



Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

Faculty of Forest Sciences

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Department of Wildlife, Fish, and Environmental studies

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Abstract

During the last five years, permitted quota of wolverine to be removed by depredation control have not been filled in the County of Västerbotten. Few hunting attempts have been successful. Because of this, issues regarding the depredation of reindeer may not be solved. The aim of this study was to evaluate the successfulness of hunting of wolverines for depredation control in Västerbotten County. Results from this study show that interviewees viewed depredation control as a positive management tool, but that possibilities for hunting were rather limited. The critical factor for a successful outcome of wolverine hunting was to find fresh tracks. However, possibilities for finding tracks were limited by weather and snow conditions. All hunting methods used were looked upon as being effective if they were conducted when weather and snow conditions were suitable. Hunting with dogs worked well during fall when there was little snow. Hunting by helicopter and snowmobile were most preferred in January, which also was the month where most wolverines were shot. Five out of seven interviewees were positive towards implementing quota harvest of wolverine in the future, if the hunting would be executed by moose hunters during the regular hunting season.

Key words: Wolverine, *Gulo gulo*, depredation control, quota harvest, hunting methods, semi-domesticated reindeer husbandry, qualitative interviews.

Sammanfattning

I Västerbottens län har kvoten för antalet järvar som fått fällas under skydds jakt inte blivit uppfylld de senaste fem åren. Få av de utförda jaktförsöken har varit framgångsrika, vilket kan medföra att järvens predation på ren inte minskar. Syftet med denna studie var att utvärdera jaktframgången vid skydds jakt efter järv i Västerbottens län. Resultaten från studien visade att studiens respondenter var positiva till skydds jakt som förvaltningsåtgärd, men att möjligheterna att utföra jakterna var begränsade. Att finna färsk järvspår ansågs vara den viktigaste faktorn för en framgångsrik jakt. Möjligheten att hitta färsk järvspår var i sin tur begränsat av väder- och snöförhållanden. Alla jaktmetoder ansågs vara framgångsrika när de valdes efter rådande väder- och snöförhållanden. Jakt med hund ansågs vara mest framgångsrikt under hösten när det fanns ett tunt snötäcke. Helikopterjakt och snöskoterjakt föredrogs att utföras i januari, vilket också är den månad där flest järvar har blivit fällda. Fem av sju respondenter var positiva till att i framtiden införa licensjakt efter järv, om jakten blir utförd av älgjägare under den allmänna jaktsäsongen.

Nyckelord: Järv, *Gulo gulo*, skydds jakt, licensjakt, jaktmetoder, rennäringen, kvalitativ intervju.

Introduction

Livestock depredation by carnivores is a common conflict worldwide, and carnivore conservation has to be balanced against social-economical, emotional and political issues (Liukkonen *et al.* 2009; Chapron *et al.* 2014). Therefore, carnivore populations are often managed by legal hunting, which is believed to achieve local acceptance of carnivores (Sæther *et al.* 2005). In Sweden, there are five native large carnivores; brown bear (*Ursus arctos*), grey wolf (*Canis lupus*), golden eagle (*Aquila chrysaetos*), Eurasian lynx (*Lynx lynx*) and wolverine (*Gulo gulo*) (Swenson & Andrén 2005). Two different types of legal hunting are used to manage the carnivore populations within population limits that have been set (Naturvårdsverket 2015 a; Linnell *et al.* 2010). *Quota harvest* is used to limit population size; and *depredation control* is used under certain circumstances to prevent damage (Naturvårdsverket 2015 b). For example, depredation control is used to manage the large carnivores' predation on reindeer (*Rangifer tarandus*), which is established general problem for reindeer husbandry and therefore the cultural heritage of indigenous Sámi people (Swenson & Andrén 2005). Danell (2009) estimates that 45,000 to 50,000 reindeer (almost 20 % of the winter population) are preyed upon annually by carnivores (Sametinget 2016 a). In accordance with a national management goal for large carnivores' reindeer depredation by large carnivores should not exceed 10 percent of winter herds (Proposition 2012/13:191).

Reindeer husbandry is a very important part of the Sámi people's cultural heritage, and it is protected by the Convention on Biological Diversity (CBD) (Article 8. In-situ Conservation) (CBD 1993). Participation in semi-domesticated reindeer husbandry is exclusively limited to Sámi people, according to Swedish constitutional law (Sametinget 2016 a). There are around 20,000 Sámi in Sweden, of whom approximately 2,500 rely on reindeer husbandry as fulltime employment (Informationscentrum 2009; Sametinget 2016 a). The area of reindeer husbandry is subdivided into 51 economic community associations called Sámi communities (Sametinget 2016 b). All total, Sámi communities cover an area of almost 50% of the country, and together the communities care for a reindeer population that varies in cycles ranging from about 225,000 and 280,000 individuals each winter (Sametinget 2016 a).

In many parts of Sweden, the main diet of wolverines is reindeer (Persson, Wedholm & Segerström 2010). The distribution of wolverines greatly overlaps with the area of reindeer husbandry in Sweden (Persson, Broseth & Svensson 2011). Depredation by wolverines creates a conflict between reindeer husbandry as a sustained cultural heritage, and wolverine conservation (Rauset 2013). Wolverines have a circumpolar distribution range, occupying tundra and boreal coniferous forests (Pasitschniak-Arts & Larivière 1995). Historically, wolverines were distributed from the northern to the southern parts of Sweden (Landa, Lindén & Kojola 2000). The population declined significantly after the mid-19th century because of persecution by humans. Thus, wolverines became protected in 1961 in Sweden. Furthermore, wolverines became protected by the Berne Convention (Convention on the Conservation of the European Wildlife and Natural Habitats) in 1979, and the European Habitats Directive in 1992 (Berne Convention 1982; Kaczensky *et al.* 2013). As a result Sweden is obliged to maintain a favorable conservation status for wolverines in their natural habitat. Today, the wolverine population has largely recovered owing to the actions taken for the protection of the species (Landa, Lindén & Kojola 2000; Chapron *et al.* 2014).

In spite of this progress, the Swedish wolverine population was classified as vulnerable in 2015 according to ArtDatabanken (2015). The population was estimated to consist of

approximately 585 (95 % CI 481-758) individuals (*Figure 1*) in 2015 (Naturvårdsverket 2015 c). The census method used for estimating the population is a survey of reproducing females (Persson & Brøseth 2011), and estimations for total population can be modelled from the number of reproducing females (Brøseth et al. 2010). However, the census has not been complete in some areas of Sweden, so it is possible that some reproducing females were not found (Brøseth & Eklund 2015).

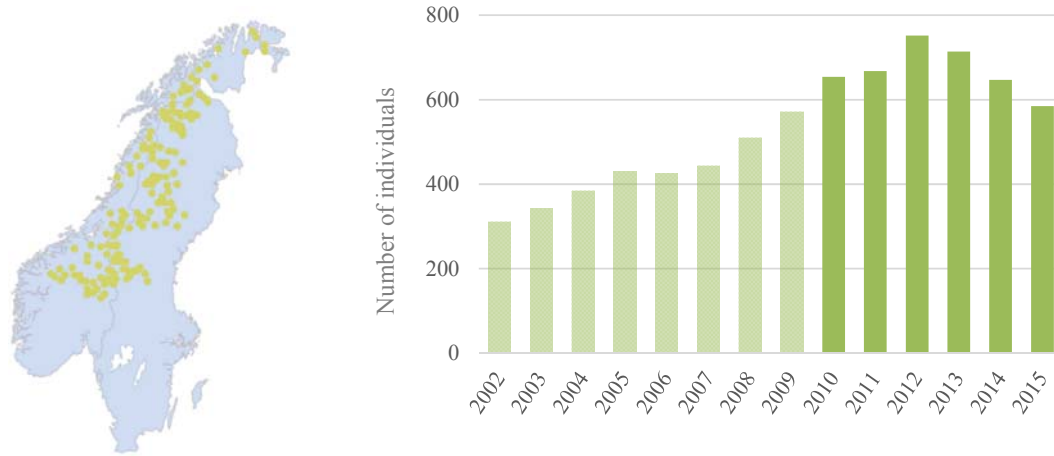


Figure 1. Left - map of reproducing wolverine females in Sweden 2015. Right - the Swedish wolverine population from 2002-2015. Source: Viltskadecenter and Rovbase¹.

