Recovery Strategy for Three Woodland Caribou Herds (*Rangifer tarandus caribou*; Boreal population) in Labrador

Prepared By:

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Disclaimer:

The Recovery Strategy for Woodland Caribou (Boreal population) in Labrador was prepared by the Labrador Woodland Caribou Recovery Team to identify recovery strategies, based on sound biological principles, to protect and recover Woodland caribou (Boreal population). It does not necessarily represent official positions of agencies and/or the views of individuals involved in the document's preparation. The goals, objectives and recovery actions identified in the recovery document are subject to the program priorities and budgetary constraints of the participating agencies and organizations. Goals, objectives, and recovery approaches may be modified in the future to accommodate new objectives or findings.

Acknowledgments:

This Recovery strategy for Woodland caribou (Boreal population) was prepared in response to the designation of 3 caribou herds in Labrador as 'Threatened' under the Endangered Species Act of Newfoundland and Labrador on July 31, 2002 (NL ESA E-10.1, 2001). The Labrador Woodland Caribou Recovery Team acknowledges the financial support of the Province of Newfoundland and Labrador (Inland Fish and Wildlife Division, Endangered Species and Biodiversity Program) in the completion of this strategy.

We would like to recognize the contribution of the many biologists, aboriginal groups and agencies whose efforts in collecting and assembling the caribou data over the years have enabled an assessment of the status, threats, and recovery potential faced by sedentary woodland caribou herds in Labrador.

Mike Cahill's previously completed compilation on the distribution and population trends of Labrador caribou herds provided a valuable foundation for a similar section in this plan.

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We are indebted to Mary Rothfels and the members of the National Boreal Caribou Technical Committee for sharing their insights and collective knowledge on caribou ecology and respective approaches taken in assessing risk, and designating and managing critical habitat, for woodland caribou populations across Canada.

Recommended Citation

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Executive Summary:

The Recovery Strategy for Woodland Caribou (Boreal population) in Labrador is a document prepared by the Labrador Woodland Caribou Recovery Team to identify recovery strategies deemed necessary, based on sound biological principles, to protect and recover sedentary Woodland caribou. This Recovery Strategy was prepared in response to the designation of the Lac Joseph, Red Wine Mountains and Mealy Mountains caribou herds as 'Threatened' under the Endangered Species Act of Newfoundland and Labrador on July 31, 2002 (ESA E-10.1, 2001). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has also designated sedentary Woodland caribou, including these herds, as 'Threatened' in 2001, and they are listed in Schedule 1 of the federal *Species at Risk Act (SARA)* as well.

Section I pertains wholly to recovery, and includes recovery goals and objectives, approaches and specific steps required to meet these, and actions that are completed or underway within each of the described approaches. The primary goals of the recovery strategy are to prevent the extinction of and improve the status of current herds until they are viable, self-sustaining populations distributed throughout their available current and historic ranges. Actions required to recover sedentary woodland caribou herds will be focused in 4 main areas: stewardship and education; habitat protection; research and monitoring; and management and protection. We outline specific steps that will be taken within each of these approaches, the anticipated outcome, and refers to the particular recovery objectives addressed by the proposed actions.

Section II provides background information on the distribution and population status for each listed herd, examines historical and potential threats faced by these herds, and outlines the ecological and cultural role of caribou in Labrador. Three herds, the Lac Joseph herd (LJH), the Red Wine Mountains herd (RWMH), and the Mealy Mountains herd (MMH) form a continuum across southern Labrador and northeastern Québec, and are bounded to the north by the migratory George River herd. Herd range adjacencies and the absence of geographical barriers between them result in range overlap, and during the winter, migratory forest-tundra caribou (*migratory* ecotype) enter outer portions of the ranges resulting in intermingling of animals from multiple herds. While historical ranges remain largely intact, changes in range use (associated with declines in population size), have occurred in all herds. Current recruitment rates in all herds indicate good recovery potential despite declining population trends, and suggest that mortality, not recruitment, may be a significant limiting factor for these herds.

Several threats contributing to the population decline or limiting recovery of sedentary woodland caribou herds in Labrador have been identified. Legal and illegal hunting and incidental mortality that occur when sedentary animals mix with winter aggregations of the migratory George River caribou herd, are a primary threat. Other factors, ranging from habitat loss and alteration to various types of disturbance, also exist. Most threats are interdependent and differ in terms of their relative current and historical significance among herds.

The approach that will be undertaken to define critical and recovery habitat is also described in Section II. Critical and recovery habitat are discussed in context of the population goals for short and long-term persistence, or survival and recovery.
From an applied perspective, these are the areas required to sustain minimum and viable populations, respectively. To derive scientifically credible definitions, both habitat and population goals are founded in the biological requirements and population ecology of the herds.

The Recovery Team has concluded that recovery of all 3 herds is ecologically and

technically feasible. While considerable portions of all 3 herd ranges are still intact, and several protected areas have been proposed, several challenges remain. Illegal hunting continues to limit recovery and/or contribute to observed declines. Additionally, resource development and extraction activities continue to increase, previously inaccessible areas are becoming so, and no protected areas have been formally established. Recruitment data suggest that the inherent capacity of all 3 herds to recover is excellent if these challenges can be managed or overcome.

The purpose of the Recovery Strategy for sedentary woodland caribou in Labrador is to outline a course of action that will lead to the recovery and de-listing of the Lac Joseph, Red Wine Mountains and Mealy Mountains caribou herds under the Endangered Species Act. Details regarding actions necessary to implement the Strategy will be included in an accompanying Action Plan, to be drafted within the next 2 years. The Recovery Strategy will be updated as new information becomes available, and revised very five years until recovery has been achieved.

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I. RECOVERY

1. Recovery Goals

- To prevent the extinction of current herds;
- To improve the status of current herds;
- To determine and achieve viable, self-sustaining wild populations distributed throughout their available current and historical ranges for each of the three threatened Woodland caribou (Sedentary, Boreal population) herds.

2. Recovery Objectives

2.1 Demographic indices for each herd must be consistent with a stable or increasing population, and herd size should show an increasing trend over a five-year period, or until the recovery goals are reached.

2.1.1 The ratio of annual recruitment versus total mortality must $ 1.

2.1.2 Annual adult survival (> 1 yr) should average $ 0.85 over a 5-year period.

2.1.3 Late winter recruitment (% calves in total population) should be > 15%.

2.1.4 Parturition rates in early June should be ≥ 0.85 for adult females > 2yrs old.

2.1.5 Population size should be stable or show an increasing trend.

2.2 To identify and protect critical and recovery habitat

2.3 To foster stewardship for the recovery and conservation of sedentary Woodland caribou, and to inform the public of ongoing research, monitoring activities, and rationale for any management actions undertaken.

2.4 To clarify, assess and prioritize existing threats with respect to the level of risk they pose to the recovery of each herd.

3. Approaches to Meet Recovery Objectives

Actions required to recover sedentary woodland caribou herds in Labrador may be grouped under 4 primary headings: stewardship and education; habitat protection; research and monitoring; and management and protection. Table 1 outlines specific steps that will be taken within each of these approaches, the anticipated outcome, and refers to the particular recovery objectives addressed by the proposed actions. All listed actions have been deemed necessary for the recovery of sedentary woodland caribou herds in Labrador by the recovery team; however to assist participating agencies and organizations in identifying priorities given budgetary constraints, priority designations of either 'urgent' or 'necessary' have been assigned. Details regarding actions necessary to implement the steps outlined in Table 1 will be found in the Action Plan, to be drafted within the next 2 years. In the interim, the Recovery Team will detail urgent items requiring immediate action.

Table 1: A summary and outline of the strategies, specific actions and anticipated outcomes, and their priority, for the recovery of sedentary woodland caribou herds in Labrador.

Priority	Objective	Strategy	Specific Steps	Anticipated Effects*
Urgent	2.3	Stewardship & Education	• Establish and develop an education and stewardship program to nurture support for sedentary woodland caribou and their habitats. These efforts should be coordinated with the province of Québec and Québec Innu for herds with shared jurisdiction and for communities proximate to the Labrador border on the Lower North Shore of Québec. • Prepare communication materials such as posters and road signage in hunting zones, and avail of local radio and other media.	Opportunity for active engagement of stakeholders and the public in the monitoring, management and conservation of sedentary woodland caribou. Improved support for and acceptance of the status and recovery of threatened herds among local residents of all ancestries.

Priority	Objective	Strategy	Specific Steps	Anticipated Effects
Urgent	2.3	Stewardship & Education	• Develop cooperative stewardship agreements involving aboriginal groups, government agencies and non-governmental interest groups. Where required, these agreements should include Québec Innu communities. • Public pressure to open new hunting zones for migratory caribou in new areas where range overlap occurs between sedentary and migratory woodland caribou herds during winter should be addressed through public education with respect to the risk this poses to threatened herds, and should involve long-term Labrador and Québec residents/hunters.	A substantial reduction or elimination of illegal harvest. A substantial reduction in incidental harvest.

*General, refers to all 'Specific Steps' listed.

Priority	Objective	Strategy	Specific Steps	Anticipated Effects
Urgent	2.2, 2.4	Habitat Protection	• Delineate critical and recovery habitat -Create a standardized approach for their delineation. -Develop a functional definition using quantitative techniques relating location data with landscape features. -Map critical and recovery habitat for each local population • Map existing protected and managed areas relative to critical and recovery habitat, identify gaps in protection and develop priorities based on areas most at risk. • Communicate and liaise with land users on the location of critical and recovery habitat and its protection.	Identify both geographically and in a functional context, habitat required for survival and recovery for each herd. Provide the information required to make informed management decisions. Identify priorities for further research, and areas in need of protection and/or mitigation.

Priority	Objective	Strategy	Specific Steps	Anticipated Effects
Necessary		Habitat Protection	• Support and assist the process of establishment of a Wilderness Reserve in the Lac Joseph-Atikonak area, and provide the biological information necessary to ensure reserve boundaries encompass critical areas.	Will ensure habitat protection of a portion of the Lac Joseph caribou herd range.
			• Support the establishment of a National Park in the Mealy Mountains in principle and in process, by sharing biological information.	Will ensure habitat protection of a portion of the Mealy Mountains caribou herd range.
			• Support the Innu Nation initiative to establish protected areas for RWMH caribou, including those outlined during forest management planning.	Will ensure habitat protection of a portion of the Red Wine Mountains caribou herd range.
			• Evaluate the impact of changes in land use, including industrial developments, forestry and new infrastructure, on the availability and biological integrity of critical and recovery habitat.	Assist in more informed decision-making.
			• Develop guidelines and recommendations to mitigate impacts of resource-based activities in critical and recovery habitat.	Development of regulations and best management practices for activities occurring in critical and recovery habitat.

Priority	Objective	Strategy	Specific Steps	Anticipated Effects
Urgent	2.1, 2.2, 2.4	Research & Monitoring	• Inventory methods must be standardized between herds to permit comparison of results. • Delineate current annual and seasonal ranges for each herd, and compare them to historical ranges to assess changes over time. • Recruitment and mortality rates to be determined annually. • Establish a central database for all caribou locational and demographic data. • Determine the relative importance of real and potential sources of mortality by reviewing mortality records and assessing risk of proposed activities. • Identify environmental features related to caribou occurrence. • Develop and implement a research strategy listing research needs and their priority. • Identify funding opportunities including grants, cooperative ventures, special funds, hunting surcharges etc. that could be used to fund research activities.	Summary of existing information can be used to derive herd-specific population growth-rates (λ). Assist in informed decision-making Identification of sources of mortality and their relative significance between herds; Development of appropriate mitigation. Improved understanding of species-habitat relationship for sedentary herds.

Priority	Objective	Strategy	Specific Steps	Anticipated Effects
Necessary		Research & Monitoring	• Determine population goals by undertaking a quantitative population viability analysis coupled with a range analysis. • Integrate scientific, aboriginal and local knowledge of the woodland herds in Labrador. • Develop an inventory program to survey populations at least every 5 years, including generating confidence limits. • Determine degree of exchange of individual animals among sedentary herds, and between sedentary and migratory herds, using location information garnered from satellite collared-animals. Couple this information with genetic data.	Results can be used to assess and document the success or failure of recover efforts Full participation in recovery planning and a sense of ownership of the process. Improved understanding of the metapopulation dynamics of sedentary caribou herds in Labrador, and a better grasp of the viability of individual herds or subpopulations.

Priority	Objective	Strategy	Specific Steps	Anticipated Effects
Necessary	2.1, 2.4	Management & Protection	• Allocate adequate financial and human resources to enforce conservation measures in existing legislation. • Continually evaluate the ability of existing resources and modify as necessary to meet current needs or future challenges. • Recommend appropriate protection where insufficient protection occurs, including the development of conservation areas, and a review of George River caribou hunting extension zones (used to protect sedentary animals from hunting mortality in the absence of large numbers of migratory animals moving into the range of sedentary herds). • In the event that a herd or population is deemed by the recovery team not to be self-sustaining in the wild, invasive or intensive management including (but not limited to) translocations, augmentations, predator exclosures, and modified seasons for predators and competing species will be considered to restore population(s). The implementation of any such management program must be based on sound scientific evidence that demonstrates that the particular action will prevent extirpation and allow the population to recover. It would also be subject to public consultation prior to implementation. Because of the sensitivity of and uncertainties associated with predator control, it will not be undertaken -Unless the herd is at risk of extinction (i.e. below a threshold size or demographic profile set by the recovery team) -If predator populations are themselves at risk, and unless there is strong evidence that without it, other recovery measures will not succeed; or: -If continuous, long-term predator control is deemed necessary to recover the herd.	Reduction of illegal hunting. Reduced mortality. Maintain or augment populations.

4. Potential Impacts of Recovery Strategy on Other Species/Ecological Processes

Sedentary woodland caribou are extremely suited to the ecological conditions of the low subarctic forests and high boreal ecoregions in which they occur, a fact reflected in their historical ranges and persistence in Labrador. Their ties to these ecoregions are such that they may be considered a 'flagship species', a concept that recognizes conservation of individual key species will often also protect other components of the ecosystems. Caribou are the largest mammalian herbivores in boreal/subarctic systems (although moose are also present, particularly in wooded river valleys). As such, sedentary woodland caribou comprise a consistent, year-round prey base for predators, unlike the prey species contained within the orders *Rodentia* and *Lagomorpha*, whose populations fluctuate dramatically over time. Recovery of sedentary woodland caribou herds to historical levels and over historical ranges may also support higher populations of northern carnivores such as gray wolves, black bears, coyotes, and scavengers.

