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National Recovery Plan for the Wolverine (*Gulo gulo*) [Eastern Population]

Recovery of Nationally Endangered Wildlife

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National Recovery Plan for the Wolverine (*Gulo gulo*) [Eastern Population]

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Recovery Strategy Approval

The National Recovery Strategy for the Wolverine (*Gulo gulo*), [Eastern Population], has been approved by the following jurisdictions:

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Disclaimer

The National Recovery Plan for the Wolverine (*Gulo gulo*) [Eastern Population] was prepared by members of the first Wolverine [Eastern Population] Recovery Team, in consultation with others, to define recovery actions that are deemed necessary, based on sound biological principles, to protect and recover the species. It does not necessarily represent official positions of the agencies or the views of the individuals involved in the plan's formulation. The goals, objectives, and recovery actions identified in the plan are subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations, as well as modifications resulting from changed objectives or new findings. Therefore, some aspects of this plan may not necessarily be implemented immediately, concurrently, or in their entirety. References to the federal *Species at Risk Act* (SARA) and information about species status are current as of December 2003.

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Definition of Terms and Risk Categories

Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (November 2003)

SPECIES: any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.

EXTINCT: a species that no longer exists.

EXTIRPATED: a species no longer existing in the wild in Canada, but occurring elsewhere.

ENDANGERED: a species facing imminent extirpation or extinction.

THREATENED: a species likely to become endangered if limiting factors are not reversed.

SPECIAL CONCERN (formerly "vulnerable")**:** a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

NOT AT RISK (formerly "not in any category")**:** a species that has been evaluated and found to be not at risk.

DATA DEFICIENT (formerly "indeterminate")**:** a species for which there is insufficient scientific information to support status designation.

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Executive Summary

The wolverine (*Gulo gulo*) is a terrestrial mustelid found in all northern regions of the globe. In the past, this species was present throughout Quebec and Labrador, but its range declined considerably between the late 1800s and 1925. The likely causes of decline include trapping and hunting during the 19th century, the growing scarcity of caribou (*Rangifer tarandus*) in the first half of the 20th century, encroachment on the wolverine's habitat, human activities, and, perhaps, the reduction in the number of wolves (*Canis lupus*), which, as a result of their predation on cervids, help to make carcass remains available for scavenging wolverines.

Caribou is considered an important food source for the recovery and maintenance of the wolverine population in Quebec and Labrador. Despite considerable increases in caribou populations since the middle of the 20th century, however, wolverine populations do not appear to be recovering. In fact, the wolverine is considered to be extremely rare in Quebec and Labrador, although the exact population size and demographic trends are not known. The status of the Eastern population is cause for concern.

The wolverine is a species at risk in Canada. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) originally assessed the eastern population of wolverine — namely, the population found in Quebec and Labrador — as Endangered in 1989, and this status designation was confirmed in 2003. In March 2000, the wolverine was legally designated as a "species at risk" in Quebec under the province's *Act respecting threatened or vulnerable species*. In July 2002, the wolverine was listed as endangered under the Province of Newfoundland and Labrador's *Endangered Species Act*. The population appears on Schedule 2 of the federal *Species at Risk Act*. If it is added to Schedule 1 it will also benefit from the protections afforded under SARA.

A team of biologists was established to develop the National Recovery Plan for the Wolverine [Eastern Population], the goal of which is to establish a self-sustaining population of wolverines in Quebec and Labrador. The term self-sustaining refers to a viable population capable of sustaining itself over the long term without human intervention. To meet this goal, the following main objectives were identified:

- reach a population of 100 adult wolverines;
- maintain this population for 10 years;
- prevent wolverine losses attributable to human activities; and
- ensure that sufficient habitat is available to meet the population objective.

The Recovery Team proposes a multifaceted strategy to meet these objectives. Proposed recovery actions include evaluating population status and distribution and developing or refining monitoring methods, promoting awareness and enlisting the support and cooperation of local people, and determining habitat needs and habitat quality and availability in Quebec and Labrador. Finally, the Recovery Team advises that the translocation of wild live-captured animals from Western Canada to Quebec and Labrador may be necessary to meet the recovery goal. Any translocated animals will be monitored and the status of the eastern population will be assessed periodically to evaluate the success of recovery actions, and to determine if the recovery goal has been met.

The total cost for both provincial jurisdictions to implement the first phase of the Recovery Plan, which covers 2004–2008, is estimated at $518.5K (i.e., approximately $60K per province per year) and 310 person-days.

1. Introduction

The wolverine once was found in all northern regions of the globe. Beginning in the late 1800s, its range declined considerably, particularly in Quebec and Labrador. Nowadays, the status of the wolverine is of concern. Despite the application of legal measures to protect the species, the population does not seem to be recovering.

This National Recovery Plan was prepared by the Wolverine [Eastern Population] Recovery Team. It reviews the status of the wolverine in order to propose measures to foster the recovery of this species in Quebec and Labrador. The analysis deals with all aspects of the species' biology, including its habitat, the food resources at its disposal, and relevant protection measures. The document concludes with the identification of steps to be undertaken over 10 years to improve the status of the endangered eastern population of wolverine.

2. General Context

The wolverine (*Gulo gulo*) is the largest terrestrial member of the family Mustelidae. Its range includes all northern regions of the globe (Hash 1987), extending east from Alaska to Russia. Two subspecies are currently recognized: the Eurasian wolverine (*Gulo gulo gulo*) and the North American wolverine (*Gulo gulo luscus*). Hatler (1989) maintains that the North American wolverine populations constitute a single genome. A study of the genetic differences between various populations of North American wolverine, originating from northwestern Alaska to eastern Manitoba, suggests that only the wolverine population of Idaho differs from the others (Kyle and Strobeck 2001).

The wolverine is a solitary animal. It resembles a small bear, with the exception of its long bushy tail, which measures roughly a quarter of the total body length. Its fur is long and coarse, the colour varying from medium brown to almost black. Distinguishing features of the wolverine's appearance are a pale face mask and yellowish stripes running from the shoulders to the base of the tail. The wolverine may be mistaken for several other mammals, such as a young bear (*Ursus americana*), a fisher (*Martes pennanti*), an American porcupine (*Erethizon dorsatum*), or a striped skunk (*Mephitis mephitis*), making it difficult to count and to validate reported sightings. Its large, powerful jaw allows it to easily devour the frozen meat of animal carcasses.

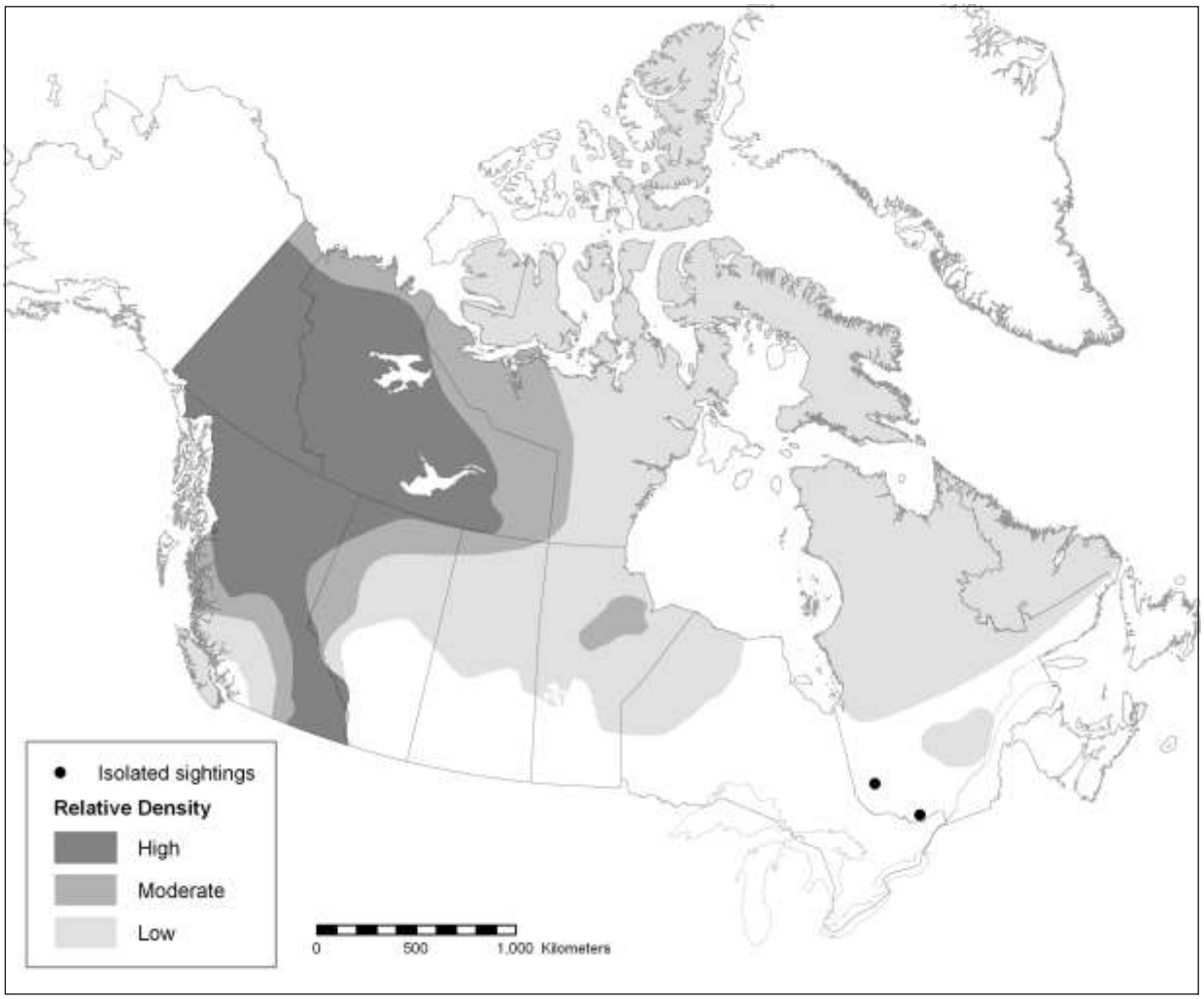
The wolverine is mainly a scavenger, which places it at the top of the food chain. Its survival depends on habitat that supports abundant food resources, which may include the remains of animals that died from predation (e.g., by wolves, *Canis lupus*) or other causes.

The size of the wolverine population in Canada is unknown. The species seems to be relatively abundant in British Columbia, in the Yukon, and in the western part of the Northwest Territories. The wolverine occurs only sporadically in the Arctic archipelago (K. Poole, pers. commun.). In northwestern Alberta and along the east side of the Rocky Mountains, the species is abundant but declining (Petersen 1997), and it is very rare or absent elsewhere in the province. The wolverine is considered very rare in Saskatchewan and northwestern Ontario (Dauphiné 1989; Dawson 2000). There is a small but stable population in Manitoba, and captures appear to have increased in the central northern part of Manitoba in recent years (I. McKay, pers. commun.). The species does not occur in the Maritimes. The density of the species decreases from west to east (Dauphiné 1989). Densities decline significantly east of the Thelon sanctuary, at approximately 103 degrees longitude west, towards Hudson Bay. There are reports that the wolverine has started to recolonize its historic range (Johnson 1990).

A map showing the distribution and relative abundance of the wolverine in Canada was prepared with information provided by the provinces and territories in which the species occurs (Figure 1). Although not quantitative in nature, this exercise made it possible to update information and to make comparisons between jurisdictions on a common basis. This approach was also applied to two ungulate species, the caribou (*Rangifer tarandus*) and the moose (*Alces alces*), which are considered to be the wolverine's main sources of food (see Figures 2 and 3 below).

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) concluded in its 1989 assessment of the wolverine that there are two populations in Canada: the eastern and western populations, and revised its 1982 status assessment. The Western population, which ranges east from British Columbia to Ontario and north into Nunavut, the Northwest Territories, and the Yukon, was designated Special Concern. The Eastern population, which is restricted to Quebec and Newfoundland and Labrador, was designated Endangered. At the time, it was considered that there were very few sightings of wolverines in eastern Canada and that the status of the population seemed extremely precarious. COSEWIC confirmed the status of both populations in 2003.

Figure 1
Current distribution, confirmed and likely, and relative abundance of wolverines (*Gulo gulo*) in Canada



The wolverine is considered a furbearer. However, hunting and trapping of this species have been prohibited since 1950 in Newfoundland and Labrador and since 1981 in Quebec, except in the northern territories referred to in the James Bay and Northern Quebec Agreement, where these activities are reserved for the beneficiaries of the agreement.

In June 1989, Quebec passed the *Act respecting threatened or vulnerable species* (R.S.Q., c.E-12.01). The Act's main objectives are to prevent the extinction or extirpation of indigenous wildlife species and to ensure that new species do not become threatened or vulnerable. It also seeks to promote the recovery of threatened or vulnerable

populations and their habitats (Gouvernement du Québec 1992). In 1992, the Ministère du Loisir, de la Chasse et de la Pêche published a list of species likely to be designated as threatened or vulnerable. The wolverine was included on this list because of its limited abundance, the reduction of its historic range, and the species' decline over the mid and long terms (MLCP 1992). Consequently, in March 2000, the wolverine received legal status as a species at risk in Quebec under the *Act respecting threatened or vulnerable species*.

In July 2002, the wolverine was listed as endangered under the Province of Newfoundland and Labrador's *Endangered Species Act*.

The Eastern population of wolverine appears on Schedule 2 of the federal *Species at Risk Act* (SARA). Since the population's status was re-assessed by COSEWIC after SARA was written, it may be added to Schedule 1 through a regulatory amendment. If the Eastern population of wolverine is added to Schedule 1, it will benefit from the protections afforded by SARA.

