



THE SITUATION OF THE WOLF (*CANIS LUPUS*) IN THE EUROPEAN UNION

An In-depth Analysis

Written by the N2K GROUP EEIG
December 2023

THE N2K GROUP
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TABLE OF CONTENTS

Key Findings	7
1. Introduction	12
1.1. Environmental context.....	12
1.2. Legal context.....	13
1.3. Political context	14
2. Conservation status	16
2.1. Wolf monitoring – challenges and good practice examples	16
2.2. Conservation status assessments according to Art. 17 of the Habitats Directive ...	21
2.3. IUCN Red List assessments at population level and Member State level	23
2.4. Updated information on wolf numbers in the European Union.....	25
2.5. Threats and mortality	32
2.6 Wolf-dog hybridization	37
3. Role of the wolf in ecosystems and impacts on society	40
3.1. Role in ecosystems’ functioning/health/balance.....	40
3.2. Predation on wild ungulates and implications for hunting	43
3.3. Predation on farm and domestic animals	44
3.4 Attacks on hunting dogs and other pets	53
3.4. Considerations regarding public safety	55
4. Available measures to improve coexistence	57
4.1. Prevention measures and livestock protection	57
4.2. Compensatory measures	60
4.3. Opportunities for nature-based tourism and education	61
4.4. Information, advice, awareness raising	63
4.5. Dialogue with, and involvement of, stakeholders	65
4.6. Lethal control/culling of wolves	66
4.7. Recommendations to address ‘bold wolves’	70
4.8. EU support for large carnivores under the Common Agricultural Policy (CAP)...	72
References cited	75
Annex:	
Target data collection on wolf population and its impacts in the EU:	
Summary of findings.....	87

KEY FINDINGS

The following is a short summary of the key issues raised in each of the four chapters of the study.

1. Introduction

Having been extirpated from most of Europe during the 18th and 19th Centuries, wolves started to recover in the 1970s and are now present in most of the EU Member States. With the return of the wolf, comes also the return of conflicts with livestock.

Wolves in the EU are protected by the Bern Convention and the Habitats Directive, but the strict protection of wolves may be derogated under certain conditions to, *inter alia*, prevent serious damage to livestock or in the interests of public safety.

After the adoption of the European Parliament's non-legislative resolution on the protection of livestock farming and large carnivores in Europe in November 2022, the European Commission has committed itself to carrying out an in-depth analysis of available scientific and technical data on the wolf in the EU.

2. Conservation monitoring

Wolf monitoring – challenges and good practice examples

Wolf monitoring is challenging because of low population densities and elusive behaviour. Within the EU, estimates of wolf numbers and their precision vary greatly across different countries, making it difficult to obtain a clear overall picture and compare numbers.

Reliable data on population size and trends and other important variables is an essential requirement for objective, science-based decisions. This is emphasised in the European Parliament resolution which deplored the lack of harmonised wolf monitoring. A number of national monitoring methodologies are described further as they represent good practice.

Assessment of the conservation status of the wolf under the Habitats Directive

According to the latest conservation status assessment undertaken under Article 17 of the Habitats Directive, covering the reporting period 2013-2018, the wolf was reported to be present in 21 EU countries. Its overall EU population at that time was estimated at around 11,000- 17,000 (best value: 13,492 wolves).

Member States reported 39 regional conservation status assessments for that period. 21 showed an improving trend in conservation status, 14 showed a stable trend and only 1 (Croatia Mediterranean) showed a negative trend. Around half (18) were favourable (FV), while the other half (19) were unfavourable (with 16 unfavourable-inadequate (U1) and three unfavourable-bad (U2)), and two unknown (XX). Compared to the previous reporting period (2007-2012), FV assessments decreased slightly from 19 to 18. The conservation status of the wolf under the Habitats Directive is not uniform across the EU.

IUCN Red List European assessment

According to the wolf assessment carried out in 2018 by the International Union for Conservation of Nature (IUCN) Red List, six of the nine European wolf populations were considered as non-threatened. Three of these populations were considered as “Near Threatened” (Iberian, Italian Peninsula and

Karelian populations) and a further three were of “Least Concern” (the Dinaric-Balkan, the Carpathian and the Baltic populations). The remaining three were listed as “Vulnerable” (the Western- Central Alps, the Scandinavian and the Central Europe populations). Red List assessment of the wolf is not uniform at a pan-European level.

Updated information on wolf numbers in the European Union

In 2023, wolves have been detected across all EU Member States except Ireland, Cyprus and Malta, and there are breeding packs in 23 countries. In this analysis, about 20,300 wolves have been estimated in 2023 across the EU, a figure slightly higher than the 19,400 wolves estimated by Boitani et al. (2022) and significantly higher than the 11,193 wolves estimated in 2012. Overall, the number of wolves in the EU is increasing.

Threats and mortality

Deliberate and accidental killing by humans is the main cause of wolf mortality in Europe. The results of mortality assessments however depend on the study method used. In studies based on the collection of ‘found-dead’ wolves, mortality from legal hunting and culling and traffic prevails over other causes whereas, in radiotracking studies, poaching emerges as an important or the most important cause of mortality, sometimes also in countries where hunting/culling is allowed.

Wolf-dog hybridisation is also considered a conservation problem for the wolf in Europe. Although hybridisation between wolves and dogs has probably occurred throughout the history of the dog’s domestication, genetic analysis demonstrates that both the dog and the wolf conserve a well-defined genetic identity. Sporadic hybridisation has been detected in all European wolf populations, but there is a higher percentage of hybrids in some Member States in southern Europe, mainly in Italy and Greece.

3. Role of the wolf in ecosystems and impacts on society

Role in ecosystems’ functioning

The wolf plays an important role in the ecosystem. Although wolves in Europe cannot trigger the trophic cascades described in North American national parks, they can, in some circumstances, limit the rates of increase and densities of wild ungulates, and so reduce browsing, damage to agriculture and forestry, as well as ungulate–vehicle collisions and the incidence of diseases (e.g., tuberculosis, African swine fever) transmitted by wild ungulates to livestock.

In addition, wolves provide carrion for scavengers, may reduce densities of golden jackals and perform other forms of ecosystem services.

Predation on wild ungulates and implications for hunting

Wolves hunt wild ungulates and may sometimes compete with hunters for prey. However, wolves kill far fewer wild ungulates than hunters and select individuals with a lesser reproductive value. In certain conditions, wolves may regulate wild ungulate populations which may require an adjustment to existing harvest strategies.

Predation on farm and domestic animals

Predation of livestock has been the main cause of wolf persecution throughout history and is currently the main source of conflict between wolves and people.

Wolves kill annually at least 65,500 heads of livestock in the EU, 73% are sheep and goats, 19% cattle and 6% horses and donkeys. The highest damage to livestock is reported to occur in Spain, France and Italy (14,000-10,000 heads annually in each country). Sheep are mainly killed in France, cattle in Spain, horses in the mountains of southwestern Europe and semi-domestic reindeer in Finland and Sweden. Considering that there are about 60 million sheep in the EU, the level of sheep depredation by wolves represents an annual killing of 0.065%.

