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Status of the wolverine *Gulo gulo* in Canada

Brian G. Slough

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Wolverines *Gulo gulo* are found in northern forested wilderness across Canada, in alpine tundra of the western mountains, and in the arctic. They formerly occupied habitats that are now heavily settled by humans in the Prairie Provinces and eastern Canada. Forest harvesting, hydro-electric development, the exploration and development of oil, gas and minerals, transportation corridors and human settlement continue to alter, remove or fragment habitats. About 6% of all current wolverine range in Canada is within parks and protected areas, and 10% of high quality habitats in western Canada are protected. The population estimate for the western population (Yukon to Ontario) is 15,000-19,000 resident wolverines, based on the best available information on densities and areas of occupancy. With the addition of juveniles, the population before the winter trapping season may approach or exceed 20,000. Wolverine populations are apparently benefiting from the cessation of wolf *Canis lupus* poisoning, harvest closures, advanced trapline and harvest management systems. Recent range recoveries have been recorded in northwestern Ontario and Manitoba, where caribou numbers have increased. Wolverine populations in Canada are stable within the normal range of long-term population fluctuations elsewhere, except locally in southern Alberta and British Columbia where caribou have declined or habitats are becoming fragmented. Wolverines may be extirpated on Vancouver Island. The eastern wolverine population is either extremely rare or extirpated. The COSEWIC (Committee on the Status of Endangered Wildlife in Canada) status designations are Endangered for the eastern population and Special Concern for the western population.

Key words: Canada, COSEWIC, *Gulo gulo*, status, wolverine

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Following COSEWIC's (Committee on the Status of Endangered Wildlife in Canada) first assessment of the status of the wolverine *Gulo gulo* in Canada, it delineated two geographically separated wolverine populations in 1989, the eastern population of Québec and Labrador and the western population of northern Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, Northwest Territories, Nunavut and Yukon (Dauphiné 1989). The eastern population was isolated from the western population by the 1960s (Dawson 2000), and densities have since declined to very low levels or possible extirpation (Fortin et al. 2005). Likewise, there has been no evidence of wolverines on Vancouver Island since 1992 where the population and/or subspecies may be extirpated (E. Lofroth, pers. comm.).

Two subspecies of wolverines are recognized in Canada (Hall 1981); *G. g. luscus*, found across Canada, and *G. g. vancouverensis*, found on Vancouver Island. Banci (1982) found little evidence for classifying the Vancouver Island population as a distinct subspecies, however it is still recognized as such (Nagorsen 1990).

Distribution

The present range of wolverines in Canada includes much of northern and western Canada (Fig. 1), where they inhabit a variety of treed and treeless ecological areas at all elevations. Range reductions began with human settlement in the mid-19th century in New Brunswick (where wolverines were extirpated), boreal Ontario, Québec and Labrador, and in the aspen parklands of Manitoba, Saskatchewan and Alberta. Wolverines never occurred in Newfoundland, Nova Scotia, Prince Edward Island, the Queen Charlotte Islands, and some islands of the northwestern Arctic Archipelago in the Northwest Territories and Nunavut (Dauphiné 1989). A similar pattern of range reduction was described in the Great Lakes region of the United States (Aubry et al. 2007). The northward range shift in Ontario may have been influenced by climatic warming since the 1800s, which has led to a decrease in snow

cover needed for successful denning (Aubry et al. 2007).

It is doubtful whether viable populations ever occurred in southern Ontario, the prairies, or the arid region of southern British Columbia, since historical depictions of wolverine range (e.g. Kelsall 1981) were largely compiled from unverifiable anecdotal evidence, extralimital records, and the interpretation of fur returns, which were tied to socio-economic factors and not necessarily furbearer populations at the source of data collection. In any case, these areas did not produce consistent long-term wolverine harvests (Novak et al. 1987). Aubry et al. (2007) found no evidence of viable historic wolverine populations in the Great Plains, upper Midwest and northeast regions of the United States.

