

Pacific Slope Consulting

598 Millstream Lake Road
Victoria, BC V9E1E7

Ecological Factors Affecting Northern Caribou in the Omineca Region, British Columbia

Year 1 (1998) Inventory Results

Prepared for

Slocan Forest Products and Finlay Forest Industries

Mackenzie Forest District



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Abstract

This report summarizes an inventory of moose conducted by Pacific Slope Consulting in 3 large areas of the Mackenzie Forest District. The 5 individual surveys composing this inventory had 3 main purposes:

- 1) to train a relatively new staff in aerial census techniques and to familiarize this staff with general study area characteristics,
- 2) to become familiar with the distribution of moose and caribou in each study area, and
- 3) to obtain preliminary data on population structure for moose within each study area.

Surveys were conducted from November 24th to December 18th, 1998 and formed the initiation of field work for a larger study on the ecological factors affecting northern caribou in this area. Based on popular theory, moose have a strong effect on caribou by supporting wolves, which then allows for sustained and high predation rates on caribou. The larger study is to assess this popular theory by collecting the necessary empirical data and by way of an adaptive management program. The adaptive management program was constructed as a key component of a higher-level plan for the area (i.e., the Mackenzie Land and Resources Management Plan).

1,480 animals were observed during these surveys, the majority of which were moose (n=1,370) and caribou (n=98). Sex ratios for both moose and caribou seemed to be consistent at 1:1. Moose calf/cow ratios differed among study areas, ranging from 20 to 54 calves per 100 cows, and samples were too low to estimate for caribou.

The surveys were valuable in aiding project staff to quickly become familiar with the 3 study areas. Simultaneously, we gained a solid estimate of moose and caribou population structures, relative abundance, and distribution given the site-specific and time-specific factors of weather and study area conditions. We also benefited from obtaining subsidiary data on kill sites and population concentrations upon which to base subsequent sampling efforts.

Erratum: Note that the species code assigned to capture session CHA981214, Transect 10, Group 4 was changed to RATA from ALAL after the summary tables were constructed. This makes a change in the observation of 4 animals from moose to caribou.

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1.0 Introduction

General Background

Woodland caribou (*Rangifer tarandus caribou*) in British Columbia (BC) are classified into mountain, northern, and boreal ecotypes based on behavioral and ecological characteristics (Heard and Vagt 1996). In BC, mountain caribou are considered to be a sensitive species because of past declines in distribution and abundance. This ecotype currently has an estimated 2300-2500 animals, distributed in 13 spatially distinct sub-populations (Heard and Vagt 1996, Hatter 1999). According to Hatter (1999), widespread habitat alteration, past over-hunting, and increased predation have contributed to the disappearance of mountain caribou from 43% of their historic range in BC. The degree to which each of these factors is independently responsible for the decline of mountain caribou, and the degree and extent of the decline itself, is still the subject of debate, largely due to a lack of conclusive data on historic populations. Declines of caribou in the 1970's were usually attributed to over-hunting (Seip and Cichowski 1994) while more recent declines are considered to be due to a combination of factors. However, most biologists agree that increased predation by wolves (*Canis lupus*) is a key factor in the recent declines (Seip and Cichowski 1994, Heard and Vagt 1996). Apparently increased moose (*Alces alces*) populations, which is believed to be related to forest management, have supported increased wolf numbers that has subsequently led to increased predation on caribou. The ensuing debate on these issues and the apparently high risk of extirpation of some sub-populations of mountain caribou has led to a draft conservation strategy for this ecotype with the goal to "*maintain caribou and their habitat in perpetuity throughout British Columbia's mountain caribou range*" (Hatter 1999). Intensive current effort given to management of individual populations, and strong support in higher-level plans for these management efforts (e.g., CCLUP Caribou Strategy Committee 1998) attests to the importance of caribou to the people of BC.

Resource managers in other parts of Canada have also recognized that specific measures are required to conserve woodland caribou populations and habitats. In Saskatchewan, objectives to manage woodland caribou include minimizing the impacts of resource development in the forest and providing and managing extensive contiguous tracts of habitat for woodland caribou (Rock 1992). In Ontario Racey and Armstrong (1998) summarized that the current status of successful caribou conservation and management programs require the consideration of both population and habitat management strategies and the recognition that the two interact. In Alberta, several programs are underway to resolve caribou management and timber harvesting issues (Hervieux et al. 1996). In the Yukon, various research programs have been conducted to collect data on caribou herd distribution, movements, demography, and habitat use (Farnell et al., 1991, Farnell and McDonald 1990, Farnell and McDonald, 1989).

By comparison, the northern caribou ecotype is abundant in BC (approximately 16,000 animals) and is not currently considered to need corrective conservation management actions. Heard and Vagt (1996) recognised 28 distinct herds of northern caribou, 10 of which at least partially reside in the Mackenzie Timber Supply Area (TSA). BC Ministry of Environment, Lands, and Parks (MELP) recently reassessed the composition and boundaries for these herds (see the most recent depictions on the MELP web site at http://prgux1.env.gov.bc.ca/pub/outgoing/for_mackenzie/caribou/coverages). Currently, MELP considers that a total of 7 herds of northern caribou and 1 herd composed of both northern and mountain caribou reside in the Mackenzie TSA. Population data for these herds are listed in Table 1.