In general, damage to livestock has increased as the wolf population has grown. But, in some of the German federal states with the highest number of wolves, the frequency of wolf attacks on livestock has decreased significantly in recent years, which was associated to the use of adequate preventive measures.

On a large scale, the overall impact of wolves on livestock in the EU is very small, but at a local level, the pressure on rural communities can be high in certain areas.

Depredation levels are typically higher on free-ranging livestock and are lower in areas where wolves have never disappeared. Natural prey availability, landscape characteristics and protection measures also shape the incidence of damage to livestock.

Considerations about public safety

Although wolves can attack humans, no fatal wolf attacks on people have been recorded in Europe in the last 40 years. To reduce even more the already small risk that wolves pose to human safety, specific protocols have been developed to address the problem of bold and/or food-conditioned wolves.

4. Available measures to improve coexistence

Prevention measures to avoid livestock predation

The best way to reduce livestock losses due to wolf attacks is to apply effective and adapted measures to prevent wolf depredation. Much information has been published in recent years on the different methods available and their effectiveness in terms of livestock protection. Many of the publications come from EU funded LIFE Projects.

All emphasise the need to ensure that prevention measures are tailored to the specific circumstances of each exploitation and that expert advice in early phases is crucial.

Most of the prevention methods used in the EU have shown a high or moderate degree of effectiveness, but protecting free-ranging livestock remains very challenging.

Some EU countries, such as France and Germany, spend a significant amount of money for damage prevention. While the measures have not shown clear effectiveness in France, they appear to have reduced the extent of livestock damage in Germany.

Some measures can also be used to protect hunting dogs. The Natural Resources Institute of Finland has informed the public on radio-collared wolf positions, reducing the risks of attacks.

Compensatory measures

Damage caused by wolves to livestock is compensated in most of the EU countries, in general using the ex post facto system that requires the damage to be documented. In the European Union, around 18.7 million euros per year are paid in compensation for wolf damages. France pays the most money in terms of compensation (about 4.1 M euros in 2022). The most affluent MS and those where livestock is free-ranging tend to pay higher compensation per wolf and per year.

Opportunities for nature-based tourism and education

Wolf-related tourism can create income in rural areas and also lead to increased tolerance toward wolves at the local level. Tourism can also educate visitors about the ecology of wolves and how to coexist with them, raising awareness and promoting conservation efforts.

Wolf-related tourism should however be properly planned and regulated to prevent any negative impacts on wolves.

Information, advice, awareness raising

Numerous websites have been developed over the years by Member States, the European Commission, the Large Carnivore Initiative for Europe (LCIE) and NGOs to provide detailed information on wolf populations in the EU, raise awareness and offer advice for reducing human/animal conflicts.

Most LIFE projects on wolves also provide comprehensive information and advice on different types of prevention measures.

Dialogue with and involvement of stakeholders

Participation processes have proven useful to address divergences among stakeholders with contrasting opinions on wolves and their management. Since 2014, the European Commission has supported the establishment of the EU Platform on Coexistence between People and Large Carnivores involving representatives of different interest groups. Since 2018, thanks to a pilot project funded by the European Parliament, regional stakeholders' platforms have also been established in six Member States to improve the co-existence of large carnivores and humans.

Lethal control/culling of wolves

For those Member States where wolves are listed in Annex IV of the Habitats Directive, derogations can be used on a case-by-case basis, in line with the requirements of the Directive. The use of derogations is highly variable in the MS.

For instance, France (Annex IV), has introduced a maximum ceiling for all the targeted lethal removal authorizations of wolves. This has increased from 10% of the wolf population size in 2004 to 19-21% in 2021. Yet, the wolf population is still increasing.

In Sweden (Annex IV), wolves are culled by means of protective hunting (targeted lethal removal) and licenced hunting (non-targeted lethal removal). In the 2022-2023 winter season, 57 wolves were legally culled (14% of the population).

In Spain north of the river Duero, the wolf is listed in Annex V of the Habitats Directive (no derogations needed). Several methods of wolf hunting and control were used by the autonomous regions before the wolf was strictly protected in 2021. In Cantabria wolves were culled and hunted, in Castile and Leon they were hunted, in Asturias they were culled for the purpose of reducing livestock damage, and in Galicia wolves were considered as a game species, but managed *de facto* as a protected species.

Evidence in North America show that lethal control reduced damage to livestock only when it was intense enough to reduce wolf populations over large areas. In France, the research conducted to assess the effects of targeted culling on wolf depredations was inconclusive.

Protocol on Bold wolves

A bold wolf is a fearless wolf that repeatedly tolerates recognizable people within 30m or even actively approaches them. To reduce the risk posed by bold wolves, experts have published a protocol detailing how to act in different circumstances.

EU support for large carnivores under the Common Agricultural Policy (CAP)

EU funding mechanisms exist under the CAP to support livestock farmers who operate in areas where large carnivores are present. Of the 24 Member States with wolf populations, 10 Member States have included specific and targeted interventions for large carnivores under Pillar II in their CAP Strategic Plans. For three Member States, the interventions focus specifically on wolves. For the remainder, they cover also other large carnivores (bear, lynx, jackal).

A further five Member States have indirect sub-measures that could potentially help address the need to protect the grazing herd from predators even if this is not the objective of the measure.

Of the ten Member States with targeted interventions, six offer both Agri-Environment-Climate measures (AECMs) to compensate for livestock damage and investment schemes to protect livestock against predators. Four Member States offer just investment schemes to protect against predators.

1. INTRODUCTION

1.1 Environmental context

The wolf (*Canis lupus*) once occupied most of the Holarctic region in Eurasia and North America and is one of the terrestrial mammals with the largest natural range in the world. In Europe, the wolf is a native wildlife species and, as such, part of Europe's biodiversity and natural heritage. As with any wild species, it plays an ecological role in the ecosystems (see section 3.1) (Hoag et al. 2022). It was once present throughout the continent, including on the islands of Great Britain and Ireland, from where it was extirpated in the 17th and 18th centuries.

The wolf is an adaptable species, able to live in almost all habitats in the Holarctic region, from the High Arctic to the Arabian desert, as well as in many human-dominated landscapes in Europe and Asia. Wolves live in packs that usually contain five to ten individuals, formed by the breeding pair and its current offspring, along with some offspring from the previous year and sometimes also unrelated wolves.

In each pack, usually a single female gives birth once a year to 5 or 6 pups, whose survival in natural habitats depends on the availability of food *per capita*. Thanks to their reproductive capacity, wolves can withstand high mortality rates, and under the right conditions, wolf populations can recover fairly quickly. For example, the average rate of increase of wolves between 2000 and 2015 in Germany has been 36% per year (Reinhardt et al. 2019).

The territory of a wolf pack may extend over several hundred km², so the wolves usually live in very low densities, between 1 and 3 individuals / 100 km². Wolves can disperse over several dozen or hundreds of kilometres from their natal pack, even in European human-dominated landscapes, which enables them to recolonize regions and countries from where they had disappeared.

Although their diet can be varied, wolves are natural hunters of wild ungulates, such as red deer, roe deer, wild boar and moose, but they also have a tendency to attack unprotected livestock, especially sheep. This tendency has fuelled the animosity of agricultural societies, which has, in the past, led to the extermination of the wolf to reduce its impact on livestock.