3. Status Assessment

3.1 Past and current distribution

Prior to the arrival of Europeans, wolverines were present throughout Labrador and Quebec (Kelsall 1981). The wolverine's historical distribution appears to have coincided with the distribution of caribou within the taiga ecoregion of the Canadian Shield (van Zyll de Jong 1972). However, the historical population size is not known. At the beginning of the 20th century, the geographic range of wolverine was thought to extend to the 66th parallel and perhaps beyond (de Puyjalon 1900). A 1913 report from the Quebec Ministry of Colonization, Mines and Fisheries states "l'espèce abondait par tout le Labrador, surtout dans les parties septentrionales, où les Inuits le prenaient jusqu'au détroit d'Hudson vers le nord (ministère de la Colonisation, des Mines et des Pêcheries 1913)."[1]

The wolverine's North American range has declined considerably over time (Kelsall 1981). According to some authors (Banfield 1974; van Zyll de Jong 1975; Hash 1987), the decline began between 1840 and 1925. The species was forced to move north (Hash 1987) and was extirpated from more than half of its historic range (MLCP 1989). The wolverine was exterminated throughout southern Quebec and the St. Lawrence Valley.

Numerous factors may have contributed to the wolverine's decline in Quebec and Labrador in the late 19th century and the early 20th century. Likely causes of the decline include trapping and hunting during the 19th century, dwindling caribou herds in the first half of the 20th century, human encroachment on the animal's habitat, and perhaps the reduction in the number of wolves, which help to supply wolverines with carcass remains (MLCP 1992).

It is difficult to establish the current range of this species in Quebec and Labrador (see Figure 1). The wolverine was thought to be limited mainly to north of the 49th parallel or thereabouts (MLCP 1992); however, recent unconfirmed sightings suggest that it may occur south of this limit, particularly in the Saguenay–Lac-Saint-Jean area. In Labrador, reports of sightings since 1965, which are mostly unconfirmed, suggest that the wolverine may frequent the entire territory, both the coastal and inland regions. However, wolverines can be very difficult to detect even in areas where they are firmly established. While wolverines are undoubtedly uncommon, in the absence of a systematic survey, considerable uncertainty regarding the status of wolverines in Quebec and Labrador remains. There are several possible scenarios. For example, an extinct population with small numbers of immigrants from Ontario, remnant localized populations at densities too low to be viable, or local populations to permit repopulation.

1 It appears that the species was abundant throughout Labrador, mainly in the north, where it was harvested by the Inuit up to Hudson Strait (Ministère de la Colonisation, des Mines et des Pêcheries 1913).

Of the provinces adjacent to Quebec, wolverines seem to inhabit only the northwestern part of Ontario, where they are found in small numbers (Dauphiné 1989; Dawson 2000). There was likely a small population in the Cape Henrietta Maria region on the coast of James Bay, in Ontario, but the last reference to its presence dates to the early 1970s (Novak 1975; N. Dawson, pers. commun.). The wolverine populations of Ontario are believed to be isolated from those of Quebec and Labrador (Kelsall 1981). It is possible, however, that some animals living west of Hudson Bay travel east of it, as these mustelids are capable of travelling very long distances (Banci 1994). The most recent reports of wolverine sightings south of James Bay in Ontario near the Quebec border date from the 1950s (S. Scholten, pers. commun.).

3.2 Population size and trends

Wolverine populations have never been systematically surveyed in Quebec and Labrador, and their actual status is unclear. Population size and demographic trends are not known.

It is difficult to make an assessment of the population, as it is certain that wildlife agencies receive reports of only a fraction of the sightings. Close to 60 sightings were reported from Quebec and Labrador between 1965 and 2004. With the exception of two captures in Labrador in 1965 and one capture near Schefferville, Quebec, in 1978 (Dagenais 1988), which was not authenticated, none of the sightings could be validated. At best, they must be considered as likely sightings. Despite the presence of numerous people over the entire area (wildlife users, Aboriginal people, workers, scientists, geologists, etc.), very few wolverines have been sighted during the last 20 years. This suggests very low population levels.

The species may occur, although rarely, on the Quebec–Labrador peninsula. Its presence in the area was last confirmed previously in 1978.In February 2004, a wolverine capture in the wild occurred at Saint-Côme, 100 km north-east of Montréal. This capture adds to the credibility of sightings. The belief that the species was never particularly abundant (MLCP 1992) appears to be substantiated by the record of pelt sales in Quebec (Table 1). This is the only indicator available that covers such a long period.

4. Factors Contributing to the Wolverine's Status

4.1 Biological factors

4.1.1 Health and malnutrition

Wolverine populations do not seem to be significantly affected by parasites or chronic disease. The most common cause of poor physical health in individuals is malnutrition (Hatler 1989).

4.1.2 Mortality

Starvation is one of the leading causes of natural mortality, particularly among young and old wolverines (Banci 1994). This was confirmed during studies of wolverines fitted with radio transmitters. Extreme hunger seems to be an inherent part of the wolverine’s existence (Hatler 1989).

A second cause of natural mortality is predation. Wolverines occasionally fall prey to wolves, cougars, and black bears. Eagles may also attack young wolverines (Banci 1994).

Harvesting by humans is a third cause of mortality. It is likely that Aboriginal people harvested wolverines prior to the arrival of Europeans. European settlers hunted and trapped the species from the early days of their colonization. However, the number of pelts harvested in Quebec and Labrador was never very high, particularly since the early 1900s, as very few pelts were offered on the market, despite their high value (see Table 1). Hunting and trapping of

Table 1
Number of wolverine pelts registered on the Quebec[1] fur market during the seasons of 1919–1982[2]

Year	Number of Pelts[3]	Average price of a pelt on the market[4] ($)
1919–20	8	
1920–21	11	
1921–22	15	
1922–23	24	
1923–24	21	
1924–25	15	
1925–26	8	
1926–27	0	
1927–28	12	
1928–29	10	
1929–30	8	
1930–31	2	
1931–32	3	
1932–33	3	
1933–34	10	
1934–35	7	
1935–36	1	
1936–37	2	
1937–38	3	
1938–39	0	
1939–40	3	
1940–41	2	
1941–42	1	
1942–43	0	
1943–44	2	
1944–45	0	
1946 to 1962–63	0	
1963–64	1	
1964–65	0	
1965–66	1	40
1966–67	1	40
1967–68	0	45
1968–69	2	75
1969–70	9	60
1970–71	4	70
1971–72	3	70
1972–73	0	96
1973–74	14	90
1974–75	13	145
1975–76	3	190
1976–77	6	185
1977–78	3	275
1978–79	6	200
1979–80	1	
1980–81	0	
1981–82	0	

[1] No wolverine pelts were registered for Newfoundland and Labrador during this period. Some pelts may have originated from outside the province of Quebec but were traded in Quebec.
[2] Note that these harvest records span a time period when wolverines were known to be scarce. Trapping records from the 1800s show larger numbers of pelts being traded.
[3] Système d'information sur les animaux à fourrure, Ministère de l'Environnement et de la Faune du Québec; cited in Canac-Marquis (1995).
[4] Statistiques sure les fourrures, Ministère du Tourisme, de la Chasse et de la Pêche du Québec.

wolverine were banned in 1950 in Newfoundland and Labrador and in 1981 in Quebec (except in the territory referred to in the James Bay and Northern Quebec Agreement). There have been virtually no accidental catches since the late 1970s, through trapping effort, particularly in remote areas, is low.

4.1.3 Home ranges and density

The low natural density of wolverines has been reported numerous times in the scientific literature (Kelsall 1981; Prescott and Richard 1982; Dauphiné 1989; Poole 1991). Dagg and Campbell (1974), citing various authors, mention that the wolverine is capable of surviving at natural densities so low that it is difficult to establish whether there is a resident population. Wolverines are neither seen nor captured in the lowlands of the Kenai Peninsula in Alaska, but a healthy and viable population occupies the adjacent mountainous area (Magoun 1996). Low densities also make it difficult to quantify the relative importance of limiting factors affecting the species (Kelsall 1981).

The home ranges of wolverines are very large, and male wolverines occupy larger home ranges than do females (see review in Banci 1999). According to radiotelemetry studies, the average area covered by males during a year is as follows: 422 km^2 in Montana (Hornocker and Hash 1981), 238 km^2 in the Yukon (Banci 1987), 637 km^2 (Gardner 1985) and 535 km^2 (Whitman et al. 1986) in south-central Alaska, 666 km^2 in Arctic Alaska (Magoun 1985), 1522 km^2 in Idaho (Copeland 1996), and 1005 km^2 (Krebs and Lewis 2000) and 1366 km^2 (Lofroth 2001) in British Columbia. The home ranges of adult and young wolverines can overlap, and there can be overlap between the home ranges of adults of the opposite sex. For example, the home range of a male may overlap occasionally with the home ranges of 2–6 females (Magoun 1985; Banci 1987). However, adults of the same sex tend to have non-overlapping or mutually exclusive home ranges.

4.1.4 Reproductive rate

Most researchers who have studied the wolverine consider it to have a low reproductive rate (Hash 1987). In the Yukon, only half of the females living in a favourable habitat give birth every year (Banci 1987). Magoun (1985) estimates that females produce an average of 0.6 young per year. Low reproductive rate and the mortality of the young contribute to a low rate of recruitment (Hash 1987). For this reason, wolverine populations have difficulty supporting a high level of harvest (van Zyll de Jong 1975).

4.2 Habitat-related factors

4.2.1 Habitat requirements

Wolverines frequent a wide variety of habitats within their range. They are found from the boreal forest to the arctic tundra (Wilson 1982). In Europe, the general habitat is the forest and the tundra. In North America, the species is thought to be more closely associated with climax-stage coniferous forests and subclimax stands throughout this biome (Shelford and Olson 1935). In Alaska, the Yukon, and the Northwest Territories, some populations live beyond the tree line year-round (Hatler 1989).

The species lives in vast tracts of undisturbed wilderness, far from human presence (Hatler 1989; Banci 1994). Kelsall (1981) maintains that the species is a habitat generalist. The use that wolverines make of specific areas seems related more to the presence of food than to the biophysical characteristics of the habitat (Hatler 1989). However, studies in British Columbia suggest that the presence of adequate parturition habitats is a determining factor for the presence of this species (Lofroth 2001) and illustrate the importance of protected areas in the choice of parturition sites (Krebs and Lewis 2000).

In North America, wolverines occur in greater densities where the habitat is varied and food is abundant. The mountainous regions of British Columbia and the Yukon, because of habitat diversity, seem to be the most productive environments in Canada for the wolverine (Dauphiné 1989). These are remote areas where large and small mammals abound and where efficient predators are found (Hash 1987).

The areas that are likely to be home to wolverine populations in Quebec and Labrador are the northern regions frequented by the large caribou herds of the George River and the Rivière aux Feuilles. These herds have ranges covering several hundred thousand square kilometres. It was estimated in the early 1990s that the total number of caribou occupying northern Quebec and Labrador approached one million (Couturier et al. 1990). The most recent survey (summer 2001) indicates that the overall numbers have held, despite the drastic decline in the George River herd. The decline in the George River herd was compensated for by the growth in the Rivière aux Feuilles herd, whose numbers have doubled (S. Couturier, pers. commun.). Densities are high, particularly when caribou congregate in calving areas in the spring (Crête et al. 1990). It is likely that predation by wolves and natural mortality generate a sufficient quantity of food (caribou carcasses) for wolverines, although no study has tested this hypothesis. Farther south, a few coniferous forest zones with a high moose (*Alces alces*) density could also support wolverine populations.

4.2.2 Impact of human activities on habitat

Human activities that likely affect wolverine populations in British Columbia include logging and forestry operations, mining developments, and activities that may significantly alter the winter habitat of ungulates (Hatler 1989). The presence of humans in remote areas may be disruptive to female wolverines with their young, mainly due to the use of motorized vehicles to chase the animals (Banci 1994).

Given that hunting and trapping of wolverines are prohibited activities in Newfoundland and Labrador and Quebec (with the exception of the harvesting right granted to beneficiaries of the James Bay and Northern Quebec Agreement), and given the large home ranges of wolverines, it is likely that only human activities that modify habitat on a large scale might affect wolverines in Quebec and Labrador. These activities include large-scale logging in the southern portion of the presumed range, which opens the territory and makes it accessible to humans, as well as hydroelectric development and mining projects. Disturbances and harassment by humans (all-terrain vehicles, snowmobiles) are threats that need to be considered, and natural disasters such as fires, which seriously disturb the environment, may be detrimental to wolverine populations.

4.3 Species' role in the ecosystem and interactions with humans

4.3.1 Ecological niche and interspecific competition

Van Zyll de Jong (1975) summarizes the wolverine's role in the ecosystem, maintaining that the wolverine may be considered a seasonal scavenger at the top of the food chain. This species' ecological niche explains its rarity within the animal community, compared with other carnivores such as the wolf and the lynx (*Lynx canadensis*), which are efficient hunters. A direct relationship is thought to exist between the biomass of large herbivores, the turnover of large herbivore populations, and the abundance and distribution of wolverines. Moreover, even under optimal habitat conditions, wolverine densities are so low that the species' presence likely has very little impact on other species (Banci 1994).

In summer, the wolverine is essentially an opportunistic feeder, eating food according to its availability. In winter, the wolverine is primarily a scavenger, devouring, among other things, animals killed and left by other carnivores, animals caught by trappers, and animals that died of natural causes.

The wolverine eats small mammals (squirrels, groundhogs, hares, mice, voles, lemmings, porcupines), beached marine mammals, birds, and fish (Rausch and Pearson 1972; Magoun 1985; Whitman et al. 1986; Banci 1987; Hash 1987; Yukon Renewable Resources 1988) and is capable of dislodging small, burrowing mammals. A diet consisting solely of small mammals would not allow the wolverine to maintain successful reproduction (Banci 1994). Nevertheless, the arctic ground squirrel (*Spermophilus parryii*) and the hoary marmot (*Marmota caligata*) could be essential food resources for the successful raising of young wolverines in northwestern Alaska and British Columbia, respectively (Magoun and Copeland 1998; Krebs and Lewis 2000; Lofroth 2001). Over most of the wolverine's North American range, ungulates represent the mainstay of its diet (Banci 1994), and the availability of carcasses throughout the year is essential for survival.