Habitat trends

Considerable wolverine habitat was lost or fragmented with the extensive settlement that began in the late 19th century at the southern edge of the range (van Zyll de Jong 1975). Losses were due to human settlement, agriculture and forest harvesting. The reduction of ungulates, an important winter prey base, during the same period contributed to wolverine habitat degradation. Much of the habitat lost during human colonization was likely not prime habitat, since wolverine harvests were low (Novak et al. 1987).

Ongoing habitat fragmentation, causing the isolation of populations and genetic differentiation, is occurring in southern British Columbia and Alberta (Kyle & Strobeck 2002). Across the range of wolverines, human settlement, transportation corridors, forest harvesting, the exploration and development of oil, gas, and minerals, and large hydroelectric reservoirs continue to threaten habitats (Krebs et al. 2004). Reduced numbers of prey remain a significant threat to wolverine populations today in southern areas where woodland caribou *Rangifer tarandus caribou* herds are being impacted by forest harvesting and other developments which cause population declines and fragmentation (Thomas & Gray

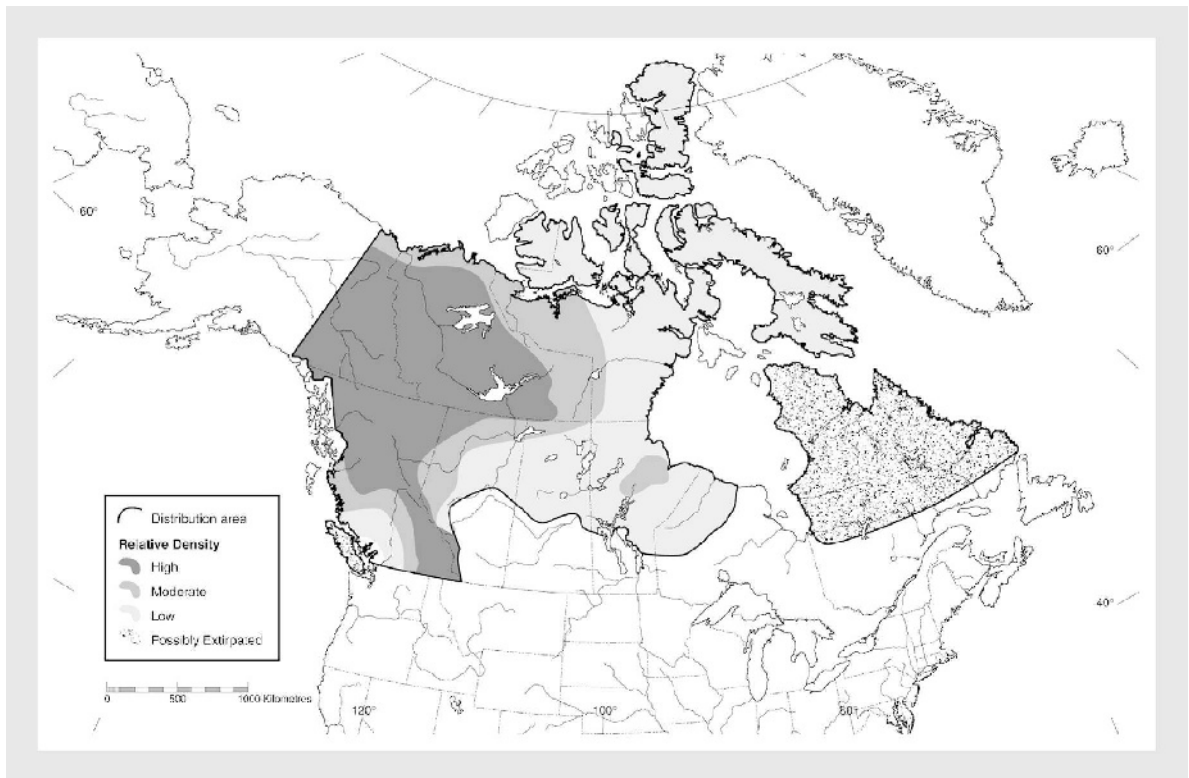


Figure 1. Canadian distribution of wolverine. Modified from COSEWIC (2003).

