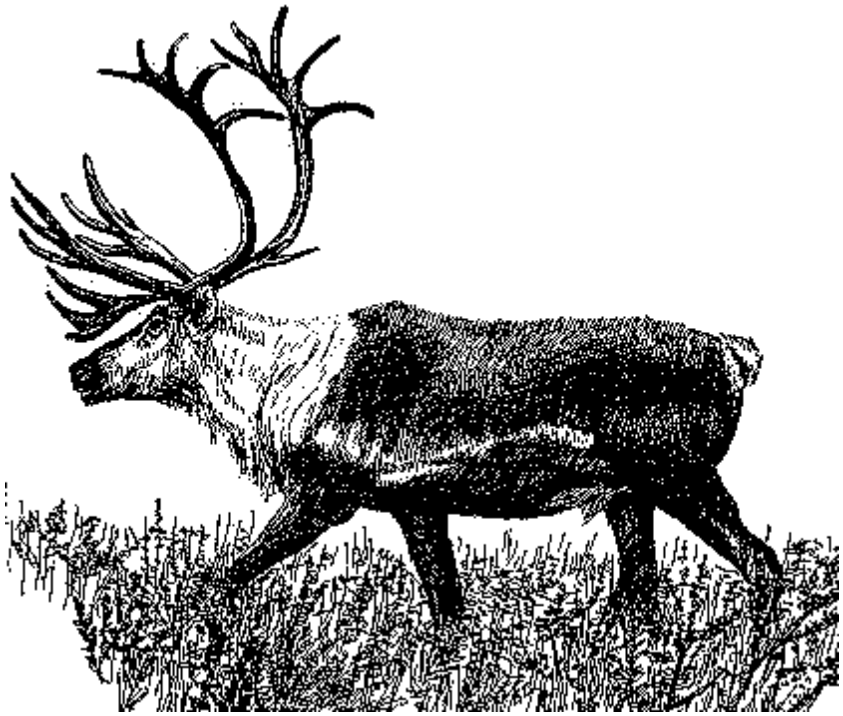
Towards Integrated Management Solutions:
The Itcha-Ilgachuz Caribou Project Radio-Telemetry Year Four Progress Report
1995-99



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SUMMARY

The Cariboo-Chilcotin Land Use Plan (CCLUP) requires the development of a caribou (*Rangifer tarandus caribou*) strategy for the Itcha-Ilgachuz caribou that maintains winter range habitat values and provides integrated management approaches to habitat management. One component of the information base that will be utilised to develop this strategy is the collection of conventional radio-telemetry data from radio-collared caribou. This progress report summarizes habitat use information collected from 34 radio-collared female caribou from October 1995 until May 1998. Monitoring of radio-collared caribou will continue until at least the end of the 1999-00 winter.

There were two different wintering strategies observed in this population. A majority of caribou in the three years of monitoring wintered in low elevation forested areas for the duration of the winter. These winter forest-dwelling caribou were further divided into two herds; the Itcha-Ilgachuz Mountains herd and the Rainbow Mountains herd based on the geographical areas where individual caribou calved. Individual home ranges showed common movement by caribou between the Itcha and Ilgachuz Mountains (the Itcha-Ilgachuz Mountains herd) and the Rainbow and Ilgachuz Mountains (the Rainbow Mountains herd), but there was little movement between the further separated Itcha and Rainbow Mountains. During the winter of 1995-96, approximately 10% of the caribou population, including the majority of the Rainbow Mountains herd, wintered on windswept, alpine ridges on the north side of both the Itcha and Ilgachuz Mountains. Only one radio-collared caribou employed the same strategy in the winter of 1997-98, and was thus considered a winter alpine-dwelling caribou.

The Itcha-Ilgachuz Mountains herd calved and then spent the summer (June-August) and early fall (September and October) near the treeline within the Itcha-Ilgachuz Provincial Park. In the late fall (November) and early winter (December to mid-January), caribou descended to lower elevations within the Montane Spruce biogeoclimatic zone, where they primarily utilised fescue meadows and mature open pine forests containing terrestrial lichens. As snow depths increased and winter progressed, caribou appeared to prefer pine stands that were either on dry or wet sites. When in forested areas, caribou utilised mature, moderately closed pine stands on poor quality sites and relatively flat terrain, between 1200-1600 meters in elevation. The majority of radio-collared animals were dispersed over a large area in the winter, utilising pine stands north, east, and south of the Itcha Mountains. In spring (May), caribou began migrating back towards their calving grounds within the Itcha and Ilgachuz Mountains, following the receding snowline.

The Rainbow Mountains herd calved throughout the Rainbow Mountains in the alpine. They spent the rest of the summer and early fall on the relatively steep alpine areas within Tweedsmuir Park before descending in the late fall into the Sub-Boreal Pine/Spruce for the winter. Throughout the winter, these radio-collared caribou were found in flat, low elevation mature pine or pine/spruce stands. They were observed to winter in the Dean River valley between Anahim Lake and Anahim Peak, before again returning to the alpine to calve in the spring.

The portion of the caribou population that was winter alpine-dwelling was found on high elevation windswept ridges within the Itcha and Ilgachuz Mountains where cratering for terrestrial lichens was possible. These alpine habitats were of relatively gentle slopes and supported caribou through the mid-winter, late winter/early spring and spring seasons. During the summer and fall, these caribou lived in similar areas to where the winter forest-dwelling caribou resided, thus summer and fall habitat use information was pooled with other data from their respective herds.

Caribou summer and winter range were often separate and distinct areas. Most caribou appeared to spend the winter within a discrete area but did not necessarily return to the same area the following winter.

ACKNOWLEDGMENTS

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Caribou capture work was skilfully completed by net gunners Pat Dielman and Doug Jury and helicopter pilots Tom Arduini and Wade Ross. Lara Webster and Chris Schmid assisted in the capture work. Fixed wing telemetry flights were safely piloted by Floyd Vaughan, Wayne Escott, Paul Hindle, Anton Forster, Ben Davidson, and Al Yard. Stefan Himmer, Kerra Shaw, Jim Young, Lara Webster, Val Young, and Steve Richberg collected the habitat information for the telemetry flights. John Youds reviewed a previous draft of this report. Jennifer Ballentine of the BC Environment GIS section produced Figures 1-2 and 4-7, all home range maps, and aided in the organisation of BEC units and CCLUP subunit data. Karen Samuelson and Jennifer Ballentine generated all of the habitat use data (excluding caribou habitat data) from computer coverages utilising telemetry flight location information. We thank all of the above for their contributions to this project.

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1.0 INTRODUCTION

The Itcha-Ilgachuz Mountains caribou (*Rangifer tarandus caribou*) herd appears to be stable and consists of approximately 1700 caribou (late fall estimate). The Rainbow Mountains caribou herd is stable, and consists of approximately 125 caribou. Because the caribou from the Itcha-Ilgachuz herd and the Rainbow herd sometimes share a common winter range, they are considered to be two herds of the same population (Hatler, 1987). These animals summer primarily in alpine and subalpine habitat in the Itcha, Ilgachuz, and Rainbow Mountains. Their winter range has shown to vary in different years. The caribou that calve in the Rainbow Range appear to winter either in the alpine habitats of the Rainbow or Ilgachuz Mountains or in low elevation pine stands along the Dean River in the vicinity of Anahim Lake. The caribou that calve in the Itcha-Ilgachuz Mountains appear to winter either in the alpine habitats of the Itcha and Ilgachuz Mountains or in mid-elevation pine stands generally to the north, east, and south of the Itcha Mountains.

Two components of caribou habitat are considered essential for ensuring viable caribou populations: summer calving habitat and winter habitat. During calving, caribou within this population require undisturbed mountainous terrain where they can distance themselves from other prey and predators. During winter, caribou require large areas of suitable habitat that contain adequate available forage and security cover. Most of the winter range habitat for the Itcha-Ilgachuz caribou is located outside of protected areas and will be subject to logging development. Most of the population summers in high elevation areas that are protected within parks (BC Government 1996).

The Cariboo-Chilcotin Land Use Plan (CCLUP) requires the development of a caribou strategy for the Itcha-Ilgachuz caribou herd by June 30, 2000. The major requirements are the initiation of a research and inventory program that will lead to the development of an integrated management approach. More specifically, the CCLUP identifies timber targets for the polygons that Itcha-Ilgachuz caribou inhabit by defining areas of “no harvest” and “modified harvest”. Although an Interim Strategy was presented in July of 1996, additional work must be undertaken to refine the options that were proposed at that time to ensure the most appropriate stands are designated in the “no harvest” or “modified harvest” categories.

2.0 OBJECTIVES

This progress report documents the results of three years of monitoring radio-collared caribou within the Itcha-Ilgachuz and Rainbow Mountains.

Specific objectives of this program are:

1) To determine seasonal landscape level habitat selection by caribou by comparing attributes of caribou radio relocations to what is available within the study area.
2) To assess caribou habitat use at the landscape level in relation to recent logging in the area, adaptive management prescriptions and bench-mark habitat use information collected in the mid-1980’s.

3) To develop and test a caribou habitat suitability model utilising radio location information in conjunction with 1:50 000 terrestrial ecosystem mapping.
4) To identify priority areas for "no harvest" and "modified harvest" designation as outlined by the Cariboo-Chilcotin Land Use Plan.

3.0 STUDY AREA

The Itcha, Ilgachuz and Rainbow Mountain ranges are located in the western part of central British Columbia within the Western Chilcotin Uplands Ecosection. The area is divided into several sub-units within the Cariboo-Chilcotin Land Use Plan (Figure 1). The alpine area of these old volcanic ranges is gentle and rolling and reaches elevations close to 2500 m. The steeper and rockier Ilgachuz Range is surrounded and separated from the Itchas by a plateau composed of pine forests and meadows. The Rainbow Range is separated from the Ilgachuz Range by the Dean River which flows north and then west into Dean Channel.

The Very Dry, Cold Sub-Boreal Pine-Spruce (SBPSxc) sub-zone, the Moist, Cold Sub-Boreal Pine-Spruce (SBPSmc) sub-zone, and the Dry, Cold Sub-Boreal Pine-Spruce (SBPSdc) subzone make up the lower elevations or valley bottoms of this plateau (<1200 m), while the predominate zone in the study area is the Very Dry, Very Cold Central Montane Spruce sub-zone (MSxv) located above the SBPS at mid-elevations (Figure 2). A narrow band of the Engelmann Spruce Subalpine Fir subzone (ESSF; >1650 m) exists at higher elevations and all three ranges contain an Alpine Tundra (AT) zone above the ESSF (>1825 m). These elevational breaks are only estimates, as the actual values differ between each range with snow pack, which affects the width of the ESSF zone (R. Coupé, Ministry of Forests, pers. comm.).

The dominant tree species in the SBPS and the MS zones is lodgepole pine (*Pinus contorta*). Interior spruce (*Picea glauca* X *engelmannii*) is associated with wetlands and mixed stands with pine. Soopolallie (*Sheperdia canadensis*) is the dominant shrub in the zones with a herb layer consisting of mosses, terrestrial lichens (*Cladina* spp., *Cladonia* spp., *Stereocaulon* spp., *Peltigera* spp.), and kinnikinnick (*Arctostaphylos uva-ursi*). Fescue lichen meadows are present in areas of cold air ponding and wet sedge fens and shrub-carrs occur along drainages and in areas where the water table is near the surface. *Festuca altaica* is the dominant grass in the meadows, and shrub birch (*Betula glandulosa*) and willows *(Salix* spp.) are associated with shrub-carrs.

The ESSF contains stands of lodgepole pine, interior spruce, and subalpine fir (*Abies lasiocarpa*). *Bryoria* spp. is the dominant arboreal lichen. The AT zone contains communities of terrestrial lichens, grasses, and dwarf scrub (*Cassiope* spp., *Phyllodoce* spp., *Empetrum nigrum, Arctostaphylos uva-ursi, Vaccinium* spp., *Dryas* spp., *Salix* spp., *Betula glandulosa*; Cichowski 1993).

Figure 1. CCLUP Sub-Units of the Study Area

Figure 2. Biogeoclimatic Zones of the Study Area

4.0 METHODS

A total of 41 caribou (40 cows and 1 bull) were successfully radio-collared between October 1995 and December 1998. All caribou were captured by net-gunning from a helicopter in open alpine and meadow habitats. In October and November of 1995, twenty animals were captured and fitted with radio collars. Thirteen caribou were captured in February and October of 1996. Nine additional caribou were collared in 1998, one in February and eight in December. Once captured, all caribou were restrained with leg hobbles, blind folded, ear tagged, and fitted with radio-collars. Six of the caribou collared in December of 1998 were fitted with GPS 1000 remote sensing collars and the remainder of the captured caribou (throughout the study) were fitted with conventional Very High Frequency (VHF) mortality-motion sensitive radio collars. During the years of the study, there have been eleven mortalities and one failed collar, leaving twenty-nine surviving and functional collared caribou as of May 1999. Data from the male collared caribou was not included in habitat attribute summaries or the home range analysis.

GPS collars were scheduled to obtain satellite position fixes 7-8 times per day (approximately every three hours) during the winter and once per day during the spring. Location, temperature and activity data was collected and stored in the collar for up to three months. Every one to three months, stored data was downloaded remotely from a fixed wing aircraft and differentially corrected at the office by Geographical Information Systems (GIS) staff using a softwear package called N3WIN. As GPS collars were not equipped with mortality-motion sensors, these animals were relocated using conventional telemetry methods approximately every 2 weeks to ensure that the collared animals were still alive and moving. This report includes conventional aerial locations from GPS collars, but does not include differentially corrected (downloaded) locations.

