2022

Framework for Transboundary Cooperation on Management and Conservation of Wolverines in Fennoscandia

Participating authorities: Ministry of Agriculture and Forestry of Finland, Norwegian Environment Agency, Swedish Environmental Protection Agency

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The Framework for Transboundary Cooperation on Management and Conservation of Wolverines in Fennoscandia describes how the relevant authorities in Finland, Norway, and Sweden plan to further develop and strengthen the cooperative management of the Fennoscandian wolverine populations in a way that is adapted to Fennoscandian challenges and conditions especially taking into account the reindeer herding and Sámi culture.

This document is not legally binding, rather it describes the history of cooperation between governments and research institutions, and outlines ongoing and future cooperation to secure viable wolverine populations in Fennoscandia.

It is important to acknowledge that this Framework builds on the Agreement between the Finnish Ministry of Agriculture and Forestry, the Norwegian Ministry of Environment, and the Swedish Ministry of Environment on developing collaboration on large carnivores – brown bear, wolf, lynx and wolverine of the 12th of August 2011. It is also necessary to recognise the important work done by the Large Carnivore Initiative for Europe in illuminating the need for transboundary cooperation in the challenging task of large carnivore management. Finally, it must be noted that Finland and Sweden are members of the European Union (EU) and thus bound by the EU Habitats Directive, whereas Norway is a signatory party to the Bern Convention, but not a member of the EU, and thus not bound by the EU Habitats Directive.

This document is the result of a close collaboration between relevant management institutions in Finland, Norway, and Sweden. Furthermore during drafting of this document the experts involved participated to the Fennoscandian Wolverine Workshops organised by the Life Euro LargeCarnivores –project. The second workshop was planned jointly with the experts drafting this document and the project personnel of the Life-project.

This document defines a common goal and identifies the actions needed to reach this goal. The Ministry of Agriculture and Forestry of Finland (MAF), the Norwegian Environment Agency (NEA), and the Swedish Environmental Protection Agency (SEPA) are dedicated to realising the goal set out in this document.

This is the second tri-lateral framework document between management authorities in Finland, Norway, and Sweden. The framework itself and the actions outlined herein will be evaluated and revised every six years in accordance with the reporting cycles of the EU Habitats Directive. The appendices will be reviewed and revised when necessary. This framework is thus valid through 2028.

Signed electronically

Jaana Husu-Kallio Permanent Secretary Ministry of Agriculture and Forestry	Ellen Hambro Director General Norwegian Environment Agency	Björn Risinger Director General Swedish Environmental Protection Agency
5/12/2022 Helsinki Date Place	7/12/2022 Trondheim Date Place	1/12/2022 Stockholm Date Place

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Seuraavat henkilöt ovat allekirjoittaneet tämän asiakirjan sähköisesti /

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This document has been signed electronically by the following persons:

Husu-Kallio Jaana 91213917D

2022-12-05

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List of Acronyms

In this document, the following acronyms will be used:

FWA	Finnish Wildlife Agency
LUKE	Natural Resources Institute Finland
MAF	Ministry of Agriculture and Forestry (Finland)
NEA	Norwegian Environment Agency
SEPA	Swedish Environmental Protection Agency

1. Common goal

The overarching goal of the Framework for Transboundary Cooperation on Management and Conservation of Wolverines in Fennoscandia is to support the long-term survival and favourable conservation status of the wolverine population in Norway, Sweden and Finland, by deepening the transboundary cooperation in management and research and by securing the connectivity within the population and thus allowing sufficient levels of gene flow. In addition, conflict mitigation and conflict management, especially towards the reindeer husbandry is an important common goal across Fennoscandia.

2. Background

Managing species across national boundaries is challenging. Most wildlife species are monitored, managed, and harvested based on regulations and limitations set by national authorities. While the Bonn Convention provides a framework for the conservation of truly migratory species, not all populations that disperse across country borders are covered under this convention. The Bern Convention and the EU Habitats Directive provide relevant countries with a framework for the successful management of their respective wildlife populations, and advocate for cooperation between countries to enhance management of transboundary populations covered by the convention.

Both the Standing Committee of the Bern Convention and the EU Commission have endorsed the guidelines for Population Level Management Plans for Large Carnivores in Europe[1] proposed by the Large Carnivore Initiative for Europe. Two fundamental concepts are recognised in this guidance document:

1) The unit for conservation planning should not be only the proportion of a population that falls within a given state's or country's boundaries. Rather it should be the entire biological unit, involving all administrative units within its distribution.

2) Conservation of large carnivores requires their integration with human activities in human-dominated landscapes. This means coexistence between large carnivores and humans, which is not always easy to achieve. It almost always requires active management (such as reintroduction, translocation, hunting, and lethal control) of large carnivore populations and coordinated planning with conflicting land uses and activities.

As is noted in the guidance document, the need - and the acceptance for - different management approaches will vary greatly throughout Europe. It is therefore essential that the Fennoscandian countries establish a framework which is both coordinated and flexible in order to permit local adaptation of the means employed to achieve a global vision. In this regard reindeer herding, which is in the essence of the traditional Saami culture in Fennoscandian countries, should be given a special consideration. Since semi-domesticated reindeer graze freely in the natural pastures, similar damage mitigation measures used for example in sheep farming, from a Swedish/Finnish perspective, are not applicable.

In Europe, present populations of wolverines are found only in the central to northern parts of Norway, Sweden, Finland and Russia. Therefore, especially Sweden, Norway and Finland – as

[1] Linnell J., V. Salvatori & L. Boitani (2008). Guidelines for population level management plans for large carnivores in Europe. A Large Carnivore Initiative for Europe report prepared for the European Commission (contract 070501/2005/424162/MAR/B2).

parties to the Bern Convention (*Convention on the Conservation of European Wildlife and Natural Habitats (10.09.1979, Bern*) - have a special responsibility to protect and manage their wolverine populations in a way that wolverine remains a functional part of the European fauna. Also, the European distribution of the wolverine partly overlap with the traditional reindeer herding areas of the Saami, the only recognised European indigenous people.

Sweden, Norway and Finland have signed the Bern Convention with no reservations for the wolverine. The wolverine is listed in Appendix II (strictly protected fauna species). Useful and necessary actions have to be taken to enhance the special protection of species listed in Appendix II; especially forbidden is every form of capture, keeping or killing, the wilful disturbance and the possession and trade with these species. Exceptions can be granted under following conditions: prevention of serious damages on livestock, culture and property; public health and safety reasons; use for scientific purposes, restocking and re-colonisation.

The wolverines in Sweden and Finland are additionally protected by the Habitats Directive *(Council Directive 92/43/EEC, Conservation of Natural and Wild Fauna and Flora, ABL L 206, 22.07.1992)* of the European Union. The wolverine was included as a priority species in the Habitat directive when Finland and Sweden joined the EU in 1995. However, wolverine is listed only in Annex II of the Habitats Directive which means that its habitats need to be protected as Natura 2000 areas. Wolverine is not included in either of the species protection Annexes IV or V unlike brown bear, lynx and wolf which are listed in the Annex IV of the Directive (except wolf in the Reindeer herding area in Finland is listed in the Annex V).

2.1. Present cooperation agreements

Historically, information flow and monitoring methodology related to large carnivore management have been largely internal processes within each of the Fennoscandian countries, with limited information exchange between countries. With growing large carnivore populations and increased knowledge about the cross-border distribution of these populations, information sharing and collaboration efforts have become a priority.

In 1991, the Environmental Council of Northern Finland, Norway, and Sweden established a working group with representatives from Nordland, Troms, and Finnmark counties (Norway), Norrbotten and Västerbotten counties (Sweden), and Lappland county (Finland). The working group's main task was to produce a report on the status of large carnivore populations in Fennoscandia and to develop a framework for coordinated population monitoring. As a result of this process, new methodology was implemented, field personnel in Norway and Sweden were connected in organised networks, joint research projects were established, and joint reporting between all three countries, e.g. on population numbers, became more common. This first attempt at regional transboundary cooperation has since been developed into a more refined and larger scale Fennoscandian cooperation. Also, Norway, Finland and Sweden constituted a coordinating group on research regarding large carnivores as early as 1996.

Cooperation between the Fennoscandian countries has been further supported by a political consensus that the transboundary nature of large carnivore populations necessitates joint, transboundary management efforts. In 2011, the Ministry of Agriculture and Forestry of Finland, the Norwegian Ministry of Environment, and the Swedish Ministry of Environment signed a consensus statement on cooperation priorities. This political agreement resulted in increased monitoring efforts, and the establishment of a Norwegian-Swedish large carnivore management database (Rovbase), with reciprocal access to data. In 2012, Norway and Sweden established a

Memorandum of Understanding on data sharing and developed additional protocols for joint reporting on the annual population status of shared Scandinavian large carnivore populations.

In terms of management, Finland, Norway, and Sweden have faced similar challenges as a result of the expansion of large carnivore populations in Europe. This has necessitated regular meetings between management authorities, led to joint financing of research projects, and resulted in a significant increase in information flow and accessibility, both for management authorities and for the public.

Below is a list of currently active bilateral and trilateral agreements relating to cooperative management of large carnivores in Fennoscandia. The documents can be requested from the respective authorities in each country.

- Agreement between the Ministry of Environment, Sweden, the Ministry of Environment, Norway, and the Ministry of Agriculture- and Forestry, Finland in developing collaboration on large carnivores – brown bear, wolf, lynx and wolverine. 12 August 2011. *(Överenskommelse mellan Miljödepartementet, Sverige och Miljöverndepartementet, Norge och Jord- och skogsbruksministeriet, Finland om utvecklat samarbete om stora rovdjur- björn, varg, lodjur och järv. 12 augusti 2011).*

- Memorandum of Understanding regarding the establishment and continuance of a public web-based database (Skandobs) for geographic information on large carnivore observations in Norway and Sweden (Norwegian Institute for Nature Research and Swedish Environmental Protection Agency). 25 March 2012.

- Memorandum of Understanding regarding the establishment and continuance of a monitoring system for large carnivores in Sweden and Norway (Norwegian Environment Agency and Swedish Environmental Protection Agency). 25 March 2015.

- Framework for Transboundary Cooperation on Management and Conservation of Wolves in Fennoscandia (Ministry of Agriculture and Forestry of Finland, Norwegian Environment Agency and Swedish Environmental Protection Agency). 6 October 2020.

2.2. The Fennoscandian wolverine population

The size and distribution of the Fennoscandian wolverine population have varied over time, and is currently monitored intensively by management authorities in the three countries. Genetic studies have found some degree of population structure, especially between the sub-population in eastern Finland and the rest of the Fennoscandian distribution. While wolverines in eastern Finland have probably been continuously connected to Russian sub-populations, the Scandinavian sub-populations have probably been small and partly isolated during many generations, leading to very low levels of genetic diversity. The size, distribution, trend and structure of the Fennoscandian wolverine population is described in detail in Appendix 1.

2.3. Management

Although Finland, Norway, and Sweden have ecological, social, and cultural similarities, the wildlife management systems differ significantly between countries. A thorough description of wolverine management in each country is provided in Appendix 2. A major challenge is that contrasting management goals in Sweden and Norway inflict on wolverine management in both countries. More extensive lethal control on the Norwegian side of the border creates a source-sink

dynamic with asymmetric migration rates, as documented in areas close to the border in the southern distribution area[2]. Keeping the Swedish part of the population above the reference values thus becomes more difficult, as well as keeping the Norwegian part of the population at the population goal.

3. Established cooperation

Recently published research on transboundary wildlife management has emphasised the importance of cooperation in management and helped identify areas where management could benefit from increased cooperation[3]. This chapter outlines cooperation between Finland, Norway, and Sweden with respect to wolverine management. Here, cooperation is described both in terms of ongoing and well-established activities. Over the past decades, management authorities and researchers in Finland, Norway, and Sweden have developed a close dialogue with regards to wildlife management in general and large carnivore management in particular.

3.1. Administration

- *Regular meetings.* The framework parties organise a minimum of one physical or virtual meeting each year. This annual meeting is used to keep framework parties informed of national developments in politics, policy, and research, as well as to maintain an open dialogue regarding transboundary management challenges. Additional meetings can be arranged if specific needs arise.

- *Online space for shared documents.* NEA has created an online project room for storing meeting minutes, relevant research reports, national management policy documents, Memorandums of Understanding, and other relevant agreements and guidelines. This platform is available to all framework parties.

3.2. Monitoring

- *Common methodology.* Since 2012, Norway and Sweden have collaborated in the monitoring of large carnivore species using a shared methodology and shared database for registering observations and other relevant data (Rovbase). In order to revise and develop methodology, SEPA and NEA have established a working group with experts from both countries. Norway and Sweden use the same markers to analyse biological samples and identify individual genetic profiles. In recent years, the increasing volume of samples analysed has necessitated the switch to single-nucleotide polymorphism (SNP) chip methodology for wolverine DNA analyses. Samples from new identified individuals are additionally analysed using microsatellite methodology in order to match and compare them to individuals from previous years.