In regions frequented by caribou, a particular dynamic may emerge between the predator (wolf), the prey (caribou), and the scavenger (wolverine). The wolverine obtains its food from carcasses or remains left by the predator; to some extent, then, the wolverine is dependent on the presence of wolves and other predators for most of its food (Banci 1994). However, this is not the case in northwestern Alaska, where numerous caribou die of natural causes during migration, thereby providing abundant food for wolverines over a long period (Magoun 1985). Also, the wolverine is reported to have killed seven caribou in British Columbia (Lofroth 2001) and is considered capable of killing semi-domesticated reindeer in Scandinavia (J. Persson, pers. commun.). The wolf may also become a major predator of the wolverine, to such an extent that female wolverines avoid places where wolves are abundant, especially during the parturition and rearing periods (Magoun and Copeland 1998).

4.3.2 Sociopolitical factors

The wolverine has a reputation for being fierce and aggressive, although its general behaviour is similar to that of other mustelids (Hash 1987). Some of the wolverine's behaviours have not endeared it to inhabitants of northern regions (Kelsall 1981). It has the reputation of being a thief and a trap plunderer. It may destroy traplines by stealing the bait and the captured animals. There have been reports of wolverines stealing from and soiling food caches and occasionally ransacking campsites (MLCP 1989). By claiming that the wolverine was overabundant in the province, Henri de Puyjalon (1900) led us to believe that the species was considered undesirable.

The wolverine's legendary or mythical value makes it of interest to the general public (Savard 1971). The species holds an important place in popular imagery in Quebec and Labrador, as reflected by its many nicknames: "devil bear," "skunk-bear," and "devil beast."

It is widely believed that the structure of the wolverine's pelt prevents frost from adhering to it. In reality, frost can adhere to the guard hairs. What is unusual is that this frost can be swept away easily, and frost accumulation on the underfur is prevented (Quick 1952). This feature makes the fur appealing for use in making clothing, and wolverine pelts are used by some Aboriginal people to make coats (Patenaude 1989; Banci 1994).

The average price of a wolverine pelt on the Canadian market was about $190 in the early 1980s, $225 in 1985, and $215 in 1998–99 (Statistics Canada 2000). Despite variable economic conditions during this period, it is a pelt that has maintained its value.

5. Recovery Potential

When it comes to the status of the wolverine in Quebec and Newfoundland and Labrador, there are several possible scenarios: a nearly extinct population with small numbers of immigrants from Ontario, remnant localized populations at densities too low to be viable, or local populations with sufficient to permit repopulation.

In the absence of systematic surveys on the wolverine in Quebec and Labrador, we can only speculate about the factors that constrain the species' expansion. The relative paucity of sightings in eastern Canada suggests that wolverines are rare here, and that the first scenario is most plausible.

Factors that prevent the species' expansion are not well understood. It is possible that densities in Quebec and Labrador are too low for the population to be able to increase in size. The likelihood of males and females encountering one another during the mating season is quite low. Also, accidental captures in traps may prevent the species' expansion. Wolverines, juveniles in particular, are vulnerable to trapping when carcasses are used as bait and when traps are not species selective. In Quebec, wolverines could be captured in killing traps (Conibear type), leg-hold traps, or snares meant for other animals, such as beaver (*Castor canadensis*), wolf, or lynx. However, trapping pressure is mainly felt in southern Quebec, where the wolverine is found only in very small numbers because of the intensity of human activities. Trapping pressure is low north of the 50th parallel and in beaver reserves where Aboriginal trappers are active. This situation reduces the likelihood of wolverines being captured accidentally. In Labrador, accidental captures of wolverines may occur in traps intended for the wolf or the lynx.

Trapping efforts for both species are limited, however, as close to 80% of traps in Labrador are intended for the American marten (*Martes americana*) rather than for wolf or lynx. In the northern regions of the Northwest Territories and in the Yukon, wolverines are often chased using a snowmobile, a technique that makes the animals susceptible to being killed (Kelsall 1981). Other, unrecognized ecological factors may also constrain wolverine recovery.

5.1 Habitat availability and quality

In Quebec and Labrador, the wolverine is likely to be found in three biomes: arctic tundra, forested tundra, and boreal forests.

The arctic tundra extends north of the 58th parallel to the northern tip of the Quebec–Labrador peninsula. It is characterized by the absence of trees and by heaths covered with lichen, mosses, standing or creeping shrubs, and bare soil and rock outcrops (Crête et al. 1990). Boulders may provide important shelter for wolverines in the tundra environment (Gardner 1985).

The forested tundra, located roughly between the 55th and 58th parallels, differs from the arctic tundra by the presence of trees that are scattered or distributed in forested clusters with openings. Dominant species include tamarack (*Larix laricina*) and black spruce (*Picea mariana*). Lichens cover the ground in clearings. Forested tundra is defined as the longitudinal (or altitudinal in mountainous areas) stretch that is situated north of the boreal forest and south of the tree line, which constitutes the northern limit (Payette 1983). The forested tundra is divided into the forested subzone in the south and arborescent subzone in the north (Payette 1983). The presence of stunted trees is a key identification criterion for this biome (Payette 1983).

Farther south, the wolverine may also inhabit the boreal forest. The northern part of the boreal forest landscape is dominated by coniferous stands such as fir stands associated with black spruce and black spruce-moss. Lichens are abundant in stands of spruce and jack pine (*Pinus banksiana*). The southern part of the boreal forest is composed of mixed zones made up of fir forests with stands of white (*Betula papyrifera*) or yellow birch (*B. alleghaniensis*) and stands of yellow birch and fir.

To date, the northern part of the boreal forest, the forested tundra, and the arctic tundra have undergone very few human-induced changes in Quebec and Labrador, and natural processes remain intact. Fire is the predominant factor that periodically disrupts the environment: the periodicity of fires is about 100 years north of the boreal forest and increases northward to several thousands of years in the tundra (Payette et al. 1989). More locally, the George River caribou herd has substantially affected the tundra in the eastern part of the Quebec–Labrador peninsula over tens of thousands of square kilometres, through excessive grazing on calving grounds and on the summer range (Morneau 1994; Manseau et al. 1996).

In mid-northern Quebec, the landscape has been altered significantly in the Rivière LaGrande basin. A large area (10 600 km^2) was flooded in 1978 to create five hydroelectric reservoirs (MLCP 1993). In 1971, the Churchill Falls hydroelectric project led to the flooding of 5600 km^2 in central Labrador. In 1988 and 1989, fire destroyed 23 000 km^2 of forest in Quebec (Couturier and St-Martin 1990).

South of the 52nd parallel, which is considered the northern limit of the mature forest in Quebec and Labrador, logging replaces natural disturbances as the main factor for forest turnover. In the boreal forest, some species that benefit from disturbed environments are favoured by fires and logging operations. Moose and black bear will take advantage of fires, in contrast with other species such as caribou, which prefer older forests (Crête et al. 1995). The large cervids on which wolverines likely depend in winter are liable to be found anywhere during the entire time sequence following a fire or logging in the boreal forest. Moose are generally more abundant than caribou. Tracts of unaffected forest can also be found in this forest mosaic. The presence of pristine territories far from human settlements appears favourable for the wolverine, which does not depend on any particular forest cover (Hatler 1989; Krebs and Lewis 2000).

5.2 Food sources

5.2.1 Status of caribou

During its annual migrations, the George River caribou herd is found in the Quebec–Labrador peninsula, between the 53rd and 59th parallels (Couturier et al. 1990). In 1987, this herd occupied a territory of 675 000 km^2 in the boreal forest, the forested tundra, and the arctic tundra (Vandal et al. 1989). In 1993, the herd consisted of approximately 800 000 caribou. Preliminary results of a July 2001 survey indicate that this herd has been reduced to 440 000 animals (S. Couturier, pers. commun.). Despite the scope of the migratory movements of this herd, certain areas used on a seasonal basis may be limited. The calving grounds are on the plateaus along the George River (Figure 2). In winter, this herd is found in the transition zone between the forested tundra and the boreal forest, as well as on the Labrador coast, where densities can exceed 1 individual/km^2. On the calving grounds, densities may reach 20–30 females/km^2.

The Rivière aux Feuilles herd is found in the northwestern zone of Quebec between the 53rd and 61st parallels (Figure 2). The number of caribou was estimated at about 260 000 in 1991 (S. Couturier, pers. commun.). The herd seemed to be growing at the time, and the individuals were in excellent physical condition (Crête et al. 1993). During July 2001, caribou numbers were estimated at some 550 000 individuals (S. Couturier, pers. commun.). Between 1991 and 1993, the herd wintered on a territory approximately 100 km wide along the northeastern coast of Hudson Bay, restricted to the south by Payne Lake and to the north by the Povungnituk Mountains (S. Couturier, pers. commun.).

The annual range of the Torngat Mountains caribou herd is confined to an area north of the Ford River (Quebec) and occupies most of the peninsula between Ungava Bay and the Labrador Sea north of Nain (Schaefer and Luttich 1998).

Woodland caribou are also present in small densities (0.01–0.03 individuals/ km^2) in mid-northern Quebec and Labrador — namely, between the 50th and 55th parallels (Newfoundland–Labrador Wildlife Division, unpubl. data; Crête et al. 1990). The total population is estimated to be between 6000 and 18 000 individuals (Ferguson and Gauthier 1992). These small populations are thought to be sedentary.

There are only a few hundred caribou south of the 49th parallel (Crête et al. 1990). On the north shore of the St. Lawrence River, two populations are well known and identified: that of the parc des Grands Jardins and that of the Val-d'Or region. Other small isolated groups exist, in particular north of La Sarre in Abitibi and in the Saguenay–Lac-Saint-Jean area. The annual natural mortality rate is about 10%, which represents roughly 100 000 animals. These deaths can generate an abundance of carcasses for the wolverine.

5.2.2 Status of moose

The moose's range covers all of Quebec and Labrador, up to the tree line. Moose numbers seem to be increasing almost everywhere below the tree line in Labrador. Recent data show that since the implementation of the provincial moose management plan in 1994, the moose population has generally grown in Quebec. Prior to the 1998 hunting season, there were an estimated 86 000 moose (Lamontagne and Lefort 2004).

Densities north of the 55th parallel are very low, and surveys have not been conducted (S. Couturier, pers. commun.). South of the 53rd parallel, moose densities generally decrease eastward (Figure 3). However, they increase south of the 48th parallel, where the highest densities in Quebec (more than 0.37 moose/km^2) are found (Lamontagne and Lefort 2004). These populations are thought to be growing slightly. On the territory between the 50th and 55th parallels and extending from James Bay to Mistassini Lake, the average density is 0.04 moose/km^2. The density of moose in the extreme southern and eastern regions of Labrador, below the 54th parallel (Figure 3), is about 0.01 individuals/km^2. However, densities increase, ranging from 0.04 to 0.16 moose/km^2 in the western part of Labrador and upstream from Melville Lake. The highest densities are found in the valleys of the major rivers of the forested areas (Newfoundland–Labrador Wildlife Division, unpubl. data).

Figure 2
Distribution of main caribou (*Rangifer tarandus*) populations in Quebec and Labrador

