THE FOREST-DWELLING CARIBOU (*Rangifer tarandus*) RECOVERY PLAN IN QUÉBEC – 2005-2012

by

The Forest-Dwelling Caribou Recovery Team

Ministère des Ressources naturelles et de la Faune

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[1] The individuals listed here are those having participated in the elaboration of the Recovery Plan since October 2003. At the time this document was published, the composition of the Recovery Plan Team no longer corresponded to this list.

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IMPORTANT NOTE

The members of the Québec Forest-Dwelling Caribou Recovery Team have agreed on the content of this document. They have used the best information available at the present time and have proposed a strategy and actions which, in their opinion, are likely to accelerate the recovery of the forest-dwelling caribou in Québec.

The Ministère des Ressources naturelles et de la Faune du Québec and all of the organizations that participated in the preparation of this Plan approve of the general approach proposed by the Recovery Team. However, they are unable to make the commitment that all of the proposed actions with be carried out, given the appropriations available for the recovery of threatened and vulnerable species, the priority assigned to each species, and the contribution of the many organizations involved over the entire duration of the Plan.

FOREWORD

In the past, the forest-dwelling caribou was present in all Canadian provinces and in most of the American states bordering Canada. However, over the last several decades, the southern limit of the forest-dwelling caribou's range has gradually moved northward and its populations have declined significantly. Since 2002, actions have been taken across Canada to safeguard this species in its current range. This Recovery Plan is among these actions applied in Québec. Indeed, the plan aims to better define the historical and present-day situation of the forest-dwelling caribou and to propose the appropriate recovery strategies.

Obviously, the preparation of a plan of this scope required the collaboration of a number of individuals and organizations from different regions and backgrounds.

The Québec Forest-Dwelling Caribou Recovery Team would like to thank Michel Damphousse, Daniel Banville and Claude Dussault for their judicious comments and suggestions concerning the various preliminary versions of this plan as well as Jacinthe Bouchard and Raymonde Lacombe for the correction and the page layout of this document.

SUMMARY

The forest-dwelling caribou is a non-migratory ecotype of the woodland caribou (*Rangifer tarandus caribou*). The southern limit of its range has continued to retreat northward, and aerial surveys have shown the precarious state of populations as well as their decline. The forest-dwelling caribou lives in small densities and has a low recruitment potential, which limits the growth of populations. However, other reasons have been cited to explain the decline of this species. Indeed, logging and sport hunting are considered the main factors in the historical decline of forest-dwelling caribou populations. Today, the accidental harvesting of forest-dwelling caribou while hunting for barren-ground caribou, the Aboriginal harvest and poaching can accentuate the precarious state of this species. Increased accessibility in managed forests has reduced the peace and tranquility of the forest-dwelling caribou, an element deemed essential for a good quality habitat. In addition, the growth of felled areas could also contribute to the elimination of the best remaining habitats. The forest-dwelling caribou is well adapted to forest fires, but there is insufficient documentation on the impact of felling activities. However, as is the case with forest fires, felling operations promote the regeneration of hardwood species which are conducive to the appearance of the moose (*Alces alces*) and, owing to this fact, of caribou predators such as the wolf (*Canis lupus*) and the black bear (*Ursus americanus*). These elements have contributed to varying degrees, depending on the regions of Québec, to the decline of forest-dwelling caribou populations. At the present time, the forest-dwelling caribou is found in the administrative regions of Côte-Nord, Saguenay–Lac-Saint-Jean, Nord-du-Québec, Abitibi-Téminscamingue and Capitale-Nationale.

In 2002, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended the status of threatened population for the forest-dwelling caribou of the boreal forest across Canada. The forest-dwelling caribou of Québec is part of this population. In March 2005, following a recommendation made by the Comité aviseur sur les espèces fauniques menacées ou vulnérables du Québec (Advisory committee on threatened or vulnerable wildlife species), the Government of Québec granted the forest-dwelling caribou the status of vulnerable species under the *Act respecting threatened or vulnerable species of Québec*. In 2003, Faune Québec set up a team in charge of drawing up a forest-dwelling caribou recovery plan in Québec. This marked the birth of the Québec Forest-Dwelling Caribou Recovery Team.

The main purpose of this Plan is **to enable the forest-dwelling caribou to return to a satisfactory state all across its range so that this species can be removed from the list of threatened or vulnerable species.** To achieve this goal, three main objectives have been established:

- **maintain the occupation of the current range of the forest-dwelling caribou;**
- **reach and maintain at least 12,000 forest-dwelling caribou in Québec, with a uniform distribution within the habitat strata;**
- **maintain and consolidate the isolated herds of Val-d'Or and Charlevoix.**

The thirty actions put forward to achieve these objectives are grouped within a strategy made up of five main elements:

- **maintain or increase the caribou survival rate;**
- **preserve adequate habitats for the forest-dwelling caribou;**
- **adopt forest management methods that maintain the integrity of the boreal forest over the long term;**
- **seek public support;**
- **continue the research and the development of knowledge.**

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1. INTRODUCTION

The Government of Québec endorses the international objectives of preserving biodiversity at the gene, species and ecosystem level. In June 1989, it passed an Act respecting threatened and vulnerable species (R.S.Q., c. E-12.01) and rapidly adhered to the Convention on Biological Diversity adopted under the aegis of the United Nations in 1992. In 2002, Québec also passed the Natural Heritage Conservation Act (R.S.Q., c. C-61.01), which provides a framework for the creation of a network of protected areas in order to meet its international commitments regarding the conservation of biodiversity. For its part, an *Act respecting threatened or vulnerable species* provides for the identification of species in difficulty and the putting in place of a strategy to restore the designated species and their habitats. The *Forest-Dwelling Caribou Recovery Plan* falls within this context.

The forest-dwelling caribou is a genetically distinct ecotype of the caribou species (*Rangifer tarandus*) which occupies the upper latitudes of the entire northern hemisphere (Courtois *et al.* 2003a). It is part of the so-called woodland caribou (*Rangifer tarandus caribou*) subspecies. Its official name is "woodland caribou, forest-dwelling ecotype" but it is commonly referred to as the "forest-dwelling caribou". Two other ecotypes are found in Québec: the barren-ground caribou, associated with the tundra, and the mountain caribou, found solely on the Gaspé Peninsula and in the vicinity of Parc national de la Gaspésie (Courtois *et al.* 2003d).

The forest-dwelling caribou is a dominant species of the boreal forest and has become an important element in the conservation of the biodiversity of this type of forest in North America. The range of the forest-dwelling caribou declined, particularly in the northeastern part of this continent, following the colonization by Europeans. Indeed, at the time of the arrival of the first Europeans in America in the early 17th century, the forest-dwelling caribou occupied the Maritime Provinces, the northern part of the State of New York, Vermont, New Hampshire, Maine as well as all of southern Québec (Moisan 1956; Courtois *et al.* 2003b). By the middle of the 20th century, south of the St. Lawrence River, the caribou only remained in the central part of the Gaspé Peninsula, whereas its range had retreated to the northern part of the Saguenay (Moisan 1956; Courtois *et al.* 2003b) (Figure 1). More recently, aerial surveys have confirmed the precarious state of forest-dwelling caribou herds and their decline over the last several decades (Courtois *et al.* 2003b). The main factors put forward to explain the decline of forest-dwelling caribou populations over the last 150 years have been excessive hunting, the loss of habitats and predation by the grey wolf (*Canis lupus*) and the black bear (*Ursus americanus*).

Concerns have been voiced about the forest-dwelling caribou throughout its entire North American range. In May 2002, following the analysis of the report written by Thomas and Gray (2001), the Committee on the Status of Endangered Wildlife Species in Canada (COSEWIC)[2] evaluated the situation of all of the forest-dwelling caribou in Canada. In 2003, the Government of Canada attributed the status of threatened species[3] to the "forest-dwelling caribou of the boreal forest" - equivalent to the forest-dwelling caribou in Québec - across Canada under the provisions of the Endangered Species Act (R.S.C., c. C-29). In Québec, as a follow-up to the recommendation of the Comité aviseur sur les espèces fauniques menacées ou vulnérables

[2] The list of the abbreviations used in this text is appended to this document.

[3] Under the Endangered Species Act, a threatened species is a wild species that is likely to become an endangered species if nothing is done to combat the factors leading to its disappearance.

(Advisory committee on threatened or vulnerable wildlife species) made in February 2002, the Government of Québec attributed to the forest-dwelling caribou, in March 2005, the status of vulnerable species, namely a taxon whose survival is not ensured over the medium and long term (MLCP 1992), under an Act respecting threatened or vulnerable species.

Recent works have made it possible to confirm the genetic uniqueness of Québec's forest-dwelling caribou and to propose explanations for its decline and its precarious situation (Courtois *et al.* 2003a). Consequently, we now have sufficient information to take action and to propose a recovery plan.

For their part, the caribou living on the Gaspé Peninsula and mainly frequenting Parc national de la Gaspésie are associated with the mountain ecotype. This population, which has been designated vulnerable, is the subject of a specific recovery plan (Comité de rétablissement du caribou de la Gaspésie 2004).

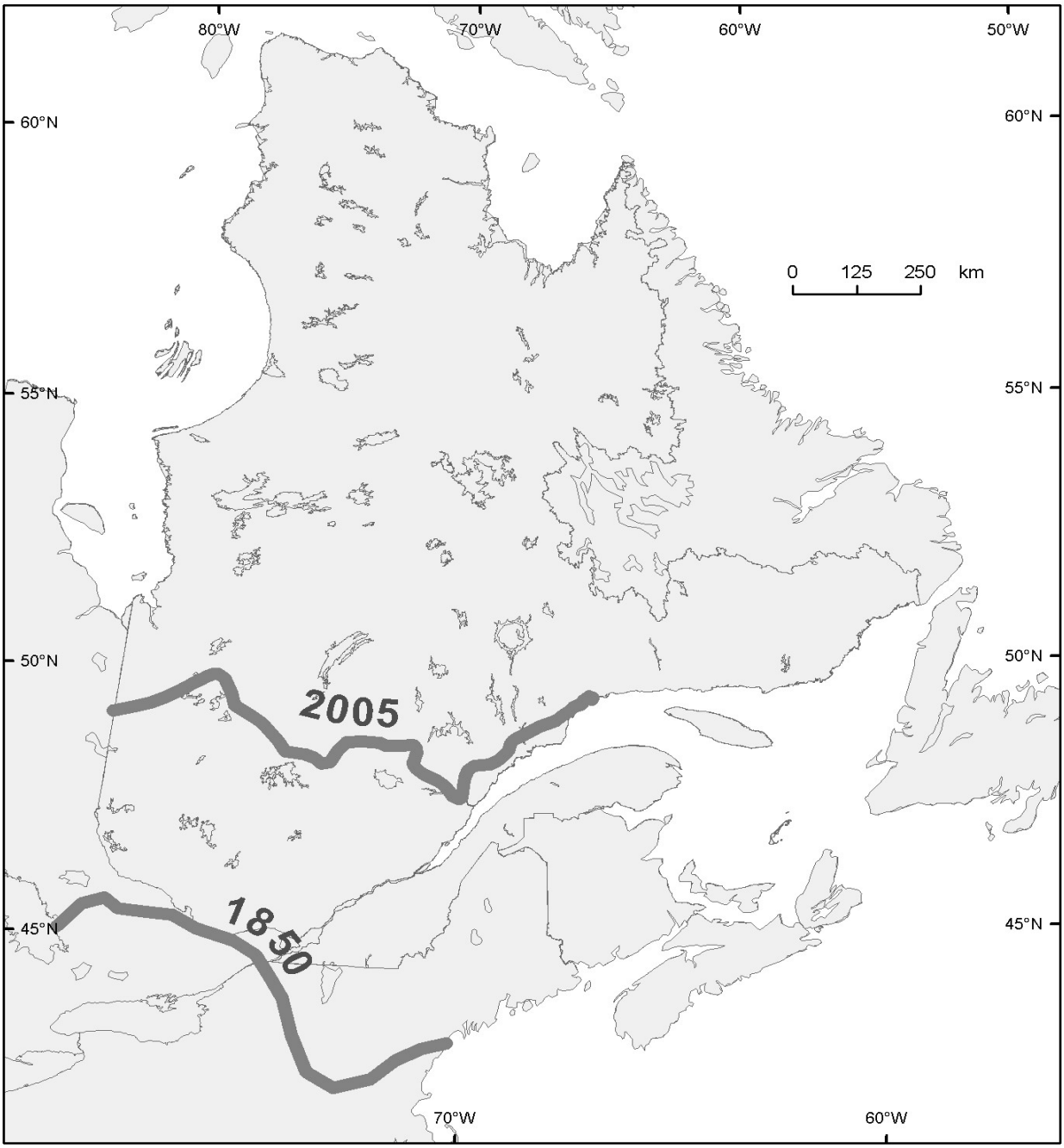

Figure 1. Evolution of the caribou's historical range in Québec from 1850 to 2005.

2. CURRENT SITUATION

2.1 DISTRIBUTION OF THE FOREST-DWELLING CARIBOU

In Québec, the forest-dwelling caribou mainly occupies the spruce-lichen and spruce-moss bioclimatic domains (Crête *et al.* 1990a; Saucier *et al.* 2003). It is found almost continuously from Ontario to Labrador, over a strip of about 500 km in width (Crête *et al.* 1990a) (Figure 2), approximately between the 49th and 55th parallel of north latitude. Forest-dwelling caribou live in low density in adjacent and genetically linked herds (Courtois *et al.* 2003a). The concept of metapopulation applies well to the forest-dwelling caribou of Québec, Ontario and Labrador (Courtois *et al.* 2003a). If its northern limit is set at the northern edge of the spruce-lichen bioclimatic domain, the continuous range of the forest-dwelling caribou currently covers some 644,000 km^2. The forest-dwelling caribou is present in Québec in the administrative regions of Côte-Nord, Saguenay-Lac-Saint-Jean, Nord-du-Québec, Abitibi-Téminscamingue and Capitale-Nationale.

Generally, the southern limit of the forest-dwelling caribou's range has tended to gradually move northward as the populations have declined and eventually disappeared. A similar situation was observed in Ontario (Racey and Armstrong 1996; Schaefer 2003). Similarly, the number of caribou seems to have declined substantially in certain sectors, notably on the Basse-Côte-Nord (Lower North Shore), likely as the result of excessive hunting (Courtois *et al.* 2003b).

The forest-dwelling caribou populations of Lac Bienville and Réservoir Caniapiscau, situated at the 55th parallel of north latitude, were the subject of a few research and inventory works between 1975 and 1983 (Brown *et al.* 1986). In several communities located in the southern part of its range, only a few isolated sightings testify to this species' survival (C. Dussault, A. Gingras, D. Saint-Pierre and M. Paré, pers. comm.) South of its continuous range, two isolated forest-dwelling populations remain: the population of Val-d'Or and that of Charlevoix. These populations were gradually isolated from the main population when the southern limit of the caribou's range moved northward. The caribou of Charlevoix, located in Réserve faunique des Laurentides, Parc national des Grands-Jardins and the adjacent territories north of Québec City, had disappeared toward 1920 as the result of abusive hunting (Jolicoeur 1993, Banville 1998). However, between 1969 and 1972, 82 forest-dwelling caribou were re-introduced from a line originating mainly from Lac Opiscotéo, located 350 km north of Sept-Îles. The caribou of Charlevoix have persisted since then in Parc national des Grands-Jardins and in the surrounding area (Banville 1998). The caribou population of Val-d'Or is of natural origin and has survived thus far, despite its very small numbers (Paré et Brassard 1994).

Toward 1980, the barren-ground caribou of the Rivière George herd began to extend their winter incursions into the boreal forest, all the way up to the range of the forest-dwelling herds of Lac Bienville (Brown *et al.* 1986) and Réservoir Caniapiscau (Paré et Huot 1985). Since 1986, satellite monitoring of the barren-ground herds of Rivière George and Rivière aux Feuilles has shown that they regularly descend to 54 degrees of north latitude and that they occasionally travel even further south (Appendix 3). The incursions of the barren-ground caribou have created a zone of overlapping between the barren-ground and forest-dwelling ecotypes.

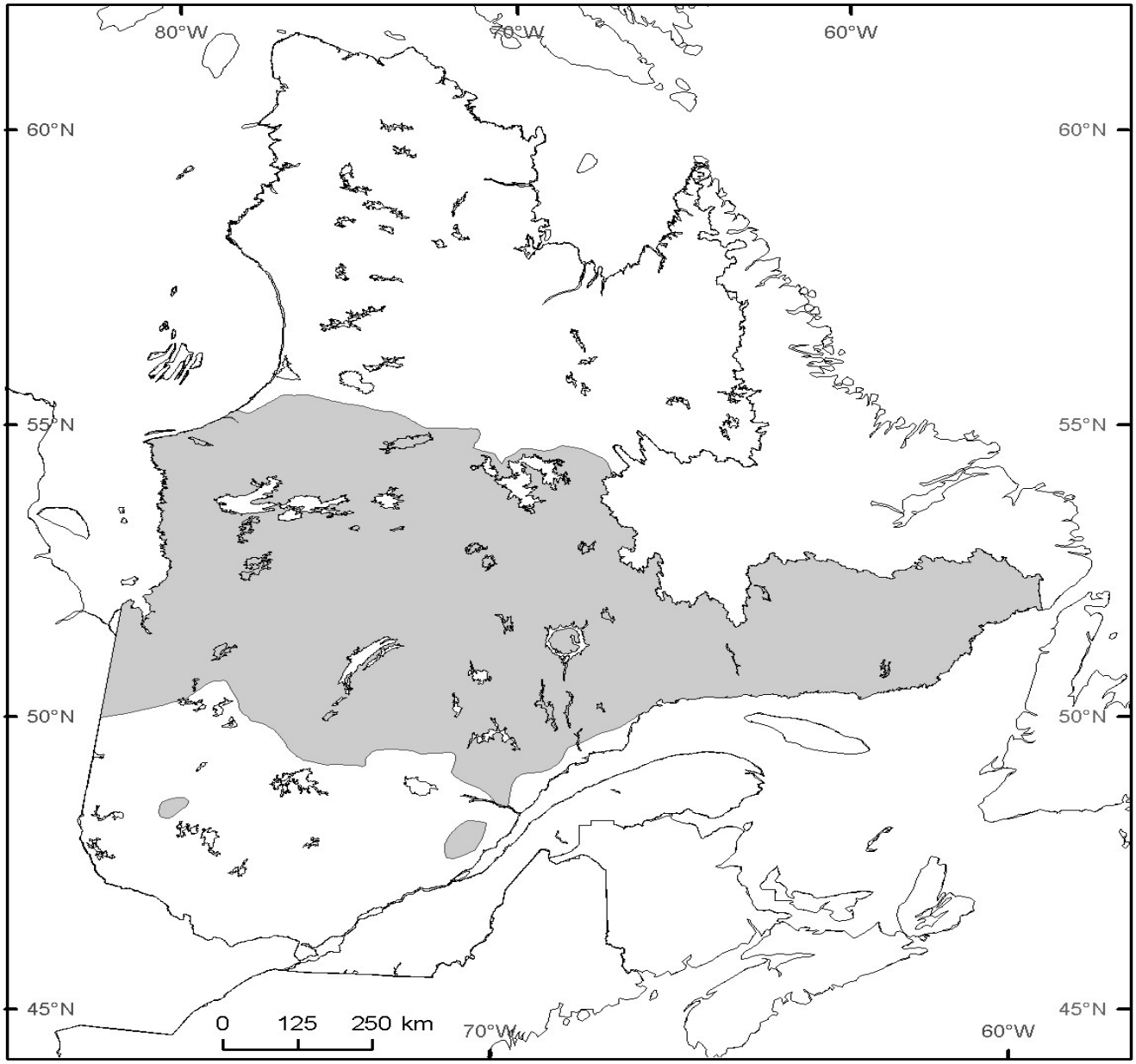

Figure 2. Range of the forest-dwelling caribou in Québec in 2005.