Today, wolverines are only managed by depredation control (Naturvårdsverket 2015 b). The Swedish Environmental Protection Agency has delegated the authority to decide on hunting of wolverines for depredation control to the County Administrations of Norrbotten, Västerbotten, Västernorrland, Jämtland, Gävleborg, Dalarna, Värmland, Örebro, Västmanland and Uppsala (Naturvårdsverket 2015 d). According to Naturvårdsverket (2014 a), the wolverine population should be at or above 600 individuals, the established national reference value for a favorable conservation status, and be stable or increasing, in order to implement quota harvest as a management method.

In Västerbotten County, 25.5 reproducing female wolverines were found during the survey in 2015, which can be recalculated to 163 individuals (by multiplying the number of reproducing females by 6.38) (Brøseth & Eklund 2015; Backlund & Schneider pers. com.²). The minimum level for Västerbotten County is 23 reproducing females, corresponds to about 148 individuals. The management goal is 30 (191) reproducing females, with a lower and upper limit of 26 (165) and 42 (267), respectively. The density of wolverines differs greatly within the County and therefore the predation on reindeer differs between Sámi communities (Naturvårdsverket 2014 a). Since November 2012, the Swedish Environmental Protection Agency has been delegating the authority to decide on hunting wolverines for depredation control to the County Administration of Västerbotten and the

¹ <http://www.naturvardsverket.se/Sa-mar-miljon/Vaxter-och-djur/Rovdjur/Fakta-om-jarv/>, respectively; The Swedish Environmental Protection Agency.

² Linda Backlund & Michael Schneider, Västerbotten County Administration, personal communication, 2015-11-24

current delegation is valid until the end of December 2016 (Naturvårdsverket 2012 b; 2013; 2014 b; 2015 e). Reindeer owners who are affected by wolverine predation usually apply for depredation control in the fall as a preventive action prior to reindeer calving in the spring, according to Backlund & Schneider (pers. com.)¹. However, depredation control is the last option used. Certain criteria must be met before a county administration can permit depredation control (Naturvårdsverket 2012 a), for example if serious damage will develop or aggravate under current circumstances without depredation control, if hunting wolverines will not obstruct the maintenance of a favorable conservation status for the species in its natural range, and if no other adequate solution exists that can be used instead of killing the predators. The hunting methods that have been used during the period 2010 to 2015 were hunting with dog, helicopter, snowmobile, stalking, excavation of natal dens, and authorization of moose hunters to harvest wolverine (Länsstyrelsen Västerbotten 2010-2015, Länsstyrelsen Norrbotten 2010-2015, Länsstyrelsen Jämtland 2010-2015). However, according to the County Administration in Västerbotten few of the hunting attempts have been successful. Consequently, permitted quota of wolverines to be removed have not been fulfilled. As a result, problems with depredation of reindeer may not be mitigated.

¹Linda Backlund & Michael Schneider, Västerbotten County Administration, personal communication, 2015-11-24

Aim of the study

The main aim of this study is to evaluate the successfulness of hunting wolverines as a method for depredation control in Västerbotten County during the period 2010-2015, and explore respondents' attitudes to suggested future implementation of quota harvest as an alternative or complementary action to depredation control

I investigate this question by following approach:

1. Estimate the outcome of executed depredation controls,
2. Investigate which hunting methods have been successfully used in the counties of Västerbotten, Norrbotten and Jämtland,
3. Stakeholder attitudes to the successfulness of different depredation control methods in Västerbotten, and
4. Explore respondents' thoughts about a suggested implementation of quota harvest.

To deal with the first and second objectives I used data of successfully removed wolverines in the counties of Västerbotten, Norrbotten and Jämtland. The third and fourth objectives are looked at by qualitative interviews with representatives from five Sámi communities in Västerbotten County.

Method

This thesis is a collaboration between the County Administration in Västerbotten and the Swedish University of Agricultural Sciences. The purpose of the thesis arose because the wolverine population in Västerbotten County has increased in recent years. Thus, predation of reindeer has increased for some Sámi communities. Today, the problems are managed by depredation control, but few of the conducted hunting attempts are successful. Thus, the problems with wolverines are not remedied, and the affected party is dissatisfied with the management system of wolverines. This study is based on basic and applied research, and a combination of different methods was used, known as triangulation (Jick 1979). The methods are: a) Literature review on existing research of wolverine, b) Comparative analysis of data from the County Administrations of Västerbotten, Norrbotten and Jämtland, and c) Semi-structured qualitative interviews with representatives from the County Administration and Sámi communities in Västerbotten.

Study area

The main study area is the County of Västerbotten (*Figure 2, ID-letter AC*), where seven Sámi communities are located. Five of the Sámi communities have been chosen to participate in this study by the occasion that these communities have applied for and performed depredation control of wolverine. Västerbotten is located in the north of Sweden, and is dominated by boreal forest, mires and high mountains (Nilsson, Cory & Wulff 2014). Västerbotten County has an area of 54,672 km², and has a population of about 260,000 residents, of whom 345 are reindeer owners, caring for about 52,000 reindeer (Nationalencyklopedin 2015 a; Sametinget 2015).

This study also compares data of depredation control of wolverine in the Counties of Norrbotten (*BD*) and Jämtland (*Z*). The data were provided by the County Administration in Västerbotten, Norrbotten and Jämtland. Norrbotten County is the largest and northernmost county in Sweden with an area of 97,257 km² and about 250,000 residents, of whom 3,947 are reindeer owners, caring for about 150,000 reindeer (Nationalencyklopedin 2015 b; Sametinget 2015). Hence, 85 percent of all reindeer owners live in Norrbotten County (Sametinget 2016 a). Jämtland County is located in the northwest of Sweden with an area of 48,945 km² and has about 127,000 residents (Nationalencyklopedin 2015 c). In Jämtland County, 373 residents are reindeer owners who care for about 46,000 reindeer (Sametinget 2015).

Hunting methods that were used between 2010 and 2015 in the three counties are presented and described in Table 1 below. Hunting methods included: dog (1), helicopter (2), snowmobile (3), stalking (4), excavation of natal dens (5), and authorization of moose hunters to harvest wolverine (6). Västerbotten County has used the hunting methods 1, 2, 3, 4, 5 and 6 during this time period. Norrbotten County has used hunting methods 2, 3 and 5, while Jämtland County has used methods 1, 2, 3 and 6. All wolverines have been removed by rifle, shotgun or revolver during depredation control. I will use the term shot when



Figure 2. Map illustrating Counties of Sweden form 2007 with ID letters.

referring to depredation control that resulted in successfully removed wolverines, and the term harvest when referring to hunting with quota harvest.

Table 1. Descriptions of hunting methods used for the counties of Västerbotten, Norrbotten and Jämtland.