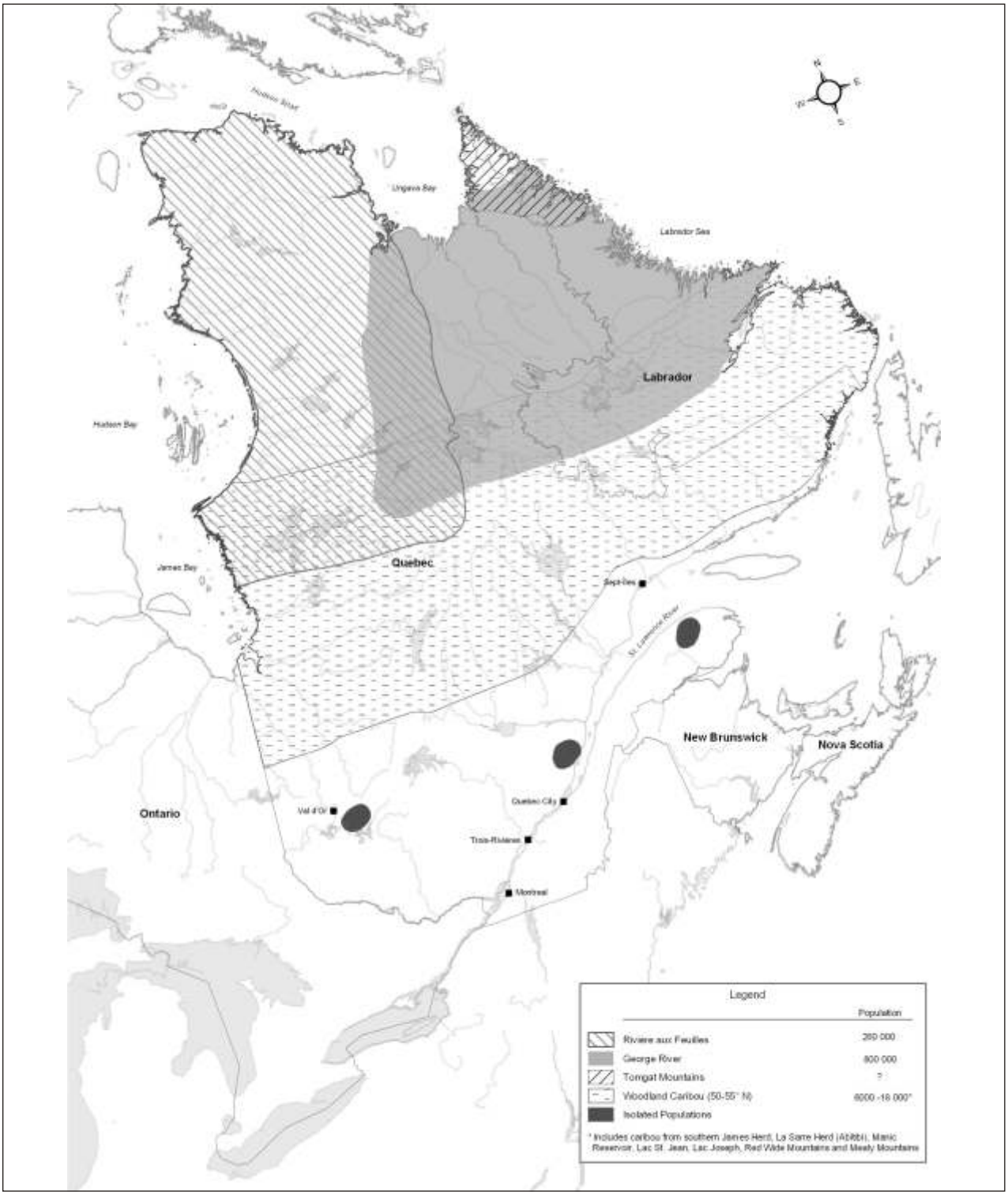
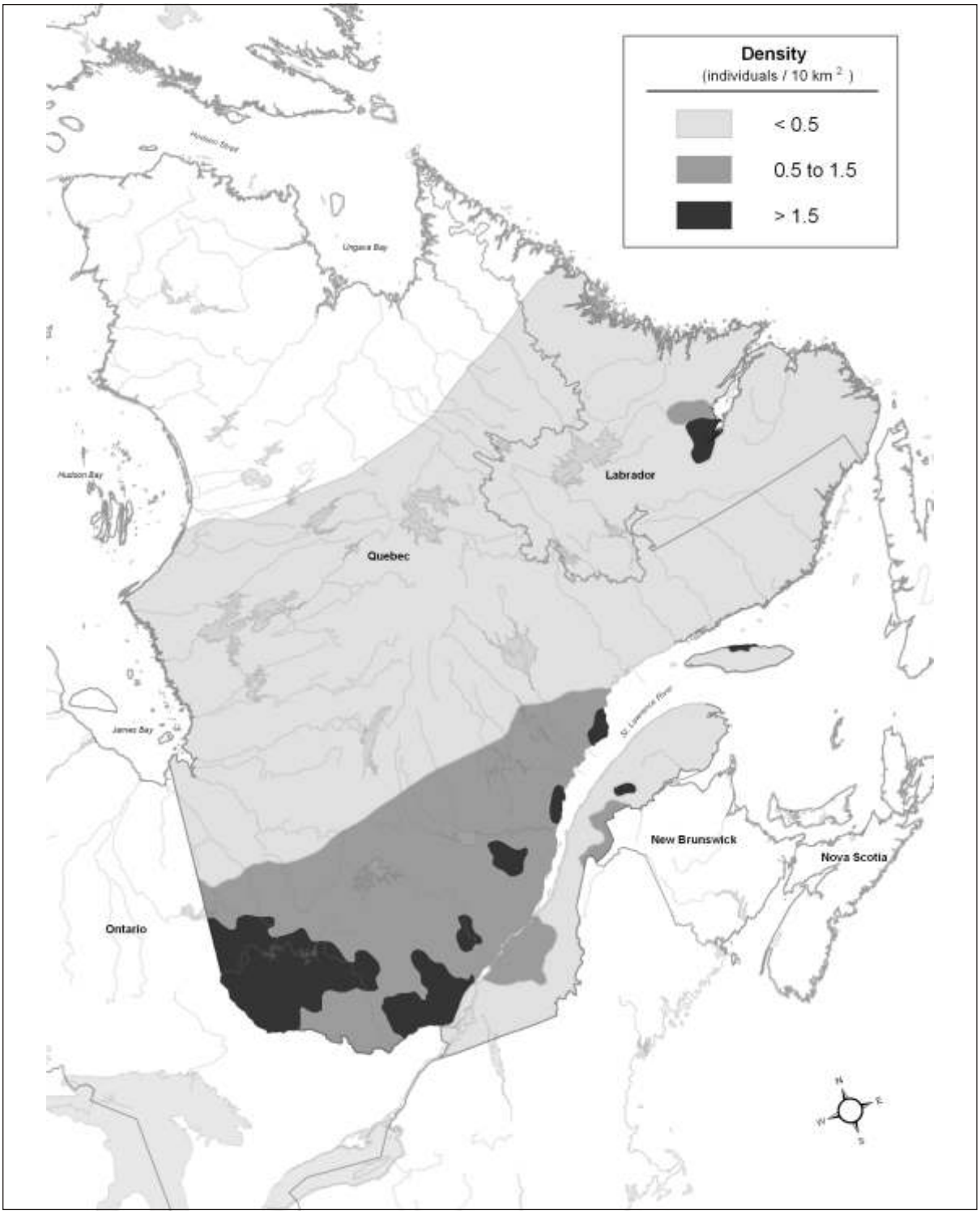


Figure 3
Distribution and density of moose (*Alces alces*) in Quebec and Labrador



5.2.3 Other food sources for wolverines

The wolverine is primarily a scavenger, but it is capable of killing prey on its own. There are about 18 species of rodents, 2 species of lagomorphs, and 8 species of insectivores in the wolverine's range in Quebec and Labrador. Hares, beavers, porcupines, marmots, squirrels, lemmings, and mice may be food sources for the wolverine, although their relative abundance and importance in the wolverine's diet are not well understood.

5.3 Biological factors influencing recovery

5.3.1 Reproductive potential

The wolverine's reproductive potential is considered rather low (Hatler 1989). Females are thought to be sexually mature at 12 or 15 months of age. However, in the Yukon, Banci and Harestad (1988) found that only 7.4% of females had their first litter at this age, compared with 53.3% at the age of 2 years. In this same study, the average number of fetuses per adult female ranged from 2.8 to 3.4. Litter size in nature is less than 3 (J. Persson, pers. commun.). Most of the telemetry studies carried out in Scandinavia on wild wolverine indicate that females have their first litter at 3 years of age or older (J. Persson, pers. commun.). For six females monitored over a 5-year period, Magoun (1985) observed a reproductive rate of 0.69 viable young per female per year. This variable reached 0.89 for four females monitored in Idaho (Copeland 1996). In the Yukon, the proportion of gestating females or females having given birth to young for a given year was 74%, which is less than the 88% found in British Columbia (Banci 1994).

In the Yukon, 92% of females aged 2 and 53% of females aged 6 were gestating, compared with only 37% of females older than 6 years of age (Banci 1994). Female productivity, as measured by the corpus luteum count in the ovaries, increases with age, reaching a maximum between the ages of 6 and 11 years (Banci and Harestad 1988). Hence, older females are able to produce a greater number of young per litter, but a smaller proportion of these females reproduce, compared with younger females (Banci 1994).

Juvenile mortality and limited reproductive success are thought to contribute to the wolverine' s rather low recruitment rate (Hash 1987). No more than four young are born alive per litter (Hatler 1989), and usually less than three young leave the den (Banci 1994). In Alaska, Magoun (1985) estimated that the average number of young per litter was 1.75 at the age of 12 weeks.

It seems that the good physical condition of females prior to the implantation of the embryo represents a key factor for reproductive success. Telemetry studies revealed that births did not necessarily occur every year, but could be one or more years apart (Magoun 1985; Copeland 1996).

The reproductive potential of the wolverine may be similar to that of the fisher, a mustelid that is relatively abundant in Quebec and whose size comes close to that of the wolverine. Male and female fishers usually reach sexual maturity at the age of 1 year, but, like the wolverine, female fishers generally have their first litter at age 2. In captivity, the average number of liveborn young per litter is approximately 2–3 (Y. Garant, pers. commun.). The theoretical annual growth potential of a fisher population is of the order of 2 — namely, the number of fishers could double annually (Y. Garant, pers. commun.). Although these two species are different, these values provide an idea of the wolverine's reproductive potential.

5.3.2 Mortality factors

The following sources of mortality were documented during a study using radio transmitters: 48% of deaths were due to hunting and trapping, 13% were due to famine, 12% were due to predation, and 24% were due to miscellaneous or unknown causes (see review in Banci 1999).

In Quebec and in Newfoundland and Labrador, where hunting and trapping of wolverines are prohibited, starvation, particularly linked to the seasonal availability of food, may represent the main mortality factor (Magoun 1985). Although caribou and moose may serve as a food resource in the territory being studied, this resource may be scarce

at certain times due to the extent of the migrations of the main caribou herds. Moreover, non-migratory populations are found only at very low densities. The moose is a non-migratory species that is available year-round, but densities remain relatively low.

5.3.3 Densities

Wolverine populations are composed of resident individuals with an established home range and transient individuals in search of a territory (Hatler 1989). Even under optimal habitat conditions, densities are low compared with those of other carnivores of similar size (van Zyll de Jong 1975). Densities may fluctuate considerably, not only between regions but also from one year to the next (Hatler 1989).

Several studies have made it possible to estimate the natural densities of the wolverine in various regions of North America:

6.0/1000 km^2	northern British Columbia (Krebs and Lewis 2000)
1.2–2.4/1000 km^2	north-central Yukon (Banci 1987)
1.5–27.0/1000 km^2	south-central Yukon (Banci 1987)
5.6/1000 km^2	southwestern Yukon (Banci 1987)
7.2–20.8/1000 km^2	northwestern Alaska (Magoun 1985)
4.8/1000 km^2	northeastern British Columbia (Quick 1953)

A more exhaustive list of publications on natural densities of the wolverine is provided by Banci (1999).

Population density cannot be estimated for the wolverines of Quebec and Labrador, as it is probably below the detectable threshold and below the minimal densities observed in North America.

5.3.4 Captive-rearing and reintroduction potential

Several countries have experimented with and succeeded in rearing wolverines in captivity. Many facilities that have succeeded in this regard have not described the methods used, so others are unable to benefit from their experience. At least 24 zoos worldwide have wolverines in captivity, representing a total of 66 animals (Grov 2000). Some of the challenges of keeping wolverines in captivity include their need for large enclosures and their intolerance of warm temperatures (Patenaude 1989). However, the wolverine is able to reproduce in captivity (Patenaude 1989), and births in captivity are not uncommon. There have been a few successful cases in nine zoos in North America and Europe, particularly in Helsinki, Finland, and at Skuane Djurpark in Sweden, where young were born and reared by their mothers in captivity without complication. In contrast, at the Pedersen breeding facilities in Washington State, where there are more than 30 individuals, mating rarely produces a litter (D. Pedersen, pers. commun.).

In some situations in might be helpful to acquire gestating females from the wild whose offspring would be born in captivity. A gestating female that was caught gave birth to three young, although there are several cases where the females miscarried or killed their offspring (A. Magoun, pers. commun.).

If necessary, wolverines could be obtained from the Yukon, British Columbia, and the Northwest Territories for captive breeding in the east. Quebec's Centre de Conservation de la Biodiversité Boréale has a captive breeding program in place through the Saint-Félicien Zoo. They have a pair of wolverines from the Yukon that has adapted well to the conditions in Quebec. In 2001, a litter produced three young, although only one individual is still alive. Since 2001, six young have been produced from the same female. Working with these animals has resulted in improved techniques for lowering the mortality rate.

Although captive breeding requires considerable cost and effort to implement, it could be a useful recovery tool if a reintroduction program is needed and sufficient numbers of wild-caught wolverines cannot be obtained. Animals obtained by captive breeding would need to be conditioned prior to release to facilitate their success in the wild.

The reintroduction of the wolverine has never been attempted, and the methodology remains to be developed. However, reintroductions of other endangered species are under way in Canada, and mustelids such as the American marten and the fisher have been successfully reintroduced in areas. These recovery projects suggest that augmentation of existing populations, or a reintroduction of wolverines via translocation of animals from western populations, may be an important recovery tool.

5.4 Recovery Team's opinion on the possibility of the wolverine's recovery

This Recovery Team believes that the recovery of the Eastern population of the wolverine is feasible. The team members are of the opinion that human intervention will be required to re-establish the wolverine in Québec and Labrador. Despite the substantial growth of caribou herds in northern areas over the last 30 years, the wolverine population does not seem to have increased. It also seems that the habitat, in the form of large undisturbed expanses, is available in sufficient quantity for wolverine but the factors preventing the expansion of the species remain unknown. Further, sufficient year-round prey from 2 large migratory caribou herds and a resident herd in the Torngat Mountains, and Ptarmigan, Arctic hare and small mammals is also available. There have been relatively few sightings and no captures since the late 1970s (Moisan 1994). Any reintroduction program would be part of a broader, multifaceted strategy that would include clarifying population status and distribution, a stewardship and education program working with aboriginal groups, and an evaluation of habitat quality and availability in Quebec and Labrador, including potential threats and limiting factors, and the development of appropriate monitoring techniques to evaluate the success of any recovery actions.

Programs to reintroduce other endangered species are underway in Canada and have generated a great deal of public interest. There have been successful reintroductions of other mustelids in North America. In the case of the American marten, examples of successful reintroductions (self-sustaining populations) are numerous, including the Black Hills region of South Dakota (1980–93), Cypress Hills Provincial Park in Saskatchewan (1986–87), Takhini River in the Yukon (1985–86), Haines Junction in the Yukon (1984–85) (Slough 1994), and a few regions in Newfoundland and Labrador. The fisher has also been reintroduced in natural environments many times (16 cases between 1955 and 1981). It seems that the procedure can be successful when carried out under favourable conditions, such as adequate habitat and no harvesting (Proulx et al. 1994).

Despite the potential risks, this Recovery Team considers that it is possible to recover the wolverine in Quebec and Labrador. At the very least, the implementation of the Recovery Plan should make it possible to avoid the extirpation of the wolverine from eastern Canada as a first step to recovery.