2.2 BIOLOGY OF THE SPECIES

2.2.1 Diet

Terrestrial lichens (*Cladina* spp., *Cladonia* spp., *Cetraria*, spp., *Parmelia* spp.) are the main element in the diet of the forest-dwelling caribou which consumes lichens in abundant quantities in winter and in smaller quantities during the other seasons (Thomas and Gray 2001). In winter, forest-dwelling caribou dig holes up to 120 cm in depth to reach lichens (Barrette et Vandal 1986) by relying on olfactive (nose buried in the snow or in vents produced by shrubs) or visual (erratic blocks, eskers, areas near wetlands) stimuli (Brown and Theberge 1990). Caribou also eat herbaceous plants (*Carex* spp, *Eriophorum vaginatum*, *Smilacina trifolia*) and leaves of shrubs, such as scrub birch (*Betula glandulosa)* or blueberry (*Vaccinium* spp.) (Gauthier *et al.* 1989; Thomas and Gray 2001). In peatlands, caribou often eat horsetail (*Equisetum* spp.) and buckbean (*Menyanthes trifoliata*), particularly in spring and summer (M. Paré, pers. comm.).

2.2.2 Longevity

The average longevity of barren-ground caribou is 4.5 years, but some individuals can live up to 15 years in a natural setting (Banfield 1977). There is every reason to believe that the values noted for the barren-ground caribou may be applied to the forest-dwelling caribou. However, these estimates are very approximate given that the population dynamics can differ widely between populations and ecotypes. Within the context of telemetry surveys of forest-dwelling caribou fitted with transmitter collars, it was estimated that they could grow to the same old age as do the barren-ground caribou (L. Breton, pers. comm.)

2.2.3 Reproduction

As with the other cervidae of Québec [the white-tailed deer (*odocoileus virginianus*) and the moose (*Alces alces*)], the rutting and mating period of the forest-dwelling caribou occurs in the fall, from September to November (Moisan 1957; Bergerud 1973). There is a clear hierarchy among males within a group, and rutting is a period of intense activity punctuated by bouts of intimidation and clashes between males (Bergerud 1973). Males are polygamous and females have a seasonal polyoestrous cycle (Banfield 1977). Mating generally occurs toward mid-October (Bergerud 1973; Stuart-Smith et al. 1997; Ferguson and Elkie 2004).

Most female caribou mate for the first time at 2.5 years of age and only give birth to one calf per year (Courtois et al. 2003c). Occasionally, a portion of the females 1.5 years of age can mate if the habitat is very productive from a food standpoint. In Québec, the majority of adult females ($\geq$ 2.5 years) reproduce each year (Courtois et al. 2003b). Calving generally occurs between May 20th and June 10th, although some births have been observed as late as the end of June (M. Paré, pers. comm.).

Usually, the calf/female at birth ratio is about 70 to 74 calves/100 females (Thomas and Gray 2001). Heard (1990) calculated a theoretical maximum growth rate of 36% per year, whereas the rates observed under the best natural conditions reach between 23 and 30%. The forest-dwelling caribou has a relatively low demographic growth potential in comparison with the other cervidae

of Québec. Indeed, earlier reproduction in females of other cervidae and the fact that they frequently give birth to twins help explain this higher potential.

2.2.4 Parasites and diseases

The forest-dwelling caribou may be affected by a host of diseases. It may be infested with certain parasites such as caribou warble fly (Oedemagena tarandi), liver fluke (*FascioloÏdes* magna), certain intestinal worms (*Taenia spp., Echinococcus spp*) and is subject to some diseases affecting wild ungulates (Fréchette 1986). However, the meningeal worm (*Parelaphostrongylus tenuis*) is the only parasite that could theoretically have a serious impact on the caribou. In fact, this parasite does not overly affect the white-tailed deer (*Odocoileus virginianus*), but it is often fatal for moose (*Alces alces*) and caribou (Fréchette 1986). According to Messier et al. (1987), the presence of the meningeal worm can create a biological barrier limiting the expansion of the forest-dwelling caribou's range. In Nova Scotia, this parasite is thought to have been the direct cause of the disappearance of the caribou reintroduced between 1968 and 1969 (Dauphiné 1975). Similarly, certain caribou reintroduced in the State of Maine died from a meningeal worm infection contracted while they were in an enclosure (McCollough 1991). In Québec, since the forest-dwelling caribou and the white-tailed deer live in very different habitats and today have separate ranges, this parasite is not considered to be a major limiting factor. The parasite is, however, present in the Gaspésie region, but no case of infestation in the Gaspésie caribou attributable to this parasite has been observed in this region despite the presence of moose and white-tailed deer in a portion of the caribou's home range (Claveau et Filion 1984; Crête et Desrosiers 1995).

2.2.5 Home ranges and migration

Depending on the season, forest-dwelling caribou move about considerably, but on a smaller scale than in the case of barren-ground caribou (Schaefer et al. 2000). They tend to congregate in winter, often near sites offering a rich source of terrestrial lichens. In spring, they disperse in softwood forests and peatlands. Forest-dwelling caribou remain isolated during calving and in summer, but congregate again in the fall for reproduction (Jolicoeur et al. 2005).

Their annual home ranges cover large areas. In Charlevoix, data obtained from 1978 to 1981 indicate that on average the surface area of the annual home range was on the order of 160 km² (Jolicoeur et al. 2005) whereas during the period from 1998 to 2001, the home ranges covered 360 km² (Sebbane et *al*. 2002). On the Haute-Côte-Nord (Upper North Shore), the surface area of annual home ranges was on the order of 495 km² (Courtois et al. 2003c). However, significant differences are noted between individual animals and populations (32 to 1,470 km^2) (Timmermann 1998; Stuart-Smith et *al*. 1997). On an individual basis, use of the home range changes from year to year. Indeed, the geographical centre of the seasonal home ranges may be from 5 to 35 km apart from one year to the next depending on the period of the year (Courtois et al. 2003c). July and August are the months when female forest-dwelling caribou are the most loyal to a part of their home range (Schaefer et al. 2000). Moreover, they do not use the same calving sites from one year to the next (Schaefer et al. 2000; Courtois et al. 2003c).

2.2.6 Density

Aerial surveys of forest-dwelling caribou carried out in Québec over the last few decades have revealed very low densities on the order of 1 to 3.5 caribou/100 km2 (see section 2.5.1). Elsewhere in Canada, forest-dwelling caribou population densities are also very low. The highest densities are found in northern Saskatchewan and northern Alberta (from 3.1 to 13.1 caribou/100 km²; Thomas and Gray 2001).

2.3 HABITAT

2.3.1 Use of the habitat

Generally, forest-dwelling caribou live in homogenous environments that are ill-suited to other cervids, possibly in order to reduce predation risks (Bergerud 1985, 1988, 1996; Seip 1991; Crête et Manseau 1996; Racey et al. 1997; Stuart-Smith et al. 1997; Crête 1999). These caribou are mainly found in mature black spruce (Picea mariana) forests whereas they avoid disturbed environments (Courtois et *al*. 2003e), such as logged areas and recent burn sites, either because the risks of predation are greater there or because lichens are destroyed by forestry operations or by fire (Cichowski 1996; Saperstein 1996). Some burn sites may occasionally attract caribou during the initial re-vegetation stages owing to the rapid development of herbaceous plants (Saperstein 1996).

In Alberta, the forest-dwelling caribou show a strong preference for open or wooded peatlands (Bradshaw et al. 1995; Stuart-Smith et al. 1997). In Saskatchewan, caribou frequent peatlands (Rettie et Messier 2000) and black spruce stands, but avoid felled areas (Rettie et *al*. 1997). In northwestern Ontario, forest-dwelling caribou mainly use sites offering a rich supply of lichens which they find in dry areas, waterlogged sand deposits, eskers, dunes or wetlands with exposed rocks (Racey et al. 1997), whereas in the northeastern part of this province, caribou mainly frequent mature spruce forests (Darby and Duquette 1986). Generally, the sites used vary according to the seasons and the surrounding environment. The variations observed are mainly determined by differences in the availability of food, antipredation strategies and reproduction sites (De Bellefeuille 2001; Courtois et al. 2003e).

In Québec, the use of the habitat by the forest-dwelling caribou has been studied in spruce-moss forests of the Côte Nord and the Saguenay–Lac-Saint-Jean (Courtois 2003), as well as in Charlevoix (Sebbane et al. 2002) and, in a less detailed manner, in Val-d'Or (Paré et Brassard 1994) and at the Réservoir Caniapiscau (Paré et Huot 1985).

In winter, forest-dwelling caribou form bigger groups than during the other seasons. They look for and prefer mature softwood forests, with and without lichens (Crête et al. 2004). In the balsam fir–white birch domain, the caribou of Charlevoix seek dense softwood stands, stands containing lichens and open areas in winter (Sebbane et al. 2002). The caribou of Val-d'Or frequent instead outcrops where lichens grow through peat-covered sectors (Ducruc et *al*. 1988; Paré et Brassard 1994). Caribou also use frozen bodies of water to move about, to distance themselves from predators and to rest (Darby and Duquette 1986).

At the time of calving, namely from mid-May to mid-June, forest-dwelling caribou continue to look for mature softwood stands with or without lichens, peatlands as well as balsam fir forests (Courtois et al. 2003e; Crête et al. 2004). In Charlevoix, caribou give birth preferably in young and open stands, in stands containing lichens and in hardwood or mixed stands (Sebbane et al. 2002). The caribou of Val-d'Or give birth in peatlands or in adjacent stands where they spend the entire snowless period (Paré et Brassard 1994). In spruce-lichen forests, forest-dwelling caribou look for the low reticulate edges of peatlands to give birth there (Paré et Huot 1985).

The summer habitat of the forest-dwelling caribou is not well defined. A few telemetric locations show sites occupied in summer after calving. No description of the habitat used may be extrapolated from these data.

During the rutting period, namely in mid-October, the forest-dwelling caribou alter the use of their habitat somewhat. These animals often need visual contact for the normal unfolding of reproduction activities, with males attempting to monopolize access to females (Bergerud 1973). During this period, forest-dwelling caribou show a preference for peatlands, softwood stands containing lichens and young softwood stands (Courtois et al. 2003e; Crête et al. 2004). The caribou of Charlevoix look for similar environments during the rutting period, namely peatlands, young open stands and stands containing lichens (Sebbane et *al*. 2002).

2.3.2 Composition and dynamics of the ecosystems used

The forest-dwelling caribou is found in the boreal forest (Figure 3). In Québec, this species mainly frequents the spruce-lichen and the spruce-moss domain. There are also a few isolated herds in the balsam fir-white birch domain, notably in the Val-d'Or and Charlevoix regions.

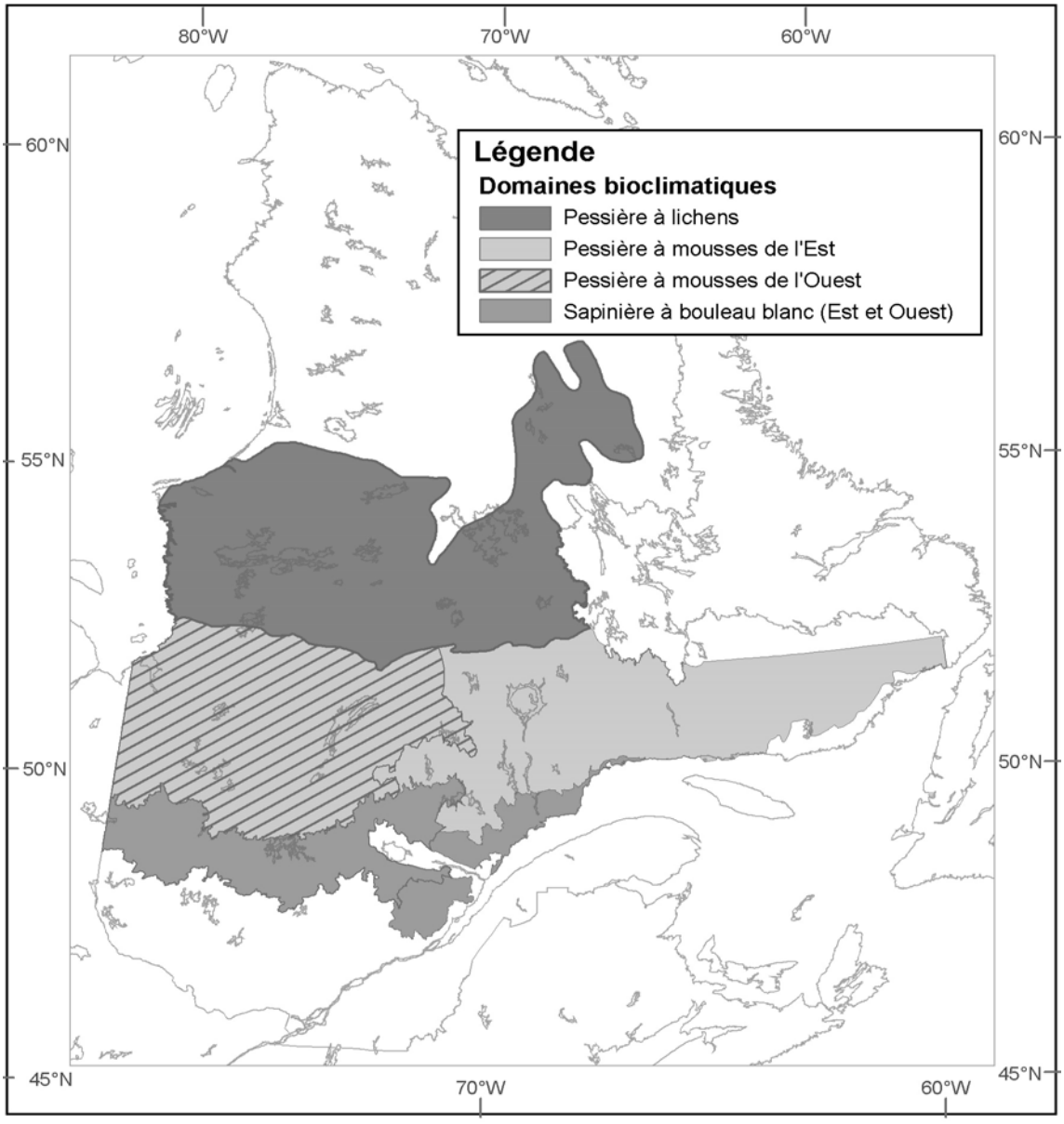

Figure 3. Location of the bioclimactic domains where the forest-dwelling caribou is found in Québec (Saucier *et al.* 2003).

Spruce-lichen bioclimatic domain

In Québec, the spruce-lichen domain occupies a strip approximately 300 km in width extending from the 52nd to the 55th parallels of north latitude, namely from James Bay to the Labrador border (Figure 3). The black spruce dominates this bioclimatic domain and forms continuous forests under mesic conditions (average moisture and drainage). On sandy soils, jack pine (*Pinus banksiana*) can form pure stands, whereas locally, paper birch (*Betula papyrifera*), tamarack (Larix laricina), quaking aspen (*Populus tremuloÏdes*) and balsam poplar (*Populus balsamifera*) are found as companion species (Payette et al. 1989). Lichens dominate the low vegetation on well-drained soils, whereas moss increases in importance when the drainage becomes deficient (Payette et al. 1989). Peatlands often occupy depressions. Lichens abound here, with the lichen biomass reaching 3,600 kg/ha in the western part of the spruce-lichen domain and 2,000 kg/ha in the east (Crête et al. 1990b).

The fire cycle is 100 years in the spruce-lichen domain, and the black spruce regenerates quickly after a fire (Sirois et Payette 1989). However, the fire often destroys the lichen carpets, which recolonize the disturbed sites according to a well established time sequence. After a fire, it takes some forty years before the lichen species sought by caribou attain a size that is suitable for this cervid (Morneau et Payette 1989).

In this part of the forest-dwelling caribou's range, the small size of trees and their relatively small density make logging operations unprofitable.

Spruce-moss bioclimatic domain

The landscapes found in the spruce-moss domain are largely dominated by the black spruce which forms a large number of monospecific stands there, occasionally associated with other companion species including the balsam fir (*Abies balsamea*) to the east or certain hardwood species to the west. However, balsam fir stands only occupy the most favourable sites. Hardwood species, such as paper birch, quaking aspen and, to a lesser extent, balsam poplar also grow in this domain. The undergrowths are covered by hypnaceous and ericaceous mosses, whereas few herbaceous species are found here.

The spruce-moss domain extends roughly between the 49th and 52nd parallels of north latitude, namely a strip of about 350 km in width from Ontario to the Basse-Côte-Nord (Figure 3). Considering the precipitation regime, the fire cycle and the distribution and composition of the forest, the spruce-moss domain is divided into two subdomains, that of the west and that of the east (Grondin *et al.* 1996). The fire cycle, the main element of the natural dynamics of the boreal forest, is about 500 years in the eastern part of the spruce-moss forest of the east (Foster 1983). The balsam fir is favoured here by the long fire cycle (Boucher *et al.* 2003).

The spruce-moss subdomain of the west is relatively dry. It is located at an altitude varying between about 25 m in the Rupert Bay sector and 450 m in the Lac Mistassini sector. The relief of this continental subdomain is dominated by plains in the James Bay region and gradually changes into hills and hillocks towards Lac Mistassini. Whereas the southern part of the subdomain is made up mainly of high-density black spruce-moss forests, in the north, it is composed of large areas dominated by open black spruce stands.

