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Temporal variation in the population characteristics of harvested wolverine (*Gulo gulo*) in northwestern Canada

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Abstract

Context. Wolverines (*Gulo gulo*) are harvested for fur in northern Canada; however, the impacts of harvest are poorly known. Additionally, wolverine population data are largely absent for much of their northern range. Demographic data collected from harvested wolverines provide information on the vulnerability and variability of different sex and age cohorts to harvest, which, in turn, may have implications for harvest sustainability.

Aims. We examined the temporal variability of different sex and age cohorts in wolverine harvest among years, and within the harvest season, in Yukon, Canada. We also examined the pregnancy status of female wolverines in relation to the harvest date, so as to evaluate the impact of the harvest-season length on breeding wolverines.

Methods. We determined the sex and age composition of harvested wolverines via dissections of 655 carcasses collected from 2005 to 2014. We determined the reproductive status and fetal measurements for female wolverines via dissections of reproductive tracts.

Key results. The harvest consisted mostly of males, particularly of young individuals. The sex ratio of harvested animals did not fluctuate significantly, but we observed variation in the age structure among years. The age structure varied within the harvest season (November to March), with a greater proportion of adults being harvested in late winter. Active gestation was evident in females harvested after mid-January, and near-term or postpartum females were harvested during late February and March.

Conclusions. Late winter harvest is likely to have a more significant impact on populations than is early winter harvest, because of increased harvest of adults and breeding females. Wolverine harvest season extends to the onset of the denning season in late February and March, indicating a concern for ethical harvest.

Implications. Limiting the legal harvest season to early winter may contribute to improved harvest sustainability and protection of breeding wolverines in northern latitudes.

Additional keywords: wildlife management, furbearer, harvest, mustelid.

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Introduction

Harvest records are commonly used to inform furbearer management, because field data on wildlife populations that span large spatial and temporal scales are rarely available. Harvest rates have been used to monitor population trends and to assess the effects of harvest regulations (e.g. Linnell *et al.* 2010); however, these may not reflect the actual population change, as capture probabilities and harvest effort may fluctuate as a result of factors unrelated to population abundance (e.g. Smith *et al.* 1984; McKelvey *et al.* 2010; DeVink *et al.* 2011). However, when combined with demographic data, such as sex and age structure, and reproductive characteristics of the harvested population, harvest records can inform furbearer

management and be used to assess harvest sustainability, as well as detect change in the structure of the harvested population in response to environmental covariates or management interventions (Rolley 1985; Chillelli *et al.* 1996; Fryxell *et al.* 2001; Anderson and Lindzey 2005).

The demographic structure of harvested furbearer populations typically does not reflect the true population structure; rather, the sex and age composition of the harvested segment of the population is a function of trapping pressure (e.g. Whitman 2003; Fortin and Cantin 2005), and sex- and age-dependent vulnerability to harvest (Buskirk and Lindstedt 1989; Anderson and Lindzey 2005). Mustelid harvest, in general, tends to be biased towards adult males and young animals (King 1975;

Hodgman *et al.* 1994; Banci and Proulx 1999; Fryxell *et al.* 2001). Males generally have larger home ranges, and they may disperse earlier and farther than females; thus, they are more likely to encounter traps (Hodgman *et al.* 1994; Vangen *et al.* 2001; Dawson *et al.* 2010; Persson *et al.* 2010). Male-biased harvest is desirable from a management perspective, because population growth rates for polygamous species are relatively insensitive to changes in male survival, but highly sensitive to changes in female survival (Taylor *et al.* 1987; 2008; Dalerum *et al.* 2008). For example, a harvest approaching 50% females for marten (*Martes americana*) and fisher (*Martes pennanti*) may compromise harvest sustainability (Douglas and Strickland 1987; Fortin and Cantin 2005), but the management threshold for females may be lower for species that occur in low density and have low reproductive output (Taylor *et al.* 1987).

