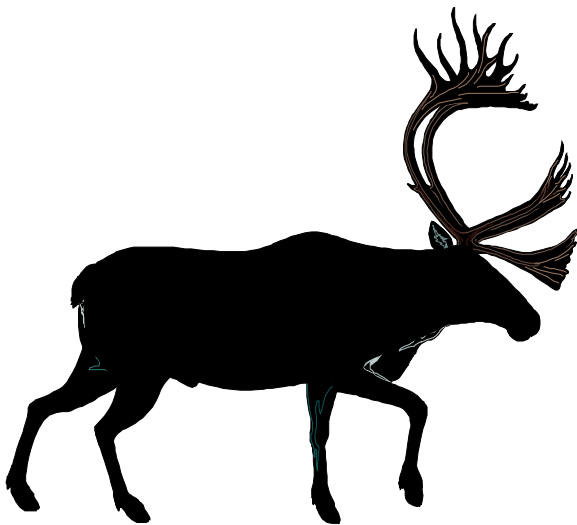


Forest Renewal BC

Central Selkirk Caribou Project

Annual Report

April 1998 to March 1999



Prepared for: Pope & Talbot Ltd.
Slocan Forest Products
Meadow Creek Cedar
Ministry of Environment, Lands and Parks

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EXECUTIVE SUMMARY

The 1999 Annual Report covers the third year of a four-year Forest Renewal British Columbia (FRBC) caribou inventory project for the Central Selkirk caribou population. The project is a joint partnership agreement involving Pope & Talbot, Meadow Creek Cedar, Slocan Forest Products and the Ministry of Environment, Lands and Parks.

Mountain caribou are a “blue listed” species in British Columbia and as such are considered “vulnerable”. In this context, the Central Selkirk caribou population is ranked sixth out of the 13 provincial Mountain caribou sub-populations for conservation purposes, but it is also ranked as having the greatest potential timber and economic impacts necessary to maintain the population. The project was initiated in order to provide the caribou population and habitat inventory necessary to effectively integrate the needs of caribou with forest stand and landscape level forest resource planning.

There are presently 20 caribou equipped with VHF radio collar transmitters within the project study area. From April 1998 to March 1999, 20 monitoring flights identified a total of 385 telemetry point locations spanning four caribou seasons. Following each flight, habitat information for each telemetry point location was extracted from forest cover and TRIM data. Additional field data was collected this summer at 150 caribou seasonal use locations identified through the telemetry monitoring. This is the first full season of telemetry monitoring under the Forest Renewal BC project.

Starting in the fall of 1999, the telemetry information and field data, along with population census and mortality data, will be analyzed to identify caribou population distribution and habitat use defined through development of stand and landscape level univariate and/or multivariate Habitat Suitability Index models.

Additional information on this project can be found in the two previous Central Selkirk Caribou Project Annual Reports for 1996/97 and 1997/98.

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1.0 INTRODUCTION

This is the third annual report on for Central Selkirk Caribou Inventory Project. At present the Forest Renewal BC agreement involves Pope & Talbot Limited, Meadow Creek Cedar, Slocan Forest Products and the Ministry of Environment, Lands and Parks.

From a provincial perspective, Mountain caribou are a “blue listed” species and are considered “vulnerable”. The Central Selkirk caribou are ranked sixth out of 13 provincial caribou sub-populations based on biological assessment of population viability, habitat threat or vulnerability, level of habitat protection and habitat capability/suitability criteria. In socio-economic terms, the Central Selkirks is ranked as having potentially the highest impacts in the province based on economic cost of conservation considering their geographic location and importance (Simpson et al. 1997).

Known and suspected caribou distribution within the Central Selkirks, previous telemetry point location data, local knowledge and professional judgement of biologists and previous project researchers was used to delineate the project area in 1996 (Figure 1). The project area is located within the North Columbia Mountains Ecoregion and southern portions of the Central Columbia Mountains and North Columbia Mountains Ecoregions and covers approximately 609,510 hectares. It is characterized by steeply sloping mountainous terrain dominated by mostly mature forest within the Interior Cedar-Hemlock Zone (ICH), Engelmann spruce-Subalpine fir Zone (ESSF), and Alpine Tundra (AT) biogeoclimatic zones.

Biogeoclimatic sub-zone forests include the mid to lower slope Interior Cedar-Hemlock moist warm variant 1 (ICHmw1), Interior Cedar-Hemlock moist warm variant 2 (ICHmw2), Interior Cedar-Hemlock moist warm variant 3 (ICHmw3) and the Interior Cedar-Hemlock wet cool variant (ICHwk1). The Engelmann spruce-Subalpine fir wet cold variant 4 (ESSF wc4) and Engelmann spruce-Subalpine fir wet mild variant (ESSFwm) dominate the mid to upper elevation forest zone. The higher elevations are reflective of the Alpine Tundra parkland (ATp) biogeoclimatic subzone classification. The rolling nature of much of the mountainous high elevation terrain generally affords favourable animal mobility throughout portions of the project area. Steep rock, glaciers and avalanche chutes are common in most valleys (Meidinger et al. 1991).