Conventional (VHF) radio-collared caribou were relocated two to four times per month by a fixed wing aircraft. Universal Transverse Mercator (UTM) co-ordinates, location, time, visual contact, and comments relating to group size and habitat use were recorded with each animal's relocation. The UTM co-ordinates were established with a Global Positioning System (GPS) in the aircraft. These co-ordinates were then plotted on 1:50,000 topographic, habitat and forest cover maps. If the points obtained were not consistent with the habitat in which the observer viewed the animals, they were adjusted on the map and the correct UTMs entered into the data base.

In the past, topographic features (slope, aspect, and elevation) were estimated when the locations were plotted on the above noted 1:50,000 scale topographic maps. Forest cover and caribou habitat attributes were obtained from plotting locations onto B.C. Forest Service forest cover maps and caribou habitat maps both at a scale of 1:50,000. During the last two years, UTM locations were entered into Unix ArcInfo 7.1.2 GIS, which generated all the attributes given in this report from the most recent coverages (except for the caribou habitat information which has not yet been digitised).

The accuracy of the data point UTMs gathered from the caribou relocation flights was estimated by placing collars in open and closed sites to represent visual and non-visual relocations of caribou, and located aerially by the contractor who usually performs these flights. Potential error may cause the computer generated data from the given

UTMs to be in a different or bordering category from the actual one the caribou was present in when relocated. This error may average out when as many data points as we have in this report are being analysed. One way employed to prevent small habitats from being under-represented was by recording in what habitat the caribou was visually observed during telemetry flights. When an animal was located and sighted, the vegetation it was observed in was recorded (e.g. pine forest, clear-cut, meadow). The computer generated attributes were compared to the observer recorded comments and changes made if necessary to keep the results as consistent to the visual observations as possible. Manually generated forest cover data was utilised for relocations in which the animal was noted to be in a forested stand, but digital information reported otherwise.

The percentage of relocations in each slope and aspect category was used to calculate different patterns of use in each season. Computer coverages gave all locations numerical values for slope and aspect, which were then divided into more comprehensive categories for graphing. In the past there had been a category of "flat" in the aspect section, however this year it was removed as the computer, using the National Topographic System (NTS), could generate aspects for all locations.

Winter divisions used were those established by Cichowski (1993). Early winter was from December until mid-January, mid-winter was from mid-January to mid-March, late winter was from mid-March until the end of April. Winter itself was December to March (inclusive). The other divisions were determined by comparing habitat use patterns between months: spring was considered May, summer was June until the end of August, early fall was September and October, and late fall was November. In an attempt to illustrate changes in habitat use patterns, results were displayed by season, month, and in one case, by week.

The average elevation for each week (+/- 1 standard deviation) was calculated along with the percentage of animal locations in each 200 m elevational band. Rough demarcations between biogeoclimatic zones were placed on the graph summarising this information. The percentage of collared animals visually detected when relocated was also determined for each season.

Snow depth and density information was obtained from observations made at two permanent snow stations, Puntzi Mountain and Nazko, monitored by BC Environment Water Management staff from Williams Lake.

Forest cover information was grouped according to dominant tree species, site class, and age class as outlined by Cichowski (1993). Since most forested relocations were in pine and pine/spruce stands, stands of other tree species were lumped into the "other" category for this analysis. Low sites were lower quality than poor sites that were in turn lower quality than medium sites. These categories were easily converted from computer generated numerical values. Age classes 1-4 (0-80 years) were grouped as immature stands and age classes 5-9 (80-251+ years) were considered mature sites. The use of different stands in each season and total winter was represented as a percentage.

Similarly, comparisons of age class and crown closure use patterns were also made in each month and season. For these two sections all forested relocations, regardless of dominant species and productivity, were included in the analysis. There were a few relocation points that had partial forest cover data, but lacked crown closure information because the map sheets have not been updated since the 1970's (G. Lee,

Ministry of Forest, pers. comm.). These points were therefore excluded from the crown closure section, but included in sections where there was complete information.

The caribou habitat polygons (individually labelled map units) were grouped according to the types and abundance of terrestrial lichens (based on percentage ground coverage) delineated by Cichowski (1993; Appendix 1). The use of each grouping for the total winter period and each season was determined. Individual habitat units are described in more detail in the legend of the caribou habitat maps (B.C. Ministry of Forests, 1987; Cichowski, 1993). In the SBPSmc and MSxv biogeoclimatic sub-zones, Dry Lichen (DL) sites contained the most terrestrial lichen followed be Lichen Moss (LM). Very little terrestrial lichen was found in Moss (M) or Seepage Forest (SF) sites. Arboreal lichens were present in all forested habitat types but were most common in moister types. Wetlands (W) and Non-forested Wetlands (NW) were wet and contained mostly grasses, sedges, and shrubs. Fescue-Lichen (FL) meadows were dry open areas containing grasses and terrestrial lichens. In the SBPSxc subzone, Dry Lichen and Kinnikinnick (K) sites contained the most terrestrial lichens while the rest of the sites contained very little (Cichowski 1993).

Home ranges of individual collared caribou were calculated digitally using the minimum convex polygon method. The single collared male caribou was excluded from this analysis.

5.0 RESULTS

A total of 3253 caribou relocation points were obtained from the first four years of the project, from October 1995 until the end of May 1999, and are mapped in Figures 4-7. Five hundred and twenty-four caribou locations were collected in the first 8 months of monitoring (1995-96), 869 in the following 12 months (1996-97), 959 in 1997-1998 and 901 in the last 12 months (1998-99). Summaries from past years can be found in this report and previous reports (Young and Loveridge 1996, Young, et al 1998).

Eighty percent of the radio-collared caribou were seen during telemetry flights. The percentage of radio-collared caribou visually observed from the aircraft while telemetry locations were obtained differed with season; decreasing from a high of 89% in the early winter to a low of 67% in late winter/early spring (Figure 3). These results may be due to varying habitat choices at different times of the year, the corresponding visibility in these habitats, as well as changing weather conditions during the telemetry flights. The average error for relocation points was estimated at 157m, with a standard deviation of 68 meters (95% confidence interval of 23.7-290.3).

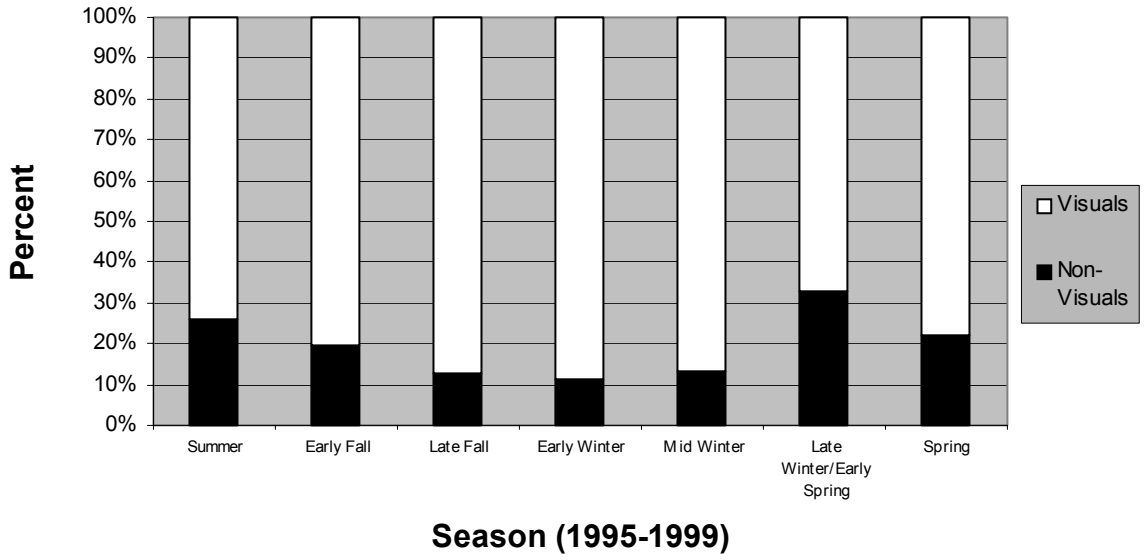

Figure 3. Percentage of radio-collared caribou seen from the aircraft when relocated by radio-telemetry

As radio-collared caribou displayed four different habitat use strategies during winter, data was summarised separately for each general pattern of use for the portion of the year where there were obvious differences in use (Figures 4-8). Some of the caribou chose to winter in the upper ESSF and AT zones (winter alpine-dwelling), primarily on windswept ridges, whereas the majority of animals wintered at lower elevations within forested habitats (winter forest-dwelling). As the low elevation or forest-dwelling

animals wintered in two separate and distinct areas, habitat use information was then divided and summarised by herd. The alpine-dwelling caribou were separated from the forest-dwelling caribou for the months of February-May (mid-winter, late winter/early spring, and spring). For the rest of each year when animals shared similar habitat use patterns, they were grouped with other radio-collared caribou. In 1995-96, the alpine-dwelling group was represented by 3 radio-collared caribou from the Itcha-Ilgachuz Mountains herd, and 5 from the Rainbow Mountains herd. They were seen among 142 caribou in the 1996 March survey. There were no winter alpine-dwellers in 1996-97 or 1998-99, and there was only one collared alpine-dweller in 1997-98. That animal was seen with 2 other caribou throughout the winter in the Itcha and Ilgachuz Mountains.

Figure 4. Radio-collared female caribou locations in the Itcha-Ilgachuz-Rainbow area between May and October.

Figure 5. Radio-collared female caribou locations in the Itcha-Ilgachuz-Rainbow area between November 1995 and April 1996

Figure 6. Radio-collared female caribou locations in the Itcha-Ilgachuz-Rainbow area between November 1996 and April 1997

Figure 7. Radio-collared female caribou locations in the Itcha-Ilgachuz-Rainbow area between November 1997 and April 1998

Figure 8. Radio-collared female caribou locations in the Itcha-Ilgachuz-Rainbow area between November 1998 and April 1999

5.1 Snow Characteristics

There are two permanent snow stations in the study area, at Puntzi Mountain and Nazko. For the 1996 late winter, Puntzi Mtn. had snow depths that were greater than average for February-April (Figure 9). In 1997, the snow depths were similar to the average for February and April, but somewhat lower than average in March. In 1998, snow depths were consistently below average in February-April, and lower than measurements taken in the other two years. Finally in 1999, snow depths were close to average throughout the winter.

The Nazko station was similar to Puntzi Mtn. In results for the winters of 1996, 1998 and 1999; with depths somewhat higher than average in Februrary 1996, and snow depths substantially lower than average in the winter months of 1998 (Figure 10). There was no snow at all recorded at either station in April 1998. The 1997 depths were all greater than average in February-April in contrast to the Puntzi Mtn. results, indicating that the snow levels were greater in the north-eastern end of the caribou range during this year.

Snow densities at Puntzi Mtn. were higher than average in March of 1997 and 1998 and lower than average in March of 1999 (Figure 11). At Nazko, 1996, 1997 and 1999 winters had similar to average snow densities. In 1998 the densities at Nazko were lower than average (Figure 12). There were no density measurements taken at either station in April 1998 because there was no snow.