Even though genetic analyses have not been used in estimating population size in Finland, non-invasive genetic research has been conducted in Finnish Lapland and East-Central Finland. Furthermore, Metsähallitus (Forest and Park Service) field personnel in Lapland have collected scats as part of a joint Nordic monitoring program in the alpine region and analysis have been done by NINA, Norway. Monitoring of Finland's wolverine population is based on the number of

[2] Gervasi, V., Linnell, J.D.C., Brøseth, H. and Gimenez, O. (2019) Failure to coordinate management in transboundary populations hinders the achievement of national management goals: The case of wolverines in Scandinavia. Journal of Applied Ecology 1–11.

[3] Bischof, R., Brøseth, H. and Gimenez, O. (2015. Wildlife in a Politically Divided World: Insularism Inflates Estimates of Brown Bear Abundance. Conservation Letters 1–9.

wolverine tracks crossing wildlife triangle transect lines (each 12 km) in counts conducted in winter, mostly in February, and areal snow track counts in the three northernmost municipalities where only a few wildlife triangles exist.

- *Common evaluation meetings.* In order to evaluate and develop the common monitoring system, SEPA and NEA organise an annual Scandinavian meeting where field- and management personnel from both the national and regional levels participate. Representatives from Finland are also regularly invited to these meetings, but the language used here is Norwegian/Swedish. Beyond improvement of the monitoring system, the meetings also aim to facilitate cross-border cooperation at the regional level by providing a meeting place for relevant personnel.

- *Shared databases.* Norway, Sweden and to a limited extent Finland and Denmark are reporting data on large carnivores to a joint database Rovbase 3.0 (rovbase30.miljodirektoratet.no). Data on observations, tracking efforts, dead animals, individuals, reproductions, damages and DNA-samples are collected and entered by various authorities and individuals involved in large carnivore census and management. Data can be entered using the web interface, batch import or through the field app for mobile phones. Individual data posts and summary reports can be visualised by managers on built-in maps or using a variety of export functions. Through Rovbase, limited large carnivore population information is also made available to the public through online interfaces (rovbase.no and rovbase.se).

The public in Sweden and Norway can install the Skandobs-application on the mobile phone for reporting of observations or traces of large carnivores on the map. Observations may be accessible for others in the app, and observations need to be verified by the respective field authorities at the county level in order to be part of the monitoring scheme.

- *Access to databases.* Management authorities in all three Fennoscandian countries provide access to their respective large carnivore databases (i.e., Rovbase, Tassu, and Riistavahinkorekisteri) to staff in each of the other Fennoscandian countries to the extent that such access is in accordance with national laws. This allows relevant staff to follow monitoring efforts related to transboundary territories or migrating individuals.

- *Common DNA-group.* In order to coordinate the use of DNA in monitoring and management of large carnivores, the authorities from all three Fennoscandian countries have established a DNA-working group with representatives from each country. This group will meet regularly in order to hold all member countries updated on current and future plans for DNA-use within each country. The group will work towards future implementation of common methodologies and genetic databases of wolverines across all three countries.

3.3. Research

- *Coordination of research financing.* Authorities from each of the Fennoscandian countries finance numerous wildlife research projects in their respective countries. In addition, Norwegian and Swedish authorities co-finance several research projects. The Swedish Wolverine Project (www.wolverineproject.se), is one such co-financed project which has coordinated research on the Scandinavian wolverine population since the late 1990ies. In addition, a number of other transboundary projects such as Grensevilt (grensevilt.weebly.com), RovQuant (aqegbio.wixsite.com/home/rovquant-1) and WildMap (www.researchgate.net/project/WildMap) also conduct wolverine research. In addition, researchers from all three countries (for example from The Swedish University of Agricultural Sciences, The University of Oulu, The Norwegian Institute

for Nature Research and Natural Resources Institute Finland) collaborate extensively on various population genetic, conservation genetic and ecological research topics.

3.4. Field work

Field personnel are involved in several aspects of wolverine management. This involvement includes, but is not limited to, monitoring, damage documentation, and evaluation of incidences where large carnivores roam or establish territories close to human settlements.

- *Cooperation between field personnel.* Field personal in the northernmost regions of Finland, Norway, and Sweden meet regularly in order to discuss cooperation in large carnivore monitoring and common management challenges, as well as to calibrate field methods. As a result of these meetings, field personnel in the north have established effective cooperation with their transboundary counterparts.

- *Transboundary monitoring efforts*. Transboundary cooperation between field personnel is not only essential for maintaining information exchange, but also for ensuring the rational use of resources in remote or sparsely populated areas. Cooperation between Swedish and Norwegian field personnel is well developed at the local scale in order to facilitate tracking of individual wolverines who cross the Norwegian-Swedish border. Furthermore, in border regions between Norway and Sweden field staff from both countries occasionally conduct monitoring work on the other side of the border, in order to use resources effectively.

4 Planned and proposed cooperation

Transboundary cooperation on wolverine monitoring and management between Finland, Norway, and Sweden has intensified continuously over the past 10 years. A large degree of cooperation and harmonisation of science-based methods is necessary for the population monitoring to be effective and trusted by all stake holders. Furthermore, information should be shared on constructive means to minimise human-wildlife conflicts. Several cooperative measures have recently been initiated, and more are planned to start in the near future. These measures are described in this chapter.

4.1. Securing the connection between populations

One of the long-term goals in the management of wolverines in Fennoscandia is to increase the genetic connectivity between the different sub-populations. It is especially important to facilitate gene-flow between the Finnish-Karelian part of the distribution and the rest of Fennoscandia (see appendix 2 for details). To allow such transboundary migration, the authorities in all three countries will have to collaborate to identify and increase survival of migrants.

- *Identification of migrants.* Individuals migrating from the Finnish-Karelian part of the population should be identified using a combination of mtDNA and autosomal SNP-markers. Markers suitable for this are currently included in the SNP-marker panel used in Scandinavian census and management and it is important that they are also included in the Finnish markers. Ideally, all newly identified individuals should be screened, based on genetic analyses of for example non-invasively collected samples. We should also aim to identify individuals migrating within Finland, between the southern (Finnish-Karelian and Western Finland) parts of the population and Northern Finland, as this is identified as the main barrier to gene flow within Fennoscandia. When genetically important

migrant individuals are detected, information should be shared between authorities in the three countries in order to initiate suitable management actions.

- *Continued survey of genetic connectivity.* In order to evaluate the measures taken to increase the gene-flow within the Fennoscandian wolverine population, it is important to continuously survey the genetic connectivity. Such studies should be performed at least every five years (approximately once each wolverine generation).

- *Monitoring of temporal trends in genetic variability.* Given the very low levels of genetic variability identified in the Scandinavian wolverine population, it is important to keep monitoring how this develops through time. Such studies could utilize existing data from genetic markers (microsatellites and SNPs) genotyped in a large proportion of the population, or regularly generate genome re-sequencing data for a representative sample of individuals.

- *Allowing reproductive wolverines to establish in the north-western part of Finland and north-eastern part of Sweden.* In order to increase possibilities for gene-flow across the Swedish-Finnish border, it would be desirable to establish stable breeding populations on both sides of the border if sufficient genetic diversity in the Scandinavian wolverine population cannot be achieved by natural migration. The establishment of a breeding population in this region would likely facilitate the increase of natural migration also to other parts of Scandinavia.

4.2. Genetic monitoring

Genetic methodology has been used extensively in monitoring and management of wolverines in Scandinavia for several decades. DNA-samples (mainly in the form of scats, secretions, hair and urine) are primarily non-invasively collected during tracking on snow, but also tissue samples from dead individuals are routinely analysed. Using SNP-genotyping, samples are assigned to species, sex and individual. In some cases, relatedness between individuals is also evaluated. Sweden and Norway use the same genotyping technology (Fluidigm SNP) and an identical marker panel. In the transition phase from microsatellite to SNP markers, individuals not represented in the SNP-database are also genotyped with a panel of 18 microsatellites as many wolverines that was detected in previous years have not been SNP-genotyped. Results are also registered into a joint database (Rovbase). In Finland, LUKE has decided to shift from microsatellite-methodology to the same cost-effective single-nucleotide polymorphism (SNP) methodology used in Norway and Sweden for the analysis of Finnish samples. This shift in methodology is an ongoing process that will require close cooperation between LUKE, Rovdata and the Swedish University of Agricultural Sciences. Several Finnish wolverine samples have already been genotyped with the Scandinavian SNP panel, enabling this transition.

Joint genotype database. An important collaboration step is to establish a joint genotype database for all three countries (for genotypes of samples and individuals). This should ideally be incorporated in Rovbase and be accessible for all labs performing genotyping of wolverine samples. Results on genotypes should be stored for individual samples as well as consensus genotypes of individuals. All data from Finland (not only samples genotyped elsewhere) should be registered in the joint database.

Capture-recapture modelling. Genotyping results from DNA samples together with data on search effort (GPS-tracks from field work) can be used in a capture-recapture modelling framework to estimate population size and spatial distribution. Such population modelling has been (and is continuously being) developed in Norway (RovQuant) and has been included in a DNA-based

census methodology in Sweden and Norway for the last three years. Similar models are also being developed in parallel in Finland. A long-term aim would be to utilise the same DNA-based methodology and modelling in all three countries. This would include joint methods for DNA-sampling, genetic analyses and DNA-based population size modelling. Such a system would enable population size estimation across the entire Fennoscandian population as well as regular evaluation of gene flow and connectivity.

4.3. Exchange of knowledge, management tools, and expertise

Although cooperation is already established between the Fennoscandian countries at different administrative levels, an increased exchange of knowledge and expertise would be beneficial for management. The exchange of personnel has been identified to be of particular interest as it encourages development and network building for future intensified cooperation. Also, the traditional knowledge of the reindeer herders and the Sami people should be recognised in the regard.

- *Increase personnel exchange between countries*. The authorities in all three Fennoscandian countries will work to facilitate and encourage exchange opportunities for personnel at all levels of management (both administrative and field personnel) and at different geographic scales (national and regional). One example of such an exchange is that Finnish field personnel are be invited to the Scandinavian management evaluation meetings. Future personnel exchanges could also include longer and more formalised opportunities. International agreements regarding exchange opportunities for public servants are already established by The Nordic Council[4].

- *Extended transboundary monitoring efforts*. Finland explores to allow the Norwegian field staff to occasionally conduct monitoring work on the Finnish side of the Finnish-Norwegian border in order to facilitate tracking and to collect DNA-samples of individual wolverines that cross the border. Transboundary cooperation between field personnel is not only essential for maintaining information exchange, but also for ensuring the rational use of resources in remote or sparsely populated areas.

- C*ontinuous meetings for mitigating of conflicts.* Each of the Fennoscandian countries have developed unique strategies and tools to manage their respective wolverine populations. In order to sufficiently share each country's unique competences and management tools, the respective authorities will work to communicate the effectiveness of various strategies, and to facilitate the implementation of these strategies and tools in the other countries when needs are identified. For example, this would include sharing of best practices in reindeer herding to achieve effective preventative measures. Involvement of reindeer herders in monitoring and research could be an important prerequisite to take traditional knowledge into account and to optimize mutual understanding.

-*Reducing illegal killing*. Illegal killing is a serious concern for wolverine conservation. Collaborate efforts across borders should be further developed in order to monitor and mitigate the extent and effects of illegal killing. Collaboration of this type was initiated three years ago between Statens Naturoppsyn in Nordland fylke (Norway) and Norrbotten County Administrative Board (Sweden).

[4] https://www.norden.org/no/information/om-nordisk-tjenestemannsutveksling-tjut

4.4. Research

Increased coordination in research financing would be beneficial to all Fennoscandian countries, particularly with regards to research efforts that address issues relevant for transboundary management. Swedish EPA has the ambition to provide long-term basic funding to national-wide large carnivore research project in order to secure the availability of expertise and continued work to improve management related methods and research.

- *Encouraging transboundary scientific cooperation.* Where similar research projects are ongoing or proposed in more than one Fennoscandian country, collaboration between institutions will be encouraged in order to produce more robust and widely applicable results, as well as to facilitate comparisons of potential differences between wolverine sub-populations.

- *Explore source-sink dynamics in wolverines.* Replacement of wolverines are compensated, but there is limited knowledge on the local source-sink implications on the population dynamics, e.g. fecundity, age distribution and density. Increased cub mortality caused by unrelated males is another effect that could be induced by source-sink relations. In Norway a number of wolverines is killed each year in order to reduce damage on semi-domestic reindeer and free grazing sheep. Optimally this conflict should be solved by culling in a way that inflict consequences on a genetic level as negligible as possible.

- *Wolverines in forested areas.* Wolverines are increasingly settling in forested areas in southern parts Finland, Sweden and Norway, characterised by co-existence with bear, lynx and wolf, and probably a better access to prey and carcasses compared to mountainous areas. Research is needed to investigate how this environment affects wolverine life history.

- *Human dimension of wolverine conservation*. Further research on the human dimension perspective and social sustainability of wolverine conservation, has been suggested as an important research topic to develop further. Evaluation of conflict mitigation efforts should also be included here. This relates especially to tolerance levels for reindeer herding and the interactions between reindeer herding and wolverines. There may be large regional and seasonal differences that need to be taken into consideration.