• Table 1. Estimated population sizes and population status for caribou herds within the Mackenzie Forest District, British Columbia.

Herd	Population Size	Population Status	Authority
Frog/Gataga	400-1200	?	Heard 1996
Upper Finlay	500-1000	?	
Akie/Ospika	200-500	?	
Chase/Sustut	600-800	stable / slowly declining	Wood 1996
Graham	800	?	Heard 1996
Wolverine	300-400	stable / slowly declining	Wood 1998
Scott/Blackwater	50-200	?	
Misinchinka	100-250	?	

Summary of Previous Studies

Most information about caribou in BC has been recently summarized by Stevenson (1991), Seip and Cichowski (1996), Heard and Vagt (1996), and Hatter (1999). Research projects on caribou in BC were summarized by Page (1988), and Stevenson and Hatler (1985). Wood and Terry (in prep) describe a local study on caribou, which has just been completed on the west side of the Williston Reservoir. This study, referred to as the Omineca Mountains Caribou Project, focused on the seasonal movement patterns, habitat use and ecology of the caribou in the Wolverine Range herd (Wood 1996). Woodland caribou from the Takla Range herd (west of the Klawli area in Mackenzie TSA) and from the Wolverine Range herd were also investigated by Johnson and Parker (1996). Their objective was to enhance the understanding of the ecology of northern caribou. This study is now in the final year of data collection. Caribou from the Chase Mountain Range in the Mackenzie area were radio-collared as part of an investigation conducted by MELP, Skeena Region. Funding for the study of these animals was no longer available as of 1998. There have also been some preliminary studies of caribou completed on the east side of the Reservoir. These studies included observations of habitat use and seasonal movements of radio-collared caribou in the Peace sub-region (Murray 1992), and seasonal habitat use and movements of woodland caribou in the Graham River drainage (Backmeyer 1991).

Other smaller, short-term inventories have been completed in the area from time to time. These ad hoc studies were restricted in area and to objectives mostly relating to herd composition and distribution. As far as we can tell, Hatler (1990) completed one of the first comprehensive investigations of herd structures in north central BC. However, his study was restricted to the northern area of the Williston reservoir only and was focused on an inventory of moose rather than caribou. Hatler's observations would have included what we have called the Akie study area. More recent surveys of the same type in that area include Wood (1994) and Terry and Handler (in prep). Similar surveys were conducted in the area we call the Wolverine by Wood (1993, 1998) and in the Chase study area by Wood (1993).

Inventory Rationale and Objectives

Despite the studies on caribou referred to above, many questions about the management of caribou and their habitats in the Mackenzie TSA remain unanswered. Numbers of caribou in individual herds

and herd productivity were poorly estimated (Table 1), because most inventories are not directly comparable in either a temporal or a spatial sense, and some inventories lack appropriate methods to estimate these parameters. Wood and Terry (in prep.) have provided significant understanding about the Wolverine herd; specifically, it's seasonal movement characteristics and habitat use patterns. Nevertheless, the relative importance of ecological factors in determining caribou population status, and hence the appropriate management tactics, remain unclear because no mechanistic tests of habitat requirements were conducted as part of these past investigations. Generally though, based on these local studies and from studies elsewhere, some ecological factors affecting caribou do seem clear. Caribou range widely to accommodate their life requisites, depend heavily on lichens in whatever form they are most abundant (terrestrial or arboreal), have low rates of reproduction, and can be seriously affected through predation by wolves and other predators. A major conclusion about their behavior over the past few decades has been that they use space (i.e., to exist at low density spatially) to avoid predators and possibly to avoid impacting the sustainability of their slow growing forage supply. Based on these generally accepted facts, a "large patch" habitat management strategy is often recommended (Racey et al. 1991, Seip 1998), and seems most appropriate in the fire-regenerated forests that northern caribou usually inhabit. However, this management strategy has not been thoroughly assessed, and the significance of the overlap between caribou and moose remains unclear.

As a commitment to strategic forest renewal in BC, Slocan Forest Products (Slocan) and Finlay Forest Industries (FFI) aim to confront this uncertainty in management with an inventory program to assess the ecological factors affecting northern caribou. This inventory will be conducted under an adaptive management system that is founded on the large patch recommendation. This inventory program on northern caribou is largely an exercise to:

- avoid the mismanagement (habitat, predators, hunters) apparent from the current state of mountain caribou populations; and
- commit to the concept of preventative management as a more efficient and effective strategy compared to corrective conservation (i.e., compare the Mackenzie LRMP's Caribou Management Strategy with the provincial Mountain Caribou Conservation Strategy).

We hope to provide a foundation upon which to base management decisions about the future of northern caribou and their habitats in the Mackenzie TSA by introducing an adaptive approach toward the implementation of the Mackenzie LRMP's Caribou Management Strategy.

This inventory program (Pacific Slope 1999) is currently being conducted in the Mackenzie Forest District and has the following goals:

- to provide basic inventory information concerning abundance, seasonal movements, and habitat needs of moose and caribou, where such basic information could then lead to better assessments of habitat values for these species;
- to provide standard expressions of, or procedures for verifying, Wildlife Habitat Assessments, where increased confidence in these assessments could then lead to better strategic planning for integrated management of forests and the ecological system involving caribou, moose, and wolves;
- to develop, implement, and monitor a strategic management plan for Caribou (i.e., the Mackenzie LRMP's Caribou Management Strategy'); and
- to aid subsequent development of, and discussion about, adaptive management initiatives with industry, government, 1st Nations, and local communities within the Mackenzie Forest District.