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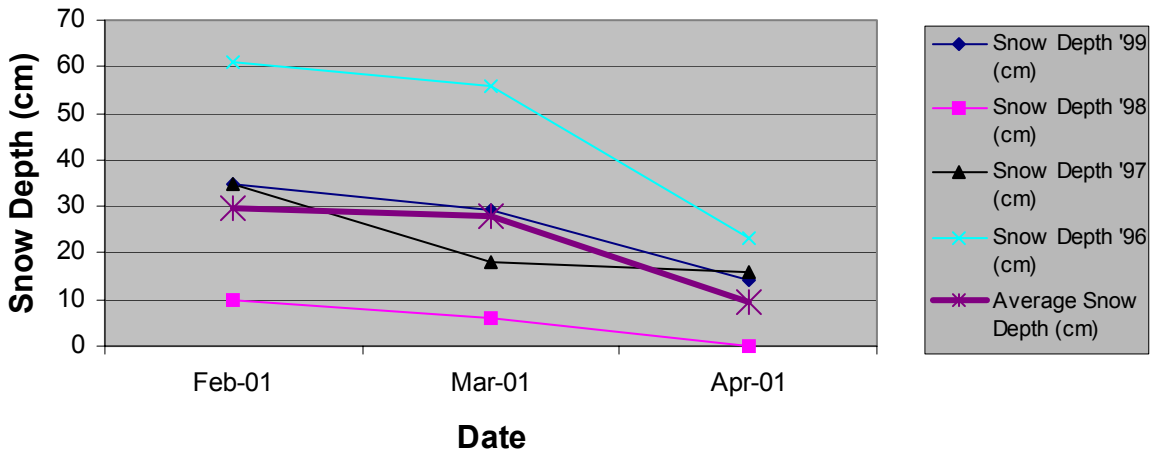

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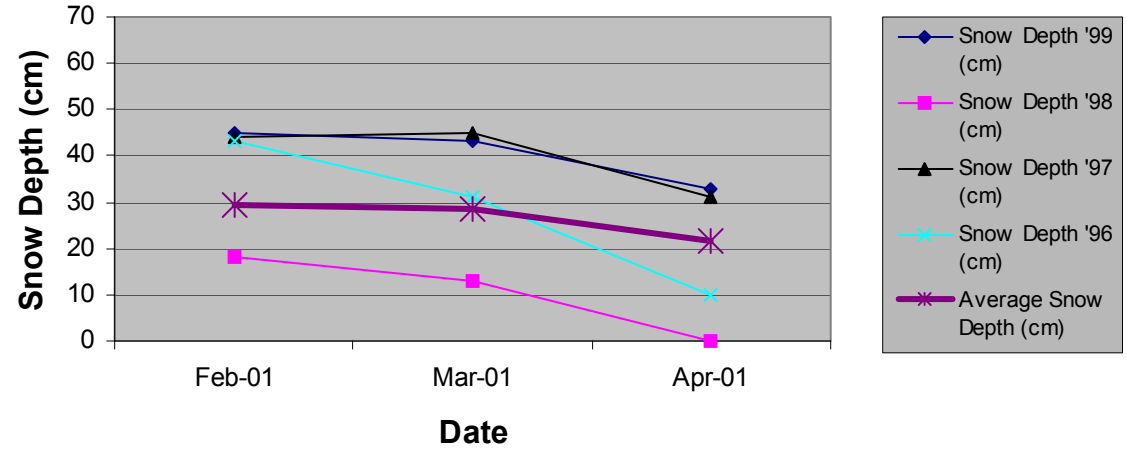

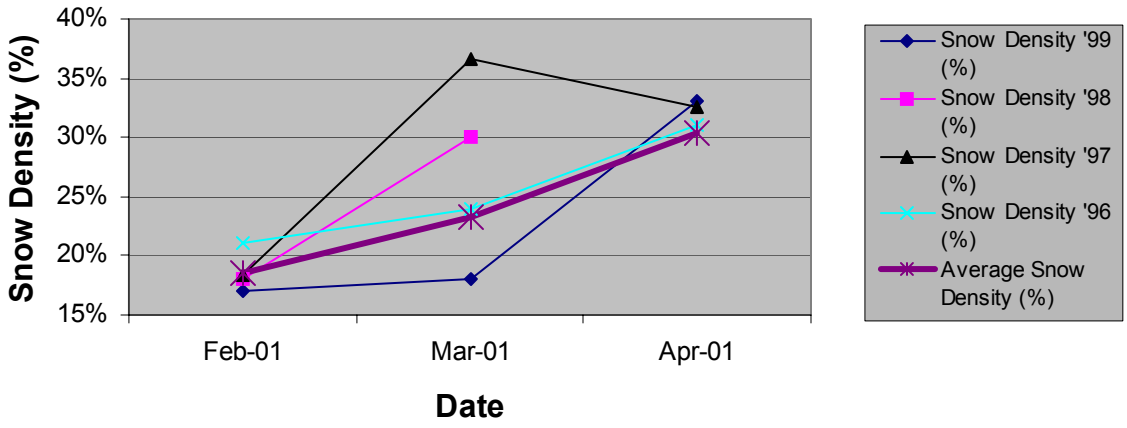

Figure 11. Snow densities at Puntzi Mountain snow station (940 m, 28 years of record).

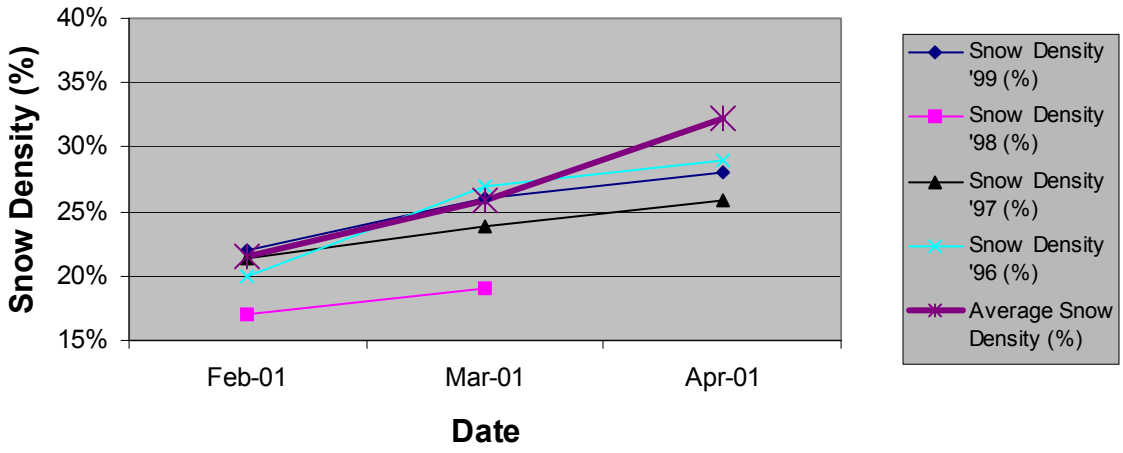

Figure 12. Snow densities at Nazko snow station (1070m, 21 years of record).

5.2 Habitat Selection with Elevational Changes

In the first year of monitoring, the caribou used winter habitat in two different ways; some wintered in the alpine and some wintered in the forest. In the winter of 1997-98, only one radio-collared caribou used the strategy of wintering in the alpine, otherwise all other radio-collared caribou in 1996-97, 1997-98 and 1998-99 wintered at low elevations within forested habitats. The alpine-dwelling and forest-dwelling caribou are separated throughout this report so comparisons can be made between the features of their chosen habitats in the mid-winter, late winter/early spring, and spring seasons, when these differences may be relevant. In the other seasons they are combined with their respective herds.

The forest-dwelling radio-collared caribou found in the Itcha-Ilgachuz area were at the highest elevations in June with 71% of relocations at elevations greater than 1800m (Figure 13). Over the intire summer 51% of relocations were above the 1800m mark

(Figure 14). Average weekly elevations showed that forest-dwelling caribou gradually travelled down the mountain sides through the fall and early winter (Figure 15). In mid-winter and late winter/early spring, the elevational use was at the lowest of the year for the Itcha-Ilgachuz caribou, with 94% of radio-collared animals relocated below 1600 m. In May, the elevations increased again as some forest-dwelling caribou moved into the upper ESSF and AT zones prior to calving.

The forest-dwelling radio-collared caribou found in the Rainbow Range area showed a similar pattern of elevational change throughout the year (Figures 16 and 17). However, in the summer and fall months, they were found at consistently greater elevations than the Itcha-Ilgachuz herd, with more than 61% of collared animals at elevations greater than 1800m in September. In the winter, they were found at lower elevations than the Itcha-Ilgachuz caribou, predominantly at elevations of less than 1200m.

The winter alpine-dwelling caribou remained at high elevations for the duration of early-winter to spring (Figures 15 and 18). In Figure 15, early winter use was only represented by one caribou from 1997-98, therefore no standard deviations were associated with those points. Early winter data was not collected from the 1995-96 alpine-dwellers, as that was the season in which they were originally collared. The majority of these alpine-dwelling animals were found in the 1800-2000m elevational range in both the Itcha and Ilgachuz Mountains. In May, there was a small decrease in the average elevation as some individuals moved into the MS zone on their migration from the Ilgachuz Mountains winter range to calving grounds in the Rainbow Mountains (Figure 18).

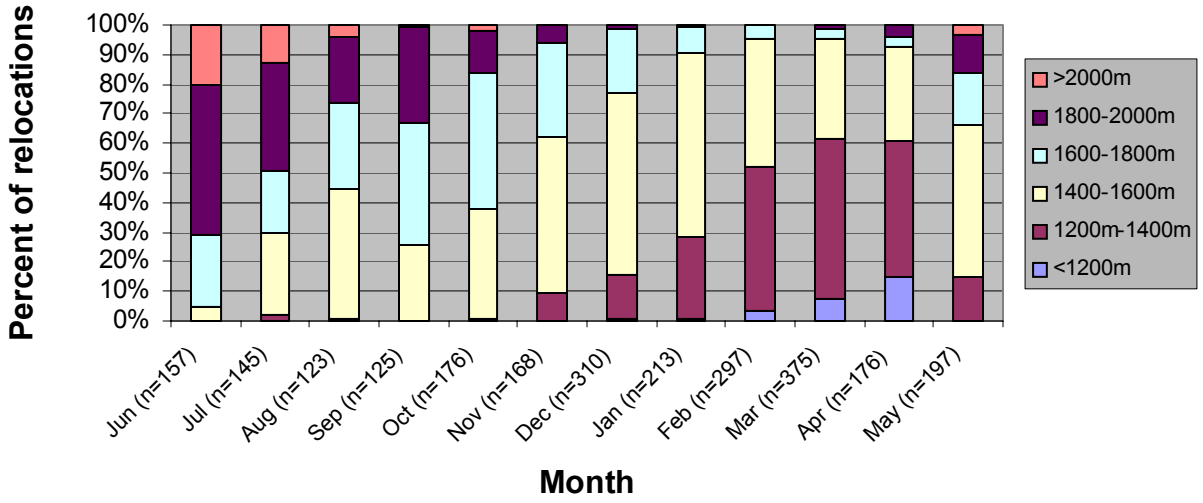

Figure 13. Percentage of winter forest-dwelling radio-collared caribou locations in each 200 meter elevational band by month for the Itcha-Ilgachuz Mountains herd

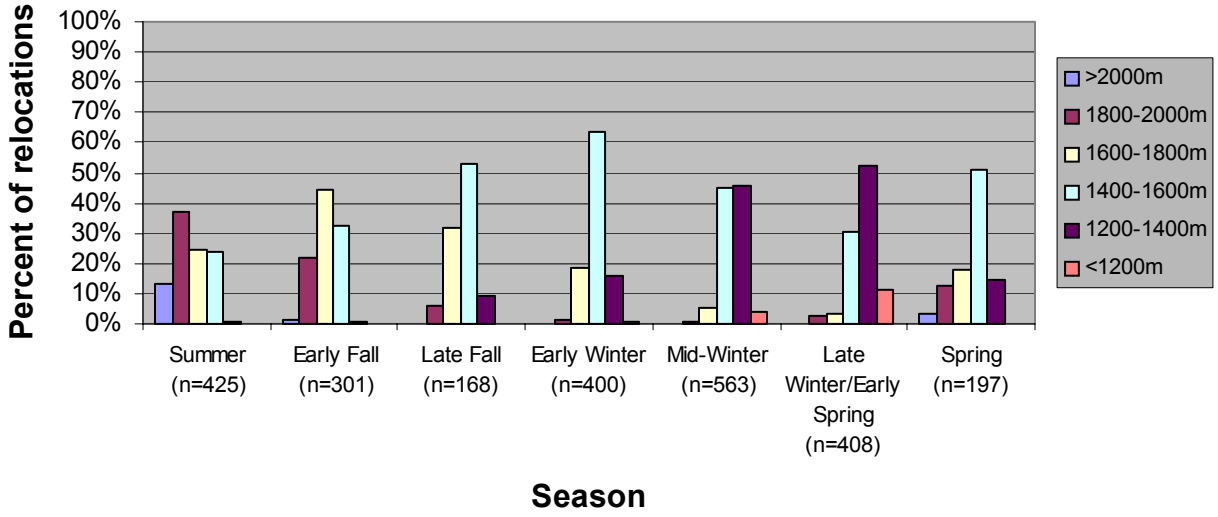

Figure 14. Percentage of winter forest-dwelling radio-collared caribou locations in each 200 meter elevational band by season for the Itcha-Ilgachuz Mountains herd

Figure 15. Mean elevation (+/- 1 standard deviation) of radio-collared caribou locations by week. The Forest-Dwelling class includes data from both the Itcha-Ilgachuz and Rainbow Mountains herds.