6. Recovery Plan

6.1 Goal and objectives

This Recovery Plan aims to establish a self-sustaining wolverine population in Quebec and Labrador. By self-sustaining population, we mean a viable population capable of sustaining itself without human intervention.

To achieve this goal, we propose the following objectives:

Reach a population of 100 adult wolverines: The proposed population objective must take into account the past status of the species in Quebec and Labrador. Historical data (see Table 1) suggest that the number of wolverines has always been low. The current objective is based on the lowest density observed in western North America, which is roughly 1 wolverine/800 km^2 (Banci 1994). It is reasonable to believe that there could be two individuals on average (one male and one female) per 1000 km^2 of territory.

Situations observed elsewhere in Canada support the objective of 100 individuals. The maximum number of wolverines found on Vancouver Island is 100 (Banci 1994); in northwestern Ontario and in Manitoba, where habitats are similar to those in Quebec and Labrador, populations have been estimated at 70–100 and 500 individuals, respectively (M. Novak, pers. commun., cited in Dauphiné 1989).

Maintain this population for 10 years: The wolverine population will be considered recovered in Quebec and Newfoundland and Labrador only if it reaches a minimum of 100 adults and remains stable or increases over a 10-year period. This interval is considered sufficient to allow natural reproduction to take over for the artificial introduction of animals. This period represents a minimum window in which to observe fluctuations in population demographics, to identify general trends, and to determine whether the population seems capable of remaining above a critical threshold. It also corresponds to the wolverine's life expectancy, which is about 8–10 years in the wild.

Prevent wolverine losses attributable to human activities: The Recovery Plan provides for the implementation of measures to prevent the loss of individuals during and after the critical reintroduction period when numbers are still low and survival is precarious. Recovery measures will have to take into account the probability of animal losses attributable to human activities, in particular accidental trapping and illegal hunting. The impacts of environmental changes also need to be documented.

Ensure that sufficient habitat is available to meet the population objective: Successful reintroduction of wolverines will depend largely on the presence of high-quality habitats. These are large areas that are isolated and mostly undisturbed and contain abundant food resources. To ensure that quality habitats are available in sufficient quantity, the Recovery Team will have to underscore the species' habitat requirements with the Ministère des Ressources naturelles, de la faune et des parcs du Québec, which is responsible for the land allocation plan in Quebec.

6.2 Intervention strategy

The overall strategy consists of documenting, planning, and implementing actions leading to a viable wolverine population.

The strategy requires:

- acquiring the necessary knowledge through scientific studies (see 7.1);
- implementing a communication plan and a public education program (see 7.2);
- implementing a release program involving animals taken from the wild (see 7.3);
- developing and implementing population management and monitoring methods (see 7.4);
- implementing habitat protection measures (see 7.5);
- periodically assessing and updating the Recovery Plan's objectives (see 7.6); and
- protecting populations and their habitat by drafting and implementing legislation (see 7.7)

These elements of the strategy are described in detail in section 7.

7. Details of the Intervention Strategy

7.1 Acquire the necessary knowledge through scientific studies

7.1.1 Assess the population's status and distribution

The distribution, relative abundance, and status of the wolverine population must be assessed periodically as new information becomes available. For example, consideration will be given to reported sightings and transactions in the fur trade, as well as any other sources of information.

7.1.1.1 Continue acquiring data on reported sightings

Sighting reports are the most basic and affordable tool to collect information on the distribution and relative abundance of wolverines in Quebec and Labrador. The gathering of information on sightings will continue. The flow of information concerning wolverine sightings is established in such a way as to ensure that all information can be compiled for the entire area. The Recovery Team has put in place a structure to collect and process information on this subject. Persons who are likely to receive sighting data (e.g., scientists, land managers, wildlife officers) are advised of the implementation of this data collection system and of their role in making it work. Information will be shared among Recovery Team members and other concerned managers in both jurisdictions. Any other indication of wolverine presence will be verified.

A proactive approach to data collection could take place and could involve: 1) surveys among Aboriginal communities, trappers, and wildlife users, as well as technical and scientific staff working in the field; and 2) information campaigns intended for the general public (newspapers, magazines, brochures, posters, etc.).

7.1.1.2 Standardize data collection methods

To ensure that the collected data will be processed uniformly, a "sighting report" form is available. Each occurrence will give rise to a sighting report, and the person who saw the wolverine will be contacted either by telephone or in person. Thereafter, an analysis protocol will be carried out using strict criteria. Records which are "confirmed" or "potential" will be shared between jurisdictions and kept in their respective data management systems. To date, there are nine sightings that are either "confirmed" or "potential." Each province will be responsible for producing and distributing the forms to the individuals responsible for compiling sighting data. These tasks will be performed when the Recovery Plan is implemented in order to take full advantage of the accumulation of sightings over time.

7.1.2 Determine the wolverine's habitat and food resource needs

According to several authors, the wolverine's habitat is defined more in terms of food resources within vast wilderness areas than in terms of the biophysical characteristics of the habitat. However, the wolverine needs cover to escape from predators. As the young are born in winter, an adequate parturition habitat is also necessary to ensure the protection of young wolverines against inclement weather conditions and predators (Magoun and Copeland 1998).

7.1.2.1 Stay up to date with the scientific literature on wolverines inhabiting biomes similar to those of Quebec–Labrador

Scientific literature will be monitored in order to gather any new information allowing the Recovery Team to identify the wolverine's habitat needs and to estimate the carrying capacity of the areas where wolverines will be reintroduced.

7.1.2.2 Develop a method to assess the quality of the habitat for the wolverine in Quebec and Labrador

This will enable us to bring together some of the elements required to prepare a map of habitat quality. Using current knowledge, links will be established between wolverine densities, habitat, and availability and diversity of food resources. Biophysical data on the environment (e.g., climate and geomorphology) will also be gathered. These theoretical studies will be carried out with data from western North America. We will also check the information available on the wolverine among the Aboriginal people of northern Quebec and Newfoundland and Labrador. Interviews will be carried out with residents to collect data on wolverine ecology (historical and current sites used, food sources, preferred habitats, limiting factors). We will combine this action with information sessions intended for northern populations. This operation will be carried out at the start of the Recovery Plan and will assist in the mapping of potential wolverine habitats.

7.1.2.3 Produce a map on the quality of the habitat in Quebec and Newfoundland and Labrador

It is essential to identify areas most likely to be home to wolverines at the present time and to be able to select the best habitats for the species (e.g., for reintroducing animals). Available information on the spatial and temporal distribution and density of ungulates (caribou and moose), wolves, and small mammals, as well as on the location and use of the territory by human populations, snow accumulation, and topography, will be compiled.

We will produce a series of maps summarizing the following information: total ungulate biomass, small mammal diversity, wolf distribution, and location and use of the territory by human populations. Subsequently, a map incorporating all of these data will be produced. Regions of Quebec and Labrador will be ranked based on their carrying capacity for wolverine.

7.1.3 Identify the information required to assess numbers and the recruitment rate needed to achieve the objective

7.1.3.1 Confirm the population objective

The population objective was established using the best knowledge available to the Recovery Team. Ideally, this objective should be confirmed. The use of theoretical models does not seem promising, as the required parameters, such as birth rate, survival rate, and rate of increase of wolverine populations in eastern Canada, are not known. However, data from other populations could be used.

The issue of the minimum viable size of large carnivore populations is currently the focus of scientific research, particularly for wolf populations in the United States. Because the wolverine is a scavenger, it is part of a specific niche. Like other large carnivores such as canids, the natural densities of the wolverine will remain low. Our recovery objective will be evaluated as new information becomes available on the minimum viable population requirements for the wolverine or other similar carnivores.

7.1.3.2 Develop methods to assess population size and trends

Even at the core of the wolverine's range, very low densities prevail: 1–20 individuals per 1000 km^2 (Banci 1994). From a statistical standpoint, the lower the densities, the higher the inaccuracies when estimating numbers. Several large carnivores share this characteristic because of their position at the top of the food chain. Regardless of the assessment technique, significant effort will always be required to determine wolverine numbers.

No population estimation method seems to have been universally adopted for wolverine management. However, a promising technique consists of estimating numbers based on snow track counts along parallel transects by plane or helicopter. This method was developed in Alaska for surveying wolverine and lynx (Becker 1991) and has been used successfully on land for the fisher in Quebec (Garant and Crête 1997). A survey of this type was done in Ontario in 2001. The use of this technique allowed the development of a coarse evaluation tool for reproduction in low density populations of wolverine (Magoun, et al., 2003). However, it is expensive, especially since its level of accuracy has not been established for the wolverine (A. Magoun, pers. commun.). A similar survey could eventually be undertaken to confirm the presence of wolverine where they are reported or where there are clues that suggest their presence.

7.1.4 Keep knowledge of wolverine ecology up to date

New information on the wolverine and its ecology will continue to be published. This information will circulate among Recovery Team members, who, with the help of a member assigned for this purpose, will have to keep their knowledge on the species up to date throughout the recovery activities. Contacts will also be established with the managers of other Canadian jurisdictions. The new data will make it possible to reevaluate the knowledge already acquired and to adjust, where necessary, the actions undertaken or to be taken. Results from studies on captive animals will also be considered. This represents an interesting potential for information that would be difficult to obtain in the wild.

7.2 Implement a communication plan and a public education program

7.2.1 Enlist the support of all stakeholders for recovery measures

7.2.1.1 Promote awareness

To gain support for recovery efforts and cooperation, it will be necessary to raise awareness among resource users, Aboriginal people, and local government agencies with respect to Recovery Plan objectives and planned recovery actions.

7.2.1.2 Develop and implement a communication plan

The general public needs to be informed of the planned recovery measures and actions in order to obtain public support and cooperation. The communication plans must stress the animal's positive aspects: ecological, cultural, and economic value. As efforts to relocate wolverines most likely will occur in northern areas, significant portions of the communication plans must be devoted to the residents, especially the various Aboriginal nations in these regions.

The communication plan will be implemented when the Recovery Plan has been approved by the authorities and will continue for the duration of the recovery activities. The communication plan will include the following actions:

- developing educational material and information;
- regularly publishing papers and/or press releases concerning the recovery activities;
- organizing information and education sessions, especially with local communities;
- informing resource managers of the implementation of this Recovery Plan;
- disseminating information on the Recovery Plan and the progress of work on the Web site of the Société de la faune et des parcs du Québec and on the Web site of The Wolverine Foundation and other appropriate public venues.

7.2.1.3 Establish partnerships with departments and agencies involved in public information and education activities

The implementation of the Recovery Plan will require collaboration with agencies to promote public awareness about the wolverine's status and recovery and to convey a positive educational message. Organizations such as Parks Canada Agency, Parcs Québec, and nature interpretation centres (or public and private organizations that engage in nature interpretation activities) could be called upon to distribute relevant information within the framework of their environmental education activities. The help of Quebec's Saint-Félicien Zoo and the Salmonier Nature Park in Newfoundland and Labrador could be enlisted when developing an educational program specific to the wolverine. These facilities could become key centres for distributing information on the species, and public interest in the wolverine could be stimulated through the presence of live animals.

7.2.1.4 Enlist support and cooperation

The support and cooperation of land users, non-governmental organizations, conservation agencies, community organizations, Aboriginal communities and organizations, trappers, local governments, and all other authorities concerned with the survival of the species are integral to the success of the Recovery Plan.

Groups involved in and responsible for wildlife management and land use management will have to be aware of the impacts of wolverine recovery and understand the merits of the program. The Recovery Team will identify all national and local agencies likely to be interested and will inform them of the Recovery Plan. An advisory group will be created to bring together and inform supporters and the main local stakeholders and to monitor the application of the Recovery Plan. These tasks should be undertaken prior to the implementation of the actions advocated under the Recovery Plan.

7.2.1.5 Involve Aboriginal people as partners

Historical sightings and the ecological characteristics of the wolverine suggest that northern Quebec and Labrador should be examined on a priority basis for the species' recovery. The use of the territory in northern Quebec is subject to an agreement between the Government of Quebec, the Government of Canada, and the resident Aboriginal communities. Moreover, the northern and central parts of Labrador are subject to land claims negotiations between the province of Newfoundland and Labrador, the federal government, and Aboriginal groups.

The Recovery Plan will have to be submitted to the Hunting, Fishing and Trapping Coordinating Committee prior to its implementation in Quebec. Tallymen and trappers will be informed, through their respective associations (e.g., Cree Trappers' Association), of the Recovery Plan, its objectives, and the recovery measures likely to concern them. These organizations and their members will be considered key partners in recovery, and they will be involved in various ways, such as fieldwork, financial and in-kind contributions, and the monitoring of released animals.

7.2.1.6 Identify funding agencies

The implementation of this Recovery Plan will be costly, and the Recovery Team will begin the search for financial support early. Agencies and organizations involved in protecting species at risk or in managing and protecting northern environments will be contacted from the outset.

7.3 Implement a release program involving animals taken from the wild

The wolverine is thought to have become extremely rare over the years. It is possible that any existing localized populations occur at densities too low to be viable, or that there is not sufficient emigration to permit repopulation from nearby Ontario. A systematic survey of the wolverine in Quebec and Labrador could clarify their status and distribution. In the event that the wolverine is incapable of reestablishing itself in Quebec and Labrador, a reintroduction of animals from the western population may be necessary to reach the recovery goal. In this case, wild-caught animals captured in western Canada would be released in Quebec and Labrador at sites selected for this purpose. All necessary efforts will be made to determine the genetic identity of the wolverines from Quebec and Labrador before the reintroduction program is initiated (i.e., before releasing any wild animals captured in western Canada). If needed and depending on availability, some individuals could be obtained from captive breeding. They should match the genetic profile needed for release and not be domesticated.