- *LIFE project possibility in the future.* Since wolverines are present only in Finland and Sweden among the EU-member states, there should be a great chance to obtain funding from the EU-Life Fund. This possibility should be elaborated further in the future.

5. Future prospects and goals

With the Frameworks for Transboundary Cooperation on Management and Conservation of Wolves and Wolverines in Fennoscandia as a foundation, the respective authorities in Finland, Norway, and Sweden have identified additional opportunities to cooperate with respect to the management of other large carnivore species. The relevant authorities from each of the three Fennoscandian countries therefore aim to initiate development of a similar framework for the management of brown bear in Fennoscandia starting in 2023.

Wolverine populations in Fennoscandia

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Introduction

The wolverine population in Fennoscandia has a continuous (but partly fragmented) transboundary distribution across the northern boreal and alpine regions in the Finland, Norway and Sweden. Within this region some further differentiation occurs at the genetic level (see under Population Genetics below). Since the population is transboundary, management responsibility is divided between several countries. But the status of the populations and the threats they face differ between countries, as do management approaches.

The Fennoscandian wolverine population forms the westernmost part of a larger Eurasian population stretching continuously across the whole northern part of Russia, Mongolia and China (Figure 1) while wolverines in northern USA and Canada are often treated as a separate sub-species (*Gulo gulo luscus*; Wilson & Reeder 1993).

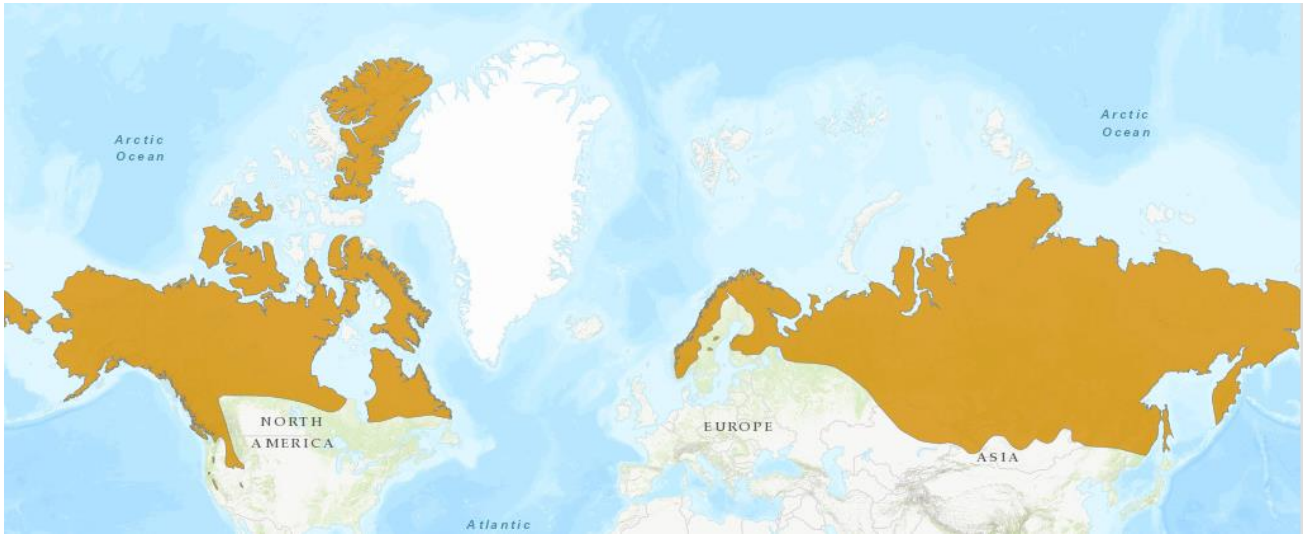

Figure. 1. Approximate world distribution of the wolverine (source: IUCN red list, https://www.iucnredlist.org/species/9561/45198537).

Population size

The size and distribution of the wolverine population in Fennoscandia have varied over time and these dynamics have been closely monitored by management authorities in all three Fennoscandian countries. The following chapter describes the history and development of the wolverine populations in Finland and Scandinavia with regard to both population size and distribution. As the monitoring systems differ between Finland and the Scandinavian countries, caution should be exercised when comparing estimates from these two populations.

Finland

As in the other Fennoscandian countries, wolverines were historically persecuted in Finland. The population, as revealed by the hunting statistics, showed a steady decline from before the turn of this century, when about 50 individuals were killed annually, to less than half the numbers around 1930. The Finnish wolverines probably reached a minimum population level before receiving protection. Wolverine protection outside the reindeer herding area in 1978 and extending of this protection to the whole country in 1982 were the first signs of contemporary wolverine population conservation in Finland. Since this watershed the almost extinct population has recovered gradually. The minimum population was 50-80 animals during the 1980's and the population distribution was shrinked so that the main population was in the northern parts of the country and the smaller part of the population was located adjacent to the Russian part of Karelia in the east-central part of Finland.

National systematic population management has been practised since 1996 via establishment of six separate wolverine management areas and population development goals. Wolverine conservation has also comprised the re-introduction of wolverines from the reindeer herding area to the Suomenselkä area in the Western Finland during 1979-1998. A comprehensive population management plan was approved in 2014.

Since the wolverine was protected and the systematic population management started, an overall recovery has been observed. The yearly population growth has been approximately 10 % between 1989 and 2020. However, the population growth was even higher in the last 10 years (Figure 2).

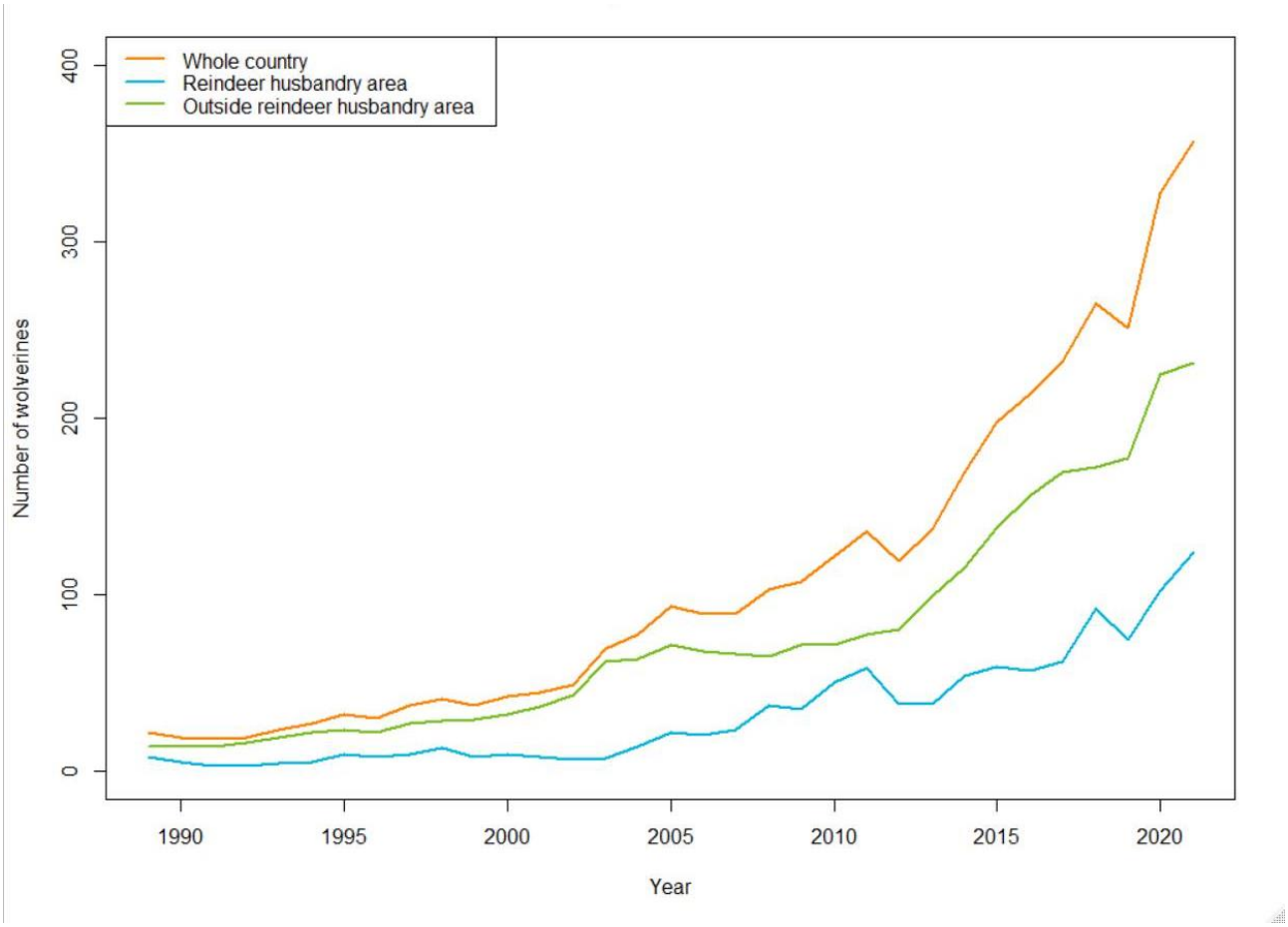

Figure 2: Most probable number of wolverines based on wildlife triangle observations from 1989-2021.

According to the latest population estimate there is approximately 385-390 wolverines in Finland. Also, the distribution of the wolverine population has been expanded and today most of the wolverines live outside the reindeer herding area of Northern Finland (Figure 2).

Scandinavia

The wolverine distribution in Scandinavia before 1800 is poorly known, but in the 1800s it covered most parts of Norway, except the southernmost periphery, and alpine and boreal areas from southcentral to northern Sweden (Landa et al. 2000). Main distribution was likely in the northern alpine and boreal areas in the reindeer husbandry area (Ekman 1910; Lönnberg 1936). According to harvest statistics from 1827-1934, wolverines occupied boreal forests down to Värmland and Dalarna in southern Sweden. The population was presumably influenced by human persecution already in the early 1800s, and during mid-1800s wolverines disappeared from the southern parts of their distribution due to extensive hunting incentivised by bounties. The population continued to decrease during the 1900s, and around 1930 the southern periphery of distribution in Sweden was presumably in southern Jämtland (Haglund 1965).

In 1960s, Haglund (1965) suggested that the population in Sweden was probably below 100 individuals, and in southern Norway the population was considered functionally extinct at this time (Landa et al. 2000). Around 1970 wolverine distribution in Scandinavia included mainly alpine

areas along the border between Sweden and Norway (Landa et al. 2000). In the early 1980s the population in Sweden was estimated to include 120-150 individuals (Bjärvall & Ullström 1985), however, this estimate was based on expert opinion and not extensive population monitoring.

Wolverines were granted protected status in Sweden in 1969, in southern Norway in 1973 and in the rest of Norway in 1982. Following their protection, the wolverine population increased both in numbers and distribution and populations were restablished in regions where wolverines had been functionally extint for over 50 years. By the end of the 1970s, new wolverine litters were documented regularly in southern Norway and from the 1970's onwards, the wolverine population increased substantially.

An extensive monitoring system was introduced in 1996. This was a result of a need for updated population estimates for management in general, and particularly due to the implementation of a new conservation performance payment system in Sweden in 1996. This system is based on documentation of wolverine reproductions (*i.e.* observations of reproductive den sites and/or females with cubs and/or their tracks. In addition, annual population size is estimated using number of reproductions (average of last 3 years to accommodate for interannual variation), age at first reproduction, proportion of adult females reproducing annually, sex ratio in the population (Landa et al. 1998). In addition, non-invasive sampling of DNA (scats, urine, hair and secrete) has been conducted at increasing intensity during the last two decades. Based on this genetic sampling, and recoveries of dead animals, population estimates have been derived using Bayesian open-population spatial capture-recapture models (OPSCR) for 2013-2019 (Bischof et al. 2019).

The number of wolverine reproductions in Scandinavia increased considerably from 2000 to 2012 (Figure 3). Particularly in Sweden, where the number of reproductions doubled from around 60 reproductions (mean 1996-1998) to 120 reproductions in 2012 (mean 2010-2012). This increase has been attributed to the Swedish conservation performance payment system that provides direct and indirect protection to reproductive females (from both the monetary value of reproductive females and presence of personnel monitoring denning females; Persson et al. 2015). It is important to note that the wolverine population has been subject to much higher harvest rates in Norway compared to Sweden. This is expected to cause differences in population dynamics; e.g., migration from Sweden to Norway compensates for harvest in Norway, and presumably limits population growth in Sweden (Gervasi et al. 2019). Thus, the different management regimes in Sweden and Norway creates a source-sink dynamic that influences population dynamics in both countries.