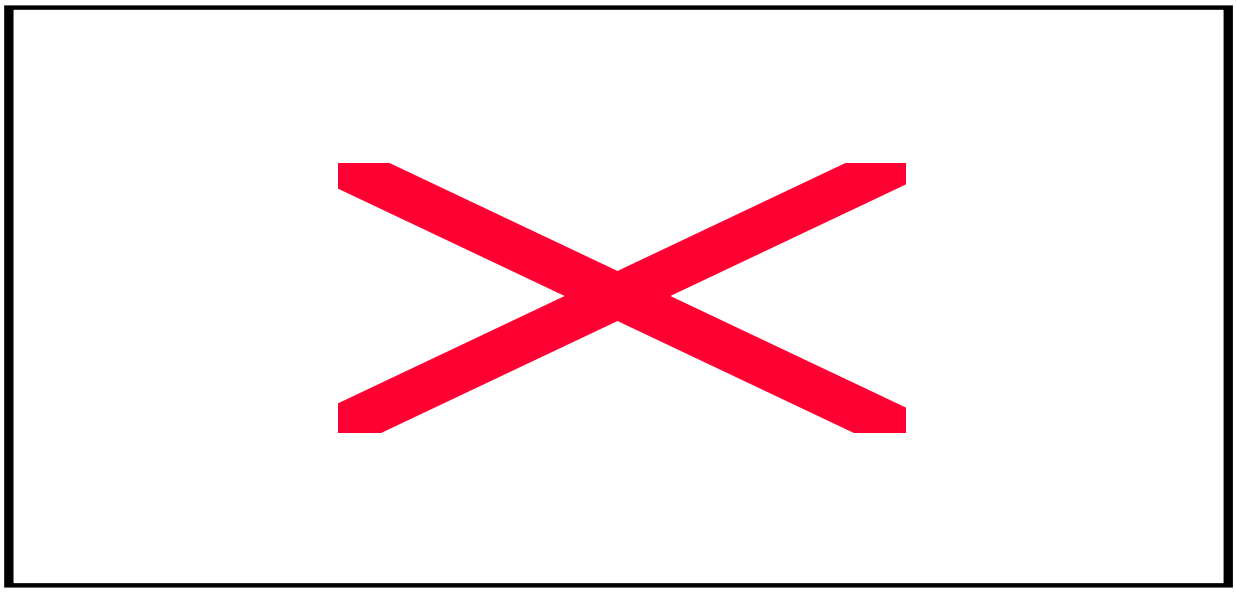

Figure 16: Percentage of winter forest-dwelling radio-collared caribou locations in each 200 meter elevational band by month for the Rainbow Mountains herd

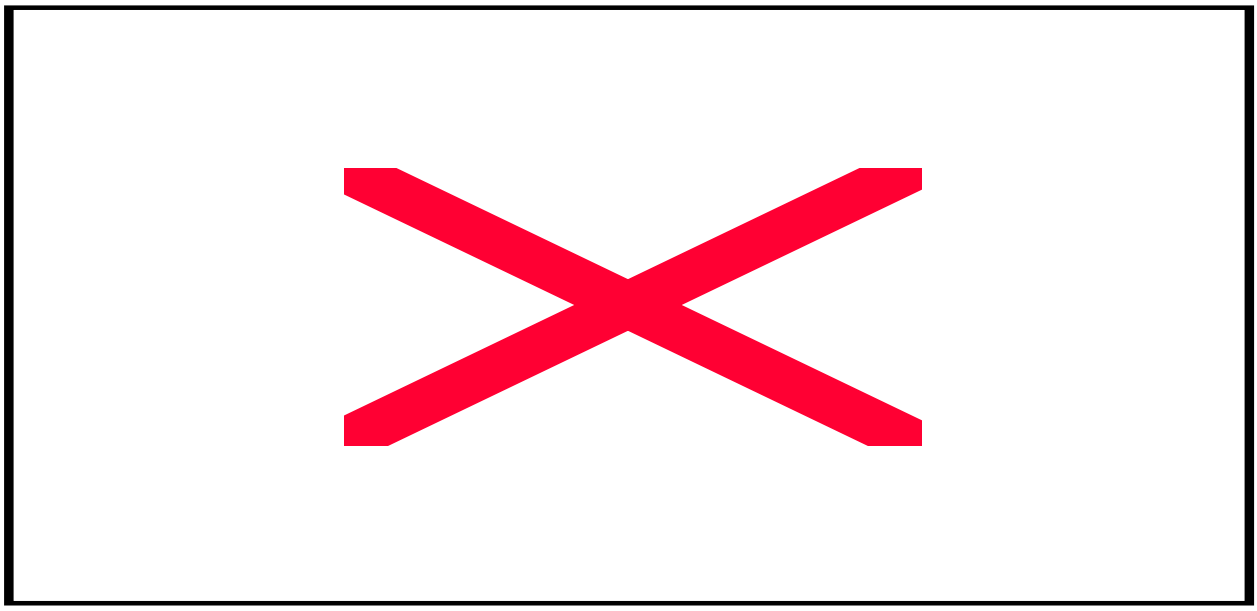

Figure 17: Percentage of winter forest-dwelling radio-collared caribou locations in each 200 meter elevational band by season for the Rainbow Mountains herd

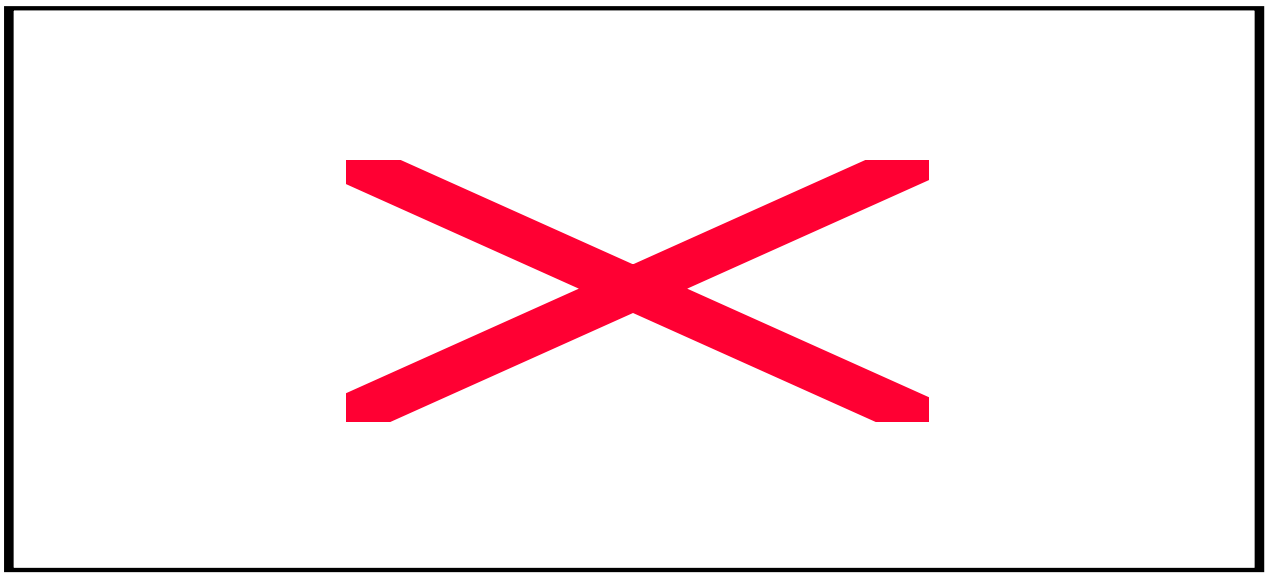

Figure 18: Percentage of winter alpine-dwelling radio-collared caribou locations in each 200 meter elevational band by season

5.3 Habitat Selection and Slope

The use of different slope categories by the three groups of caribou is represented in Figures 19 through 21. Throughout the year, winter forest-dwelling radio-collared caribou from the Itcha-Ilgachuz herd were located at least 50% of the time on slopes of 10% or less. In the late fall and throughout the winter, this percentage increased to a maximum of 90% in the late winter/early spring. Caribou used steeper slopes during the summer season, when 32% of relocations were on slopes greater than 20%.

The winter forest-dwelling radio-collared caribou from the Rainbow Mountains herd also spent the majority of their time in habitats of 10% or less slope. However, their annual trends showed more seasonal variation. In the summer and early fall, caribou were found on relatively steep slopes, but this gradually decreased to a low of 2% in the early winter. Although the winter forest-dwelling caribou were most often in areas with little or no slope during the year, in almost every season there was at least a small representation on steeper slopes.

Winter alpine-dwelling caribou were generally found on steeper slopes than the forest-dwellers, with less than 46% of relocations on slopes of 10% or less through the winter and spring seasons (Figure 21).

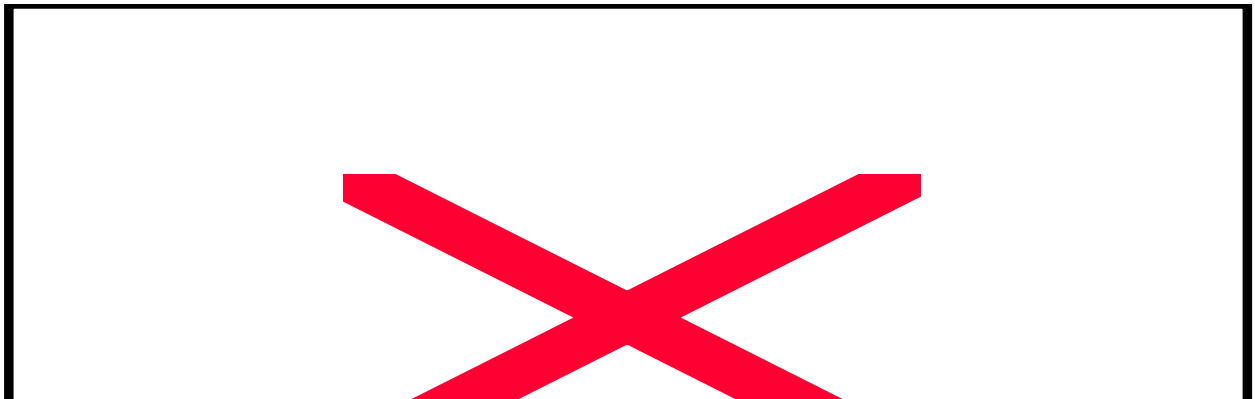

Figure 19. Percentage of winter forest-dwelling radio-collared caribou locations in each slope category by season for the Itcha-Ilgachuz Mountains herd

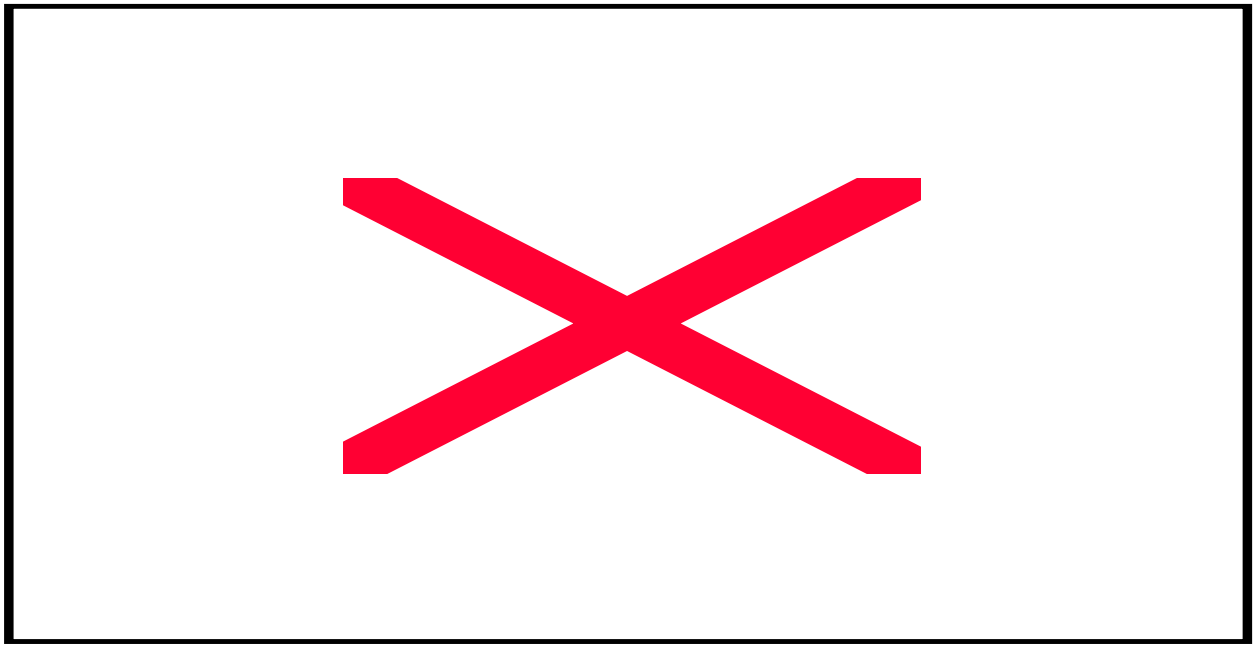

Figure 20. Percentage of winter forest-dwelling radio-collared caribou locations in each slope category by season for the Rainbow Mountains herd

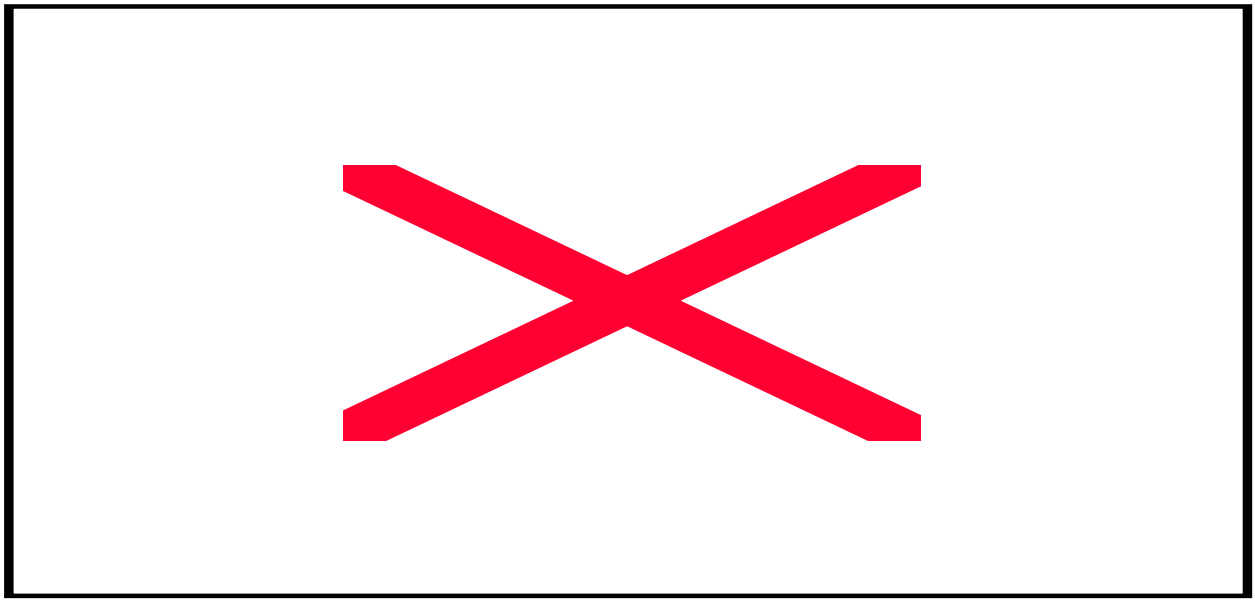

Figure 21. Percentage of winter alpine-dwelling radio-collared caribou locations in each slope category by season

5.4 Habitat Selection and Aspect

Radio-collared winter forest-dwelling caribou from the Itcha-Ilgachuz herd were found in all aspect categories throughout the year (Figure 22). Little variation was shown, except for a very slight preference for northerly aspects.