5. Actions Completed or Underway

There are several stewardship, monitoring, habitat protection and recovery activities directed toward one or several of the three threatened woodland herds in Labrador. These are listed below:

<u>Stewardship &Education</u>

- Labrador Species at Risk Stewardship Program (LSARSP):
  Through the Government of Canada's Habitat Stewardship Program for Species at Risk (HSP), funding has been secured since 2001 to hire a stewardship facilitator within both the Innu Nation and the Labrador Inuit Association. The stewardship facilitators have been active in influencing a stewardship ethic within their communities. Discussions have also taken place with the HSP coordinator from Québec to encourage the development of a similar program in that province. The aboriginal community in Québec has also been made aware of this program and has been encouraged by the Innu stewardship facilitator to apply to CWS Québec Region for HSP funding to implement a similar program. In March of 2002 a stewardship workshop was held at North West River to introduce the Innu and Inuit communities to LSARSP, to seek their input into issues and to provide guidance for the implementation of the stewardship program. Representatives of the Québec Innu (Mamit Innuat) attended this workshop.

  The Alder Institute, as a component of the LSARSP, produced "Rare Air", a series of audio programs on Labrador species at risk. Audio materials containing information about the biology, ecology, and habitat needs of species at risk in Labrador, as well as their evolving relationships with the human communities and stewardship efforts were produced in English, French, Innu-Aimun, and Inuktitut. A total of 8 hours of radio programming were produced as well as 16 public service announcements. These programs were broadcast on various radio stations and are also available at www.alder.nf.ca . Two programs specifically targeted woodland caribou "Caribou: history, practice, spirituality" and "Innu Elders discuss the Red Wine Mountain caribou herd".

  Three general species at risk posters were produced and widely distributed, one in Innu-Aimun, English and French, one in Inuktitut and English and one in English, French, Innu-Aimun and Inuktitut. One poster specific to sedentary woodland caribou was produced in Inuktitut and English.

  A species at risk calendar was produced in English and Inuktitut. It combined historic

and current photos and children's art, and delivered a strong stewardship message. A brochure on Species at risk was produced in Innu-Aimun and English and highlighted sedentary woodland caribou.

- The Labrador Inuit Association is working to incorporate relevant components of Inuit 'Customary Law' into resource management policy and to revive traditional concepts of stewardship.

- The Innu Nation stewardship program member conducted media interviews for CBC and on Innu radio stations regarding area closures in regions where both sedentary and migratory woodland caribou ecotypes were occurring. Signage (in English, French, Innu Aimun) was erected at access areas to these protected zones.

- Several articles on the general ecology and distribution of sedentary woodland caribou herds in Labrador were written and published in local newspapers by members of the Recovery Team.

Habitat Protection

Portions of the ranges of all three herds are being considered within proposed protected areas. These include national parks, provincial wilderness reserves, and areas set aside under forest management plans.

- The Parks and Natural Areas Division and the Wilderness and Ecological Reserves Advisory Council (WERAC) began examining the possibility of a wilderness reserve in southwestern Labrador in 1973. The Lac Joseph-Atikonak Lake area has been identified as a major calving and summering area for the threatened Lac Joseph Woodland Caribou herd.
  On several occasions (1993 & 1995) and more recently in February 2003, the Advisory Council has engaged in discussions with the general public and local interest groups in western Labrador. Discussions and education campaigns have yielded positive results. The Parks and Natural Areas Division and WERAC will continue to work with provincial and local groups to pursue the areas' designation as a wilderness reserve.

- The Mealy Mountains area of Labrador was first identified as a candidate site for the establishment of a national park in 1976 and in March 2001 the federal government funded feasibility study. This proposal has gained support from local communities, and the proposed park has been named as 1 of 10 new parks to be established within the next 5 years.

- The forest management plan for central Labrador (District 19) includes extensive areas protected from commercial and domestic forestry harvesting to protect habitat areas of notable ecological and cultural importance. Included among these regions is a portion of the Red Wine Mountains caribou herd range, a significant concession given the accessibility and value of forests in this area.

Critical Habitat

Substantial groundwork has been laid to facilitate the process of designating critical habitat, and to ensure completeness and soundness of the final designation. The following list describes current actions:

- Identification of data requirements, and an assessment of the adequacy of existing information to address these needs.

- A compilation of historical kill sites of sedentary woodland caribou has been assembled by the Innu Nation. This data will be incorporated into the critical habitat designation process.

- A survey of existing remotely-sensed and topographical information available for central Labrador has been undertaken. This process included the identification of data gaps and the location and cost associated with acquiring missing landscape information.

Research & Monitoring

Regular locational monitoring has been directed at the Lac Joseph and Red Wine Mountains herds over the past 10 years. In 2002-2003 renewed efforts to determine the distribution and density of the Mealy Mountains herd began. All 3 herds have been surveyed to estimate population size at least once since 2001.

- Mealy Mountains Herd: Beginning in 2002, 6 animals were fitted with Very High Frequency (VHF) radio-collars in order to improve understanding of range use and herd distribution in this herd. A late winter classification was conducted in March of 2002, and an additional 11 radio-collars were also deployed. Furthermore, in 2003, a randomized block survey of areas within the 'impact corridor' (10 km on either side of the proposed road) during calving and post calving was conducted for the proposed route and an alternate route as part of the environmental impact assessment for the proposed extension to the Trans-Labrador Highway between Goose Bay and Cartwright .

- Red Wine Mountains Herd: As most of the range of this herd is contained within the low-level flying training area, DND regularly monitors this herd as part of its mitigation program. Currently, there are 17 radio-collared (primarily VHF) animals, comprising about 20% of the total herd. Each June, radio-collared females are assessed for their reproductive status, and classifications are conducted during late fall and winter. This information is adequate to assess sources and timing of mortality and annual herd productivity.

- Lac Joseph Herd: Range use and distribution of this herd is currently monitored remotely via 12 animals fitted with ARGOS satellite transmitters. These radio collars transmit locations weekly between March through September, and monthly during all other months. In addition, all radio-collared caribou are assessed for their reproductive status each June. Herd classifications are conducted regularly in the fall, and occasionally during late winter.

6. Evaluation

The ultimate indication of a successful recovery would be the attainment of the demographic parameters (as indicated by monitoring) listed under 'Recovery Objectives', and an increasing population trend, approaching recovery goals, in each of the 3 threatened herds.

The following list outlines other key indicators that can be used to evaluate the progress of implementation of the Recovery Strategy.

- A map of current occurrence for each herd, coupled with a delineation of critical and potential or recovery habitat.
- Identification of areas of critical and recovery habitat that may be at risk.
- Cooperative stewardship agreements, and local stewardship programs, between aboriginal groups, government agencies and other parties.
- Frequent and regular visits by compliance officers to accessible and inaccessible areas within the herds' ranges.
- A reduction in incidental mortality, and loss of animals to illegal harvest.
- Continued collection and analysis of demographic data, including an assessment of population viability.
- An improved understanding of the characteristics and functional attributes of sedentary woodland caribou habitat in Labrador.
- An improved understanding of the relative importance of different sources of mortality and their real and potential effects on population growth based on a review of existing mortality records.
- Standardized censuses conducted at suitably regular intervals.

II. BACKGROUND

7. Species Information

Common Name:
Woodland Caribou (Boreal population)
Napattumiutait Tuktuit (Inuktitut)
Minashkuau Atik (Innu Aimun)

Scientific Name:
Rangifer tarandus caribou

COSEWIC Assessment Summary

Status:
Threatened

Reason for Designation:
A widespread population ranging across the boreal forests of northern Canada. Populations have decreased throughout most of the range. Threatened from habitat loss and increased predation, the latter possibly facilitated by human activities.

Occurrence:
NT BC AB SK MB ON QC NL

Status History:
May, 2002 (No change)

8. Distribution

General Distribution

Forest-dwelling boreal caribou range over a large portion of northern Canada from the Mackenzie Mountains in the west to south-central and coastal Labrador in the east (Thomas and Gray 2002; COSEWIC 2001). Across North America, sedentary populations of woodland caribou have experienced range contractions and population declines in the last three decades (Bergerud 1974, Seip 1992, Rettie and Messier 1998; Schaefer et al. 1999; 2003). In Labrador, three herds are currently recognized: the Lac Joseph herd (LJH), the Red Wine Mountains herd (RWMH), and the Mealy Mountains herd (MMH). These herds form a continuum across southern Labrador and northeastern Québec, occupying areas of up to 59 000 km^2, 46 000 km^2 and 28 000 km^2 respectively, and are bounded to the north by the migratory George River herd (Fig. 1). Herd range adjacencies and the absence of topographical barriers between the herds result in range overlap, and during the winter, migratory forest-tundra caribou (*migratory* ecotype; Bergerud 1988) enter

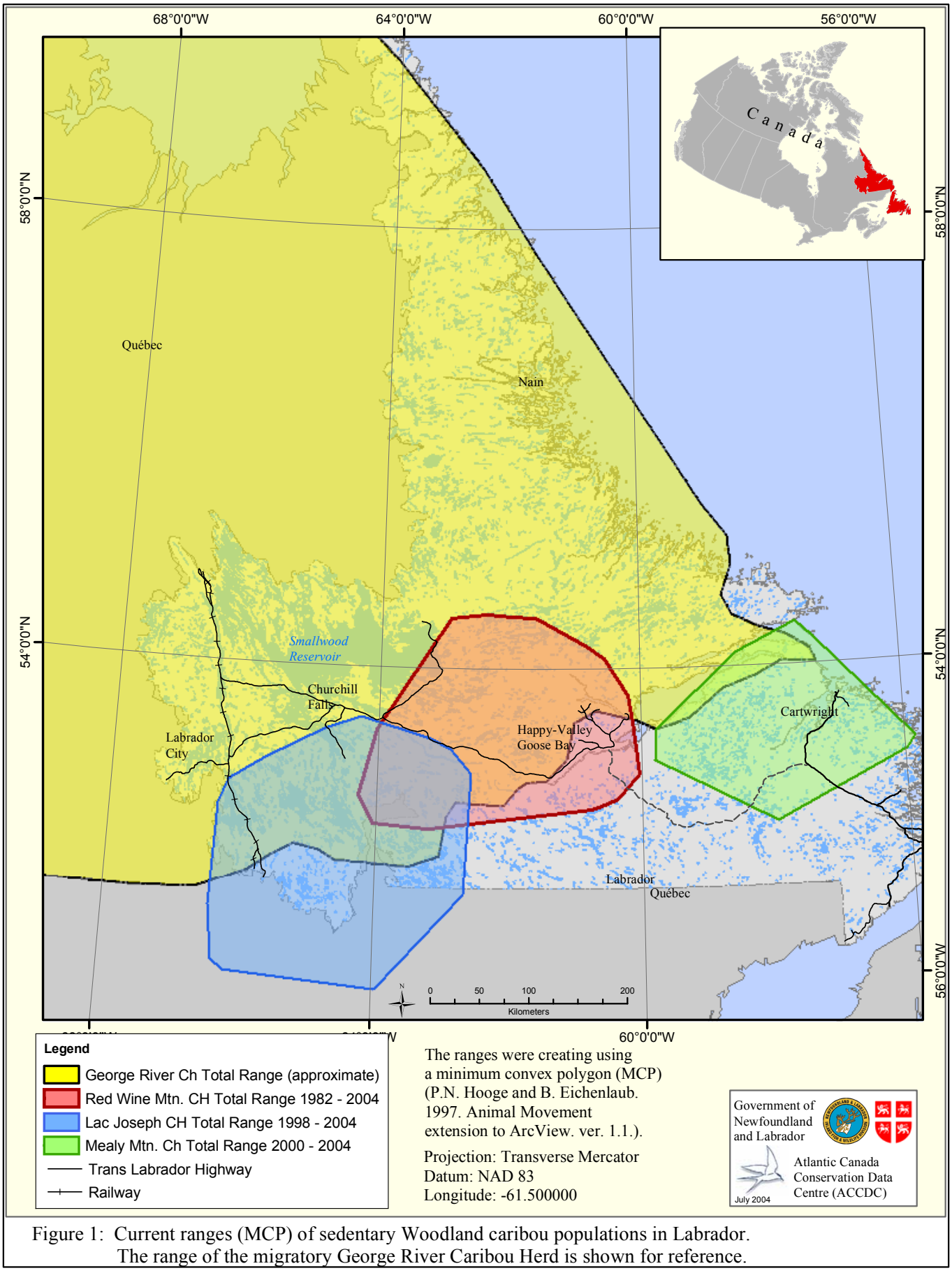

Figure 1: Current ranges (MCP) of sedentary Woodland caribou populations in Labrador. The range of the migratory George River Caribou Herd is shown for reference.

northern portions of the three southern herds resulting in intermingling of animals (Brown et al. 1986; Québec FAPAQ and NL Wildlife Division, DND in Litt.). Ecotypes are classes of populations that have adapted to different landscapes or environments, and are distinguished on the basis of migratory habits and feeding behaviour (Thomas and Gray 2002). Bergerud recognized sedentary/migratory and montane/boreal ecotypes (Bergerud 1988), and woodland caribou in Labrador belong to the *sedentary* ecotype. All 3 herds occur in the southern taiga and boreal ecozones (Brown and Theberge 1985; Meades 1990). The Red Wine Mountains and the Mealy Mountains are the dominant topographical features for the Red Wine Mountains and Mealy Mountains herd ranges, and consist of rounded, barren hills dominated by tundra vegetation (ericaceous shrubs, lichens, grasses and sedges). The Romaine River Mountains occur in the eastern portion of the Lac Joseph herd range. At lower elevations, a mosaic of open conifer-lichen forest, extensive peat bogs, lakes, rivers and river valleys, and streams occur within each range. A small number of *sedentary* woodland caribou occur in 2 remnants of existing herds due to the range contraction, historically referred to as the St. Augustin herd and the Dominion Lake herd (Brassard 1972). It should be noted that the ranges of all three herds noted below will be continually updated and modified as necessary as new information such as local and aboriginal knowledge becomes available.