FIGURE 1: CENTRAL SELKIRK CARIBOU PROJECT AREA

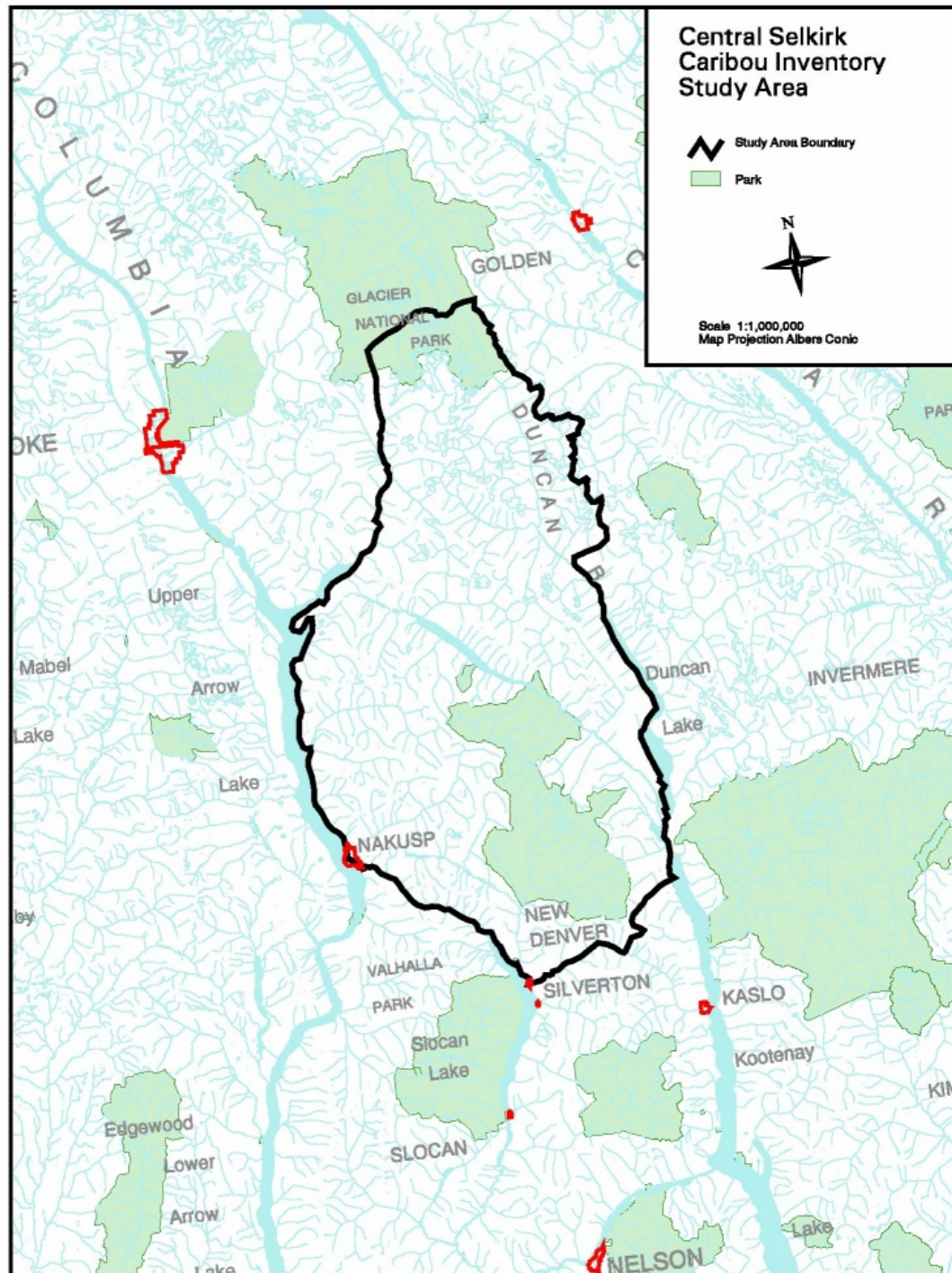


Table 1 summarizes the number of hectares for each biogeoclimatic subzone within the project area.

TABLE 1: BIOGEOCLIMATIC ECOSYSTEM CLASSIFICATION - CENTRAL SELKIRK CARIBOU PROJECT AREA

BIOGEOCLIMATIC ECOSYSTEM CLASSIFICATION	AREA (HA)
Atp	196,398
ESSFwc4	191,713
ESSFwm	6898
ICHdw	42
ICHmw1	30
ICHmw2	157,685
ICHmw3	563
ICHwk1	56,181
TOTAL	609,510

The first three caribou in the Central Selkirks to be equipped with VHF radio transmitter collars were in the Duncan River drainage in February of 1992. In 1995, 14 caribou in the Hamling Lakes/Halfway River/Cape Horn/Wilkie Creek areas were captured and equipped with VHF radio transmitters. Responsibility for aerial monitoring of these collared caribou varied between contractors and government researchers from 1992 to fall of 1996, when the current FRBC project was approved.

Since fall of 1996, the project has involved the capture and VHF collaring of 14 additional caribou, aerial monitoring of the collared caribou, a 1997 population census, necropsy of collared caribou mortality, and winter and summer field surveys of forest stand/habitat attributes at caribou telemetry use sites. At present, 20 caribou collars remain active within the project area.

Winter population censuses conducted in 1996 and 1997 indicate a caribou population of around 250-260 animals (Hamilton and Herbison 1997). The Central Selkirk caribou exhibit the traditional seasonal migration patterns of other Mountain caribou populations within the Kootenay region, most notably the North Columbia Mountains caribou population (Apps et al. 1998, Apps and Kinley 1995, Hamilton and Herbison 1997, Hamilton and Herbison 1998).