7.3.1 Acquire essential data on wolverine captures and releases

7.3.1.1 Review literature pertaining to the reintroduction of mustelids

Experimental reintroductions of a number of mustelid species, including the American marten and the fisher, have been successful in several regions of North America. All available information on the subject will be compiled and reviewed to support the wolverine reintroduction efforts outlined in this Recovery Plan.

Improving our knowledge and understanding of the wolverine's behaviour during the reintroduction process will maximize the likelihood of success.

7.3.1.2 Develop and apply wolverine captive breeding techniques

Captive breed wolverines could contribute to the reintroduction. Requirements for captive breeding of wolverines are not well known. Reproductive success is highly variable. Future studies include nutrition, healthcare, optimal rearing conditions, triggers for breeding. To increase our chance of success in this respect we should keep close contact with zoos active in similar programs, seek collaboration or consultation as needed.

7.3.1.3 Determine the genetic identity of the Quebec and Newfoundland and Labrador wolverines

According to recent hypotheses, there is only one species of wolverine in North America. Every effort will be made to obtain tissue samples from wolverines in Quebec and Labrador to determine the genetic identity of this population. We will call on museums, teaching institutions, Aboriginal communities, auction houses, research centres, and any other sources that can help us establish the genetic profile of the wolverines of Quebec and Labrador.

7.3.2 Determine how to obtain wild wolverines

The release of wolverines in the wild will require the procurement of individuals from other provinces or territories. It may be possible to obtain wolverines from western Canada, from regions where they are abundant and where their capture is permitted. The collaboration of government agencies will be required.

7.3.2.1 Identify the source population

The Recovery Team will have to identify the most suitable source populations — that is, the ones most likely to be successfully introduced in Quebec and Newfoundland and Labrador. This aspect can be evaluated by using, among other things, ecological characteristics, such as the similarity of habitats, climate conditions, and food sources. The results of studies dealing with the genetics of wolverine populations in North America could influence the choice of source populations.

7.3.2.2 Establish terms for procuring wolverines with the source jurisdictions

Given that wolverine management is the responsibility of each province or territory, Quebec and Newfoundland and Labrador will have to approach the appropriate government authorities to solicit collaboration for animal procurement. In cooperation with the wildlife management officials of the provinces and territories in question, the terms for the procurement and the transportation of animals from the point of origin to their destination will need to be established for the duration of the reintroduction program.

7.3.3 Develop a release program

Developing a release program for wild individuals is one of the main objectives of this Recovery Plan. As no attempt has been made to reintroduce wolverines into the wild, it is important to carefully plan the operations in order to attain the ultimate objectives of a viable wolverine population in Quebec and Labrador. Achieving this objective depends directly upon the success at the time of the reintroduction. The reintroduction program will include multiple steps, and a specific calendar of achievements will be prepared. It will be important to ensure that released animals are in good health to avoid transmitting diseases and parasites, etc., to local wildlife. A technical document explaining the various steps will be prepared.

7.3.3.1 Review and adapt techniques for releasing mammals, in particular, mustelids

The reintroduction of animals in the wild requires an array of technical operations: transporting, restraints, handling of animals, acclimatizing animals to the new environment, tagging, releasing, monitoring, etc. Several release projects have been done in the past. However, some of the techniques to be used will require an in-depth review and will have to be adapted according to the specific needs of the wolverine and the biogeographical context of Quebec and Labrador. We will pay special attention to devising techniques pertaining to the restraint and transportation of wolverines, as well as to the proper period for and frequency of releases.

7.3.3.2 Identify wolverine release sites

The success of the release operations depends on the selection of appropriate release sites. A map of habitat quality and a literature review will serve as the basis for the selection of suitable sites. Sites will be chosen based on criteria such as the quality of habitats, the diversity and abundance of available food resources, and the extent and nature of disturbances. Logistical considerations, such as accessibility, costs, and ease of monitoring, will also be taken into consideration when developing and applying site selection criteria.

7.3.3.3 Establish release parameters

Reintroductions of wild or captive-bred animals will be carried out in two phases: an experimental phase and a release or operational phase. Releases will take place gradually during both phases in order to acclimatize the individuals. In this procedure, known as a soft release, animals are first kept in a large enclosure for a short time. Once released, wolverines continue to be fed for a time to facilitate their adaptation to the new environment.

7.3.3.3.1 Implement experimental releases

An experimental phase is required, because the reintroduction of wolverines has never been tested, and we do not know how reintroduced animals will react. We estimate that the experimental phase will last between 2 and 3 years.

The experimental releases involving a few individuals (for example, two males and four females) will be done at a site chosen for this purpose. Released wolverines will be monitored carefully to determine survival rate and productivity in the new environment. The best time for releases will be determined.

7.3.3.3.2 Update the release program and techniques

The results of the experimental phase will be used to establish the parameters for the second phase of release operations. A technical report determining the optimal conditions for releases will be prepared prior to the second phase.

7.3.3.4 Implement releases in a natural environment

Release operations will include large-scale releases with the objective of establishing wolverines in selected sites. Initially, a 5-year reintroduction plan will be implemented at each site and will include an annual evaluation and an overall assessment. The number of animals to be released each year will be decided based on such factors as productivity and mortality rates, home range size, carrying capacity of the environment, and the availability of wolverines from source populations.

A sufficient number of wolverines will have to be released at each site for viable populations to become established in the wild. At present, it is not possible to specify the total that will need to be released to reach the objective. Nevertheless, this Recovery Team suggests that two sexually mature adult males and four sexually mature adult females should be released at each site every year for 5 years.

The most important aspect of the releases is to carefully monitor the released animals to evaluate the success of the operations. An ongoing follow-up will help to determine the number of wolverines needed to attain the population objective.

7.4 Develop and implement population management and monitoring methods

7.4.1 Develop a monitoring program for released animals

7.4.1.1 Study the dispersal of released animals and the range occupied

Telemetry is the best way to study wolverine dispersal, and telemetry studies will have to begin as soon as the first animals are released. Once wolverines are released into the wild, we will monitor their movements using satellite or conventional telemetry in order to determine their dispersal patterns and seasonal use of habitats. We will also use the information gained from telemetry studies to identify the most suitable areas for releasing animals. People living in or visiting the area could also help to determine the area that is occupied or the area that is potentially suitable for population expansion, by reporting sightings and conducting surveys of animal tracks.

It is important to determine whether animals establish a home range. The presence of a few individuals of both sexes in the same sector is necessary for reproduction to occur.

7.4.1.2 Monitor release populations

We will conduct number counts to determine the survival rate of released animals and to check demographic trends. An effective census technique will be developed. Possible methods might include: following up on incidental observations, active searches or aerial surveys. Annual population estimates will be provided beginning in the first year of the releases.

7.4.1.3 Determine the survival rate of adults and young and population dynamics

The newly established wolverine population must be self-sustaining and able to grow. It is important to evaluate progress towards the long-term objective for population recovery.

Population dynamics are influenced by rates of birth, mortality, emigration, and immigration. The birth rate can be measured or estimated by examining the ovaries and genital tract or by monitoring females at parturition sites. Mortality rates, causes of death, and rates of emigration and immigration can be determined through telemetry studies.

The survival rate and its level of accuracy can be estimated by regularly locating animals and by determining the time of death. Using radiotelemetry, we will determine the survivorship of young and adult wolverines. Because radiotelemetry cannot be used to estimate survivorship between the time of birth and the time that young animals become self-sufficient, we will also use sightings of females with their young to help estimate survivorship in early life stages.

The annual survival rate of radio-collared animals and the annual production of young will be incorporated into simulation models to determine demographic trends for the population.

7.5 Implement habitat protection measures

The wolverine's habitat needs are defined mainly in terms of food availability and the presence of large territories free from human disturbance.

7.5.1 Consider the wolverine's needs in land use plans

Large-scale development projects will likely have significant impacts on northern ecosystems, potential habitats for wolverines, and the conditions necessary for the species' recovery. Maintaining the wolverine's habitat, as well as the habitat of its main prey, in sufficient number and quality may be hampered by hydroelectric developments, mining, and logging in the territory. Industrial or military uses of sites frequented by the wolverine or its food sources may lead to site abandonment by the wolverines.

Agencies that are responsible for land use practices (e.g., Ministère des Ressources naturelles de la faune et des parcs du Québec, Ministère des Affaires municipales du sport et du loisir, Hydro-Québec, and federal Department of National Defence) will receive a copy of the Recovery Plan. These agencies will be asked to take the Recovery Plan's goal, objectives, and recovery actions into account during their planning processes and in development projects that will affect the sector targeted by the Recovery Plan. This will be done once the Recovery Team has identified the most suitable areas for the reintroduction of the species. Northern development projects likely to affect the ecological conditions of the areas targeted for the release of wolverines will be identified, and the promoters will be informed.

7.5.2 Consider the wolverine's needs in big game and wolf management plans

To survive in winter, the wolverine depends on animal carcasses and remains left by wolves and other predators. The abundance and diversity of food resources seem to be determining factors for maintaining viable wolverine populations. Since starvation can be an important mortality factor in wolverine populations, maintaining sufficient levels of food is a prerequisite for the success of the Recovery Plan.

7.6 Periodically assess and update the Recovery Plan's objectives

7.6.1 Follow up on recovery activities and periodically produce a report

Following up on Recovery Plan activities will enable us to assess the various steps and to review the progress made. In addition, through the publication of periodic reports beginning in the first year of implementation of the plan, we will be able to inform the other stakeholders of our progress and keep attention focused on this issue.

7.6.2 Collect and analyze data on the biology of wolverine populations in Quebec and Newfoundland and Labrador, update status, and prepare a report

Demographic data will be summarized and analyzed to assess the success of recovery actions. The analysis will deal mainly with wolverine movements, annual home ranges, population densities, reproduction, identification of parturition sites, food, and mortality rates. Results will be presented in a report. This report will serve as a reference for updating the species' status and for evaluating progress towards the recovery objectives.

7.6.3 Review recovery objectives and assess progress

The new wolverine population will have to be monitored closely to ascertain whether recovery objectives (demographics) continue to be realistic and whether the status of the species should be reevaluated. A population model such as the SIMCON software program could be used to determine the extent to which the population objective had been met. The report (see 7.6.2) will include a critical assessment of the results obtained thus far. It will be important to make an objective assessment of activities, to identify weaknesses or failures, and to make the necessary corrections and adjustments.

7.6.4 Update the Recovery Plan

The Recovery Plan will be updated periodically to take into account new knowledge, to compensate for unforeseen situations, and to reassess the relevance of the proposed actions. The Recovery Plan will be revised every 5 years and will be based on the results and the effectiveness of the actions taken. Individual or collective tasks could be modified, and new actions could be proposed to better guide recovery.

7.7 Protect populations and their habitat by drafting and implementing legislation

7.7.1 Review legislation and regulations intended to protect wolverine populations

Given their scarcity and endangered status, the wolverines of Quebec and Newfoundland and Labrador must benefit from appropriate legal protection. It is essential to ensure that released animals and their offspring are adequately protected. Existing legislation in both provinces should be reviewed and modified as necessary prior to initiating the reintroduction program.

7.7.2 Grant the wolverine appropriate legal status in both provinces

The eastern population of wolverine was designated as Endangered by COSEWIC in 1989, and this status was confirmed in 2003. The wolverine was legally designated as a threatened species by the Quebec government in 2001. The wolverine is protected in Quebec under the *Act respecting threatened or vulnerable species*. The wolverine is protected as an 'endangered' species in the Province of Newfoundland and Labrador under the Province's *Endangered Species Act*. The Act has prohibitions protecting the wolverine and its residence, and provisions allowing for the protection of its critical habitat.

7.7.3 Put in place legislation to protect the wolverine and present its advantages to the public

We will invite aboriginal communities to participate in assessing the value of protecting wolverine from any harvesting in the James Bay and Northern Quebec territories to ensure its survival. The *Act respecting hunting and fishing rights in the James Bay and New Quebec territories* (R.S.Q., c. D-13.1, 1979) has specific provisions for protecting species at risk.

The Recovery Team will examine the relevance of amending existing laws and regulations in Quebec and Newfoundland and Labrador to prevent accidental captures of wolverines in the areas in which the species will be reintroduced. The non-selectivity of certain trapping devices could be addressed during public information sessions.

7.7.4 Obtain the collaboration of neighbouring provinces for the Recovery Plan

The recovery of the wolverine in Quebec and Newfoundland and Labrador may be promoted by maintaining a continuous distribution from western to eastern Canada. We will inform the Manitoba and Ontario authorities of the Recovery Plan and its objectives. If necessary, discussions could be held with the provinces concerned to reconsider wolverine harvesting on their territory.

8. Implementation

8.1 Identification of priorities and implementation schedule

The establishment of a self-sustaining wolverine population in Labrador and Quebec is the recovery goal. Considerable time and effort will be required to achieve this goal.

This Recovery Plan details a multifaceted strategy to meet the recovery goal, including the planning and preparation of a release program.

Clarifiying wolverine status and developing a reintroduction strategy are crucial components of the Recovery Plan and form the basis for the first phase of its implementation. This present plan presents the priority actions need to be completed in the initial phase of implementation. The implementation schedule for recovery actions is indicated in Table 2. The first phase of this Recovery Plan represents years 1–5. The second phase represents years 6–10. Some actions will be undertaken each year on a continuous basis throughout the first phase, while others will be undertaken in a single year. Some activities will be initiated and/or continued in the second phase of recovery. Once the first (experimental) phase is completed, the project's success will be assessed to prepare for the second phase, which consists of the release phase (see 7.3.3.4). A glimpse of the actions to be carried out in the operational phase is provided in Table 2.

Recovery actions are assigned priority rating from 1 to 3 (Table 2). Priority is the degree of importance of an action with respect to establishing a viable wolverine population in Quebec and Newfoundland and Labrador. Essential actions are "Priority 1" ; important actions are "Priority 2"; desirable actions are "Priority 3." Recovery actions have been prioritized taking into account the sequence in which events will take place and their potential impact on the chances of successfully reintroducing a new population.