The trapping susceptibility of sex- and age classes of furbearers typically varies during the harvest season, which occurs in winter when pelts are prime (Banci and Proulx 1999). For example, early winter harvest of marten and fisher typically consists of non-reproductive juveniles, and the proportion of adults increases in late winter (Douglas and Strickland 1987; Strickland and Douglas 1987), indicating that harvest in late winter may have an impact on the reproductive segment of the population more than in early winter. The timing of harvest may be used as a management strategy to limit the harvest of reproductive individuals by opening the harvest season when the fur reaches acceptable primeness in early winter, and closing the harvest season when the juvenile proportion of harvest diminishes (Douglas and Strickland 1987). The timing of harvest may have a strong impact on population, because the reproductive value of an individual varies seasonally, with the highest value immediately before breeding season (late winter and spring for most northern furbearers), and the lowest after the breeding season (fall and early winter; Kokko 2001). Thus, understanding the seasonal changes in the demographic structure of harvest, and reproductive chronology of the harvested species, can be used for determining the optimal timing of harvest for sustainability.

Wolverines (*Gulo gulo*) are large mustelids that occur in the circumpolar tundra and boreal regions, and they are harvested for fur in much of their range. Wolverines occur in naturally low density and they have a low reproductive output (e.g. 0.7 kits per female per year in Alaska and Sweden (Magoun 1985; Persson *et al.* 2006)). Consequently, wolverines are considered susceptible to overharvest (Weaver *et al.* 1996; Banci and Proulx 1999), and the population persistence is sensitive to the survival of females, particularly adults (Dalerum *et al.* 2008). Female wolverines become reproductive when they are ~2 years old (Banci and Harestad 1988), but their prime reproductive age is not reached until ~4 years old (Persson 2005; Rauset *et al.* 2015). Wolverines exhibit delayed implantation (Wright and Rausch 1955), which is a bet-hedging reproductive strategy that allows flexibility to produce litters or forgo reproduction, similar to other species that live in harsh environments with unpredictable food resources, such as polar bear (*Ursus maritimus*; Taylor *et al.* 1987). Most mature female wolverines mate successfully (Banci and Harestad 1988), but their reproductive output depends on the combination of age-related reproductive costs and winter food availability (Persson 2005; Rauset *et al.* 2015). Wolverines give

birth from February to March, which is earlier than for other non-hibernating, northern carnivores (Inman *et al.* 2012b).

In the present study, we examined the demographic structure of harvested wolverines in Yukon, Canada, through a carcass-collection program during 2005–14. Specifically, we sought to understand how sex and age structure may vary among and within harvest seasons. Additionally, we were interested in assessing the harvest of females in relation to the timing of their reproduction. Understanding when female wolverines, particularly breeding adults, may be most vulnerable to harvest can be used for evaluating the impact of harvest on wolverine populations in respect to harvest timing. This information can be used by harvest managers for establishing the optimal harvest season for wolverine, so as to improve the harvest sustainability of this sensitive furbearer species.

Materials and methods

Study area

We obtained wolverine carcasses across Yukon, Canada. Yukon is ~482 000 km² with the human population of 36 700 people, which mostly live in the City of Whitehorse (~76%; Yukon Bureau of Statistics 2014). Yukon has a rugged and complex topography, characterised by mountain ranges, plateaux, valleys and lowlands, and much of the land area is unfragmented and remote. The climate is subarctic continental, which is relatively dry. The annual precipitation ranges from 250 to 600 mm, and mostly falls as snow from October to May. The mean temperature varies seasonally, ranging from –15°C to –30°C in January and from 10°C to 15°C in July. Yukon is characterised by boreal forest in valley bottoms, and shrub communities and alpine tundra at and above the treeline respectively (Smith *et al.* 2004).

Wolverine populations in Yukon are largely unknown. A crude total population estimate is 3500–4000 wolverines, and it is considered stable on the basis of the annual harvest numbers and trapper questionnaires (COSEWIC 2014). A population density of 5.6 resident wolverines per 1000 km² was estimated in Kluane in south-western Yukon (Banci 1987), and a total of 9.7 wolverines per 1000 km² in Old Crow in northern Yukon (Golden *et al.* 2007). Wolverines are harvested throughout Yukon mostly by fur trappers, and the harvest is managed by spatial and temporal regulation. Wolverine pelts must be sealed, and there is no bag limit. Trappers can harvest furbearers only in trapping areas assigned to individual, licenced trappers, and the harvest season occurs in winter from 1 November to 10 March. Approximately 132 ± 31 (mean ± s.d.) wolverines are harvested annually, and the harvest has remained steady over time (1988–2015; Kukka 2017).