The goal of the project is to provide resource managers with inventory information on caribou distribution, abundance, habitat selection and seasonal use patterns leading to the development of stand and landscape level Habitat Suitability Index capability/suitability modeling and mapping (Apps et al 1998, Apps and Kinley in prep).

2.0 ACKNOWLEDGEMENTS

Neil Munro, the aerial monitoring spotter/recorder must be acknowledged for long, bumpy hours spent in a fixed wing aircraft locating the collared caribou. He relies mostly on pilot Robin Tidswell from Nelson Mountain Air and, when Robin is unavailable, Dave Mair from Silvertip Aviation in Revelstoke. Field crews of Doug and Paul Seaton and Neil Munro put in the long hours getting to and from remote caribou locations to conduct summer and winter field sampling. Brenda Herbison assisted when available. The task of overall project coordination between Meadow Creek Cedar, Slocan Forest Products, Ministry of Environment, Lands and Parks and Pope & Talbot was efficiently accomplished by Donna Underwood from Pope & Talbot. Cheryl Hillier from Meadow Creek Cedar has also assisted in this regard. Graham Smith, from GeoSense Consulting Ltd., provided all aspects of the geographic information systems support for the project. Michael Panian acted as contract monitor on behalf of Ministry of Environment, Lands and Parks and Rhiannon Daloise provided the professional clerical services.

The experience, support and advice of Bruce McLellan, John Flaa and Trevor Kinley – all with current caribou research/inventory projects within the Kootenay region – is most appreciated. Doug Lang and Cam Leitch from Pope & Talbot must also be acknowledged for getting this project off the ground in the initial stages.

3.0 ANNUAL REPORT

Module 1: Project Management

Project management included the development and implementation of overall project sampling design and methodology in consultation with other regional caribou biologists and project partners. Review of aerial telemetry results following each flight, field sampling site selection and assignment of field staff to selected sampling locations, participation in field studies, and communication with GIS and modeling specialists was also conducted. Other tasks involved data capture and management, review and participation in winter and summer field sampling, quality assurance field checks with ministry and industry representatives, developing communication releases, facilitating project meetings with government, industry and other caribou researchers and participating in the Atlas/Simfor modeling assessment project. The project manager also prepared monthly progress reports and the annual report.

Module 2: Caribou Capture, Collaring and Collared Caribou Mortality

INTRODUCTION

The objective of this module is to maintain a proportional distribution of radio-collars on roughly ten percent of the total Central Selkirk estimated caribou population of 230-260 animals. Investigation of the cause of collared caribou mortality is initiated as soon as possible after the discovery of the mortality.

METHODS

During April of 1998, Bighorn Helicopters from Cranbrook was sub-contracted to deploy their specially equipped Hughes 500 helicopter, experienced pilot, netgunner and ground crew to capture and equip additional caribou with VHF radio transmitter collars. The areas considered for capture/collaring were identified through assessment of current collar distribution relative to population distribution and previous census data.

Site investigations and necropsy on collared caribou mortality were conducted as soon as possible after the mortality was discovered. A copy of the mortality report was sent to the contract monitor. Femur, jaw, teeth, fecal, rumen and other samples collected at the site were forwarded to Revelstoke to John Flaa, Parks Canada, for additional laboratory analysis as to the cause of mortality.

RESULTS

Seven caribou (two males and five females) were captured and equipped with VHF radio collars on April 9, 1998 (Table 2). The male captured at Ranch Ridge died in August of the same year due, apparently, to grizzly bear predation – the grizzly bear was still in the

vicinity when the radio collar and lower jaw of the caribou were retrieved from the mortality site.

TABLE 2: CARIBOU CAPTURE/COLLARING LOCATIONS

LOCATION	MALES	FEMALES
Hamling Lakes		1
Ranch Ridge	1	1
Silvercup		1
St. Leon	1	1
Nacillewaet		1

During this reporting period there were three other mortalities, bringing the total number of collared caribou mortality to four. Two of the three 1992 collared caribou from the Duncan River died in 1998. One died in June of unknown causes and the other died in October, probably of massive heart failure. None of the original 1992 collared caribou from the Duncan River area is now alive. The total number of presently active collars for the Central Selkirk caribou population is 20 (Table 3).