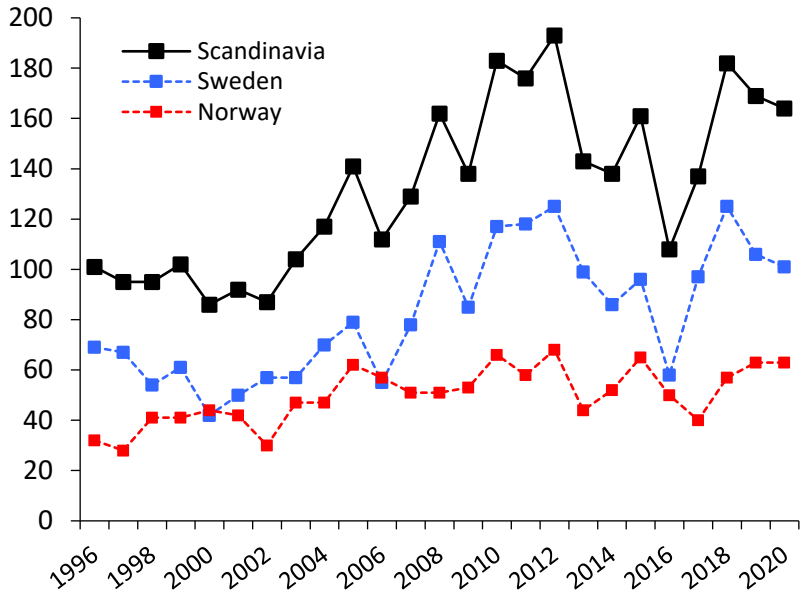

Figure 3 Number of documented reproductive events (reproductive den sites, observations of females with offspring and/or their tracks) in Scandinavia, Sweden and Norway, respectively, 1996-2020. Note that the census instructions were changed and harmonised between the two countries after 2012.

After the population peak in 2012 the number of documented reproductions has showed a variable trend, with a specific dip in 2016. This, however, likely reflects poor monitoring conditions in northern Sweden, rather than a drastic decline in the population (Brøseth m.fl. 2016). This highlights that estimated population size and trends are influenced by monitoring conditions and intensity (e.g. distribution outside the reindeer husbandry area is monitored less intensive than areas in the Swedish reindeer husbandry area and Norway; Aronsson & Persson 2017).

Since 2013, Norway and Sweden have collaborated in the monitoring of all large carnivore species. Monitoring results for wolverines are presented annually in a Norwegian-Swedish status report where results are presented for Scandinavia as a whole as well as at the national level for both countries. The reports are published in an online open access database (Rovdata homepage 2019a).

The most recent population estimate for the Scandinavian wolverine population is from 2022 (Figure 4). According to this estimate the number of wolverines in Scandinavia was 1 019 (95 % CI = 861–1282), with 351 (95% CI = 283–456) individuals in Norway and 668 (95% CI = 540–869) in Sweden.

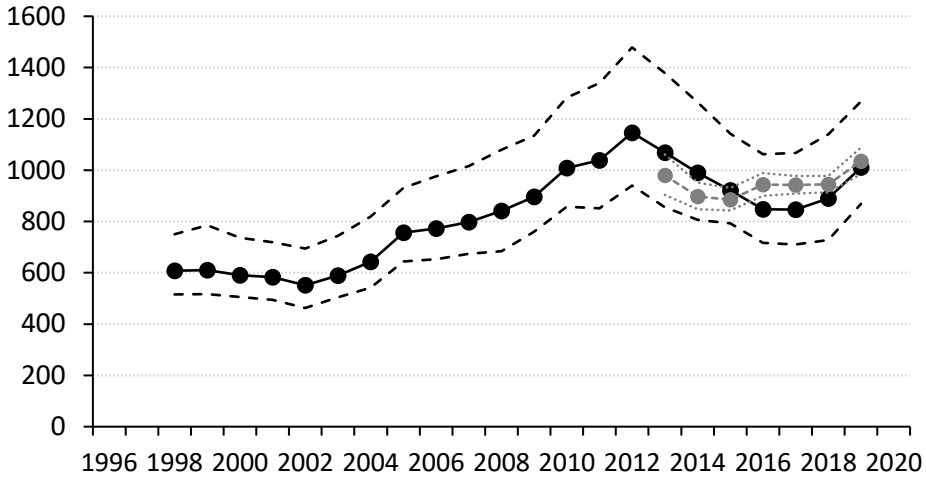

Figure 4. Estimated population size (black lines; mean and 95% confidence intervals) in Scandinavia 1998–2020 based on mean number of reproductive events the last 3 years (black lines; Mattisson et al. 2020 and reports available at www.rovdata.no). And population size (dark grey lines; mean and 95% Credible Intervals; 2013-2019) based on genetic sampling and recoveries of dead animals in Bayesian open-population spatial capture-recapture model (Bischof et al. 2019)

Accompanying the increase in wolverine population size has been a pronounced expansion of the distribution. Most noteworthy has been the east and southward expansion into boreal forests outside the reindeer husbandry area primarily in Sweden, but also in Norway (Fig. 3; Aronsson & Persson 2017). From being mainly distributed in northern alpine areas, the distribution now includes boreal forests down to southern Dalarna and northern Värmland counties, and near the coast in Gävleborg county, in Sweden (Figure 5). Interestingly, the current distribution largely overlaps with what is believed to have been the distribution in the early 1800s, except possibly, for the lack of current reproductions in the easternmost parts of Norrbotten and Västerbotten counties in northern Sweden.

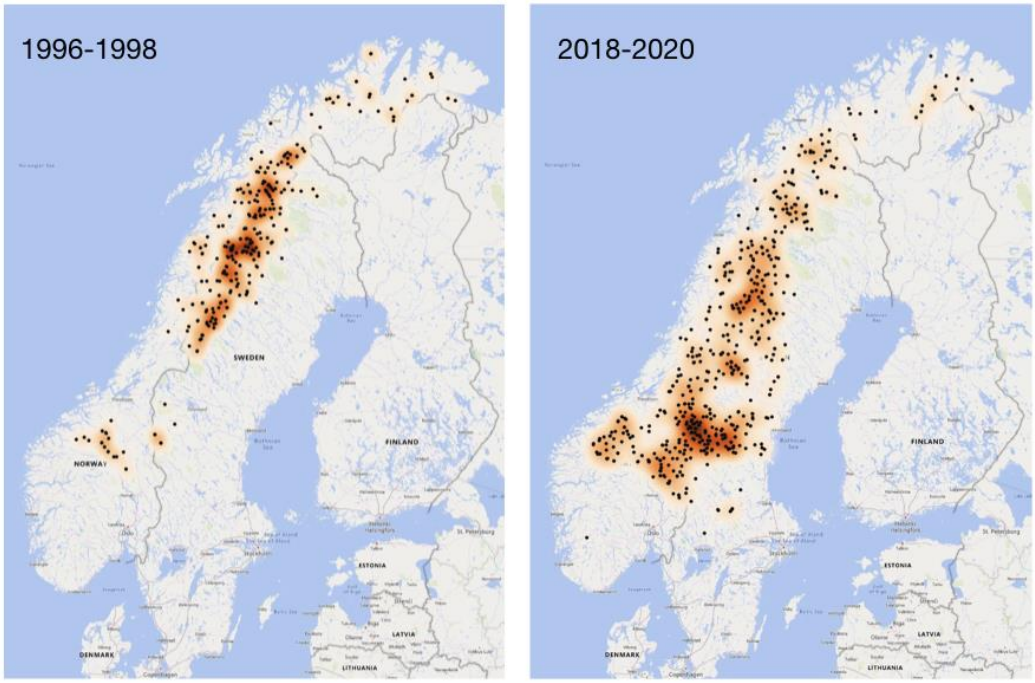

Figure 5. Distribution of documented wolverine reproductions in Scandinavia from the first years of extensive monitoring (1996-1998) and the last 3 years (2018-2020).

Population genetics

DNA-based methods have been extensively used in Norway and Sweden to monitor and manage wolverine populations during the last two decades (Flagstad et al 2012; 2021). The primary aim has been to assign individual id and sex to samples collected during census, mostly in the form of non-invasively collected samples such as scats, secretions, urine, and hair (Hedmark et al 2004). Recently DNA-based monitoring has also been initiated in Finland. As a result of the early incorporation of genetic identification as a monitoring tool, there is detailed knowledge on the genetic status of the Scandinavian wolverine population. Genetic sampling has also been used in making population size estimates using rarefaction and capture-recapture approaches (Flagstad et al. 2007). Recently this work was extended into a more complex population model including both an open population, spatial capture-recapture sub-model, an individual based population dynamic sub-model and a sub-model accounting for observation effort and detection probability (Bischof et al 2020).

Initially, microsatellite markers were developed and used for genetic monitoring of Scandinavian wolverines, together with specific Y-linked markers for sex-assignment (Hedmark et al 2004). More recently, precision and effectiveness of genotyping have been improved by the transition to SNP (Single Nucleotide Polymorphism) markers (Ekblom et al 2021). The SNP marker panel currently in use (Fluidigm, 96.96 Dynamic Array™ IFC) consist of 96 markers and includes sex-chromosome markers for simultaneous sex-identification. In order to identify variable nucleotides in the wolverine genome, a whole genome sequencing and assembly project was conducted. Here a focal individual was sequenced to 75 X coverage and ten additional individuals (from different parts of the Scandinavian population) were re-sequenced to 10 X coverage. From this data, 1.3 million variable nucleotide positions in the wolverine genome were identified (Ekblom et al 2018).

Finland
The wolverine population in Finland is most likely connected to the larger Russian population along most parts of the Finnish-Russian border. In a recent study Lansink et al. (2020) investigated conservation genetic aspects of Finnish wolverines using a combination of microsatellite markers and mtDNA sequences (control region). Data from both marker types suggest that Finnish wolverines fall broadly into two genetic clusters, one representing northern Finland and one representing south-eastern Finland. Similar results have also been found using SNP data (Kleven et al. 2019; Lansink et al. unpublished). Microsatellite F_{ST} (a measure of genetic differentiation) between these two clusters is about 0.10. Interestingly animals sampled in western (Ostrobothnia) and central Finland cluster genetically together with the northern Finnish samples. This is most likely an effect of several translocation events of wolverines from the reindeer herding area of northern Finland that took place during the 1980ies and 1990ies.

Two mitochondrial haplotypes were identified in this study. The more common haplotype was identical to the previously identified (only) haplotype from Scandinavia (see below). The less common haplotype was almost exclusively found in the eastern Finnish samples and southernmost samples from the northern region (Figure 6). Effective population size (N_e) for both the northern and the eastern Finnish populations were estimated to be smaller than 50 individuals (Lansink et al. 2020).

Figure 6. Map showing the geographical distribution of two different mtDNA haplotypes (green and red) from Scandinavian wolverines (figure from Kleven et al. 2019).

Norway-Sweden

The Scandinavian wolverine population is relatively small and has probably been partly isolated for some time. This (together with a long-term population decline) has resulted in extremely low levels of genetic variability remaining in the population. Genome-wide nucleotide diversity (π) was estimated to 0.00051, placing Scandinavian wolverines in the same range, in terms of genetic variation, as for example Tasmanian devil, Iberian lynx, cheetah, and snow leopard (Ekblom et al. 2018). In an early study Walker et al. (2001) found only one mtDNA control region haplotype. Using sequencing data from complete mitochondrial sequences Ekblom et al. (2014) could verify that there is indeed only a single mitochondrial haplotype present in Scandinavian wolverines (this is the same as the major haplotype also common in Finland).

Early population genetic research (Walker et al. 2001) suggested the presence of three genetic clusters of wolverines in Scandinavia (south-western Norway, central Scandinavia, and northern Scandinavia) (Figure 7). The southwestern Norway population (situated west of Østerdalen and Glomma) was probably established from a few immigrant individuals in the late 1970s, and the genetic differentiation (F_{ST} = 0.088, as determined from 16 microsatellite loci) observed between this and the rest of the Scandinavian population may have been a result of the founder effect. In more recent years this genetic structure seems to have diffused and F_{ST} have decreased over time (Flagstad et al. 2004; 2006; Ekblom et al. unpublished). Similarly, the founding of populations in the forest region in eastern Sweden in the mid 1990-ies (Hedmark & Ellegren 2007), led to a temporary genetic subdivision (F_{ST} = 0.08) which was subsequently erased as this region became part of a more continuous distribution in central Scandinavia. In the north, there has also been indications of a genetic subdivision between northern Fennoscandia (including the Norwegian counties of Troms and Finnmark as well as the northernmost parts of Sweden and Finland) and central Scandinavia (Flagstad

et al. 2012). The rather diffuse border between these two sub-populations is located somewhere around the Narvik and Torneträsk regions. The degree of genetic variation between these are lower than with the other discussed population sub-divisions (F_{ST} = 0.023; Walker et al. 2001).