Range Description: Lac Joseph Caribou Herd

This herd has been identified as a distinct population since the mid 1800s (Folinsbee 1979; Banfield and Tener 1958). Bergerud (1974) indicated that the herd occurred south of the Lake Michikamau (now the Smallwood Reservoir), south to 51^0 N and between 62^0 W and 66^0 W. The herd is currently found primarily in a region south of the Trans-Labrador Highway (TLH) between Winokapau Lake (on the Churchill River) in the east and Wabush to the west (Fig. 2a, 2b). Sainte-Martin and Theberge (1986) estimated the range size to be 35 000 km^2. The range is bisected by the Québec North Shore and Labrador Railroad. Historical accounts of range use suggest that LJH caribou have a strong fidelity to their range, typical for a sedentary woodland caribou herd. This remains true in spite of several incursions of migratory GRCH into LJH winter range since 1987 (NLWD in Litt.; Couturier et al. 1999).

Seasonal range use by LJH has changed with fluctuations in herd size. Bergerud (1963b) indicated that traditional calving areas were large muskegs and string bogs north of 52^0 N. Traditionally, the LJH calved in 2 general areas: north of the Trans-Labrador Highway, and around Lac Joseph and Atikonak Lake (Folinsbee 1979; Pilgrim 1978). However, following a decline in herd size beginning in the 1970s, few females were found in the Lac Joseph-Atikonak Lake area (Folinsbee 1976; Jean 1976; Folinsbee 1979). Saint-Martin and Theberge (1986), based on radio-telemetry data, found that female caribou dispersed over most of the annual range, and that densities were below 0.03 caribou per km^2. Similarly, Brown et al. (1986)reported that based on a sample of 18 radio-collared caribou, the LJH exhibited a highly dispersed distribution during calving and a general fidelity toward general calving locations (82 % of these animals were located less than 10 km from their previous year's site).

Saint-Martin (1987) speculated that the northern calving range (as described in Folinsbee 1979) was abandoned after 1970 due to flooding and/or increased traffic on the TLH and that summer ranges were simply extensions of the calving ranges. During October, caribou densities increase to 2.5 caribou per km^2 on the rutting range (Brown et al. 1986). Historical winter ranges

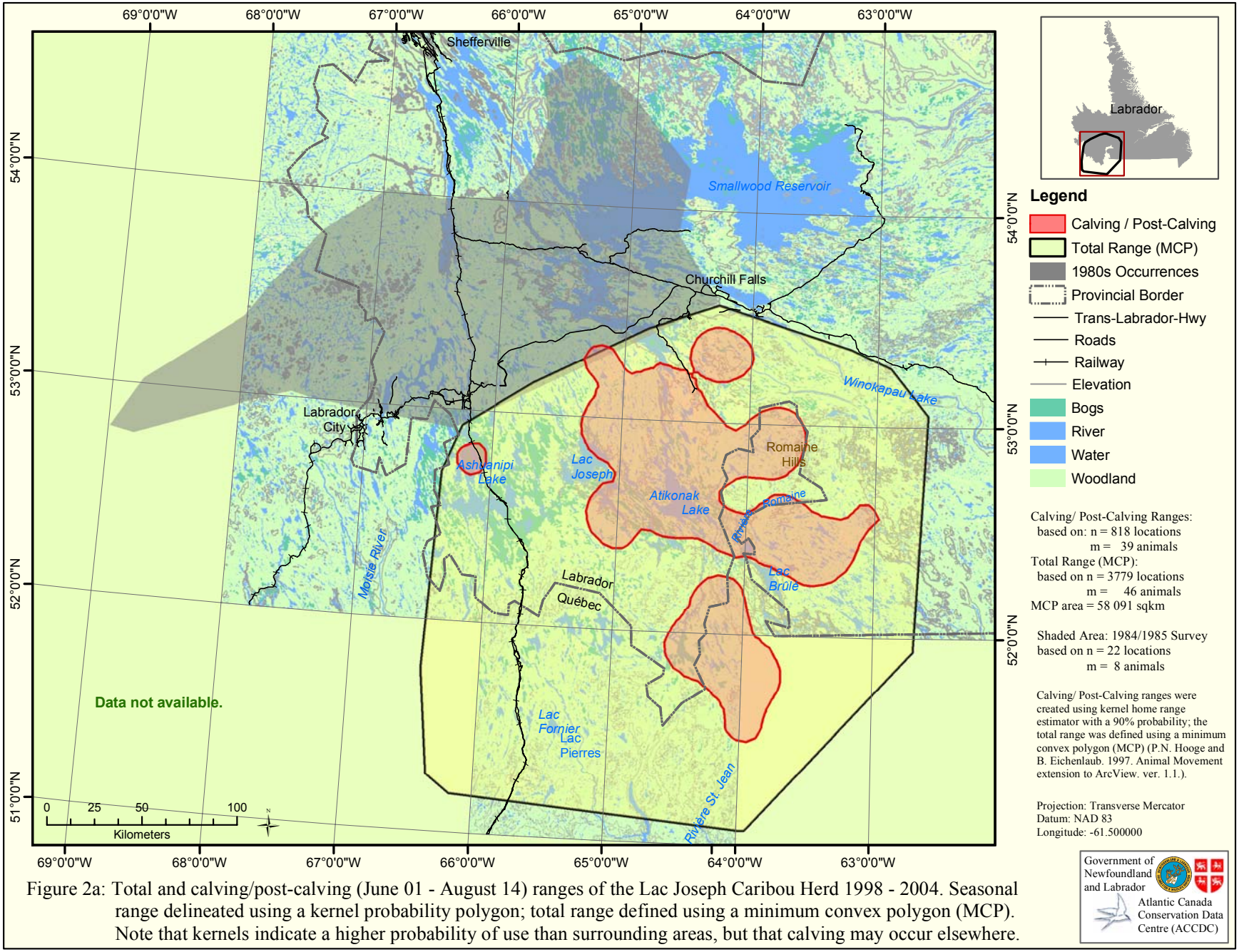

Figure 2a: Total and calving/post-calving (June 01 - August 14) ranges of the Lac Joseph Caribou Herd 1998 - 2004. Seasonal range delineated using a kernel probability polygon; total range defined using a minimum convex polygon (MCP). Note that kernels indicate a higher probability of use than surrounding areas, but that calving may occur elsewhere.

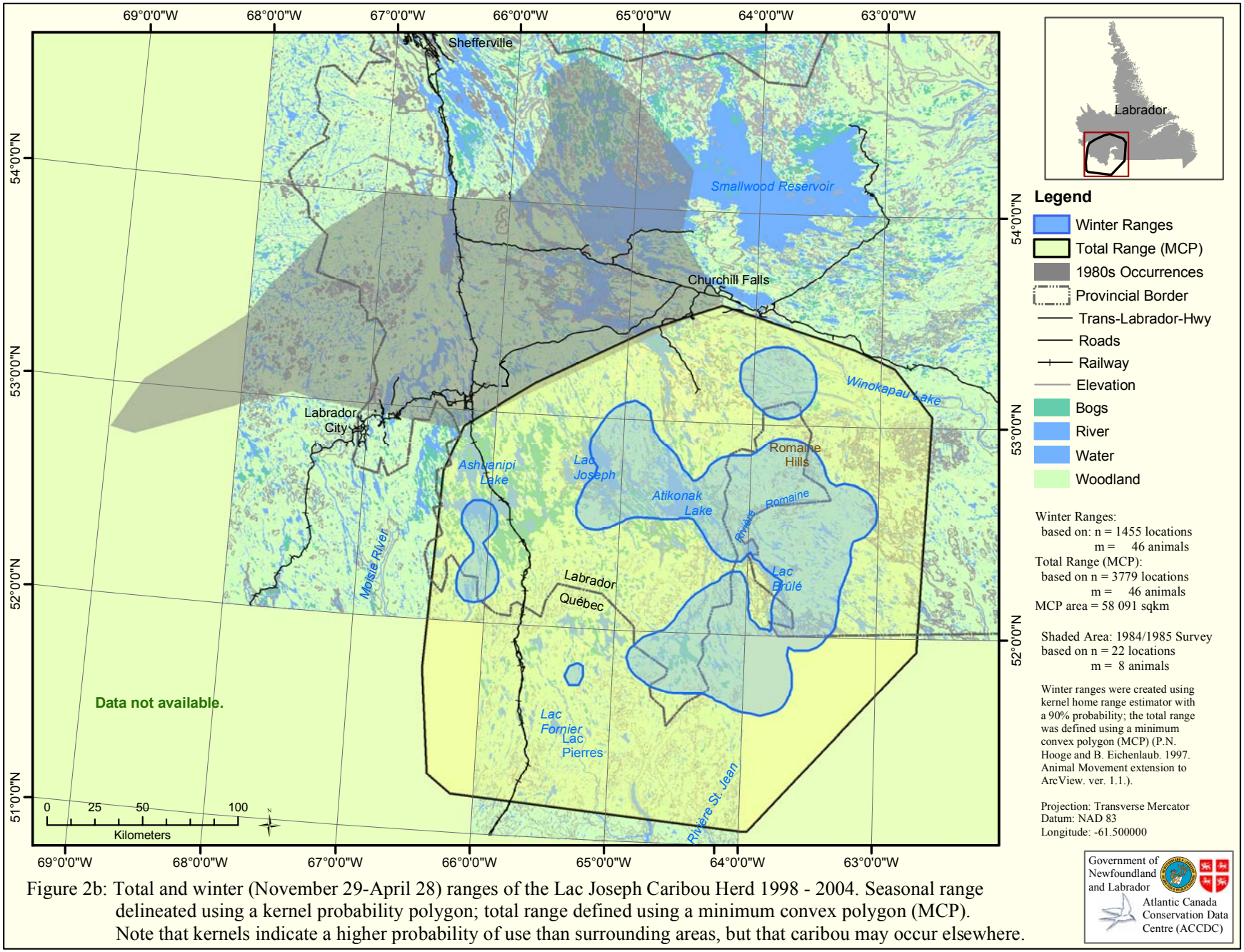

Figure 2b: Total and winter (November 29-April 28) ranges of the Lac Joseph Caribou Herd 1998 - 2004. Seasonal range delineated using a kernel probability polygon; total range defined using a minimum convex polygon (MCP). Note that kernels indicate a higher probability of use than surrounding areas, but that caribou may occur elsewhere.

(as described in Folinsbee 1979) included the area between the Moisie River and the Québec North Shore and Labrador Railroad from just south of Labrador City, south to the Lac Pierres-Lac Fournier region, then widening to a point described by a horizontal line north of Lac Manitou between the Marguerite River and St. Jean River. Bergerud (1994) described the winter range as the uplands and sand flats along river courses south of 52^0 N between the Marguerite River and St. Jean River to north of Lac Manitou. A recent study designed to assess the current winter range of the LJH by Couturier et al. (1999) indicated that the Lac Brule and Romaine hills were used. Figures 2a and 2b depict the current range, including calving and wintering areas, of the LJH, based on VHF and satellite-collared caribou from 1998 to 2004.

During winter, LJH caribou used forest-wetland habitat more than upland tundra areas (Brown et al. 1986; Saint-Martin and Theberge 1986), though this observation may simply be related to snow depth. In an effort to determine the effect of snow conditions on the foraging preferences and distribution of caribou, Folinsbee (1975a, 1978) studied the physical characteristics of the traditional winter range of LJH. He found that wintering ranges had significantly lower snow depths than areas not used, and that snow conditions under the forest canopy were softer and shallower than outside areas. He concluded that these factors were important to the fidelity of LJH caribou to their winter ranges, but noted that snow depths even within the ranges exceeded apparent threshold depths for movement determined by other researchers. Brown and Theberge (1990) also examined the effect of extreme snow cover and feeding site selection by RWMH caribou, finding that snow depth and hardness influenced cratering activity, and that cratering would not occur above a threshold depth. Winter range use is the most variable of all seasonal distributions (Folinsbee 1979; Brown 1986; Ferguson and Messier 2000), as is common among woodland caribou.

Range Description: Red Wine Mountains Caribou Herd

The existence of a distinct caribou herd in central Labrador was first described in the literature by Bergerud (1963a), who observed approximately 150 animals during the winter of 1958, and named it the Red Wine Mountains caribou herd. The herd range was initially described by Brown and Theberge (1985) as an area of 26 000 km^2 centered on the Red Wine Mountains (elevations 600 - 900 m), and the surrounding upland boreal plateau (elevation 400m). Other prominent geographical features include several major river valleys, extensive string bogs, and numerous water bodies. The landscape is also characterized by open conifer-lichen forests, tundra and low shrubs at higher elevations, and closed conifer forests including burned areas. The area is remote, and permanent settlements are restricted to the vicinity of Happy-Valley Goose Bay, in the extreme eastern portion of the range. The Trans-Labrador highway bisects the RWMH range. Trapping and hunting activities are confined largely to a corridor around this road. Logging activities have been restricted to an area less than 50 km north and west of Goose Bay, but are to include previously inaccessible areas south of the Churchill River.