2002). However, woodland caribou numbers have increased in many other regions.

Habitat protection

Approximately 6% of the wolverine's present range in Canada and 10% of the 'high' relative density range (see Fig. 1) in western Canada is within parks and protected areas. Kelsall (1981) and Dauphiné (1989) assumed that the relatively large number of parks and protected areas, which act as refugia from trapping and development in western Canada, had secured wolverine habitat in that area. However, human recreation, such as snowmobiling and other forms of snow travel, may disturb wolverines, particularly during the denning season. Moreover, the impacts of resource development and associated roads on wolverine habitat quality are largely unknown, due to relative lack of study in such areas; hence there is a lack of knowledge on the role of protected areas in developed landscapes. Trapping is permitted in many protected areas, and wolverines that range beyond protected area boundaries, particularly in roaded areas, are vulnerable to trapping.

Population sizes and trends

Annual reported wolverine harvests average about 500 per year, and range from 350 to > 600 (Table 1). Unreported harvests from the Northwest Territories and Nunavut may add several hundred wolverines to this total. The earliest fur harvests attributed to specific Canadian jurisdictions indicate that wolverine populations began declining in the Prairie Provinces in the 1920s (Novak et al. 1987). Harvests in Québec, Labrador and Ontario were already low by that time. Wolverine populations were reduced by hunting, trapping and poisoning directed at wolves.

Low densities, large home range sizes, long-distance movements by dispersing individuals and a low reproductive rate contribute to the wolverine's vulnerability to trapping (Banci & Proulx 1999). Despite these factors, some local populations have recovered from overharvest. Improved fur harvest systems such as registered trapping concessions and trapper education, in tandem with a general downturn in the number of active trappers, applied over several decades have contributed to this recovery (Johnson 1990). The eastern wol-

Table 1. Reported wolverine harvest in Canada during 1989/90-2003/04. Source: Statistics Canada, Fur Statistics. LB = Labrador, QC = Québec, ON = Ontario, MB = Manitoba, SK = Saskatchewan, AB = Alberta, BC = British Columbia, YT = Yukon Territory, NT = Northwest Territories and NU = Nunavut. Northwest Territories statistics included Nunavut until 1992/93.

Season	LB	QC	ON	MB	SK	AB	BC	YT	NT	NU	Canada
1989/90	0	0	9	31	10	40	113	206	93	-	502
1990/91	0	0	5	29	6	34	127	121	92	-	414
1991/92	0	0	7	73	16	30	142	218	201	-	687
1992/93	0	0	4	48	2	44	236	176	93	34	637
1993/94	0	0	6	76	12	27	97	117	121	29	485
1994/95	0	0	8	52	11	23	186	145	119	15	559
1995/96	0	0	18	45	7	9	135	72	59	5	350
1996/97	0	0	14	46	14	27	230	161	86	26	604
1997/98	0	0	12	66	10	50	152	118	175	24	607
1998/99	0	0	4	33	4	40	123	104	62	15	385
1999/00	0	0	4	18	6	10	160	157	99	22	476
2000/01	0	0	7	53	23	37	162	188	56	19	545
2001/02	0	0	7	39	14	19	183	110	111	33	516
2002/03	0	0	8	39	0	35	120	131	106	29	468
2003/04	0	0	6	43	16	23	119	138	132	41	518
Total	0	0	119	691	151	448	2285	2162	1605	292	7706

verine population has been historically low and shows no sign of natural recovery at this time (Fortin et al. 2005).

Throughout Canada, wolverine populations are monitored with area-specific harvests, trapper questionnaires, track surveys and intensive biological studies conducted in specific areas.