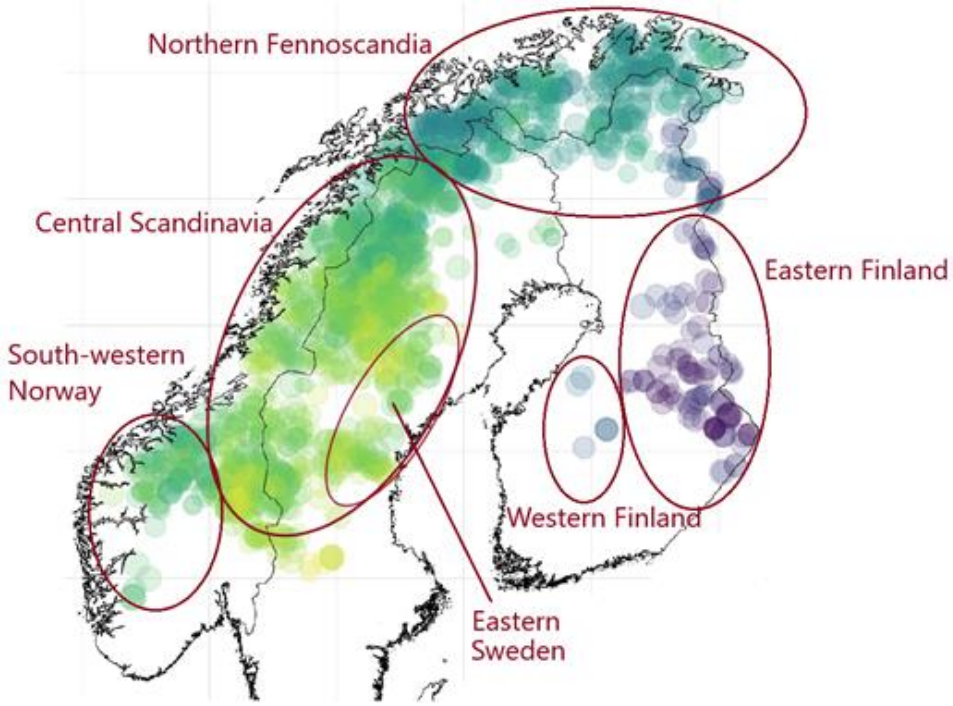

Figure 7. Results from a spatial PCA (principal component analysis), visualising geographic patterns of genetic structure in Fennoscandian wolverines (inferred from SNP data). Colour tones (from yellow to purple) represent genetic similarity between samples (first eigenvector). The main distribution regions discussed in the text are shown by dark red ovals (figure adapted from Kleven et al. 2019).

The current level of effective population size (N_e) for Scandinavian wolverines has been estimated to less than 100 individuals (Ekblom et al. 2018). Together with the very low levels of genetic variability observed, this raises concerns about the long-term viability of this population. A population with such limited genetic variation may have reduced ability for evolutionary adaptation to novel environmental conditions (for example in the face of climate change). Furthermore, limited genetic variation may cause problems in the short term due to inbreeding depression, especially through the expression of deleterious recessive alleles. It should be noted that mating between close relatives occur in Scandinavian wolverines, especially in peripheral part of the distribution (Hedmark & Ellegren 2007). But such behaviour seems to be relatively rare (Ekblom et al. 2021). There are also no documented cases of inbreeding depression (reduced survival and/or reproductive performance of inbred individuals), but this may simply be a result from lack of data on this topic (Ekblom et al. 2018).

In order to increase N_e and secure long-term survival of the Scandinavian wolverine population, it would be desirable to secure sufficient genetic exchange from populations in the Finnish-Karelian population. This population is located sufficiently near the Scandinavian population as to allow individual wolverines to enter Scandinavia through natural dispersal north of the Bothnian bay. It is well known that wolverines have large dispersal capabilities. In Scandinavia, especially males (but sometimes also females) have been observed to migrate more than 500 kilometres from their natal area before settling in a new breeding territory (Ekblom et al. 2018; Flagstad et al. 2004; 2007). But still migration from the eastern part of Finland into the Northern Fennoscandian or Scandinavian sub-populations seem to be limited (see below).

Population connectivity

In Fennoscandia the most pronounced population sub-division for wolverines occur between the eastern Finland region and the rest of the distribution (see above). The extent of gene flow has been estimated to 0.04-0.46 effective migrants per generation from eastern Finland to central Scandinavia and 15-22 from northern Fennoscandia to central Scandinavia (Kleven et al. 2019). There is thus considerable geneflow between northern Fennoscandia and central Scandinavia but limited genetic exchange between eastern Finland and the Scandinavian populations (Table 1). Interestingly, the eastern Finland sub-population have higher levels of genetic variation than samples from northern Finland and Scandinavia. This could suggest some degree of connectivity between the eastern Finland population and the more continuous Russian part of the species distribution (Lansink et al. 2020).

Table 1. Migration rates between different wolverine sub-populations (m = the fraction of individuals in population X that were migrants derived from population Y, per generation). Standard deviations (SD) are given in parentheses. (Table from Kleven et al. 2019)

Population X	Migration rate (m) from population Y*		
	Central Scandinavia	Northern Fennoscandia	Southern Finland
C-Scandinavia	-	0.0445 (±0.0082)	0.0006 (±0.0005)
N-Fennoscandia	0.0810 (±0.0178)	-	0.0095 (±0.0035)
Southern Finland	0.0080 (±0.0067)	0.0613 (±0.0168)	-

**When multiplied with population size (of the recipient population) this will give the number of migrants per generation.*

In southern Scandinavia the different management goals in Sweden and Norway, with almost complete protection in Sweden and a strict population cap with extensive culling in Norway, have led to a situation with asymmetrical geneflow across the country border. Due to higher survival probability in Sweden, migration is larger from Sweden to Norway than the other way around (a phenomenon called compensatory immigration). This generates a source-sink dynamic in this part of the population, which can have important consequences for the management of the populations on both sides of the border (Gervasi et al. 2015).

The northern parts of Finland, Norway, and Sweden are part of a defined reindeer herding area, where reindeer husbandry is practiced primarily by native Sámi people. Wolverines cause significant costs to reindeer husbandry, both through depredation of reindeer and through disruption of herds. Consequently, there are reimbursement systems in place to compensate for losses that occur. But there is also significant protective hunting performed to reduce damage and conflict. Such measures may hinder natural migration of wolverines into and across reindeer husbandry areas. To help increase the natural migration of wolverines between sub-populations (and especially from eastern Finland into northern Fennoscandia and central Scandinavia) continuous surveillance of individual migrants (either through GPS tracking of marked individuals or through DNA analyses of non-invasively collected samples) could be performed routinely in both Finland, Norway and Sweden. Other measures to increase genetic diversity of the population could include facilitated migration and translocations of individuals.

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Wolverine Management in Finland, Norway, and Sweden.

Table of Contents

List of Acronyms

The following acronyms will be used in this document:

CABs	County Administrative Boards (Sweden)
FWA	Finnish Wildlife Agency
GMAs	Game Management Associations (Finland)
LCMBs	Large Carnivore Management Boards (Norway)
LUKE	Natural Resources Institute Finland
MAF	Ministry of Agriculture and Forestry (Finland)
NEA	Norwegian Environment Agency
SEPA	Swedish Environmental Protection Agency

Introduction

Management structures and policies related to wolverines differ substantially between countries. These differences are apparent both in the way that management authorities are organized, as well as by the administrative level at which management decisions are made. The unique management structures in Finland, Norway, and Sweden are described below.

Finland

The overarching long-term objective of the Finnish large carnivore policy is for wolf, brown bear, wolverine, and lynx populations to reach and maintain favorable conservation status in accordance with the EU Habitats Directive (92/43/EEC), while taking into account both social and economic sustainability. The Habitats Directive has been incorporated into both the Finnish Hunting Act (615/1993) and the Hunting Decree (666/1993).

In Finland, the parliament does not set political goals regarding large carnivore populations. Rather, large carnivore policy is steered and controlled by means of policy decisions made by the Finnish Ministry of Agriculture and Forestry (hereafter MAF). The implementation of wildlife management policy in Finland is carried out by the Finnish Wildlife Agency (FWA). The FWA is responsible for educating hunters and implementing preventative measures to reduce damages caused by large carnivores. The FWA also regulates hunting and lethal removal of large carnivores through issuing derogations. Derogation decisions are made independently by the FWA, without guidance or direction from the ministry, the government, or the parliament. Both policy decisions (MAF) and derogation decisions (FWA) are made based on large carnivore research and population estimates provided by the Natural Resources Institute Finland (LUKE).

At the local level, Game Management Associations (GMAs) operate under the Finnish Wildlife Agency and carry out operational tasks including administering hunting exams and shooting tests, inspecting wildlife damage sites, and supervising and enforcing lawful hunting. Game wardens from Metsähallitus, the Finnish Forest Administration, work in close cooperation with the police to ensure that hunting and fishing are practiced in accordance with the regulations and restrictions defined by Finnish law. Finally, the Finnish Food Authority is responsible for zoonosis and the administration of subsidies for damages caused by large carnivores.

Both the Finnish National Wildlife Council and Regional Wildlife Councils also promote national game policy and large carnivore policy in Finland. The objective of these wildlife councils is to secure transparent and interactive stakeholder cooperation in game management and to promote the harmonization of diverse interests. Wildlife councils also participate in the preparation and revision of national management plans and organize stakeholder consultations related to both national and regional management planning work.

A descriptive diagram of the Finnish management system is given in the figure below (figure 1).

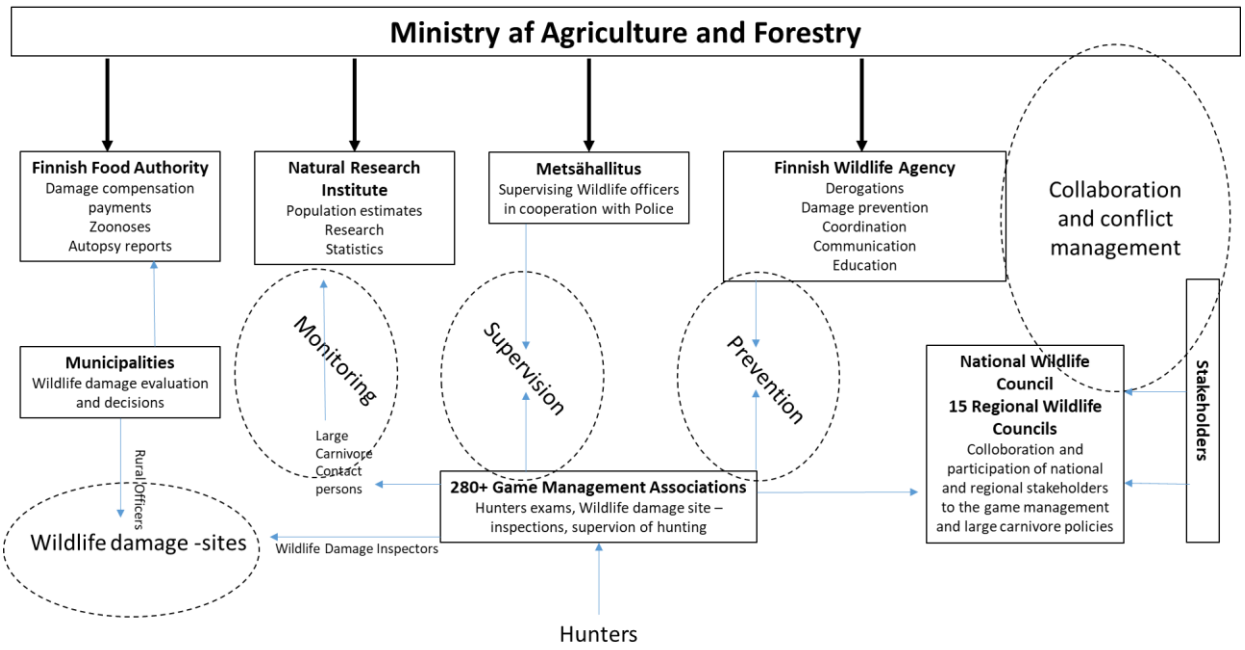
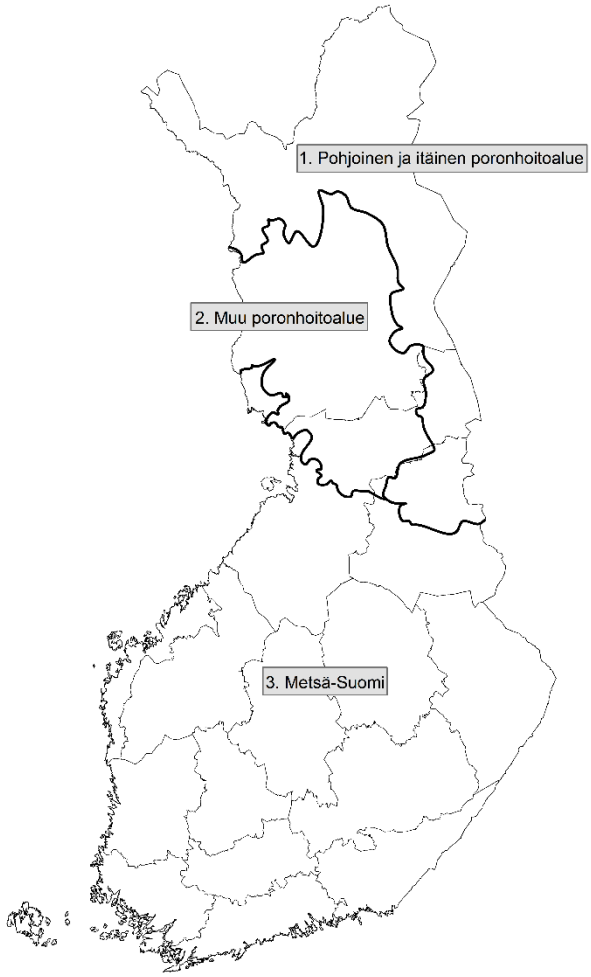


Figure 1: *Diagram showing the responsibilities of the authorities involved in the Finnish large carnivore management system.*

As there are no political goals for Finland's large carnivore populations, population management plans are the most important tool for implementing large carnivore management strategy. Management plans are approved by MAF and prepared in collaboration with key stakeholders and interest groups from both the national and regional levels.