Brown (1986) described the historical range as extending from the Kanairiktok River in the north to Grand Lake in the east, the Smallwood Reservoir in the west, and to about 40 km south of the Churchill River in the south. When reevaluated by Bergerud (1994), the range description was only slightly modified from previous descriptions. Caribou densities were estimated at 0.03 animals per km^2 in 1986 (Brown 1986; Brown et al. 1986), and again in 2000 (IEMR personal communication), despite a range contraction over this same period. Most seasonal ranges occurred on the forest-wetland matrix of the plateau, but during late winter (March-April) caribou

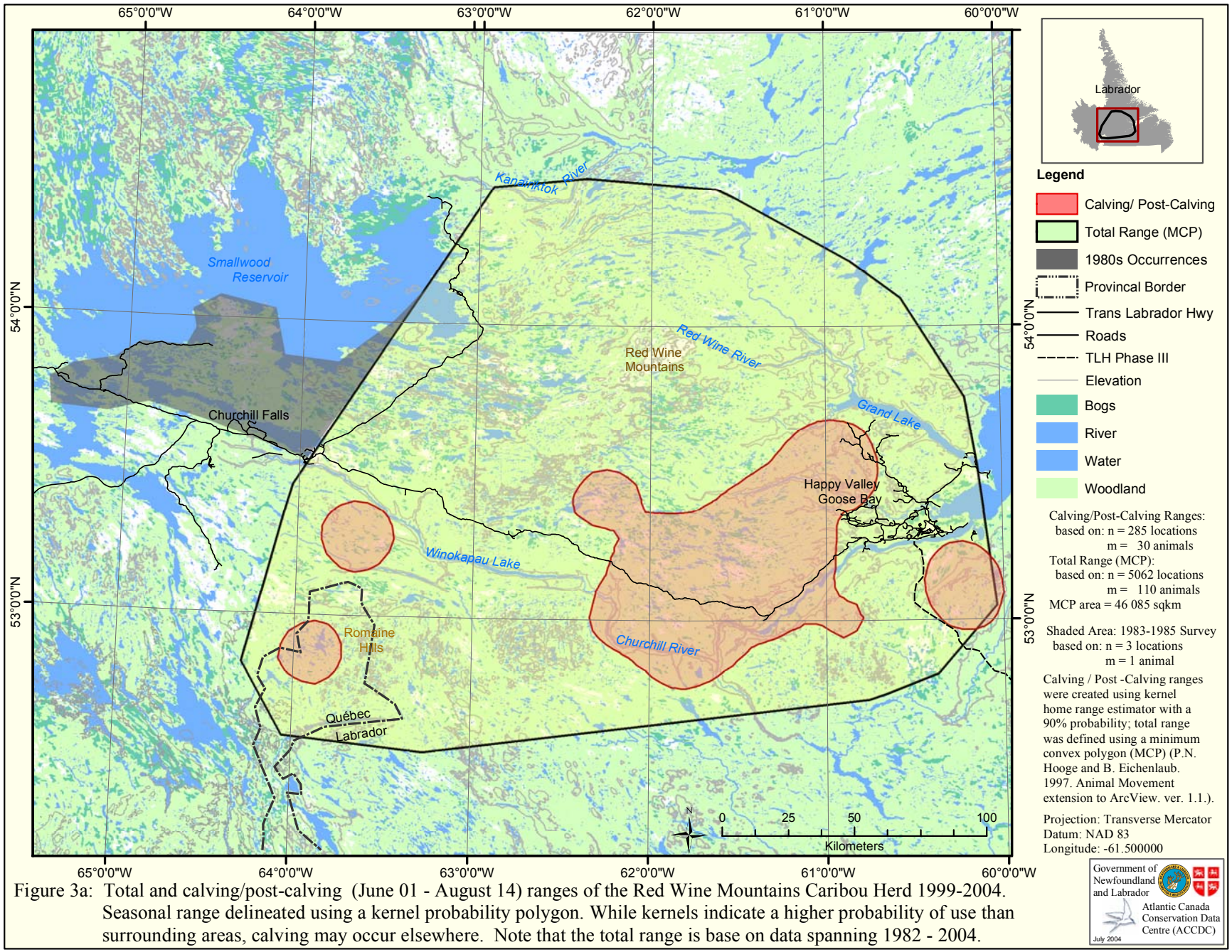

Figure 3a: Total and calving/post-calving (June 01 - August 14) ranges of the Red Wine Mountains Caribou Herd 1999-2004. Seasonal range delineated using a kernel probability polygon. While kernels indicate a higher probability of use than surrounding areas, calving may occur elsewhere. Note that the total range is base on data spanning 1982 - 2004.

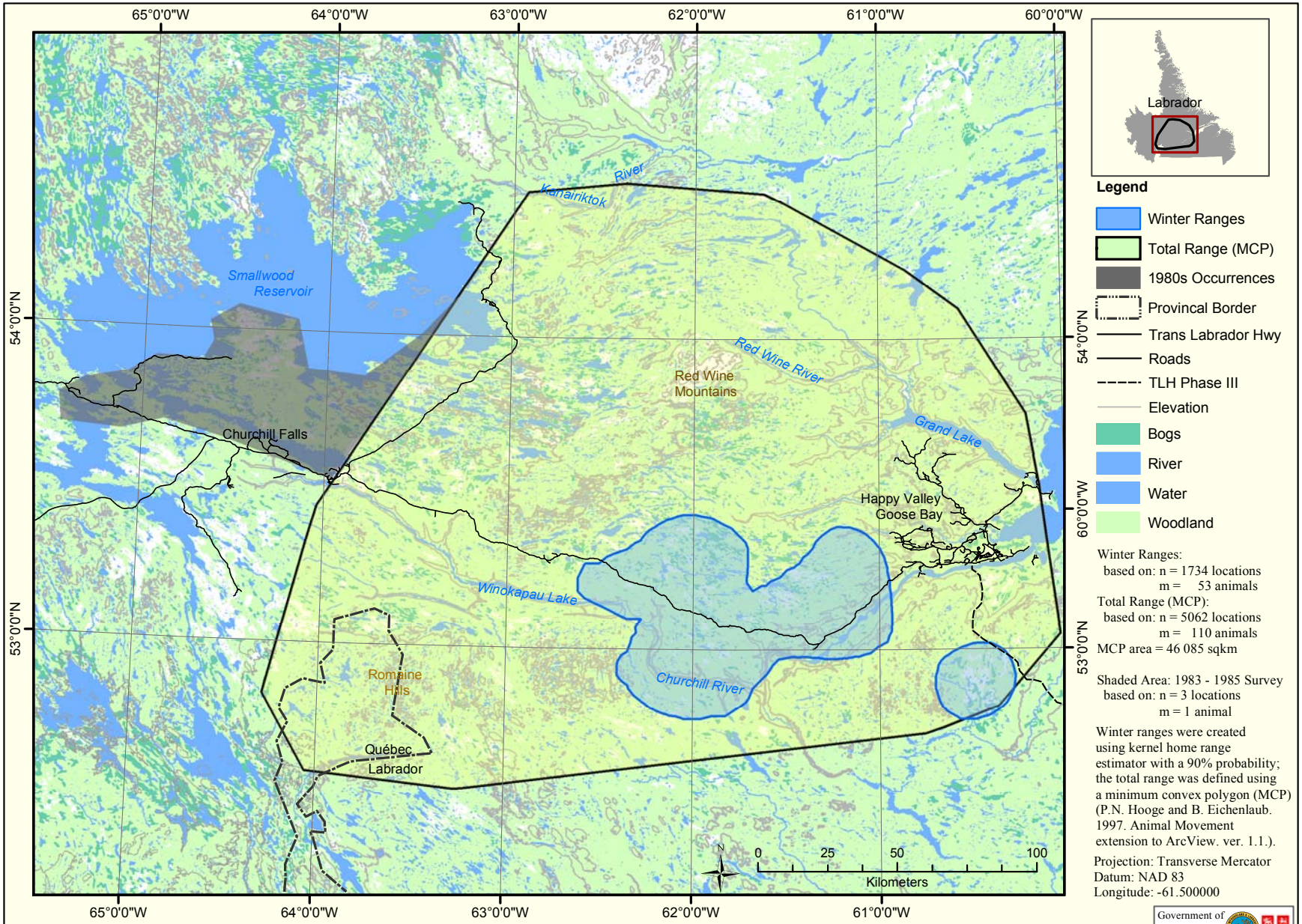

Figure 3b: Total and winter (November 29-April 28) ranges of the Red Wine Mountains Caribou Herd 1999-2004. Seasonal range delineated using a kernel probability polygon. While kernels indicate a higher probability of use than surrounding areas, caribou may occur elsewhere. Note that the total range is based on data spanning 1982 - 2004.

aggregations would move into the tundra habitat of the Red Wine Mountains or elsewhere within the range, possibly to avoid increasing accumulations of snowfall at lower elevations (Brown 1986; Brown and Theberge 1990). During May, the majority of the herd would disperse back down onto the plateau, primarily in a southeasterly orientation, for the pre-calving dispersal period (Bergman et al. 2000). During calving, males remained in small groups while females were solitary. Generally, this pattern persisted until the rut in late October, which often took place in the southeast part of the range (Brown 1986). Current total, calving/post-calving and wintering ranges of the RWM herd are shown in Figures 3a and 3b.

Since the 1990s, changes in range use by RWMH have occurred, concurrent with a reduction in population size. Schaefer et al. (2001) compared spatio-temporal variation in range use and mortality between 2 time periods, May 1982 to October 1988 and March 1993 to August 1997, and documented a decline in range use in the northern and western components of the range. They found that the RWMH population could be split into 4 subpopulations, and that disproportionate declines in space use (as measured by proportion of animals, radio-days, and calving events) had occurred in the northern and western subpopulations during the 'late' time period. Conversely, use of the southern portion of the range more than doubled during the 1990s. In areas exhibiting a decline in use, mortality rates generally increased while calving activity declined. In fact, based on known calving locations, an erosion of the northern and western portions of the calving range occurred between the two time periods (Fig. 4 in Schaefer et al. 2001). The range contraction was not associated with changes in home range size.

Recent radio-telemetry data corroborates these findings. Since 1999, caribou have been routinely observed south of the Churchill River, a historically unusual occurrence (IFWD / DND in Litt.). Changes in range use are not uniform across the range however, and caribou occurrence within a core area at the heart of the range has remained unchanged since 1993 (Fig. 4). Instead, use of peripheral areas shifted. Further, while caribou still occurred throughout the total range, their relative abundance over portions of the range has altered. These results are supported by a survey to determine the distribution and density of RWMH caribou on their winter range in March 2001, which found that the core winter range (as defined by an adaptive kernel based on a 50% probability distribution) included an area south of the Churchill River (IEMR personal communication). Since 1997 the RWMH appears to have abandoned use of their namesake, the Red Wine Mountains.

Range Description: Mealy Mountains Caribou Herd

The Mealy Mountains caribou herd (MMH) occupies an area of approximately 24 000 km^2 east of the Kenamu River in southern Labrador, ranging from Double Mer and Groswater Bay in the north to the headwaters of the Alexis and St. Augustin Rivers in the south, and including extensive coastal areas and offshore islands, and the Mealy Mountains (Fig. 5a, 5b). The MMH is the most accessible herd to residents of central and southern Labrador, and as a result is of significant historical and regional importance to hunters (Bergerud 1967). A significant amount of local and traditional knowledge, particularly with respect to historical range use, exists for the MMH (Armitage and Stopp 2003; Bergerud 1967). Also, several Innu families, from both Labrador and Québec, have a long association with the Mealy Mountains area. Additionally, in the pre-settlement period when trading occurred on the coast of Labrador, travel through the Mealy Mountains and Eagle River plateau was frequent. As a consequence, historical calving locations, as well as wintering areas in which Innu were most likely to encounter caribou, are

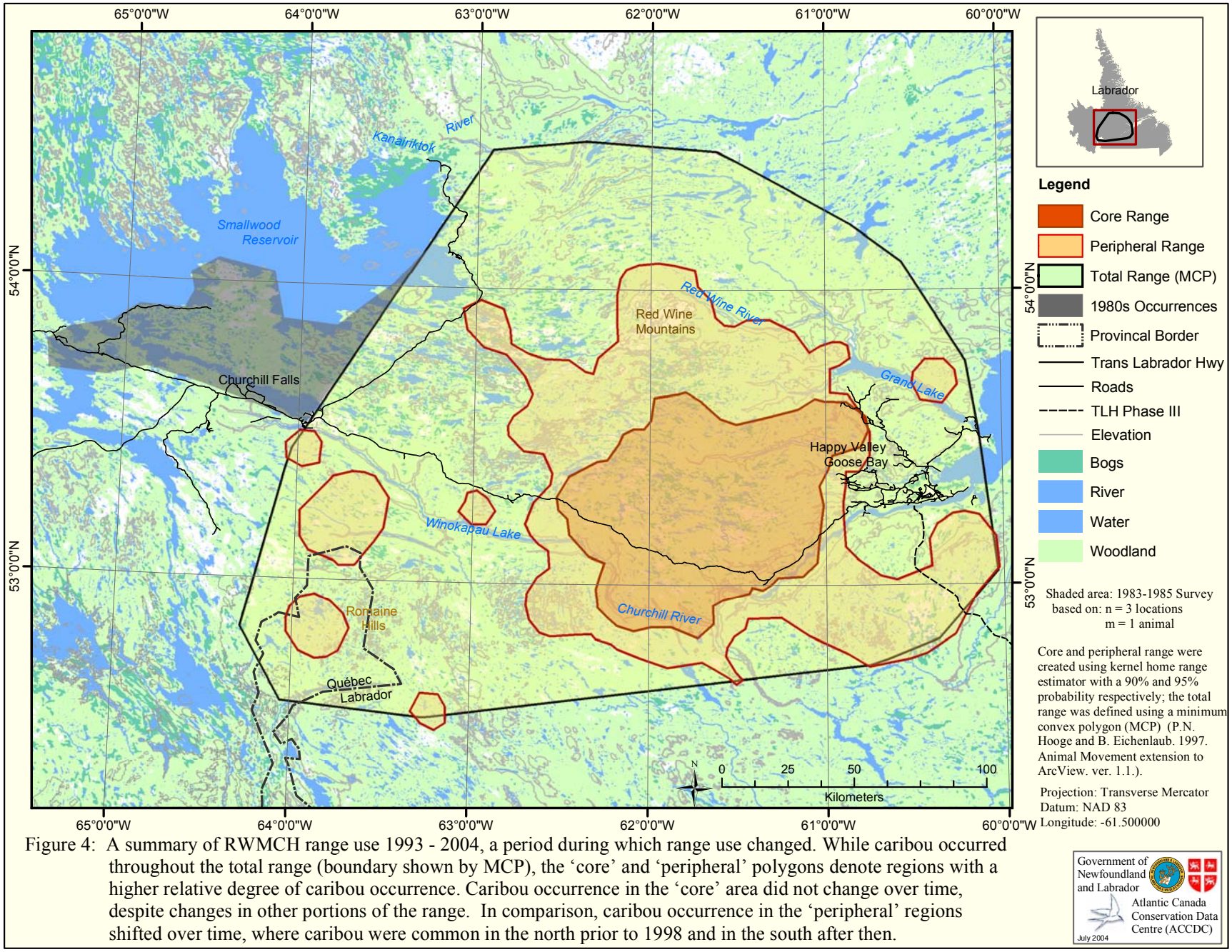

Figure 4: A summary of RWMCH range use 1993 - 2004, a period during which range use changed. While caribou occurred throughout the total range (boundary shown by MCP), the 'core' and 'peripheral' polygons denote regions with a higher relative degree of caribou occurrence. Caribou occurrence in the 'core' area did not change over time, despite changes in other portions of the range. In comparison, caribou occurrence in the 'peripheral' regions shifted over time, where caribou were common in the north prior to 1998 and in the south after then.

known (Armitage and Stopp 2003).