Wolverine carcasses

We solicited voluntary submission of skinned wolverine carcasses by licenced fur trappers between 2005 and 2014. Trappers provided the location and harvest date of each wolverine carcass submitted for a CA\$30 reward. Trappers are legally required to check traps once a week at minimum; consequently, the actual kill date may be up to 6 days earlier than the reported harvest date. Carcasses were kept frozen at –20°C for 6–10 months before necropsy. There was no

incentive for fur trappers to submit or withhold information on particular sex or age class of wolverines they harvested.

We determined the sex of each carcass, and collected a tooth for aging. Sex was determined by the presence or absence of a baculum or a reproductive tract. Age was determined in a commercial laboratory (Matson's Laboratory LLC, Milltown, Montana, USA) via counting cementum annuli of a premolar, or, in rare cases (2%), a canine tooth. Wolverines with no cementum annuli were classified as juveniles; those with one cementum annuli were classified as subadults, and those with ≥ 2 cementum annuli were considered adults. Because the accuracy of age estimation for wolverines from cementum annuli is largely unknown, owing to a lack of studies comparing known-age wolverines and cementum age, error in age determination is possible.

Reproductive status of female wolverines was determined through dissection of the ovaries to determine the presence and count of corpora lutea (Banci and Harestad 1988), and macroscopic inspection of the reproductive tract for active gestation. A female was considered reproductive when corpora lutea and/or fetuses were present. Where applicable, we measured the mass of fetuses with an electronic scale (± 0.1 g), and calculated the mean fetus weight per litter. Wolverine kits are fully furred at birth and typically weigh >90 g (Blomqvist 1995, 2012). Thus, reproductive females were considered to be near parturition when their unborn kits were well developed and furred, with a mass approaching or exceeding 90 g.

Analyses

We assessed temporal autocorrelation by examining autocorrelation function plots for each age and sex class, over six time lags, using SYSTAT (version 13; Systat Software Inc., San Jose, USA). Substantial autocorrelation was noted if the correlation function exceeded the upper or lower 95% confidence interval. Correlograms did not show any substantial autocorrelation in our data, because all correlation functions were well within the 95% confidence intervals.

We tested for differences in the sex and age composition of the harvested population, and their interaction, using a two-way ANOVA, where sex and age class were the main treatments. We used the likelihood ratio chi-square (G -test) for testing for differences in the sex and age structure, and reproductive status,

among years. We used G -tests and paired Student's t -tests for investigating differences in the sex and age structure between early (1 November to 31 January) and late (1 February to 10 March) in the harvest season. We based the division of the early and late season on the approximate onset of wolverine denning (Inman *et al.* 2012b). We used R (version 3.1.1; The R Foundation) for all statistical tests, and $P \leq 0.05$ to denote statistical significance.

Results

Wolverine submissions

Trappers submitted 655 wolverine carcasses, including eight trapping seasons from 2005–06 to 2013–14. We were unable to administer the carcass-collection program in winter 2012–13. On average, 82 ± 11 (mean $\pm$ s.d.; range = 68–101) wolverine carcasses were submitted each season, which represented $67 \pm 8\%$ of the annual total harvest (range = 56–79%; Table 1). Cementum age was determined for 640 (98%) of 655 wolverines. Carcasses originated across Yukon and they were submitted throughout the trapping season, and our sample closely represents the spatial and temporal distribution of the total harvest. We are, thus, confident that our sample accurately reflected the entire harvest.

Wolverines were harvested throughout the trapping season from the beginning of November to early March. The harvest increased as the season progressed (Table 1); relatively few wolverines were harvested in November (6%), followed by December (21%), January (29%), February (32%) and early March (12%). The proportion of harvest between the early season (November through January) and the late season (February through early March) ranged from 40% to 70% and 30% to 60% among years respectively, but the difference was not significant ($G_7 = 11.1$, $P = 0.13$). However, the harvest rate (mean $\pm$ s.d., adjusted for the different lengths of the early and late seasons) was significantly higher in the late season than the early season (0.8 ± 0.2 and 0.5 ± 0.1 wolverines day $^{-1}$; $t_7 = -5.20$, $P < 0.01$).