To accomplish these goals, we will focus the inventory program on the following project components:

- 1) caribou population structure (general distribution, relative abundance, sex/age structure),
- 2) caribou habitat use patterns (including seasonal movements),
- 3) predation rates by wolves (*Canis lupus*) (population characteristics, movement patterns, and kill frequencies), and
- 4) potential for distribution overlap with moose (*Alces alces*) populations (general distribution, relative abundance, sex/age structure, and habitat use patterns).

The inventory program has been established in 3 study areas which are roughly consistent with the Wolverine, Chase/Sustut, and Akie/Ospika herd areas.

Objectives Specific to Project Initiation 1998

This report summarizes an inventory of moose conducted by Pacific Slope Consulting in the 3 study areas referred to above and described below. The 5 individual surveys composing this inventory fall under the inventory program component number IV (above) and had 3 main purposes:

- 1) to train a relatively new staff in aerial census techniques and to familiarize this staff with general study area characteristics,
- 2) to become familiar with the distribution of moose and caribou in each study area, and
- 3) to obtain some preliminary data on population structure for moose within each study area.

Acknowledgements

Financial support for this work came from Forest Renewal BC as part of approved 5-year Plans developed and implemented by Slocan Forest Products (Wolverine and Akie study areas) and by Finlay Forest Industries (Chase study area). Doug Heard, Glen Watts, and Doug Wilson have regularly supported this project, and their help in initiating field work was greatly appreciated. Dana Becker (DQB Consultants) contributed to this report through an earlier subcontract by preparing a preliminary habitat model for northern caribou.

2.0 Study Areas

The study areas were generally bounded by 3 caribou herd areas (i.e., the Wolverine, Chase/Sustut, and Akie/Ospika herds) in the Mackenzie TSA in northern BC. This TSA is located within the Omineca subregion and includes all of the Mackenzie Forest District. Study area boundaries are displayed in Appendix 5 or ftp://prgux1.env.gov.bc.ca/pub/outgoing/for_mackenzie/caribou/coverages. Map sheet numbers for these study areas are provided in Appendix 1 as part of the standard Wildlife Inventory Project Description form.

Landscape units associated with the 3 study areas are as follows:

- **Wolverine:** Manson, Klawli, Germansen, Wolverine, Upper Omineca, Lower Omineca, Discovery;

- **Chase/Sustut:** Upper Osilinka, Lower Osilinka, Tenakihi, Mesilinka, Factor Ross, Carina Tomias, Swannell, Aiken, Upper Ingenika, Lower Ingenika, Thutade; and
- **Akie/Ospika:** Collins, lower Ospika, Upper Ospika, Davis, Chowika, Pesika, Lower Akie, Upper Akie, Paul, Kwadacha.

Ecoregions included in the study areas are the Skeena and Omineca Mountains Ecoregions, and Biogeoclimatic zones include SBS, ESSF, AT and BWBS (Appendix 2).

3.0 Methods

We conducted 5 aerial census surveys for moose during the fall and early winter of 1998; 2 surveys in each of the Akie and Wolverine study areas and 1 survey in the Chase study area. Each survey was conducted over 4-5 days, between November 24th and December 18th (Appendix 2). We used standard methods consistent with survey intensities for both Presence/Not Detected and Relative Abundance surveys (Resource Inventory Committee 1998a,b,c,d,e), because our objectives included measures of both distribution and population characteristics. Classification of ungulates was consistent with a level 3 survey. Data were recorded on standard data sheets (Pacific Slope 1999) based on Resource Inventory Committee standards for aerial inventory of selected ungulates.

We surveyed major drainages, focusing on valley bottom habitats, riparian areas, deciduous stands, burns, cut blocks, etc. (i.e. areas considered to have high moose densities). These habitats were chosen so as to maximize the potential encounters with moose, although sightings of other ungulates, particularly caribou, were of interest. The surveys were conducted using a Bell 206 Jet Ranger helicopter using a navigator, an animal spotter, and a habitat observer in addition to a pilot experienced in conducting ungulate surveys. When animals of interest were spotted, we classified each one by age and sex (i.e. using signs such as antler configuration, vulva patch presence, etc.). A Loran GPS location was taken, then the approximate location was plotted on 1:150,000 scale base maps. Habitats were classified according to information required on standard data sheets. Observations of Broad Ecosystem Units (BEU) were not made since this was an aerial inventory (i.e., terrestrial-based data collection was not possible) and since no BEU mapping was available for the study areas.

4.0 Results and Discussion

In addition to sightings of non-target species (e.g., wolves, elk, and goats – see Appendix 3 for all observations), we observed 1,370 moose and 98 caribou during the 5 aerial surveys (Table 1). With the exception of the survey done during December in the Wolverine area, the number of male and female moose seen was similar. Juveniles per 100 mature females ranged from about 54 in both of the Wolverine surveys, to 37 in the Chase study area, and to about 20 in both of the Akie surveys. The significance of these apparent differences will be explored in subsequent surveys and analyses.