The Recovery Plan will be revised every 5 years, at which time achievements, goals, and objectives will be reevaluated.

Table 2.
Priority and activity schedule for the implementation of the National Recovery Plan for the wolverine (*Gulo gulo*) [Eastern population]

Action	Recovery Ref. No.	Priority[1]	Year (Phase 1)[2] '04	'05	'06	'07	'08	Years (Phase 2) 2009-2013
Acquire the necessary knowledge through scientific studies	**7.1**							
Assess the population's status and distribution	7.1.1							
Continue acquiring data on reported sightings	7.1.1.1	2	x	x	x	x	x	
Standardize data collection methods	7.1.1.2	2	x					
Determine the wolverine's habitat and food resource needs	7.1.2							
Stay up to date with the scientific literature on wolverines inhabiting biomes similar to those of Quebec–Labrador	7.1.2.1	3	x	x	x			
Develop a method to assess the quality of the habitat for the wolverine in Quebec and Labrador	7.1.2.2	1	x					
Produce a map on the quality of the habitat in Quebec and Newfoundland and Labrador	7.1.2.3	1	x					
Identify the information required to assess numbers and the recruitment rate needed to achieve the objective	7.1.3							
Confirm the population objective	7.1.3.1	3					x	
Develop methods to assess population size and trends	7.1.3.2	3						x
Keep the knowledge on wolverine ecology up to date	7.1.4	1	x	x	x	x	x	x
Implement a communication plan and a public education program	**7.2**							
Enlist the support of all stakeholders for recovery measures	7.2.1							
Promote awareness	7.2.1.1							
Develop and implement a communication plan	7.2.1.2	1	x	x	x	x	x	x
Establish partnerships with departments and agencies involved in public information and education activities	7.2.1.3	2			x	x	x	x
Enlist support and cooperation	7.2.1.4	1	x	x	x	x	x	x
Involve Aboriginal people as partners	7.2.1.5	1			x	x	x	x
Identify funding agencies	7.2.1.6	1	x	x	x	x	x	x
Implement a release program involving animals taken from the wild	**7.3**							
Acquire essential data on wolverine captures and releases	7.3.1							
Review literature pertaining to the reintroduction of mustelids	7.3.1.1	1		x				
Develop and apply wolverine captive breeding techniques	7.3.1.2	2	x	x	x	x	x	x
Determine the genetic identity of the Quebec and Newfoundland and Labrador wolverines	7.3.1.3	1	x	x	x	x	x	x
Determine how to obtain wild wolverines	7.3.2							
Identify the source population	7.3.2.1	1		x				
Establish terms for procuring wolverines with the source jurisdictions	7.3.2.2	1		x	x			
Develop a release program for wild individuals	7.3.3							
Review and adapt techniques for releasing mammals, in particular, mustelids	7.3.3.1	1		x				
Identify wolverine release sites	7.3.3.2	1			x			
Establish release parameters	7.3.3.3							
Proceed with experimental releases	7.3.3.3.1	1				x		
Update the release program and techniques	7.3.3.3.2	1					x	x
Proceed with releases in a natural environment	7.3.3.4	1						x

Table 2. (continued)

Action	Recovery Ref. No.	Priority[1]	Year (Phase 1)[2] '04	'05	'06	'07	'08	Years 2009-2013 (Phase 2)
Develop and implement population management and monitoring methods	**7.4**							
Develop a monitoring program for released animals	7.4.1							
Study the dispersal of released animals and the range occupied	7.4.1.1	1				x	x	x
Proceed with number counts	7.4.1.2	3						x
Determine the survival rate of adults and young and population dynamics	7.4.1.3	1				x	x	x
Implement habitat protection measures	7.5							
Consider the wolverine's needs in land use plans	7.5.1	3						x
Consider the wolverine's needs in big game and wolf management plans	7.5.2	3						x
Periodically assess and update the Recovery Plan's objectives	**7.6**							
Follow up on recovery activities and prepare an annual report	7.6.1	1	x	x	x	x	x	x
Collect and analyze data on the biology of wolverine populations in Quebec and Newfoundland and Labrador, update status, and prepare an annual report	7.6.2	1	x	x	x	x	x	x
Review recovery objectives and assess progress	7.6.3	1					x	
Update the Recovery Plan	7.6.4	1					x	
Protect populations and their habitat by drafting and implementing legislation	**7.7**							
Review legislation and regulations intended to protect wolverine populations	7.7.1							
Grant the wolverine appropriate legal status in both provinces	7.7.2	3	QC	NL				
Put in place legislation to protect the wolverine and present its advantages to the public	7.7.3	3	x					
Obtain the collaboration of neighbouring provinces for the Recovery Plan	7.7.4	3	x					

[1] Recovery actions are assigned priority rating as follows: essential actions are "Priority 1"; important actions are "Priority 2"; desirable actions are "Priority 3."

[2] QC = Quebec; NL = Newfoundland and Labrador.

8.2 Cost of implementing the Recovery Plan

The costs associated with recovery actions and the roles and responsibilities for implementing recovery actions are summarized in Table 3. The total cost for both jurisdictions to implement the first phase of the Recovery Plan, which spans 5 years, is estimated at $518.5K, or approximately $60K per province per year, and 310 person-days. The release and monitoring stages will be the most costly.

Responsibility for the implementation of recovery actions is designated as either "Lead" or "Cooperators" (Table 3). Lead agencies are in charge of carrying out the action, while cooperators are those participating in implementing recovery efforts.

Table 3.
Projected costs and responsibilities of implementing the National Recovery Plan for the wolverine (*Gulo gulo*) [Eastern population]

Action	Recovery Ref. No.	Cost $ (1000s)	Cost Person -days	Responsibility[1] Lead	Responsibility[1] Cooperators
Acquire the necessary knowledge through scientific studies	**7.1**				
Assess the population's status and distribution	7.1.1				
Continue acquiring data on reported sightings	7.1.1.1		20	QC, NL	AG, TA, SFZ, HFTCC
Standardize data collection methods	7.1.1.2		5	QC	
Determine the wolverine's habitat and food resource needs	7.1.2				
Stay up to date with the scientific literature on wolverines inhabiting biomes similar to those of Quebec-Labrador	7.1.2.1	not defined	not defined	QC, NL	NT, MB, Univ.
Develop a method to assess the quality of the habitat for the wolverine in Quebec and Labrador	7.1.2.2	30		QC, NL	NT, MB, AG, Univ.
Produce a map on the quality of the habitat in Quebec and Newfoundland and Labrador	7.1.2.3	10		QC, NL	Univ.
Identify the information required to assess numbers and the recruitment rate needed to achieve the objective	7.1.3				
Confirm the population objective	7.1.3.1			QC, NL, Univ.	
Develop methods to assess population size and trends	7.1.3.2	80[2]		QC, NL	NT, other provinces, Univ.
Keep the knowledge on wolverine ecology up to date	7.1.4		25	QC, NL	
Implement a communication plan and a public education program	**7.2**				
Enlist the support of all stakeholders for recovery measures	7.2.1				
Promote awareness	7.2.1.1				
Develop and implement a communication plan	7.2.1.2	20	20	QC, NL, SFZ	AG
• Develop educational material and information		5	30		
• Regularly publish papers and/or press releases concerning the recovery activities		10	20	QC, NL	
• Organize information and education sessions, especially with local communities[3]		5	10		AG, TA
• Inform resource managers of the implementation of this Recovery Plan[4]		1	5		
Establish partnerships with departments and agencies involved in public information and education activities	7.2.1.3		10	QC, NL	Provincial parks, SFZ, SNP
Enlist support and cooperation	7.2.1.4	5	20	QC, NL	
Involve Aboriginal people as partners	7.2.1.5	5	20	QC, NL	AG
Identify funding agencies	7.2.1.6		5	QC, NL	
Implement a release program involving animals taken from the wild	**7.3**				
Acquire essential data on wolverine captures and releases	7.3.1				
Review literature pertaining to the reintroduction of mustelids	7.3.1.1		30	QC, NL	Univ.
Develop and apply wolverine captive breeding techniques	7.3.1.2	?	?	SFZ	
Determine the genetic identity of the Quebec and Newfoundland and Labrador wolverines	7.3.1.3	5	20	QC, NL	Univ.
Determine how to obtain wild wolverines	7.3.2				
Identify the source population	7.3.2.1		10	QC, NL	NT, MB, YT, SFZ

Table 3. (continued)

Action	Recovery Ref. No.	Cost $ (1000s)	Cost Person -days	Responsibility[1] Lead	Responsibility[1] Cooperators
Establish terms for procuring wolverines with the source jurisdictions	7.3.2.2	55	206	QC, NL	NT, MB, YT, SFZ
Develop a release program for wild individuals	7.3.3				
Review and adapt techniques for releasing mammals, in particular, mustelids	7.3.3.1		20	SFZ, QC, NL	Univ.
Identify wolverine release sites	7.3.3.2		20	QC, NL, HFTCC	AG, Univ.
Establish release parameters	7.3.3.3				
Proceed with experimental releases	7.3.3.3.1	100		QC, NL	SFZ, YT, MB, NT
Update the release program and techniques	7.3.3.3.2		10	QC, NL, HFTCC	AG, Univ.
Proceed with releases in a natural environment	7.3.3.4			QC, NL	SFZ, YT, MB, NT
Develop and implement population management and monitoring methods	**7.4**				
Develop a monitoring program for released animals	7.4.1				
Study the dispersal of released animals and the range occupied	7.4.1.1	200		QC, NL	AG, Univ.
Proceed with number counts	7.4.1.2			QC, NL	Univ.
Determine the survival rate of adults and young and population dynamics	7.4.1.3	80		QC, NL	Univ.
Implement habitat protection measures	**7.5**				
Consider the wolverine's needs in land use plans	7.5.1		5	QC, NL	
Consider the wolverine's needs in big game and wolf management plans	7.5.2		5	QC, NL	
Periodically assess and update the Recovery Plan's objectives	**7.6**				
Follow up on recovery activities and prepare an annual report	7.6.1				
Collect and analyze data on the biology of wolverine populations in Quebec and Newfoundland and Labrador, update status, and prepare an annual report	7.6.2	2	20	QC, NL	AG, Univ., NGO
Review recovery objectives and assess progress	7.6.3		10	QC, NL, HFTCC	AG, Univ., NGO
Update the Recovery Plan	7.6.4	5	30	QC, NL, HFTCC	NGO, Univ., AG
Protect populations and their habitat by drafting and implementing legislation	**7.7**				
Review legislation and regulations intended to protect wolverine populations	7.7.1				
Grant the wolverine appropriate legal status in both provinces	7.7.2	3.5	10	QC, NL	HFTCC
Put in place legislation to protect the wolverine and present its advantages to the public	7.7.3	10	20	QC, NL	HFTCC, TA
Obtain the collaboration of neighbouring provinces for the Recovery Plan	7.7.4		10	QC, NL	MB, ON

1 Acronyms used: AG = Aboriginal group; HFTCC = Hunting, Fishing and Trapping Coordinating Committee; MB = Manitoba; NL = Newfoundland and Labrador; NGO = Non-governmental organizations; NT = Northwest Territories; ON = Ontario; QC = Quebec; SFZ = Saint-Félicien Zoo (Quebec); SNP= Salmonier Nature Park (Newfoundland and Labrador); TA = Trappers Association; Univ. = University (academic institution to be determined); YT = Yukon.

2 The breakdown of this amount is as follows: $50K for aircraft, $10K for accommodation, $20K for personnel.

3 Cost includes educational materials, accommodation, and training (for the spokesperson).

4 Includes cost of copying documents, materials for mailing, attendance at meetings, and travel costs (note: travel costs are high in northern Quebec).

5 Travel.

6 Includes stay in the province, time at capture sites, obtaining animals, health tests and veterinary care, which require a technician in the region.

9. Literature Cited

Banci, V.A. 1987. Ecology and behavior of the wolverine in Yukon. Unpubl. M.Sc. Thesis, Simon Fraser University, Burnaby, British Columbia. 178 pp.

Banci, V.A. 1994. Wolverine. Pages 99–127 *in* L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski (eds.), The scientific basis for conserving forest carnivores. American marten, fisher, lynx and wolverine in western United States. Report RM 254, Rocky Mountain Forest and Range Experimental Station, Forest Service, U.S. Department of Agriculture.

Banci, V.A. 1999. Draft — Updated status report of the wolverine in Canada in 1999. Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Ottawa, Ontario. 37 pp.

Banci, V.A. and A.S. Harestad. 1988. Reproduction and natality of wolverine (*Gulo gulo*) in Yukon, Canada. Ann. Zool. Fenn. 25:265–270.

Banfield, A.W. 1974. Les mammifères du Canada. Les Presses de l'Université Laval, Québec.

Becker, E.F.A. 1991. A terrestrial furbearer estimator based on probability sampling. J. Wildl. Manage. 55:730–737.

Canac-Marquis, P. 1995. Données sur l'exploitation commerciale des animaux à fourrure sauvages au Québec 1917 à 1993. Internal report, Ministère de l'Environnement et de la Faune du Québec. 142 pp.

Copeland, J. 1996. Biology of wolverine in Central Idaho. M.Sc. Thesis, University of Idaho, Moscow, Idaho. 188 pp.

Couturier, S. and G. St-Martin. 1990. Effet des feux de forêt sur les caribous migrateurs, nord du Québec. Internal report, Ministère de l'Environnement et de la Faune du Québec.

Couturier, S., J. Brunelle, D. Vandal, and G. St-Martin. 1990. Changes in the population dynamics of the George River caribou herd, 1976–97. Arctic 43:9–20.

Crête, M., R. Nault, and H. Laflamme. 1990. Plan tactique — caribou. Service de la faune terrestre, Ministère du Loisir, de la Chasse et de la Pêche du Québec. 73 pp.