Based on this information, a historical calving ground for the MMH was located in the headwaters of the English River south to the Eagle River (Armitage and Stopp 2003: 49). Similarly, Folinsbee (1979) describes caribou calving on large bogs at the headwaters of the English, North, White Bear and Eagle Rivers (all located to the east and southeast of the Mealy Mountains).

Seasonal range use by the MMH was estimated by Hearn and Luttich (1987), based on 30 radio-collared caribou between 1985-1987. They found that solitary animals or small groups dispersed throughout the total range during summer, with one exception, the central Mealy Mountains (Hearn and Luttich 1987: 58, 60). Pooled locations suggest that females will move southward off the mountains and inland, to calve. Females displayed a strong fidelity toward former calving locations, with the majority located <15km from their calving location the previous year, the same pattern observed by Brown et al. (1986) for the RWMH.

Winter distribution appears to be dependent on snowcover. In years of heavy snowfall, caribou move up into the Mealy Mountains or onto the bogs along the south shore of Lake Melville between Carter Basin and Etagaulet Bay, and at the mouth of Groswater Bay, on the southern shore (Bergerud 1967, Hearn and Luttich 1987). MMH caribou congregate into aggregations during winter. This pattern may not occur in years with low snowfall, when caribou can also be found in the heavily forested areas south of the mountains (Bergerud 1967). Hearn and Luttich comment that their results are generally consistent with distributions noted during previous winter censuses (e.g. Folinsbee 1979, Berger 1982). During the 1950s, Banfield and Tener (1958) noted caribou on the south coast of Labrador, south of Charlottetown, an area not utilized during the latter study, or currently. Absence of use in a portion of the herds historical range suggests range retraction has occurred concurrently with the population decline since the 1950s. In comparison with the distribution denoted in Hearn and Luttich (1987:14), Schaefer (1997a) noted fewer caribou in the regions of Parke Lake and east of the Mealy Mountains. Information on range use since 1988 is limited. However, locations from 15 radio-collared females and a census conducted in 2002 confirm Schaefer's observations, and indicate that the Kenemich River marshes, on the south shore of Lake Melville, no longer contain large winter aggregations of caribou. Summer ranges are similar to historical data, with the exception that caribou are reduced in the area southwest of Parke Lake, and east of the Mealy Mountains in comparison with the 1987 range. Total range and calving/post-calving and winter ranges based on caribou outfitted with VHF radio-collars since March 2002 are shown in Figures 5a and 5b. While based on a small sample size, these observations suggest that in general, seasonal distribution of caribou throughout their range is consistent with previous surveys. However, they also suggest that the occupied range of the MMH may be dwindling, particularly in the extreme southern portions of the traditional range.

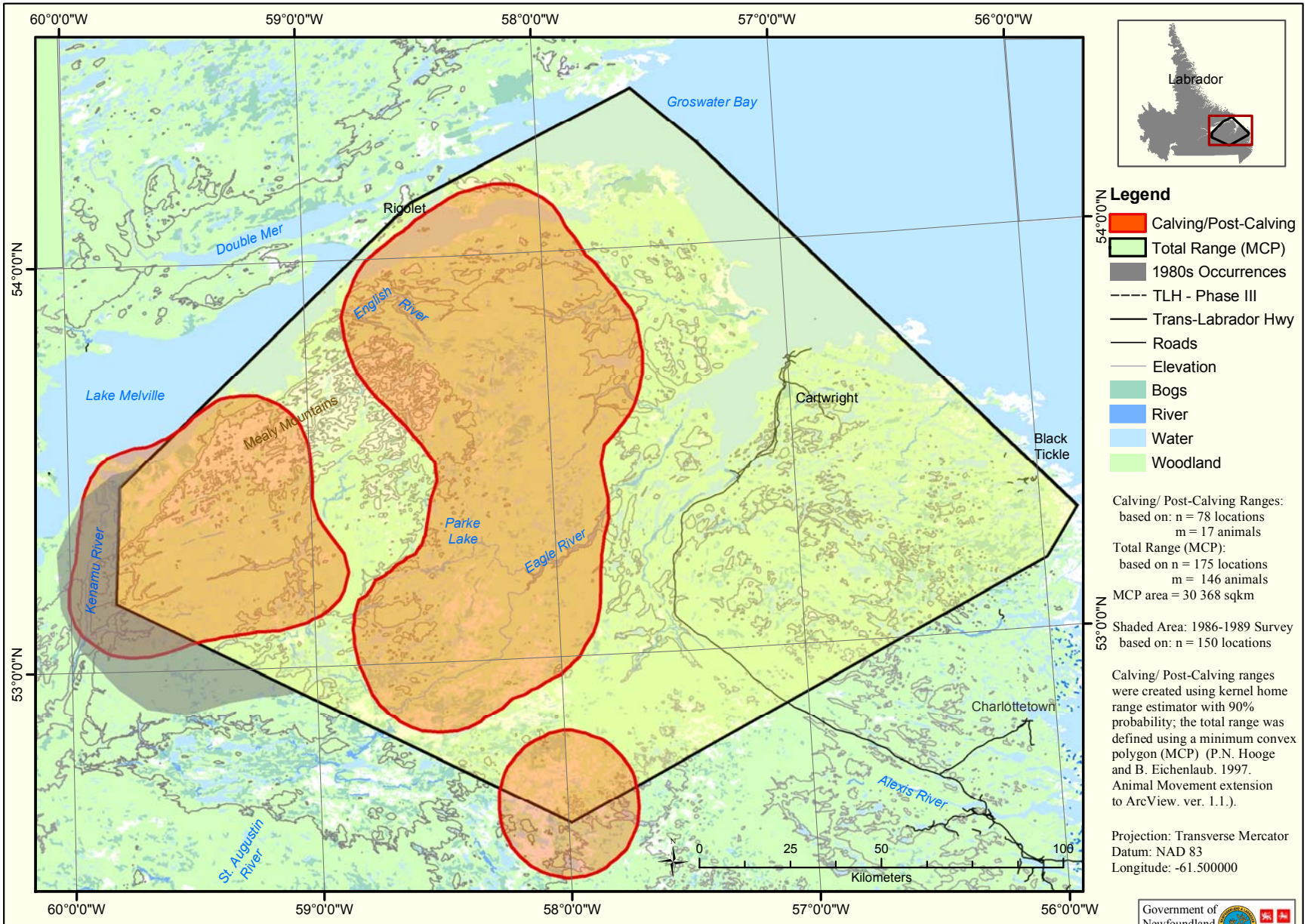

Figure 5a: Total and calving/ post-calving (June 01 - August 14) ranges of the Mealy Mountain Caribou Herd 2002 - 2004. Seasonal range delineated using a kernel probability polygon; total range defined using a minimum convex polygon. Note that kernels indicate a higher probability of use than surrounding areas, but that calving may occur elsewhere.

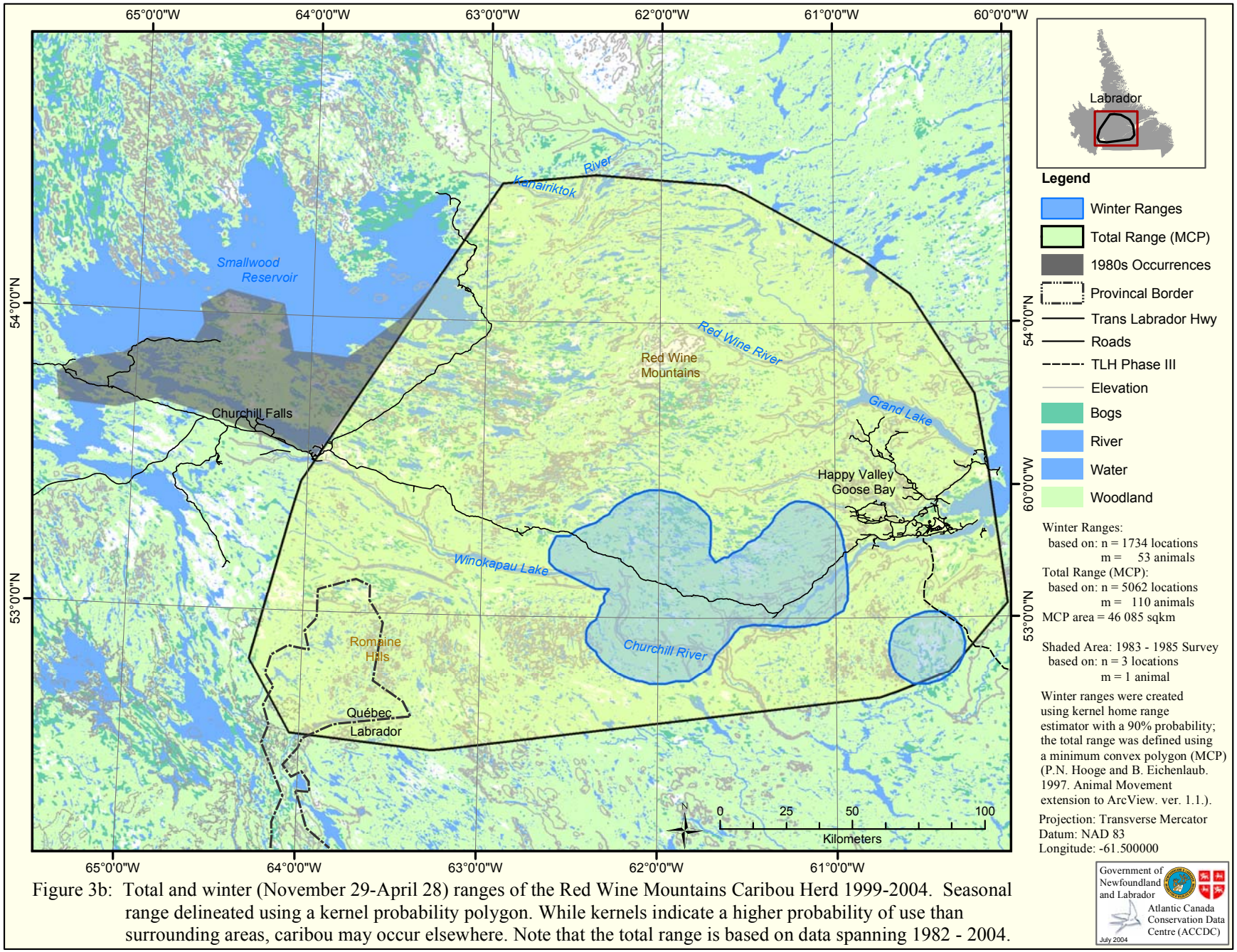

Figure 3b: Total and winter (November 29-April 28) ranges of the Red Wine Mountains Caribou Herd 1999-2004. Seasonal range delineated using a kernel probability polygon. While kernels indicate a higher probability of use than surrounding areas, caribou may occur elsewhere. Note that the total range is based on data spanning 1982 - 2004.

9. Population Size and Trend

Lac Joseph Caribou Herd

Uncertainty in census results and differing methodologies between censuses make it difficult to describe population trends in this herd with any accuracy. However, the surveys are useful benchmarks, and underscore that the present abundance is considerably reduced from historical levels. Table 2 summarizes all known population estimates for the LJH including confidence intervals (where available). Historical accounts suggest that the LJH first began to decline during the 1860s (Folinsbee 1979), and continued to do so until at least the late 1890s (Banfield and Tener 1958). Initial attempts to census caribou between 1963 and 1972 suggest that there were at least 5000 animals in the southern Ungava peninsula, and that the herd was stable at around 5000 caribou (Des Meules and Brassard 1963; Brassard and Bouchard 1968; Brassard 1972). However, the description of the survey area indicate that these figures are likely an estimate of all sedentary woodland caribou herds, rather than simply the Lac Joseph herd itself, for that time period. The first census to survey the Lac Joseph Herd exclusively was conducted in 1977 (Folinsbee 1978; reinterpreted by Bergerud 1994), and estimated 1317 animals (1900 if using Bergerud's interpretation). That the herd was declining rapidly during the 1970s was confirmed by a further census completed in 1978, resulting in an estimate of 570 $\pm$ 250 caribou (Pilgrim 1979). A 1986 estimate (445 ± 398 animals, including 240 caribou that were observed) indicated similar levels of abundance based on coverage of the entire herd range (Saint-Martin and Theberge 1986). The latter estimates correspond to a density of less than 0.03 caribou/km^2, typical of other sedentary woodland caribou across Labrador. The most recent census in 2000 appears to suggest an increase in herd size to 1,101 (with a minimum count of 482 animals; Chubbs et al. 2001).

Table 2: Lac Joseph Caribou Herd population estimates 1975 – 2000.

Year	Estimate	CI [1]	Min. Count	Caribou Density (No./ km^2)	Estimator	Method	Survey Area [+] (km^2)	Reference
1975	3,050	N/A	1100		Not given	Strip Transect	5,370	Folinsbee 1975a
1977	1,317	N/A		<0.03	Complete Count (winter range)	Strip Transect	26,000	Folinsbee 1978
1978	562	+/- 250	22			Strip Transect	16,225	Pilgram 1979
1985			225	<0.02		Radio Telemetry	38,000	Brown et al. 1986
1986	445	+/- 398	240	<0.03	Randomized Block	Stratified Transect	35,000	St Martin and Théberge 1986
1998		N/A	198			Strip Transect		Couturier et. al 1999
2000	1,101	756-1933[2]	482		Lincoln-Peterson/ Joint hypergeometric maximum likelihood	Mark-Recapture	38,000	Chubbs et al. 2001

\+ Study area, not area surveyed on flight lines
[1] Confidence Interval
[2] Confidence Interval 0.10

Table 3 summarizes recruitment information collected in 5 separate classifications from 1998-2003. Using the criteria of Bergerud (1980), these statistics suggest that recruitment rates in the LJCH are consistent with a stable and increasing population. Adult sex ratios are female-biased, ranging from a low of 29% males in 2002 to a high of 46% in 2000. A female-biased population structure is typical for Boreal caribou, and where it has been reported, appears to be in the range of 35% males (Bergerud 1980).

Table 3: Demographic parameters for the Lac Joseph Caribou herd. Data are compiled from classification surveys conducted during winter (2000-2002) or late fall (1998, 2003).