Only 6 caribou were observed in the Akie study area. This was likely because of the timing and focus of this particular survey (i.e., focused on lower-elevation, moose habitat during late fall). Again, this factor can be assessed in subsequent analyses as habitat maps and more survey data are available. As with moose, there was an equal number of male and female caribou observed. The number of calf caribou per 100 mature females ranged from 120 to 27 but sample sizes for these estimates are likely too low to elicit much confidence in the apparent difference.

Table 2. Number of moose and caribou observed during 5 aerial census surveys conducted from November 24 through December 18, 1998 in 3 study areas (Wolverine, Chase, and Akie) within the Mackenzie TSA.

	WOLVERINE 11-98	WOLVERINE 12-98	CHASE 12-98	AKIE 11-98	AKIE 12-98	Grand Total
MOOSE						
Male		34		105	45	184
Mature Male	87	29	91	16	95	318
Yearling Male	28	27	11	4	18	88
Female	123	98	118	88	91	518
Mature Unknown	8	14	4	14	15	55
Juvenile Male	2		2	3		7
Juvenile Female	9	10	11		7	37
Juvenile Unknown	58	41	31	14	12	156
Unknown		3	1		3	7
Subtotal	315	256	269	244	286	1370
CARIBOU						
Male				4		4
Mature Male	8	1	15			24
Yearling Male	3		1			4
Female	10		22			32
Mature Unknown	2	2	4		6	14
Juvenile Male	2					2
Juvenile Female	4					4
Juvenile Unknown	6		6			12
Unknown			2			2
Subtotal	35	3	54	0	6	98
Grand Total	350	259	323	244	292	1468

Most animals were positioned in meadow, burn, riparian, willow, avalanche tracks, or cut blocks when observed (Appendix 4). Because the design of these surveys was biased to these habitat types, we place no significant interpretation on this general pattern of habitat use. During subsequent analyses, we would choose to consider the availability of habitats along transects flown and to sightability differences before making any conclusion about habitat choice exhibited by the animals observed. Also, we would discourage the use of the data in Appendix 3 to generate an index of abundance based on time since the sum of time on some transects does not always equate to the time spent sampling.

5.0 Critique of Protocols and Management Recommendations

We found splitting standard data collection and recording into 3 separate sheets (i.e., census – navigation, census – observation, and census – habitat) had a number of benefits both during the surveys and afterwards during data manipulation. Each observer could more efficiently focus on their role in the inventory and this enabled easier and quicker maintenance of the data after the survey. Most other techniques and methods used were similar to other surveys of the same type and proved adequate. Most of this historic protocol could be made to adhere to current Resource Inventory Committee standards, but the concept of transects on this particular survey is troublesome. The method involves flying wherever a trained biologist considers necessary to maximize the likelihood of

observing the target taxa. The given course can vary dramatically in topography and habitat as a function of time of year, general and specific weather patterns, and the general and site-specific nature of the study area. Hence, standard transects are unlikely to be beneficial unless surveys are conducted systematically. Conversely, the definition of a transect can be considered to be so general as to include broad areas, and in that manner allow some increased flexibility in how each individual flight is conducted (which is how we structured this survey).

Our basic objectives, in order of priority, were:

- 1) to train a relatively new staff in aerial census techniques and familiarize this staff with general study area characteristics,
- 2) to become familiar with the distribution of moose and caribou in each study area, and
- 3) to obtain some preliminary data on population structure for moose within each study area.

Generally, our survey accomplished these objectives. We were able to train all project staff in standard survey methods, and simultaneously familiarize each individual with the study areas. Other observations (e.g. kill sites) critical to objectives of the larger project (Pacific Slope 1999) were beneficial in that they provided a foundation for follow-up sampling. Obviously, the distribution of moose and caribou would be expected to change temporally and, as with any survey, we cannot expect to draw conclusive results from these surveys. The power in understanding moose distributions will only be determined, as this survey is set into context with other, past, and future surveys. Since most population statistics for moose were reasonably similar among surveys, we feel we have sufficient sample sizes to estimate some critical population parameters when compared to subsequent surveys of the same type.

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Appendix 1: Wildlife Project Description Forms

Wildlife Inventory Project Description Form

Project Name *An Inventory of Ecological Factors Affecting Northern Caribou in the Omineca Region, British Columbia*

Project Agency *Slocan Forest Products Ltd. and Finlay Forest Industries Ltd.*

Project Coordinator *Scott McNay (Slocan) Wayne Lewis (FFI)*

Start Date *1998 / Sept / 01*

End Date *2002 / Dec / 23*

Funding Agencies

Funding Agency Name	Funding Agency Project ID
<i>FRBC</i>	<i>99840023 , 99840012 (Multi-year Agreement Number)</i>
<i>FRBC</i>	<i>10251, 10288 (Activity Number)</i>

Mapsheet(s) # *93N.094-93N.100, 93N.084-93N.090, 93N.074-93N.080, 93N.064-93N.070, 93N.055-93N.060, 93N.046-93N.050, 93N.036-93N.040, 93N.027-93N.030, 93O.081, 93O.071, 93O.061-93O.063, 93O.051-93O.053, 93O.041-93O.043, 93O.031-93O.033, 93O.021-93O.023, 94C.001-94C.008, 94C.011-94C.018, 94C.021-94C.090, 94D.030, 94D.040, 94D.050, 94D.060, 94D.068-94D.070, 94D.078-94D.080, 94D.088-94D.090, 94B.021, 94B.031, 94B.041, 94B.051, 94B.061, 94B.062, 94B.071, 94B.072, 94B.081, 94B.091, 94G.001, 94C.095-94C.100, 94F.004-94F.010, 94F.013-94F.020, 94F.023-94F.030, 94F.032-94F.040, 94F.042-94F.050, 94F.052-94F.059, 94F.062-94F.068, 94F.073-94F.077, 94F.084-94F.087*