The spruce-moss forest of the west is made up of close to 90% pure spruce stands unlike the spruce forest of the east where there are many more balsam fir stands and mixed spruce and balsam fir stands. The majority (62%) of the stands of the spruce forest of the west have a regular structure, whereas irregular structures make up close to 70% of the stands of the spruce forest of the east.

The fire cycle is about 100 years towards the north of the spruce-moss forest of the west (Payette *et al.* 1989) and a little longer, namely around 200 years, in the south and towards the centre of Québec (Bergeron *et al.* 2001; Lesieur *et al.* 2002). The fire cycle has tended to grow longer since the mid-19th century (Bergeron *et al.* 2001; Lesieur *et al.* 2002).

The spruce-moss forest of the east is characterized by a maritime climate which brings with it greater rainfall levels which in turn lead to a relatively long fire cycle, namely from 200 to 500 years (Gauthier *et al.* 2001). This subdomain is situated at high altitude (> 800 m) to the west of Réservoir Manicouagan, but gradually slopes downward as it approaches the Gulf of St. Lawrence.

Black spruce stands with a dense forest cover - namely a forest cover density of between 40% and 60% - and balsam fir stands are mainly concentrated in the southern part. Further north, open black spruce stands, dominate the landscape.

The softwood cover and the mixed cover extend respectively over 58% and 6%, of the territory whereas open environments, such as outcrops and peatlands, represent only 17% of the territory. Due to the remoteness, logging operations only began here in the early 1990s. Based on the territories for which forestry data exist, 38% of spruce-moss forests are thought to be made up of stands over 120 years of age and close to 50% of stands between 50 and 90 years of age (MRNF, unpublished data).

Balsam fir-white birch bioclimatic domain

In Québec, the balsam fir-white birch bioclimatic domain covers a strip approximately 150 km wide, between the 48th and 49th parallels of north latitude (Figure 3) from the Ontario border to the west part of the Côte-Nord, but excludes the perimeter of Lac Saint-Jean and of the Gaspé Peninsula (Saucier et al. 2003). The forest landscape here is dominated by balsam fir and white birch (Picea glauca), mixed with paper birch on mesic sites.

The balsam fir-white birch domain may be divided into two subdomains: that of the west, where the relief is relatively flat and variations in level are minor and that of the east, which has a more maritime climate and a more rugged relief.

Throughout this domain, logging has played an important role since the start of the industrial period. On less productive sites, black spruce, jack pine and tamarack are found, often in the company of paper birch or quaking aspen. Yellow birch (*Betula alleghaniensis*) and red maple (*Acer rubrum*) are also found in the southern part of the domain. In several places, natural and man-made disturbances have promoted the development of hardwood and mixed stands.

In the subdomain of the east, the spruce budworm (*Choristoneura fumiferana*) is the main natural disturbance factor (Blais 1983; Bélanger 2001), while small-scale forest fires are common in the subdomain of the west (Bergeron et *al.* 2004).

2.4 LIMITING FACTORS AND THREATS

2.4.1 Changes to the habitat

Changes to the habitat are among the causes put forward to explain the decline of the forest-dwelling caribou, both in Québec and elsewhere in Canada. The changes to the habitat generally lead to the relocation of caribou, even their disappearance (Cumming 1992). Studies have underscored the negative impact of logging (Dumais 1979; Bertrand 1987), hydroelectric developments (Paré 1987; Brassard et Brault 1997) and the expansion of agriculture on forest-dwelling caribou (Dumais 1979). In western Canada, the negative effects of the exploitation of natural gas, hydrocarbons, mines and peatlands (AWCCSDC 1996) have also been observed.

Forest fires are the main natural disturbance factor of northern forests and their recurrence changes depending on the weather conditions. In Québec, in the continuous range of the forest-dwelling caribou, the length of the fire cycle varies from approximately 100 to 500 years (Payette et al. 1989; Bergeron et al. 2001; Gauthier et al. 2001). The caribou has adapted to fires but, over the short term, fires create habitats without lichen, which are not very conducive to this species. Lichen carpets regenerate progressively according to a well established succession of species (Morneau et Payette 1989). In the spruce forest, black spruce regenerates normally when viable seeds are present. Otherwise, the stand may evolve towards open stands with lichens (Gagnon et Morin 2001). If companion species exist in burn areas, such as jack pine, quaking aspen or paper birch, they can replace the original black spruce stand (Gagnon et Morin 2001). Conversely, when the interval between disturbances is very long, the black spruce can replace the jack pine due to its greater longevity and its ability to produce layers from 50 to 70 years after the fire (Lavoie et Sirois 1998).

In managed forests[4], felling and forest fires are major sources of habitat disturbances. Current forest management practices impose rotations that are shorter than the fire cycle (Spies et al. 1994; Gauthier et al. 1996), reduce the area of mature and old-growth forests, standardize age classes and rejuvenate the forest constantly (Rowe and Scotter 1973; Bergeron et al. 1999; Burton et al. 1999). Forest management activities are increasingly frequent in the spruce forest zone between the 49th and 51st parallels of north latitude and are progressing northward. For example, in 2000, felling areas covered approximately 800 km2 in the softwood forest of the Saguenay–Lac-Saint-Jean region and 300 km² on the Côte Nord (Parent et Fortin 2002). In all of Québec, some 4,500 km² of forest were harvested in 1999-2000 (Parent et Fortin 2002). At this rate, it is feared that the best habitats of the forest-dwelling caribou may disappear in fifty years or sooner in some sectors (Courtois et al. 2003d).

[4] Forest Act, Chapter II: Forest Management, Division 1: Management Permit, 3- Forest management includes timber felling and harvesting, installing, improving, maintaining and closing infrastructures, carrying out silvicultural treatments including reforestation and the use of fire, suppressing insect epidemics, cryptogamic diseases and competing vegetation, and all other activities affecting the productivity of a forest area

Indeed, we do not know if forest management suitably imitates the effect of fires, notably from the standpoint of forest regeneration (Courtois et *al*. 2003d). However, it is plausible that differences exist between the two types of disturbances (Klein 1982; Schaefer and Pruit 1991; Nguyen-Xuan et *al*. 2001). For example, a fire promotes a regeneration resulting from seedlings in the black spruce stand (Gagnon et Morin 2001), whereas felling favours a pre-established regeneration, which often results from layers. The structural elements and the composition should thus differ between the two types of disturbances (Kafka et al. 2001; Bergeron et al. 2002; Perron 2003). These differences are illustrated first at the stand level, with the fire leaving a greater variability in the structure of the residual forest. This variability is created because the fire does not burn uniformly all of the areas affected, leaving a good number of live trees behind. One of the ways of trying to limit the long-term consequences of this partial disturbance by fire is to resort to new forest management practices such as cutting with protection of small merchantable stems (CPMS), cutting with protection of high regeneration and soils (CPHRS), etc. These forms of variable retention cutting make it possible to keep structural elements while maintaining a softwood-based composition. In addition, it is important to diversify the surface area of aggregated cutblocks, to increase their dispersion over the territory, to maintain the high residual forest, and to diversify its configuration in aggregated cutblocks (Perron 2003).

Moreover, after a fire or a felling operation, the regeneration of hardwood species may be promoted, which benefits animal species adapted to this type of vegetation, such as moose. The growth of the moose density may lead to an increase in the wolf density and, consequently, in caribou predation (Crête et Manseau 1996; Courtois 2003). Similarly, the rejuvenation of vegetation and the ensuing proliferation of blueberries and raspberries promote the black bear (*Ursus americanus*), an important predator of cervid calves (Ballard 1994; Crête et Desrosiers 1995; Courtois *et al.* 2003d).

Over the medium term, the possible invasion of hardwood species in the black spruce forest could have major consequences for the forest-dwelling caribou in that this phenomenon would be beneficial for the moose and, indirectly, the wolf (Seip 1992; AWCCSDC 1996). It would seem that the invasion of hardwoods and the production of wild berries have not yet manifested themselves with sufficient importance in the most disturbed sector studied by Courtois et al. (2003c) to permit the establishment of a dense moose and black bear population. Grondin et al. (2003) concluded that the risks of hardwood invasion were low for spruce-balsam fir stands on till, whereas recent studies have shown that spruce and balsam fir trees have persisted in stands regenerated by natural gaps on the Côte Nord, without the invasion of hardwoods (Pham et al. 2004; Ruel et al. 2004).

2.4.2 Sport hunting

In Québec, hunting has often been cited as the main cause of the decline of forest-dwelling caribou populations (Cinq-Mars 1977; Folinsbee 1979; Gingras et Malouin 1993; Bourbonnais et al. 1997). On the Basse-Côte-Nord, Cinq-Mars (1977) estimated that caribou numbers had fallen by 60% in five years (1972 to 1977) likely as the result of the rather liberal hunting of that period. The history of the harvesting of forest-dwelling caribou in Québec testifies to a gradual awareness of the fragility of caribou populations to hunting.

In the early 20th century, caribou hunting was authorized throughout Québec in fall although the annual harvest by non-resident hunters was limited to five animals per hunter beginning in 1895 (Moisan 1956). In 1937, hunting was banned for a period of five years, except in the counties of Gaspé and Bonaventure, where it continued until 1950. Between 1950 and 1963, caribou were no longer hunted in Québec. Beginning in 1964, hunting reopened north of the 50th parallel of north latitude for a period of 17 days in fall. In 1972, hunting was banned west of the 71st meridian of west longitude in order to protect the small populations of James Bay. In 1979, it was also prohibited east of the railway line linking Sept-Îles and Schefferville, whereas a limit was set on the number of licences to the west of the railway line. Initially, 300 licences were granted in this hunting zone (19 south) annually, and this number rose progressively to 600 even though the harvest declined from 75-100 at the outset to 40-60 caribou at the end of 1990s (Lefort et *al*. 2004). The number of licences was reduced to 300 in the fall of 2000 for a harvest of 40 caribou. Hunting has been banned in Zone 19 south since the fall of 2001.

The spectacular growth of the Rivière George barren-ground caribou herd in the 1960s and, later, that of the Rivière aux Feuilles herd created a new opportunity to harvest caribou in Québec. Beginning in 1983, a series of measures was put forward to stimulate the harvest of barren-ground caribou, notably by establishing a winter hunting season (Crête et *al*. 1990a). The winter harvest has developed to such an extent that it has surpassed the fall harvest for several years now (Lefort et *al*. 2004). Winter hunting takes place in the southern part of the area occupied by barren-ground caribou in hunting zones 22 and 23 (Appendix 1), namely a sector that overlaps the range of the forest-dwelling caribou. Approximately 39% of the range of the forest-dwelling caribou is also occupied by barren-ground caribou in winter, which exposes forest-dwelling caribou to hunting as well as to predation by wolves that follow the barren-ground caribou. Indeed, jagged fluctuations have been noted in the winter harvest of caribou depending on the presence or absence of barren-ground caribou during the hunting season in Zone 23 since 1997 (Lefort et *al*. 2004). The relative importance of the forest-dwelling caribou in the winter sport harvest is not known, but considering their respective numbers and the total harvest, it may represent a very small proportion of the harvest. This cause of caribou mortality does, however, factor into the equation and could be reduced. In Labrador, Schaefer et al. (2001) observed that the survival rate of forest-dwelling caribou exposed to Rivière George caribou had declined since the start of contact between the two ecotypes in question, due mainly to greater predation by wolves.

2.4.3 Aboriginal harvest

For hundreds of years, the Aboriginal peoples have maintained close relations with the caribou. The use of this species has varied according to the communities, the availability of the resource and the seasons (Dumais 1979; Trudel 1979). Generally, the caribou was mainly used by the Cree, Algonquin, Innu and Inuit communities that penetrated inland in winter when shoreline resources became rare (Taylor 1979; Trudel 1979; Morantz 1979). The caribou then represented a vital resource for food, clothing and bedding.

Still today, the caribou is an important cultural reference for several Aboriginal communities. Subsistence hunting is an integral part of the way of life of the Aboriginal peoples. However, its role goes well beyond consumption for subsistence purposes, for it also includes consumption

within the context of ritual and social activities. For example, as part of their ancestral practices, members of the Innu nation of the Côte Nord still practice caribou hunting. For example, the Innu of Betsiamites frequent the territory around Réservoir Pipmuacan to hunt for caribou there (Courtois et al. 2003f). Based on the information that we have, the harvests made by members of this community have declined substantially, dropping from some twenty animals in 1999 to less than eight in 2004 (J. St-Amand, pers. comm.). Moreover, the Innu Community of Essipit has decided to impose a moratorium on the hunting of forest-dwelling caribou. Some of the five communities of the Moyenne-Côte-Nord and the Basse-Côte-Nord still organize hunting expeditions for forest-dwelling caribou using snowmobiles, but the success of such expeditions is not known at the present time. As for the community of Mashteuiatsh, at most one or two caribou per decade were harvested by members spending long periods of time on their trapline.

In the James Bay sector, the Crees harvest caribou for food purposes, but it is impossible to divide their kills between the forest-dwelling and barren-ground ecotypes (Courtois et al. 2003d). This harvest is done by the beneficiaries of the James Bay and Northern Québec Agreement under the harvest right and under a guaranteed harvesting level. The harvest by Algonquins is not known, but is likely low (Courtois et al. 2003d).

The current and future allocation of the caribou for harvesting purposes should take place according to the generally accepted order of priority, namely: (i) the protection of the resource, (ii) subsistence hunting by the Aboriginal peoples and (iii) sport hunting.

2.4.4 Poaching

The available information on the causes of caribou mortality indicates that poaching does not seem to be a major cause of mortality for caribou within this species' range. However, poaching has been a major cause in the past on a non-recurrent basis in certain sectors. For example, it was the case between 1992 and 1999 in the western sector of the Côte Nord and in the Saguenay-Lac-Saint-Jean region.

Occasionally, caribou are inadvertently killed in sectors where moose hunting is practiced. Moreover, in the Saguenay-Lac-Saint-Jean and Côte Nord regions, caribou care occasionally chased using snowmobiles in order to obtain photos of them or for poaching, which is prohibited.

During anti-poaching operations in the part of the range used by the forest-dwelling caribou and the barren-ground caribou, it has been shown that the telemetric locations of barren-ground caribou, disseminated on the web site of the Ministère des Ressources naturelles et de la Faune (MRNF), is used by poachers to locate caribou. Using this information, poachers hunt caribou to the south of the zones where hunting is allowed and, owing to this fact, harvest forest-dwelling caribou that frequent these sectors.

With a view to combating the effects of poaching, the regional wildlife protection services of the MRNF have implemented intervention strategies in certain sectors where caribou herds are well known. This is particularly the case in the Saguenay-Lac-Saint-Jean region where, since 2001, protection plans have existed notably in the Manouane, Péribonka, Pipmuacan and Portneuf reservoir sectors (C. Beauchemin, pers. comm.). Similarly, the Côte Nord protection service has a

protection plan specific to the forest-dwelling caribou (G. Bélisle, pers. comm.). For 2003-2004, five cases of poaching were reported in the Côte-Nord region and four in the Nord-du-Québec (Northern Québec) region.

2.4.5 Human disturbances

Often, the forest-dwelling caribou is not very distrustful of humans, which increases this species' vulnerability to hunting and poaching (Bergerud 1974). Moreover, peace and tranquility along with the absence of human disturbances are necessary prerequisites for a good quality habitat for the forest-dwelling caribou. In Alberta, researchers have found that forest-dwelling caribou tend to avoid oil wells, mineral exploration activities as well as roads. Moreover, the latter act as semi-permeable barriers to the unimpeded circulation of these animals (Dyer et al. 2001, 2002). The avoidance distance was on the order of 250 m for roads and mineral exploration activities, whereas it was 1 000 m for oil wells. The distance was greater at the end of winter and during calving, probably because road traffic was more intense during these periods (Dyer et al. 2001). In Newfoundland, a hydroelectric development was found to have modified the migratory behaviour of caribou (Mahoney and Schaefer 2002). In southern Norway, Nellemann et al. (2001) report that high-voltage power lines, vacation centres and roads cause wild reindeer (European name of caribou) to change locations.

Forest-dwelling caribou regularly frequent open areas, which facilitates their observation for interpretation purposes. Within this context, a winter interpretation program was set up in 1993 in Parc national des Grands-Jardins (Banville 1998). However, it has been shown that hikers can disturb caribou (Duchesne et al. 2000) and cause them to frequent less conducive environments where these animals become more vulnerable to predation (Crête et al. 1990a). This program was however interrupted in the early 2000s due to a major forest fire in 1999 which destroyed almost all of the caribou's traditional wintering area, where the interpretation activities were being carried out.

A study carried out in Parc national de la Gaspésie showed that the presence of hikers modified the behaviour of caribou, notably by causing them to flee and to abandon the sites that they had been frequenting (Dumont 1993). Protection measures have been taken to reduce the impact of the disturbance. For example, access to summits is currently prohibited during the rutting and calving periods of this mountain caribou.

With forest management activities progressing ever further northward, road access is also increasing in the range of the forest-dwelling caribou. The road network opens the way to vacationing and outdoor activities, whereas the use of all-terrain vehicles (ATV) and snowmobiles pushes back the boundaries of those places offering adequate peace and tranquility for the forest-dwelling caribou. Given the increase in road access, it is highly probable that caribou are now vulnerable to human disturbances practically everywhere in the forest. The presence of roads also exposes caribou to the danger of collisions involving cars and heavy vehicles (DeBellefeuille 2001). Access to this environment associated with forestry companies could force caribou to concentrate in the inaccessible remaining habitat, thereby increasing their risk of mortality.

Each activity that creates a disturbance affects the use of the habitat by the caribou. However, the degree of importance of each disturbance is not known. Indeed, no study on the comparative impacts of the various types of disturbances is available.

2.4.6 Interspecific relations

While excessive harvesting has certainly played a major role in the decline or disappearance of several populations of forest-dwelling caribou since the arrival of the Europeans in North America, it seems that predation has often been responsible for the low survival rates observed in populations on the decline (Begerud and Elliot 1986; Seip 1992; Kinley and Apps 2001). The caribou is perhaps more vulnerable to predators than other cervidae in a forest setting. Indeed, the caribou is smaller in size than the moose and it is harder for the caribou to defend against the attacks of a wolf based on its physical capacities. Furthermore, the caribou's lower productivity makes this species more fragile to predation-related losses than the white-tailed deer, for example. Forest-dwelling caribou populations are regulated by predation. (Crête et Manseau 1996; Stuart-Smith et al. 1997) unlike barren-ground caribou which seem to be regulated by competition for food in summer (Bergerud 1996; Crête et Manseau 1996) or in winter (Ouellet et al. 1994).