(Nr.) Hunting method	Description
1. Dogs	<i>One or two dogs pursue a wolverine until the wolverine is hold at bay or other opportunity to shoot the wolverine by foot is given.</i>
2. Helicopter	<i>Using (a) snowmobile(s) to track and encircle wolverine, then calling for a helicopter to finish the hunt by shooting the wolverine from the air.</i>
3. Snowmobile*	<i>Using (a) snowmobile(s) to track and chase the wolverine, and finish the hunt by shooting from the snowmobile or by foot.</i>
4. Stalking	<i>Pursue and shoot the wolverine by foot.</i>
5. Excavation of natal dens	<i>Excavating wolverine natal dens and shooting female with young.</i>
6. Authorization of moose hunters to harvest wolverine	<i>One moose hunting team had permission to shot wolverine if they encountered one during moose hunting.</i>

*Pursuit and shooting from snowmobile was practiced until 2013. Since then, only tracking and encircling by snowmobile was practiced, but not shooting from the snowmobile.

Each permit for depredation control has a time period of when hunts should be executed. In Västerbotten County, the hunting periods have ranged from September to January. Furthermore, Västerbotten County has not permitted hunting after the 15th of January, due to the fact that reproducing females could give birth in late January (Backlund & Schneider pers. com.¹) In Norrbotten County the time periods have ranged from October to June, where most of the permits for excavation of natal dens were conducted in spring. In Jämtland County, time periods have ranged from October to March.

The season for moose hunting lasts from the first Monday in September until the 31th of January in northern Sweden (Länsstyrelsen Västerbotten 2016). However, respecting the rutting season of moose, hunting is not allowed between the 25th of September and the 10th of October (Naturvårdsverket 2016).

Method

a) Literature review

A literature review of existing research was made to answer the study's objectives. To acquire the information SLUs web database with Google Scholar as the search engine was used.

b) Comparative data analysis

Data concerning applications for and documentation of executed depredation control of wolverine were collected from the County Administrations of Västerbotten, Norrbotten and Jämtland. This data were used to answer the first and second objectives, "*Estimate the outcome of executed depredation controls*" and "*Investigate which hunting methods have*

¹Linda Backlund & Michael Schneider, Västerbotten County Administration, personal communication, 2015-11-24

been successfully used in the counties of Västerbotten, Norrbotten and Jämtland”, and as a complement to the third objective “Stakeholder attitudes to the successfulness of different depredation control methods in Västerbotten”.

The data contained hunting permits after successful applications, quotas for depredation control, successfully executed hunts, hunting methods, hunting periods, and permitted weapons during 2010-2015 for the three counties. Permitted applications for depredation control of wolverine before November 2012 were processed by the Swedish Environment Protection Agency. The County Administration in Norrbotten could not acquire all necessary data concerning depredation control of wolverine. Also, a major part of data provided by Norrbotten County were lacking important information, for example the hunting methods used. This resulted in a large source of error for the comparative studies between the three counties. However, the data for the Counties of Västerbotten and Jämtland were complete.

c) Qualitative interviews

The purpose of the interviews were partly to contribute to the third objective, and primarily to answer the fourth objective; *“Explore stakeholders’ attitudes to implementation of quota harvest as an alternative or complementary action to depredation control”* The advantage of qualitative interviews is that they can provide an insight into social processes and perspectives of individual life situations (Magne & Solvang 1991). All interviews were semi-structured, which means that the questions were partly structured, but also allowed openness and flexibility within the questions. The questionnaire was arranged with five different themes regarding background, carnivores, management actions, depredation control, and quota harvest (*see appendix 1*). In total, the material consisted of about 27 questions.

The interviews were conducted with six representatives from five Sámi communities, and one Wildlife ranger employed at the County Administration in Västerbotten. The Wildlife ranger has participated in depredation control of wolverines. Contact information for the representatives from the Sámi communities were provided by the County Administration in Västerbotten. All interviewees are anonymous in this study. The interviews were conducted face-to-face when possible. This was the desired method, because it provided the interviewer greater control of the learning process. In face-to-face interviews one can for example notice the interviewee’s reactions and better gauge whether the interviewee understood the question correctly (Trost 2010). Four of the seven interviews were conducted face-to-face, the other three had to be executed by phone. All respondents consented to being recorded. The interviews were given and transcribed in Swedish. Then important findings were translated into English, and presented in a coherent text. To better understand wolverine management conflicts and to substantiate facts, two administrators at the County Administration in Västerbotten were also interviewed. These interviews were not included in the results, but rather were used to gain a deeper understanding of the management of wolverines and its problems in Västerbotten County.

Limitations

The County Administration in Västerbotten provided me with contact information for the participants in this study. Thereby, the County Administration selected the representatives, with whom they already had dialogues about the subject matter. The interviewees have

different positions within the Sámi communities and have different knowledge and experience of depredation control of wolverines. For example, some interviewees had participated in more wolverine hunts than others. This could of course affect the thoughts and views of wolverine management, if some reindeer owners experience more or less problems concerning wolverines than the other ones.

Only six representatives from five Sámi communities within the County of Västerbotten participated in this study. Therefore, it could be beneficial to include more interviewees to further understand management problems of the wolverine population. For example, 85 percent of the reindeer owners in Sweden live in the County of Norrbotten, which also contains the majority of the wolverine population. Another limitation is that there is no data of unsuccessful hunting attempts. Consequently, it is not possible to compare the differences in success between used hunting methods in this study.

Results

Objective 1. Outcome of executed depredation control

The total quota for depredation control of wolverine has not been met in the County of Västerbotten during the period 2010 to 2015. Only 42 percent of permitted animals were shot during depredation controls. In Norrbotten and Jämtland County, the figures are 48 percent and 35 percent, respectively. These data are presented in Figure 3. Excavation of natal dens during this time period was permitted in Västerbotten and Norrbotten Counties. In Västerbotten County, attempts to excavate a reproducing female were made in one case, but without any success. In Norrbotten County, permits to excavate eleven reproducing females, resulted in twelve shot wolverines. Data pertaining to the excavation of natal dens is not presented in Figure 3.

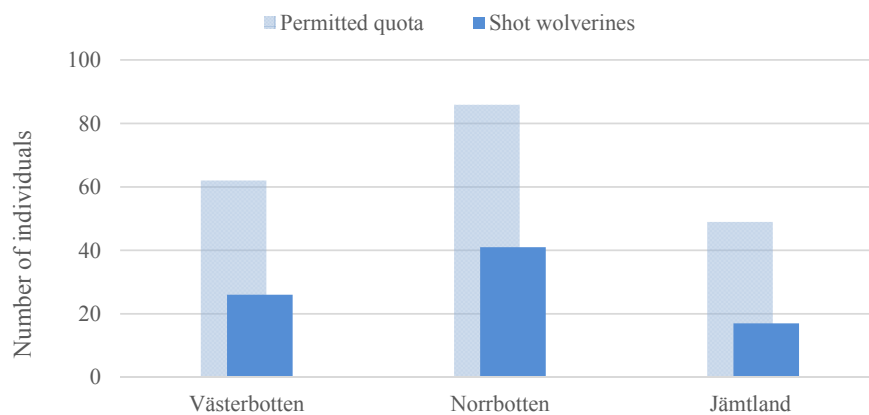


Figure 3. Number of permits to remove wolverines during depredation control (light red color), and shot wolverines during depredation control (darker red color), from 2010 to 2015 in Västerbotten, Norrbotten and Jämtland. Source: County Administrations' permits for hunting wolverine and reported results of conducted depredation control, provided from the County Administration of Västerbotten.