Sex and age structure

The wolverine harvest was dominated by males ($F_{1,48} = 42.290$, $P < 0.001$) and young animals ($F_{2,48} = 4.173$, $P = 0.022$).

Table 1. Wolverine (*Gulo gulo*) carcass submissions from licenced fur trappers in Yukon from winter 2005–06 to 2013–14
Harvest month was unknown for some carcasses. Absolute numbers (n) are indicated in parentheses

Harvest season	Percentage of harvest submitted (n)	Percentage of harvests per month (n)				
		November	December	January	February	March
2005–06	70.8 (68)	1.7 (1)	19.0 (11)	31.0 (18)	31.0 (18)	17.2 (10)
2006–07	78.8 (78)	7.0 (5)	11.3 (8)	38.0 (27)	33.8 (24)	9.9 (7)
2007–08	66.9 (93)	3.4 (3)	23.0 (20)	32.2 (28)	26.4 (23)	14.9 (13)
2008–09	57.3 (75)	12.1 (8)	16.7 (11)	30.3 (20)	22.7 (15)	18.2 (12)
2009–10	75.4 (101)	6.1 (6)	35.7 (35)	13.3 (13)	35.7 (35)	9.2 (9)
2010–11	56.2 (73)	4.8 (3)	12.7 (8)	28.1 (24)	38.1 (24)	6.3 (4)
2011–12	61.4 (81)	5.6 (4)	9.7 (7)	26.4 (19)	44.4 (32)	13.9 (10)
2012–13	–	–	–	–	–	–
2013–14	67.2 (86)	3.9 (3)	33.8 (26)	29.9 (23)	22.1 (17)	10.4 (8)
Mean	66.7 (655)	5.6 (33)	21.3 (126)	29.1 (172)	31.8 (188)	12.3 (73)

The mean annual harvest consisted of 40% young males (juveniles and subadults), 25% adult males, 20% young females and 15% adult females (Fig. 1). The age structure by sex for males ($n=417$) was 30% juveniles, 33% subadults and 37% adults, and, for females ($n=223$), it was 28% juveniles, 29% subadults and 43% adults. However, the interaction term for sex by age class was not significant ($F_{2,48}=0.028$, $P=0.973$), suggesting that the overall age structure of harvest was similar for both sexes. The mean and median cementum ages of harvested animals were 1.9 ± 2.2 (s.d.) and 1 respectively. The mean ages of females (2.0 ± 2.4) and males (1.8 ± 2.2) in our sample population of harvested wolverines were not significantly different ($t_{422}=1.12$, $P=0.27$). The oldest male and female in our sample were estimated to be 11 and 12 years old respectively.

The female proportion of harvest ranged from 30% to 45% (Fig. 1), but the difference in sex ratio was not significant among years ($G_7=8.62$, $P=0.28$). The overall age structure differed significantly among years ($G_{14}=34.28$, $P=0.002$), and was most pronounced for juveniles. The proportion of juveniles in the harvest ranged from 12% (2007–08, $n=11$) to 41% (2011–12, $n=33$).

The mean sex ratio (years pooled) was 2.1 ± 0.7 (males per females) for the early season and 1.9 ± 0.8 for the late season, indicating a slightly higher female proportion of harvest during the onset of the denning season, but this difference was not significant ($t_7=0.89$, $P=0.40$). The proportion of young animals decreased as the winter progressed (from 79% in November to 54% in March), and the harvest of adults increased (from 21% in November to 46% in March). Adult females constituted 6%, 16%, 13%, 17% and 20% of the harvest in November ($n=2$), December ($n=20$), January ($n=22$), February ($n=32$) and March ($n=14$) respectively (Fig. 2).