In addition to the grey wolf, the black bear kills caribou - particularly calves - during their first weeks of life (Ballard 1994; Adams et al. 1995). In a literature review, Ballard (1994) estimated that black bears killed between 6 and 30% of caribou calves. In Parc national de la Gaspésie, Crête et Desrosiers (1995) concluded that the black bear was involved in three out of four cases of predation on caribou calves. In the Charlevoix region, several indicators identify the black bear as being an important predator of forest-dwelling caribou (Banville, 1998; R. Courtois and P.-É. Lafleur, pers. comm.).

However, grey wolf predation is better documented. For example, it is known that forest-dwelling caribou populations do not seem to be able to survive when wolf densities exceed 0.65/100 km2 (Courtois et al. 2003d). Conversely, the control of this predator promotes the growth of caribou populations (Boertje et al. 1996). In northern British Columbia, the control of wolves allowed a caribou population to grow, while two neighbouring populations, with no intensification of wolf harvesting, declined (Bergerud and Elliot 1986). Moreover, controlling the number of wolves results not only in an increase in the number of caribou, but also in the number of moose (Boertje et al. 1996).

Forest-dwelling caribou densities are considered to be too small to support viable wolf populations (Seip 1991; Crête et Manseau 1996). The wolf is instead dependent on the moose which offers a greater food biomass, because this animal is bigger and more abundant. Bergerud (1974, 1985) proposed that the increase in moose populations in North America has led to an increase in wolves, which are efficient caribou predators. Hence, the presence of dense moose populations would not permit the survival of caribou and, in order to survive, the caribou must dissociate itself from the moose. The clearest support for this hypothesis, known as "common enemies with the moose", comes from the study done by Seip (1992) in central British Columbia. In that province, while the population of Quesnel Lake was rapidly declining because it shared its summer habitat with the moose and the wolf, the adjacent population of Wells Gray Provincial

Park was growing slowly because female caribou dispersed in summer in the unproductive mountains far from habitats conducive to the moose.

On the basis of tracks in the snow, Cumming et al. (1996) studied the coexistence of the moose and the caribou north of Thunder Bay in Ontario. These authors clearly showed a spatial separation between the two cervidae, with wolves remaining associated with the moose. The authors put forward the hypothesis that in certain habitats, for example frozen lakes, caribou could be harder-to-catch prey than moose, which explains why wolves focus on moose.

In the peaty landscape of northern Alberta, caribou concentrate mainly in peatlands, whereas moose occupy well drained sites, notably the banks of watercourses. In this type of environment, wolves concentrate on moose for food, whereas caribou are greatly under-represented in the wolf's diet (James et al. 2004).

2.5 Situation in Québec

2.5.1 Population size and trends

In Québec, the forest-dwelling caribou, in the form of interrelated local populations, currently occupies a large continuous range of 644,000 km2 extending from the Ontario border to the Labrador border. Moreover, there are two isolated herds further south: the population of Val-d'Or and the reintroduced population of Charlevoix.

Starting in the early 1980s, the use of helicopters for moose surveys together with telemetry allowed researchers to produce more accurate density estimates and to calculate the visibility bias for this species (Crête et al. 1986). Afterwards, this same method was extended to the caribou (Crête 1991), but correction factors specific to this species were only calculated recently (Courtois et al. 2003f). Since the early 1990s, several aerial surveys of forest-dwelling caribou have been carried out in the continuous range (Table 1). They have revealed relatively homogenous but small densities, generally ranging between 1 and 2 caribou/100 km2.

The northern limit of the continuous range of the forest-dwelling caribou has been set at the 55th parallel of north latitude because populations of this ecotype existed at that latitude before barren-ground caribou came to spend the winter there (Brown et al. 1986) and because this limit corresponds roughly to the northern limit of the forest environment. The direct observation of animals and signs of their presence has made it possible to draw the current southern limit of the known range. The total area covers 644,000 km² (Figure 2). The zone of overlapping with barren-ground caribou represents 248,000 km2, whereas the forest under management occupies 165,000 km^2, namely 37% and 26% of the total range respectively.

The consistency of the results obtained by the surveys carried out over more than a decade (Table 1) makes it possible to put forward the hypothesis that the current average density is between 1 and 2 caribou/100 km^2. However, based on the available data, it is impossible to estimate the total number of forest-dwelling caribou in Québec with a reasonable margin of error. It has thus been estimated that in the early 2000s, there were between 6,000 and 12,000 forest-dwelling caribou in Québec in the continuous range. To this number must be added some thirty animals for the

population of Val-d'Or (M. Paré, pers. comm.) and some 75 animals for the population of Charlevoix (D. Banville, pers. comm.).

In Québec, it is hard to analyze the evolution of forest-dwelling caribou populations because no systematic survey has been carried out for this ecotype. Some surveys done in the 1960s highlighted the presence of a number of big herds which no longer seem to exist. Moreover, the disappearance of certain isolated populations in the southern part of this species' continuous range and the growing scarcity of certain populations of the eastern Côte Nord provide us with information on population trends. (Courtois et al. 2003e). For example, there were caribou close to Sept-Îles, Baie-Comeau and Rivière Saguenay around 1980, a situation that is only found occasionally today. Similarly, small groups present near Rivière des Outaouais in the Abitibi as well as in Matagami have disappeared. Only a few small caribou herds exist today south of the 50th parallel of north latitude in the Côte Nord and Saguenay-Lac-Saint-Jean regions. It is not known whether the Saint-Augustin herd on the Basse-Côte-Nord still exists, whereas that of Petit Manicouagan seems to have disappeared. Finally, the Rupert herd was not seen again during the surveys that followed its discovery in the 1970s.

Table 1. Summary of the aerial surveys carried out in the continuous range of the forest-dwelling caribou since the early 1990s.

Region	Zone	Year	Area surveyed (km^2)	Estimated density (caribou /100 km^2)	Reference
09	19 west	1991	12,000	1.4 (0.2[a])	Gingras et Malouin (1993)
	19 east	1993	12,000	1.0 (0.1)	Bourbonais *et al.* (1997)
	Kruger	1999	9,600	1.8 (n.a.[b])	Courtois (1999)
		2002	2,831	1.8 (n.a.)	Rochette (2003a)
		2003	2,831	2.0 (n.a.)	Rochette (2003b)
		2004	2,860	3.8 (n.a.)	Rochette et Gingras (2004)
		2005	3,684	3.1 (n.a.)	Rochette et Gingras (2005)
	Île René-Levasseur	2001	2,030	2.3 (n.a.)	Rochette et Gingras (2001)
	Toulnoustouc	2003	17,300	1.8 (n.a.)	Rochette et Gingras (2003)
	Gagnon	2004	1,996	1.2 (n.a.)	Rochette et Gingras (2004)
	Matamec	2004	625	0 (n.a.)	
	Moisie	2004	6,834	2.5 (n.a.)	
		2005	2,479	1.2 (n.a.)	
	North of Sept-Îles	2004	10,940	2.4 (n.a.)	
	Natashquan	2005	12,290	1.0 (n.a.)	Rochette et Gingras (2006)
	Rivière St-Jean	2005	1,162	0.0 (n.a.)	
	Natashquan	2005	12,290	1.0 (n.a.)	
02/09	Manicouagan (herd 12)	1999	11,300	1.6 (0.2)	Courtois *et al.* (2003c)
	Manouane (herd 26)	1999	17,000	2.1 (0.3)	
	Pipmuacan (herd 42)	1999	11,200	1.2 (0.2)	
02	North of Lac Saint-Jean	2003	13,700	1.7 (n.a.)	Dussault (2003)
	North of Saguenay-Lac-St-Jean	2004	24,560	0.2 (n.a.)	Dussault (2004)
10	Southwest of James Bay	2001	6,500	3.5 (n.a.)	Paré et Jourdain (2002)
	Lac Mistassini	2002	5,470	2.0 (n.a.)	St-Pierre et Rivard 2002
	Lac Mistassini/ Harricana	2003	35,000	1.4 (n.a.)	St-Pierre, pers. comm.
03	Charlevoix	1992	3,000	4.0 (n.a.)	Sebbane *et al.* 2002
		1998	3,127	3.3 (n.a.)	

[a] Standard error of the mean
[b] Not available

For the populations of the continuous range, little information is available concerning their evolution. However, for the Manicouagan herd studied by Courtois et al. (2003b) in 1999 and for which use may be made of the data from a 1991 survey, the results obtained suggest that the caribou density remained relatively stable there throughout the 1990s.

The two forest-dwelling caribou populations that live isolated to the south of the continuous range have exhibited a negative population trend in recent years. The population of Val-d'Or had 60 to 80 individuals in 1974, approximately fifty between 1980 and 1999, but only between 25 and 30 individuals in 2003 (M. Paré, pers. comm.). The aerial surveys carried out over the years have shown that the population of Charlevoix grew at an annual rate of 5% during the 1980s peaking at 126 individuals in 1992 (Cantin 1991). In 1998, the population was estimated at 103 individuals (Banville 1998). Counts made from 1999 to 2001, in parallel with telemetry work, revealed a decline in the population of Charlevoix, which numbered 61 caribou in 2001 (D. Banville, pers. comm.). However, this figure represents the minimum number of caribou in the population at that time (Sebanne et al. 2002). The most recent aerial survey, carried out in the winter of 2004, indicated a population of about 75 individuals (D. Banville, pers. comm.).

2.5.2 Dynamics of the populations

The examination of the data on the survival and reproduction of the studied populations makes it possible to draw a portrait of the current situation in terms of the dynamics of forest-dwelling caribou populations (Table 2). Fairly complete data are available for three adjacent populations of the Côte Nord and Saguenay-Lac-Saint-Jean regions (Courtois et al. 2003c) as well as for the population of Charlevoix (Sebbane et al. 2002). The first study, carried out from 1999 to 2001, reveals an average number of calves/100 females of 49, 28 and 41 respectively (Table 2), whereas their density was estimated in March 1999 at 1.6, 2.1 and 1.2 caribou/100 km² respectively (Table 1). It should be recalled that sport hunting was banned in the current hunting zones 19 and 29, where the three populations under study are located. As a result, caribou could be harvested by hunters during the first two years of the study. During this study, the survival rate of females fitted with a transmitter collar was estimated at 80%, 87% and 81% for each of the populations respectively. Seven of the 23 cases of mortality that occurred during the study were attributed to legal (6) and illegal (1) hunting. Between 2001 and 2003, the survival rate of animals still tracked varied between 91% and 95%. Among the animals observed during the winter fly-overs, calves represented 15%, 21% and 22% of the estimated population in 2001, 2002 and 2003 respectively.

Using simulations, Crête et Desrosiers (1995) estimated that 27.5 calves/100 females in winter were needed to stabilize a caribou population when the annual survival rate of adult females reaches 92%. This parameter was estimated at 66 calves/100 females if the survival rate drops to 80%. Based on these simulations, the three populations studied by Courtois et al. (2003c) likely decreased in number during the study, since the annual survival rate of females was 80%, 87% and 81% respectively and the ratio of calves/100 females was 49, 28 and 41 respectively. However, recruitment likely made it possible to partially compensate for the low survival rate of females, because this recruitment varied inversely to the survival rate. On the basis of data from the tracking of animals fitted with transmitter collars and aerial surveys, Courtois et al. (2003c) concluded that one herd had fallen to an annual rate of 5% during the study, whereas the other two herds remained stable. In this region, the ban on hunting in 2001 eliminated a major mortality factor, resulting in an apparent increase in the survival of females since then (Sebbane et al.

2003). The observations made between 2001 and 2003 for a herd still being monitored confirm that the annual survival rates are now above 90%.

For the southern-most herd, a reflection on the shared enemy hypothesis – namely moose, wolf, caribou, was carried out by Courtois et al (2003c). Moose harvest statistics, an indicator of their density (Courtois et Crête 1993), indicate that the moose density was roughly twice as high in the range of this herd (0.97 harvested moose/100 km^2) than in the other two herds (0.48 and 0.38 harvested moose/100 km^2). The moose density estimated in the range of the southern-most caribou herd was on the order of 4 to 6 moose per 100 km^2, but does not seem to have been sufficient to sustain a large wolf population (Courtois et al. 2003c). The habitat likely offered a limited potential for the black bear with the end result that the survival of caribou calves was good, namely on the order of 50% during the study period, and the gestation rate of females of reproductive age was close to 100% (Courtois et al. 2003c).

The available data are more fragmentary in the case of the population of southern James Bay, notably because the data come from a study underway in Ontario. During the survey of a 6,500 km^2 territory located between latitudes 49º 45' N and 50º 40' N, namely immediately to the east of the Ontario border, the density was estimated at 3.5 caribou/100 km^2. Among the animals for which it was possible to determine the age and sex (139/196 caribou), 34 calves/100 females and 70 males/100 females were observed (Paré et Jourdain 2002). Several caribou of the Ontario study frequented the large peatlands of southern James Bay. The proportion of calves per female was lower for the observations made in Ontario during marking operations, namely 25, 24 and 23 calves/100 females in 1999, 2000 and 2001 respectively. For each of these years, the annual survival rate was 71%, 80% and 80%. As a result, it was estimated that the population had declined by 22%, 11% and 11% respectively (J. Rettie, unpublished data).

The mortality factors are not well known, but it seems that predation by the grey wolf and the black bear is the most important factor (J. Rettie, unpublished data). Based on fragmentary observations, it is possible that the survival and productivity of the caribou of southern James Bay increase as one moves northward (M. Paré, pers. comm.). One cannot reasonably speculate about the future of the transborder population of Ontario and southern James Bay without knowing the extent of man-related mortality causes (poaching, subsistence hunting, etc.). However, this is the forest-dwelling caribou population living at the highest known density in Québec, namely 3.5 caribou/100 km^2.

Table 2. Summary of the data dealing with the dynamics of the forest-dwelling caribou populations of Québec.

Region	Zone	Year	Type of study	Survival	Number per 100 females		Reference
					Calves	Males	
09	19 west	1991	I[a]	-	30	73	Gingras et Malouin (1993)
	19 east	1993	I	-	52	191	Bourbonais *et al.* (1997)
	Kruger	1999	I	-	30	70	Courtois (1999)
		2002	I	-	42	57	Rochette (2003a)
		2003	I	-	50[b]	-	Rochette (2003b)
		2004	I	-	53[b]	-	Rochette et Gingras (2004)
		2005	I	-	39[b]	-	Rochette et Gingras (2005)
	Île René-Levasseur	2001	I	-	20	33	Rochette et Gingras (2001)
	Gagnon	2004	I	-	29[b]	-	Rochette et Gingras (2004)
	Matamec	2004	I	-	-	-	
	Moisie	2004	I	-	46[b]	-	
		2005	I	-	67[b]	-	
	Natashquan	2005	I	-	54[b]	-	Rochette et Gingras (2006)
02/09	Côte Nord/Saguenay-Lac-St-Jean	1999	T[c]/I	80	49	-	Courtois *et al.* (2003c)
		2000	T	87	28	-	
		2001	T	81	41	-	
02	North of Lac Saint-Jean	2003	I	-	40[b]	-	Dussault (2003)
		2004	I	-	27	87	Dussault (2004)
10	South of James Bay	1999	T	71	25[b]	-	Paré et Jourdain (2002)
		2000	T	80	24[b]	-	
		2001	T/I	80	23 to 34	70	
	Lac Mistassini	2002	I	-	51	105	St-Pierre et Rivard 2002
	Lac Mistassini/Rivière Harricana	2003	I	-	48	-	St-Pierre, pers. comm.
03	Charlevoix	1992	I	-	19	56	Sebbane *et al.* 2002
		2000	T	69	69[b]	89	
		2001	T	-	43[b]	48	

[a] Population dynamics data estimated on the basis of an aerial survey.

[b] The number of calves per 100 females was estimated using a value of 70 males per 100 females.

[c] Population dynamics data estimated on the basis of telemetry studies.

In the winter of 2002, 96 forest-dwelling caribou were spotted during the aerial survey of a 5,500 km^2 territory located to the east of Lac Mistassini. The density there was estimated at 2 caribou/100 km^2, with a sex ratio close to parity and a proportion of 51 calves/100 females (St-Pierre et Rivard 2002). In the winter of 2003, during a more extensive survey carried out over an area of 35,000 km² between Lac Mistassini and Rivière Harricana, 435 caribou were observed, which made it possible to determine that the productivity was 48 calves/100 females (D. St-Pierre, pers. comm.). The caribou population on the entire territory studied is thought to consist of 500 caribou for a corrected density of 1.4 caribou/100 km^2. In accordance with the James Bay and Northern Québec Agreement, the Crees are allowed to hunt the caribou for subsistence purposes in this sector. The rate of harvesting by the Crees was estimated at 18% in 2002 (St-Pierre et Rivard 2002) and at 7.8% in 2003 (D. St-Pierre, pers. comm.).

During the survey of an area spanning 13,700 km^2 located to the north of Lac Saint-Jean in March 2003, 205 caribou (1.7 caribou/100 km^2) were observed. Of that number, 22% were calves (Dussault 2003). In 2004, the density in the sector located immediately to the south only reached 0.2 caribou/100 km^2, 14% of which were calves (Dussault 2004). A similar aerial survey covering 17,300 km^2 was carried out in March 2003 in the watershed of Rivière Manicouagan and Rivière Toulnoustouc on the Côte Nord (Rochette et Gingras 2003). The survey revealed 271 caribou (1.6 caribou/100 km^2), of which 28% were calves. Assuming a ratio of 70 males/100 females, one comparable to that observed in southwestern James Bay (Paré et Jourdain 2002), a ratio of 48 and 27 calves/100 females is obtained for the populations of Saguenay-Lac-Saint-Jean and of 67 calves/100 females for the population of the Côte Nord. These results and those obtained to the east of Lac Mistassini (51 and 48 calves/100 females in 2002 and 2003 respectively) and along the Ontario border (34 calves/100 females) in 2001 suggest that calf mortality was relatively moderate in 2001, 2002 and 2003 in the spruce-moss sectors surveyed and that recruitment would have sufficed to maintain the survival rate of adults at close to 90%.

After having witnessed a decline of close to 50% of its numbers immediately following its reintroduction in 1972, the forest-dwelling caribou population of Charlevoix increased slowly during the 1980s (Cantin 1991) reaching a peak of 126 individuals in 1992 (Banville 1998; Sebbane et al. 2002). As these caribou occupy an area of slightly over 3,000 km^2, the density was about 4 individuals/100 km^2 at that time. Surveys carried out in 1995 and 1998 suggest that this population declined somewhat during the 1990s. Between 1999 and 2001, a study was done on the use of the habitat of the caribou of Charlevoix. During this study, 28 adult females fitted with transmitter-collars were followed. The average annual survival rate of these animals was 69% (Sebbane et al. 2002). All of the deaths were caused by natural factors, but predation by the grey wolf and the black bear was the number one cause (Sebbane et al. 2002). During marked caribou tracking operations, 80 and 61 different animals were observed in 2000 and 2001 respectively, of which 29% and 20% were calves. By assuming a sex ratio of 70 males/100 females, 69 and 43 calves/100 females would have been counted in 2000 and 2001 respectively. Given the high mortality of adult females during the study, the remarkably high survival rate of calves would not have sufficed to maintain the population and the latter would have declined rapidly between 1999 and 2001 (Sebbane et al. 2002). The excellent survival of Charlevoix caribou calves is somewhat of an enigma since caribou calf mortality normally rises when predation increases among adult animals. The survey carried out in March 2004 produced an estimate of about 75 caribou, which points to a stabilization of numbers since 2000-2001 (D. Banville, pers. comm.).