FIGURE 2: CARIBOU CAPTURE/COLLAR MAP

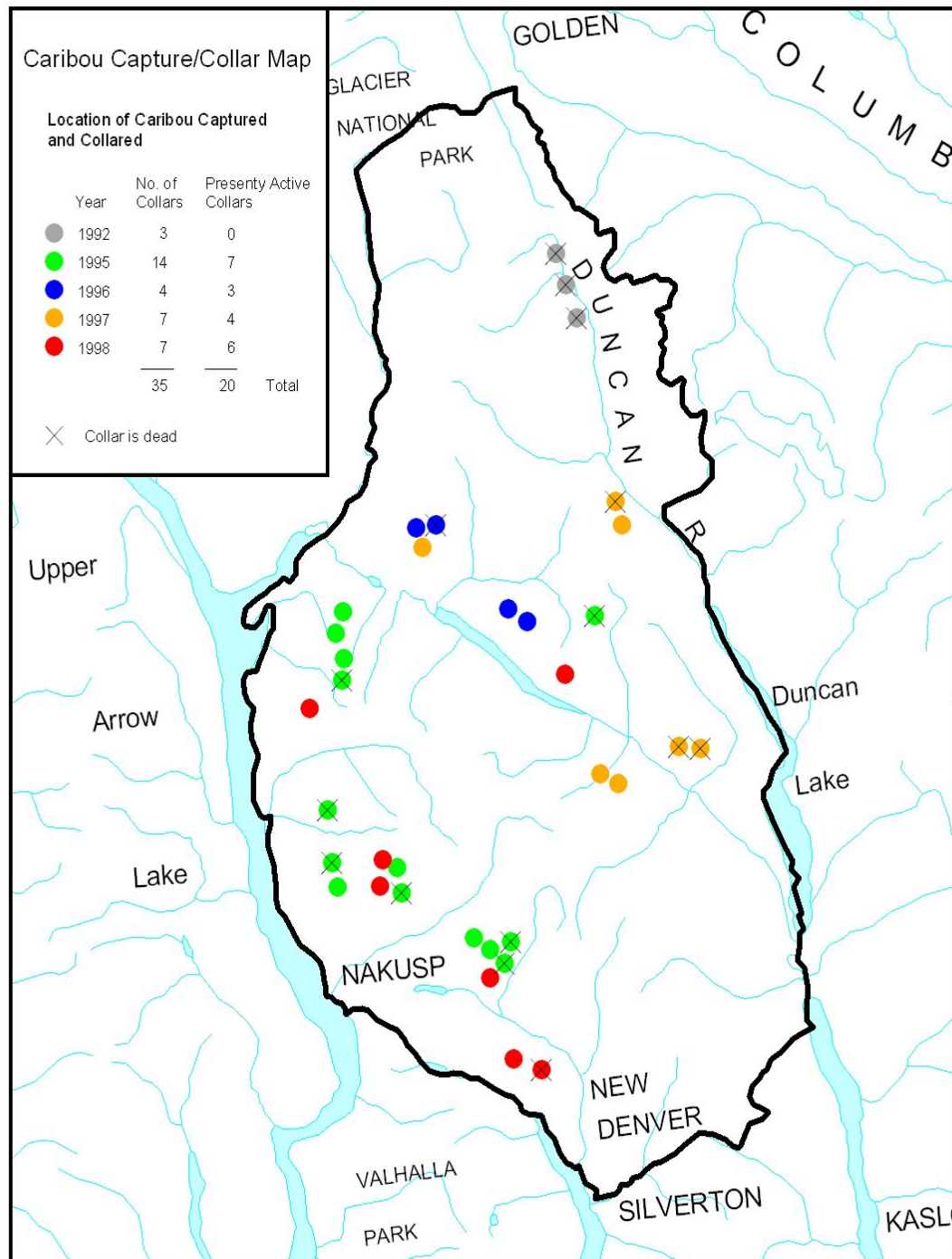


TABLE 3: CENTRAL SELKIRK CARIBOU RADIO COLLAR STATUS

IDENTIFIER NUMBER	COLLAR FREQUENCY	DATE COLLARED	LOCATION	STATUS ¹ (MO-YR)	SEX
54	150.115	Feb. 1992	Duncan	Dead 10-98	M
55	150.133	Feb. 1992	Duncan	Dead 06-98	F
53	150.150	Feb. 1992	Duncan	Dead 03-93	F
1	151.060	March 1995	Fitzstubbbs		M
2	151.070	March 1995	Wood	Dead 07-97	F
3	151.150	March 1995	Ione Falls		F
4	151.176	March 1995	Wood	Dead 07-97	F
5	151.015	March 1995	St. Leon	Dead 02-97	F
6	151.036	March 1995	Turner		F
7	151.090	March 1995	Cape Horn		M
8	151.099	March 1995	Cape Horn/Wilkie	Dead 11-97	F
9	151.045	March 1995	Hill		F
10	151.079	March 1995	Hill		M
11	151.119	March 1995	Halfway	Dead 09-97	F
12	151.184	March 1995	Wilkie		F
13	151.130	March 1995	Halfway	Dead 08-95	F
14	151.110	March 1995	Healy	Dead 08-96	F
15	151.025	March 1996	Lardeau		F
16	150.810	March 1996	Silvercup		F
17	151.006	March 1996	Humphries		F
18	151.434	March 1996	Payne Creek	Dead 09-97	F
19	151.260	March 1997	Mt. Goat Creek		F
20	151.110	March 1997	Swedish	Dead 01-98	F
21	151.206	March 1997	Swedish		F
22	151.142	March 1997	Mt. Johnson	Dead 07-97	F
23	151.195	March 1997	Mt. Johnson	Dead 04-98	M
24	151.330	March 1997	Gallo/Tenderfoot		F
25	151.412	March 1997	Gallo/Tenderfoot		F
26	151.572	April 1998	Hamling Lakes		F
27	151.482	April 1998	Ranch Ridge		F
28	151.581	April 1998	Ranch Ridge	Dead 08-98	M
29	151.420	April 1998	Silvercup		F
30	151.130	April 1998	Upper St. Leon		M
31	151.350	April 1998	Nacillewaet		M
32	151.590	April 1998	St. Leon/Gardner		F

¹ Where the field is blank, the collars are presently active.

DISCUSSION

Since 1992, within what is now the Central Selkirk caribou study area, there have been 35 caribou captured and equipped with VHF radio collars. Thirteen of the 35 collars were put on prior to initiation of the FRBC caribou inventory project in late fall of 1996. Of the 15 collared caribou mortalities, 13 mortalities occurred within less than 2.6 years and as near as four months from initial time of capture and collaring. The only exceptions were two out of the three caribou captured and collared in the Duncan River in 1992. These two animals supported active radio collars for over six years.