Year	N	Males[1]	Females[1]	Calves[2]	Unknown	Calves/100 Females	Recruitment Rate (% Calves)	Males: 100 Females	Source[3]
1998	135						11.9		FAPAQ/ IFWD/ DND
2000 (Feb-Mar)	482	187	203	82	10	40.4	20.5	92.1	IEMR/ DND/ IFWD
2001 (Jan)	178	69	76	28	5	36.8	15.7	90.8	DND
2002 (Jan)	147	46	79	22	0	27.8	15.0	58.2	DND
2003 (Nov)	96	31	46	19	0	41.2	19.8	67.4	DND

[1] Adult caribou > 1 yr
[2] Caribou < 1 yr
[3] See Appendix 1 for list of Acronyms

Red Wine Mountains Caribou Herd

Estimates of herd size vary between surveys, and range from < 100 animals in 1978 and 2001 to a high of 900 in 1968 (Table 4). Due to differences in survey methodology, range coverage, and timing between surveys, estimates are of limited use for interpreting trends in population size. Nonetheless, they are useful as an index of herd size, particularly surveys conducted since the 1980s, in which systematic sampling and mark-recapture techniques were employed.

Following Bergerud's (1963) report of 150 caribou observed in the Red Wine Mountains in the winter of 1958, several attempts were made in the subsequent 20 years to estimate herd size. Wetmore (unpublished data cited in Phillips 1982) estimated 900 caribou on the Red Wine Mountains in 1968. Four subsequent surveys in the 1970s (whose accuracy is questionable due to the limited extent of aerial surveys and because they were conducted in different seasons) estimated 600 (1972), 702 (1973), 267 (1974) and less than 100 (1978) animals (Folinsbee 1974; 1979; Pilgrim 1981). By the 1980s, the herd was considered to be stable to decreasing, largely because losses due to adult mortality were not being offset by recruitment of yearling animals (Brown 1986). Herd size estimates were 736 ± 172 in 1983 (Brown 1986), 796 in 1984 (Brown and Theberge 1985), and 741 ± 165 in 1989 (Veitch 1990). Undoubtedly, the herd declined during the 1990s; a survey in 1997 counted only 129 animals (95% confidence interval 65-251; Schaefer 1997b recalculated). A further census in 2001 estimated that only 97 (90 % confidence interval 72-189) animals remained in the herd (Chubbs et al 2001). Survey methodologies were unique for

each survey, and with the exception of the most recent census, are summarized in Schaefer et al. (1999).

Table 4: Red Wine Mountains Caribou Herd population estimates 1983 – 2003.

Year	Estimate	CI [1]	Min. Count	Caribou Density (No./ km^2)	Estimator	Method	Survey Area (km^2)$^+$	Reference
1983	736	+/- 172	--	0.03	Jolly (1969) Licoln (1982)	Strip Transect & Mark-Resight	25 000	Brown 1986
1987	610	592-628[2]	--	0.03	Siniff & Skoog (1964)	Stratified Random Quadrant		Veitch, 1990; Veitch et al. 1993
1989	741	+/- 165	--		Caughley (1977); Siniff & Skoog (1964)	Strip Transect and Random Quadrant		Veitch 1990
1997	129[5]	65-251[2]	75	?	Peterson (in Krebs 1989)	Mark-Resight	19 700	Schaefer 1997b
2001	97	72-189[3]	67	0.008[4]	Maximum Likelihood (White 1996)	Mark-Resight	29 900	Chubb et al 2001
2003	87	--	87	--		Based on known, collared animals and associated animals in groups	--	Phillips pers.com.

$^+$ Study area, not area surveyed on flight lines
[1] Confidence Interval
[2] Confidence Interval 95%
[3] Confidence Interval 90%
[4] Based on 100 animals on a 13 124 km^2 winter range area of 13 124 km^2 (95% Adaptive kernel model; Worton, 1995)
[5] Recalculated from Schaefer (1997)

Declines in herd size were coupled with concurrent changes in population demographic parameters. A study comparing the population characteristics over two periods, 1981-1988 and during the decline, 1993-1997 found that the decline was associated with significantly lower recruitment and increased mortality of adult female caribou (Schaefer et al. 1999) (Table 5). Annual survivorship of adult females declined from 0.80 to 0.70 between the two time periods. Additionally, the recruitment rate (measured as % calves, and the number of calves per 100 females) declined from 18.5 % to 8.9 % and from 37.8 to 17.0 respectively. The parturition rate did not vary between periods. Schaefer's estimates for the 'early' time period are comparable with demographic statistics reported in Veitch (1990), who estimated an annual recruitment rate of 17.5 % and an adult mortality rate of 16.3 %. Schaefer et al 1999 also indicated that the population growth was near zero during the 1980s, and declining rapidly (between 13% and 20%) during the 1990s.

Table 5 summarizes recruitment information collected in 11 separate mid-winter classifications from 1981-2003. Calving surveys (n < 10) of radio-collared females suggest that approximately 85% of all females give birth to a calf each year. Using the criteria of Bergerud

(1974), these statistics suggest that recruitment rates in the RWMH are consistent with a stable and increasing population, despite the declining population trend. Adult sex ratios are also female-biased in this herd, ranging from 26% males in 2002 to 40.3% in 2003, but within the range observed in other caribou herds across North America (Bergerud 1980).

Table 5: Demographic parameters for the Red Wine Mountains Caribou Herd from 1981 -1988, 1993-1997 (average), and 2001-2004, respectively.

Year	N	Males[1]	Females[1]	Calves[2]	Unknown	Recruitment Rate (% Calves)	Calves/100 Females	Males: 100 Females	Source[3]
1981-1988	1,323					18.5	37.8		Schaefer et al. 1999
1993-1997	462					8.9	17.0		Schaefer et al. 1999
2001 (Mar)	65	25	31	8	1	12.3	25.8	80.6	DND
2002 (Jan)	64	13	25	12	14	18.8	48.0	52.0	DND
2003 (Feb)	93	27	40	25	1	26.9	62.5	67.5	DND

[1] Caribou > 1 yr
[2] Caribou < 1 yr
[3] See Appendix 1 for list of Acronyms
Note: no fall or winter classifications were done in 2004 due to the large number of George River caribou herd animals present in the RWMH winter range beginning November 2003.

Mealy Mountains Caribou Herd

Herd size has been estimated several times between 1958 and 2001, though the majority of these surveys occurred from 1970 to 1985. Table 6 summarizes past censuses, including minimum counts and algorithms used to generate population estimates. While surveys differ in the methodology used and accuracy and precision of results, they are still an adequate indicator of population trends and herd status. Historical surveys indicate that the MMH underwent a marked decline between the late 1950s and mid 1970s, from a high of 2600 individuals in 1958 (Bergerud 1963b), to a low of only 207 animals in 1977 (Pilgrim and Chaulk 1978). Even though the 1977 survey was later considered to underestimate the true herd size by approximately 200 animals (Hearn and Luttich 1987), results suggest the herd decreased an average of 20% per year over that time period.

Table 6: Mealy Mountains Caribou Herd population estimates 1958 – 2002.

Year	Estimate	CI [1]	Min. Count	Caribou Density (No./km^2)	Estimator	Method	Survey Area (km^2)$^+$	Reference
1958	2600	n/a	355		Extrapolated from total count	Systematic strip transect (Fixed wing)	Portion of range	Bergerud 1963b
1960	1575	n/a	604		Extrapolated from total count	Systematic strip transect (Fixed wing)	Portion of range	Bergerud 1963b
1970	788	n/a	90		Extrapolated from total count, plus 20% buffer	Systematic strip transect (Fixed wing)	14% of total range	Wetmore 1971
1971	800	n/a	114			Systematic strip transect (Fixed wing)	17% of total range	Wetmore 1971
1974	264	n/a	47		Extrapolated from total count	Systematic strip transect (rotor)	18% of total range	Folinsbee 1975b
1975	284				Total count	100% search (Rotor)	100% coverage	Pilgrim 1980
1977	207	n/a	207		Total count	100% search	100% coverage	Pilgrim an d Chaulk 1978
1981	701	n/a	528		Total count plus estimate number of uncensused groups	Systematic survey of total range (fixed wing) to identify activity centers, subsequent census of these areas by helicopter	100% coverage, census limited to activity centers	Berger 1982
1987	1932	n/a	1856		Same as above	Same as above	Same as above	Hearn and Luttich 1987
1994	--	n/a	506		Minimum count	Concentrations determined from recent winter censuses; strip transect	Activity centers only	Chubbs 1994
1997[2]	223	0 - 534 [1]	11	0.013	Gasaway 1986	Density-distribution	1272 km2 surveyed, systematic distribution	Schaefer 1997b
2002	2585	989 - 4181[1]	276[3]	Not provided	Gasaway 1986	Density-distribution	Not stated; similar to above	Otto 2002

+ Study area, not area surveyed on flight lines

[1] Confidence Interval 90 %

[2] As only 11 animals were seen on-transect, the results of this survey are unreliable and should not be used to draw conclusions on population trends.

[3] Minimum count derived by pooling animals seen over a 2-week period by two different survey crews.

Beginning in 1975 (following a closure on hunting), the herd began to recover, increasing approximately 17% annually between 1975 and 1987 (Hearn and Luttich 1987). No reliable census exists between 1987 and 2001, though a survey in 1994 (Chubbs (1994) provides a minimum count and a good classification with a high sample size (Table 7). Using age-specific fecundity and survival rates Hearn and Luttich (1987) projected a finite rate of increase of 1.0 to 1.05, suggesting that the herd size would remain stable or increase by 5% annually. This projection was contingent on a mortality rate of 15% in adult females (including yearlings) and a recruitment rate of 18 %.

Table 7: Demographic parameters for the Mealy Mountains Caribou Herd 1971-2002.

Year	N	Males[1]	Females[1]	Calves[2]	Unknown	Recruitment Rate (% calves)	Calves/100 Females	Males: 100 Females	Source
1971 (Feb)	69	17	26	18	8	26.1	69.2	65.4	Wetmore 1971
1974 (Mar)	81	28	41	12	0	14.8	29.3	68.3	Folinsbee 1975b
1975 (Mar)	284	87	136	60	57	21.1	44.1	68.9	Pilgrim 1980
1977 (Dec)	67	14	39	14	0	20.9	35.9	35.9	Pilgrim and Chaulk 1978
1981 (Feb)	409	106	228	75	0	18.3	33.3	46.5	Berger 1982
1985 (Mar)	759	228	359	172	0	22.7	47.9	63.5	Hearn & Luttich 1987
1987 (Mar)	1371	431	698	242	0	17.7	34.7	61.7	Hearn & Luttich 1987
1994	492	128	301	63	0	12.8	20.9	42.5	Chubbs 1994
2002 (Mar-April)	118	28	56	34	0	28.8	60.7	50.0	Otto 2002

[1] Caribou > 1 yr
[2] Caribou < 1 yr

An estimated population size of 2585 in 2002 appears to verify this projection. Calculating the rate of increase between 1987 and 2002[1], we see that the exponential rate of increase, *r*, is 0.021, and the corresponding finite rate of increase is 1.02. That is, the MMH population has grown by 2% a year since 1987 (this assertion is contingent on the accuracy of the censuses). This result is surprising given the high recruitment rates (the proportion of calves in the herd, and the

[1] In cases where population estimates are more than 1 year apart, we can calculate *r* by using the following equation: **ln (popn time *t*) – ln (popn time *t-n*) / No. of years between surveys. The associated finite rate of increase:**
$\lambda = e^{r}$

Calf: 100 Female ratio) observed in 2002 versus 1987. One can surmise from this that any gains in recruitment are being offset by an increase in mortality of adult animals, and that this mortality in all likelihood exceeds the 15% noted by Hearn and Luttich in 1987. An important component of current monitoring programs should be to clarify adult mortality rates in the MMH.

Table 7 summarizes information collected in 8 separate classifications from 1971 to 2002. Only 2 classifications have been conducted since 1987 underscoring the shortcomings in our current understanding of population structure in the MMH. Recruitment in the MMH has been variable, ranging from a low of 14.8 in 1971 to a high of 28.8 in 2002. These rates reflect high calf survival to late winter, suggesting that recruitment is not limiting herd growth. Sex ratios in the adult population are female-biased, as is the norm. While the proportion of males in the population has dropped from levels typically observed during the 1970s and 80s, they are within the normal range (approximately 36% male) reported in Bergerud (1980) in his review of sex ratios in North American caribou herds.

10. Biological Limiting Factors

Caribou possess several life history characteristics that may limit the potential of populations to recover from a decline. First, caribou have a low reproductive potential relative to other ungulates. While females of adequate physical condition can produce young as early as 16 months, typically females produce young for the first time at 28 months of age, then giving birth to only a single calf (Bergerud 1980; 2000). In addition, calf mortality, particularly within the first 30 days after birth, can be high due to predation by black bears, wolves, abandonment, inclement weather and accidents. While the population may consist of 30% calves at birth, a population that is numerically stationary will have only 15% calves in late winter, , (Bergerud and Elliot 1986). In small populations with fewer births, even if 15% of calves survive to late winter, the potential for population growth is low. Loss of adult animals, particularly breeding females, may severely limit the ability of small populations to recover.

In fact, small population size is in and of itself a limiting factor, a phenomenon known as the 'small population paradigm' (Caughley 1994). The Red Wine Mountains caribou herd, currently numbering < 100 animals, is likely subject to this condition. In this situation, the likelihood of a small population increasing or decreasing over a year can be less dependent on age-specific reproduction and mortality rates than it is on chance alone (demographic stochasticity). Small populations are also more vulnerable to the effects of fluctuations in environmental conditions. Collectively, these indicate that population growth is likely to be highly variable in small populations. This is worrisome because simulations have shown that if the variation in population growth is greater than the growth rate itself, the population will go extinct (Lande 1993).