Yukon

The wolverine population is monitored in the Yukon using fur harvest statistics and an annual trapper questionnaire to obtain local knowledge about populations and trends (T. Jung & H. Slama, unpubl. data). All available information points to a healthy and stable population within the normal range of long-term population fluctuations over the past 20 years. Large-scale wolf *Canis lupus* poisoning through the 1970s likely had a detrimental impact on wolverines, however populations have apparently since recovered.

Banci & Harestad (1990) estimated wolverine density to be 10.75/1,000 km² in continuous and saturated habitat in the south-central Yukon. The estimate using radio-collared wolverines only (assuming variable habitat quality and not all habitat was saturated) was 5.65/1,000 km². Recently, Golden et al. (2007) observed a density estimate of 9.74 wolverines/1,000 km² on the Old Crow Flats, a unique topographic basin of lakes and wetlands, in the northern Yukon. The total population estimate for the Yukon based on the range of statistical and non-statistical density estimates, and expert opinion which assumes that high quality ha-

bitats predominate, is 3,500-4,000 resident wolverines.

Northwest Territories

Wolverine densities in the Northwest Territories have been presumed higher in the mountains of the west and in the taiga than in the arctic tundra habitats of the north and east (see Fig. 1; K. Poole, pers. comm.). However, large numbers of barren-ground caribou and wolves in the taiga and tundra habitats indicate that carrion should be abundant and wolverines may be common (Mulders et al. 2007, Cardinal 2004b). Mulders et al. (2007) gave a closure corrected population estimate of 44 wolverines, or 17.2/1,000 km², in a study area in arctic tundra habitat.

The fur trade statistics for the Northwest Territories are based on furs exported to fur auction and not total harvest (see Table 1). Many wolverine pelts remain in the north and are used domestically for parka trim (Cardinal 2004b). Based on carcass collection programs, the actual wolverine harvest of some communities here and in Nunavut may be underestimated by up to 80% (COSEWIC 2003). The population estimate, based on a rough extrapolation of the Yukon estimate over the range and relative abundance of wolverine in the Northwest Territories is 3,500-4,000 resident wolverines.

Nunavut

Wolverine densities are moderate in the west and low on the arctic islands and eastern Nunavut (see

Fig. 1) where numbers are believed to be stable but sensitive to harvest pressures. Aboriginal traditional knowledge holders, however, reported significantly increasing populations in the eastern arctic (Cardinal 2004b). As in the Northwest Territories, many pelts are used domestically and harvest statistics (see Table 1) are greatly underestimated. The population estimate, based on a rough extrapolation of the Yukon and Northwest Territories estimates over the range and relative abundance of wolverine in the Nunavut is 2,000-2,500 resident wolverines.

British Columbia

The wolverine density was estimated by Quick (1953) to be 4.76/1,000 km² in northeast British Columbia. Krebs & Lewis (2000) estimated an average density of 6.16/1,000 km² in southeastern British Columbia. Wolverine numbers are believed to be stable over much of the province, where they have been estimated at about 2,100-3,600 individuals based on ranges and densities estimated in ecological zones (E. Lofroth, pers. comm.).

Alberta

A rabies control program in the 1950s, involving the non-selective poisoning of about 5,500 wolves, may have had a serious impact on the wolverine population which took decades to recover (Petersen 1997). Opinion surveys of trappers in 1994 indicated a recent province-wide declining population (Petersen 1997). A rough population estimate using expert opinion and comparisons with neighbouring jurisdictions is 1,500-2,000 wolverines.

Saskatchewan

Wolverines are common in northern Saskatchewan and rare in the southern boreal forest, based on fur harvest records (J. Keith, pers. comm.). A rough population estimate using expert opinion and comparisons with neighbouring jurisdictions is 1,000 wolverines.