Irrespective of mortality of collared caribou over the years there has never been a VHF collar failure or malfunction – although the signals transmitted from the Duncan River area caribou collars put on in 1992 were definitely weakening prior to going on mortality signal.

Module 3: *Aerial Monitoring of Radio-collared Caribou*

INTRODUCTION

Aerial monitoring of caribou equipped with VHF radio transmitters was conducted to provide point location data on population distribution and seasonal habitat use patterns for all four caribou seasons.

METHODS

Radio-collared caribou were located using a twin engine Cessna 337 fixed-wing aircraft and a Lotek STR1000 scanning receiver. Depending on weather conditions, monitoring flights were attempted weekly from the beginning of November to the end of January and bi-monthly thereafter.

Following each flight, the spotter/recorder captured the telemetry point location data and associated terrain and forest cover attributes using ArcView GIS software with Landsat satellite imagery, digital TRIM and forest cover as base themes with a resolution of 100 meters. The spotter/recorder also discussed flight results with the Project Manager after each flight to identify and select telemetry locations for follow-up field sampling.

RESULTS

Between April 1, 1998 and the end of February 1998 there were 20 telemetry flights which identified 385 collared caribou point locations by caribou season of use (Figure 3). Including telemetry locations dating back to 1992, this brings the total number of caribou telemetry point locations to 1,500 (1:125,000 map in Appendix A).

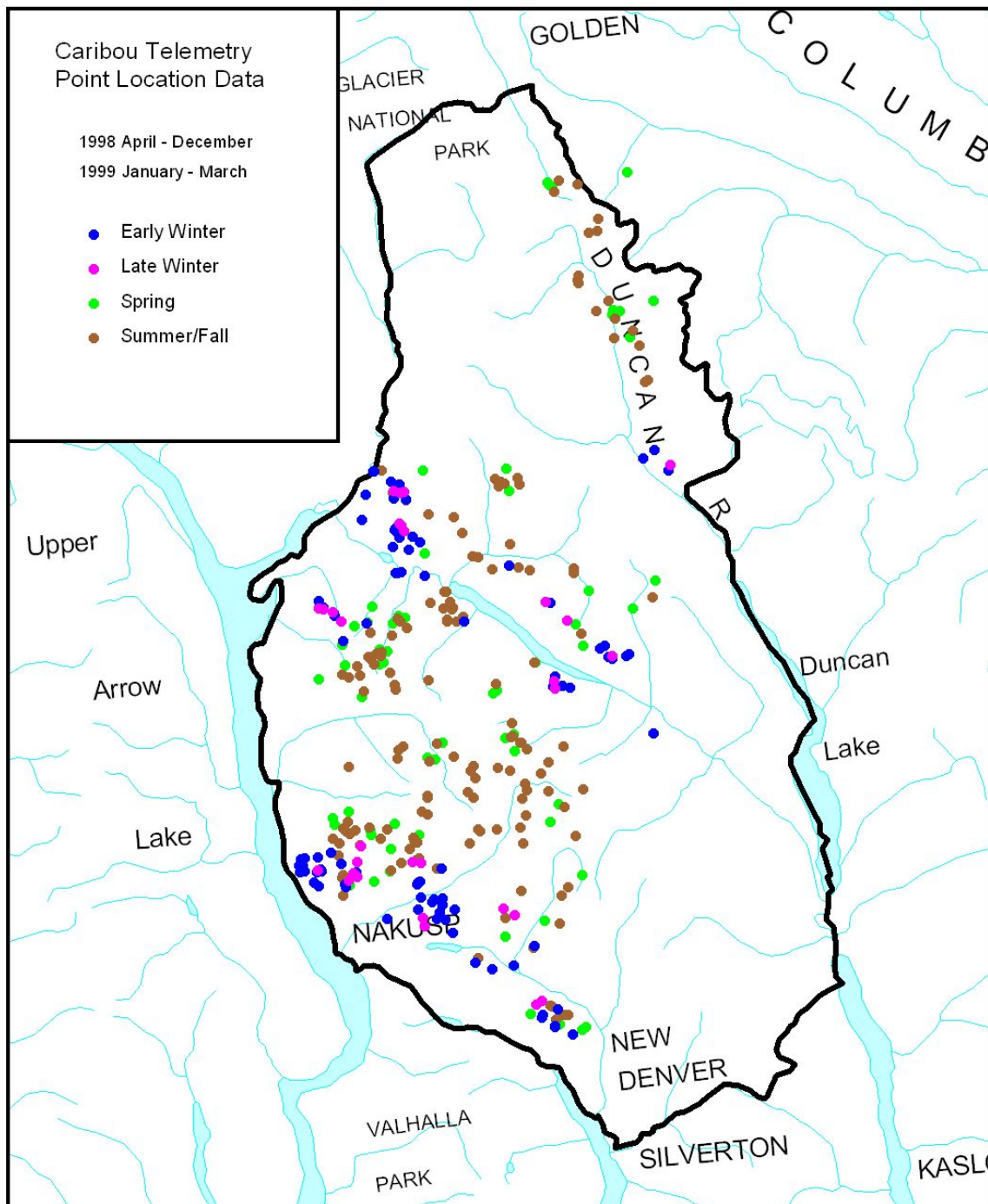
DISCUSSION

This is the first full year of aerial telemetry monitoring and data collection since the project was approved in October of 1996. Out of a potential for 28 flights during this reporting period, 20 were completed. Most of the missed flights were intended for the

early winter period from November through January when weekly aerial monitoring is scheduled. As in past years, inclement weather most often prevented the planned flights.