The winter forest-dwelling Rainbow Mountains herd showed more evidence of utilising particular aspects. In the early fall, the use of north-eastern aspects is at a low of 12%, increasing to a high of 36% in early winter when it again begins to decline (Figure 23). In the seasons when the north-east use is lower (early fall, late fall, late winter/early spring and spring), the use of north-west aspect tends to increase. In the summer there appears to be no preference for particular aspects.

The winter alpine-dwelling caribou were found in habitats represented by all aspects in the mid-winter. In the late winter/early spring and spring, they had a slight preference for west and north-westerly aspects (Figure 24).

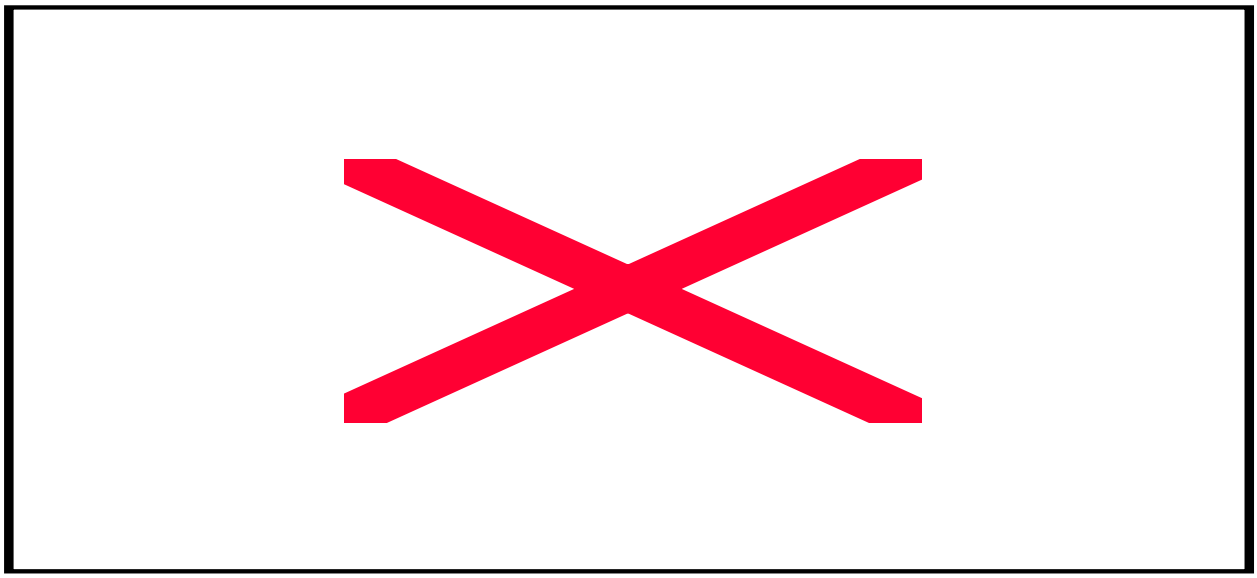

Figure 22. Percentage of winter forest-dwelling radio-collared caribou locations in each aspect by season for the Itcha-Ilgachuz Mountains herd

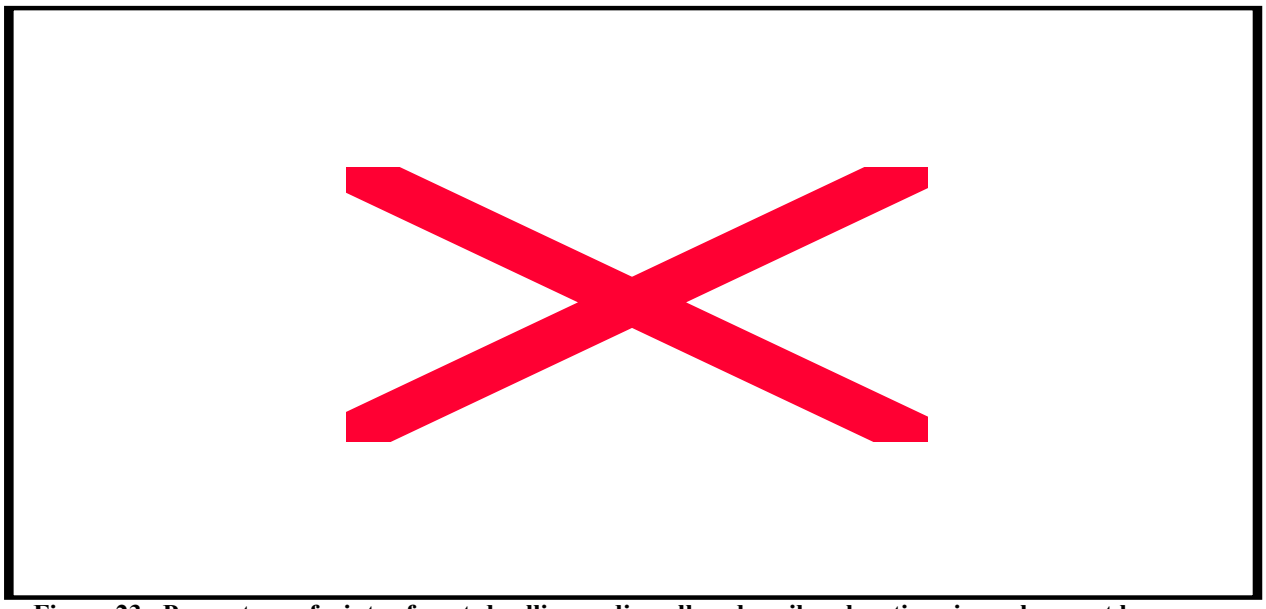

Figure 23. Percentage of winter forest-dwelling radio-collared caribou locations in each aspect by

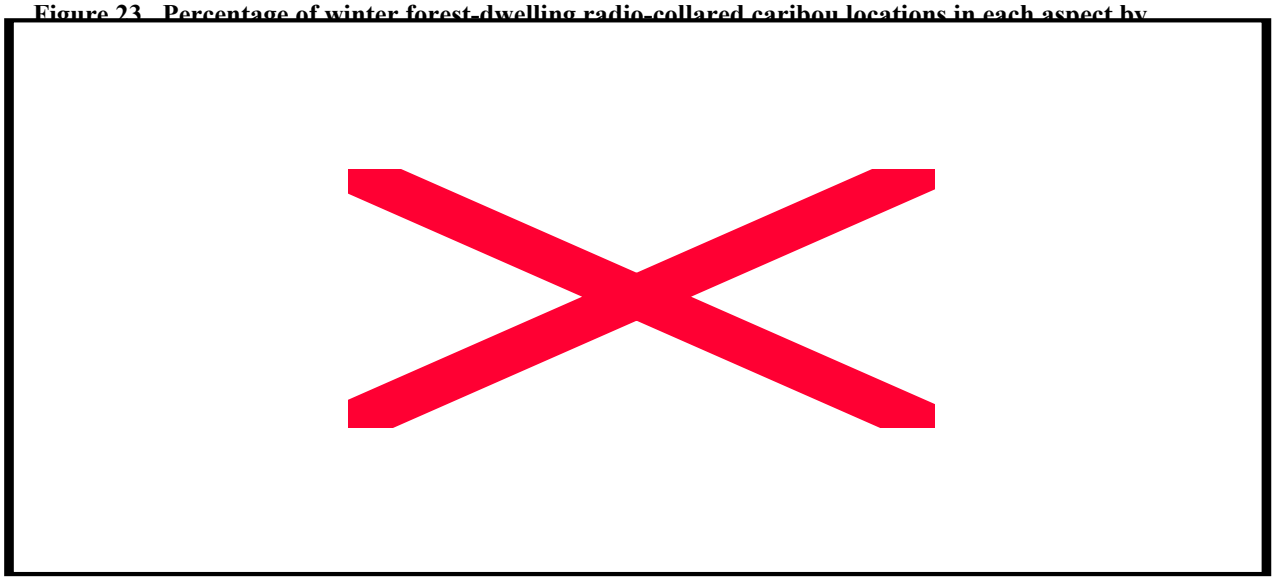

Figure 24. Percentage of winter alpine-dwelling radio-collared caribou locations in each aspect by season

5.5 Biogeoclimatic Zone Use

The Itcha-Ilgachuz herd predominantly used the Alpine Tundra (AT) biogeoclimatic zone during the summer and early fall (85% in June), but moved down into the MS zone for the winter and spring months (89% in February) (Figure 25 and 26). In April 23% of relocations were in the SBPS xc sub-zone, otherwise there was little use in the other forested subzones of the SBPS.

In the Rainbow herd, more animals were relocated in the AT zone (88% in June and 94% in July) than the Itcha-Ilgachuz herd, and for a longer period of time (Figure 27). They spent the majority of the summer, early fall, and additionally the late fall and spring in the AT (Figure 28). They were relocated in the SBPS (especially the SBPS xc sub-zone) more often than the Itcha-Ilgachuz collared caribou, with SBPS use peaking at 81% in February.

During winter, alpine-dwelling caribou were predominantly found in the AT zone (Figure 29). Approximately 25% of the radio-collared animals that wintered in the alpine descended into the ESSFxv and MSxv sub-zones in the spring (May).

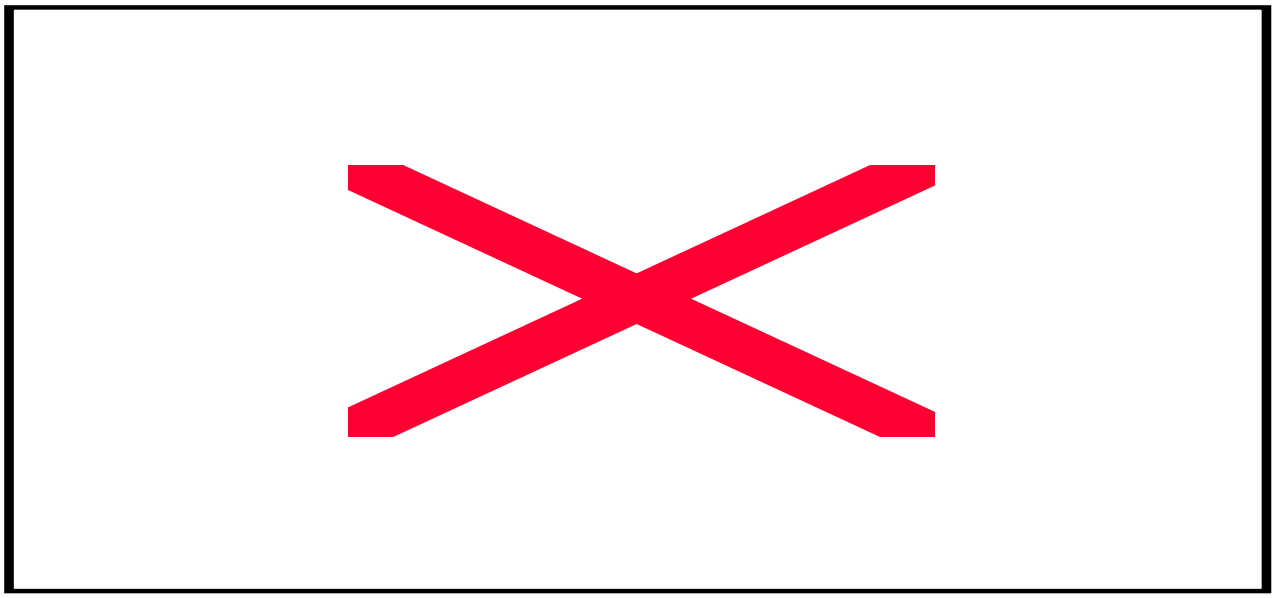

Figure 25. Percentage of winter forest-dwelling radio-collared caribou in each biogeoclimatic sub-zone by month for the Itcha-Ilgachuz Mountains herd

Figure 26. Percentage of winter forest-dwelling radio-collared caribou in each biogeoclimatic subzone by season for the Itcha-Ilgachuz herd