As a result, many wolf populations disappeared, especially at the end of the 19th century and during much of the 20th century. In the 1960s and 1970s wolf populations reached their lowest levels in Europe. They almost completely disappeared from Finland, Scandinavia and central Europe and were confined to Eastern Europe and the southern European peninsulas, where a few small and fragmented populations survived close to extinction (Boitani 2003).

However, around 1970 the ecological and social changes that occurred in Europe allowed the recovery of the wolf and other large carnivores. The rural-urban migration led to natural reforestation and a dramatic increase of wild ungulates, thereby greatly improving habitat conditions for wolves. The combination of land abandonment, improvement of attitudes, legal protection and reduced human impacts on the landscape over the last decades of the 20th century has created the right conditions for a large-scale recovery of the wolf across Europe (Chapron et al. 2014).

Having been extirpated from large parts of the continent in the past, wolves are on the rebound and have resettled in parts of the EU, such as France and Germany and, more recently, even in densely populated countries like the Netherlands and Belgium.

1.2 Legal context

The conservation of the wolf in Europe is essentially governed by the Bern Convention¹ and the EU Habitats Directive². The Bern Convention on the Conservation of European Wildlife and Natural Habitats came into force in 1982. The Bern Convention aims “*to conserve wild flora and fauna and their natural habitats, especially those species and habitats whose conservation requires the co-operation of several States*”, giving particular emphasis to “endangered and vulnerable species”, including wolves.

In particular, the Bern Convention requires its parties to take “appropriate and necessary legislative and administrative measures” to ensure the “protection” of Appendix III fauna and the “special protection” of Appendix II fauna. For species listed in Appendix II, the Convention requires the prohibition of, *inter alia*, the deliberate killing, capturing, and disturbing of individual animals belonging to listed taxa. Derogations are however possible under Art. 9 Bern Convention.

The wolf is listed as a specially protected species in Appendix II of the Convention. However, nine contracting parties of the European Union have submitted reservations on its legal status in their countries. Two of these countries (Lithuania and Spain) apply instead the more flexible protection regime of Appendix III to their wolf populations. The other seven states (Bulgaria, Czech Republic, Finland, Latvia, Poland, Slovakia and Slovenia), treat the wolf as not being listed on either of the Appendices of the Bern Convention (Trowborst and Fleurke 2019).

Adopted in 1992, the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. Together with the Birds Directive, it forms the cornerstone of Europe's nature conservation policy and establishes an EU wide ecological network of protected areas - called Natura 2000 - which should enable the natural habitat types and the species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status in their natural range.

The overall objective of the Habitats Directive is to maintain or achieve a “favourable conservation status” for the species and natural habitat types listed in its annexes I, II, IV and V. The status of a species is deemed favourable when, *inter alia*, the species “is maintaining itself on a long-term basis as a viable component of its natural habitats” and “there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.”

For the majority of Member States, the wolf is listed in both Annex II of the Habitats Directive which requires Member States to designate core areas for the species under Natura 2000 and in Annex IV which requires its strict protection across its natural range both inside and outside protected areas.

Finland, Estonia, Greece (north of the 39th parallel), Latvia, Lithuania, and Spain (north of the Duero River) are not required to designate Natura 2000 sites for wolf (because of geographical exemptions given in Annex II for these countries). Moreover, for Bulgaria, Estonia, Latvia, Lithuania, Poland, Slovakia and parts of Greece (north of the 39th parallel), Finland (reindeer management area) and Spain (north of the Duero River) the wolf is listed in Annex V, which means that the wolf is not a strictly protected species in these Member States.

Some of Member States have also accorded a higher degree of protection for the wolf under national legislation, than that provided by the Directive. For example, in Poland, Greece (north of the 39th parallel), Spain (north of the Duero River) and Slovakia, wolf populations are strictly protected under national legislation despite being listed in Annex V of the Directive.

¹ coe.int/en/web/bern-convention

² [The Habitats Directive \(europa.eu\)](https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32006L0060)

Derogations are nevertheless possible under Article 16 in order to prevent serious damage (in particular to crops, livestock, forests, fisheries and water and other types of property) and in the interests of public health and public safety. Derogations are also possible for other imperative reasons of overriding public interest, including those of a social or economic nature, or in order to allow, under strict conditions, the taking or keeping of certain specimens of the species enjoying strict protection in limited numbers specified by the competent national authorities.

In other words, the existing rules on derogations make it possible to balance different interests against the conservation aims of the Directive. The Directive thus authorises Member States to take action to derogate from certain provisions in order to address the specific challenges they are currently facing in relation to the wolf population. In this context, Member States have at their disposal the appropriate means to address local conflicts and circumstances, in line with the principle of subsidiarity.

Member States make varying use of derogations. Some Member States have never or almost never used derogations to remove wolves (e.g., Portugal, Italy), some use derogations in a very limited way (e.g., Germany) while some others make use of derogations frequently or systematically (e.g., France, Sweden).

Considering the fragmented legal landscape and the transboundary nature of most wolf populations, transboundary cooperation at the population level has become a leading paradigm for large carnivore conservation both under the Bern Convention and the Habitats Directive (Linnell et al. 2008).

1.3 Political Context

In the 30 years since the Habitats Directive came into force, wolves in the EU have recovered significantly and are now occupying new Member States from where they had disappeared, such as France in the early 1990s, Germany in the early 2000s, and other countries of central and western Europe more recently. Some wolf populations that were endangered in 1992 have since then significantly increased (Chapron et al. 2014).

With the wolf's return, more frequent conflicts arise with livestock breeders mainly in areas where it was absent for decades. In such areas, the husbandry methods had adapted to a landscape devoid of large carnivores, leading to a decline in practices for managing and protecting grazing livestock in the presence of large predators. The recovery of wolf populations has led to a resumption of their predation on livestock.

On the other hand, the wolf also continues to enjoy strong public support, as demonstrated by the targeted data collection exercise launched by the European Commission in 2023³. Even if the aim of the exercise was not to collect opinions in favour or against the strict protection of the wolf in the EU, but to collect relevant data to feed into the comprehensive analysis of the wolf situation, over 70% of the respondents expressed their support for maintaining wolf protection status, compared to 29% in favour of reducing its protection status. An opinion poll conducted by Savanta on behalf of Eurogroup for Animals in six countries of the EU in 2020 also found that the majority of public believed that “wolves have a right to exist in the wild; belong to our natural environment and should be strictly”⁴. Another more recent survey of residents in rural communities conducted by Savanta on behalf the same organisation in 10 EU countries reported “a significant 68% of those surveyed advocating to maintain the strict protection status of large carnivores”⁵.

³ [Wolves in Europe \(europa.eu\)](https://wolves.europa.eu/)

⁴ <https://www.eurogroupforanimals.org/news/new-poll-shows-eu-citizens-stand-wolves>

⁵ https://www.eurogroupforanimals.org/files/eurogroupforanimals/2023-11/20231129_Survey%20Report%20Large%20carnivores.pdf

In 2022, Switzerland proposed downlisting the wolf from Appendix II (strictly protected species) to Appendix III (protected species) to the Bern Convention. The proposal was rejected by the parties of the Convention on 29 November 2022.