To increase the probability of successful monitoring flights, one other field-crew member from Nakusp has been trained as an additional spotter/recorder. This may allow for flights out of Revelstoke when flights from Nelson are negated – and vice versa. The Project Manager remains as back-up spotter.

FIGURE 3: CARIBOU TELEMETRY POINT LOCATIONS - APRIL 1998 TO MARCH 1999



Module 4: *Habitat Measurements and Mapping*

INTRODUCTION

Stand level habitat field measurements and observations of caribou winter use sites were conducted within one to two days following an early winter telemetry flight – weather, site accessibility and crew safety factors permitting. Summer field sampling of representative all season caribou use sites was also conducted. This field data will be assessed together with the telemetry data to develop predictive spatial habitat models.

METHODS

Following completion of aerial telemetry surveys, a trained field crew used information provided by the project manager to conduct field tracking and habitat measurements of caribou winter use sites identified through aerial telemetry monitoring. The methods developed and described in the September 1997 Annual Report were used (Hamilton and Herbison 1997).

The same field crews that conducted the winter field sampling conducted the summer field sampling. Sample sites were selected to provide a representative sample of caribou use sites for all four seasons and considered:

- | | |
|---|--|
| <input type="checkbox"/> Project area stratification polygons | <input type="checkbox"/> Elevation |
| <input type="checkbox"/> Season of use (all four caribou seasons) | <input type="checkbox"/> Slope class |
| <input type="checkbox"/> Aspect | <input type="checkbox"/> Forest age class |
| | <input type="checkbox"/> Biogeoclimatic zonation |

The data was entered into an ArcInfo point file and Microsoft Access database (Appendix B).

For the Central Selkirk caribou population and project, seasonal habitat use is defined as:

Spring	April 16 th to June 15 th
Summer/fall	June 16 th to October 24 th
Early winter	October 25 th to January 15 th
Late winter	January 16 th to April 15 th

RESULTS

Eight different caribou winter use sites were sampled between November 1998 and January 1999. During the summer, habitat measurements were conducted at 128 sample sites (Figure 4).

Preliminary analysis of the telemetry point location data with forest cover and TRIM data provides some initial indications of collared caribou habitat use. For example, 70 percent of the caribou early winter telemetry point locations, 76 percent of the late winter locations, 54 percent of spring locations and 67 percent of summer/fall locations were in age class 8 and 9 forests (Table 4).