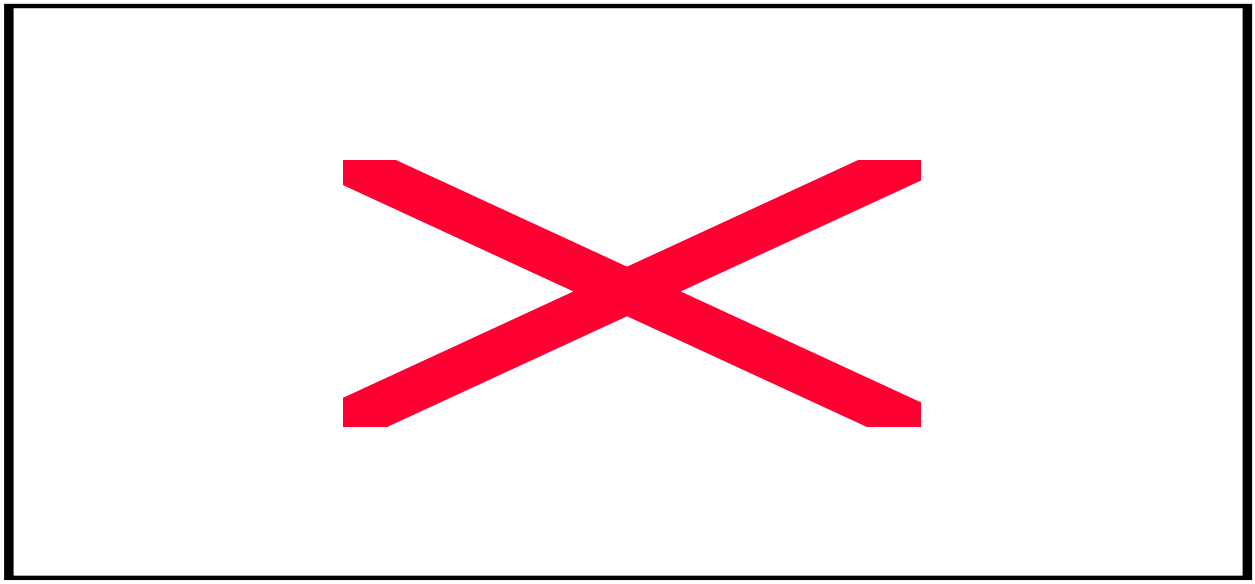

Figure 27. Percentage of winter forest-dwelling radio-collared caribou in each biogeoclimatic subzone by month for the Rainbow Mountains herd

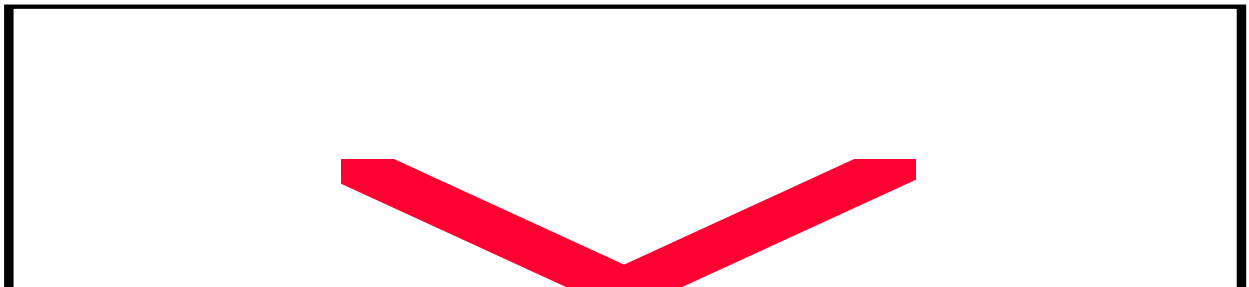

Figure 28. Percentage of winter forest-dwelling radio-collared caribou in each biogeoclimatic sub-zone by season for the Rainbow Mountains herd

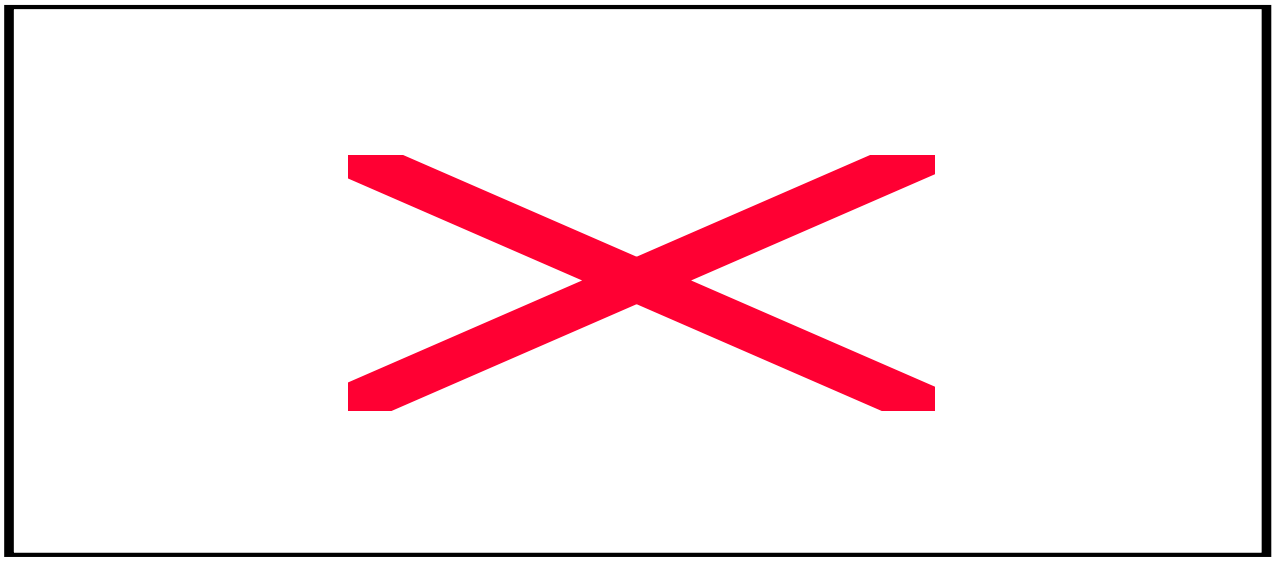

Figure 29. Percentage of winter alpine-dwelling radio-collared caribou in each biogeoclimatic sub-zone by month

5.6 Caribou Habitat Type Use

As the majority of caribou relocations during summer were at high elevations outside the area of existing habitat mapping, no habitat type use data is presented for this season.[2] In addition, most relocations for the winter forest-dwelling Rainbow Mountains herd caribou were outside areas mapped into habitat units, therefore they were not included in this summary. This is also true for winter alpine-dwelling caribou, thus they were excluded from this section of analysis as well.

There was a decrease in Fescue-Lichen (FL) meadow use in the fall, from 52.9% in 1995, to 21.7% in 1996, to a low of 15.9% in 1997 before increasing to 21.8% in 1998 (Tables 1-4). Instead of FL habitat use in the fall seasons of 1996, 1997 and 1998 there was an increase of use in Dry Lichen/Lichen Moss (DLLM) and Lichen Moss (LM) sites. These habitats were also the most heavily used in winter, although in 1995-96 there was also some use of Moss/Seepage Forests (18.7% of relocations in MSF).

In spring there was a shift from drier forested habitats to wetter sites resulting in an observed increase in the use of MSF sites. Although there was an increase in MSF sites during May, there was still substantial use of DLLM and LM sites, especially in 1997-98 and 1998-99. Looking at overall use in the 4 years (Table 5), DLLM, LM and MSF sites were used the most (see Appendix 1 for description of caribou habitats).

Table 1: Percentage of forest-dwelling radio-collared caribou locations in each caribou habitat type by season in 1995-96 for the Itcha-Ilgachuz Mountains herd

Habitat Type	Fall Use	Early Winter Use	Mid-Winter Use	Late Winter/ Early Spring Use	Total Winter Use	Spring Use
DLLM	23.5%	50.7%	24.8%	20.3%	29.9%	33.3%
LM	5.9%	16.4%	19.7%	15.2%	18.7%	14.8%
DLLM MOSAIC	5.9%	6.8%	2.2%	1.3%	3.2%	11.1%
MDLLM	2.9%	13.7%	16.1%	15.2%	15.1%	11.1%
MSF	8.8%	2.7%	24.1%	24.1%	18.7%	25.9%
W/FW	0%	2.7%	7.3%	19.0%	8.4%	3.7%
FL	52.9%	2.7%	1.5%	0%	1.6%	0%
SBPS-DLK	0%	1.4%	4.4%	5.1%	3.6%	0%
SBPS-OTHER	0%	2.7%	0%	0%	0.8%	0%
N	**34**	**73**	**137**	**79**	**251**	**27**

Table 2: Percentage of forest-dwelling radio-collared caribou locations in each caribou habitat type by season in 1996-97 for the Itcha-Ilgachuz Mountains herd

Habitat Type	Fall Use	Early Winter Use	Mid-Winter Use	Late Winter/ Early Spring Use	Total Winter Use	Spring Use
DLLM	37.8%	27.5%	43.2%	35.3%	36.9%	24.0%
LM	16.2%	20.9%	22.9%	29.4%	24.2%	24.0%

[2] Terrestrial Ecosystem Mapping (TEM) is currently underway to fill voids in data, which will allow for more complete coverage of the study area.

DLLM MOSAIC	8.1%	4.4%	0.8%	5.9%	3.2%	6.0%
MDLLM	10.8%	7.7%	3.4%	2.9%	4.8%	2.0%
MSF	0%	9.9%	9.3%	17.6%	10.7%	34.0%
W/FW	5.4%	5.5%	5.1%	5.9%	4.4%	4.0%
FL	21.6%	7.7%	0.8%	1.5%	3.2%	6.0%
SBPS-DLK	0%	13.2%	7.6%	0%	8.3%	0%
SBPS-OTHER	0%	3.3%	6.8%	1.5%	4.4%	0%
N	**37**	**91**	**118**	**68**	**252**	**50**

Table 3: Percentage of forest-dwelling radio-collared caribou locations in each caribou habitat type by season in 1997-98 for the Itcha-Ilgachuz Mountains herd

Habitat Type	Fall Use	Early Winter Use	Mid-Winter Use	Late Winter/ Early Spring Use	Total Winter Use	Spring Use
DLLM	34.4%	43.6%	49.6%	34.8%	43.7%	33.3%
LM	28.1%	25.5%	32.5%	15.2%	27.2%	33.3%
DLLM MOSAIC	3.1%	2.1%	6.8%	9.1%	5.1%	0%
MDLLM	9.4%	8.5%	0%	4.5%	3.9%	8.3%
MSF	4.7%	5.3%	3.4%	3.0%	3.5%	16.7%
W/FW	4.7%	4.3%	5.1%	6.1%	4.7%	0%
FL	15.6%	10.6%	0%	0%	3.9%	8.3%
SBPS-DLK	0%	0%	0.9%	13.6%	3.9%	0%
SBPS-OTHER	0%	0%	1.7%	13.6%	3.9%	0%
N	**64**	**94**	**117**	**66**	**249**	**12**

Table 4: Percentage of forest-dwelling radio-collared caribou locations in each caribou habitat type by season in 1998-99 for the Itcha-Ilgachuz Mountains herd

Habitat Type	Fall Use	Early Winter Use	Mid-Winter Use	Late Winter/ Early Spring Use	Total Winter Use	Spring Use
DLLM	37.2%	45.7%	32.7%	29.4%	37.3%	26.1%
LM	30.8%	23.9%	40.4%	22.4%	31.6%	30.4%
DLLM MOSAIC	2.6%	2.2%	1.9%	2.4%	2.0%	8.7%
MDLLM	2.6%	2.2%	0%	1.2%	0.8%	4.3%
MSF	3.8%	9.8%	5.8%	3.5%	6.6%	17.4%
W/FW	1.3%	10.9%	1.0%	9.4%	6.1%	6.5%
FL	21.8%	2.2%	2.9%	0%	2.0%	6.5%
SBPS-DLK	0%	0%	6.7%	11.8%	4.9%	0%
SBPS-OTHER	0%	3.3%	8.7%	20.0%	8.6%	0%
N	**78**	**92**	**104**	**85**	**244**	**46**

Table 5. Percentage of forest-dwelling radio-collared caribou locations in each caribou habitat type by season in 1995-99 for the Itcha-Ilgachuz Mountains herd

Habitat Type	Fall Use	Early Winter Use	Mid-Winter Use	Late Winter/ Early Spring Use	Total Winter Use	Spring Use
DLLM	34.3%	41.4%	36.3%	29.5%	36.6%	27.4%
LM	23.5%	22.0%	28.4%	20.5%	25.5%	25.2%

DLLM MOSAIC	4.2%	3.7%	2.9%	4.4%	3.4%	7.4%
MDLLM	6.1%	7.7%	5.0%	6.0%	6.0%	4.4%
MSF	4.2%	7.1%	11.8%	12.1%	10.1%	25.9%
W/FW	2.8%	6.0%	4.8%	10.4%	5.9%	4.4%
FL	24.9%	6.0%	1.1%	0.3%	2.6%	5.2%
SBPS-DLK	0%	3.7%	5.7%	7.7%	5.6%	0%
SBPS-OTHER	0%	2.3%	4.0%	9.1%	4.4%	0%
N	**213**	**350**	**476**	**298**	**1001**	**135**

5.7 Forest Cover Type Use

As the majority of summer caribou relocations are within the alpine, use of forested sites for the summer season was not summarised in Tables 6 and 7.