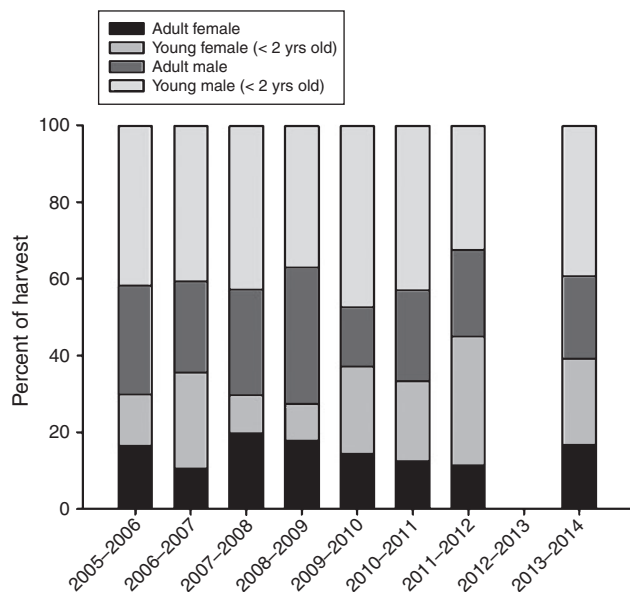


Fig. 1. The sex and age distribution of harvested wolverines (*Gulo gulo*) in Yukon from winter 2005–06 to 2013–14 (data were not available for the 2012–13 trapping season).

Reproduction

At the time of their harvest, 44% of females were reproductive. The proportion of reproductive females by cementum age class was 81%, 38% and 1%, for adults, subadults and juveniles respectively. Among adults, 64% of 2-year-old females were reproductive, increasing to >90% for females 3–5 years old, then dropping to 76% for females ≥ 6 years old. The proportion of adult females that were reproductive ranged from 71% to 100% among years, but the difference was not significant ($G_7=7.12$, $P=0.42$).

Active gestation was observed in 48 females harvested after mid-January, the majority of which were adults (85%), with the cementum age (mean $\pm$ s.d.) of 4 ± 2.1 years old. Those harvested in mid- to late January ($n=8$) were mostly in the early stages of gestation; only two females had discernible fetuses. In February, most females had discernible fetuses (83%; $n=29$), whereas in March ($n=9$), females had well developed fetuses or were postpartum. The average litter size was 2.8 ± 0.9 , on the basis of macroscopic observation of fetuses, with a similar average number of corpora lutea (2.7 ± 1.0). The sample size for litter size was too small in some years to allow comparison among years.

We were able to determine the harvest date and the mean mass of fetuses per litter for 23 female wolverines in our sample. We increased our sample size of unborn litters to 32, by including mean fetal measurements from females harvested during 2015–16. The mass of fetuses varied widely over the harvest dates, indicating individual variation in the timing of gestation, and, consequently, parturition. Unborn litters near parturition ($n=6$) were observed after mid-February (Fig. 3).

Discussion

We examined variability in the sex and age structure of harvested wolverines across broad spatial and temporal scales, so as to provide data that may be useful for managing harvest sustainability. We were particularly interested in the harvest of adult females within, and among, harvest seasons, given

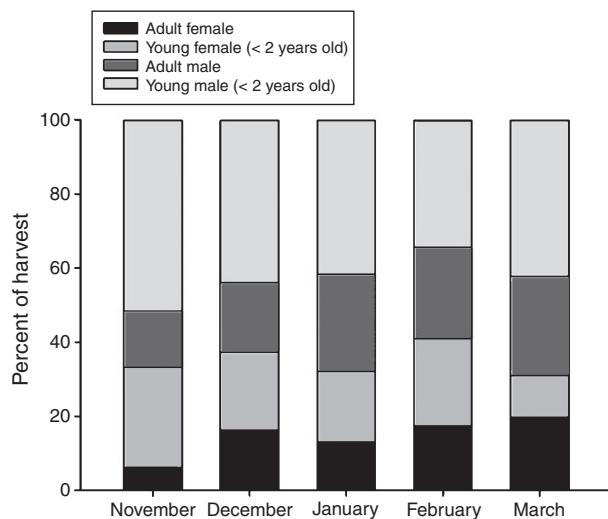


Fig. 2. The sex and age distribution of harvested wolverines (*Gulo gulo*) from November to March during 2006–14 in Yukon (years pooled).