Loc Name *Mackenzie TSA*

Loc Desc *Wolverine (Landscape Units): Manson, Klawli, Germansen, Wolverine, Upper Omineca, Lower Omineca, Discovery, Chase/Sustut (L.U.), Upper Osilinka, Lower Osilinka, Tenakih, Mesilinka, Factor Ross, Carina Tomias, Swannell, Aiken, Upper Ingenika, Lower Ingenika, Thutade, Akie/Ospika (L.U.), Collins, lower Ospika, Upper Ospika, Davis, Chowika, Pesika, Lower Akie, Upper Akie, Paul, Kwadacha*

MELP Region *Prince George Region*

Forest District(s) *Mackenzie District*

Ecoregion(s) *Skeena and Omineca Mountains Ecoregion*

Special Objectives

To address inventory concerns relating to:

- 1) a lack of basic inventory information concerning abundance, seasonal movements, and habitat needs of large ungulates where such basic information could then lead to better assessments of habitat values for these species;*
- 2) a lack of standard expressions of, or procedures for verifying, Wildlife Habitat Assessments where increased confidence in these assessments could then lead to better strategic planning for integrated management of forests and wildlife;*
- 3) development, implantation, and monitoring of a strategic management plan for Caribou (i.e., the Mackenzie LRMP's "Caribou Management Strategy"); and*
- 4) use this activity to aid subsequent development of, and discussion about, adaptive management initiatives with industry, government, 1st Nations, and local communities within the Mackenzie Forest District.*

Appendix 2: Wildlife Inventory Survey Description Forms

Wildlife Inventory Survey Description Form - General: Part A

Project Name *An Inventory of Ecological Factors Affecting Northern Caribou in the Omineca Region, British Columbia*

Survey Name *1998 Aerial Inventory for Moose*

Survey Period: Start Date *1998 / Nov / 15* End Date *1998 / Dec / 23*

Survey Type

Survey Intensity PN : RA : AA

Target Taxa	Class Level
<i>M – ALAL</i>	<i>3</i>

Transport *Pacific Western Bell 206 Helicopters Avg Spd 80 Km/hr*

Survey Coordinator

First	Second	Surname
<i>Line</i>		<i>Giguere</i>

Surveyors

First	Second	Surname
<i>Line</i>		<i>Giguere</i>
<i>Landon</i>		<i>Wilson</i>
<i>Helen</i>		<i>Davis</i>
<i>Jackie</i>		<i>Caldwell</i>
<i>Jeff</i>		<i>Joy</i>
<i>Ruth</i>		<i>Van den Driessche</i>
<i>Rich</i>		<i>Weir</i>
<i>Wayne</i>		<i>Cook</i>
<i>Jacques</i>		<i>Perrault</i>
<i>Leslie</i>		<i>Yaremko</i>

Survey Objectives (continue on back side if needed)

- 1 *To determine the distribution and relative abundance of moose across the three main study areas*
- 2 *To determine Moose use of clear cuts, valley bottoms, ridge tops, and her habitat features in the study areas.*

Wildlife Inventory Survey Description Form - General: Part A (Cont.) and Part B

Project Name *An Inventory of Ecological Factors Affecting Northern Caribou in the Omineca Region, British Columbia*

Survey Name *1998 Aerial Inventory for Moose.*

Survey Objectives (continued)

Wildlife Inventory Survey Description Form - General: Part B

Capt Sess Label	Start Date	End Date	Duration
WOL981124	1998 / 11 / 24	1998 / 11 / 27	4 DAYS
WOL981208	1998 / 12 / 08	1998 / 12 / 12	5 DAYS
AKI981126	1998 / 11 / 26	1998 / 11 / 29	4 DAYS
AKI981214	1998 / 12 / 10	1998 / 12 / 14	5 DAYS
CHA981214	1998 / 12 / 14	1998 / 12 / 18	5 DAYS
	____ / ____ / ____	____ / ____ / ____	

Note: completion of Part B of this form is only required if the survey type chosen involves animal capture during one or more specific time period(s) or capture session(s)

Wildlife Inventory Survey Description Form - General: Part C

Project Name *An Inventory of Ecological Factors Affecting Northern Caribou in the Omineca Region, British Columbia*

