidental reports; numbers may be increasing in the Incommapleaux (Doug Seaton pers. comm.). Of indirect relevance to predation, it is noted that ungulates overlapping with summer ranges of caribou in the study area include moose, elk, white-tailed deer, and mule deer. "Core" caribou drainages appear to support very low numbers of these ungulates.

Out of a total of 28 caribou radio-collared to date, eight had died by the end of March 1997.

4.2 Habitat Use

Seasonal selection within home ranges

Information to date suggests that the extent to which low elevations are selected by caribou in early winter in the Central Selkirks may be roughly intermediate between Revelstoke and the South Selkirks. However, caution is advised in interpreting early winter information to date, as data from early winter is still disproportionately scarce from the present study. No conclusions should yet be drawn. It appears that ICH biogeoclimatic zones may be used more frequently, in winter, at mid slope and "perched" ICH slope positions than at toe slope elevations. In some instances, this can be explained by the lack of old forest, or presence of human disturbance in the valley bottoms (e.g., Lardeau River). However, in other cases (e.g., Duncan Hall-Stephens "benches", 1950s and Trout Lake face, 1990s) this does not appear to be the explanation.

There *appear* to be a disproportionate number of telemetry locations between elevations 1200m and 1800m elevation in all seasons in the Central Selkirks, except in late winter.

Selection of Home Range

In looking at features that may determine home range selection/suitability for caribou, an informal map overview indicates the following habitat features appear to characterize “core” range areas as opposed to “peripheral” ranges used by caribou in the 1990s

- no human settlement (now recreational ski lodges in some cases),
- roads nil to small secondary, intermittent use,
- forested area including first to second pass logged areas but also undeveloped subdrainages, “some” age class 9 in the upper ICH and the ecotone, and significant areas of age class 8/9 in the ESSF.

Generally speaking, it appears that ‘core’ range areas (i.e., areas where caribou ‘reappear very frequently or reside’) are primarily above 1000m elevation, and that this appears to have been the case since as far back as the 1950s in the Central Selkirks. Observations at elevations lower than this, to valley bottoms at 450 (Arrow) or 600m (Lardeau River), appear to be associated with reports of caribou “traveling”(e.g., Galena Bay highway north of Nakusp, Trout Lake shore/road, East Creek area, Lardeau River and road), or special food sources (e.g., false box at Box Lake area).

Core ranges are typically mid to upper ends of the larger creek drainages, and groups of same, which are connected by travelable passes. Within core habitat areas, it appears caribou use a wide diversity of habitats, sometimes varying widely in elevation/forest types used within a given ‘season’ according to variable mountain weather conditions. This pattern of habitat use is more complex than that implied by the traditional concept of double elevational migration considered generally typical of mountain caribou. The same sort of pattern has apparently been observed in other caribou populations as well (G. Woods, pers. comm.).

It appears clear that home ranges for caribou need to include the full range of habitats, suitable for the full range in seasons, either within close proximity or linked by easily travelled corridors free of ‘fracture zones’.

5.0 CONCLUSIONS

History has shown that caribou clearly have tolerance limits for human disturbance and habitat loss. Caribou population declines have generally followed the progress of human settlement and land use change. It is not clear from history where tolerance limits lie, because mortality factors have been many and interacting, and information is scarce.

The present FRBC caribou project is designed to provide statistical validation, or possibly repudiation, of trends in habitat selection and tolerance limits that are currently being assumed by land/resource planners. The project will provide more sophisticated tools for planning at all scales and a better understanding of limits.

The following partial list of apparent priorities for research and management emerges from the information to date.

- **Travel zones, or corridors** - It appears important to maintain conditions suitable for travel between the groups/sub-populations of caribou, to avoid fragmentation of the population as a whole. A better understanding is needed of travel habitat requirements, a clearer definition of 'connectivity' and 'fracture zones' for caribou. Mapping is needed of precise locations, of travel routes if and where they exist. Attention is especially required in main river valley bottoms, in zones that appear to connect potentially separable subpopulations (e.g., the Staubert Lake area).
- **The early winter (November to late December) season** - This is generally considered a critical season by BC caribou researchers (Simpson Woods 1987, Antifeau 1987). Yet, telemetry data and field sampling of use sites is scarce for this season, as weather conditions are typically poor for aerial monitoring and access. It is suggested that alternative means of investigation for this period be strongly considered for 1998-99.
- **Special habitats (e.g., hot springs, snowpatches, calving, rutting)** - The significance, management/protection needs, and specific locations of special habitats are poorly understood. It appears these should be studied more closely in case a critical role is being overlooked. Two questions, for example, are (1) Are snow patch - lush meadow combinations critical for calf survival (re: insect stress, rich food supply for cows, and/or predation)?, and (2) What disturbance protection needs are required in rut habitats and calving areas?
- **Remnant habitats** - There are cases where remnant stands are being used in critical seasons (early winter) and these stands are the subject of Development Plans. Attention is required in these situations.
- **Operational level detail on caribou habitat and caribou use** - This is required in areas now actively being developed within core ranges, in order to undertake meaningful planning/protection of caribou habitat. Ground truthed mapping of caribou use, and caribou habitat, can feasibly be undertaken within the areas of influence of development plans. This fine-filter mapping is also needed in order to apply models from fine filter attribute/selection analyses to result from the present FRBC project.