FIGURE 4: CARIBOU SUMMER/WINTER FIELD SAMPLE PLOT LOCATIONS

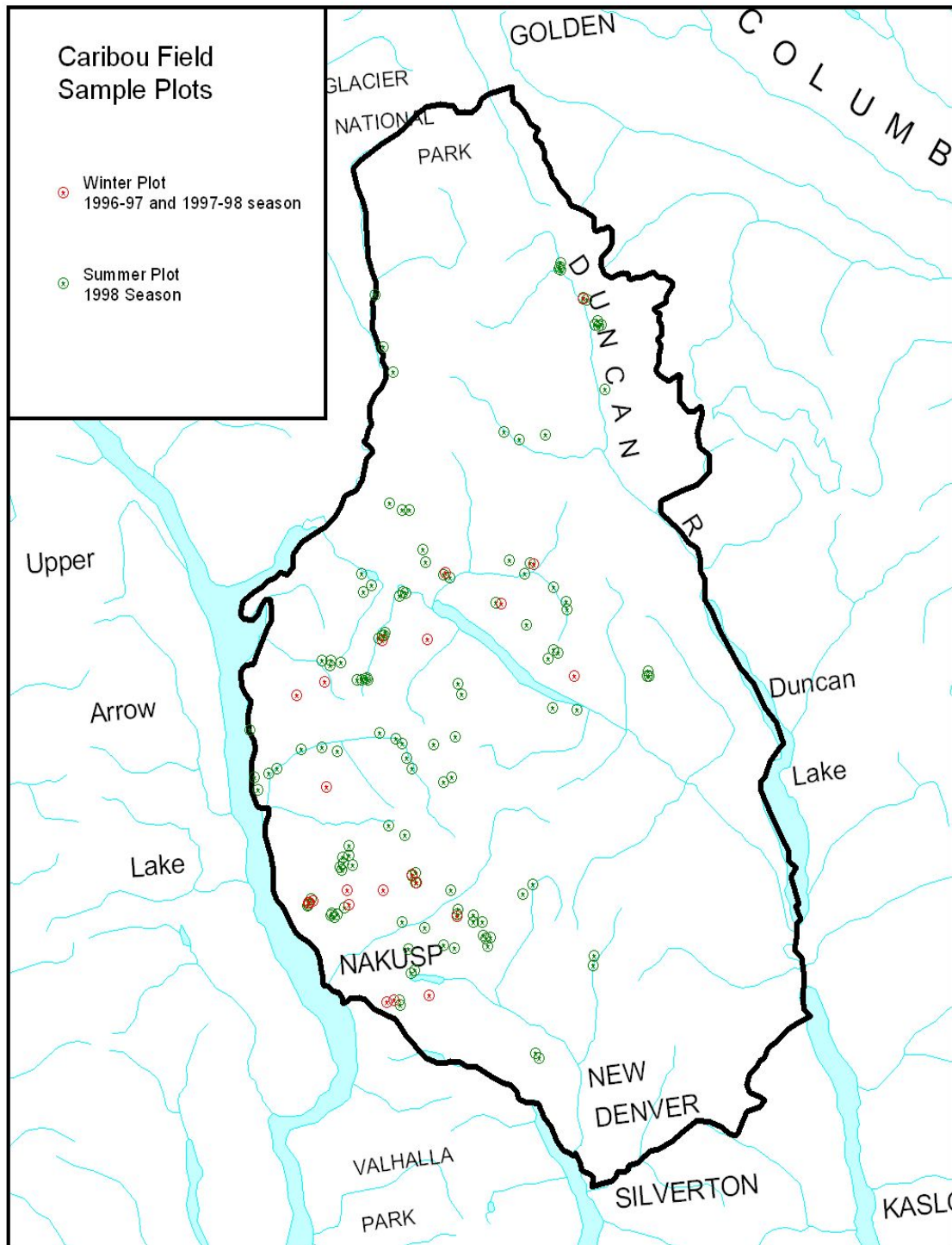


TABLE 4: FOREST AGE CLASS OF SEASONAL HABITATS USED BY COLLARED CARIBOU IN THE CENTRAL SELKIRKS

FOREST AGE CLASS	EARLY WINTER (%)	LATE WINTER (%)	SPRING (%)	SUMMER/FALL (%)
0	9	18	37	26
1	2	0	2	1
2	1	0	1	2
3	2	2	0	1
4	3	2	0	1
5	5	1	1	1
6	4	1	2	1
7	4	0	3	0
8	52	65	37	52
9	18	11	17	15
Observed	359	358	253	530

Twenty-nine percent of the early winter telemetry locations were in ICH forest habitat, 36 percent were in ESSF forest habitat and 18 percent were in subalpine parkland habitat. The ESSF, subalpine parkland and alpine habitats accounted for 87 percent of the late winter collared caribou locations. Avalanche paths, generally in association with adjacent forested habitat, accounted for 18 percent of spring telemetry locations (Table 5).

TABLE 5: HABITAT TYPES USED BY COLLARED CARIBOU IN THE CENTRAL SELKIRKS

HABITAT CODE	HABITAT TYPE	EARLY WINTER (%)	LATE WINTER (%)	SPRING (%)	SUMMER/FALL (%)
1	ALPINE	0	4	2	5
2	SUBALPINE PARKLAND	18	54	22	18
3	MEADOW	0	0	0	0
4	ESSF (SPRUCE - FIR)	36	30	27	45
5	CLEARCUTS (< 20 YRS)	2	1	2	1
6	BURNS (< 30 YRS)	1	1	4	2
7	CEDAR - HEMLOCK (ICH)	29	6	19	14
8	SLIDEPATH	2	1	18	7
9	IMMATURE FOREST (AGE CLASS 2-3)	2	1	1	2
10	RIPARIAN WETLAND	0	0	1	2
11	CEDAR - SPRUCE (ICH)	3	1	2	2
12	ROCK/ ICE/ LAKE	1	0	0	2
13	SEMI-MATURE (AGE CLASS 4-5)	7	1	1	1
	Observed (#telemetry locations)	359	358	253	530

The mean elevation used by collared caribou during the early winter period was 1502 meters – with a minimum elevation of 721 meters and a highest elevation of 2225 meters. The widest elevational distribution of collared caribou occurs during spring when the animals are located at elevations ranging between 427 to 2250 meters (Table 6).

TABLE 6: SEASONAL ELEVATION RANGES USED BY COLLARED CARIBOU IN THE CENTRAL SELKIRKS

SEASON	OBSERVED (# TELEMETRY POINTS)	AVG. ELEVATION (M)	MIN. ELEVATION (M)	MAX. ELEVATION (M)
Early Winter	359	1502	721	2225
Late Winter	358	1851	884	2260
Spring	253	1526	427	2250
Summer/Fall	530	1643	760	2280

For all seasons except spring, more collared caribou were located on west aspects than any other aspect. At least twice as many telemetry point locations were recorded on north, south and west aspects than on east aspects during early winter. During the summer/fall season, the collared caribou were located on west slopes only 10 percent of the time (Table 7).

TABLE 7: ASPECTS USED BY COLLARED CARIBOU IN THE CENTRAL SELKIRKS

ASPECT	AZIMUTH	EARLY WINTER (%)	LATE WINTER (%)	SPRING (%)	SUMMER/FALL (%)
North	316-45	22	20	14	28
East	46-135	14	22	37	27
South	136-225	27	19	15	10
West	226-315	37	39	34	35
Observed		359	358	253	530