The Val-d'Or herd has a replacement rate that seems deficient. Indeed, for several years now, the number of calves observed during fly-overs has been low. Only one calf was observed in 2005 and three calves were observed in 2006, namely only 6 and 16% of the total population respectively. From 1995 to 2001, the gestation rate was evaluated at 69% (11 pregnant females /16 females) for females whose age was not specified. The ten caribou fitted with a transmitter collar in 2001 and 2002 had a mortality rate of close to 50% (M. Paré, unpublished data). In March 2005, during a transmitter collar replacement operation, an evaluation of the gravidity rate of females was made using blood samples. The results obtained show that for six adult females approximately 2.5 years of age or older, only three were gestating. The reasons for this low fecundity are not known. However, this gravidity rate is insufficient to ensure the replacement of individuals in this isolated herd.

2.5.3 Habitat availability

To survive, the members of an animal population must obtain food, survive by eluding predators and by minimizing other mortality factors, reproduce and ensure that their offspring reach adult age. Their habitat must provide all of the elements required to make it through these stages and functions related to their life cycle.

Lichens dominate the diet of the forest-dwelling caribou in winter. Grass-like plants, herbaceous plants and the leaves of woody plants dominate the diet during the growing season (Timmermann 1998). Based on the annual production of terrestrial lichens, Courtois et al. (2003c) estimated that the spruce-moss forest could support between 4.1 and 7.7 caribou/100 km^2, values that are three to five times greater than current densities. In spruce-lichen forests, the biomass is even greater (Crête et al. 1990b). For the Charlevoix herd, Sebbane et al. (2002) estimated the carrying capacity to be 3.8 caribou/100 km^2 based on the availability of terrestrial lichens. The range of the forest-dwelling caribou thus offers plenty of food. Moreover, forest-dwelling caribou densities in Newfoundland and those of reindeer in Norway reach levels of up to 100 times greater than those observed in Québec in the absence of predators (Skogland 1986; Crête et Manseau 1996).

The availability of large expanses of mature softwood forests seems to represent a major component of the habitat of the forest-dwelling caribou (Courtois et al. 2003e). Such expanses are now rare in the balsam fir-white birch forest, whereas they are still abundant in the spruce-moss domain where more than half of the stands are 90 years of age or older. However, in the spruce-moss domain, logging is progressing rapidly northward and large expanses of mature and old growth forests are becoming rare in managed sectors. Further north, in the spruce-lichen domain, the forest environment is still in a natural state. Logging activities are absent and only a few quarries and sandpits have affected the environment. However, the major hydroelectric reservoirs of the James Bay Territory are present.

As a species, the caribou likely evolved in an open landscape and seems to be poorly adapted to ward offer predators in a wooded landscape (Crête et Manseau 1996). However, the forest-dwelling ecotype has developed specific behaviours to counter predators in the forest environment, notably by dispersing during calving (Bergerud et al. 1984). In Québec, females seem to look for dense conifer forests and the edges of peatlands during this period, since their calf is highly vulnerable (Courtois et al. 2003e; M. Paré, pers. comm.). The preferences shown by

forest-dwelling caribou for open environments such as peatlands, dry barren sites, lichen stands and frozen lakes likely bear witness to an adaptation to detecting danger by sight rather than by hearing as is the case with other forest-dwelling cervidae. Finally, the small density at which forest-dwelling caribou are found is a passive means of combating predation since the small biomasses of big prey are insufficient to sustain a resident predator population (Crête et Manseau 1996; Crête 1999). This strategy has allowed the forest-dwelling caribou to survive for a very long time throughout the boreal forest of North America just as the reindeer has been able to do in Eurasia.

It is likely that peace and tranquility also represent a major component of the habitats sought by the forest-dwelling caribou. Indeed, while it is difficult to show the role that this intangible factor may play, recent studies suggest that peaceful habitats must be offered to forest-dwelling caribou. The development of the road network for logging purposes promotes access to managed forests and consequently, an intensification of the number of visits for vacationing, fishing, hunting, snowmobiling, riding all-terrain vehicles and ecotourism, which increases the possibilities of disturbing the caribou present in these sectors.

2.5.4 Essential habitats requiring protection

The forest-dwelling caribou uses all of the habitats available in its continuous range. Research done throughout North America, including Québec, has not made it possible to identify precise habitats that are essential for the forest-dwelling caribou. Generally, all year round, the forest-dwelling caribou looks for relatively old softwood forests with or without lichens and peatlands. Further south, in mixed forests, this species seeks out expanses of less productive landscape such as peatlands, spruce stands, pine forests and outcrops.

The protection of the caribou's habitat requires that all of the components of the boreal forest be maintained at an appropriate scale. Indeed, as forest-dwelling caribou occupy home ranges on the order of 500 km^2 in Québec (Courtois et al. 2003c), it is important to plan the conservation of this species' habitat at this scale. For the isolated herds of Val-d'Or and Charlevoix, it has been possible to delimit and include in protected areas sectors that are essential for the survival of these populations (M. Paré, per. Comm..; Lafleur et al., 2006).

In managed forests, it is impossible to shield the entire forest-dwelling caribou population from human activities. Provision should be made for additional intensive management areas or adapted protected areas at the level of individuals, namely a few hundred square kilometres (Courtois et al. 2003g). In these protected expanses, peatlands, softwood-lichen stands, including dry barren sites and dense and old softwood stands should be over-represented. Moreover, human disturbances should be minimized here. It would be important to avoid isolating these expanses by the juxtaposition of cuttings or recent fires that would inhibit the circulation of caribou. Courtois et al. (2003g) established the main elements of such a forest management strategy.

To the north of the limit of managed forests the preservation of adequate habitats for the forest-dwelling caribou is easier to ensure for the time being (Comité sur la limite nordique des forêts attribuables, 2000). The creation of a few large protected areas adapted to the caribou and its predators would represent an invaluable acquisition for the conservation of this ecotype as well as a point of comparison with the rest of the area of application of the Recovery Plan.

2.6 SOCIOECONOMIC IMPORTANCE OF THE SPECIES

Socially, the forest-dwelling caribou has taken on greater importance in recent years. Indeed, the precarious situation of the forest-dwelling caribou is now better known to the public and the caribou has become the emblem species of the boreal forest for a number of people.

The estimate of the socioeconomic value of an animal species or of any activity associated therewith can be relatively simple if one limits oneself to readily quantifiable points such as the value of venison, for example. However, the inclusion in the socioeconomic analysis of cultural or social considerations makes the quantification more difficult, if not impossible. Since the value of the forest-dwelling caribou depends more on social and cultural considerations than on economic aspects, we will limit our estimate to the qualitative level for the needs of this Recovery Plan.

The presence of the forest-dwelling caribou in a region influences the economy in many ways. Among the direct impacts, there are the spin-offs related to the practice of sport hunting or ecotourism activities associated with the species. One must also consider subsistence hunting, which holds a fundamental place in the social and historical values of Aboriginal communities. It is also important to take into account the indirect economic impacts. Voluntary actions on the part of the forestry industry, involving measures to protect the habitat of this cervid, are likely to enhance the reputation and the credibility of this industry, even facilitate access to certain markets.

Ecotourism is expected to gain in popularity in the years to come, protected areas (for example, national conservation parks) will play an important role in the enhancement of those species having a precarious status. Unfortunately, the forest-dwelling caribou does not lend itself to observation activities and may be sensitive to the related disturbances. Forest-dwelling caribou observation activities in Parc national des Grands-Jardins in winter altered the behaviour of animals without causing them to abandon the sector that they used (Duchesne et al. 2000). The long-term effect of such a disturbance has not, however, been evaluated. In Parc national de la Gaspésie, the observation of mountain caribou is one of the main attractions. In a mountainous landscape, it is easier to observe caribou at a distance. But even in this environment, visitors disturb caribou and increase the risks of mortality (Dumont 1993). Greater emphasis should be placed on interpretation activities dealing with the forest-dwelling caribou (history, habitat, etc.) than on the direct observation of the species to generate economic spin-offs.

Subsistence hunting plays an important role for several Aboriginal communities of Québec. The few forest-dwelling caribou killed for subsistence purposes are harvested to meet social, cultural, food or clothing needs. A few Innu communities have already agreed to suspend this activity given the precarious situation of the forest-dwelling caribou at the present time. For forest-dwelling caribou populations on Cree territory, the Hunting, Fishing and Trapping Coordinating Committee is the favoured contact when it comes to the hunting rights of beneficiaries of the northern agreements.

2.7 LOOK-BACK AT THE KEY ELEMENTS OF THE FOREST-DWELLING CARIBOU'S SITUATION

Female caribou only produce one calf per year and their first parturition occurs, under the best of conditions, at age two. Moreover, among cervidae, the caribou has a relatively low demographic growth potential. The survival of adults is the central element in the stability of large ungulate populations, which can more easily support the fluctuations in the survival rate of their young (Gaillard et al. 1998). For example, for the caribou population of Parc national de la Gaspésie, it was calculated that a winter ratio of 27.5 calves/100 females (approximately 70-80 calves at birth/100 females) sufficed to maintain a stable population with an annual survival rate of females of 92% (Crête et Desrosiers 1995). In British Columbia, a forest-dwelling caribou population having an annual survival rate at adult age of 71% declined at a rate of 25% per year (Seip 1992). Another population in the southern part of the same province declined at an annual rate of between 12 and 38% during a period when the annual survival of adults stood at 76% when accompanied by a massive mortality of young caribou (Kinley and Apps 2001). Meanwhile, the population of Wells Gray Provincial Park, in the Rockies, grew slowly with an adult survival rate of 92% and a winter ratio of 37 calves/100 females (Seip 1992).

Predation and hunting represent the main direct mortality factors for the forest-dwelling caribou. The wolf and the black bear are the two main predators of the forest-dwelling caribou in Québec. Seip (1992) proposed that the abundance of moose populations and their expansion, as the result of changes to habitats, promoted the growth of predator populations and increased caribou mortality. This hypothesis supports the proposition of Crête et Manseau (1996) that the caribou is unable to survive in productive forests because the quality of the environment permits the maintaining of a biomass of cervidae which itself supports resident predator populations.

The knowledge that we have on the ecology of the forest-dwelling caribou leads to the following findings:

- Forest-dwelling caribou populations continue to remain at very small densities, between 10 and 100 times less than those attained by barren-ground populations or by forest-dwelling caribou populations protected from predators.
- When the annual survival rate of adult females falls below 90% or when the proportion of calves is less than 15% of the total population, a decline in populations often occurs.
- Predation and harvesting by humans seem to play a major role in population declines.
- Large moose populations support predator populations which have a negative impact on the dynamics of caribou populations.
- Dispersion may allow caribou to persist in a landscape shared with the moose and the wolf.
- The forest-dwelling caribou is put at a disadvantage by the major pressures exerted on the habitat in forests managed for industrial purposes.
- The compatibility of the forest-dwelling caribou and forest management has not been shown.
- The forest-dwelling caribou seems to be intolerant to the development of the territory and its use recreational and industrial purposes.

3. RECOVERY

3.1 AREA OF APPLICATION OF THE RECOVERY PLAN

The Recovery Plan will apply on the major part of the recognized range of the forest-dwelling caribou while taking into account certain specific characteristics. From south to north, the environment gradually evolves from the balsam fir-white birch domain to the spruce-lichen domain. Similarly, in the south, changes to the habitat, the human presence and predators are more frequent, whereas the north presents a less disturbed environment. Consequently, the Recovery Plan must take into account the different realities between the various parts of its area of application. This area of application of the Recovery Plan is divided into four zones, north, centre, south and isolated herds, (Figure 4) corresponding to as many different sets of problems and calling for different means of action. The entire area of application of the Forest-dwelling Caribou Recovery Plan represents 644,000 km^2.

The north

In the northern part of its range (248,000 km²), the caribou benefits from a relatively little disturbed environment. Logging is absent here. Although most of the disturbances caused by the James Bay hydroelectric development are now over, other relatively large projects are under study or in progress. This sector is characterized by the periodic presence of large barren-ground caribou herds that frequent the sector according to their annual migrations. Genetic characterization data do not reveal major exchanges between the two ecotypes and the fact that their ranges overlap does not alter the dynamics of the forest-dwelling caribou population. However, in this sector sport hunting for caribou is authorized and hunters can bag forest-dwelling caribou or barren-ground caribou indiscriminately. The impossibility of visually differentiating the two ecotypes results in the harvesting of some forest-dwelling caribou during the caribou hunting period. Hunting is particularly detrimental to the forest-dwelling caribou when the migration of barren-ground caribou does not reach the hunting sectors during this period. This part of the Recovery Plan's area of application is thus defined by the sector where the movements of barren-ground herds overlap the range of the forest-dwelling caribou.

The centre

The barren-ground caribou makes no incursions into this zone (226,000 km²). There are no forest management activities and the other disturbances of human origin are of little importance, making this area a good quality environment for the forest-dwelling caribou. Moreover, sport hunting for caribou is limited to a small area around James Bay. However, the proximity of Aboriginal communities to the east and west facilitates the use of this resource for food, ritual or ancestral purposes. This part of the Plan's area of application is the zone between the north and south zones.

The south

This is a large part of the Plan's area of application corresponding to the southern portion of the continuous range of the forest-dwelling caribou (165,000 km²). It includes the entire managed forest in which forestry harvesting operations are very dynamic. The habitat of the forest-dwelling caribou is increasingly disturbed in this zone from north to south. The modification of the forest cover and the development of access infrastructures are particularly significant. Access to the territory has led to major use of the environment by vacationers, anglers and hunters. Moose, predators, poaching and hunting by certain Aboriginal communities can affect caribou populations. This part of the Plan's area of application is defined by the presence of forests managed for industrial purposes.

Isolated herds

The regions of Val-d'Or and Charlevoix are home to two forest-dwelling caribou herds (5,000 km²) that are isolated in relation to the continuous range of the forest-dwelling caribou. In both cases, genetic exchanges and immigration are impossible due to the remoteness and physical obstacles. These herds are remnant populations of the historical range of the caribou which use to cover all of Québec. These populations are greatly affected by the development of the territory and the use of resources of every kind. The populations' habitats are residual and few improvements are possible. For each of these herds, protected areas help ensure a minimum protection of their habitat. The boundaries of the Plan's area of application for these herds were defined by several studies on space use.

3.2 RECOVERY POTENTIAL

In the north and centre

Québec currently is home to between 6,000 and 12,000 forest-dwelling caribou, close to 80% of which are in the northern part of the managed forests. In the upcoming decades, the populations living north of the forest limit should remain sheltered from human disturbances in the absence of large moose densities and major road network developments. Moreover, this strip of unexploited forest extends from Ontario to Labrador and, in so doing, ensures the connectivity between the caribou populations that inhabit the strip. It is plausible to think that, without major climate change, the forest-dwelling caribou will survive at least in this portion of its range in the foreseeable future. Relatively stable and small densities, on the order of those recently measured pretty much throughout Québec, should be maintained here. In this northern part of Québec, the establishment of large protected areas should help ensure the protection of the habitat of the forest-dwelling caribou required for the long-term conservation of this species.

The forest-dwelling caribou shares a portion of this territory with the large barren-ground populations that frequent the portion of this area of application of the Recovery Plan during their fall or winter migrations. This overlapping of populations makes it hard to

count forest-dwelling caribou here. Moreover, the abundance of barren-ground caribou may contribute to maintaining high predator populations. In this zone, changes to the habitat and activities likely to directly affect forest-dwelling caribou populations, such as sport hunting and subsistence hunting, will have to be supervised and limited.

To the south

The situation becomes more uncertain for the populations occupying the managed forests of the spruce-moss domain or the balsam fir-white birch domain. Concerted actions will have to be envisaged in order to minimize those situations that are unfavourable to the caribou while improving conditions that are conducive to this species. The recovery of the forest-dwelling caribou thus requires maintaining, even increasing its numbers. Harvesting in all its forms must be controlled here. The presence of expanses bringing together the various components of the habitat of the forest-dwelling caribou is essential. It is therefore important to ensure on a permanent basis the maintaining of suitable habitats in managed forests.

We hypothesize that the chances of survival of the forest-dwelling caribou in the managed forests of the spruce-moss domain are good if:

- efforts are made to minimize mortalities caused by legal and illegal hunting;
- provision is made for large protected expanses, on the order of 250 km², in which the components of the caribou's habitat will be maintained and where the disturbance of caribou will be reduced to a minimum. These expanses can take the form of protected areas or other protection entities;
- forest management maintains the characteristics of current forests at the forest landscape level.

Isolated herds

Val-d'Or herd

With limited means but great determination, the regional managers of the Val-d'Or caribou population have succeeded in monitoring the evolution of this small population fairly well and affording it some protection since the 1970s (Paré et Brassard 1994; Paré et al. 1994). This forest-dwelling caribou population was made up of between 60 and 80 individuals in 1974. It had declined to approximately 50 individuals in 1980, and numbers seem to have remained at this level up until 1999. Since then, the total number of caribou has fallen significantly, as has the proportion of calves among the animals surveyed. The some ten caribou fitted with a transmitter collar in 2001 and 2002 had a mortality rate of close to 50% (M. Paré, unpublished data). Consequently, the Val-d'Or caribou population only numbered between 25 and 30 animals in 2004 (M. Paré, pers. comm.).

Despite the efforts made to protect certain parts of its range, this small population has proven to be very vulnerable to predators which have grown accustomed to exploiting

these caribou on a regular basis. Since 1989, a forest management plan has been in place for this population, the heart of whose frequented sector is now protected by the Lac Sabourin biodiversity reserve (378 km²), which was created in 2003. The long-term chances of survival of the Val-d'Or population, which is small and likely isolated from other forest-dwelling caribou populations, are very uncertain if nature is allowed to take its course. In addition to the establishment of a protected area, an adequate management of the species' habitat in the vicinity of the protected area should be advocated.