The present Management Plan for the Wolverine population was approved in 2014. The main aim of the Management is to allow an increase in the number of individuals in the population to support the spreading of wolverines into new ranges outside the reindeer herding area. For the purposes of wolverine population management, Finland is divided in the management plan into three major areas:

1) Northern and Eastern Reindeer Herding Area, 2) Rest of the Reindeer Herding Area, and 3) Forest Finland.



1. Northern and Eastern Reindeer Herding area
2. Rest of the Reindeer Herding Area
3. Forest Finland

Figure 2: The wolverine management areas

Furthermore, the Management plan aims to through active measures reduce damage to reindeer caused by the wolverines. Compensating damages to the reindeer herding is one of the main actions of the Management Plan. The current Management Plan is somewhat outdated and needs to be revised.

Wolverines and other large carnivores are classified as protected game species in Finland and fall under the management authority of MAF. All large carnivore species in Finland are protected under the Hunting Act, however the FWA can grant derogations from this protection in accordance with requirements laid out in the Habitats Directive and the Finnish Hunting Act (613/1993). Derogations can be divided into two main categories: those granted based on damage to livestock or to protect human safety (*protective hunting*), and those granted based on population management (*license*

hunting). Derogations are issued by the FWA after request by application, and derogation decisions can be appealed to the Finnish Administrative Court.

The following criteria must be assessed when issuing derogations:

- the existence of other satisfactory solutions or alternatives for preventing the damage
- whether the derogation will affect the probability of reaching or maintaining favourable conservation status
- whether the derogation can help to prevent particularly significant damage (this criterion is only relevant for damage-based derogations).

Even though wolverine isn't listed in the Annex IV of the Habitats directive Finland applies Article 16 criteria also to wolverines. Damage-based derogations are issued by the FWA based on criteria laid out in the Finnish Hunting Act (41§ and 41a§ 1-2 mom, 615/1993), which is an implementation of article 16.1 a-d of the Habitats Directive. In addition, past court rulings may determine and define the limits and outcomes of future derogation decisions. Each case, however, must be assessed by the FWA on its individual merits, and no general policies can be developed to guide the decision-making. The administrative burden related to damage-based derogations and the limitations related to their implementation are based on judgments made by the European Court of Justice (C-342/05 Commission of the European Communities v Republic of Finland). When derogations are granted based on damage to livestock, any lethally removed large carnivores belong to the state and cadavers must be turned over to LUKE and the Finnish Food Authority for analysis.

Damage-based derogations to remove individual wolverines causing damages to the reindeer herding is allowed according to the management plan only in the Northern and Eastern Reindeer Herding Area.

Table 1. Number of legally hunted wolverines by damage-based derogations in Finland during the last 10 years. Data from Finnish Wildlife Agency.

Year	Damage-based derogations
2012	-
2013	-
2014	-
2015	-
2016	-
2017	8
2018	8
2019	13
2020	3
2021	5

In acute cases where large carnivores – mainly brown bears and wolves - endanger human life or health, cause significant damage to property, or display undesired behavior in proximity of human settlements, the Police Act 2:16 § (872/2011) contains provisions which give police officers authority to, as a last resort, lethally remove problem animals.

Derogations granted based on population management are covered in the Government Decree on Derogations (452/2013). These derogations may only be granted when specific criteria are met, and under carefully defined conditions which limit hunting or lethal removal to select individuals of a given species. Derogations granted based on population management are not granted for wolverines in Finland.

All known dead wolverine individuals in Finland are to be handed either to LUKE or to the Finnish Food Authority for analyses and genetic identification. As a result of this regulation, most dead wolverines are recovered and studied, and the information obtained is used for population modelling.

In Finland, the scheme for compensating damages caused by large carnivores is regulated in the Act on game animal damages. The compensation scheme includes regulations for compensating damages both for domestic animals (including livestock and dogs) and for semi-domestic reindeer. Species regarded as large carnivores in the Finnish legislation are brown bear, lynx, wolf and wolverine, which are managed under the governance of the ministry of agriculture and forestry. Damages caused by golden eagle (and other species protected by the nature protection act) are compensated based on a separate legislative framework governed by the Ministry of Environment.

In order to claim compensation for the damages, those reindeer (and domestic animals) found to be killed or injured by large carnivores must be reported to the municipality official responsible for rural livelihoods in the area. The compensation for found and documented damage is paid in most cases to the owner of the reindeer, but in case the owner is impossible to identify (e.g. due to ears or whole head of reindeer missing), to the reindeer herding cooperative. From 5 to 10 % of the reported reindeer damages are inspected in the field by the municipality officials, often accompanied by the representatives of the reindeer herding cooperative and local game management association, who have right (but not obligation) to participate in the inspection. In the amendment of the Act on game animal damages in 2019, a photograph of the killed or injured reindeer and damage site was added as a requirement when reporting damage from the field. Differing from the inspecting practice of reindeer damages, all damages on livestock and other domestic animals are inspected at site.

Compensations for documented losses of semi-domestic reindeer are paid within the limits of the State budget once a year. For each reindeer type (e.g. calf, adult hind, stag, draught reindeer) a normative value is set and these values are adjusted at least in five years intervals to follow e.g. the producer price of reindeer meat. In addition to found and compensated damages, the reindeer herding cooperatives are reimbursed annually with a specific computational calf loss compensation, whereby those calves lost or found between birth and 30 November are addressed. Those reindeer herding cooperatives situated in areas with higher density of large carnivores and higher damages receive proportionally more calf loss compensations than areas with less damages.

Compensations for reindeer damages in Finland have varied annually between 6-10 M€, of which ca. 2 M€ is paid and distributed among cooperatives as reimbursement for calf loss. Most of the found and documented reindeer damages in Finland are caused by wolverine, which has caused during last decade more damages than other three large carnivore species in total. In 2020, also partly due to difficult winter conditions for reindeer herding, almost 6 000 semi-domestic reindeer were found and compensated as large carnivore damages, of which 60 % were compensated as wolverine damages. However, in 2021 the number of compensated reindeer was in total 4 862, of which 40 % were caused by wolverine. Fewer damages and proportional shift in the share of wolverine damages was caused presumably by easier winter conditions, but also by significant increase in the damages caused by wolves, 13 % of all damages in 2020 and 31 % in 2021, respectively. Total compensation for wolverine damages including also calf losses has varied during last decade between 4-6 M€.

Differing from the compensation scheme for semi-domestic reindeer, damages on livestock and dogs and other domestic animals, as well as damages on beehives, are compensated directly after the application for compensation has been processed. This is possible as the compensations for other damages than reindeer comprise annually only 5-6 % (less than 0,5 M€) of total compensations paid based on Game animal damage act, and thus annual compensations are well predictable. Wolverine causes very few other damages than reindeer damages. Wolverines have caused some damages on sheep and even demolished some beehives. During last decade (2012-2021) there are records in the Finnish Game Damage Register on 46 sheep, two cattle (calves), three damages on beehives and four on dogs. In addition, there are few cases where wolverines have caused damages e.g. on chicken coops and property. Compensations paid for wolverine damages (from 2010-2021) varied from zero in 2013 to 7 430 € in 2018. In general, compensations have increased significantly from early 2010 to more recent years the average annual compensation from 2016-2021 being ca. 5 500 €.

Norway

The dual governing principle of the Norwegian large carnivore policy is to ensure the survival of Norway's brown bear, wolf, lynx, wolverine, and golden eagle populations, while still ensuring viable free-range grazing livestock husbandry and semi-domestic reindeer herding practices.

The Norwegian wolverine management policy is based on a government report (white paper) amended and adopted by the Parliament in 2004 (WP No. 15 (2003-2004)) and a unanimous Parliamentary agreement in 2011 (Document 8:163 S (2010-2011)) where the Parliament set population targets for each of the four large carnivore species in Norway (brown bear, wolf, lynx, and wolverine).

Norwegian large carnivore management is hierarchically organised. The Government sets the agenda and policy, amended and approved by the Parliament, and ministries are responsible for implementing policy. In Norway, the Parliament determines both the population targets for large carnivores at the national level as well as how these targets are further distributed at the regional level. Large carnivore management is decentralised, and several actors are involved in the management hierarchy (figure 4). The main authorities are the Ministry of Climate and Environment, the Norwegian Environment Agency (hereafter NEA), the Regional Large Carnivore Management Boards (Rovviltnemnder in Norwegian, hereafter LCMBs), and the County Governors.

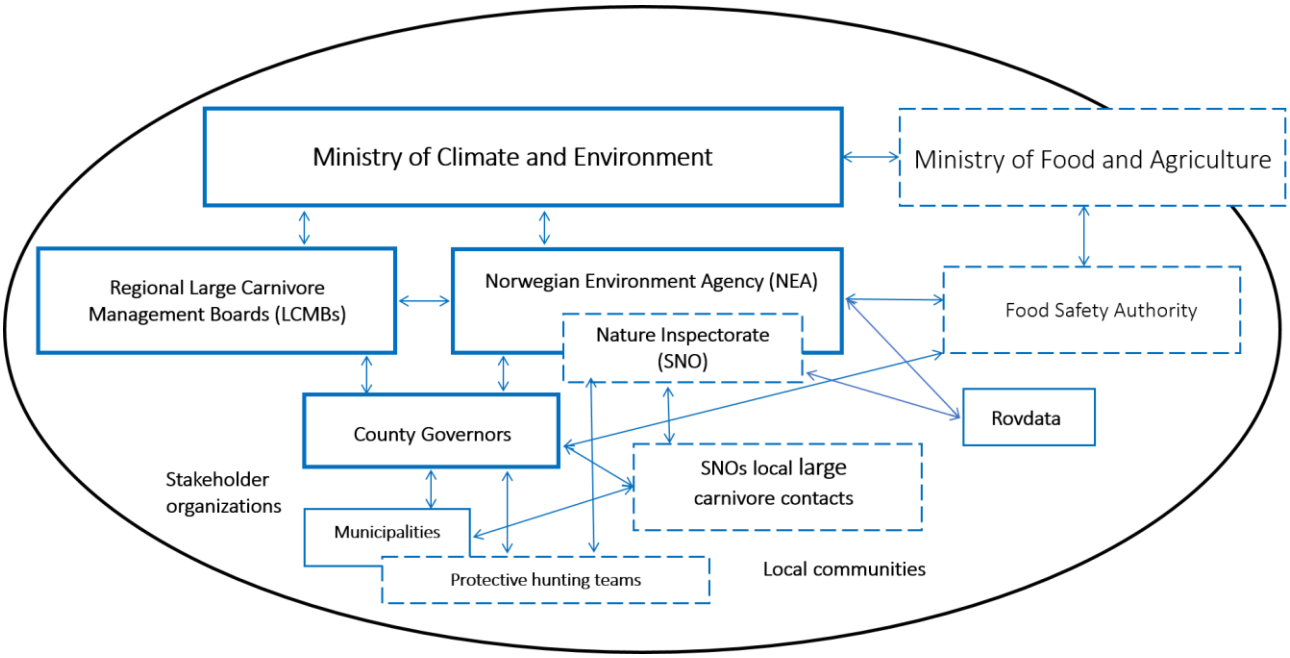


Figure 3*: Schematic figure outlining the hierarchical relationship between authorities involved in large carnivore management in Norway.*

The Ministry of Climate and Environment is responsible for ensuring that large carnivore management is implemented in accordance with current policy and does so by creating and amending regulations. Day-to-day public administration of large carnivore management is carried out by NEA at the national level and County Governors at the regional level. The Norwegian Ministry of Food and Agriculture is also involved in large carnivore management at both the national and regional levels. In addition to Food Safety Authority mentioned in fig. 3, the Directorate of Agriculture has recently received formal tasks connected to the large carnivore management. The Norwegian Nature Inspectorate (SNO) is NEAs operative field branch, responsible for monitoring natural areas and ensuring compliance with environmental regulations and legislation.

On an administrative scale, Norway is divided into eight large carnivore management regions (figure 4). Each management region is represented by a LCMB made up of representatives from the pertinent county councils, in addition to representatives from the Saami parliament in reindeer herding regions. One of the County Governors in the region is appointed as the secretariat for the LCMB and plays an advisory role in regional large carnivore management.

In the Norwegian large carnivore management system, NEA and the LCMBs represent the same hierarchal level, they are both subject to the ministry of Climate and Environment, but have different responsibilities. As the national management agency, NEAs role is to carry out policies as instructed by the Ministry, as well as to contribute in an advisory capacity to the Ministry in matters related to large carnivore management. The LCMBs are responsible for creating regional management plans for the large carnivore species in their respective regions, and in doing so must adhere to the national large carnivore policy and its dual governing principle. Both NEA and the LCMBs may set quotas for the lethal removal of wolverines to avoid and prevent damages. NEA is responsible for setting quotas and issuing derogations in regions where the wolverine population is below the regional population target. In regions where the wolverine population exceeds the regional population target, the LCMBs assume resposet quotas and derogations are issued by County Governors.