While caribou are superbly adapted to the extreme climatic condition of the subarctic and boreal environments, inclement weather and snow conditions can limit foraging and locomotion, thereby influencing physical condition and susceptibility to predation, respectively. Brown and Theberge (1990) examined the effect of extreme snow cover and feeding site selection by RWMH caribou. With annual snowfall in excess of 400 cm, and mean snow cover depths exceeding 160 cm throughout most of the winter (Environment Canada[2]), the caribou of central Labrador must tolerate

[2] http://climate.weatheroffice.ec.gc.ca/climatenormals/results/

snow depths greater than all other North American caribou herd with the exception of the mountain caribou of southern BC), Snow depth and hardness were found to influence the RWM herd, where a threshold for cratering activity occurred at snow depth of 125 cm. At snow depths in excess of this threshold, caribou fed on exposed lichens scraped from erratics and, infrequently, arboreal lichens. Further, lichen regrowth is slow, and its removal exceeds the annual increment in lichen biomass where caribou occur in sufficient density (Arsenault et al. 1997).

Finally, recent classification data suggests that the sex ratio is skewed toward females in all three herds, and field observations suggest that mature adult stags may be scarce. Other studies of ungulate populations with a female-biased sex ratio and young male age structure suggest that this structure may delay conception and hence parturition, thereby negatively influencing calf survival (Holand et al. 2003; Saether et al. 2003).

11. Threats

Several threats contributing to the observed population decline in woodland caribou across North America have been identified. These include habitat loss or change, hunting and predation, disturbance, and weather and climate conditions (Bergerud 2000). Many of these factors are interdependent, and often act at multiple spatial scales. In Labrador, factors that have been suggested as contributing to the decline, or possibly limiting the recovery of sedentary woodland caribou include hunting, both legal and illegal, and incidental mortality that occurs when the sedentary animals comingle with the large, legally hunted, George River caribou herd (GRH).

To protect sedentary woodland caribou, 'extension zones', located in the northern periphery of LJH and RWM sedentary woodland caribou ranges, were established in 1984. These zones exist in areas that contain both sedentary woodland caribou ranges and a portion of the winter range of the migratory GRH. These zones whose purpose is to allow for hunting of abundant migratory animals while minimizing the risk of incidental harvest of resident sedentary woodland caribou, are opened only when large numbers of migratory caribou enter, and are closed when they leave. Nonetheless, incidental harvest of an unknown number of resident caribou does occur within these zones. Other threats include predation, possibly enhanced due to a northward range expansion of moose (Chubbs and Schaefer 1997; Rettie and Messier 2000); disturbance associated with low-level flying military training (Harrington and Veitch 1991; 1992); loss of habitat as a result of hydro-electric projects and mineral exploration and development, timber harvesting, both through the loss of habitat and the altered forest seral stages which promote presence of moose and exposure to predators (Samson and Huot 1998; Chubbs et al. 1993); increased access afforded hunters through the further development and improvement of the Trans Labrador Highway and other linear corridors; disturbance associated with recreational activities such as snowmobiling; and climatic conditions, particularly snow depth, ice cover and adverse weather immediately post-calving. While some threats are common to all three herds, most differ among herds in terms of their historical significance and the current menace they pose, and hence are discussed in herd-specific summaries.

Lac Joseph Caribou Herd

Banfield and Tener (1958) attributed the decline during the 1800s to overharvest as a result of the fur trade and the advent of improved weapons. Similarly, Folinsbee (1979) believed the decline of the herd during the 1970s to be partially attributable to overharvest of adults. Additionally, he considered poor recruitment of yearlings due to wolf predation to be an important limiting factor in several years. Saint-Martin (1987) and Folinsbee (1979) surmised that the removal of the northern portion of the traditional calving range due to flooding as a result of hydroelectric development could also have contributed to the decline.

Since the mid-1980s, the winter range of the migratory George River caribou herd has overlapped with that of the LJH. The subsequent increase in hunting activity may result in greater mortality for the sedentary woodland caribou as animals from both herds intermingle and hunters do not distinguish between sedentary and migratory animals. In addition, subsistence harvest continues to occur with 5 animals taken in 2000 (IEMR 2002). Several radio-collared animals have been killed by hunters between 1998 and 2003 (DND /IFWD unpublished).

Other potential threats include increased wolf predation during periods of George River ingress (as has been observed in the adjacent Red Wine Mountains sedentary woodland caribou herd; (Schaefer et al. 1999) and further incidental mortality on the sedentary animals. Low-level military flying in the Lac Joseph annual range has been suggested as a possible form of disturbance to this sedentary group of caribou, particularly since the recent reconfiguration of the low-level training area may overlap with the herd range (DND unpublished). Moreover, mineral exploration and development and additional hydro-electric projects could reduce the amount and integrity of existing habitat.

Red Wine Mountains Caribou Herd

Numerous sources of mortality have been documented in the Red Wine Mountains caribou herd. For deaths of known cause, predation by wolves, and secondarily by black bears, were found to be a primary source of mortality for animals older than 1 year (Brown 1986; Schaefer et al. 1999). The latter studies spanned the periods 1982-1988, and 1993-1997, and suggest that wolves accounted for approximately 75% of all radio-collared caribou deaths. Predation rates may be associated with the presence of moose over RWM caribou range; as the herd declined, moose densities increased (Chubbs and Schaefer 1997; Schaefer et al. 1999). It has been hypothesized that the presence of alternate ungulate prey may lead to greater number of wolves and heightened incidental predation on caribou (Bergerud and Elliot 1986; Seip 1992). The presence of migratory George River caribou during winters in the 1990s would also act as a significant source of alternate prey. However, the potential role of alternate prey on RWMH predation rates remain unclear. For example, at low caribou densities, the functional response for wolves predicts that predation rates on caribou will decline. Additionally, the temporal duration of potential prey switching by wolves is unclear, and other declining caribou herds have recovered despite constant wolf densities (Seip 1992). Although an intriguing hypothesis, the implications of the predator-multiple prey dynamic need to be better researched before any conclusions can be drawn for RWMH (and the other sedentary woodland herds) caribou.

While the RWM population has been closed to licensed hunting since 1972, subsistence hunting continued to occur legally until 2002, when hunting of any threatened population was prohibited under new provincial endangered species legislation. Despite the prohibition on hunting, illegal hunting continues to occur. In April 2003, 15% of the total RWMH were poached in one

incident. As consumptive or subsistence use of this herd represents an additive source of mortality, such losses are completely unsustainable for a herd numbering less than 90 individual animals.

Mortality incidental to the licenced harvest of the GRC herd is difficult to quantify, but may be significant. For example, three known incidental mortalities were documented during the 1990s (Schaefer et al. 1999), but in all probability that figure is conservative. Veitch (1990) reported that up to 38 caribou were taken over a one year period 1987-1988. Ingress of the GRC herd onto the RWMH winter range has frequently occurred over the last several years. As sedentary and migratory ecotypes are difficult to distinguish from one another, incidental mortalities occur.

Potential threats may arise from proposed industrial developments, particularly hydro-electric operations and commercial forestry (Chubbs et al 1993), and the associated road development and changes in human access and use these entail. For example, the development of the facility in Churchill Falls, and the subsequent creation of the Smallwood Reservoir flooded portions of the ranges of both the Lac Joseph and Red Wine Mountains caribou herd ranges. The proposed development on the lower Churchill River could affect the range of the RWMH caribou. To date, forest harvest operations have been restricted to an area < 50 km west and northwest of Goose Bay, or a small portion of the RWMH range. However, further developments of harvesting activities within the range of the RWMH have been proposed, and would result in loss of habitat. Additionally, and timber harvesting produces seral forest communities conducive to moose**,** and results in a direct loss of habitat, thereby potentially indirectly affecting caribou (e.g. Chubbs and Schaefer 1997).

Beginning in 1981, a portion of the RWMH range was included in a training zone for low-level military flying. The training area was expanded in 1996, and now encompasses most of the range of the RWM herd. Disturbance from low-level flying has been associated with a variety of problems ranging from behavioral responses to changes in movement patterns and survival in ungulates. Overt behavioral responses and changes in movement patterns were noted in both woodland and barren-ground caribou in response to jet aircraft (Harrington and Veitch 1991; 1992; Maier et al. 1998). Gunn et al. (1985) documented a decreased frequency of nursing in barren-ground caribou in response to helicopters. In addition, female RWMH caribou exposed to jet overflights experienced lower calf survival than those not subjected (Harrington and Veitch 1992). Since 1991, the Department of National Defense has implemented and Environmental Management Program which includes a program of avoidance of the RWCH by military jets to minimize potential disturbance (DND 1994; Jung et al. 2001).

Mealy Mountains Caribou Herd

Historical data (aerial inventories, classifications, population demography) gathered on the MMH have enabled several analyses of the population trends and threats facing this herd (Bergerud 1967; Hearn and Luttich 1987). Each has concluded that hunting mortality has dramatically influenced population size and trend in the MMH. Bergerud (1967) calculated that total mortality exceeded recruitment 3-fold between 1958 and 1963 (for example, 900 animals were killed in 1958-59, while only 250 calves were recruited), and attributed this imbalance to the dramatic population decline observed over the same time period. In their analysis of the same data in 1987, Hearn and Luttich estimated that between 30-35% of the herd was removed on an annual basis (55% in 1963-64), and that the herd decreased at an annual rate of 20%. Bergerud (1978) described the relationship between calf recruitment and adult survival as one where calf recruitment declines as adult mortality increases in a herd being naturally regulated by predators (which would prey on both adults and calves, especially the latter). One can thus predict low adult mortality in instances of

high calf recruitment, and an increasing population. Based on this relationship, where discrepancies exist between high calf recruitment and little to no population growth, one must assume that hunting is an important component of adult mortality. Hunting seasons were open to 1965 (except 1960-61), closed between 1965 and 1972, opened again the following year for three years, and have remained closed since 1976, with the exception of a single licensed hunt in 1989. However, numerous reports attest to continued hunting of animals in this herd; illegal hunting accounted for 33% all mortalities of 30 radio-collared females 1985-87 (Hearn and Luttich 1987); during the same year 56 uncollared caribou were killed during one hunt; 59 animals were killed in 2 hunts during 1994 (Chubbs 1994); 6 were killed in 2003. In fact, kills have been reported in virtually every year, underscoring the notion that hunting has been and continues to be a primary threat limiting the recovery, or indeed, contributing to the decline, of the Mealy Mountains caribou herd. Reluctance of local residents (including communities along the Lower North Shore of Québec) to adhere to hunting regulations stem in part from the high visibility of winter aggregations along the shores of Lake Melville and Groswater Bay, which induce them to dismiss census results as too conservative. Stewardship to convince hunters to consider the herd in light of its total occupied range and population size and trend is necessary to correct this perception.

Other potential threats include habitat loss through the further development of commercial forest industry near Cartwright, and the construction of the Trans-Labrador Highway (TLH) between Goose Bay and Cartwright. The proposed road traverses the area south of the Mealy Mountains in close proximity to the southern limit of the current calving/ post-calving range (Fig. 5a, 5b). The proposed highway will permit improved access to previously inaccessible areas and may increase hunting pressure. These potential threats must be closely evaluated for their impact on herd size and demography as construction progresses.

12. Habitat Requirements

Caribou habitat selection occurs at multiple spatial scales, where decisions made at coarser scales are related to environmental features more important to individual fitness than finer scales (O'Brien and Manseau 2003, Johnson et al. 2001; Rettie and Messier 2000; Schaefer and Messier 1995). At course scales, selection is for habitat (including islands, string bog complexes, coastal barrens or alpine regions) of sufficient extent to enable caribou to avoid predation either by maintaining low densities across the landscape, or by permitting escape. At finer scales, caribou select for forage in treed, peatland complexes dominated by larch (*Larix laricina*) and black spruce (*Picea mariana*), and avoid early seral stage forests and recently disturbed areas (Stuart-Smith et al. 1997; Rettie and Messier 2000). Taken collectively, the general habitat requirements of woodland caribou would be a mosaic of habitat containing large, contiguous patches of older forest with terrestrial lichens, bog complexes, regions with snow depths in an acceptable range during winter, and limited human disturbance (Johnson et al. 2001; Seip 1998, Wittmer 2004).

Critical habitat is required to be identified under both provincial and federal endangered species legislation. From a legal perspective, critical habitat is considered to be the habitat necessary for the survival of the species (NL ESA E-10.1 2001). Similarly, recovery habitat (included under the 'critical habitat' definition in federal legislation) must also be identified. Critical and recovery habitat then, from an applied perspective, are areas required to sustain minimum and viable populations. The two concepts may be conceptualized on a continuum of viability, where survival is a lesser viability objective than recovery. Accordingly, area habitat requirements also differ. Critical habitat, associated with a short-term maintenance or survival

objective, is the minimum area required, and will in itself not lead to recovery. Conversely, recovery habitat is the area required for a self-sustaining population distributed throughout their current and historical range. Consequently, the discussion of critical and recovery habitat are made in context of the population goals for short and long-term persistence, or survival and recovery. To derive scientifically credible definitions, both habitat and population goals are founded in the biological requirement s and population ecology of the herds.

Several different processes will be used to define critical and recovery habitat for sedentary woodland caribou herds in Labrador. The first defines critical areas using current occurrence and observed densities of caribou on the landscape. The second is an analytical approach relating caribou occurrence to landscape features, and will be used to create a predictive model of habitat suitability. Finally, this model will be applied to the landscape over the current and historical ranges of the sedentary woodland herds to delineate and map potential recovery habitat. This approach develops a functional definition of critical habitat for sedentary woodland caribou, maps them, and identifies areas that are of a high conservation priority.

12.1 Critical Habitat

The term 'survival' in the critical habitat definition refers to the population, or in this case, the herd, not an individual animal. In this sense, survival implies a population with short-term resilience to catastrophic events or demographic uncertainty. For very small herds (less than several hundred animals), achieving the survival objective may include either maintaining or increasing population size and distribution. Depending on the size of the population and the threats it faces, this could involve either arresting a population decline or maintaining current population size. The simplest approach for defining critical habitat in this case would be to use caribou occurrence as an indicator of suitable habitat, and to designate the current occupied range as critical habitat, since abundance and distribution of caribou are linked.

An alternative interpretation of this definition is an area containing enough suitable habitat to support a population above an extinction threshold. The lower threshold may be construed as a 'quasi-extinction' level, or the probability that a population will fall below a given threshold or fraction of its size (Ginzburg 1982; Schneider and Yodzis 1994; Otway et al. 2004). Populations occurring at abundances below this threshold value are at risk of extinction. Quantitatively determining this threshold requires accurate estimates of population size, survival, and sampling variability (the calculation depends on the mean and variance of the log of annual growth increments) that are not currently available for the Labrador herds. However it may be possible to employ this technique in the future.