Objective 2. Hunting methods successfully utilised

The methods that have been used during depredation control differs among the counties. According to provided data from the County Administration, in Västerbotten County the majority of removed wolverines (11 out of 26) were shot during hunts with dogs (*Figure 4*). Hunting by helicopter resulted in seven shot wolverines, where one of the wolverines was tracked by helicopter and shot by foot. The use of snowmobiles resulted in seven shot wolverines, five shot from snowmobiles and two shot by foot. A hunter shot one wolverine by stalking during the moose hunting season in 2015. Västerbotten County differs from the other two counties in that the majority of removed wolverines in Norrbotten and Jämtland were shot using a helicopter (*Figure 5*). In Jämtland County a hunter shot one wolverine with the help of a dog during the moose hunting season in 2015. Norrbotten is the only county with successful excavation of wolverine natal dens, and twelve reproducing females were shot by this method. In Västerbotten County a single attempted excavation of a natal den was unsuccessful.

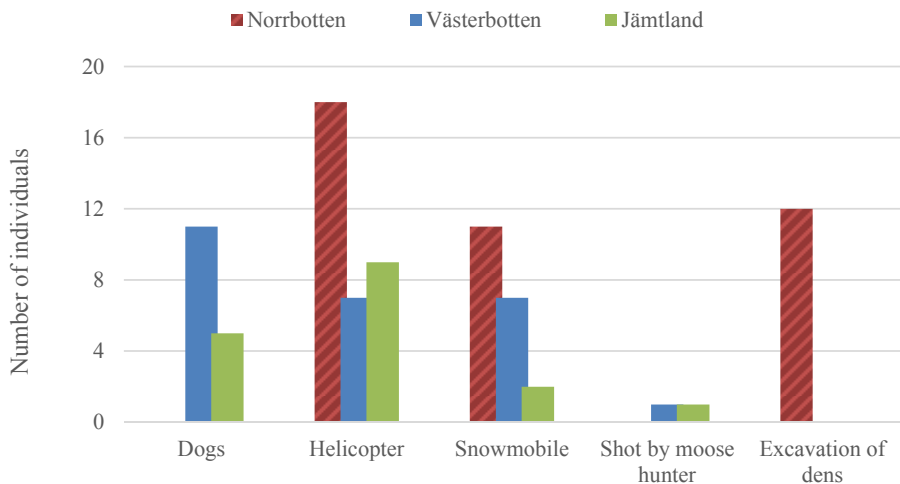


Figure 4. Successful hunting methods during depredation control of wolverines in Västerbotten, Norrbotten and Jämtland Counties, during the period 2010-2015. Data provided by the County Administration of Västerbotten.

The data shows that in Västerbotten County, hunting with dogs was permitted for 21 individuals and resulted in the removal of 11 wolverines. Use of helicopter was permitted for 34 individuals which resulted in seven removals. The use of snowmobiles were permitted for 35 individuals and seven individuals were removed by this method. Moose hunters were permitted to harvest five individuals, which resulted in one removed wolverine. Excavation of natal dens and use of carrion during still hunt have been permitted for one and six individuals, respectively, without success. Below (Figure 5) is the summary comparison of successful depredation controls for each method with respect to the number of times that method has been permitted.

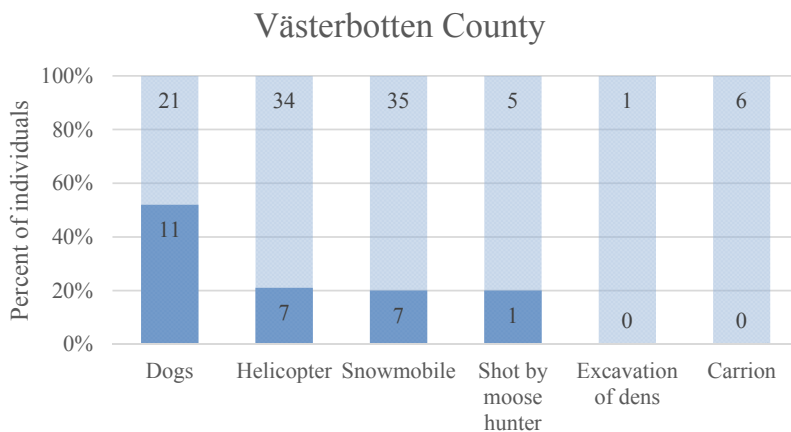


Figure 5. Percentage of successful depredation control hunting methods compared to the number of times each hunting method has been permitted to use for each wolverine individual. From 2010 to 2015 in Västerbotten County. Darker blue bars represent successfully used hunting methods, and lighter blue bars represent number of permits for each hunting method. Data provided by the County Administration of Västerbotten.

In Jämtland County, hunting with dogs has been permitted for 13 individuals, and five individuals have been removed by this method (*Figure 6*). The use of helicopters was permitted for 29 individuals, and this approach resulted in nine removed wolverines. Two wolverines were removed by using snowmobiles, which was permitted hunting method to use for 38 individuals. Moose hunters were permitted to harvest 19 individuals, which resulted in one removed wolverine. Excavation of natal dens has not been permitted during this period. Using trap and permission to use carrion during still hunt have been permitted for one and four individuals, respectively, without success.

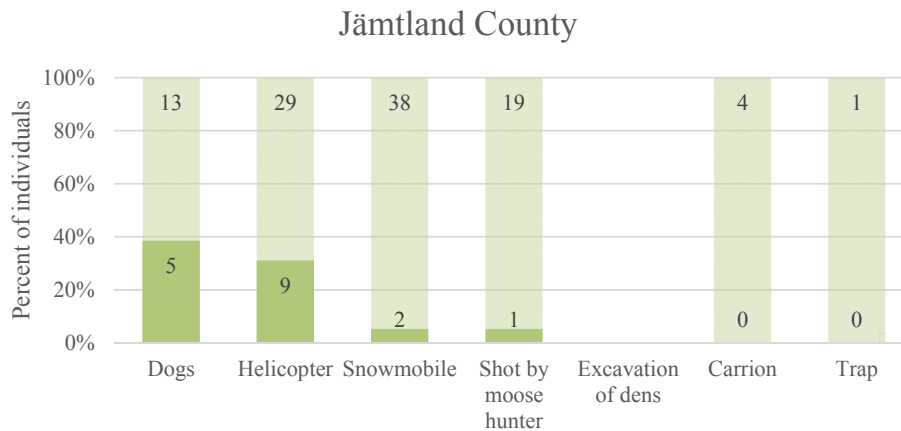


Figure 6. Percentage of successful depredation control hunting methods compared to the number of times each hunting method have been permitted to use for each wolverine individual. From 2010 to 2015 in Jämtland County. Darker green bars represent successfully used hunting methods, and lighter green bars represent number of permits for each hunting method. Data provided by the County Administration of Västerbotten.

Interviewees' experiences of depredation control of wolverine

In general, depredation control was thought of as a positive short-term management tool. The interviewees expressed that the advantage with this system was that hunting became directed to areas with high depredation. Alternative methods for managing wolverine depredation, for example excavation of natal dens and moving reindeer by truck from problematic areas, have been carried out but with less success. Excavation of a natal den was attempted once without success in Västerbotten, because the den was too deep underground. Negative factors identified regarding the removal of reindeer to coastal winter pastureland, a method that had been used earlier, included conflicts with hunters in the coastal areas and the likelihood of long-term damage of pasture land due to a harder grazing pressure on the slow-growing lichens. Some of the interviewees expressed that the regulations limiting the possibilities of how to carry out depredation control have been too narrow, which has made it difficult to effectively conduct the depredation control:

That is a question of interpretation when you are out in the terrain and conducting it [the hunt] [...] then it is really difficult to execute this hunting in a way that it would be effective. Therefore, I can say that I do not think it [depredation control] is good (interviewee 6).