The radio-collared caribou of the Itcha-Ilgachuz Mountains herd spent most of their time in mature pine stands throughout the year (Table 6). They predominantly chose these stands on poor sites (up to 35.6% in the early winter), but also were on low quality sites around 20% of the time for all seasons. Immature stands of pine and pine/spruce were rarely used (>6.5%), and mature pine/spruce or other forest types were used less than 14% of the time in all seasons. Meadows, open range or wetlands were used to the greatest degree in the fall (21%), spring (18%) and early winter (13%).

The radio-collared caribou of the Rainbow Mountains herd also spent the majority of time in mature pine stands on poor quality sites (32.9% in late winter/early spring and 31.9% in early winter). Rainbow caribou did not spend much time on low quality sites (>11%) or in immature stands of pine, or pine/spruce (>10%). They differed from the Itcha-Ilgachuz herd in the time they spent in mature pine/spruce stands on poor quality sites. Here they were found from 10.9% (mid-winter) to 27.3% (fall) of the time. In the fall, winter, and spring they spent a substantial amount of time in stands other than pine or pine/spruce, with a maximum in spring of 60.9% (n=23).

Table 6: Percentage of forest-dwelling radio-collared caribou locations in each forest cover type by season in 1995-99 for the Itcha-Ilgachuz Mountains herd

Forest Cover Type	Fall Use	Early Winter Use	Mid-Winter Use	Late Winter/ Early Spring	Total Winter Use	Spring Use
Pine						
Immature						
L	0.8%	1.5%	2.5%	2.5%	2.2%	0.6%
P	1.1%	4.1%	6.5%	5.8%	5.4%	1.3%
M	0.0%	0.3%	0.5%	0.8%	0.6%	1.3%
Mature						
L	19.8%	22.6%	21.7%	18.2%	20.9%	15.8%
P	28.1%	39.6%	35.5%	37.9%	37.5%	25.9%
M	0.3%	2.3%	8.4%	3.8%	5.6%	5.1%
Pine/Spruce						
Immature						
L	0.0%	0.0%	0.2%	0.3%	0.2%	1.3%
P	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

M	0.0%	0.3%	0.2%	0.0%	0.2%	0.0%
Mature						
L	7.5%	2.0%	1.3%	1.8%	1.6%	13.9%
P	3.9%	5.1%	8.2%	9.8%	7.6%	3.2%
M	0.0%	0.0%	0.2%	0.3%	0.1%	0.6%
Other	16.7%	9.1%	8.4%	11.4%	9.2%	13.3%
Meadow/Open Range/Wetland	21.7%	13.2%	6.5%	7.6%	9.0%	17.7%
N	**359**	**394**	**558**	**396**	**1179**	**158**
Alpine	92	6	5	12	16	39

Table 7: Percentage of forest-dwelling radio-collared caribou locations in each forest type by season in 1995-98 for the Rainbow Mountains herd

Forest Cover Type	Fall Use	Early Winter Use	Mid-Winter Use	Late Winter/ Early Spring	Total Winter Use	Spring Use
Pine						
Immature						
L	0.0%	0.0%	5.4%	3.7%	3.1%	0.0%
P	0.0%	0.0%	0.8%	0.0%	0.3%	0.0%
M	0.0%	3.4%	1.6%	6.1%	2.7%	0.0%
Mature						
L	0.0%	5.2%	10.9%	4.9%	8.2%	0.0%
P	21.2%	31.9%	26.4%	32.9%	29.9%	13.0%
M	0.0%	1.7%	5.4%	4.9%	4.1%	4.3%
Pine/Spruce						
Immature						
L	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
P	0.0%	4.3%	0.0%	1.2%	1.7%	0.0%
M	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Mature						
L	3.0%	0.9%	3.1%	0.0%	1.7%	0.0%
P	27.3%	17.2%	10.9%	11.0%	12.6%	17.4%
M	0.0%	0.9%	0.0%	0.0%	0.3%	0.0%
Other	45.5%	11.2%	24.8%	26.8%	21.4%	60.9%

Meadow/Open Range/Wetland	3.0 %	23.3%	10.9%	8.5%	13.9%	4.3%
N	**33**	**117**	**129**	**82**	**294**	**23**
Alpine	103	1	8	20	19	36

Age class	Immature (0-80years) Mature (>80 years)	Other: Aspen, Aspen/Pine/Spruce/Balsam, Pine/Aspen, Spruce, Spruce/Balsam, Spruce/ Pine/Balsam, NP Pine/Spruce, NP Spruce, NSR, NPBr, Lake and River (and all types of alpine forest)
Site class	L=Low P=Poor M=Meduim	

5.8 Habitat Selection and Stand Age

The majority (83-98%) of the forest cover age classes utilised by forest-dwelling caribou from the Itcha-Ilgachuz Mountains herd in every month of the year were class 5 or higher (80+ years; Figure 30). Age classes 8 and 9 (141-251+ years) were used most in the fall (Figure 31), although (with the exception of mid-winter) during all seasons they were used more often than other age classes. Recently logged areas (less than 20 years of age) were used less than 7% of the time during all months.

Radio-collared caribou from the Rainbow herd also spent most of their time in stands greater than 81 years old (Figures 32 and 33). However, they used recently logged sites to a greater degree, especially in November, March and May (late fall, late winter/early spring, and spring). The majority of this young stand use (especially in March, and May) was in the low snow year of 1997-98.

Figure 30: Percentage of forest-dwelling radio-collared caribou locations in each forest cover age class by month for the Itcha-Ilgachuz Mountains herd

Figure 31: Percentage of forest-dwelling radio-collared caribou locations in each forest cover age class by season for the Itcha-Ilgachuz Mountains herd

Figure 32: Percentage of forest-dwelling radio-collared caribou locations in each forest cover age class by month for the Rainbow Mountains herd

Figure 33: Percentage of forest-dwelling radio-collared caribou locations in each forest cover age class by season for the Rainbow Mountains herd

5.9 Habitat Use and Stand Crown Closure

The dominant crown closure classes in every month for the radio-collared caribou from the Itcha-Ilgachuz Mountains were classes 4-5 (41-61%; Figure 34). Use of this crown closure category was highest during the late fall, when up to 58% of the caribou were relocated in these stands (Figure 35). Summer months had smaller sample sizes than other months as data was only collected during this period in the second, third and fourth years of the project, and not all the relocations were found in forest sites that had crown closure information associated with them. Stands of 56-75% closure were also used throughout the year, with a low in June (6%) and a high in July (34%). Stands of crown closure classes 0-1 (0-15%) were made up of recently logged sites as well as other older stands with minimal closure, and were used most in the spring.

Rainbow Mountains caribou were also found in crown closure classes 4-5 to the greatest degree in the summer, fall, and spring (Figures 36 and 37). In the winter months, stands with high crown closure (classes 6-7) were used the most (55% in January). Categories 0-1 were used by this herd in mid to late winter, spring and late fall, corresponding with the recently logged and young forest usage shown in Section 5.8.

Figure 34: Percentage of forest-dwelling radio-collared caribou locations in each crown closure class by month for the Itcha-Ilgachuz Mountains herd

*Assumes all unlabelled NSR sites were recently logged (and therefore in category "0")

Figure 35: Percentage of forest-dwelling radio-collared caribou locations in each crown closure class by season for the Itcha-Ilgachuz Mountains herd

*Assumes all unlabelled NSR sites were recently logged (and therefore in category "0")

Figure 36: Percentage of forest-dwelling radio-collared caribou locations in each crown closure class by month for the Rainbow Mountains herd

*Assumes all unlabelled NSR sites were recently logged (and therefore in category "0")

Figure 37: Percentage of forest-dwelling radio-collared caribou locations in each crown closure class by season for the Rainbow Mountains herd

*Assumes all unlabelled NSR sites were recently logged (and therefore in category "0")

5.10 Park and CCLUP Sub-Unit Use

Radio-collared caribou from the Itcha-Ilgachuz herd spent the summer and early fall primarily in the Itcha-Ilgachuz Provincial Park (54%), and to a lesser degree in the surrounding Itcha-Ilgachuz Special Resource Development Zone (44%; Table 8). In the winter seasons they descended from the alpine and spent most of their time in the Itcha-Ilgachuz SRDZ (56%) and spread throughout the other zones. In the spring, they began to move back up into the park again (34%).

The Rainbow herd also summered in the alpine, but mainly within the confines of Tweedsmuir Provincial Park (77%; Table 8). When they began their descent in late fall, they dropped down into the surrounding Anahim Integrated Resource Management Zone (IRMZ) in the early winter. The entire winter use was divided between the Anahim IRMZ (65%), the Itcha-Ilgachuz SRDZ (24%), and the Itcha-Ilgachuz Provincial Park (11%).

The alpine-dwelling caribou spent almost all the winter months within the confines of the Itcha-Ilgachuz Provincial Park. In the spring, some animals were also relocated in Tweedsmuir Provincial Park and the Itcha-Ilgachuz SRDZ.

Table 8: Percentage of winter alpine-dwelling and winter forest-dwelling radio-collared caribou in each CCLUP sub-unit by season in 1995-99

CCLUP Sub-Units	Summer Use	Early Fall Use	Late Fall Use	Early Winter Use	Mid Winter Use	Late Winter/ Early Spring Use	Total Winter Use	Spring Use
Winter Forest-Dwelling Itchas-Ilgachuz Mountains Herd								
Anahim Lake IB	0.9%	0.0%	0.6%	7.5%	3.2%	3.7%	4.9%	0.5%
Baezaeko E1	0.2%	0.7%	4.8%	7.8%	11.0%	10.8%	9.8%	0.5%
Chezacut IC	0.9%	0.4%	6.0%	11.0%	20.1%	29.9%	19.6%	0.0%
Ecological Reserve	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
Itcha Ilgachuz P8	51.3%	57.6%	41.7%	17.0%	2.8%	4.9%	7.4%	34.5%
Ilgachuz SF	44.9%	41.3%	47.0%	56.2%	60.6%	47.1%	56.3%	58.9%
Kleena Kleene	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%
Kluskus IA	0.0%	0.0%	0.0%	0.5%	2.3%	3.4%	1.9%	3.6%
N	**425**	**283**	**168**	**400**	**563**	**408**	**1195**	**197**
Winter Forest-Dwelling Rainbow Mountains Herd								
Anahim Lake IB	4.2%	0.0%	42.9%	78.6%	60.6%	52.9%	65.2%	16.9%
Itcha Ilgachuz P8	4.2%	0.0%	2.0%	0.0%	15.3%	22.6%	10.9%	33.9%
Itcha Ilgachuz SF	8.4%	0.0%	16.3%	20.5%	24.1%	24.5%	23.6%	15.3%
Tweedsmuir Provincial Park K West of zone area	76.9%	100%	38.8%	0.9%	0.0%	0.0%	0.3%	33.9%
	6.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
N							**313**	
Winter Alpine-Dwelling								
Itcha Ilgachuz P8					100%	100%	100%	62.5%
Itcha Ilgachuz SF					0%	0%	0%	18.8%
Tweedsmuir					0%	0%	0%	18.8%

Prov.incial Park K								
N					**46**	**53**	**72**	**16**

5.11 Home Ranges

Home ranges of the radio-collared caribou are shown in Appendix 2. The relocations were divided into summer (May-November) and winter (December-April) ranges, which are often separate and distinct areas. A map of all home ranges combined is located in Appendix 3. Most caribou range within a discrete area during each winter, but may not return to that same area the following year as illustrated by the yearly home range boundaries and Figures 4-8. The length of monitoring time varied for individual caribou as they were captured at different times and there were some mortalities and one collar failure, therefore the home range sizes were not all directly comparable (Appendix 4).

The Itcha-Ilgachuz Mountains portion of the population has been represented by 26 collared animals that have never been observed to cross to the west side of the Dean River, but easily move between the Itchas and Ilgachuz Mountains and their surrounding lowland areas. Yearly home ranges of Itcha-Ilgachuz radio-collared caribou with 12 consecutive months of monitoring had home ranges varying greatly from 251 sq. km to 2325 sq. km, with the average at 1357 sq. km (n=34). When Itcha-Ilgachuz caribou home ranges were compared between animals having 24 months of monitoring, home ranges again varied greatly from 597 sq. km to 4475 sq. km, with the average at 2720 sq. km (n=15).

The Rainbow Mountains portion of the population has been represented by 8 caribou which have either stayed completely on the west of the Dean River, or which have been observed to go as far east as Tundra Mountain in the Ilgachuz. The exceptions are caribou with the collar frequencies of 150.522 and 150.701 which have wandered more extensively east of the Ilgachuz even though they are predominantly Rainbow Range caribou. In this report caribou 150.701 was classified as an Itcha-Ilgachuz Mountains herd caribou for the monitoring year of 1995-96 and a Rainbow Mountains herd caribou for 1996-98. When Rainbow Mountains radio-collared caribou were compared, the average home range after 12 consecutive months of monitoring was 955 sq. km., ranging from 626-1323 sq. km (n=12). After 24 consecutive months of monitoring, this increased to 1945 sq. km., ranging from 1568-2485 sq. km (n=5).