On 24 November 2022, the European Parliament adopted a non-legislative resolution on the protection of livestock farming and large carnivores in Europe⁶. The resolution reflects the different views of stakeholders about the wolf conflict.

It acknowledges the positive role played by EU biodiversity policy in the recovery of large carnivores. It stresses the importance of ensuring a balanced coexistence between humans, livestock and large carnivores, in particular in rural areas, and asks the Commission and the Member States to ensure long-term funding for both damage prevention and compensation.

It acknowledges that flexibilities exist under the current legal framework to manage trade-offs, while noting that these flexibilities should be explored further. The text emphasizes in particular that the rapid increase in the wolf population and in attacks on livestock makes it hard for national administrators to act effectively and decisively with the tools currently available to them, which causes detrimental impacts on livestock farming and rural communities.

It welcomes and supports the Swiss proposal to downgrade the protection status of wolves under the Bern Convention, pointing out that the conservation status of the wolf at pan-European level justifies a mitigation of its protection status. It asks the Commission to carry out additional studies and analyses, as well as an assessment of the effectiveness of damage mitigation measures tested or implemented under LIFE and other EU funding mechanisms. Finally, the resolution asks the Commission to develop an assessment procedure to enable the protection status of populations in particular regions to be amended as soon as the desired conservation status of species has been reached.

In its reply to the European Parliament's resolution, the European Commission⁷ stated *inter alia* that in the course of 2023, the Commission would carry out an in-depth analysis of all available scientific and technical data, and all other relevant circumstances at hand, in order to assess whether further measures are needed, including for adapting the protection status of species of Community interest based on technical and scientific progress. This report constitutes the in-depth analysis that the Commission had undertaken to carry out.

⁶ https://www.europarl.europa.eu/doceo/document/TA-9-2022-0423_EN.html

⁷ https://environment.ec.europa.eu/news/follow-european-parliament-non-legislative-resolution-protection-livestock-farming-and-large-2023-06-06_en

2. CONSERVATION STATUS

2.1. Wolf monitoring – challenges and good practice examples

Monitoring wolf populations is challenging because of low population densities and elusive behaviour, but reliable data on population size and trends and other important variables, is an essential requirement for objective science-based decisions to be made on wolf management, especially at a time when public debate is highly polarized. This is emphasised in the European Parliament resolution which deplored the lack of harmonised wolf monitoring. It called on the Commission to ensure that Member States use appropriate monitoring methods for each of the different large carnivore species to allow for the compilation of high-quality, comparable and standardised data for an effective assessment of population levels.

In their report on wolf status in geographic Europe, Boitani et al. (2022) also highlighted that estimates of wolf numbers and their precision vary greatly across different countries, making it difficult to compare numbers. While most countries estimate the number of individuals, several countries estimate instead reproductive units (i.e., packs and pairs) and use conversion factors to translate it to numbers of individuals.

Boitani et al. (2022) considered that pack/pair numbers for monitoring purposes (i.e., keeping track of variation through time and space) but are less suited to meet the requirements of the current Red List system and other international systems for status assessment. “Pack to individual conversion factors are most frequently between 6 and 8 but may range from 4 (Belgium) to 10 (Sweden). The variation of conversion factors produces large variations in the estimates of wolf numbers and may be relevant when applying thresholds for conservation assessment.” (Boitani et al. 2022).

The benefits of using the same wolf monitoring methods throughout the European Union has been pointed out many times, but this is not easy because wolf monitoring depends not only on ecological aspects (the size of the wolf population, the characteristics of the landscape, the availability of snow in winter, etc.) but also on operational and social aspects, such as the availability of economic and scientific resources, the availability of volunteers or workers to carry out field work, and the ability of institutions to coordinate the work.

Some EU countries, such as Sweden, France and Germany, carry out high-quality wolf monitoring and provide an open and efficient dissemination of the results. The three countries spend substantial economic and scientific resources and began monitoring when the first wolves appeared after their extinction. In addition, Sweden and the alpine zone of France have snow every winter, which facilitates wolf tracking and the collection of demographic and genetic data. We summarize below the characteristics of the permanent monitoring carried out in these countries as well as the monitoring at a population level of the Alpine wolf population carried out in seven European countries.

Wolf monitoring in Sweden

The Scandinavian wolf population is jointly monitored every year by Norwegian and Swedish authorities. The Swedish Environmental Protection Agency and the Norwegian Environment Agency have joint Scandinavian guidelines and instructions for monitoring of wolves. The County Administrative Boards in Sweden and the Norwegian Nature Inspectorate (SNO) together with Inland Norway University of Applied Sciences are responsible for collecting field data. They also confirm reports of tracks and other observations by the public, whose contributions are very important. Wolves

are classified in different categories: family groups (three or more animals sharing a territory), territorial pairs, other stationary wolves, and vagrants. Also, number of reproductions is determined each year. This number is especially important as national management goals for the wolf population in both countries are expressed as number of reproducing units.

Three methods are used in combination. Snow-tracking is the basic method. At least 100 field workers are employed full time or part time to find and follow tracks of wolves during the monitoring season 1 October – 31 March. The second method is DNA-analysis, mainly based on wolf scats collected during tracking. DNA-analysis helps verify reproductions, identify newly established pairs, differentiate between neighbouring territories and identify new immigrants from the Finnish/Russian population. The third method is radio telemetry. 10-20 wolves are equipped with GPS-collars each year, this is used to determine the extent of their territories and to differentiate between neighbouring territories. All monitoring data are recorded in national databases and compiled each year in annual monitoring reports. The annual budget for large carnivore monitoring in the two countries combined in 2011 was approximately 5.8 million euro, of which approximately 1.5 million was spent on wolves (Liberg et al. 2012a; Wabakken et al. 2022).

A recent evaluation study concluded that the applied methods for wolf monitoring in Scandinavia worked well, suggesting that virtually all wolf packs, territorial pairs, and reproduction events were detected. Compared to the estimates of many other wildlife species, this yields an extremely low level of uncertainty regarding number and distribution of wolves. A major strength of the Scandinavian monitoring program is the combination of field observations from snow tracking and the collection of samples for DNA analyses. The identification of resident scent-marking individuals in territorial pairs and packs also provides important information about social status and reproduction, which allow for a better understanding of the drivers behind population dynamics and changes in genetic variation. Snow is an important factor for this kind of integrated methodological approach. Without snow, managers would have to rely solely on DNA analyses (Åkesson et al. 2022).