Charlevoix herd

The Charlevoix herd also finds itself in a difficult situation. Following a major decline in the early 2000s, the number of caribou is now estimated at about 75 animals. This caribou population is isolated by Rivière Saguenay from the other nearest forest-dwelling caribou populations. Parc national des Grands-Jardins ensures the protection of a portion of the area that this population occupies. Indeed, 603 km² of its habitat are legally protected by an Act respecting the conservation and development of wildlife (R.S.Q., c. C-61.1). This herd also uses Parc national de la Jacques-Cartier and Parc national des Hautes-Gorges-de-la-Rivière-Malbaie. A management plan for the specific habitat of this population was finalized in 2006 (Lafleur et al., 2006 However, the long-term survival of this population is not ensured. Special conservation measures will be necessary with respect to caribou, the habitat, disturbances and possibly the control of predators.

Despite the difficult situation facing these isolated populations, the example of the Quesnel Lake caribou population in British Columbia should encourage Québec managers to persevere (Seip and Cichowski 1996). Indeed, it is possible that a population may recover when its numbers fall to very low levels (Seip and Cichowski 1996), since the predation rate may depend on the density of caribou populations, and even if the densities are only on the order of a few individuals per 100 km². Generally, the clear-sighted management of populations and their habitat should make it possible to curb the retreat of the range and the decline of forest-dwelling caribou numbers.

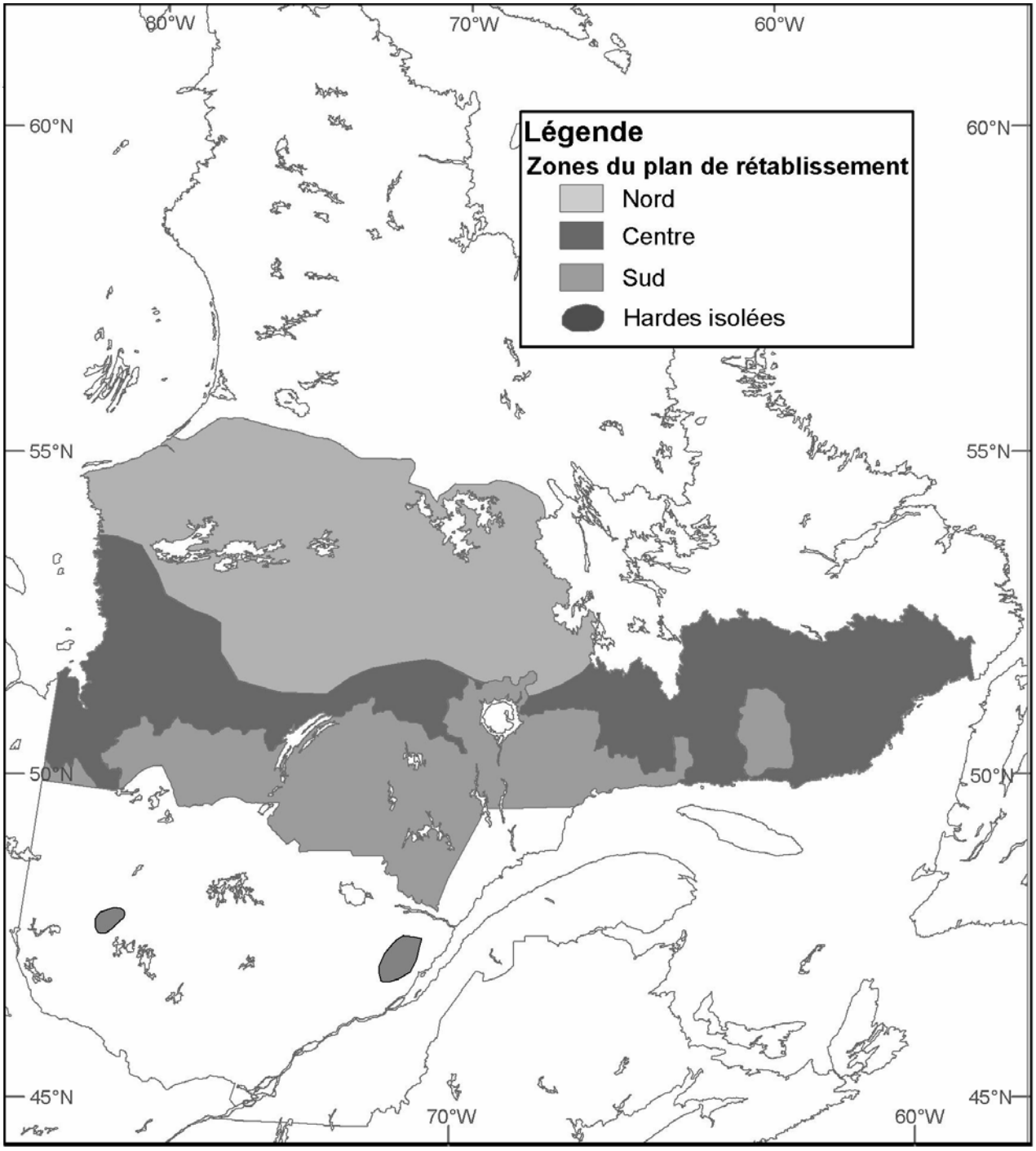

Figure 4. Area of application of the *Forest-Dwelling Caribou Recovery Plan* in Québec. The two isolated populations are those of Val-d'Or to the west and Charlevoix to the east.

3.3 FEASIBILITY OF THE RECOVERY

The outlook for the recovery of the forest-dwelling caribou in Québec remains reasonably good at the present time. The situation of the caribou and its habitat varies according to the limiting factors present on the territory. The recovery potential and the state of the environment make it easier for us to hope for the recovery of the caribou in the north and centre zones of its current range. Due to the connectivity between populations and their generally better demographic statistics, those populations occupying the continuous range of the forest-dwelling caribou have better chances of survival (Courtois *et al.* 2003a, g). However, in the south zone of the range and for isolated herds, the multitude of attacks on the environment and the caribou make the recovery and the very survival of the forest-dwelling caribou precarious. However, it is clear that certain parts of the species' historical range can no longer provide lasting support for caribou populations due to the major changes that have occurred in the environment and the development of large moose and predator populations.

3.4 RECOVERY STRATEGY

3.4.1 Goal

The outlook for the recovery of the forest-dwelling caribou in Québec remains relatively good, and the Recovery Team hopes that this taxon may one day return to a satisfactory state, throughout its range, so that it can be taken off the list of endangered or vulnerable species.

3.4.2 Objectives

To achieve the goal of the Forest-Dwelling Caribou Recovery Plan, three objectives are proposed.

Objective 1: Maintain the occupation of the current range of the forest-dwelling caribou

Since the colonization of the North American continent, the caribou's range has continued to retreat northward. The Recovery Plan aims to put a stop to this retreat by paying special attention to the southern limit of this range.

Objective 2: Attain and maintain a global population of at least 12,000 forest-dwelling caribou in Québec, with a uniform distribution within the habitat strata.

The habitat's potential is not uniform within the range of the forest-dwelling caribou. Moreover, certain other factors, notably the proximity of moose or barren-ground caribou, can affect the forest-dwelling caribou's survival. The Recovery Team considers that the population level is safe if globally the numbers reach 12,000 individuals in winter, namely about 2 individuals/100 km^2. However, the Team has set this safety

threshold at 3 caribou/100 km^2 in the centre zone of the continuous range and at 1.5 caribou/100 km^2 in the north and south zones (Figure 4). Moreover, the Recovery Team believes that it is a good idea to set a minimum threshold below which extraordinary actions will have to be taken. The Team has set this threshold at 1 caribou/100 km^2 for the entire range, namely 0.8 individuals/100 km^2 for the north and south zones, and at 1.5 caribou/100 km^2 in the centre zone.

Sub-objective 2.1: Maintain all of the current herds

To ensure the recovery of the forest-dwelling caribou, the density objective must take into account the distribution of caribou across the territory. Indeed, the herds must be considered entities requiring protection and their preservation must be ensured. The maintaining or increasing of local densities will make it possible to achieve the global density objective while respecting the natural distribution of the forest-dwelling caribou.

However, the location of the herds is not known, The herds studied by Courtois et al. (2003c) occupied between 11,000 and 17,000 km^2 depending on the years and the populations. The territorial subdivisions where protection and management actions will be carried out will have to be planned at that level to permit the monitoring of each herd. Indeed, in order to maintain the herds, the territory must be subdivided into biological units of the size of the herds and eventually be delimited by their location. These biological units should also periodically be the subject of aerial surveys to define the distribution of herds and the evolution of the number of forest-dwelling caribou.

Sub-objective 2.2: Maintain a dynamic population

The composition of the forest-dwelling caribou population in winter may provide an indication of its demographic trend. When the survival of reproductive females hovers around 90%, a ratio of 30 calves/100 females is sufficient to stabilize caribou numbers. This variable corresponds to 15% of calves in the population if the sex ratio is 70 males/100 females, a recognized sex ratio for a non-harvested caribou population. A proportion of calves below 30 calves/100 females, (15% of numbers), if it persists, would be a very likely sign of a population in decline. Similarly, we should be concerned about a caribou population where the annual survival rate of reproductive females moves too far away from the 90% figure. This parameter should be measured to evaluate the state of populations during operations to monitor forest-dwelling caribou herds.

Objective 3: Maintain and consolidate the isolated herds of Val-d'Or and Charlevoix

The Recovery Team considers that all possible efforts must be made to maintain and consolidate the isolated populations of forest-dwelling caribou of Val-d'Or and Charlevoix. The recent creation of a protected area comprising a good portion of the area used by the caribou of Val-d'Or will mean that these two isolated herds will be able to count on a legal status to ensure the perennial nature of a portion of their habitat. However, other actions will also be necessary to increase their chances of survival.

The Recovery Team recommends a similar approach for the herds of Val-d'Or and Charlevoix, namely the setting of a safe population level and a minimum level, below which extraordinary actions should be undertaken. The Team proposes a safe number of 50 and 100 individuals respectively in winter for the population of Val-D'Or and Charlevoix. It is important to bear in mind that the current numbers of these herds are below the indicated thresholds. As a goal to be reached, the Team suggests a population of 50 individuals in 2015 for the Val-d'Or herd and of 100 individuals for the Charlevoix herd.

3.4.3 Strategy proposed by the Recovery Team

Based on the biological characteristics of the species and the problems outlined above, various intervention avenues may be defined to achieve the identified objectives. The actions to protect the caribou and its habitat will be carried out by considering two intervention levels. First, the immediate needs of the forest-dwelling caribou such as the reduction of the mortality rate of forest-dwelling caribou due to human intervention will have to be met. Targeted management activities directly addressing the caribou's habitat and tranquility requirements will have to be applied in sectors where the caribou's presence is currently greater and more sustained. Afterwards, at a larger scale, the management of the territory's resources will have to consider the entire area of application of the Recovery Plan as being the potential habitat of the forest-dwelling caribou. The development of all this territory and the management of other animal species will have to address the general concerns of maintaining biodiversity and ecosystems, and consequently will have to preserve the potential of finding suitable environments for the caribou there. This strategy comprises five complementary elements.

First element: maintain or increase the caribou survival rate

The first element of the strategy will be to maintain or increase the survival rate of the forest-dwelling caribou and consequently to minimize, over the short term, any excessive mortality. While sport hunting is now banned in the greatest portion of its current range, poaching, hunting for food, ritual or social purposes practiced by certain Aboriginal communities, and hunting for barren-ground caribou are responsible for a certain number of harvests. Efforts will have to be made to limit, wherever possible, these activities.

As was shown before, predation by the grey wolf and the black bear is a cause of mortality among forest-dwelling caribou. This species is particularly vulnerable to predation by the wolf when alternative prey populations are high, for this results in an increase in wolf populations and consequently, tends to reduce caribou numbers. An effective management of these predators and their prey should permit a reduction of predation on the forest-dwelling caribou.

Second element: maintain suitable habitats

The second element of the strategy will consist of maintaining suitable habitats for the caribou in forest harvesting sectors and of ensuring the caribou the peace and tranquility it needs.

It seems advisable that various components of the forest ecosystem in which the caribou lives, namely softwood stands, should be maintained. Logging leads to a rejuvenation of forests, whereas the forest-dwelling caribou prefers mature forests. Moreover, any change in the habitat that promotes the establishment of hardwood species will result in the growth of moose populations, and consequently, an increase in predation on caribou. Given that large areas of the boreal forest are actively exploited and that logging activities take place in sectors frequented by the caribou, it is important to ensure that forest sites suitable for the caribou are maintained within managed forests.

For this purpose, a network of sites corresponding to habitats currently used by the caribou will be the subject of as many forest-dwelling caribou habitat forest management plans. These plans will make it possible to delimit areas dedicated to the protection of the habitat of the forest-dwelling caribou taking the form of expanses of physical and forest elements (forests, peatlands, dry areas and others) sought and chosen by the forest-dwelling caribou. Such protected expanses will be of sufficient size, around 250 km², to ensure the availability of suitable habitat for the caribou, particularly during the winter period. The forest cover in its current condition will be maintained there. These protected expanses will be adjacent to replacement expanses which will ensure over the short and medium term a rotation of the sectors available for the caribou. The management plans will identify the necessary forestry activities in all of the protected and replacement expanses to maintain or improve the forestry characteristics, and thus accelerate the return of forests that can be used by the caribou. These plans will present the necessary interventions between the protected and replacement expanses over the entire area of application of the Recovery Plan, such as migration corridors, the application of specific wood harvesting methods, etc.

In parallel to this network of expanses, the establishment of protected areas dedicated, among other things, to the forest-dwelling caribou, established under the Natural Heritage Conservation Act, will be added for the protection of the caribou's habitat. In addition, the problem of the forest-dwelling caribou should be taken into account in the identification of new protected areas or the remodeling of existing areas together with biodiversity representativeness criteria.

To survive, the caribou requires a certain amount of peace and tranquility. In conjunction with the establishment of protected and replacement expanses, it will undoubtedly be necessary to review the recreational activity development strategy. In order to maintain the full effectiveness of protected and replacement expanses, no consideration may be given to intensifying the development of vacationing beyond a certain density level.

Third element: adopt forest management measures that maintain the integrity of the boreal forest over the long term

The third element of the strategy will aim at adopting forest management measures that maintain the integrity of the boreal forest over the long term.

The forest-dwelling caribou is currently found in a large portion of the boreal forest and in particular, in the spruce-moss domain and the spruce-lichen domain. Here and there, the caribou finds and chooses habitats that are necessary for its needs. The great mobility of the species and the homogeneity of the ecosystems of the boreal forest are such that the caribou would be capable of occupying all parts of its range. However, the various natural or man-made disturbances of this environment have modified the habitats available to the caribou. In order to ensure the long-term survival of the caribou throughout its current range, silvicultural interventions will notably have to be carried out in such a way as to respect the integrity of the ecosystem of the boreal forest and to maintain all of the forest stands that characterize this ecosystem. These interventions complement the protection provided by the network of expanses and protected territories over the rest of the territory.

As for the sectors between the expanses, they will be subject to special measures. The caribou should find the elements necessary for its survival throughout the forest cycle of the boreal forest. Such practices are in line with the concerns conveyed by the Convention on Biological Diversity regarding the maintaining of ecosystems and of the species in these ecosystems.

Fourth element: seek public support

The fourth element of the strategy aims at seeking public support for the implementation of the measures proposed in the Recovery Plan and also at modifying certain attitudes that are detrimental to the forest-dwelling caribou.

The Forest-Dwelling Caribou Recovery Plan will have to pay special attention to awareness promotion directed at the general public and all of the stakeholders of a given territory. It would be a mistake to think that the solutions put forward can be entirely effective without the support and participation of all of the persons concerned. For example, new forest harvesting methods that can modify the approaches will have to be put forward. Similarly, the establishment of snowmobile and motorized ATV trails and even the practice of these activities will have to change. Moreover, the setting up of a network of protected areas for the caribou habitat will require the public's comprehension, which explains the need for awareness promotion activities to arrive at practices that respect the forest-dwelling caribou and its habitats.

Fifth element: continue research and development

The fifth element of the strategy calls for the continuation of research and the development of knowledge about the forest-dwelling caribou and its habitats.

Several aspects of the caribou's biology and of its occupation of the territory are still not known or must be better documented. For example, the predator-prey relationships between the caribou, the moose and their natural predators still need to be clarified. Similarly, the development of knowledge is necessary concerning the impacts of forestry and of the various softwood forest regeneration practices on the caribou and its habitat as well as on the role of protected areas within managed zones. Moreover, the mechanisms whereby human activities cause disturbances to the forest-dwelling caribou are not yet well known. Consequently, the protection and management actions undertaken will have to be supported by applied research.

4. ACTION PLAN

The actions to be carried out will be supported by the most up-to-date scientific knowledge, and published research developments will be incorporated in the works of the Recovery Plan. However, we intend to act according to the adaptative management principle for the choice of actions and their application, despite the shortcomings or uncertainties regarding available information.

To achieve the objectives set by following the developed strategy, the Recovery Team has identified 30 actions in relation to the objectives set and the developed strategy. These actions are presented in the form of tables and, for each one, a description specifies the context for which the action is required. The information includes the sectors of the Plan's area of application where the action is required as well as the organizations concerned for the implementation. More specifically, under the "In charge" column, the name in bold characters designates the organization that we recognize as being responsible for coordinating this action. It is not the organization that must carry out the action, but rather the organization that must see to it that the action is indeed carried out. It is up to this organization to associate the other partners concerned. The organizations identified in plain characters are listed for information purposes and on a non-exclusive basis. It is important to emphasize that the identified organizations have not all been consulted concerning their responsibility regarding these actions and that their agreement will be sought when the time comes. An order of priority has been assigned to each action according to the level of necessity required to achieve the objectives. A priority 1 level is an activity deemed essential and in the absence of which the achievement of the plan's objectives is compromised. A priority 2 level is an activity deemed important, whereas a priority 3 level is an activity deemed necessary.