The current large carnivore policy advocates for geographically differentiated management, which involves designating certain areas as *large carnivore areas* and others as *free-range grazing livestock areas.* LCMBs must address these requirements when creating regional large carnivore management plans. Inside areas prioritised for large carnivores, animal husbandry practices must adapt to the permanent presence of large carnivores and preventative measures should be prioritised to reduce damage to livestock. In free-range grazing livestock areas, free-range grazing husbandry practices are prioritised and lethal removal of large carnivores through *licence* and *protective hunting* are the primary management tools employed to reduce damages. These management tools are implemented though issuing derogations in accordance with requirements set out in the Norwegian Nature Diversity Act.

Norway's national wolverine population target is 39 annual litters. This national target is further

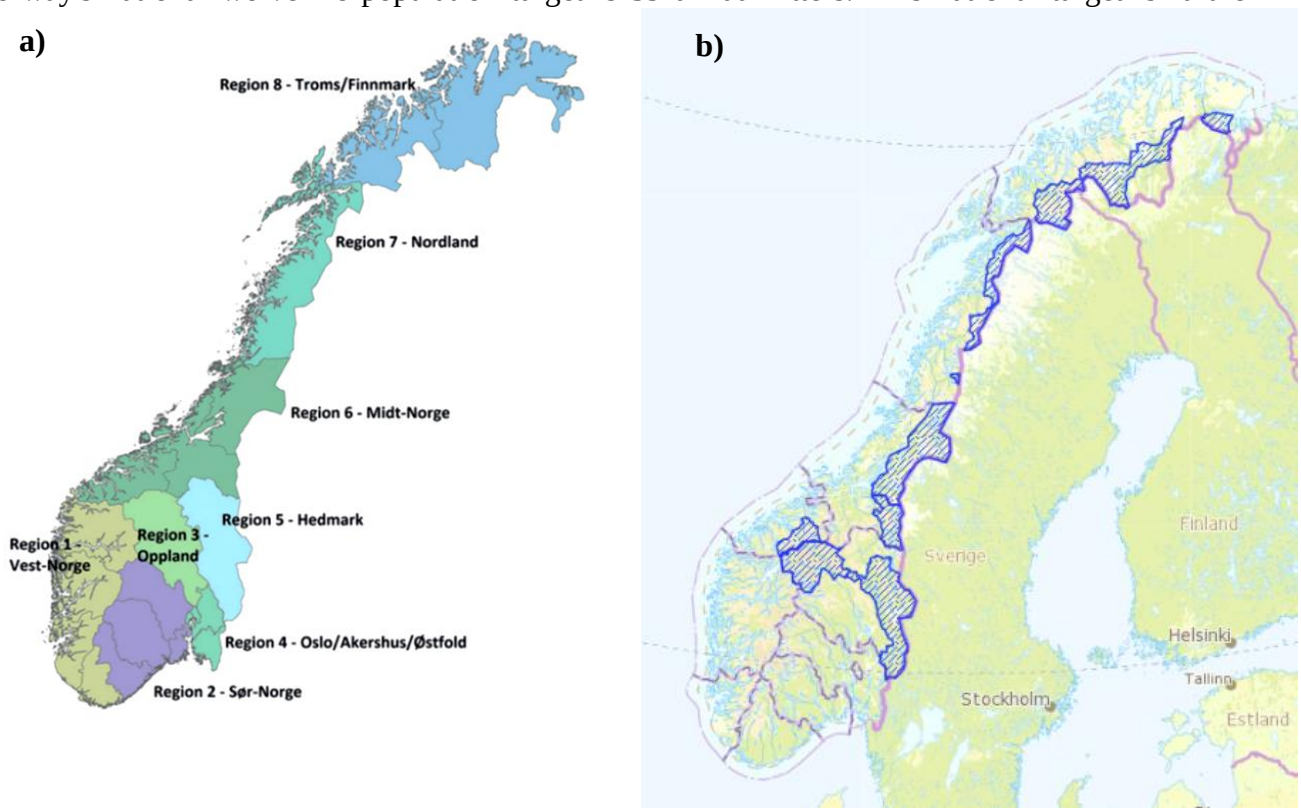


Figure 4: a) *Map showing the spatial distribution and extent of Norway's eight large carnivore management regions*, b) *Map showing the location and extent of Norway's wolverine management areas.*

distributed to five of Norway's eight large carnivore management regions. The LCMBs in these five regions define suitable wolverine management areas which are described in their respective large carnivore management plans. The designated wolverine management areas should be of sufficient size and quality as to support regional population targets, however litters born both inside and outside wolverine management areas are included when assessing population status with regards to regional targets.

In addition to considering the existing range of the Norwegian wolverine populations, the geographical extent of the wolverine management areas also takes into account Norway's traditional farming practices and extensive use of grazing areas in large parts of the country. This has resulted

in a concentration of wolverine management areas along the borders to Sweden and Finland in addition to the mountain areas of south-central Norway.

Table 2: *Wolverine populations targets (number of litters) for each of Norway's eight large carnivore management regions. The national population target is 39 litters per year, the sum of the regional population targets.*

Large carnivore management region	Wolverine population target (number of litters per year)
Region 1 West-Norway	-
Region 2 South-Norway	-
Region 3 Oppland	4
Region 4 Oslo/Akershus/Østfold	-
Region 5 Hedmark	5
Region 6 Mid-Norway	10
Region 7 Nordland	10
Region 8 Troms/Finnmark	10
National population target	39

Wolverines and other large carnivores in Norway are protected under the Norwegian Nature Diversity Act (Naturmangfoldloven, LOV-2009-06-19-100) and through Norway's commitment to the Bern Convention. In order to mitigate damages caused by wolverines, however, management authorities can set quotas for license and protective hunting and issue derogations from the strict protection in accordance with requirements laid out in the Nature Diversity Act, paragraph 18, which is further regulated by the Regulation on Large Carnivore Management (FOR-2005-03-18-242).

Derogations can only be issued if the following criteria are met:

- The derogation and subsequent removal will not threaten the survival of the population
- The damage or safety concern cannot be addressed in any other satisfactory way.

In Norway, licence hunting is the primary management tool implemented to regulate the wolverine population and to reduce damage potential outside designated wolverine management areas. The licence hunting season spans from September 10th to February 15th to take into account the breeding season and nursery dependent young of the year. Licence hunting quotas are normally set in late spring and summer based on population developments with respect to reproduction and in response to management.

Table 3. Number of legally hunted wolverines in Norway during the last 10 years. Data from Rovbase.

Year	License hunting	Protective hunting
2012	55	80
2013	47	47
2014	39	46
2015	51	67
2016	47	39
2017	52	55
2018	47	23
2019	40	48
2020	65	55
2021	57	29

Protective hunting is implemented primarily to prevent damages, and in acute situations can also be used to stop impending or ongoing incidents. Protective hunting derogations can only be issued against specific individuals within a restricted area and for a defined period.

Under certain conditions, game species may also be lethally removed if removal is considered necessary to eliminate a current threat or significant risk of human injury, or an immediate and significant risk of damage to livestock, dogs, or domestic reindeer (Norwegian Nature Diversity Act § 17).

Large carnivores lethally removed through protective hunting are the property of the state Wildlife Fund and cadavers must be turned over for analyses and genetic identification. Applications to assume the rights to skins or skeletons from such animals are submitted to the Wildlife Fund and processed by NEA. Large carnivores killed through license hunting must also be turned in for scientific analysis and genetic identification, however, license hunters are permitted to retain skins from such animals. In the event that hunters fail to comply with regulations regarding dead game species, the Wildlife fund assumes all rights to the specimens in question. All specimens legally retained by hunters or acquired by application are marked and registered in an online database.

Animal owners in Norway are entitled to compensation for loss when livestock or semi-domestic reindeer are killed or injured by large carnivores. Large carnivores are brown bear, lynx, wolverine, wolf and golden eagle. The legal basis for this right is the Nature Diversity act.

There are two compensation regulations in Norway for large carnivore related loss and damages, one for livestock and one for semi-domestic reindeer. In order to receive compensation, animal owners have to apply for compensation to the County governor. The County governor compensate every documented loss as concluded by the Norwegian Nature Inspectorate in addition to probable losses, based on knowledge about the carnivore populations, carnivore behaviour, damage history and other causes of losses in the area.

The Norwegian Nature Inspectorate are called upon when animal owners find carcasses or seriously wounded animals and they suspect large carnivores to be the primary cause. They inspect dead or wounded animals in accordance with guidelines from the Inspectorate and report their findings in Rovbase.
In 2021, 7156 sheep were compensated as killed or seriously wounded by wolverines in Norway. Just above 4 % of them are documented lost to wolverines by the Inspectorate. For the reindeer-hearding year 2020/2021, 6739 reindeers were compensated by the County governors as lost to wolverines. Just above 3 % were documented losses to wolverines.

Wolverine losses represent 42 % of all sheep compensated as lost to carnivores in 2021, and equivalent 30 % of all reindeer compensated as lost to carnivores in 2020/2021. In addition there is a lesser amount of animals which are compensated as lost to unknown protected carnivore species.

The County governor compensate for loss of value for each animal in addition to consequential losses connected to the loss, according to rates determined by the Norwegian Environment Agency. For 2020/2021 a total of 105 mill. kroner were paid as compensation for reindeer lost to big predators. Close to 44 mill. kroner were paid as compensation for loss of sheep to big predators in 2021. The amount of sheep compensated as loss to big carnivores have gradually been reduced to less than 50 % compared to the level 15 years ago. For reindeer we can see no current trend in compensation development.

To receive compensation, applicants need to fulfill certain defined conditions. One of them is to implement reasonable preventative measures related to the values at stake to reduce or avoid loss. The LCMBs and NEA dispose a sum each year which is used as grants to applicants for preventative and conflict reducing measures connected to big carnivores. Most measures are planned, but it is also possible to apply for means to implement preventative measures in acute situations. In 2021, 55 mill. kroner were spent on preventative and conflict reducing measures in Norway.

Sweden

The overall long-term objective of the Swedish large carnivore policy is for the wolf, brown bear, wolverine, lynx, and golden eagle populations to reach and maintain favourable conservation status, while ensuring that livestock husbandry is not severely hindered, and that socioeconomic consideration is taken. Favourable conservation status is defined in accordance with guidelines from the EU Habitats Directive. Wolverines, as opposed to brown bears, wolves, and lynx, are not protected according to article 12 in the Habitats Directive (92/43/ EEC). But it is protected through the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and is managed the same way as the other large carnivores.

The Swedish large carnivore management policy is based on several white papers which served as the basis for succeeding government bills. The most recent white paper on large carnivores was published in 2012 (SOU 2012:22) and followed by a government bill in 2013 (prop. 2012/13:191) which was adopted by the Swedish Parliament the same year (bet. 2013/14:MJU7, rskr. 2013/14:99).

In Sweden, state authorities are independent units governed by laws, governmental ordinances, and parliamentary decisions. The main authorities involved in large carnivore management in Sweden are the Swedish Environmental Protection Agency (SEPA), the County Administrative Boards (CABs), and the Sami Parliament (Figure 5). As the national wildlife management agency, SEPA's role is to carry out policies as instructed by the Ministry, as well as to contribute in an advisory capacity to the Ministry, politicians, and the CABs in matters related to large carnivore management. The CABs are regional operational authorities whose responsibilities include census and monitoring of carnivore populations, issuing derogations, inspecting carnivore-related damages, administrating reimbursements for damages, and implementing preventive measures.

The CABs are also responsible for creating regional management plans for the large carnivore species in their respective counties. The Sami Parliament is primarily involved in large carnivore management through their role as the national agency for carnivore damage reimbursements related to reindeer herding. SEPA is responsible for reviewing and confirming annual population counts for the large carnivores.

Although the management structure in Sweden is relatively flat, both SEPA and the Sami Parliament can establish further regulations which may steer or govern other authorities. Regardless of their role in the management system, however, all authorities must adhere to the requirements set out by the Habitats Directive, Convention on the Conservation of European Wildlife and Natural Habitats, the corresponding Swedish Ordinance on Species Protection (SFS 2007:845), the hunting legislation (SFS 1987:259 and1987:905), and the Ordinance on Management of Large Carnivores (SFS 2009:1263).