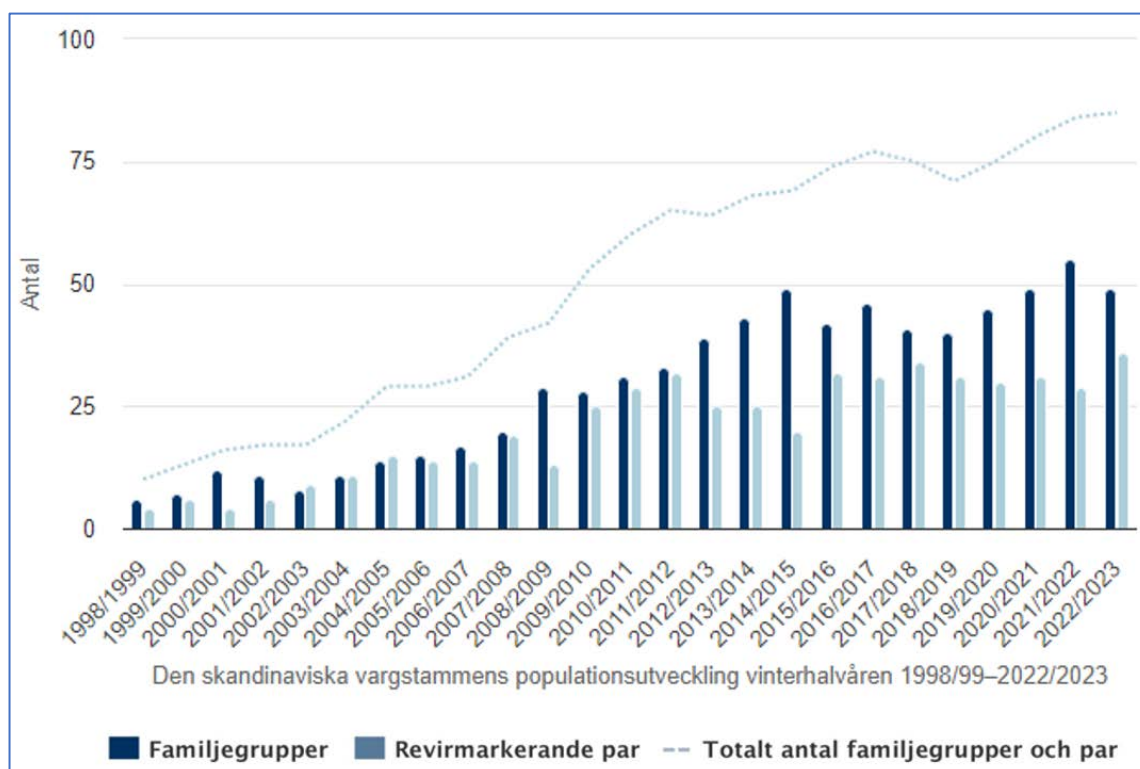


Fig. 2.1.1. Trend in territorial wolf units in Scandinavia (Sweden and Norway). Dark blue bars, packs; light blue, marking pairs. From [Varg, population Skandinavien \(naturvardsverket.se\)](https://naturvardsverket.se/Varg/population/Skandinavien).

During winter 2022-2023, 49 packs of wolves were documented in Scandinavia (Sweden and Norway); 40 within Sweden, six across the Norwegian-Swedish border and three within Norway. 36 territorial pairs were confirmed: 29 within Sweden, three across the border and four within Norway. Multiplying the number of reproductions by 10, Scandinavian wolf numbers were estimated to 510 (95% CI = 403-663). The Swedish sub-population was estimated to 450 wolves (95% CI = 356-585), including half of the cross-boundary wolves. The calculations include both alive and dead wolves during the monitoring period. The method also allows for the detection of new Finnish-Russian immigrant wolves and an estimation of the inbreeding coefficient which is particularly important in this population with a severe inbreeding depression (Svensson et al. 2023).

Wolf monitoring in France

In France, monitoring is based on a national network of trained observers ($n > 4000$) distributed across the whole country. Members of the network collect data on signs of wolf presence (scat, visual observations, etc.) in their sampling area and report back to regional coordinators at the Office Français de la Biodiversité (OFB), the public agency responsible for monitoring the wolf population at the national scale. Data are individually checked against standardised technical criteria to check their reliability.

The data are then compiled and synthesised by the OFB in a single national database, and results are published regularly on a public website (<https://www.loupfrance.fr/>) following annual monitoring campaigns in both summer (new pack detection through elicited howling) and winter (population trend indexes and demographic parameter estimates using sign survey and non-invasive genetic capture-recapture estimates). The OFB also regularly provides training and workshops on wolf monitoring for new members of the network across the country.

Monitoring consists of two steps:

- First, a survey of signs of wolf presence at a large scale provides data from unknown individuals, thereby allowing the detection of new wolf occurrences, new pack formations, and the documentation of geographical trends. Reporting is done opportunistically over the whole area covered by the expert network. Validated data are mapped to monitor the change in wolf distribution over time on the 10 x 10 km EU reference grid.
- Second, when the wolf's presence is considered permanent, each territory is surveyed to estimate pack composition and population parameters (number of individuals, reproduction events, etc.). Surveys are carried out during both winter and summer. The winter survey is based on snow-tracking or on camera traps to monitor pack sizes and composition whereas, in summer, elicited howling protocols are implemented to confirm reproduction.

Finally, non-invasive molecular tracking has been conducted in France since 1995 to identify haplotypes, for genotyping and to monitor wolf-dog hybridization. This non-invasive monitoring is conducted by analysing the scats collected during the snow-tracking survey and then used to model population trends and demography using capture-recapture models (Duchamp et al. 2012; Duchamp & Simon 2022).

Thanks to this information there has been continuous information on the trend of permanent areas of wolf presence, number of breeding packs and estimated number of wolves in France since 1992. The wolf population is estimated at 1,104 individuals at the end of winter 2022-2023, and the 2021-2022 figure was revised upwards from 926 to 1,096 wolves by the OFB thanks to genetic analysis. In the summer of 2021, 145 Permanent Presence Zones including 128 packs and 17 non-packs were identified (Fig. 2.1.2). The wolf is still increasing and expanding in France⁸.

⁸ <https://www.loupfrance.fr/suivi-du-loup/situation-du-loup-en-france/>

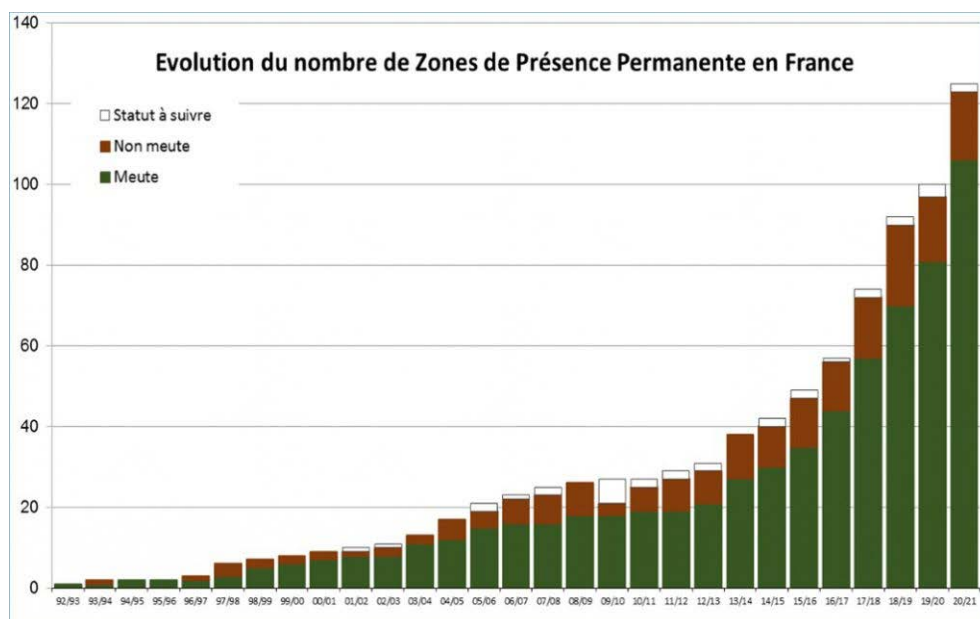


Fig. 2.1.2. Trend in Permanent Presence Zones of wolves in France (OFB). Green: pack; red: no pack; white: uncertain. From <https://www.loupfrance.fr/suivi-du-loup/situation-du-loup-en-france/>

Wolf monitoring in Germany

Following their extinction in the early 20th century, the first wolf pack was detected in Germany in 2000. Germany is a federal country consisting of 16 federal states (Länder) that are responsible for wolf monitoring. In order to make documentation and observations comparable across Germany, national monitoring standards for large carnivores were developed in 2009 and subsequently updated (Reinhardt et al. 2015).