- **Mortality factors** - A better understanding is needed of the real limiting factors for caribou, and of how the various direct and indirect factors interact. For example, a better definition is needed of what constitutes a “hard winter” for caribou.
- **Planning from a ‘caribou habitat use area’ perspective** - Improvement is needed in ability and will to plan broad caribou use areas ‘as a unit’. Such planning should consider relationships between seasonal habitats, their juxtaposition, minimum and optimum total areas, travel corridors, fracture zones and the temporal planning (control) of disturbance impacts. Eventual habitat modeling from the FRBC project may be useful for this sort of broad landscape planning.

6.0 LITERATURE CITED

- Antifeau, 1987. The significance of snow and arboreal lichen in the winter ecology of mountain caribou in the North Thompson watershed of BC, M.Sc. thesis, University of BC, Vancouver.
- Bergerud, A.T., 1978. The status and management of caribou in British Columbia. BC Fish and Wildlife Branch report.
- Hatler, D.F., and S. Stevenson, 1985. Woodland caribou and their habitat in southern British Columbia.
- Harling, J. and J. Snyder, B. Herbison. 1975. Unpublished report on Central Selkirks caribou study. Notre Dame University, Nelson, BC.
- Herbison, 1973. Observations of Mountain Caribou in the Duncan and Lardeau River Valleys and at the north end of Kootenay Lake. Selkirk College (course report)
- Rominger, E.M. and J. Oldemeyer, 1989. Early winter habitat of mountain caribou in the Southern Selkirk mountains. *J. Wildl. Manage.* 53(1): 238-243
- Russel, J. and B. Jamieson, R. Demarchi. 1975. Printed in 1978. Mountain Caribou in the Kootenay Region. Status Report. Unpublished BC Wildlife Branch Report.
- Seip, D., 1990. Ecology of woodland caribou in Wells Gray Provincial Park. BC Wildlife Bulletin No. B-68.
- Simpson, K. and G. P. Woods, 1987. Critical habitats of caribou in the mountains of British Columbia. BC Wildlife Bulletin No. B-57.

Appendix B
Caribou Distribution Map from 1900s to 1975

Appendix C
Caribou Distribution Map from 1976 to Present

Appendix D

Central Selkirks Caribou Project

Explanation of Access 97 Database Tables

This “relational” database in Access was established for recording the data collected at ground level – at winter and summer sampling sites. It links with the aerial telemetry database [CAR-TEL] through the “telemetry code” number which serves as the “primary key” in all tables.

It is through the telemetry code primary key that the UTM's must be obtained for the field data. The reason for this is that the program will not accept continuous identical entries except the primary key (UTM's stay the same for all of the records at each site).

The telemetry code is built out of year/month/date_counter number.

The table called *Collar Frequency-Counter Key and Original Capture Data* links the collar frequencies with the “counter numbers” which are used in the aerial telemetry database, and on maps. [It will be noted that the capture information is missing from this table. It exists in Revelstoke. It should be added as part of data 1998/99 contract].

The data recorded in the field has been sorted into four tables described below. Each table represents a different set of measurements (i.e., different attributes, different intervals or plot shapes), but all in the same general site area and in some cases, on the same square inch of ground. See Figure 3 for an illustration of how the data recorded in the tables is collected in the field.

The tables are all linked by a common “primary key” which is the telemetry code. This allows for the tables to be easily joined and used together in any combination.

Just as the “telemetry code” links the telemetry location and field sampling data, the “Transect ID” links circular plot and 10 metre measurements to their respective transects (CT and FA).

KEY TO TABLES

Table 1: Caribou Field Site Data

This is site/stand information, recorded in the field, applicable to the general area of the transects and plots. This information is usually recorded at the P.O.C, before and/or after the transects and plots have been done. NOTE: This table is linked with the transect and circular plot data through the Transect ID number.

Since this table is linked to the Telemetry Location Table and through this to the forest cover database through UTM's, the field information can be used to update information on forest cover polygons, etc.

Table 2: Caribou Transect Data

This is data on trees and lichen abundance recorded at distances along the 50 m x 2m transects, Foraging Area and Caribou Trail transects (total of six transects per site). The data in this table is linked to its appropriate site by the Telemetry Code.

Table 3: Caribou Circular Plot Data

This is data on trees, shrubs and lichen recorded in circular plots at the ends of Foraging Area transects (total of three circular plots per site). It is linked to its respective transect through the Transect ID number and through this to the site.

Table 4: Caribou 10m/Snow Data

This is data recorded at 10 metre intervals along each transect, on snow, lichen blowdown, false box, and crown closure. There is one of these table for each of the six transect tables. It is linked as above.

Appendix E
Point Location Map