However, some interviewees experienced that the preparatory work for requesting depredation control was more problematic than the execution of permitted hunts. Other

concerns were that the County Administration stopped the practice of shooting from snowmobiles, that tracking was no longer supported by a co-operating Wildlife ranger, and the economic cost of using helicopters. The interviewees experienced that the conditions for executing depredation control have become too narrow, which has affected the efficiency of depredation control of wolverine. As a rejection of the current conditions for hunting, one Sámi community have chosen not to execute permitted depredation control for two years:

Yes, we have not decided anything [hunting method to use] in our Sámi community, and we think that the system resembles nothing at all [the system does not work]. That is why we have not executed any depredation control the last years, the last two years (interviewee 3).

Weather and snow conditions were defined as major factors affecting the efficiency of hunting methods used.

[...] the weather has a huge impact. Nowadays, each fall has very different conditions; there can be snow crust or snow storms [...] and drifting snow which can lead to losing the tracks [wolverine tracks] (interviewee 2).

Objective 3. Stakeholder attitudes to the successfulness of different depredation control methods

When

For Västerbotten County the majority (12 individuals) of removed wolverines were shot during January (Figure 7). The use of helicopter resulted in five shot wolverines in January and two shot wolverines in November. Use of snowmobiles resulted in six shot wolverines in January and one in December. Use of dogs was the only successful method for all five months. A moose hunter shot one wolverine during moose hunting in October.

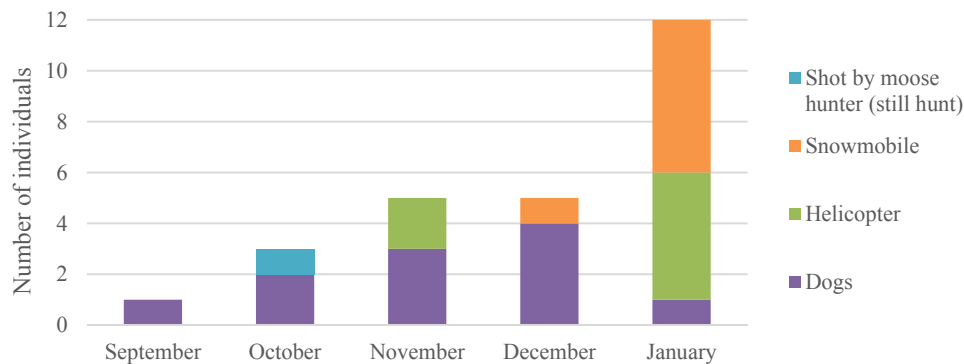


Figure 7. Used hunting methods for wolverines shot during depredation control, sorted by the wolverines' month of death. Time period 2010-2015, in Västerbotten County. Data provided by the County Administration of Västerbotten.

The results correspond with the other two counties (*Figure 8*), where the majority of removed wolverines were shot in January. In Norrbotten and Jämtland Counties, 16 and 10 wolverines, respectively, were shot in January. Data from both counties indicate shot wolverines in the period November to February. In addition, Jämtland County had removed wolverines in October. Norrbotten County was the only county reporting successful excavation of natal dens, actions which were carried out in March and April.

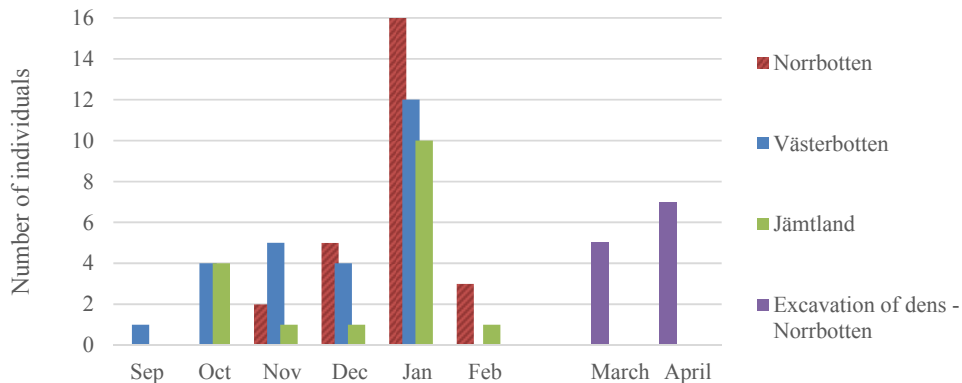


Figure 8. Months of death for shot wolverines, during the period 2010 to 2015 in Västerbotten, Norrbotten and Jämtland Counties and for excavated dens in Norrbotten County. Striped red bars represent Norrbotten County, blue bars represent Västerbotten County, and green bars represent Jämtland County. Purple bars represent wolverines removed by excavation of natal dens in Norrbotten County. Data provided by the County Administration of Västerbotten.

The interviewees were asked why they thought that most of the wolverines were shot in January. The majority assumed that it depended on the weather conditions. Snow condition, weather, and amount of daylight have been pointed out as the most crucial factors influencing the success of a wolverine hunt. The interviewees experienced that the snow cover is deeper in January, compared to the other months. Consequently, deep snow cover enables snowmobiles to travel faster and for wolverine tracks to be more easily seen from helicopters.

[...] It can be a week of groundwork for a successful hunt. You have to be out there constantly and know where the tracks are, know where they [wolverines] are. You have to know so many things for a successful hunt. That is nothing you do in one day, if you are not very lucky (interviewee 2).

The interviewees stated that reindeer owners usually are occupied from August to December when they are herding and moving reindeer from the mountains to winter grazing grounds in areas closer to the coast. Also, several of the interviewees experienced that they did not have the time to conduct depredation control during the given period for hunting. However, in January most of the work is done, which gives some reindeer owners an opportunity to execute depredation control.

Why

The interviewees had different experiences from hunting. Some interviewees have conducted more hunts than others, some had only used one hunting method, and some had only hunted wolverine once. However, all interviewees experienced that the wolverine had a large impact on their reindeer husbandry, by depredation and by scattering reindeer herds.

Hunting with dogs

The interviewees experienced that hunting with dogs worked well when the conditions were right, for example when there was a thin snow cover. A thick snow cover made it difficult for the dogs to move. However, the most critical factor for a successful hunt was to find fresh wolverine tracks for the dog to follow. Consequently, one needs to know in advance where a wolverine is located. Two interviewees were against the use of dogs, because they found the method inefficient. Two interviewees pointed out that hunting with dogs usually results in drawn-out hunts, but it could also be quick and effective:

Hunting with a dog can become a terribly drawn-out hunt, unless the wolverine climbs up a tree or something. He [the wolverine] can run on and on with a dog behind him (interviewee 7).

For a successful hunt the environmental circumstances have to be right and the dogs need to be well trained. Two of the interviewees were positive towards hunting with dogs, and their Sámi community has hired a professional hunter to use this method. Few people are involved in wolverine hunting, and there is a limited access to well-trained hunting dogs that follow wolverine tracks.

Hunting by helicopter

Using helicopter was the most preferred hunting method by the interviewees. It was thought of as a quick and effective method to achieve results. However, weather and snow conditions need to be right for the method to be successful:

It has to be perfect conditions; right tracking conditions, and right light so you can see the tracks clearly from the air (interviewee 4).

To be able to see and follow wolverine tracks from the air; the snow cover needs to be rather thick. Also, bad weather and poor daylight conditions affect the use of helicopter. Reindeer owners track and encircle a wolverine with snowmobiles, skis and snowshoes, before they call for a helicopter to finish the hunt. Using a snowmobile also requires a thick snow cover. Many of the interviewees expressed that they felt safe when using helicopter. This is because the shooting is conducted by the County Administration's employees and therefore there will not be any uncertainties about the hunt being conducted correctly:

It [the hunting] should go fast and easy. We do not have the time to deal with this [depredation control], it is rather demanding. And when the County Administration brings the helicopter; they have to manage it. Then it is no talk about if it was managed the wrong way (interviewee 4).