Determining critical habitat for larger (yet still threatened) herds will be based on telemetry, other locational information, ecological knowledge, and a distribution representative of historic range use. These will be used to determine core use areas. These could be determined using a nonparametric kernel density estimator (Worton 1987). Kernel estimators create probability density estimates in the form of a 'use distribution' based on locational data (Seaman and Powell 1996). The core area of a given probability is the area enclosed by a contour within which locations are closer together than would be expected under the assumption of uniform use of the area (Worton 1987). The recovery team will decide which probability polygons (e.g. 75%, 90% etc.) best reflect core use areas of the herd. Note that this designation could encompass a portion or all of the currently occupied range.

Areas designated as critical habitat for any herd are done so to the extent possible given

current knowledge and a precautionary philosophy. As knowledge on habitat requirements and population viability improve, designations may change to incorporate these.

12.2 Recovery Habitat

Recovery habitat is the area required to ensure a viable, self-sustaining population buffered against demographic and environmental variability, and deterministic changes such as habitat loss and overexploitation, over the long-term. By definition, it would include all critical habitat plus any additional areas necessary to achieve the recovery goal.

We will relate caribou location data (from field sampling, telemetry and ecological knowledge) with environmental data (elevation, forest stand cover types and land cover types from LANDSAT imagery, abundance of other ungulates) using Geographic Information Systems (GIS) and statistical modeling. A similar analytical approach has been used to define critical habitat for caribou in the NWT (A. Gunn personal communication.). The results will be represented as gridded maps that identify areas of suitable habitat and rank the probability of occupancy within a given grid cell. This technique is appropriate in that it does not assume habitat requirements *a priori*. Instead occupancy is used to derive habitat features and map potential habitat and probability of caribou occurrence. The final model can be tested using field sampling to determine presence or absence in predicted cells. While results are mapped, they are not static; use of a functional definition to delineate potential or recovery habitat ensures that landscape changes or knowledge gained in the future can be incorporated as they occur.

To effectively allocate recovery habitat, an estimate of viable population sizes for each herd are necessary. Population viability analyses (PVA) are a tool used by conservation biologists to estimate the probability that a population of a specified size will persist for a given length of time (e.g. Beissinger and McCullough 2002; Kelly and Durant 2000). While there are a number of limitations to the use and interpretation of PVA (Beissinger and Westpahl 1998), the act of undertaking a PVA itself can lead to insights on population–specific life history information and a recovery goal couched in the population ecology of the herd. Using information garnered from classification surveys, reproductive surveys and population structure, we will construct structured matrix models for the Lac Joseph and Red Wine Mountains caribou herds. As current information becomes available, this technique will also be possible to apply to the MMH. Matrix models are mathematical tools that permit processes such as survival and reproduction to be translated into population-level consequences (Caswell 1989). Consequently, they have been employed as a means of assessing population viability for species of conservation concern (Crouse et al. 1987; Wisdom et al. 2000). To assess the influence of different vital rates on population growth, sensitivity and elasticity analyses will also be conducted (de Kroon et al. 2000).

The results of both the habitat suitability mapping and viability analyses can be compared to estimates made using a simple range analysis. For example, given a desired density of 0.03 caribou per km^2, and a range area of 26 000 km^2, one might expect as many 780 caribou on that range.

13. Ecological Role

The subspecies *caribou* is virtually endemic to Canada, and the loss of local populations would diminish biological diversity in boreal forests across Canada. Caribou are extremely well adapted to life in the subarctic forests and taiga of central Labrador, a climatically harsh subarctic region that remains snow-covered for 8 months of the year, with large annual fluctuations in day length and temperature. The *sedentary* woodland ecotype is unique both behaviorally and morphologically. Unlike their migratory counterparts, sedentary woodland caribou remain on their range year-round, live alone or in small groups, and disperse, rather than aggregate, at calving. Warm-blooded herbivores make a large contribution to energy flow in the arctic. Though they share the southern part of their range with moose, caribou are the sole large herbivores in many parts of their range. Their foraging on lichen and seasonally available leafy plants converts above ground primary production to energy and returns minerals in to the soil to a readily usable form via their feces and urine. This process results in an increase in the cycling of matter and the subsequent productivity of the vegetation. With respect to an ecological niche, caribou exploit a food source, lichens, not consumed by any other herbivore (e.g. small mammals, ptarmigan, moose, and hares) in the system. Additionally, caribou are an important prey source in a system in which there are few sources of large prey available. As such, they are vital to northern carnivores such as gray wolves and black bears, and numerous scavengers.

14. Importance to People:

Perspective of the Labrador Inuit Association

- The Inuit view caribou as an important food source. Most Inuit families depend on caribou as a source of food. For communities in the southern part of the land claim area these herds once provided a proximate and readily available source of food year round.

- Caribou hides and hair are used on a small scale for clothing and craftwork. Crafts are sold to supplement incomes.

- With the creation of two new national parks, some of our membership is becoming interested in eco-tourism business opportunities. Abundance of wildlife is a part of Labrador's appeal. Easier access to Labrador will increase the demand for eco-tourism services and potential for economic growth in local communities.

- Although caribou are seen as a food source, there are also cultural values regarding when and how wildlife resources are utilized. If these herds are not recovered a piece of our identity will be lost. Inuit identity is defined by our relationship with the land and wildlife. If Inuit activities are directly related to the demise of these herds, we will have definite concerns regarding the preservation of our cultural values.

Perspective of the Innu Nation:

- Caribou are a significant source of food for the Innu and are important in their diet year-

round. In recent years, when the migratory George River caribou herd has been coming south, the Innu hunt enough caribou to store food through the summer until the next time the herd returns.

- Caribou hides were a primary source of clothing, and are still used to make moccasins and snowshoes (which are still used for traveling). They are also used to make crafts such as tea dolls, and hunting bags, and are sold in a craft shop by the Innu.

- Caribou are an important religious iconic symbol because of their relation to the 'Caribou Master', or Kanipinikassikueu, seen by the Innu as a protector of faunal or mammalian creatures, and important in the Innu's storytelling.

- Conservation for the Innu has been when Innu who hunted in a certain place moved to another place until the other place had replenished itself. The strategy was never directed at a single species, but rather the whole area.

Perspective of Non-Aboriginal Local Residents

- Non-aboriginal people have been continuously hunting caribou in Labrador since the mid-1700's especially in southeastern Labrador. Most however came post 1940 with many now second and third generation residents. Many of these people came with already strong subsistence hunting traditions, including caribou. These people, especially those residing in central and southern Labrador, have in many instances integrated their hunting and other activities with those of aboriginal peoples. Much has been shared and learned between the various groups; the aboriginal people in particular have shared their knowledge of the land and its wildlife.

- Non-aboriginal people, especially those with longstanding association with and roots in Labrador, would like to see the recovery of Labrador woodland caribou to a level that would support a hunt. They know that the George River caribou herd varies cyclically in abundance and is thus not reliably available. They also realize the recovery of Labrador woodland caribou will probably take generations. The single most important thing is for the caribou to recover.

15. Anticipated Conflicts or Challenges:

- Illegal hunting is still taking place. No one knows to what extent, but in 2003 15 animals were poached from the RWM herd, 2 in the Lac Joseph herd, and 6 in the Mealy Mountains herd. During the winter of 2003-2004, multiple charges were laid for illegal hunting in closed areas in both the LJH and RWMH ranges. These numbers are known incidents and under represent actual losses. Demographic information suggests that mortality is not being offset by recruitment, and that hunting mortality is additive, not compensatory (Bergerud 1994). Therefore, hunting mortality likely limits recovery and/or contributes to observed herd declines. Adequate enforcement and continued stewardship are necessary in order to effectively address this problem.

- Industrial development including commercial forestry, hydroelectric development, military operations, mineral exploration and the construction of a Trans-Labrador highway collectively continues to expand in Labrador. Currently an extension of the Trans-Labrador highway from Goose Bay to Cartwright traverses the range of the Mealy Mountains herd, proposed hydroelectric projects to flood portions of both RWMH and LJH ranges, and commercial forest operations are being undertaken and planned for areas within the ranges of all three herds. These activities cumulatively fragment herd ranges, cause disturbance, and permit access to previously inaccessible areas to hunting through the construction of linear corridors and ancillary facilities.

- The incursion of tens of thousands of legally-hunted migratory caribou from the George River herd into the ranges of sedentary woodland caribou herds during winter results in accidental deaths as the morphological differences between the two ecotypes are not readily apparent in the field, and may not be consistent through time. As these southerly caribou are also the most readily accessible to hunters, this results in a conflict between managing a sustainable hunt for a large herd and protecting threatened sedentary woodland caribou herds.

- Increased tourism, including the development and use of new or improved snowmobile trails, will increase hunting pressure.

- Depending on the types of management guidelines and restrictions established for critical habitat, numerous conflicts with land users could arise.

- If or as the herd(s) recover, there will be increased public pressure to allow limited harvesting. Will the Labrador herds' status always be linked to the national status? Also, can individual herds be delisted pending their recovery status?

- Several different agencies and government departments over the last 30 years have undertaken the collection of information regarding the distribution, abundance and population structure of each of the 3 herds. In order to assist recovery, this information must be compiled, summarized, and made available to the recovery team and government agencies responsible for the management and recovery of the herds. This may require an MOU between appropriate parties.

16. Knowledge Gaps

- Essential to recovery planning is current information on population size, structure, distribution, and a comparison with historical values. Adult mortality and survival rates must also be determined in order to assess the impact of threats and determine recovery potential. In addition, the latter information should be integrated in a quantitative population viability assessment (PVA) for each herd. The population size(s) required to attain the recovery goals for each of the 3 herds must also be determined, and can be done in part using the results of the herd-specific PVAs.

- It will also be necessary to quantitatively establish the characteristics of high-value caribou habitat and its occurrence throughout the ranges, and to test and verify the model by sampling for caribou presence in predicted areas. Areas that may be at risk must also be identified, and the possible impact of any threats ascertained.

- Both the Lac Joseph and Red Wine Mountains herds have been the subject of monitoring and research over several decades, and thus the existing data for these herds will provide the foundation for several of the latter questions. New information requirements may arise as we undertake recovery objectives.

- While there are excellent historical data, current information on the Mealy Mountains herd is lacking. Information on current calving range, seasonal range use, and population structure or demographics must be collected in order to complete the viability assessment for this herd.

- In order to determine the relative importance and level of current or potential risk posed by the latter threats, the Recovery Team will undertake a review of existing mortality records. This process will allow threats to be ranked according to their relative significance between herds and, accordingly the development of appropriate mitigation. Studies will be designed to acquire additional clarification or information where deficiencies exist.

- Metapopulation dynamics among Boreal caribou herds, and also among herds of sedentary and migratory ecotypes, are poorly understood. Exchange of individual animals between the sedentary woodland caribou herds could in theory help to buffer low population sizes and assist reestablishment of other subpopulations. Future studies should work to quantify the degree of exchange among herds. A genetic study comparing the relatedness among herds might shed insight into the origins of, degree of exchange among, and possible metapopulation dynamics as well.

- Given the possible relationship between moose abundance, wolf presence and caribou predation, it would be useful to census the abundance and distribution of moose (last done in 1994), particularly within the range of the RWMH caribou. More detailed information on all recovery activities will be found in the Woodland Caribou (Boreal population) Action Plan.

17. Ecological and Technical Feasibility of Species Recovery:

The Recovery Team has concluded that recovery of all 3 herds is ecologically and technically feasible. Regular classifications have been undertaken of both the RWM and LJ herds, and these data suggest that parturition rates are consistent with a stable or increasing population. Similarly, recruitment rates (the proportion of calves that survive to become adults and enter the breeding population, usually measured as both calves/100F and percent calves in late winter) are good (> 20%) and have actually increased each year since 2001, underscoring the recovery potential of these 2 herds. Populations of Boreal woodland caribou are generally considered stable if calves make up at least 15% of the herd during late winter, assuming adequate (>85%) adult survival (Bergerud 1980). Current demographic data for the Mealy Mountains caribou herd are not adequate to assess this herd's inherent capacity to recover, though excellent historical data exist. However, here too,

the 2003 classification suggest that recruitment is adequate to allow the population to recover.

With respect to availability of suitable habitat, a considerable portion of the historical ranges of all 3 herds remains intact. In addition, areas identified under several proposed protected areas would encompass segments of the ranges of all herds. However, resource development and extraction activities continue to increase, previously inaccessible areas are becoming so, and none of the proposed protected areas have yet been established.

Mortality of adult females (male animals have not been fitted with radio-collars) however, is high and appears to be increasing. Given the significant contribution of breeding females to population growth, if mortality of adult animals remains high, it will severely limit the potential of these herds to recover, and contribute further to their present decline. Due to the small herd sizes (and low densities across the landscape), mortality attributable to illegal hunting/incidental to legal hunts are 'additive'. Additive mortality describes a situation where mortality increases linearly with harvest due to the absence of density-dependent compensation at low population levels. Fortunately this component of mortality can be managed by regulating human behaviour through stewardship, increased surveillance to encourage compliance with endangered species and wildlife regulations, and through new regulations designed to protect sedentary woodland animals in situations where migratory and sedentary herds have intermingled. While support for this type of approach is increasing, regulations that involve restricting access to migratory caribou when they are within the winter ranges of sedentary animals these regulations are politically unpopular, and difficult to enforce. Any such efforts must be coupled with stewardship initiatives to improve their success.

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APPENDIX 1: A Glossary of Acronyms

COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DND	Department of National Defense
FAPAQ	Société de la Faune et des Parcs aux Québec
GRH	George River Caribou Herd
IEMR	Institute for Environmental Monitoring and Research (Goose Bay, Labrador)
IFWD	Inland Fish and Wildlife Division, Government of Newfoundland and Labrador
LJH	Lac Joseph (Caribou) Herd
LSARP	Labrador Species at Risk Stewardship Program
MMH	Mealy Mountains (Caribou) Herd
NL ESA	Newfoundland and Labrador Endangered Species Act
NLWD	Newfoundland and Labrador Wildlife Division (same as IFWD)
PVA	Population Viability Analysis
RWMH	Red Wine Mountains (Caribou) Herd.
SARA	Species at Risk Act (Federal)
TLH	Trans-Labrador Highway
VHF	Very High Frequency radio collars. These collars must be monitored remotely by scanning for their radio-frequency from an aircraft.