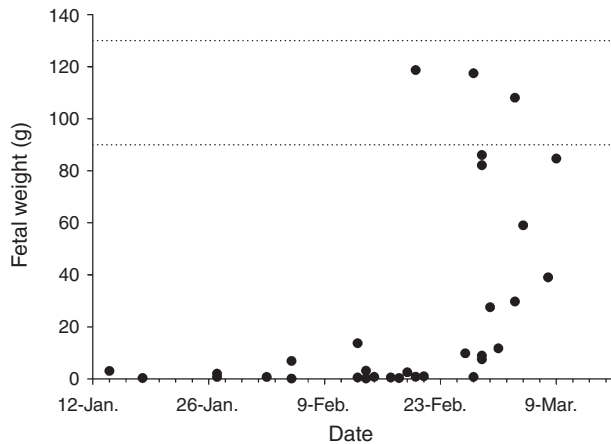


Fig. 3. The mean fetus weight of pregnant wolverine (*Gulo gulo*) harvested in Yukon from winter 2005–06 to 2015–16 ($n=32$; years pooled). The dashed lines represent the range of birthweights of wolverine kits in captivity in Europe. The birthweight data are from *G. g. gulo*, which may be larger overall than is *G. g. luscus* (L. Blomqvist, pers. comm.; Shilo and Tamarovskaya 1981; Blomqvist 1995, 2012).

that they are likely to be the most demographically important segment of the population (Dalerum *et al.* 2008). We also studied the reproductive characteristics of harvested females, and the fetal development in pregnant females, in relation to the timing of harvest so as to evaluate the effect of late winter harvest on breeding wolverines.

We found that the sex and age structure of harvested wolverines in Yukon is similar to that reported in other harvest studies on wolverines and other mustelids (Banci 1987; Strickland and Douglas 1987; Lee 1995; Lofroth and Ott 2007; Webb *et al.* 2013). Male wolverines, particularly young individuals, dominated the harvest. High proportions of young males are expected in harvested wolverine populations, because vacant areas created by the removal of resident animals may be filled by dispersing animals, which are typically young males (Magoun 1985). Dispersing animals are more vulnerable to being trapped, compared with residents, because they may travel widely in search of available territory, thus increasing their likelihood of encountering traps. Because males typically hold larger home ranges than do females (Persson *et al.* 2010), and, consequently, fewer home ranges are available to males, dispersing individuals may have to search widely for available territory. This may cause males to remain in the transient population for extended periods of time, even years (Magoun 1985; Inman *et al.* 2012a), and thus remain vulnerable to harvest for longer than females. In regularly harvested areas, home-range behaviour may be disrupted altogether because of insufficient time for individual territory establishment (Hornocker and Hash 1981; Banci 1987).

As with other northern carnivores occurring at low density, the survival of females, particularly adults, is important for the sustainability of wolverine harvest (Taylor *et al.* 1987; Dalerum *et al.* 2008). In our study, the mean annual female proportion of harvest was 35%, and the adult female proportion was 15% of the harvest. The harvest of female cohorts may be a management concern in some years, because the survival of females is

particularly important for species that have low reproductive output. For example, female proportions of harvest exceeding 30% for grizzly bears (*Ursus arctos*), and 40% for black bears (*Ursus americanus*), are considered as indicators of management concern. The harvest thresholds for adult females specifically were estimated near 8% and 20% respectively, for grizzly bears and black bears (Poulin *et al.* 2003; McLellan *et al.* 2016). To our knowledge, sex- and age-specific management thresholds have not been estimated for managing wolverine harvest. Further research is needed to assess the potential application of such thresholds for wolverine harvest. Simulation studies have suggested that migration, and the survival of adults and females, are important parameters for the persistence of harvested wolverine populations (Dalerum *et al.* 2008). Because wolverine trapping techniques are non-selective with respect to sex and age, conservative harvest strategies are required (Krebs *et al.* 2004). Further, wolverine harvest may be sustainable only if adequate harvest refugia exist (Krebs *et al.* 2004; Golden *et al.* 2007; Dalerum *et al.* 2008). Wolverine harvest in Yukon is spatially heterogeneous and concentrated in south-western Yukon (Kukka 2017). Consequently, sustainability of wolverine harvest should be assessed at a regional scale, because harvest rates and amount of harvest refugia are likely to differ among regions.