4.1 ACTIONS TO MAINTAIN OR INCREASE THE SURVIVAL OF CARIBOU

- Six actions concerning:
  - Stopping hunting
  - Controlling poaching
  - Managing predators and their prey

No.	Action	Description	Intervention sectors	In charge	Priority
1	Maintain the ban on sport hunting for caribou with the exception of zones 22A, 22B, 23 and 24.	Any harvesting of forest-dwelling caribou in the Plan's area of application not shared with the barren-ground caribou takes place to the detriment of forest-dwelling caribou populations and prevents the attainment of the objectives sought. The major barren-ground caribou populations more than suffice for sport hunting needs. The ban on hunting applied in 2001 must be maintained to limit forest-dwelling caribou mortalities.	South, centre, isolated herds	- **MRNF - Faune sector**	1
2	Reach with the Aboriginal communities concerned a special agreement, the objective of which is to stop hunting for forest-dwelling caribou.	In the part of the Plan's area of application not shared with the barren-ground caribou, any harvest of forest-dwelling caribou, however minimal, is likely to call into question the attainment of the objectives sought. The stopping of harvesting activities must apply to all stakeholders. Eventually, a partial or total lifting of the ban on Aboriginal hunting may be agreed to with the communities concerned once the situation of the forest-dwelling caribou will have improved.	North, south, centre, isolated herds	- **MRNF - Faune sector** - First Nations - HFTCC	1
3	Identify and implement mechanisms to improve the management of the winter hunting of barren-ground caribou (sport and Aboriginal) practiced in sectors A and B of Zone 22 and in Zone 23 south with a view	Winter hunting for caribou takes place in the range of the forest-dwelling caribou. This hunting must be oriented towards barren-ground caribou in order to avoid, wherever possible, the undesired harvesting of forest-dwelling caribou. The harvesting conditions and terms should be reviewed to	North	- **MRNF - Faune sector (Region 10)** - HFTCC	1

No.	Action	Description	Intervention sectors	In charge	Priority
	to minimizing forest-dwelling caribou mortalities.	identify problematic periods and sectors.			
4	Establish and implement regional protection plans specific to the forest-dwelling caribou to combat poaching and other illegal acts.	Any illegal harvesting of forest-dwelling caribou is detrimental to the populations and prevents the attainment of the objectives sought. Poaching of forest-dwelling caribou is a cause of mortality that should be controlled. All facets related to poaching such as hunting at times and places when/where it is banned, harassment or accidental kills will have to be the subject of on-going education, oversight and repression measures throughout the implementation of the Recovery Plan based on interventions planned ahead of time.	North, south, centre, isolated herds	- **MRNF - Faune sector** Regional operations sector	1
5	Put a stop to the public dissemination on the web site of the MRNF of the location of barren-ground caribou fitted with transmitter collars, when they cross, southward, the southern limits of sectors A and B of Zone 22 and Zone 23 south.	Information on the location of barren-ground caribou contributes to the attraction of hunters in zones and during periods when hunting is banned. This information should be reserved for resource managers. This measure will help to limit poaching.	North and centre	- **MRNF - Faune sector**	1
6	If necessary, implement an integrated management program intended for predators and their prey for the preservation of isolated herds.	Predation by grey wolves and black bears can cause small herds to fall to critical population levels. A management of predators and alternative prey (moose and other) could be essential to limit the effect of predation and, in so doing, contribute to the preservation of population dynamics that are favorable to the survival of a sufficient number of forest-dwelling caribou. This action must be preceded by appropriate interventions seeking to limit the other mortality factors such as road accidents, poaching and disturbances. While this action applies to isolated herds, other herds could eventually be the subject of similar attention.	Isolated herds	- **MRNF - Faune sector (regions 03 and 08)**	1

4.2 ACTIONS TO PRESERVE SUITABLE HABITATS

- Eleven actions concerning:
  - Protected and replacement expanses
  - Protected areas
  - Habitat management strategy
  - Peace and tranquility
  - Legal protection
  - Cumulative impacts

No.	Action	Description	Intervention sectors	In charge	Priority
7	By involving the stakeholders concerned, put in place in the sectors of interest identified in the forests under management forest-dwelling caribou habitat management plans, including notably: 7.1 A network of protected and replacement expanses, as defined in the *Stratégie d'aménagement de l'habitat du caribou forestier (Forest-dwelling caribou habitat management strategy)* (Provincial Caribou Committee – being prepared). 7.2 Protected areas meeting, among other things, the requirements of the forest-dwelling caribou, with which adjacent expanses will be associated.	The forest-dwelling caribou occupies certain parts of its habitat more intensively. Management plans must be produced for these sectors of interest. Each plan shall include a certain number of protected and replacement expanses (ideally of about 250 km^2) that will provide the forest-dwelling caribou with habitats that are essential for the survival of this species. Protected areas (generally greater than 250 km^2) can also contribute as protected expanses in several zones under forest management. The immediate safeguarding of these elements of the boreal forest is essential over the short term for the survival of the forest-dwelling caribou in forests under management.	South and isolated herds	- **MRNF - Faune, Forêt, Territoire sectors** - **PCC** - **Forestry companies** - **First Nations** - **CQFB** - **MDDEP**	1
8	Complete the network of protected areas as quickly as possible in the forest under management in order to optimize the recovery of the forest-	The creation of a network of protected areas that is representative of the ecological conditions of the boreal forest by way of the Plan d'action stratégique sur les aires protégées (Strategic action plan on protected areas) will	South and isolated herds	- **MDDEP** - MRNF - Faune, Forêt, Territoire	1

No.	Action	Description	Intervention sectors	In charge	Priority
	dwelling caribou.	contribute to maintaining the characteristics of the ecosystem of the boreal forest. The legal framework of protected areas ensures that they will be preserved in their natural state over the long term and thus permits the protection of a significant part of the forest-dwelling caribou's habitat. Under the objectives of the Québec strategy on protected areas, several of these areas will have to be established in forests under management. The location of these territories (which are generally bigger than 250 km²) may coincide with sectors of interest for the forest-dwelling caribou. The network of protected areas will have to be integrated in the territory's forest and wildlife planning process.		sectors	
9	Create, mainly to the north of the limit of the forest under management decreed in 2002, major protected areas in the range of the forest-dwelling caribou.	The aim of this action is to permit the establishment of large territories (of several thousand km²) maintained in a natural state covering all of the natural provinces, among other things, to the north of the limit of the forest under management. They will ensure a suitable long-term habitat for the forest-dwelling caribou and will serve as references to judge the effectiveness of our conservation strategy on the entire territory. This action will also make it possible to provide protection against possible developments that could affect the forest-dwelling caribou.	North and centre	- **MDDEP** - **MRNF - Territoire** - First Nations	2
10	Have the Implementation Team approve the upcoming amendments to the *Stratégie d'aménagement de l'habitat du caribou forestier (Forest-dwelling caribou habitat management strategy)*.	The document entitled *Stratégie d'aménagement de l'habitat du caribou forestier* presents the elements used by the Provincial Caribou Committee for the preparation of forest-dwelling caribou habitat management plans. Following the acquisition of new knowledge on the habitat needs of the species and on the forest ecosystem, this document is likely to evolve. The conformity of this document with the strategy of the Forest-Dwelling Caribou Recovery Plan should be ensured.	South and isolated herds	- **PCC**	2

No.	Action	Description	Intervention sectors	In charge	Priority
11	Obtain from the Implementation Team an opinion on *Les lignes directrices pour des alternatives à la coupe en mosaïque dans la pessière (Guidelines for alternatives to block cutting in the spruce forest)* (MRNF – being prepared) (RNI).	The alternatives to block cutting that will be developed will have to be compatible with the requirements of forest-dwelling caribou concerning habitat and the disturbance of the environment. The proposed alternatives must be approved by the Implementation Team.	South and isolated herds	- **MRNF – Forêt Québec sector**	2
12	Avoid the development of vacationing and recreational, commercial and industrial infrastructures in the network of protected and replacement expanses as well as in the protected areas for the caribou.	Vacationing and recreational, commercial and industrial activities cause disturbances that are likely to render unusable sections of territories intended for the preservation of the forest-dwelling caribou. Territory use planning documents (protected area conservation plans, regional plans for public land development (PRDTP), development schemas, public land assignment plans (PATP) and others) must identify the network of protected and replacement expanses as well as protected areas as zones where the development of human activities must be adapted to the needs of the caribou (snowmobile and ATV trails, vacationing, hydroplane bases and others). This action will ensure the forest-dwelling caribou the tranquility that it needs to use the habitats reserved for this species.	North, centre, south, isolated herds	- **MRNF - Territoire** - MDDEP - MRNF - Faune and Mines sectors - First Nations - RCM	1
13	Plan the establishment of main roads in a forest setting to avoid experimental, protected and replacement expanses as well as protected areas.	The main roads in a forest setting permanently alter the habitat, facilitate the circulation of predators and increase human disturbances, all factors that reduce the frequentation of the territory by the forest-dwelling caribou. When planning main roads, which are necessary for silvicultural, mining or other operations, it is important to avoid habitats reserved for this species.	South and isolated herds	- **Forestry companies** - MRNF - Forêt, Faune and Territoire sectors - Access Committee under the Peace of the Brave Agreement - MDDEP	1
14	Adjust the regulatory framework to permit, in certain cases, the temporary	In those places where forest roads already exist, it is necessary to reduce the negative impact generated by	South and isolated herds	- **MRNF**	1

No.	Action	Description	Intervention sectors	In charge	Priority
	or permanent closing and/or putting back into production of roads in a forest setting in protected or replacement expanses and in protected areas for the caribou.	clearing work and human disturbances. Following the carrying out of development work in replacement and experimental expanses as well as in protected areas, all forest roads should be reforested. At the very least, when they are required for silvicultural operations after cutting, they should be closed to human traffic. The current regulations do not permit the closing of these roads and, consequently, their reforestation. A regulatory amendment is thus required.		- MDDEP - Access Committee under the Peace of the Brave Agreement	
15	Revise the legal definition in the Regulation respecting wildlife habitats and the Regulation respecting Standards of forest management for forests in the domain of the State (RNI) regarding the area frequented by the caribou south of the 52nd parallel.	The current definition of the area frequented by the caribou south of the 52nd parallel found in the *Regulation respecting wildlife habitats* and the RNI is not applicable in the majority of situations. More specifically, the requirement of the presence of at least 50 caribou makes this regulation inapplicable. A revision of this definition should consider the other legal measures that will be chosen (action 16).	North, centre, south, isolated herds	- **MRNF - Faune sector**	3
16	Establish a level of legal protection for protected and replacement expanses in the habitat of the forest-dwelling caribou.	The protected and replacement expanses agreed upon in the forest-dwelling caribou habitat management plans are an important part of the residual habitat intended to help ensure the survival of the forest-dwelling caribou. The legal protection of these entities should make it possible to ensure respect for the characteristics of the habitat specific to the forest-dwelling caribou and the tranquility required for its use. Several legal possibilities exist such as the *Québec Act respecting the conservation and development of wildlife* (habitats and wildlife sanctuaries), the *Forest Act*, the *Natural Heritage Conservation Act* and the *Endangered Species Act*, The analysis of the choice of the method of legal protection needs to be completed.	South and isolated herds	- **MRNF – Faune, Forêt and Territoire Québec sectors** - MDDEP	3
17	During environmental assessment studies:	It is likely that large-scale projects, whether industrial or other, requiring recourse to environmental assessment studies, will eventually be tabled in the area of application of	North, centre, south and isolated herds	- **MDDEP** - MRNF	2

No.	Action	Description	Intervention sectors	In charge	Priority
	17.1 Recognize the forest-dwelling caribou as a target species. 17.2 Consider the cumulative impact of the interventions on the habitat of the forest-dwelling caribou.	the *Recovery Plan*. It will be important to make sure that the forest-dwelling caribou is identified as a target species so that the precarious situation of this species is taken into consideration in the environmental impact assessment and review process. The impacts of already authorized activities should also be considered. This action may lead to changes to projects being examined or to the implementation of mitigation measures to make the work compatible with the requirements of the forest-dwelling caribou.		- JBACE - Environment Canada	

4.3 ACTIONS TO ADOPT FOREST MANAGEMENT MEASURES THAT MAINTAIN THE INTEGRITY OF THE BOREAL FOREST OVER THE LONG TERM

- One action concerning:
  - Ecosystemic approach
  - New cutting dispersion patterns

No.	Action	Description	Intervention sectors	In charge	Priority
18	In an ecosystemic perspective and throughout the application area of the Plan: 18.1 Apply cutting dispersion models that are more appropriate than traditional models. 18.2 Apply appropriate silvicultural practices with a view to maintaining the softwood characteristics of the habitat and to promoting the return of the habitat of the forest-dwelling caribou.	The commercial harvesting of wood compromises the ecosystem of the boreal forest by substantially altering the forest cover and the age of stands. The aim of this action is to make sure that the characteristics of this ecosystem are maintained over the entire area of application of the Plan and to hasten the return of habitat conditions that are conducive to the forest-dwelling caribou. Based on current knowledge, the fragmentation of forest stands created by mosaic pattern cutting goes against the principles of conservation of the habitat of the forest-dwelling caribou. Alternatives should therefore be developed. A good knowledge of the evolution of the boreal forest ecosystem and of the impact of silvicultural practices is essential for carrying out this action. The boreal forest ecosystem must ensure the preservation of the habitat components conducive to the forest-dwelling caribou in order to ensure its sustainability over the medium and long term.	South and isolated herds	- **MRNF- Faune Forêt sectors** - **PCC** - **Forestry companies** - **First Nations** **CQFB**	1

4.4 ACTIONS TO SEEK PUBLIC SUPPORT

- One action concerning:
  - The public
  - Aboriginal peoples
  - Hunters
  - Forestry workers

No.	Action	Description	Intervention sectors	In charge	Priority
19	Draw up a communication plan to inform the various stakeholders of the content of the Recovery Plan to: 19.1 Inform the public and the Aboriginal peoples of the management practices put forward to maintain the habitat of the forest-dwelling caribou. 19.2 Promote the awareness of the public and Aboriginal peoples about the effects of harvesting, poaching, accidental kills and the disturbance of caribou. Promote the awareness of the public, Aboriginal peoples and the workers concerned about the importance of the contribution of protected areas for the protection of the caribou.	The implementation of the Forest-Dwelling Caribou Recovery Plan requires the support of society as a whole, whether it be citizens, Aboriginal communities, users of the territory or forest workers. Several actions of the Recovery Plan are likely to modify recreational (vacationing, hiking, hunting and fishing) or silvicultural practices in the area of application of the Plan. A communication strategy to disseminate information on the situation of the forest-dwelling caribou will be prepared. Press releases, media campaigns, pamphlets and a web site are among the tools that should be favoured. The dissemination of information on the situation of the forest-dwelling caribou, the objectives of the Plan and the actions to be carried out seeks to obtain broad social acceptance of the Plan.	North, centre, south and isolated herds	- IC - MRNF - First Nations - HFTCC - Forestry companies - MDDEP - NGOs (environment and wildlife)	1

4.5 ACTIONS TO CONTINUE RESEARCH AND THE DEVELOPMENT OF KNOWLEDGE

- Eleven actions concerning:
  - State of populations
  - Fine-scale use of the habitat
  - Predator-prey relationships
  - Impact of forest management and developments
  - Impact of human disturbances
  - Aboriginal knowledge

No.	Action	Description	Intervention sectors	In charge	Priority
20	Complete the surveys in order to determine: 20.1 The current level of populations. 20.2 The survival of calves and females	The situation of the caribou (location, population, density, dynamics) is not known throughout the area of application of the Plan. For some sectors, the data date back several decades. The data resulting from these surveys will make it possible to validate the population and density objectives set in the Recovery Plan. The collection of information on the dynamics of the populations must be drawn from the results of surveys and the monitoring of marked animals (collars or other) for the purposes of evaluating the situation of herds.	North, centre and south	- **MRNF – Faune Québec** - First Nations	1
21	Obtain population parameters (number, sex, age classes) and the spatial distribution every: 21.1 Five years in forests under management. 21.2 Ten years elsewhere.	The objectives pursued in the Recovery Plan require the accumulation of data on the distribution of the forest-dwelling caribou, its abundance, its densities as well as on the dynamics of the populations. The standardized collection of periodic information will make it possible to measure the degree of attainment of the objectives set. Given the slow evolution of caribou populations, the survey rotation period can be spread out over a long period (10 years). However, the rapid development of forests under management requires a tighter supervision (5 years) of the southern part of the area of application. The results obtained will make it possible to revise the objectives or actions to be carried out to achieve these objectives.	North, centre, south and isolated herds	- **MRNF - Faune sector** - First Nations	1

No.	Action	Description	Intervention sectors	In charge	Priority
22	Specify the impacts of grey wolf and black bear predation on caribou.	Predation has a major influence on the survival of the forest-dwelling caribou. The mechanisms whereby predation is expressed are not well known. The state of the habitat and the presence of moose and other prey may significantly affect the impact of predation on the forest-dwelling caribou. The results will make it possible to judge the relevance of managing predators or developing the habitat in such a way as to promote the caribou and limit predators.	North, centre, south and isolated herds	- **MRNF - Faune sector** - First Nations - Universities	1
23	Experiment with the isolation of females during calving to increase productivity.	In certain critical situations, predation can jeopardize the survival of small herds. The putting of females in enclosures limits the predation on calves and contributes to greater recruitment. Given that this action requires major human and financial resources, it is the last resort in order to ensure the recruitment necessary for the herd's survival.	Isolated herds	- **MRNF - Faune sector (region 08)** - First Nations	1
24	Evaluate the causes of fertility problems.	The latest gestation rate results for the forest-dwelling caribou of Val-d'Or are very low and the cause for this is not known. Given the precarious state of these caribou, poor reproduction can contribute to the disappearance of the herd.	Val-d'Or herd	- **MRNF - Faune sector (region 08)**	1
25	Describe the fine-scale use of environments by the forest-dwelling caribou.	The work carried out to date has made it possible to characterize the habitat of the forest-dwelling caribou at the level of its home range. The fine-scale characteristics of the habitat allowing the forest-dwelling caribou to complete the various phases of its life cycle (rutting, calving, diet) are not well known. This action will serve to identify specific sites that should be afforded protection. This information will also make it possible to better define the forest-dwelling caribou habitat management plans.	North, centre, south and isolated herds	- **MRNF - Faune Québec** - First Nations - Universities - MDDEP	1
26	Evaluate the caribou's response:	The conventional CPRS has not shown itself to be compatible with forest-dwelling caribou survival. In this case, the return of a good-quality habitat may take several decades. Experimenting with alternative cutting methods	South and isolated herds	- **MRNF – Faune sector** - MRNF – Forest	1

No.	Action	Description	Intervention sectors	In charge	Priority
		(CPMS and others) could possibly shorten the time it takes for the return of a quality habitat for the forest-dwelling caribou.		sector - First Nations - University - Forestry companies - See 26.1 and CQFB - See 26.2 and MDDEP	
	26.1 To alternative cutting methods such as CPMS, partial cuts, CPHRS, etc.	26.1 The parceling of forest stands created by block cutting goes against forest-dwelling caribou habitat conservation principles and promotes alternative prey such as the moose, thus being prejudicial to caribou through predation and increases human disturbances. The scope of these impacts should be documented.			
	26.2 To block cutting.	26.2 The survival of forest-dwelling caribou over the short and medium term depends on the use of protected expanses and protected areas created mainly for this species. This strategy is innovative and we do not know if it will respond to all the requirements of the caribou. Aerial surveys inform us of the location of yards at the time of the survey. Between two aerial surveys, we have no other data allowing us to verify the use of the managed sectors. Hence, it would be important to evaluate and adjust this strategy according to the use that the forest-dwelling caribou will make of the sectors. The fitting of transmitter collars (ARGOS system) on a few animals per herd would make it possible to monitor caribou on an annual basis.			
	26.3 To the global management strategy, notably with respect to protected areas, protected and repla-cement expanses, and movements by forest-dwelling caribou between expanses.				
27	Describe the return and the use of the caribou in disturbed sectors in relation to its annual cycle.	An important element of the forest-dwelling caribou habitat management plans is rotation between protected expanses and replacement expanses. The rotation periods are established according to forest management models. The action seeks to specify the characteristics of the stands (composition, age, density, height) starting from which the forest-dwelling caribou begins to use them again. These data will serve as inputs in the forest-dwelling caribou habitat management plans.	South and isolated herds	- **MRNF – Faune sector** - MRNF Forêt Québec sector - First Nations - University	2