Survey Name *1998 Aerial Inventory for Moose*

Survey Study Areas

Study Area Name	Study Area UTM			BGC Unit		Census unit / Location Description
<i>Wolverine Nov 98</i>				SBS	wk 2	<i>West of Williston Reservoir, southern portion Including landscape units ; Manson, Klawli, Germansen, Wolverine, Upper Omineca, Lower Omineca, Discovery</i>
				ESSF	mv 3	
				AT	p	
				BWBS	dk 1	
				ESSF	wk 2	
<i>Wolverine Dec 98</i>				SBS	wk 2	<i>West of Williston Reservoir, southern portion Including landscape units ; Manson, Klawli, Germansen, Wolverine, Upper Omineca, Lower Omineca, Discovery</i>
				ESSF	wv 3	
				AT	p	
				BWBS	dk 1	
				ESSF	wk 2	
<i>Akie/Ospika Dec 98</i>				SWB	mk	<i>North and East of Williston Reservoir including landscape units ; Collins, Lower Ospika, Upper Ospika, Davis, Chowika, Pesika, Lower Akie, Upper Akie, Paul, Kwadacha</i>
				ESSF	m 4	
				AT	p	
				BWBS	dk 1	
				SBS	wk 2	
				SBS	mk 2	
<i>Chase/Sustut Dec 98</i>				BWBS	dk 1	<i>West of Williston Lake, northern portion including landscape units; Upper Osilinka, Lower Osilinka, Tenakih, Mesilinka, Factor Ross, Carina Tomias, Swannell, Aiken, Upper Ingenika Lower Ingenika, Thutade</i>
				ESSF	mv 3	
				AT	p	
				SBS	mk 2	
				ESSF	mv 4	
				SWB	mk	
<i>Akie/Ospika Nov 98</i>				SBS	mk 2	<i>North and East of Williston Reservoir including landscape units; Collins, Lower Ospika, Upper Ospika, Davis, Chowika, Pesika, Lower Akie, Upper Akie, Paul, Kwadacha</i>
				SWB	mk	
				ESSF	m 4	
				AT	p	
				BWBS	dk 1	
				SBS	wk 2	

Appendix 3: Data Observations

* Habitat Code

WA Water
SB Spruce Engl./Subalpine Fir/
TA Talus Slope
WE Wetland/Bog
 Scrub Birch
SU Subalpine
ME Meadow
CD Coniferous/Deciduous Mix
BU Burn
RI Riparian
CS Cottonwood/Spruce
CU Cut Block
WS Willow/Shrub
BS Black Spruce
UV Unvegetated
DE Deciduous
AR Alpine Ridge
RD Road
LP Lodgepole
AV Avalanche Track
LG Landing

* Species Code

M-RATA ⇨ Caribou (*Rangifer tarandus*)
M-ALAL ⇨ Moose (*Alces alces*)
M-CEEN ⇨ Elk (*Cervus elephanus nelsoni*)
M-ODHH ⇨ Mule Deer (*Odocoileus hemionus hemionus*)
M-ODVI ⇨ White tailed Deer (*Odocoileus virginiana*)
M-ORAM ⇨ Mountain Goat (*Ovis canadensis*)
M-OVCA ⇨ Bighorn Sheep (*Ovis canadensis*)
M-OVDA ⇨ Thinhorn Sheep (*Ovis dalli*)
M-CALU ⇨ Wolf (*Canis lupus*)
M-CALA ⇨ Coyote (*Canis latrans*)
M-VUVU ⇨ Fox (*Vulpes fulva*)
M-URHO ⇨ Grizzly Bear (*Ursus horribilis*)
M-EUAM ⇨ Black Bear (*Ursus americanus*)
M-PACO ⇨ Cougar (*Panthera concolor*)
M-LYCA ⇨ Lynx (*Lynx canadensis*)
M-LYRU ⇨ Bobcat (*Lynx rufus*)

* Species / Age Code

M Male
MM Mature male
YM Yearling male
F Female
MU Mature unknown
JM Juvenile male
JF Juvenile female
JU Juvenile unknown
Uncl Unclassified

Appendix 4: Data Observation Summaries

* Habitat Code

WA Water
SB Spruce Engl./Subalpine Fir/
TA Talus Slope
WE Wetland/Bog
 Scrub Birch
SU Subalpine
ME Meadow
CD Coniferous/Deciduous Mix
BU Burn
RI Riparian
CS Cottonwood/Spruce
CU Cut Block
WS Willow/Shrub
BS Black Spruce
UV Unvegetated
DE Deciduous
AR Alpine Ridge
RD Road
LP Lodgepole
AV Avalanche Track
LG Landing

* Species Code

M-RATA ⇨ Caribou (*Rangifer tarandus*)
M-ALAL ⇨ Moose (*Alces alces*)
M-CEEN ⇨ Elk (*Cervus elephanus nelsoni*)
M-ODHH ⇨ Mule Deer (*Odocoileus hemionus hemionus*)
M-ODVI ⇨ White tailed Deer (*Odocoileus virginiana*)
M-ORAM ⇨ Mountain Goat (*Ovis canadensis*)
M-OVCA ⇨ Bighorn Sheep (*Ovis canadensis*)
M-OVDA ⇨ Thinhorn Sheep (*Ovis dalli*)
M-CALU ⇨ Wolf (*Canis lupus*)
M-CALA ⇨ Coyote (*Canis latrans*)
M-VUVU ⇨ Fox (*Vulpes fulva*)
M-URHO ⇨ Grizzly Bear (*Ursus horribilis*)
M-EUAM ⇨ Black Bear (*Ursus americanus*)
M-PACO ⇨ Cougar (*Panthera concolor*)
M-LYCA ⇨ Lynx (*Lynx canadensis*)
M-LYRU ⇨ Bobcat (*Lynx rufus*)

* Species / Age Code

M Male
MM Mature male
YM Yearling male
F Female
MU Mature unknown
JM Juvenile male
JF Juvenile female
JU Juvenile unknown
Uncl Unclassified

• Table 3. Animal observations made during survey WOL9811 summarized by species, sex/age group and habitat type.