The age structure of harvested wolverines fluctuated significantly among years during our study. This may be due to annual variation in either juvenile abundance or their trap vulnerability. The abundance of juveniles in the winter population may vary depending on the reproductive success of females in the previous year, as well as their survival during their first summer. It is also possible that the vulnerability to trapping is not constant among years. During food scarcity, wolverines are likely to travel more in search of food. Because juveniles may be inexperienced in securing food, they may be more attracted to novel food sources, and, hence, more vulnerable to traps than are adults during food scarcity.

The increased overall harvest of wolverines in late winter could result from either increased trapping effort or greater vulnerability of wolverines to trapping, or a combination of both. We were not able to evaluate seasonal trapper effort, although we expected some increase in late winter owing to better snow and ice conditions for accessing trapping areas than earlier in the harvest season. Trap vulnerability of wolverines may change throughout the season, owing to factors such as food availability or snow depth. The proportion of adult wolverines in the harvest increased in late winter, although young animals formed the majority of harvest throughout the harvest season (>50% during all months). Adult males may extend their movements for breeding opportunities, and high energetic demands of reproduction may influence adult female habitat selection in late winter before denning (Magoun 1985; Magoun and Copeland 1998; Krebs *et al.* 2007; May *et al.* 2012).

Our findings confirmed that female wolverines do not typically reach sexual maturity until 2 years of age (Banci and Harestad 1988), because 81% of harvested adult females, but only 38% of subadults, were reproductive. Other studies have suggested that the prime age for successful reproduction for female wolverines is 4–7 years, and that successful reproduction

in wolverine further depends on the combination of age-related reproductive costs and winter food availability (Persson 2005; Rauset *et al.* 2015). In our study, more than 90% of 3–6-year-old females were reproductive, and the mean age of actively gestating females was 4 years old. Food availability for wolverines is largely unpredictable, because they rely largely on scavenging opportunities (van Dijk *et al.* 2008b). The diet of reproductive females may differ from that of males and non-reproductive females (Lofroth *et al.* 2007; van Dijk *et al.* 2008a; Koskela *et al.* 2013), suggesting they may make behavioural adaptations to optimise litter production. For example, preliminary results on the winter diet of wolverine in Yukon have suggested that snowshoe hare (*Lepus americanus*) may be an important food item, particularly for female wolverines (Robitaille, J.F.; Kukka P.M. and Jung T.S., unpubl. data).

Our study confirmed large individual variability in the timing of gestation and parturition, as has been reported elsewhere (Banci 1987; Inman *et al.* 2012b). Active gestation was not evident in our sample before mid-January. On the basis of a 45-day gestation period (Inman *et al.* 2012b), parturition would occur from late February onward. We also detected early stages of gestation in animals harvested after mid-February, predicting parturition for late March or early April. Because the wolverine harvest season extends to 10 March in Yukon, female wolverines near or postpartum may be legally trapped. The harvest of denning female wolverines is a potential concern regarding harvest ethics, because of the inevitable mortality of dependent kits in their natal den (*sensu* Parker and Rosell 2001). Establishing a harvest season to ensure total protection of breeding female wolverines is difficult, given that there is individual variation in the timing of reproduction. However, our data demonstrated that most pregnant wolverines are in advanced stages of gestation after mid-February, a time when they remain susceptible to legal harvest.

Our data demonstrated the value of data from carcass-collection programs for the management of wolverine harvest, particularly where the actual population data are absent. Our study pointed to management interventions that can be applied to promote the sustainability of the harvest of wolverines. Specifically, the late winter harvest is likely to have a larger impact on wolverine populations than is the early winter harvest, because of the increased proportion of adults in the harvest and the possibility of trapping breeding females that are near-term or postpartum. Because wolverines reproduce earlier than other non-hibernating furbearer species, restricting their harvest in late winter through an earlier harvest-season closure is recommended. Because wolverines may be susceptible to traps set for other furbearer species (e.g. wolves; *Canis lupus*), their incidental harvest in late winter should be further assessed.

Conflicts of interest

The authors declare no conflicts of interest.

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