Once a year, the national wolf monitoring meeting is coordinated by the Bundesamt für Naturschutz (BfN), the federal agency for nature conservation. Federal states present the data which are jointly evaluated and then compiled at a national level by the Dokumentations- und Beratungsstelle des Bundes zum Thema Wolf (DBBW), the federal documentation and consultation centre on wolves⁹ that publishes the results of the monitoring in annual reports and on the website. In 2015 the CEwolf scientific consortium was also founded to conduct standardized wolf genetic surveys in eight countries of Central Europe¹⁰.

In Germany, the annual wolf monitoring aims to identify the area of occurrence (number of 10×10 km grid cells with confirmed wolf presence) and the population's size at a national level. Population size is calculated as an index which considers the number of confirmed packs and pairs (minimum count). The number of single territorial wolves (wolves that are resident in an area for at least 6 months, but as yet without a mate) is also provided. In addition, mature individuals confirmed within the wolf territories are counted. However, no attempt is made to get a robust estimate of the total number of wolves, as this would significantly increase the monitoring effort and associated costs. The number of packs and pairs is considered to be biologically more meaningful than the total number of individuals. During summer, reproduction events are verified (mostly via camera traps) while the priority in winter is to collect genetic samples, if possible from the breeding (marking) individuals. The genetic analyses

⁹ <https://www.dbb-wolf.de>

¹⁰ <https://www.senckenberg.de/en/institutes/senckenberg-research-institute-natural-history-museum-frankfurt/division-river-ecology-and-conservation/cewolf-consortium/>

conducted by the Senckenberg Centre for wildlife genetics play an important role in the monitoring (Reinhardt 2022).

Between 1 May 2022 and 30 April 2023, 184 packs, 47 pairs and 22 territorial lone wolves were detected in Germany. The reproduction of 169 packs and the presence of 635 pups were confirmed. The territorial wolves occurred in 12 federal states and 21 packs crossed federal state borders¹¹.

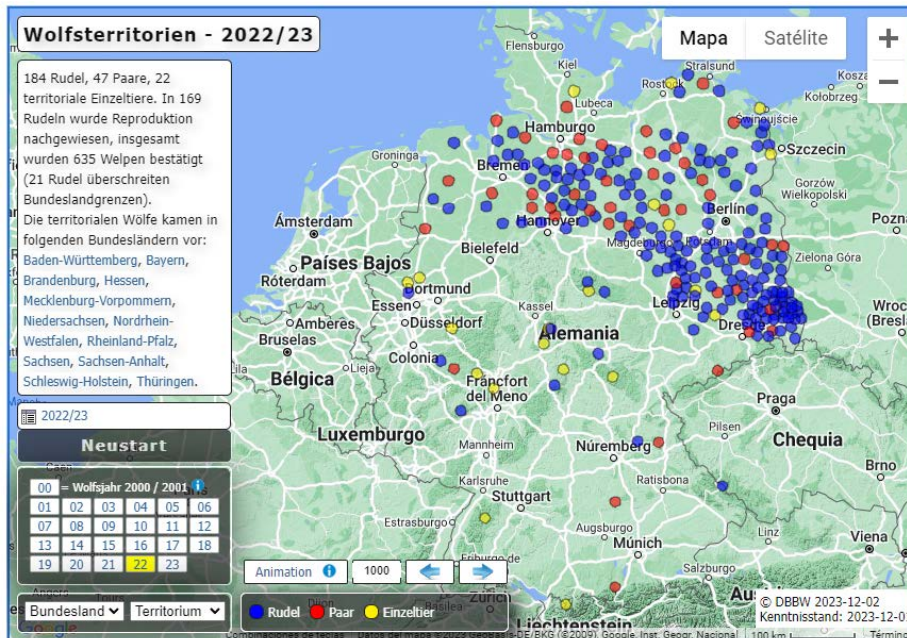


Fig. 2.1.3. DBBW website which shows the results of monitoring in Germany. Blue: pack; red: pair; yellow: lone wolf. From <https://www.dbbw-wolf.de/Wolfsvorkommen/territorien/karte-der-territorien>

Wolf monitoring in Italy

In Italy, a first national wolf survey was carried out during 2020-2021 both in the Alps and in the Apennines. The survey method included transects along 85,000 km carried out by more than 3,000 field assistants in the 1000 10x10 km grids where wolf presence had been previously detected, and also involved the collection and genotyping of scats and the estimation of wolf numbers using spatially explicit capture-recapture models.

The information provided by snow-tracking and camera traps was also used. In the study period, wolves were present in 41,600 km² in the Alps and in 108,534 km² in the Apennine. In total, 3307 wolves were estimated (confidence interval 95%: 2945-3608) in both areas. The field monitoring required a huge logistical, technical and coordination effort, involving a large number of field assistants, institutions and associations from all over Italy. The creation of a national network of trained operators will be another important outcome of this project in the long term¹².

Monitoring at a population level: the Alpine wolf population

Wolf expansion in Europe is occurring over administrative boundaries and most wolf populations are shared by two or more countries (see section 2.3 on European wolf populations). The “Guidelines for

¹¹ [dbb-wolf.de/wolf-occurrence/confirmed-territories/map-of-territories](https://www.dbbw-wolf.de/wolf-occurrence/confirmed-territories/map-of-territories)

¹² Risultati — Italiano (isprambiente.gov.it)

Population Level Management Plans for Large Carnivores in Europe” (Linnell et al. 2008), endorsed by the European Commission, emphasized the importance of monitoring wolves at the population level.

As already seen, this transboundary monitoring is carried out in the Scandinavian wolf population, between Sweden and Norway. Another notorious case of monitoring at a population level is that of the Alpine wolf population that began to form in the early 1990s with wolves that dispersed from the Apennines (Fabbri et al. 2007). This population currently covers seven countries (Italy, France, Austria, Switzerland, Slovenia, Liechtenstein and Germany), making the development of a joint and coordinated monitoring program particularly challenging (Marucco et al. 2023).