		Hab 1															
Spp	Data	BS	BU	CD	CU	DE	EB	ME	MS	RI	SB	SP	WA	WE	WS (blank)	Total	
M-ALAL	Sum of M																
	Sum of MM		3	2	51	2	1	2	1	1				1	22	1	87
	Sum of YM	1	1		21	2		1				1			1		28
	Sum of F	3		3	84	8	1		1	1	5			1	16		123
	Sum of MU			2	4	1						1					8
	Sum of JM	1			1												2
	Sum of JF				4	1	1								3		9
	Sum of JU			1	40	7					3			1	6		58
	Sum of Uncl																
M-CALU	Sum of M																
	Sum of MM																
	Sum of YM																
	Sum of F																
	Sum of MU							2				1				3	
	Sum of JM																
	Sum of JF																
	Sum of JU																
	Sum of Uncl																
M-RATA	Sum of M																
	Sum of MM							4						4		8	
	Sum of YM							2						1		3	
	Sum of F							7						3		10	
	Sum of MU													2		2	
	Sum of JM							2								2	
	Sum of JF							3						1		4	
	Sum of JU							3						3		6	
	Sum of Uncl																
(blank)	Sum of M																
	Sum of MM																
	Sum of YM																
	Sum of F																
	Sum of MU																
	Sum of JM																
	Sum of JF																
	Sum of JU																
	Sum of Uncl																
Total Sum of M																	
Total Sum of MM			3	2	51	2	1	6	1	1				1	26	1	95
Total Sum of YM		1	1		21	2		3				1			2		31
Total Sum of F		3		3	84	8	1	7	1	1	5			1	19		133
Total Sum of MU				2	4	1		2				1	1		2		13
Total Sum of JM		1			1			2									4
Total Sum of JF					4	1	1	3							4		13
Total Sum of JU				1	40	7		3			3			1	9		64
Total Sum of Uncl																	
Grand Total		5	4	8	205	21	3	26	2	2	8	2	1	3	62	1	353

• Table 4 . Animal observations made during survey WOL9812 summarized by species, sex/age group and habitat type.

Spp	Data	Hab 1															Total	
		BS	BU	CD	CS	CU	DE	LP	P/SB	ME	RI	SB	SF	UV	WE	WS		(blank)
M - ALAL	Sum of M	1	4	3		14		2		6	4							34
	Sum of MM			1	2	18	1			4			1		2			29
	Sum of YM			2		20				4				1				27
	Sum of F	1		9		47	5	4	1	21	6		1		1	2		98
	Sum of MU			3	2	2	1	2		1	1		1	1				14
	Sum of JM																	
	Sum of JF					8				1				1				10
	Sum of JU			5		17	3	2	1	5	5	1			1	1		41
	Sum of Uncl			1									2					3
M - RATA	Sum of M																	
	Sum of MM								1									1
	Sum of YM																	
	Sum of F																	
	Sum of MU								2									2
	Sum of JM																	
	Sum of JF																	
	Sum of JU																	
	Sum of Uncl																	
(blank)	Sum of M																	
	Sum of MM																	
	Sum of YM																	
	Sum of F																	
	Sum of MU																	
	Sum of JM																	
	Sum of JF																	
	Sum of JU																	
	Sum of Uncl																	
Total Sum of M	1	4	3		14		2		6	4								34
Total Sum of MM			1	2	18	1			5			1		2				30
Total Sum of YM			2		20				4				1					27
Total Sum of F	1		9		47	5	4	1	21	6		1		1	2			98
Total Sum of MU			3	2	2	1	2		3	1		1	1					16
Total Sum of JM																		
Total Sum of JF					8				1				1					10
Total Sum of JU			5		17	3	2	1	5	5	1			1	1			41
Total Sum of Uncl			1									2						3
Grand Total	2	4	24	4	126	10	10	2	45	16	1	5	3	4	3	0	259	

• Table 5 Animal observations made during survey AKI9811 summarized by species, sex/age group and habitat type.

		Hab 1												
Spp	Data	AV	BU	CD	CU	DE	LP	ME	RI	RU	SB	WS	(blank)	Total
M - ALAL	Sum of M	22	18	3	3			10	26	2	8	7	6	105
	Sum of MM	1	2					3	8		1	1		16
	Sum of YM								2		1	1		4
	Sum of F	33	21	4	5			16	6		3			88
	Sum of MU	6		2	1	1	1				2	1		14
	Sum of JM	2									1			3
	Sum of JF													
	Sum of JU	5	1	3				5						14
	Sum of Uncl													
M - CEEL	Sum of M								3					3
	Sum of MM													
	Sum of YM													
	Sum of F													
	Sum of MU													
	Sum of JM													
	Sum of JF													
	Sum of JU													
	Sum of Uncl													
(blank)	Sum of M													
	Sum of MM													
	Sum of YM													
	Sum of F													
	Sum of MU													
	Sum of JM													
	Sum of JF													
	Sum of JU													
	Sum of Uncl													
Total Sum of M		22	18	3	3			10	29	2	8	7	6	108
Total Sum of MM		1	2					3	8		1	1		16
Total Sum of YM									2		1	1		4
Total Sum of F		33	21	4	5			16	6		3			88
Total Sum of MU		6		2	1	1	1				2	1		14
Total Sum of JM		2									1			3
Total Sum of JF														
Total Sum of JU		5	1	3				5						14
Total Sum of Uncl														
Grand Total		69	42	12	9	1	1	34	45	2	16	10	6	247

• Table 6 Animal observations made during survey AKI9812 summarized by species, sex/age group and habitat type.