The major problem with helicopter is that it is an expensive method to use. Before 2015, the Sámi community and the County Administration shared the cost for the helicopter.

Today, to pay the expenses for helicopter use, the Sámi communities can apply for funding from the Sámi Parliament. Another problem was that the helicopter and the County Administrations employees sometimes were occupied by other assignments. This meant that reindeer owners that had encircled a wolverine had to wait for their turn until a helicopter could arrive and finish the hunt:

[...] We knew where we had the wolverines, we had encircled them and everything, we stood there and they could not come with a helicopter (interviewee 1).

Reindeer owners from different Sámi communities have been out hunting wolverines during the same occasions, due to the fact that good days for helicopter hunting were few during the given hunting period. Many of the interviewees expressed that weather and snow conditions for using helicopter and snowmobile would be more suitable in February to April than the current hunting period from September to January. During the current hunting period the thickness of the snow cover varies greatly, and the hours with daylight are few.

Hunting by snowmobile

Until 2013, hunting permits allowed the use of snowmobiles to pursuit and shoot wolverines. Since then, snowmobiles are merely used as a tool for tracking and encircling wolverines. Many of the interviewees held that hunting from a snowmobile was an effective method. This method was considered to be safe, from the interviewees' point of view, because County Administration staff did all shooting of wolverines from snowmobiles. Because of this, participating reindeer owners felt that they would not be accused of conducting the hunt incorrectly. Weather and snow conditions and a fresh track were thought of as critical factors for the hunt to be successful. For example, one of the interviewees described that if it snowed two to three centimeters the night before the hunt, then one could know that tracks that were found were less than twelve hours old. If the tracks would be older, it would take a long time to catch up with the wolverine by snowmobile. In addition, to travel fast by snowmobiles, the snow cover needs to be thick. Otherwise, it would be difficult to drive the snowmobiles fast enough to catch up with the wolverine and shoot it. January was considered to be the month with highest probability of thick snow cover, compared to the other months when depredation control was permitted. Consequently, using snowmobiles could be difficult to do successfully before January. Snowmobiles were considered to work well in the mountains, due to the wide and open areas. However, a problem with hunting in the mountains was snow drifting that could erase a wolverine track within minutes. One of the interviewees had tried this method but without success:

Well, it is the thing with the weather again, we never had such good weather that it was possible to implement it [shooting from snowmobile] (interviewee 2).

Authorization of moose hunters to harvest wolverine

In fall 2015, moose hunters were allowed to shoot wolverines during the regular moose hunting season, within one Sámi community in Västerbotten. This method was implemented as a test for a suggested future implementation of quota harvest. The method resulted in one moose hunter shooting one wolverine by stalking. Interviewees from this Sámi community described that the method worked well, and no conflicts occurred during

the period. Thus, harvesting wolverines by moose hunting could be an efficient complement to existing depredation control. Other interviewees did not have much to contribute regarding this new method, because it has only been implemented once.

Objective 4. Stakeholders' attitudes to implementation of quota harvest as an alternative or complementary action to depredation control

In the case of implementation of quota harvest of wolverines, moose hunters would be allowed to shoot a wolverine if they encountered one during the moose hunting season. In addition, moose hunters would be allowed to use dogs. Questions used for investigating reindeer owners' thoughts regarding a future implementation of quota harvest were: *What do you think about implementing quota harvest? Are there any benefits/disadvantages with quota harvest? In that case, what are they? When do you think quota harvest should be conducted, and why? And, who should conduct the harvest?*

Five out of seven interviewees were positive towards a future implementation of quota harvest. The advantages for both reindeer owners and the County Administration in Västerbotten would be that they do not need to spend as much time and resources on depredation control. In addition, it would create an opportunity for interested hunters to hunt wolverine:

I think that it [quota harvest] would be great. It is an approach that I believe in, in several aspects. Primarily because it gets cheaper when the hunters do it. And you get a completely different acceptance from the hunters, if you start hunting wolverines (interviewee 7).

By involving hunters, the chances of shooting wolverines could be higher because then the possibility of encountering a wolverine is higher when more people are out in the forest. Five of the interviewees were positive towards implementing quota harvest. They thought that moose hunting teams should be allowed to hunt wolverine during the regular hunting season. However, two interviewees were against an implementation of quota harvest. Their opinions were that the County Administration should conduct all removal of wolverines themselves, and that hunters' dogs could disturb the reindeer:

I think you should remove them [wolverines] quickly and easily by helicopter. Also, it is disruptive with the dogs, because the wolverines are where the reindeer are, so the dogs could run off and hunt reindeer instead. I prefer the helicopter, it seems simple (interviewee 4).

Other interviewees were also concerned about hunters' dogs. This is because wolverines are usually found near reindeer which could be problematic if the dogs start to hunt and scatter reindeer. None of the interviewees were fond of the thought of dogs chasing the reindeer during quota harvest, but some of them thought that it could be solved with good communication with the hunters:

Yes, one disadvantage is if they [the hunters] should happen to hunt in areas where we currently have many reindeer. If there should be quota harvest of wolverines by licensed hunters; then we will have a very close dialogue with them. So that they do not

harm us unnecessarily, when there are a lot of reindeer in the area. But we could manage that with a very good dialogue (interviewee 5).

Another concern was about how the quota of wolverines would be divided between the municipalities in Västerbotten County. The interviewees were unanimous that the quota for quota harvesting should be directed to areas with high depredation:

Then one could direct the hunt within certain areas, you would have quota harvest for two animals in Sorsele and two in Vilhelmina. I think it would be a good approach (interviewee 7).

The interviewees thought of future quota harvesting as a complement to the existing depredation control. If harvesting fails, then depredation control would be carried out as usual.

Discussion

The majority of the wolverines in Västerbotten County were shot during depredation control with dogs. However, hunting quota for depredation control, hunting methods used, and shot wolverines differ between the five Sámi communities that were interviewed in this study. For example, one Sámi community has shot 11 of the 26 wolverines during the study period. The same community has also been permitted the highest quota of wolverines to hunt, and has shot seven wolverines during hunts with dogs. However, there is no data collection of when reindeer owners have tried to hunt wolverine and failed. Consequently, one cannot draw any conclusions that hunting with a dog would be more successful than other hunting methods. The same applies for the counties of Norrbotten and Jämtland where the majority of the successfully removed wolverines have been shot during hunts with helicopter. However, according to Backlund & Schneider (pers. com.¹) helicopters are far more often utilised in Norrbotten and Jämtland Counties than in Västerbotten. Norrbotten County is the largest County in Sweden (Nationalencyklopedin 2015 b) and therefore greater distances have to be covered during wolverine hunts.

Nevertheless, an analysis regarding hunting methods used compared to the number of times each hunting method has been permitted to be used for each wolverine individual was made for Västerbotten and Jämtland County. Norrbotten County lacked necessary data for this analysis. In Västerbotten, for example, 21 wolverines were permitted to be removed by hunting with dogs. Thus, 11 wolverines were removed by this approach resulting in the quota for hunting with dogs being fulfilled by 52 percent. However, each permit almost always permits several methods for use in a depredation control for one or more wolverines. In the period 2010-2015 only a single permit allowed only one method. Since it is unknown how frequently a method has failed or if a method is not utilized we are unable to use the permit data as a measure of effectiveness of a method. The results (*Figure 5 & 6*) should be examined as an indicator for which methods are most often used with success. Furthermore the data does not state a reason for the use of a method. When asked, reindeer owners generally said, the method chosen suited the environmental conditions of the season and region in which the depredation control took place.