Manitoba

Wolverines inhabit the northern part of Manitoba and are not as rare as once thought (van Zyll de Jong 1972, 1975, Holbrow 1976; D. Berezanski, unpubl. data) Van Zyll de Jong's (1972) population estimate of 60 wolverines was based on fur sales records. A population increase followed the cessation of indiscriminate wolf poisoning in the mid-1970s, with a subsequent increase in the wolf

population, and the adoption of a limited harvest season (Johnson 1990). Johnson (1990) estimated the Manitoba wolverine population at 500-800 individuals, and more recently the population has been estimated at 1,100-1,600 wolverines (D. Berezanski, unpubl. data, based on harvest data and the assumption of a sustainable harvest rate).

Ontario

Wolverines are found in small numbers in north-western Ontario following declines since the 1800s (Dauphiné 1989). Aerial surveys conducted in late winter 2003-2005 indicated a relatively continuous distribution in the western half of northern Ontario (Magoun et al. 2004; J. Ray, A. Magoun & N. Dawson, unpubl. data) and discontinuous distribution in the eastern half where recolonization may be occurring (Dawson 2000). A rough population estimate using expert opinion and comparisons with neighbouring jurisdictions is ≤ 300 wolverines.

Québec and Labrador

The eastern wolverine population is either extremely low or extirpated. Wolverines have not been confirmed in Québec since 1978 (Fortin et al. 2005) and in Labrador since the 1950s (J. Brazil, pers. comm.). There have been close to 60 unconfirmed sightings since 1935, but an aerial survey conducted in 2005 revealed no evidence of wolverines (Schmelzer 2006). A recovery plan (Fortin et al. 2005) for the eastern wolverine population has the main objective of establishing a self-sustaining population through reintroduction and protection.

Western population estimate

The total western wolverine population is estimated at 15,000-19,000 individuals, based on the best available information on densities and areas of occupancy. There have been five wolverine radiotelemetry studies in western North America (Krebs et al. 2004), one statistical density estimate (Golden et al. 2007), one aboriginal traditional knowledge study (Cardinal 2004a,b), winter track-count surveys and local knowledge surveys (i.e. trapper questionnaires) which have guided the experts. Cardinal (2004b) and R. Mulders (pers. comm.) commented that the relative density estimates used for the Northwest Territories and Nunavut population estimates were low. Nonetheless, the estimated resident population of wolverine in western Canada apparently

exceeds COSEWIC's quantitative criteria for Threatened ($< 10,000$ mature individuals and declining population) or Endangered. COSEWIC's criteria are based on the IUCN Red List categories (IUCN 2001).

The fall (pre-trapping) population estimate including juveniles can be $\leq 6.4\%$ higher than the resident adult population in untrapped areas (Krebs et al. 2004). The average annual harvest of wolverines over the past 15 seasons is 514, or $< 3\%$ of the population estimate (see Table 1), therefore the harvest is likely sustainable at a national level. In fact a harvest of 1,000 wolverines, factoring in unreported harvests of up to 80% in the Northwest Territories and Nunavut, should be sustainable. The local overharvest of wolverines occurs in many areas (Krebs et al. 2004) and is, in fact, a harvest strategy where untrapped refugia (often underutilized or inaccessible trapping areas by default) are relied on for immigrants. Cardinal (2004a) identified several refugia from trapping in the three northern territories, and many exist in the western provinces as well. In areas where densities are naturally low, such as the southern part of their range (Petersen 1997) and Ontario (J. Ray, Appendix 6 in Cardinal 2004a) wolverines are rarely targeted by trappers.

Current status

The western wolverine population is designated as Special Concern, since its' habitat is becoming increasingly fragmented by industrial activity, increased motorized access will increase harvest and disturbance, and vast secure areas are required to maintain viable populations (COSEWIC 2003). Populations remain healthy and well above the threshold for a Threatened designation. The eastern wolverine population is Endangered, with no verified reports in the past 25 years, and a small population that is either at risk of extinction or extirpated.

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