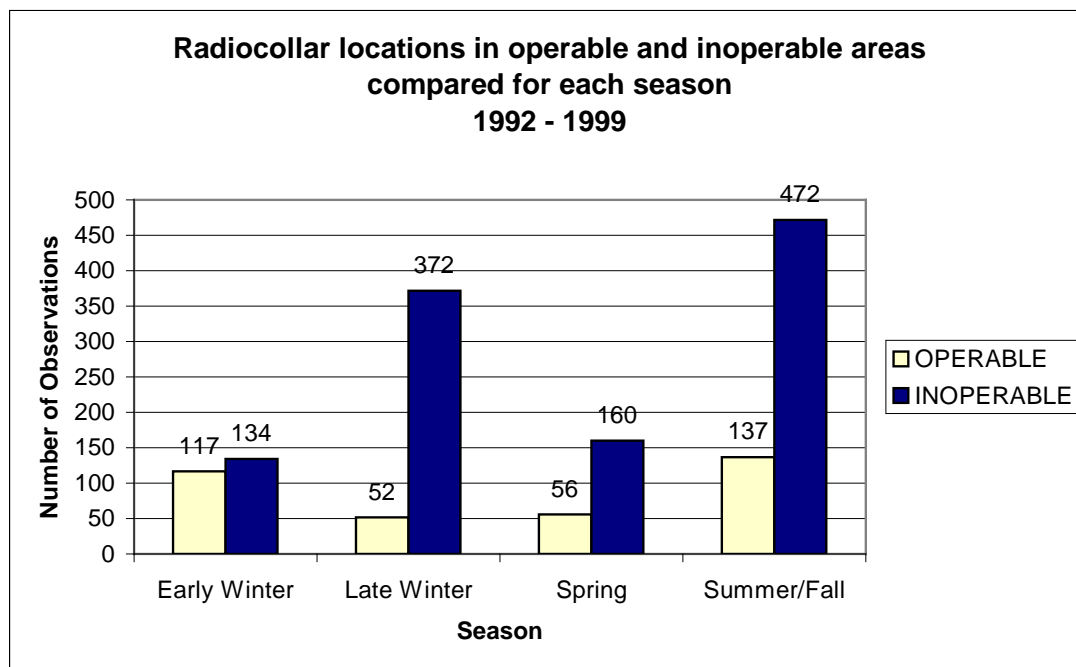
Most of the collared caribou were located on slopes ranging between 0-60 percent during all four seasons, with less than one percent of locations on slopes greater than 80 percent. In early winter, 80 percent of the telemetry locations were on less than 60 percent slopes.

TABLE 8: SLOPE CLASSES USED BY COLLARED CARIBOU IN THE CENTRAL SELKIRKS

SLOPE CLASS	SLOPE PERCENT	EARLY WINTER (%)	LATE WINTER (%)	SPRING (%)	SUMMER/FALL (%)
1	<= 30%	19	30	36	36
2	> 30% <= 45%	27	32	26	35
3	> 45% <= 60%	34	25	27	26
4	> 60% <= 80%	19	13	11	13
5	> 80%	1	0	0	1
Observed		359	358	253	530

Collared caribou use the operable and inoperable forest land base almost equally in early winter. However, during the other seasons the caribou definitely demonstrate two (2) to six (6) times greater use of the inoperable area over the operable area (Figure 5).

FIGURE 5: A COMPARISON OF COLLARED CARIBOU SEASONAL USE BY TIMBER OPERABILITY (OPERABLE AND INOPERABLE FOREST LAND)



DISCUSSION

The results and discussion presented here are based on preliminary data analysis and interpretation - any extrapolation or interpolation should be made within this context.

During the spring and summer/fall seasons, collared caribou used a broad range of habitats (mature/old forests, subalpine parkland, clearcuts, avalanche chutes, riparian

areas) over a wide range of elevations (427m to 2280m), aspects (all) and slope classes (0 to 80 percent). Based on telemetry monitoring and field sampling, use of a particular habitat is often associated with another but different habitat in close proximity. The aerial monitoring and the forest cover/TRIM databases were designed to identify caribou location by primary habitat type (e.g., where the animal is located) and secondary habitat type (other habitat in close proximity to the telemetry location). A moving window habitat analysis approach will be used to assess this hypothesis at a later date.

In early winter collared caribou are most often located in low to mid elevation forests (age class 8 and 9) on west and south aspects. Field observations suggest the presence of stand level attributes such as lichen abundance, presence of snags, lichen litterfall and sight distance may be important in determining habitat selection and/or preference at both the stand and landscape levels. Regardless of elevation, collared caribou use the ICH/ESSF transition forest during the early winter has been noted and will be further assessed. The use of a wide range of elevations (721-2225m) and habitats (ESSF/subalpine parkland/ICH) during the early winter period may reflect caribou response to climatic conditions influencing snow depth and snow consolidation. Project staff have observed caribou movement to lower elevations when snow depths and conditions limit animal movement and mobility and movement back upslope after the snow consolidates or is reduced in depth due to warm weather.

In late winter the collared caribou used subalpine-parkland forests (age class 8 and 9) in association with early seral (age class 0) or alpine habitat. Aspect determinations from the TRIM database may not truly represent late winter habitat use by collared caribou in that late winter habitats are often associated with gentle, rolling topography lacking in well defined ecological differences usually associated with slope and aspect. This winter, weather limited aerial monitoring flights and a combination of weather and snow conditions restricted field crew access to caribou winter telemetry sites to conduct field sampling.

Module 5: *Geographic Information Systems (GIS) Support*

The caribou radio telemetry results were recorded in Geographic Information System (GIS) ArcInfo and Microsoft Access formats. Telemetry point locations have been mapped to display seasonal habitat use and caribou distribution within the project area. Preliminary analysis of telemetry and winter/summer field data was conducted.

4.0 LITERATURE

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APPENDIX A

CENTRAL SELKIRK CARIBOU TELEMETRY POINT LOCATION MAP

APPENDIX B

**CENTRAL SELKIRK CARIBOU PROJECT ARCINFO AND MS ACCESS DATA FOR
TELEMETRY AND WINTER/SUMMER FIELD SAMPLING**