According to the interviewees, all methods could be successful. The crucial factor for a successful hunt rather were circumstances other than the method used, for example weather and snow conditions. When the hunting methods was adapted to those circumstances, the hunt could be successful. Wolverines tend to prefer remote, forested, and steep areas over flat and non-forested ones (Persson 2007). To access these remote areas, snowmobile and helicopter could be necessary. To be able to use these machines successfully, the right weather and snow conditions are key factors. However, with changing climate it is going to be increasingly difficult to predict weather and snow conditions. In the future, the snow period could be delayed until after January, and this scenario would make it difficult to hunt with both snowmobile and helicopter, given the current season for depredation control.

The majority of the interviewed persons experienced some difficulties with depredation control as management tool, both regarding the time needed for writing applications and the efforts needed to conduct the hunts. Permitted methods were too strict and during the fall and pre-winter the weather could be problematic. Some interviewees experienced that shooting from snowmobile was a highly effective method, and they expressed their

¹Linda Backlund & Michael Schneider, Västerbotten County Administration, personal communication, 2015-11-24

displeasure that the County Administration had stopped the practice in 2013. They expressed that since 2013 the only alternative was depredation control by helicopter, which was thought of as being too expensive. Previously, Sámi communities and the County Administration equally shared the cost for the helicopter that were generated within the boundaries of concerned Sámi community during hunts for depredation control. Since 2015, Sámi communities can apply for funding from the Sámi Parliament to pay the expenses for helicopter use during depredation control.

Hunting with dogs was considered to be most successful during autumn, preferably with a thin snow cover on the ground. According to Liinamo's *et al.* (1997) study, Finish hunting dogs had better results when following trails on snow compared to bare ground. One of the interviewees pointed out that there should be a discussion about the actual successfulness of hunting with dog. He argued that right now this method is successful, but it could be dependent on the abundance of wolverines within a certain area. According to Bischof *et al.* (2012) it is easier to hunt wolverines in areas where they are abundant. However, in areas where wolverines are scarce, a necessity for depredation control usually does not arise (Backlund & Schneider pers. com.¹).

During the interviews, wolverines were described as assiduous animals. Among the interviewees the use of dogs was believed to result in long-drawn hunts, were the wolverines could be forced to run long distances. According to Pasitschniak-Arts & Larivière (1995), wolverines can travel more than 30 km daily. However, hunting with dogs could result in a quick hunt, if the dog manages to make a wolverine to climb a tree, where it easily can be shot

Based on data from Västerbotten County, most wolverines have been shot during January and the majority has been killed by using helicopter or snowmobile. The interviewees suggested the same causes of why January had the largest amount of shot wolverines. For example, the snow cover is important when using machines such as helicopter and snowmobile during hunts. Snowmobiles require a deep snow cover to be able to travel fast enough when tracking and encircling the wolverines. In January, there is a higher probability that the snow cover is deep compared to November or December. Deep snow cover is also important when using helicopter, because then it is easier to see and follow tracks from the air. From October to December, the days are short and daylight is limited to just a few hours. In January, the days become longer for each passing day, which allows more time for hunting wolverines. Another benefit with hunting in January was that more reindeer owners had time over for hunting. In January, most of the work is done and the reindeer owners have time for other activities. Ideally, hunting wolverines by helicopter and/or snowmobile should be conducted from January to April. Then the snow cover would be deep enough, and the days would be longer. However, the County Administration in Västerbotten only permit execution of depredation control until the 15th of January (Backlund & Schneider pers. com.¹). This is because female wolverines give birth to their young in February and Mars, and in rare cases in late January (Pulliainen 1968). Therefore, the probability of shooting lactating females with dependent young would be high if depredation control would be allowed from January to April (Bischof *et al.* 2012). However, shooting a female animal which has dependent young is often considered to be unethical (Nilsen & Solberg 2006).

¹Linda Backlund & Michael Schneider, Västerbotten County Administration, personal communication, 2015-11-24

Excavation of natal dens and shooting females with cubs could be used as an alternative method during the spring. Norrbotten County has successfully used this method and shot at least 12 individuals in March and April in 2013 and 2015. In Västerbotten County, excavation of a natal den has been tried on one occasion, but without success.

Five of seven interviewees were positive towards implementing quota harvest of wolverine. The two interviewees that were negative thought that the County Administration should conduct all removal of wolverines. Thus, they stated that nobody else would be involved and the concerned Sámi community could choose to participate if they wanted to. The fact that the majority of the interviewees have positive attitudes towards an implementation of a quota harvest will probably make the management of wolverines in Västerbotten easier. However, at the moment quota harvest of wolverines cannot be implemented. The size of the wolverine population has to be above the minimum levels for both Västerbotten County and Sweden as a whole. Västerbotten County has a wolverine population above the minimum level, but according to the latest census report the Swedish wolverine population was around 575 individuals. This means that the wolverine population is beneath the national reference value of 600. However, the latest census was not complete for some parts of Sweden (Brøseth & Eklund 2015). Therefore, it is difficult to determine if the wolverine population actually consists of less individuals than the national reference value. Nevertheless, quota harvest of wolverine could be relevant in the future.

All of the interviewees expressed thoughts about when and where the quota harvest should be conducted and who would be hunting the animals. According to them, the hunting should be conducted from the start of the regular moose hunting season. The interviewees were unanimous that moose hunting teams should be authorized to shoot wolverine during moose hunting. Many hunters are out in the forest during this time, which increases the probability of encountering wolverines and to harvest them. Some of the interviewees did not believe in permitting quota harvest in the mountain regions. The reasoning includes that there could be reindeer nearby, and if dogs are used, they can chase reindeer instead. The majority had the opinion that hunting in forests close to the mountains and in the coastal areas of the county could be allowed. Some interviewees meant that dialogues with the hunters could solve most of the problems. Good communication will probably be essential when managing dogs and reindeer during a possible future quota harvest.

The data of depredation control in the County of Norrbotten is not complete, which is a major limitation when comparing the three counties. For Norrbotten County, information was missing on several vital subjects, for example regarding the hunting method used when hunts were successful and to what extent permitted quotas for depredation control actually were filled. The cause for the lack of data from Norrbotten was that none of the employees at the County Administration had the time to provide this study with the information needed.

The fact that the majority of the interviewees had positive thoughts of quota harvest will benefit the County Administration if quota harvest is to be implemented in the future. The interviewees were receptive towards quota harvest as method of removal, but the method requires good communication between participating hunters, the County Administration, and the concerned Sámi communities. Problems could arise if the reindeer owners were not allowed to conduct depredation control parallel with the quota harvest when needed. Their view of quota harvest is that it would be a complement to existing depredation control.

However, the factors suggested to have the largest impact on hunting success were weather and snow conditions, which cannot be controlled. Hunting with dogs requires no snow or little snow, whereas using helicopters and snowmobiles requires snow to be effective. Thus, permits for depredation control would preferably be flexible in the use of hunting methods, in order to be possible to execute with a higher probability.