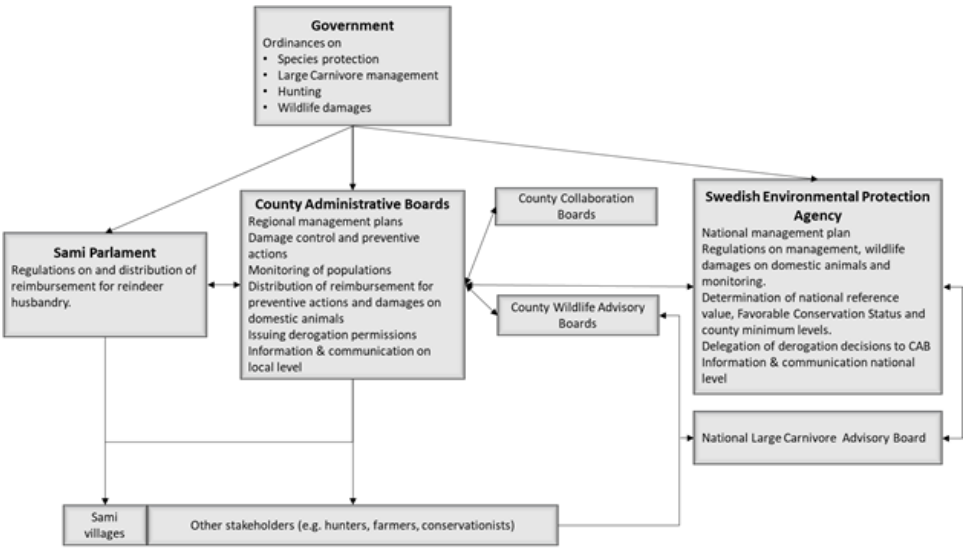


Figure 5: *Schematic diagram outlining Swedish management authorities, their responsibilities, and the legal framework regulating large carnivore management in Sweden.*

In Sweden, population management plans are the most important tools for implementing large carnivore management strategy. The present National Management Plan for the wolverine population in Sweden was adopted by SEPA in 2016 (ISBN 978-91-620-8759-3) and is about to be revised for the period 2022-2027. Based on the national management plan, the CABs prepare or revise the regional management plans. Figure 6 describes the main objectives of the current National Management Plan for the wolverine population in Sweden, and the four main points are listed below.

1) Attain and maintain Favourable Conservation Status:

- The number of wolverines in Sweden should at least 600 individuals, which is the same number as the reference value (Favourable Reference Population) for Favourable Conservation Status.
- At least one new reproducing immigrant individual from either Finland or Russia per wolverine generation (7 years) is needed for the Scandinavian wolverine population to continue having favourable conservation status from a genetic point of view.
- The reference value for favourable conservation status regarding distribution (Favourable Reference Range) in Sweden is the alpine region of the mountain range and forested areas close to the mountains in the counties of Norrbotten, Västerbotten, Jämtland, Västernorrland and Dalarna. This is a minimum value, which means this is the smallest possible area which is required to maintain a long-term viable wolverine population.
- The size and distribution of the wolverine population in forested areas within and outside the reindeer husbandry area has priority and should be promoted.

2) Limited damage:

- The tolerance level for damages to reindeer herders from large carnivore predation is at a maximum of 10 %, calculated from the actual numbers of reindeer in each Sami-village.

3) Increased trust for management:

- Compared to earlier surveys, an increased fraction of the general public tolerates having large carnivores in their vicinity.
- Compared to earlier surveys, an increased fraction of the general public has trust for SEPA and CAPs.

- The process for evaluation and revising of the management plan for large carnivores in Sweden is seen as legitimate and inclusive. Stakeholders have participated in the process of revising the plans and they are perceived as fair.
- The regional targets for the management of large carnivores include a clear socioeconomic perspective considering animal husbandry, activities of leisure, as well as business and cultural heritage work. The goals can be measures and clear measures are in place for implementation and monitoring.

4) No poaching

- All affected parts of the society continue to work for reducing the extent of poaching of large carnivores.

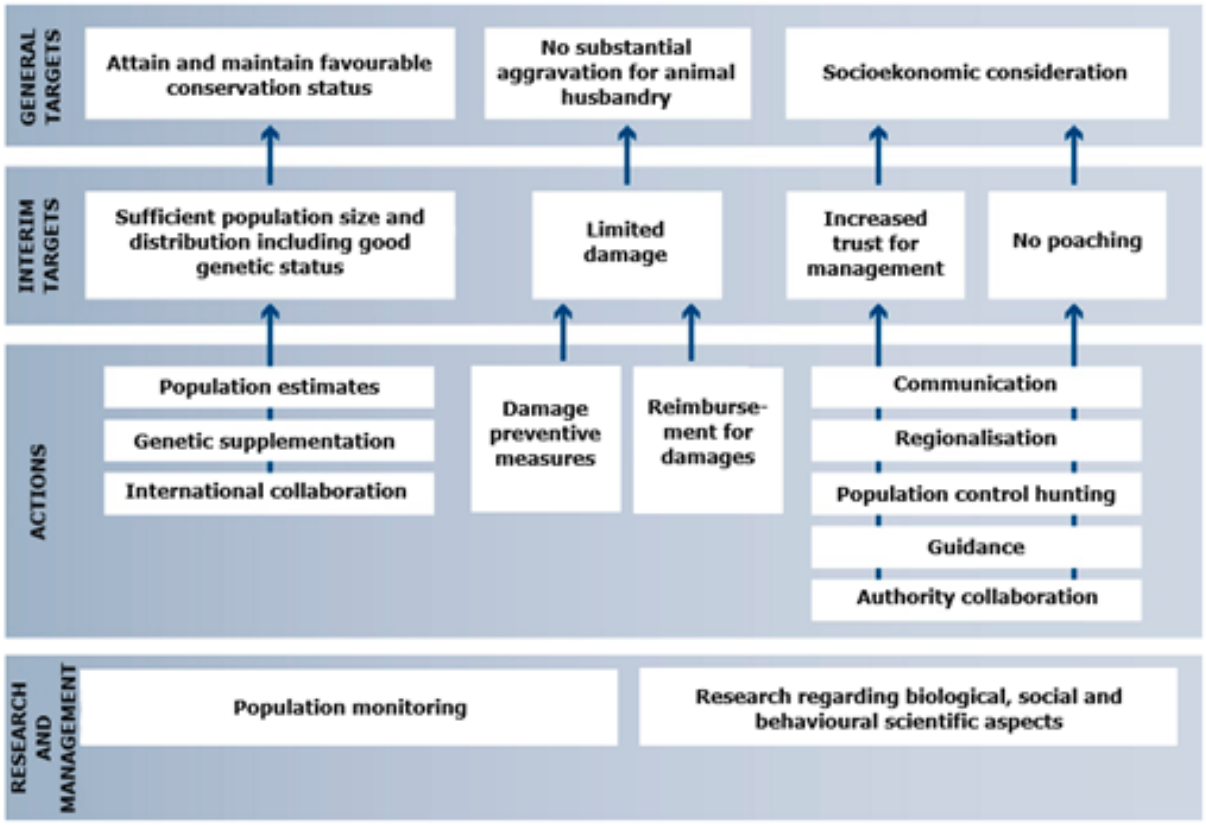


Figure 6: *Main objectives from the National Management Plan for wolverine in Sweden*

The Favourable Reference Range of wolverines in Sweden includes the alpine region of the Scandinavian mountain chain and the forested areas close to the mountains in Norrbotten, Västerbotten, Jämtland, Västernorrland and Dalarna county. This is the minimum area required for the population. The distribution of wolverines should increase or continue to be stable in both alpine as well as in the boreal zones of Sweden.

Figure 7. *The three large carnivore management areas in Sweden. Wolverines only reproduce in the Northern (green) and Middle (blue) management areas.*

The minimum viable population size (MVP) for wolverine in Scandinavia has been estimated to 500 based on population modelling (Nilsson 2013, SEPA Report 6549). In order to fulfil the general target of an effective population size (N_e) higher than 500, the total Fennoscandian population should be approximately 1400 individuals. SEPA has thus defined the Favourable Reference Population for Sweden to be >600 (thus having some margin down to the MVP and also getting close to the N_e 500 value if also including Norwegian and Finnish populations). This reference value must be met when the CABs distribute and define population goals in their regional management plans. To coordinate this, the Swedish management system has defined three large carnivore management areas (Figure 7), each of which is represented by a regional collaboration board. In 2020, SEPA decided about minimum levels for number of wolverine reproductions in each of the management areas. Using the 2019 census data and a conversion factor of 6,3 for calculating number of adult individuals (>1 years old) from number of reproductions it was stated that the northern management area should have at least 89 reproductions and the middle management are should have at least 7 reproductions (no reproductions in the southern management area) in order to ensure that the population does not fall below the favourable reference population level.

The CABs are responsible for implementing the management plans within their county. In addition to collaboration with other CABs within each large carnivore management area, regional stakeholder advisory boards also assist the CABs in making decisions on overall guidelines for wildlife management. The function and composition of the stakeholder advisory boards is regulated in an ordinance (SFS 2009:1474), and all major stakeholder groups are represented, e.g. conservation organizations, hunting organizations, forestry, agriculture, reindeer husbandry and politicians. Regional large carnivore management is to be conducted in accordance with both national and

regional management goals, and the same legislation is applicable at both the national and regional levels.

In order to compensate for the economic losses from carnivore predation on reindeer, the government and the Sami parliament issues reimbursement to reindeer herders. The Swedish compensation system in the reindeer husbandry area is a form of Conservation Performance Payment (CCP; a system where there is a direct link between monetary payments and the production of desired conservation objectives; Persson *et al.* 2015 Cons. Lett. 8:345-350). Payments are intended to cover losses in reindeer production resulting from depredation or disturbance, while simultaneously accounting for the conservation value of wolverines. For wolverine, the level of reimbursement is decided based on the number of wolverine reproductions occurring in each respective Sami village area. Since 2002, payments have been set at 200 000 SEK per each documented wolverine reproduction, 70 000 SEK is paid for regular occurrence and 35 000 SEK for sporadic occurrence. Approximately a total of 20 million SEK is paid annually in reimbursement to compensate for reindeer losses.

The CABs provide direct compensation for other life-stock losses due to carnivore depredation and also issues allowance for preventive measures. The wolverine has recently spread south and is now also successfully reproducing outside of the reindeer husbandry areas. Despite the wolverine being a predator on free-ranging sheep in Norway, wolverines have only very rarely been reported to attack sheep in Sweden. The differences between the two countries probably comes from the rules that manages animal husbandry, and the number of sheep life stock. In Sweden there are practically no free-grazing animals and the number of sheep is also much lower than in Norway. Between 2016 and 2021 there were a total of 1055 wolverine damage reports from Sweden registered in RovBase. Of these 1050 are damages on reindeer and 5 are on hunting dogs.

In Sweden, wolverines are protected by the Swedish Ordinance on Species Protection, and it is illegal to catch, kill or disturb it (SFS 2007:845). In cases where wolverines cause damage, or in order to prevent damages, management authorities (SEPA and the CABs) may, however, issue derogations from this protection in accordance with requirements laid out in the Swedish Ordinance on Hunting (SFS 1987:905). SEPA is the main authority responsible for issuing such derogations to allow the lethal removal of wolverines. SEPA can also delegate this authority to the CABs, in accordance with the political decision in 2013 to regionalise large carnivore management in Sweden. With this delegation, the CABs assume responsibility for formulating rules and restrictions, setting quotas for hunting, and carrying out surveillance to ensure that hunting is performed in line with the given rules and restrictions. The derogation decisions issued by the CABs can be appealed to the National Administrative Court. When management authority is delegated to the CABs, SEPA maintains an advisory role in interpreting the legislation, and a supervisory role in ensuring that the conservation status is not endangered. If favourable conservation status is not upheld, SEPA can withdraw their delegation of authority.

In response to damage caused by wolverines, CABs may also issue derogations to allow *protective hunting*. When issuing derogations, CABs must assess the criteria laid out in the Hunting Ordinance § 23 a-b (SFS 1987:905). The criteria that must be assessed when issuing derogations to allow protective hunting include:

- the existence of other satisfactory solutions for preventing the damage
- whether the derogation will affect the probability of reaching or maintaining favourable conservation status
- whether the derogation will help to prevent particularly significant damage.

Past court rulings may also determine and define the limits and outcomes of derogation decisions. Under certain conditions, for example when a wolverine is close to domestic animals and an attack is imminent, domestic animal owners have the right to defend or protect their animals through protective hunting, without the need for a specific protective hunting permit (§ 28 a-d, SFS 1987:905).

Table 4 Number of legally hunted wolverines in Sweden during the last 10 years. No wolverines have been killed during license hunting in Sweden in these years (license hunting was issued during 2019, but no wolverines were felled at this occasion). Data from Rovbase.

Year	Protective hunting
2012	9
2013	33
2014	22
2015	38
2016	12
2017	11
2018	3
2019	15
2020	21
2021	13

After delegation from SEPA, the CABs can also issue derogations to allow *license hunting*. The regulations for licence hunting can be found in the Hunting Ordinance § 23 c-f (SFS 1987:905). License hunting of large carnivores can be allowed when there are no other suitable management solutions, and as long as the hunt does not impede maintenance of favourable conservation status for the pertinent species in its natural range. For wolverines, both population size and population composition from the preceding monitoring season must be taken into consideration when considering license hunting as a population management tool. License hunting can only be permitted during years when the population exceeds the reference value and must be implemented under strictly controlled conditions. In recent years License hunting has only been allowed in 2019, but no wolverines were killed during this hunt.

All known dead wolverine individuals in Sweden are to be handed to the Swedish Veterinarian Institute for analyses and genetic identification. As a result of this regulation, most dead wolverines are recovered and studied, and the information obtained is used for population modelling and to inform future management decisions.