After founding the Wolf Alpine Group (WAG), researchers developed uniform criteria for the assessment and interpretation of field data collected in the frame of different national monitoring programs. This standardization allowed for data comparability across borders and the joint evaluation of distribution and consistency at the population level. The WAG documented the increase in the number of wolf reproductive units (packs and pairs) over 21 years, from 1 in 1993–1994 up to 243 units (206 packs and 37 pairs) in 2020–2021, and examined the pattern of expansion over the Alps. This long-term and large-scale approach is a successful example of transboundary monitoring of a large carnivore population that, despite administrative fragmentation, provides robust indexes of population size and distribution that are relevant for wolf conservation and management at the transnational Alpine scale (Marucco et al. 2023).

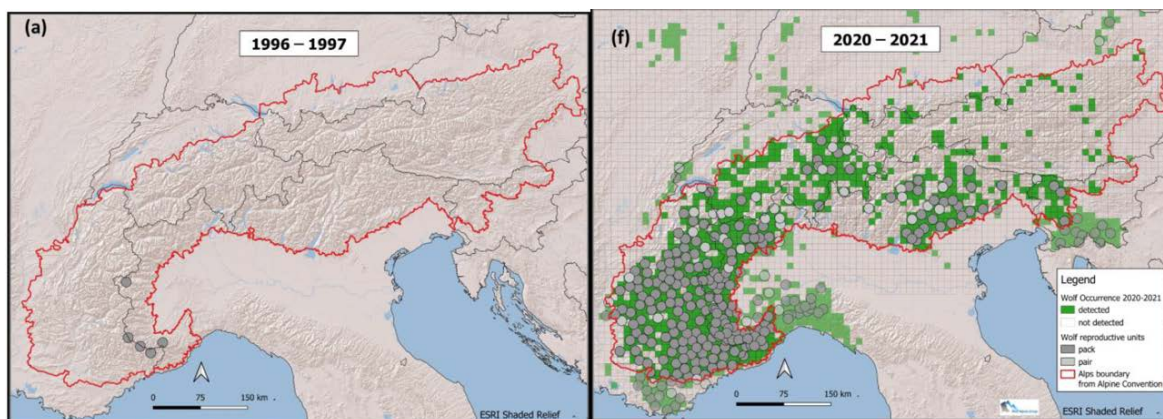


Fig. 2.1.4. Increase and expansion of the Alpine wolf population from 1996-1997 to 2020-2021. From Marucco et al. (2023).

2.2. Conservation status assessments according to Article 17 of the Habitats Directive

Under Article 17 of the Habitats Directive, each Member State is obliged to report every six years to the European Commission on the conservation status of the natural habitats and species listed in the Annexes that are present in their country. The European Environment Agency then pools the data together and makes an assessment of the conservation status per EU biogeographic region in order to see how well they are faring within each of the EU’s nine biogeographical regions.

At the EU biogeographical level, the most recent ‘Article 17’ reports covering the period 2013-2018 conclude that the wolf is present in seven biogeographical regions of the European Union (Pannonian, Continental, Alpine, Atlantic, Mediterranean, Black Sea and Boreal)¹³. However, it only has a favourable conservation status in the Alpine region¹⁴. In the other six, the wolf has an unfavourable-

¹³ <https://nature-art17.eionet.europa.eu/article17/species/summary/?period=5&group=Mammals&subject=Canis+lupus®ion=>

¹⁴ The Alpine biogeographical region includes the Alps, the Apennines, the Pyrenees, the Scandes and the Carpathians

inadequate conservation status, meaning that, even if the species is no longer threatened in the foreseeable future, further efforts are required for it to reach a favourable conservation status across the region. In the previous assessment (2007-2012), the wolf was in favourable conservation status in two of the seven biogeographical regions, the Alpine and the Atlantic.

To recall, according to the Habitats Directive, the status of a species is deemed favourable when, *inter alia*, the species “is maintaining itself on a long-term basis as a viable component of its natural habitats” and “there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.”

For species, the four components that define a conservation status assessment are range, population, habitat and future prospects. All four elements need to be favourable (or three favourable and one unknown) for the species to be considered to have reached a favourable conservation status. The latest Article 17 provides the following information on each of the components as regards the wolf:

- **Range.** Wolves extend over an area of 1,706,690 km² in the EU. The largest area is found in the Boreal biogeographic region (44.5% of the wolf range), followed by the Continental (23.8%) and the Mediterranean (15.7%). The range is increasing in 6 of the 7 regions and stable in the remaining (Black Sea). The status of the range is favourable in three regions (Alpine, Black Sea and Boreal) and unfavourable –inadequate in the remaining four regions.
- **Population Status.** In 2013-2018 there were around **11,000-17,000 wolves in the EU (best value: 13,492 wolves)**, of which 28.5% were in the Continental region, 27.8% in the Alpine and 23.7% in the Mediterranean. The population trend is increasing in four regions (Pannonian, Continental, Mediterranean and Boreal), stable in two (Alpine and Black Sea) and unknown in the Atlantic. The population status is favourable in one region (Alpine) and unfavourable –inadequate in the remaining six. In accordance with the art. 17 reporting guidelines, the short-term trends assessed by MS refer to a period of about 12 years/two reporting cycles (Table 2.2.1).
- **Habitat.** The habitat is improving in two regions (Alpine and Mediterranean) and stable in the rest. The status of the habitat is favourable in six regions and unfavourable –inadequate only in the Mediterranean region.
- **Future prospects.** The future prospects are favourable for the Alpine and Boreal regions, unfavourable –inadequate for the remaining four regions and unknown for the Atlantic region.

MEMBER STATES	Number of wolves	Trend
Austria	29-36	+
Belgium	4-6	Not reported
Bulgaria	800-1200	=
Croatia	172-194	+
Czech Republic	5-80	+
Estonia	180-260	+
Finland	168-193	=
France	387-477	+
Germany	152-166	+
Greece	907-1134	+
Hungary	40-60	+
Italy	1363-2765	+
Latvia	1126-1187	+
Lithuania	136-200	=

Luxembourg	1-2	+
Poland	1190-2582	+
Portugal	118	=
Romania	2500-3000	=
Slovakia	302-610	=
Slovenia	72-78	+
Spain	1234-2390	uncertain
Sweden	310-430	+

Table 2.2.1. Number of wolves and trend in EU Member States according to the last Art. 17 reporting (2013-2018). + increasing; = stable.

In the reporting 2013-2018, 21 countries reported 39 national biogeographic assessments, of which 18 were favourable (FV), 16 unfavourable-inadequate (U1), three unfavourable-bad (U2), and two unknown (XX). The previous reporting (2012-2017) included 33 regional assessments. Although wolves have shown an overall positive population trend since 2017, the wolf assessments with a favourable conservation status decreased slightly from 19 (2007 – 2012) to 18 (2013 – 2018). At the same time, the number of wolf assessments with an unfavourable conservation status (U1 + U2) increased from 13 to 19.

At the Member State level, in the period 2013-2018 the wolf had not yet achieved a favourable conservation status in most countries. Only five (Romania, Lithuania, Latvia, Estonia and Italy) have reported the wolf as being in favourable conservation status in all their biogeographical regions where the species occurs.