No.	Action	Description	Intervention sectors	In charge	Priority
				- Forestry companies	
28	Document the hardwood invasion of the caribou's habitat.	The forest-dwelling caribou prefers softwood stands during all phases of its life cycle. Silvicultural operations can modify the forest composition through the development of hardwood species. This phenomenon must be monitored to determine its scope and the impact on the habitat of the caribou and the moose. The results may lead to changes in silvicultural practices throughout the area of application of the Recovery Plan.	South and isolated herds	- **MRNF – Forêt Québec sector** - First Nations - MRNF - Faune and Forêt Québec sectors - Universities	3
29	Evaluate the impact of human disturbances: 29.1 With respect to the presence of vacationing and recreational activities. 29.2 During logging. 29.3 Other activities such as low-altitude flights. 29.4 Regarding commercial and industrial activities. 29.5 And, if possible, establish the acceptability thresholds	The forest-dwelling caribou is particularly sensitive to disturbances of human origin. Several actions of the Plan seek to limit disturbances. The impact of the various types of disturbance should be analyzed more closely. Based on the literature and available study results, document the impact of the disturbance caused by low-altitude flights. Representations may be made with military officials if necessary.	North, centre, south and isolated herds	- **MRNF Faune sector** - First Nations - MRNF - Territoire and Forêt sector - MDDEP	1 3 3 3
30	Document Aboriginal knowledge on the forest-dwelling caribou (habitat, current and historical distribution, behaviour, etc.).	As secular occupants of the forest territory, Aboriginal communities have developed traditional knowledge of the forest-dwelling caribou. Information on certain behavioural traits of the caribou, on the use of parts of the territory or specific sites can be integrated into the various protection activities involving the caribou and its habitat. The confidential nature of information will have to be respected.	North, centre, south and isolated herds	– **First Nations** – MRNF – Faune sector – Institut du développement durable - MDDEP	3 2

5. SOCIOECONOMIC CONSIDERATIONS

Several actions identified in the Forest-Dwelling Caribou Recovery Plan may have variable consequences, positive or negative, at the social, economic and political levels, whereas other actions will entail no specific impacts. This is notably the case of actions dealing with regulatory aspects (actions 15 and 16), environmental assessments (action 17), research and development activities (actions 20 to 30 communication and awareness promotion activities (action 19) as well as the follow-up on the achievement of the results and of the Recovery Plan (action 21). However, the application of the conclusions of certain research and development works may have repercussions on other activity sectors.

Human disturbances are one of the causes identified in the Recovery Plan that may compromise the survival of forest-dwelling caribou. Certain actions have been identified to combat such disturbances, notably by reducing the accessibility of the territory (actions 12 and 14). These actions could have a negative socioeconomic impact, mainly concerning the development of vacationing and the use of the territory. These actions will entail, among other things, a regulatory amendment seeking to close access roads temporarily or permanently (action 14) following the completion of silvicultural activities, as well as the creation of protected areas dedicated to the forest-dwelling caribou (actions 7.2, 8 and 9) and protected and replacement expanses (actions 7.1 and 12).

Hunters also risk being affected by possible measures regarding the revision of management methods associated with the winter hunting of barren-ground caribou (action 3). It will be necessary to take into account the outfitters operating in these zones, since their reservations are made a long time in advance. The spatial distribution of the harvested caribou must also be considered in order to identify the most adequate measures. Putting an end to the public dissemination of the location of certain barren-ground caribou fitted with transmitter collars (action 5) may affect hunters and Aboriginals, as this is a tool used to plan their activities.

The maintaining of the ban on hunting in zones 19, 22 and 29 (action 1) will not make it possible to develop activities related to hunting. Even assuming that all of the actions put forward make it possible to restore forest-dwelling caribou populations, we do not anticipate the return of sport hunting for this species, given its fragility to harvesting. However, the development of a recreational tourism component geared to this resource would make it possible to promote economic spin-offs. The peace and tranquility required by the forest-dwelling caribou would nevertheless have to be maintained.

The Aboriginal peoples will also be concerned by certain actions. The negotiation of specific agreements seeking to suspend caribou harvesting (action 2) will contribute to the re-establishment of certain forest-dwelling caribou populations. Once the situation has improved, the Aboriginal people would be able to resume their harvesting according

to certain terms and conditions agreed upon between the parties. The putting in place of such a strategy will contribute to the maintaining, if not the increase, of the herd which could, under optimal conditions, ensure the sustainability of this traditional activity. As for the action seeking to document Aboriginal knowledge on the forest-dwelling caribou (action 30), it will contribute to associating this group of citizens in the implementation of this species' Recovery Plan.

The objective of maintaining the softwood character of the spruce forest (action 18.2) will likely have a negative impact on the opinion of moose hunters, as they would like to see a hardwood invasion leading to the growth of this species' potential. Without a good understanding of the stakes of biodiversity, hunters might have second thoughts about this strategy. Moreover, the management of predator and prey populations (action 6) risks leading to debates, in particular on the part of groups involved in the protection of animals. For these two actions, the communication plan (action 19) is of particular importance.

The forestry industry, mining and energy sectors will certainly feel the economic impacts related to the implementation of the actions. In this respect, mention should be made of the possible loss of the wood potential associated with the creation of protected areas and protected expanses for the forest-dwelling caribou (actions 7.2, 8 and 9). The impacts should be limited, among other things, by the overlapping of sectors of interest for the caribou with the territories chosen for the implementation of Québec's Strategy on Protected Areas.

The implementation of forest-dwelling caribou habitat management plans and the development of alternative cutting dispersion methods (actions 18.1 and 18.2) could also lead to a decline in the wood potential as well as to additional costs, both at the planning level and at the operational level. Machine operators will have to adapt to new approaches. The costs per hectare associated with these treatments will likely be higher initially, but may decline over time as expertise is developed. In addition, certain new treatments which could be advocated (action 18.2) are not currently recognized in the tariff scale established by the Forêt Québec sector of the MRNF. Furthermore, the impacts related to these new approaches may be variable depending on the terms and conditions chosen. A positive evaluation (action 26) of the new approaches will make it possible to better adapt the caribou protection strategy.

The action related to the planning and construction of roads could also affect the forestry industry. The avoidance of certain sectors for caribou protection purposes (action 13) could lead to an increase in the construction cost of roads. Moreover, their planning could require greater cooperation between the various stakeholders of the community.

In addition to these potential effects on the forestry industry, the setting up of protected expanses, replacement expanses or protected areas (action 7.1) may prove difficult in certain cases, given the small leeway available in the allocation of wood. However, the implementation of actions seeking to restore the caribou could prove profitable for the

forestry industry. For example, the actions aiming to maintain the softwood character of the territory (actions 18.2 and 27) will be beneficial over the long term for users of this raw material. In addition, the putting back into production of certain roads (action 14) will also contribute to increasing the productive forest area. What is more, the forestry industry will certainly obtain intangible yet real benefits from the protection of the woodland caribou, notably by way of forestry certification.

Finally, several actions require major monetary investments in order to evaluate the state of populations and consequently, to preserve forest-dwelling caribou herds over the short, medium and long terms. This is notably the case of the monitoring, research and knowledge acquisition work (actions 4, 20 to 26 and 29). Despite the importance of the sums required, one cannot ignore the positive spin-offs for the scientific community, whether it be in terms of job creation, creativity, consensus-building or collaboration.

The actions put forward in this Plan seek to correct the shortcomings of the past and to put in place today conditions that are conducive to the survival of the forest-dwelling caribou. The recovery of this ecotype will also be an important contribution to preserving North American, even global biodiversity. The recovery strategy proposed in the Plan also falls within the context of an ecosystemic approach to forest management (action 18, among others), as advocated by the Commission d'étude sur la gestion de la forêt publique québécoise (2004).

6. IMPLEMENTATION

The implementation of the Forest-Dwelling Caribou Recovery Plan will be achieved by carrying out all of the actions identified in the action plan. Each action will be accomplished by the organization(s) involved according to their field of jurisdiction, their interest and their own dynamics, and also taking into account the legal, social or economic context surrounding the carrying out of the action. An Implementation Team will be created and made up of several stakeholders involved in the drafting of the Recovery Plan. This Team will see to the follow-up on the carrying out of the actions and will adjust the Recovery Plan according to developments that may occur with respect to the situation of the caribou, the effectiveness of the measures put in place, and new knowledge.

At the time of publication of this document, several actions listed in the action plan have already been taken. Indeed, the Provincial Caribou Committee is actively working on the harmonization of the caribou habitat management plans which are being drawn up in most regions. Some protected areas were recently created in the boreal forest and others are still to come in order to complete the representative network of the ecological conditions of this major ecosystem.

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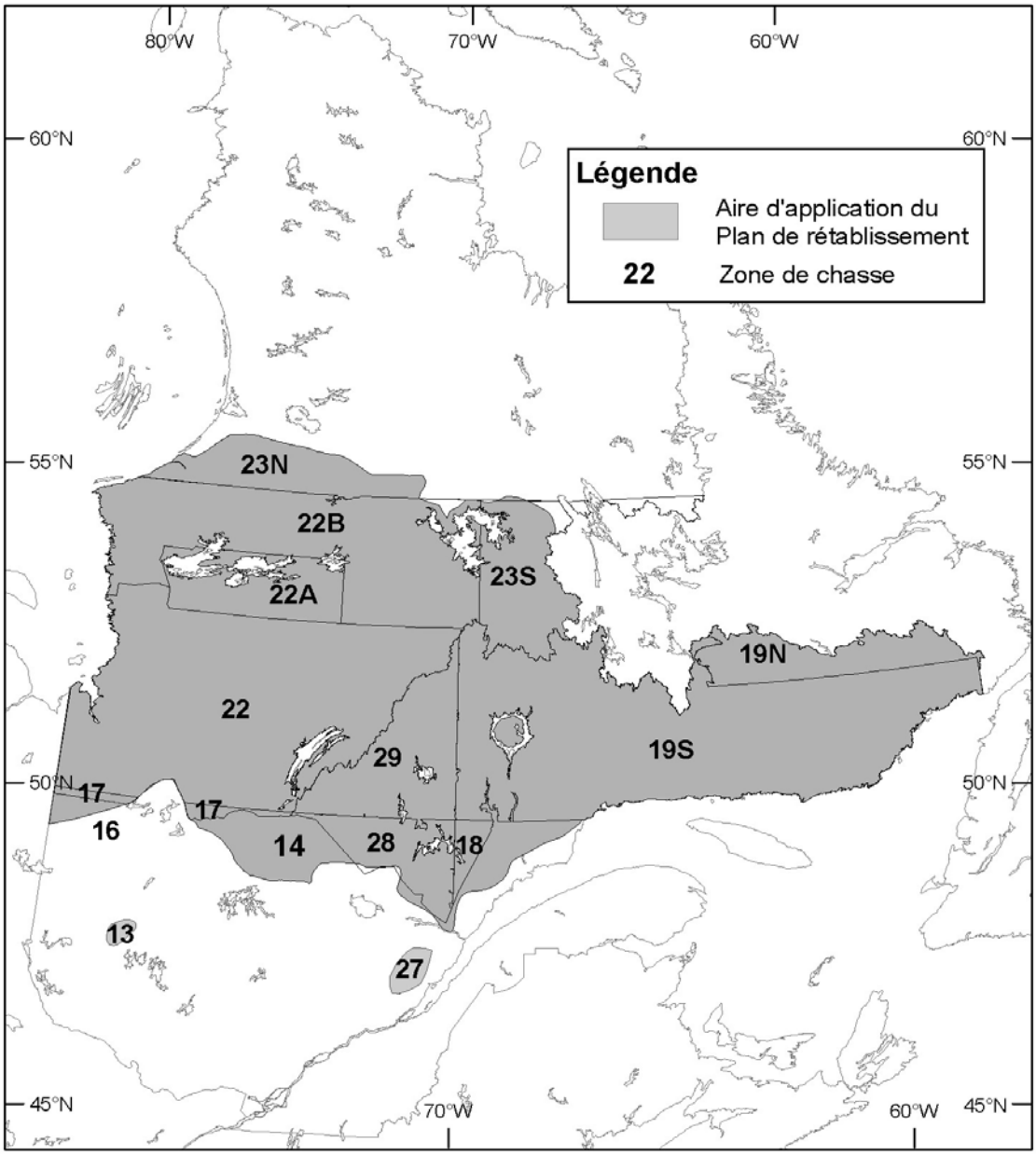


Appendix 1. Hunting zones in the range of the forest-dwelling caribou in Québec.

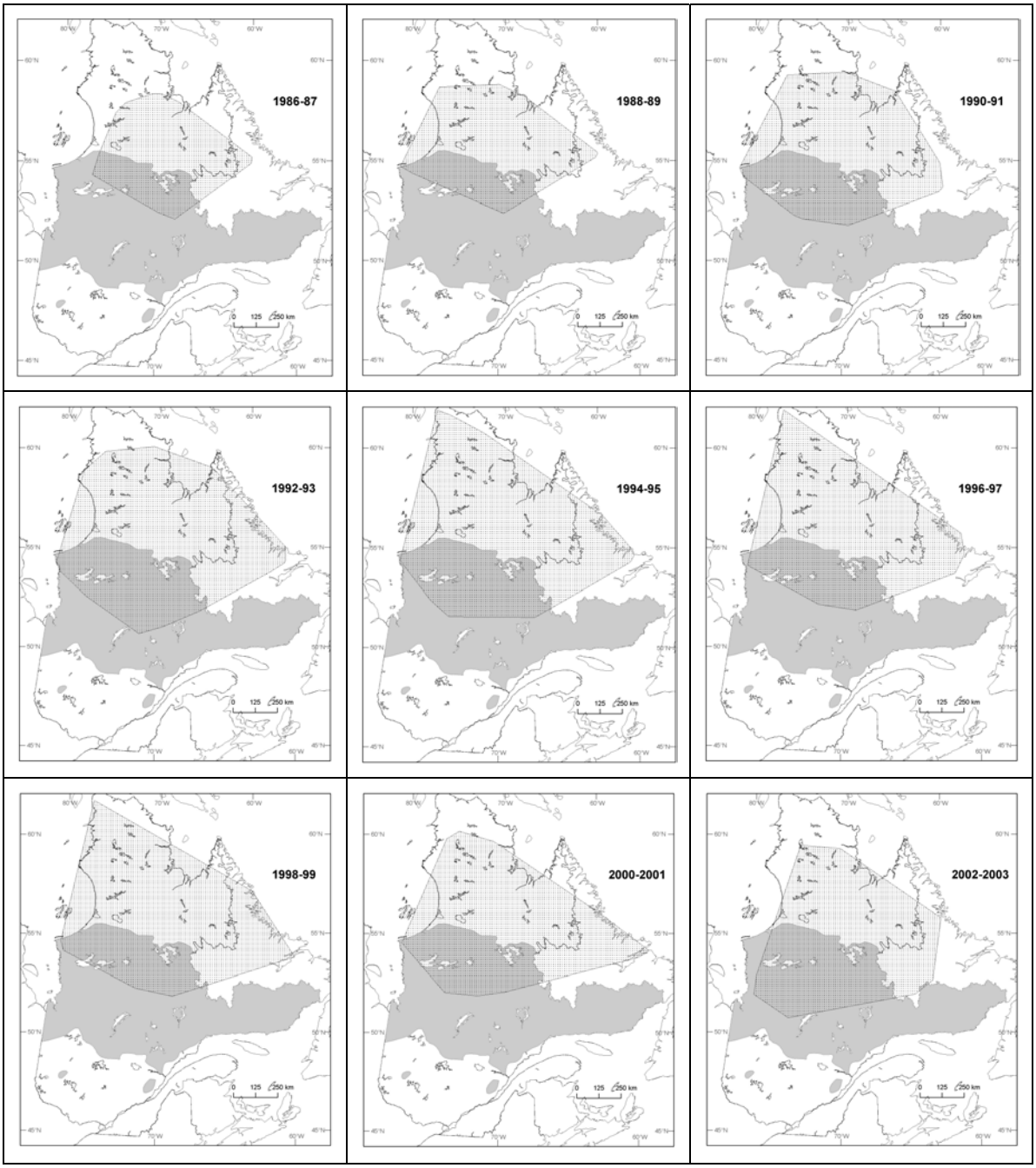
Appendix 2. List of the abbreviations and administrative regions of Québec mentioned in the document.

Abbreviations:

ARGOS:	Satellite-based location and data collection system
AWCCSDC:	Alberta's Woodland Caribou Conservation Strategy Development Committee
HFTCC:	Hunting, Fishing and Trapping Coordinating Committee
JBACE:	James Bay Advisory Committee on the Environment
CQFB:	Cree-Québec Forestry Board
IC:	Implementation Committee
PCC :	Provincial Caribou Committee
CPHR:	Cutting with protection of high regeneration and soils
CPMS:	Cutting with protection of small merchantable stems
MDDEP:	Ministère du Développement durable, de l'Environnement et des Parcs
MLCP:	Ministère du Loisir, de la Chasse et de la Pêche
RCM:	Regional County Municipality
MRNF:	Ministère des Ressources naturelles et de la Faune
NGO:	Non-governmental organizations
PGAF:	General forest management plan
RNI:	Regulation respecting standards of forest management for forests in the domain of the State
ATV:	Motorized all-terrain vehicle
RHF:	Regulation respecting wildlife habitats

Administrative regions of Québec:

Region 02:	Saguenay-Lac-St-Jean region
Region 03:	Capitale-Nationale region
Region 08:	Abitibi-Témiscamingue region
Region 09:	Côte-Nord region
Region 10:	Nord-du-Québec region



Appendix 3. Continuous range of the forest-dwelling caribou in Québec (grey) and area occupied in winter by the barren-ground caribou of the Rivière George and Rivière aux Feuilles herds (dotted) between 1986 and 2003 (Source of the telemetric locations of barren-ground caribou: Department of National Defence, Government of Newfoundland and Labrador and Government of Québec).