6.0 DISCUSSION

6.1 Habitat Use and Seasonal Movements

Due to the date in which the monitoring of radio-collared caribou began, this summary is for data collected for two summers (1996 and 1997) and three winter periods (1995-96, 1996-97, and 1997-98). Three different seasonal strategies were

observed in this one population of caribou, and have been separated throughout this report. The winter forest-dwelling caribou were made up of two herds; one that calved in the Rainbow Mountains and one that calved and resided in the Itcha-Ilgachuz Mountains and surrounding area. There was also a group of caribou that sometimes wintered in the alpine areas, instead of descending to lower elevation forests.

WINTER FOREST-DWELLING CARIBOU

Itcha-Ilgachuz Mountains herd

The Itcha-Ilgachuz Mountains herd calved in June, at an average elevation of 1975 m (Young and Shaw, 1998). They spent most of the rest of the summer at high elevations and within gently sloped alpine (AT). Most relocations were within the Itcha-Ilgachuz Provincial Park.

During the fall, caribou migrated from the high alpine calving grounds to lower elevation wintering habitat surrounding the Itcha and Ilgachuz Ranges. In the early fall, the caribou were still at relatively high elevations, descending from the AT and ESSF to the MSxv in the late fall. In the fall of 1995, there was high use of Fescue-Lichen meadows north and east of the Itcha Mountains. However, by December this use declined abruptly and was much less during the early winter period than reported by Cichowski (1993). In the fall seasons of 1996 and 1997, there was more use of the Dry Lichen/Lichen Moss and Lichen Moss forested habitats than in 1995, but still more use of Fescue-Lichen meadows than at any other time of the year. This annual shift from open meadow habitats to forested habitats was likely triggered by an overall increase in snow accumulation during the late fall/ early winter period (Cichowski 1993).

For the winter of 1995-96, caribou primarily used either dry or wet forested sites. There was less observed use of DLLM habitats and an increase in use of Moss/Dry Lichen/Lichen Moss and Moss/Seepage Forest habitats as compared to observed use in the mid 1980's. Accompanied by this variation in habitat use was a shift in the predominant wintering area for the majority of the Itcha-Ilgachuz caribou. Snow levels may have contributed to this shift in use, because as noted in Section 5.1, mid-winter snow depths were above average, particularly in the southern part of the winter range. This may have influenced the unusually high degree of use in the northern portion of the winter range in the vicinity of the headwaters of the Coglistiko and Baezaeko Rivers (Figure 6). This area is dominated by wetter habitat units, thus the deeper than average snow levels observed throughout the winter range may have resulted in caribou seeking out habitat types with a higher abundance of arboreal lichens rather than drier sites with terrestrial lichens buried deep under the snow. This area is also influenced by its geographical proximity to the Itcha and Ilgachuz Mountains and their associated winter weather patterns, which may have provided some form of a snow shadow. To further contrast winter use, in the late winter of 1995-96, only 5.1% of the caribou locations were found within lower elevation SBPS Dry Lichen/Kinnikinnick sites whereas Cichowski (1993) observed 29.0% use of these sites during the same season in the mid-1980's.

During the winter of 1996-97, there was a shift to using drier stands more frequently, with over 60% of relocations in the DLLM or LM habitats. Both of these habitat types had an increase of use from 1995-96, while MSF and MDLLM site usage

decreased. New wintering areas were again observed, as caribou were found both north and south of the Itcha Mountains (Figure 6). The majority of the radio-collared caribou did not shift to the southern part of the winter range, even though snow station data suggested snow depths there were well below average and in the northern part of the winter range snow depths were well above average.

In the winter of 1997-98, radio-collared caribou showed caribou habitat use very similar to 1996-97. As a result, DLLM sites were used 43.0% of the time, and LM sites 27.7% of the time (43.6% and 26.6% respectively in 1996-97). The wintering area in 1997-98 was a combination of previously observed wintering areas (Figure 7). Itcha-Ilgachuz caribou were found mostly south of the Itchas or around them from Whitetop Mountain, around Satah Mountain, and down to Puntzi River. Snow depths were very low, thus caribou appeared not to be restricted in their movements throughout their winter range. It appears that in years where snow may prevent forested sites containing terrestrial lichens (DLLM, LM) from being utilised, because of depth or density, there is an increase in wetter sites being used, as in 1995-96. In that event, arboreal lichens may play a more substantial role in the caribou diet. When snow does not seem to be an impediment, the caribou chose drier sites with more terrestrial lichens, as in 1996-98 and the 1980's (Cichowski, 1993).

Throughout the three winters, the Itcha-Ilgachuz Mountains caribou generally utilised mature (>80 years) moderately closed (>36% crown closure) pine stands on poor quality sites. These stands were generally located on flat terrain (<10% slope) in the mid elevations (1200-1600 m) of the MSxv biogeoclimatic zone. Caribou spent over 50% of their time in the Itcha-Ilgachuz Special Resource Development Zone, and the rest divided among the other CCLUP sub-units.

In May, the majority of collared caribou migrated back towards the calving grounds, following the receding snowline up into the Itcha and Ilgachuz Mountains, through forested habitats within the Shag, Pan and Carnlick Creeks. The greatest number of relocations in cutblocks were found in the spring, possibly because snow melted faster in these open sites and allowed easier access to forage.

Rainbow Mountains herd

The radio-collared caribou of the Rainbow Mountains herd calved then spent their summers in the alpine (AT) of the Rainbow Range, on relatively steep, high elevation slopes (>1800 m) in Tweedsmuir Park.

During the early fall, caribou were still found on sloping alpine and at the highest elevations of the year. They then started their descent from Tweedsmuir Park to the surrounding Anahim Lake IMZ and Itcha-Ilgachuz SRDZ in the late fall through mature pine, pine/spruce and other stands, bringing them into the MSxv, SBPSxc, and SBPSmc biogeoclimatic zones.

In 1995-96, Rainbow caribou wintered on the north side of the Ilgachuz Mountains in the alpine, so there were no winter forest-dwellers. In the winters of 1996-97 and 1997-98, the caribou were found in the lower elevation forest of the Dean River valley. In winter, Rainbow herd caribou were generally in mature (>80 years), close-canopied (>56%) mature pine or mature pine/spruce on poor sites. These stands were generally located in the Anahim Lake IMZ or the Itcha-Ilgachuz SRDZ. These sites were

relatively flat (<10%) and at low elevations (>1200 m) areas, predominantly within the SBPSxc biogeoclimatic zone.

In the spring, the caribou began returning to higher elevation alpine calving grounds, generally on the northerly side of the Rainbow Range. In the spring, the Rainbow herd was also found to a higher degree in recent cutblocks, although they were also found there in March.

WINTER ALPINE-DWELLING CARIBOU

Habitat use patterns for winter alpine-dwelling caribou were included in either the Itcha-Ilgachuz herd or Rainbow herd during the summer, fall, and early winter seasons. During the rest of the winter and spring, habitat use information was summarised separately. Caribou were found on the north side of the Ilgachuz Mountains in 1995-96, and the north side of the Itcha Mountains in 1997-98. Habitat use was at high elevations (1800-2000 m) and predominantly on gentle slopes (20% or less), in the alpine (AT) of the Itcha-Ilgachuz protected area. Areas of use had shallow snow depths due to the exposure to prevailing winds. Areas and years with no use appeared to have deeper snow that would have made cratering for lichens more difficult. In the spring of 1996, some of the caribou that wintered on the north side of the Ilgachuz migrated across the Dean River towards calving grounds in the Rainbow Mountains.

6.2 Future Directions

Monitoring of radio collared caribou will continue at least until the end of the winter of 1998/99. Over the next year the availability of habitat will be quantified utilising GIS. This will include quantifying attributes of topography, forest types, caribou habitat units and soon to be completed TEM units. TEM ground work has been completed, and the final product is expected to be returned in early 1999. Habitat use and availability analysis will be completed following techniques developed by Neu et al. (1974) to determine if use of some attributes varies significantly from availability. This data will be utilised to develop a caribou habitat suitability model for the area that will be used in refining ‘no harvest’ and ‘modified harvest’ areas for the study area.

7.0 LITERATURE CITED

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Appendix 1: Caribou Habitat Types in the Itcha-Ilgachuz Study Area

Caribou Habitat Type	Description and associated polygon units
DLLM	Dry Lichen/ Lichen Moss combination DL, DL/LM, DL//LM, LM/DL, LM//DL, DL//M
LM	Lichen Moss -lichen moss pure and lichen moss dominant over moss LM, LM//M
DLLM MOSAIC	Dry Lichen/ Lichen Moss Ecomosiac -combination of dry lichen or lichen moss with adjacent wetlands or seepage forests DL/SF, DL/W, W/DL, SF/DL, DL//SF, DL//SF, DL/S/W, W//DL, SF//DL, LM/SF, LM/W, W/LM, SF/LM, LM//SF, LM//W, W//LM, SF//LM
MDLLM	Moss/ Dry Lichen/ Lichen Moss -lichen moss, dry lichen, moss, leading but not dominant DL/M, M/DL, LM/M, M/LM
MSF	Moss/ Seepage Forest combinations -includes moss dominant over lichen moss and dry lichen M, M/SF, M//SF, SF, SF/M, SF//M , M//DL, M//LM
W/FW	Wetlands/ Forested Wetlands -includes wetlands with fringe forests or seepage forest of moss W, W//M, W//SF, W/M W/SF, M/W, SF/W, M//W, SF//W
FL	Fescue lichen meadows -includes fescue-lichen meadows with fringe forests of dry lichen or lichen moss and fescue-lichen/ wetland combinations FL, FL//W, FL/W, W//FL, W/FL, FL//DL, FL//LM, FL/DL, FL/LM
SBPS-DLK	SBPSxc - Dry Lichen/ Kinnikinnick combinations -includes dry lichen and kinnikinnick dominant over other SBPSxc units DL, DL/K, DL//K, K, K/DL, K//DL, DL//R, DL//LM
SBPS-OTHER	SBPSxc - units other than SBPS-DLK units

Symbols
A/B A leading over B (Amount of A = amount of B, in polygon)
A//B A dominant over B (Amount of A > amount of B, in polygon)

Appendix 2: Home Range Maps

Appendix 3: Combined Home Range Map

Appendix 4: Lifetime and Annual Home Ranges of 34 Radio-collared Caribou in 1995-98

Frequency #	Capture #	Lifetime Home Ranges (sq. km)	Monitoring Period	# Months	Status	Yearly Home Ranges (sq. km)		
						1995-96	1996-97	1997-98
Itcha-Ilgachuz Mountains herd								
150.754	1	1504	Oct. '95 - May '98	32		274	**746**	**1063**
150.662	2	3045	Oct. '95 - May '98	32		1325	**1841**	**1971**
150.807	3	3103	Nov. '95 - May '98	31		1660	**1639**	**1487**
150.691	4	3257	Oct. '95 - May '98	32		1112	**433**	**1468**
150.671	5	1729	Oct. '95 - Mar. '97	18	Dead	1241	1568	
150.826	6	2694	Oct. '95 - May '98	32		1467	**1190**	**1753**
150.816	7	3336	Oct. '95 - May '98	32		854	**2325**	**2150**
150.766	8	2027	Oct. '95 - Apr. '98	31	Dead	1272	**1364**	1473
150.612	10	3152	Oct. '95 - May '98	32		2058	**780**	**2042**
150.650	11	4498	Oct. '95 - May '98	32		933	**2252**	**1810**
150.561	12	3051	Oct. '95 - May '98	32		1095	**974**	**1532**
150.630	13	2136	Oct. '95 - Dec. '96	15	Dead	1334	420	
150.450	15	1718	Oct. '95 - Dec. '96	15	Dead	945	524	
150.463	17	3623	Nov. '95 - May '98	31		1171	**1945**	**1532**
150.432	18	2221	Nov. '95 - June '96	8	Dead	2208		
150.621	20	2152	Nov. '95 - May '98	31		1069	**1238**	**1072**
150.549	21	2522	Nov. '95 - May '98	31		1135	**939**	**1183**
150.571	22	3279	Nov. '95 - May '98	31		975	**945**	**1587**
150.511	23	942	Dec. '95 - June '96	7	Dead	696		
150.641	25	1994	Feb. '96 - May '98	28		23	**651**	**1649**
150.421	26	981	Feb. '96 - Dec. '96	11	Dead	76	851	
150.590	32	476	Feb. '96 - May '98	28		18	**251**	**346**
150.531	35	2218	Nov. '96 - May '98	19			353	**1578**
150.470	36	2330	Nov. '96 - May '98	19			984	**1487**
150.119	37	1302	Nov. '96 - May '98	19			288	**919**
150.321	38	398	Feb. '98 - May '98	4				398
Rainbow Mountains herd								
150.701	9	3805	Oct. '95 - May '98	32		1603	**989**	**853**
150.522	27	2128	Feb. '96 - May '98	28		48	**1323**	**1162**
150.602	28	1308	Feb. '96 - May '98	28		67	**942**	**626**
150.500	29	1255	Feb. '96 - May '98	28		124	**884**	**904**
150.441	30	1856	Feb. '96 - May '98	28		8	**794**	**1249**
150.682	31	296	Feb. '96 - Aug. '96	7	Failure	29	33	
150.581	33	1650	Nov. '96 - May '98	19			337	**833**
150.350	34	1100	Nov. '96 - May '98	19			333	**904**
Averages		2150		24		886	972	1297

* Bolded numbers represent complete years (12 months) of data