Conclusion

1. In Västerbotten County during the last five years the total hunting quota of 62 wolverines has not been filled. Only 26 wolverines have been shot during the period. The results for the other two counties were 41 out of 86 for Norrbotten County, and 17 out of 49 for Jämtland County.
2. In Västerbotten County, hunting methods used were dogs, helicopters, snowmobiles, and stalking by moose hunters. Hunting methods used in the County of Norrbotten were helicopter, snowmobile and excavation of natal dens. In Jämtland County, hunting method included dogs, helicopters, snowmobiles, and shot by moose hunter with dog.
3. A successful hunt is achieved by using a method that suits the circumstances. Weather and snow conditions and access to fresh wolverine tracks were the most critical factors for an efficient hunt. Hunting with dogs was more successful during fall and pre-winter when only little snow covers the ground. Interviewees expressed that dog hunting has been efficient, but often it results in a drawn-out hunt. Helicopter and snowmobile hunting was most successful during January, when the snow cover was thick. Helicopter hunting and snowmobile were the most preferred hunting methods according to the interviewees. These methods were also considered to be safe methods, due to a participation of County Administration staff in the hunts. This protected participants from accusations of illegal hunt execution.
4. Five out of seven interviewees were positive towards implementing quota harvest of wolverine. Preferably, the hunting would be executed by moose hunters during the moose hunting season. Also, the Sámi communities would need to have a close dialogue with involved hunters. Some interviewees expressed their worries about hunting dogs disturbing the reindeer, and others thought that the County Administration should execute all depredation control themselves.

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Appendix

Appendix 1. Interview template

Interview template for reindeer owners within Västerbotten County, performed in Swedish.

Nr	Tema 1. Vem är du?
1	Kan du beskriva vem du är och hur länge du varit renskötare?
2	Har du erfarenhet av rovdjur?
3	Har du jagat rovdjur?
Tema 2. Rovdjur - järv	
4	Hur ser påverkan av rovdjur ut i er sameby?
5	Kan du beskriva när järven är ett problem? Tid på året? Områden?
6	Kan du beskriva vad som hänt med järven de senaste 5 åren? Förändring?
Tema 3. Åtgärder	
7	Nu skulle jag vilja att du utvecklar din syn på järven och då är jag intresserad av att veta vilka åtgärder ni använder för att hantera problem med järv. Typ av åtgärder?
8	Beskriv vad du tycker om skydds jakt för att hantera antalet av järv? Varför? Bättre metoder?
9	Är järven lätt eller svår att jaga? Varför?
Tema 4. Skydds jakt	
10	Kan du nu beskriva hur du tycker att jaktframgången varit de senaste 5 åren? Problem? Vad har varit bra/dåligt? Samarbete med Länsstyrelsen?
11	Beskriv vad du anser är en lyckad skydds jakt efter järv? Effektiv? Billig?
12	Vilken eller vilka jaktmetoder tycker du var framgångsrika?
13	Vilken jaktmetod anser du att samebyn har mest kontroll över?
14	Någon annan metod som du tror skulle vara framgångsrik?
15	Vilka metoder anser du är dåliga? Varför?
16	När är den eller de jaktmetoderna framgångsrika? Tidpunkt?
17	När är den eller de jaktmetoderna inte framgångsrika? Varför var den/de jaktmetoderna framgångsrika (eller inte) anser du? Väder?

18 Snö?

Tema 5. Licensjakt

19 Vad anser du om att införa licensjakt efter järv i Västerbotten?

Om positiv:

20 När på året bör licensjakt utföras?

21 Inom vilka områden bör licensjakten äga rum?

22 Bra/dålig metod för att kontrollera populationen?

23 Vilka ska få delta i en ev. licensjakt? De med jakträtt? Älgjägare? Jaktkort?

Om negativ:

24 Varför dålig metod?

25 Varför inte inom vissa områden?

26 Varför inte den tiden på året?

27 Anser du att licensjakt är bättre/sämre än skyddsjakt? Varför? Alternativ?

Interview template for reindeer owners within Västerbotten County, performed in Swedish, translated to English.

Theme 1. Who are you?	
1	Can you describe who you are and how long you been a reindeer owner?
2	Do you have any experience with large carnivores?
3	Have you hunted large carnivores?
Theme 2. Carnivores - wolverine	
4	How does large carnivores influence your Sámi village?
5	Can you describe when the wolverine is a problem? Time of the year? Areas?
6	Can you describe the situation with wolverines over the last 5 years? Any changes?
Theme 3. Actions	
7	Now, I want you to explain your view of the Wolverine, and I am especially interested in actions you take to deal with the problems caused by Wolverine.
8	Describe what you think of depredation control as a tool to manage the amount of Wolverines? Why? Any better methods?
9	Is the Wolverine easy or difficult to hunt? Why?
Theme 4. Depredation control	
10	Can you describe your view of the successfulness of depredation control of wolverine over the last 5 years? Problems? Good and bad? Cooperation with County Administration?
11	Describe your view of successful depredation control? Effective? Cheap?
12	Which method(s) do you think were successful?
13	Which method(s) do you think the Sámi community has the most control over?
14	Any other method(s) that you know of that could be successful?
15	Which method(s) do you think are bad? Why?
16	When are the method(s) successful? Time? Date?
17	When are the method(s) not successful?
18	Why do you think the method(s) were successful (or not)? Weather? Snow?

Theme 5. Quota harvest

- 19 What do you think of introducing quota harvest as a hunting method in Västerbotten County?
- If positive:*
- 20 Which time of the year should quota harvest be implemented?
- 21 Where, in which areas, should quota harvest take place?
- 22 Good/bad method to manage the population?
- 23 Who should participate? Those with hunting rights? Moose hunters? Small game hunters?
- If negative:*
- 24 Why is it a bad method?
- 25 Why not in those areas?
- 26 Why not that time of the year?
- 27 Do you think that quota harvest is better or worse than depredation control? Why? Alternatives?

SENASTE UTGIVNA NUMMER

- 2016:2 Ecological requirements of the three-toed woodpecker (*Picoides tridactylus* L.) in boreal forests of northern Sweden
Författare: Michelle Balasso
- 2016:3 Species Composition and Age Ratio of Rock Ptarmigan (*Lagopus muta*) and Willow Grouse (*Lagopus lagopus*) Shot or Snared in The County of Västerbotten: Possible Implementations For Grouse Winter Management
Författare: Alisa Brandt
- 2016:4 Prevalence of Puumala virus (PUUV) in bank voles (*Myodes glareolus*) after a major boreal forest fire
Författare: Seyed Alireza Nematollahi Mahani
- 2016:5 Dispersal of young-of-the-year brown trout (*Salmo trutta* L.) from spawning beds - Effects of parental contribution, body length and habitat
Författare: Susanna Andersson
- 2016:6 Intra and interhabitat migration in juvenile brown trout and Atlantic salmon in restored tributaries of the Vindelriver
Författare: Matti Erikoinen
- 2016:7 Skogsarbete i björnområde – en pilotstudie om arbetsmiljöfrågor
Författare: Moa Walldén
- 2016:8 Älgavskjutning och slaktviktsutveckling Malingsbo-Klotenområdet
Författare: Sofie Kruse
- 2016:9 Immediate effects on the beetle community after intensive fertilization in young Norway spruce (*Picea abies*) stands
Författare: Martin Johansson
- 2016:10 Effectiveness of a fish-guiding device for downstream migrating smolts of Atlantic salmon (*Salmo salar* L.) in the River Piteälven, northern Sweden
Författare: Linda Vikström
- 2016:11 Artificial gap creation and the saproxylic beetle community: The effect of substrate properties on abundance and species richness
Författare: Nils Bodin
- 2016:12 Extended phenotypes in the canopies of Norway spruce
Författare: Christofer Johansson
- 2016:13 Comparison of three different indirect methods to evaluate ungulate population densities
Författare: Sabine Pfeffer
- 2016:14 Estimation of maximum densities of young of the year brown trout, *Salmo trutta*, with the use of environmental factors
Författare: Johanna Wärnsberg