Crête, M., J. Huot, R. Nault, and R. Patenaude. 1993. Reproduction, growth, and body composition of Rivière George caribou in captivity. Arctic 46(3):189–196.

Crête, M., B. Drolet, J. Huot, M.-J. Fortin, and G.J. Doucet. 1995. Chronoséquence après feu de la diversité de mammifères et d'oiseaux au nord de la forêt boréale québécoise. Can. J. For. Res. 25:1509–1518.

Dagenais, J. 1988. Rapport sur la situation du carcajou (*Gulo gulo*) au Québec et dans les Maritimes. Internal report, Ministère du Loisir, de la Chasse et de la Pêche du Québec. 33 pp.

Dagg, A.I. and C.A. Campbell. 1974. An annotated bibliography on the status and ecology of the wolverine in Canada. Manuscript report, Canadian Wildlife Service. 45 pp.

Dauphiné, C. 1989. Status report on the wolverine *Gulo gulo* in Canada. Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Ottawa, Ontario. 24 pp.

Dawson, N. 2000. Report on the status of the wolverine (*Gulo gulo*) in Ontario. Committee on the Status of Species at Risk in Ontario, Ontario Ministry of Natural Resources, Thunder Bay, Ontario. 39 pp.

De Puyjalon, H. 1900. Histoire naturelle à l'usage des chasseurs canadiens et des éleveurs d'animaux à fourrures. Imprimerie du Soleil, Québec. 428 pp.

Ferguson, M.A.D. and L. Gauthier. 1992. Status and trends of *Rangifer tarandus* and *Ovibos moschatus* populations in Canada. Rangifer 12:127–141.

Garant, Y. and M. Crête. 1997. Fisher, *Martes pennanti*, home range, characteristics in a high density untrapped population in southern Quebec. Can. Field-Nat. 111:359–364.

Gardner, C.L. 1985. The ecology of wolverines in southcentral Alaska. M.Sc. Thesis, University of Alaska, Fairbanks, Alaska. 82 pp.

Gouvernement du Québec. 1992. Politique québécoise sur les espèces menacées ou vulnérables. 27 pp.

Grov, B. 2000. Successful management of the captive wolverine (*Gulo gulo*): institutional differences in management and breeding success. B.Sc. Thesis, Anglia Polytechnic University, Cambridge. 55 pp.

Hash, H.S. 1987. Wolverine. Pages 575–585 *in* M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch (eds.), Wild furbearer management and conservation in North America. Ontario Trappers Association, and Ontario Ministry of Natural Resources, Toronto, Ontario.

Hatler, D.F. 1989. A wolverine management strategy for British Columbia. Wildlife Bulletin No. B-60, Wildlife Branch, B.C. Ministry of Environment, Victoria, British Columbia. 124 pp.

Hornocker, M.G. and H.S. Hash. 1981. Ecology of the wolverine in northwestern Montana. Can. J. Zool. 59:1286–1301.

Johnson, C.S. 1990. Re-evaluation of the status of the wolverine in Manitoba. Technical Report No. 90-01, Wildlife Biological Services, Manitoba Natural Resources, Winnipeg, Manitoba. 25 pp.

Kelsall, J.P. 1981. Status report on the wolverine (*Gulo gulo*) in Canada in 1981. Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Ottawa, Ontario. 47 pp.

Krebs, J.A. and D. Lewis. 2000. Wolverine ecology and habitat use in the North Columbia Mountains: Progress report. Pages 695–703 *in* L.M. Darling (ed.), Proceedings of a Conference on the Biology and Management of Species and Habitats at Risk. Volume 2. B.C. Ministry of Environment, Lands and Parks, Victoria, British Columbia; and University College of the Cariboo, Kamloops, British Columbia. 974 pp.

Kyle, C.J. and C. Strobeck. 2001. Genetic structure of North American wolverine (*Gulo gulo*) populations. Mol. Ecol. 10:337–347.

Lamontagne, G., and S. Lefort (ed.). 2004 Plan de gestion de l'orignal 2004-2010. , Société de la faune et des parcs du Québec, Direction du développement de la faune, Québec.49 pp.

Lofroth, E.C. 2001. Wolverine ecology in plateau and foothill landscapes: 1996–2001. 2000/01 year end report. Unpublished manuscript, B.C. Ministry of Environment, Lands and Parks. 96 pp.

Magoun, A.J. 1985. Population characteristics, ecology and management of wolverines in northwestern Alaska. Ph.D. Thesis, University of Alaska, Fairbanks, Alaska. 211 pp.

Magoun, A.J. 1996. Wolverines head for the hills on the Kenai Peninsula, Alaska. Pages 23-41 *in* H.N. Golden (ed.), Furbearer management technique development. Federal Aid in Wildlife Restoration Research Progress Report, Division of Wildlife Conservation, Alaska Department of Fish and Game, Anchorage, Alaska (Grants W-24-3 and W-24-4, Study 7.18).

Magoun, A.J. and J.P. Copeland. 1998. Characteristics of wolverine reproductive den sites. J. Wildl. Manage. 62:1313–1320.

Magoun, A.J., G. Lipsett-Moore, J.R. Ray, C. Lipsett-Moore, N. Dawson, and C. Fortin. 2003. Aerial track surveys as a tool for assessing coarse-scale wolverine distribution in Northern Ontario. Abstract of presentation at the 11th northwest furbearer conference, Whitehorse, Yukon.

Manseau, M., J. Huot, and M. Crête. 1996. Effects of summer grazing by caribou on composition and productivity of vegetation: community and landscape level. J. Ecol. 84:503–513.

Ministère de la Colonisation, des Mines et des Pêcheries. 1913. Extraits de rapports sur le District d'Ungava.

MLCP (Ministère du Loisir, de la Chasse et de la Pêche du Québec). 1989. La faune menacée au Québec. Les Publications du Québec, Québec. 66 pp.

MLCP (Ministère du Loisir, de la Chasse et de la Pêche du Québec). 1992. Liste des espèces de la faune vertébrée susceptible d'être désignées menacées ou vulnérables. 107 pp.

MLCP (Ministère du Loisir, de la Chasse et de la Pêche du Québec). 1993. État de l'environnement au Québec, 1992. Guérin, Montréal. 560 pp.

Moisan, M. 1994. Évaluation de la situation du carcajou (*Gulo gulo*) au Québec et au Labrador. Internal report, Ministère de l'Environnement et de la Faune du Québec.

Morneau, C. 1994. Perturbation de la végétation et analyse dendroécologique de l'activité du caribou dans le nord-est du Québec et au Labrador. Pages 4–15 *in* S. Roy and M. Crête (eds.), Évolution récente et future de l'habitat estival des caribous de la rivière George. Final report presented to Hydro-Québec by Centre d'études nordiques, Université Laval, Québec.

Novak, M. 1975. Recent status of the wolverine in Ontario. Ontario Ministry of Natural Resources, Toronto, Ontario. 16 pp.

Patenaude, F. 1989. Projet: Repeuplement du carcajou (*Gulo gulo*). Phase: Garde en captivité, faisabilité et proposition. Internal report, Ministère du Loisir, de la Chasse et de la Pêche du Québec. 40 pp.

Payette, S. 1983. The forest tundra and present tree-lines of the northern Quebec–Labrador peninsula. Nordicana 47:3–22.

Payette, S., C. Morneau, L. Sirois, and M. Desponts. 1989. Recent fire history of the northern Quebec biomes. Ecology 70:656–673.

Petersen, J. 1997. Status of the wolverine (*Gulo gulo*) in Alberta. Wildlife Status Report No. 2, Wildlife Management Division, Alberta Environmental Protection, Edmonton, Alberta. 17 pp.

Poole, K.G. 1991. Wolverine carcass collections in the western Northwest Territories. Progress report, Northwest Territories Department of Renewable Resources. 5 pp.

Prescott, J. and P. Richard. 1982. Mammifères du Québec et de l'est du Canada. Volume 2. France-Amérique, Montréal. 429 pp.

Proulx, G., A. Kolenosky, M. Badry, R. Drescher, K. Seidel, and P. Cole. 1994. Post-release movements of translocated fishers. Pages 197–203 *in* S.W. Burskirk, A.S. Harestad, M.G. Raphael, and R.A. Powell (eds.), Martens, sables and fishers: biology and conservation. Cornell University Press, Ithaca, New York.

Quick, H.F. 1952. Some characteristics of wolverine fur. J. Mammal. 33:492–493.

Quick, H.F. 1953. Wolverines, fisher and marten studies in a wilderness region. Trans. N. Am. Wildl. Conf. 18:513–533.

Rausch, R.A. and A.M. Pearson. 1972. Notes on the wolverine in Alaska and the Yukon territory. J. Wildl. Manage. 36:249–268.

Savard, R. 1971. Carcajou et le sens du monde, récits montagnais-naskapi. Éditeur officiel du Québec, Séries culture amérindienne, Ministère des Affaires culturelles du Québec. 141 pp.

Schaefer, J.A. and S.A. Luttich. 1998. Movements and activity of caribou (*Rangifer tarandus caribou*) of the Torngat Mountains, Northern Labrador and Quebec. Can. Field-Nat. 112(1):486–490.

Shelford, V.E. and S. Olson. 1935. Sere, climax and influent animals with special reference to the transcontinental coniferous forest of North America. Ecology 16(3):375–402 [cited in Hatler 1989].

Slough, B. 1994. Translocations of American Marten: an evaluation of factors in success. Pages 165–178 *in* S.W. Burskirk, A.S. Harestad, M.G. Raphael, and R.A. Powell (eds.), Martens, sables and fishers: biology and conservation. Cornell University Press, Ithaca, New York.

Statistics Canada. 2000. Statistiques du bétail. Catalogue No. 23-603-UPF, Ottawa.

Vandal, D., S. Couturier, D. Rémillard, and S. Luttich. 1989. Distribution saisonnière et migrations des caribous des rivières George et aux Feuilles de 1983 à 1987. Direction régionale du Nouveau-Québec, Ministère du Loisir, de la Chasse et de la Pêche du Québec. 88 pp.

van Zyll de Jong, C.G. 1972. The status of the wolverine in Manitoba. Manuscript Report No. 72-2, Research Branch, Manitoba Department of Mines, Resources and Environment Management. 17 pp.

van Zyll de Jong, C.G. 1975. The distribution and abundance of the wolverine (*Gulo gulo*) in Canada. Can. Field-Nat. 89:431–437.

Whitman, J.S., W.B. Ballard, and C.L. Gardner. 1986. Home range and habitat use by wolverines in southcentral Alaska. J. Wildl. Manage. 50:460–463.

Wilson, D.E. 1982. Wolverine. Pages 644–652 *in* J.A. Chapman and G.A. Feldhamer (eds.), Wild mammals of North America. Biology, management, and economics. Johns Hopkins University Press, Baltimore, Maryland.

Yukon Renewable Resources. 1988. Managing your wolverine trapline. Yukon Trapline Management Series, Department of Renewable Resources, Whitehorse, Yukon.

Previous National Recovery Plans

1.	Canadian Whooping Crane Recovery Plan	December 1987
2.	*Anatum* Peregrine Falcon Recovery Plan	October 1988
3.	National Recovery Plan for the Baird's Sparrow	April 1993
4.	National Recovery Plan for the Roseate Tern	June 1993
5.	National Recovery Plan for the Greater Prairie-Chicken	October 1993
6.	National Recovery Plan for the Whooping Crane (1994 update)	January 1994
7.	National Recovery Plan for the Loggerhead Shrike	March 1994
8.	National Recovery Plan for the Marbled Murrelet	May 1994
9.	National Recovery Plan for the Gaspésie Caribou	November 1994
10.	National Recovery Plan for the Vancouver Island Marmot	December 1994
11.	National Recovery Plan for the Ferruginous Hawk	December 1994
12.	National Recovery Plan for the Harlequin Duck in Eastern North America	March 1995
13.	National Recovery Plan for the Burrowing Owl	April 1995
14.	National Recovery Plan for the Newfoundland Marten	August 1995
15.	National Recovery Plan for the Swift Fox	April 1996
16.	National Recovery Plan for the Blanchard's Cricket Frog	March 1997
17.	National Recovery Plan for the Henslow's Sparrow	August 1997
18.	National Recovery Plan for Blandings Turtle (*Emydoidea blandingii*) Nova Scotia population	January 1999
19.	National Recovery Plan for the Vancouver Island Marmot (*Marmota vancouverensis*) 2000 Update	May 2000
20.	National Recovery Plan for Acadian Flycatcher (*Empidonax virescens*) and Hooded Warbler (*Wilsonia citrina*)	November 2000
21.	National Recovery Plan for the Wood Bison (*Bison bison athabascae*)	October 2001
22.	National Recovery Plan for the Piping Plover (*Charadrius melodus*)	March 2002
23.	National Recovery Plan for Long's Braya (*Braya longii Fernald*) and Fernald's Braya *(Braya fernaldii Abbe*)	September 2002
24.	Conservation Strategy for Bowhead Whales (*Balaena mysticetus*) in the Eastern Canadian Arctic	September 2003
25.	National Recovery Strategy for Species at Risk in the Sydenham River: An Ecosystem Approach	October 2003

Recovery of Nationally Endangered Wildlife

In 1988, the Wildlife Ministers' Council of Canada endorsed a new strategy to rescue wildlife species at risk of extinction and to prevent other species from becoming at risk. Called RENEW (the acronym for Recovery of Nationally Endangered Wildlife), the strategy brings together all responsible agencies and interested organizations and individuals to work as a team for the recovery of wildlife at risk. RENEW focuses on those species or populations that have been designated as extirpated, endangered, or threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The responsible jurisdictions establish a National Recovery Team of experts for each species to produce a recovery plan, which becomes the basis for a recovery program carried out by the responsible governments in cooperation with aboriginal groups, universities, nongovernment organizations, businesses, and private citizens.

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