		Hab 1														
Spp	Data	AR	AT	AV	BU	CD	CU	DE	ME	RI	SB	SU	WE	WS	(blank)	Total
M - ALAL	Sum of M			12	1	8	3	6		3	4	1	1	6		45
	Sum of MM	3	1	30	38	7	3	1		1	2		6	3		95
	Sum of YM			5	6	2				3			2			18
	Sum of F			26	27	10		2	1	1	3	13	1	5	2	91
	Sum of MU		2	6	1	2					3			1		15
	Sum of JM															
	Sum of JF			2	1	1			1			1		1		7
	Sum of JU			2	4	2	1				1			1	1	12
	Sum of Uncl							2							1	3
M - CALU	Sum of M															
	Sum of MM															
	Sum of YM															
	Sum of F															
	Sum of MU												6			6
	Sum of JM															
	Sum of JF															
	Sum of JU															
	Sum of Uncl															
(blank)	Sum of M															
	Sum of MM															
	Sum of YM															
	Sum of F															
	Sum of MU															
	Sum of JM															
	Sum of JF															
	Sum of JU															
	Sum of Uncl															
Total Sum of M				12	1	8	3	6		3	4	1	1	6		45
Total Sum of MM		3	1	30	38	7	3	1		1	2		6	3		95
Total Sum of YM				5	6	2				3			2			18
Total Sum of F				26	27	10		2	1	1	3	13	1	5	2	91
Total Sum of MU			2	6	1	2					3		6	1		21
Total Sum of JM																
Total Sum of JF				2	1	1			1			1		1		7
Total Sum of JU				2	4	2	1				1			1	1	12
Total Sum of Uncl								2							1	3
Grand Total		3	3	83	78	32	7	11	2	8	13	15	16	17	4	292

• Table 7 Animal observations made during survey CHA9812 summarized by species, sex/age group and habitat type.

Spp	Data	Hab 1														Total	
		AR	AV	BS	BU	CU	DE	LP	ME	PL	RI:OCK	SB	WA	WE	WS (blank)		
M-ALAL	Sum of M		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sum of MM		8	0	12	32	0	4	9	6	0	18		2	0		91
	Sum of YM		3	0	1	5	0	0	0	0	1	1		0	0		11
	Sum of F		9	1	13	52	1	1	3	12	2	22		0	2		118
	Sum of MU		1	0	0	1	0	0	0	1	0	1		0	0		4
	Sum of JM		0	0	0	2	0	0	0	0	0	0		0	0		2
	Sum of JF		1	0	0	6	0	0	0	0	1	2		0	1		11
	Sum of JU		5	0	4	6	1	0	1	7	0	7		0	0		31
Sum of Uncl		0	0	0	0	0	0	0	0	0	1		0	0		1	
M-CALU	Sum of M								0								0
	Sum of MM								0								0
	Sum of YM								0								0
	Sum of F								0								0
	Sum of MU								1								1
	Sum of JM								0								0
	Sum of JF								0								0
	Sum of JU								0								0
Sum of Uncl								0								0	
M-ORAM	Sum of M	0									0						0
	Sum of MM	1									0						1
	Sum of YM	0									0						0
	Sum of F	0									1						1
	Sum of MU	0									1						1
	Sum of JM	0									0						0
	Sum of JF	0									0						0
	Sum of JU	0									0						0
Sum of Uncl	2									0						2	
M-RATA	Sum of M							0	0			0	4				4
	Sum of MM							6	1			4	4				15
	Sum of YM							0	0			1	0				1
	Sum of F							2	2			12	6				22
	Sum of MU							3	1			0	0				4
	Sum of JM							0	0			0	0				0
	Sum of JF							0	0			0	0				0
	Sum of JU							2	0			3	1				6
Sum of Uncl							0	0			2	0				2	
(blank)	Sum of M															0	0
	Sum of MM															0	0
	Sum of YM															0	0
	Sum of F															0	0
	Sum of MU															0	0
	Sum of JM															0	0
	Sum of JF															0	0
	Sum of JU															0	0
Sum of Uncl															0	0	
Total Sum of M		0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4
Total Sum of MM		1	8	0	12	32	0	10	10	6	0	22	4	2	0	0	107
Total Sum of YM		0	3	0	1	5	0	0	0	0	1	0	2	0	0	0	12
Total Sum of F		0	9	1	13	52	1	3	5	12	2	1	34	6	0	2	141
Total Sum of MU		0	1	0	0	1	0	3	2	1	0	1	1	0	0	0	10
Total Sum of JM		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Total Sum of JF		0	1	0	0	6	0	0	0	0	1	0	2	0	0	1	11
Total Sum of JU		0	5	0	4	6	1	2	1	7	0	10	1	0	0	0	37
Total Sum of Uncl		2	0	0	0	0	0	0	0	0	0	3	0	0	0	0	5
Grand Total		3	27	1	30	104	2	18	18	26	4	2	74	15	2	3	329

Appendix 5: Study Area Map A

Note that in-block roads and status of mainline roads are to be interpreted as approximations only

Appendix 6: Transect Locations Maps B

Note that in-block roads and status of mainline roads are to be interpreted as approximations only.