2.3. IUCN red list assessment at population level and Member State level

The Large Carnivore Initiative for Europe (LCIE) categorized the wolf into 10 populations based on a combination of distribution and social, ecological and political factors (Boitani et al. 2015; Boitani 2018): North-Western Iberian, Sierra Morena, Alpine, Italian Peninsula, Carpathian, Dinaric-Balkan, Baltic, Karelian, Scandinavian and Central European Lowlands.

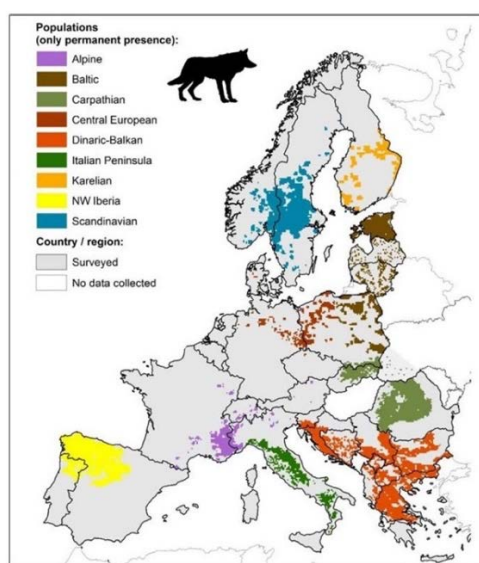


Fig. 2.3.1. Wolf populations in Europe in 2015 (from Boitani et al. 2022). The map does not show yet the wolf areas recently established in the Netherlands, Belgium and other countries of central Europe.

All populations are the results of natural dynamics as no wolf reintroduction has ever been carried out in Europe. The Sierra Morena (southern Spain) population has been declared (virtually) extinct in 2014, although it was probably already extinct when it was first established, between 2012 and 2015.

European Red List assessment of the wolf

The International Union for Conservation of Nature (IUCN)'s Red List of Threatened Species has become the world's most comprehensive information source on the global conservation status of animal, fungi and plant species. The assessment considers qualitative data on the geographic range, the population size (the main information used for wolves) and trend for the classification of species or populations. Threatened populations can be in three categories: Critically endangered (CR): extremely high risk of extinction in the wild; Endangered (E): very high risk of extinction; or Vulnerable (VU): high risk of extinction. The non-threatened categories are Near Threatened (NT) (not threatened but close to qualifying for or likely to qualify for a threatened category in the near future) or Least Concern (LC): widespread and abundant taxa.

The conservation status of species can be assessed on a global scale, considering their entire distribution area, or on a regional scale. The smaller the scale at which a population is assessed, the more likely it is to be listed as threatened, since it has fewer individuals and a smaller range. Sometimes, the wolf assessment on a national (especially in small countries) or local scale becomes meaningless.

The conservation status of the wolf (*Canis lupus*) has been assessed by the IUCN at the global level, at the European level and also at the level of each European population. At a global scale, the wolf is listed as Least Concern (Boitani et al. 2018). The global population is stable and estimated to be in the order of 200-250 thousand individuals. In geographic Europe, the wolf is also listed as Least Concern (Boitani 2018). The overall European wolf population can be viewed as a large metapopulation with several distinct fragments, although dispersal could theoretically connect almost all fragments, and connections are being re-established in many areas. Following the bottleneck of the 1960s and 1970s, the European wolf population is generally increasing in number and expanding its distribution range.

However, some European populations are still small and not all have more than 1,000 mature individuals (the thresholds below which a population would be listed as "Vulnerable" under the Red List criterion D.1). The number of wolves in geographic Europe (excluding Russia) was likely to exceed 17,000 in 2018.

The conservation status of each European population has been assessed by Boitani (2018). Of the nine currently existing European populations, six were considered as non-threatened and the three remaining were listed as Vulnerable (the Western- Central Alps, the Scandinavian and the Central Europe populations), all of them under the criteria D.1, i.e., "population size estimated to number fewer than 1000 mature individuals"¹⁵. Alpine and Central Europe populations have increased and expanded from 2018 until 2022 (Boitani et al. 2022; Marucco et al. 2023). Three of the non-threatened populations have been considered as NT (Iberian, Italian Peninsula and Karelian populations) because their numbers are close of the category Vulnerable, and the remaining three populations are large enough to be considered as LC. They are the Dinaric-Balkan (c.4,000 wolves), the Carpathian (c.3,460-3,840 animals) and the Baltic population, with c.1,713–2,240 wolves in the EU member states, but contiguous with Russia and Belarus wolf range (Boitani 2018).

¹⁵ (<https://www.iucnredlist.org/resources/categories-and-criteria>)

National Red List assessment of the wolf in different Member States

Many EU Member States have assessed the wolf conservation status in their country according to IUCN criteria, as has been recently shown by Boitani et al. (2022). Nevertheless, these listings must be considered with some caution. On the one hand, most of the national red books in the European Union are out of date, and some of them even date from 2005 (Boitani et al. 2022, table 2). In addition, as some countries are very small, they cannot harbour large populations of wolves, so they inevitably have higher threat categories than the biological populations where they are integrated (Boitani 2018).

Almost a quarter of the EU countries do not have the wolf included in their Red Books, in some cases because they have very recent (Netherlands) or very small (Luxemburg) populations. Two countries, Austria (2005) and Belgium (2011), considered wolves as Regionally Extinct when they had not yet been established in them. Otherwise, the red books of 11 countries (44%) consider wolves threatened (CR, E, or VU) within their national territories, five as Near Threatened (Croatia, Italy, Poland, Slovak Republic and Spain) and only Romania considers it as Least Concern.

	Member States
Not included in RB	Bulgaria, Hungary, Latvia, Lithuania, Luxemburg, Netherlands
Regionally Extinct	Austria (2005), Belgium (2014)
CR	Czech Republic (2017)
EN	Finland (2019), Portugal (2022), Slovenia (2002), Sweden (2020),
VU	Denmark (2018), Estonia (2022), France (2017), Germany (2020), Greece (2009)
NT	Croatia (2014), Italy (2022), Poland (2001), Slovak Rep. (2001), Spain (2007)
LC	Romania (2002)

Table 2.3.1. Wolf threat category in each Member State according to the national Red Books (RB). From Boitani et al. (2022)

When comparing the Red List assessment with those of the art. 17 of the Habitats Directive assessments, some apparent inconsistencies appear. For example, Sweden listed their wolf population as Endangered in the national Red Book (2020), but in the last report of the art. 17 (2013-2018) the wolf conservation status in the boreal region of Sweden was considered favourable. By contrast, Poland and Spain listed the wolf as Near Threatened in their national Red Books, but in the art. 17 reporting Poland considered it as unfavourable-inadequate in the Continental region, and Spain also considered it as unfavourable-inadequate in its three biogeographic regions (Alpine, Atlantic and Mediterranean). These differences may be explained in part by the fact that red data books measure the risk of extinction of a population while the art. 17 reporting reflects the difference between the favourable reference values and the current status of wolves.

2.4. Updated information on wolf numbers in the European Union

This section presents the most recent information available on wolf numbers in the EU. It is based on several sources of information:

- The first is the report by Boitani et al. (2022), submitted to the Bern Convention which gave updated information on wolf numbers and trends in geographic Europe, using data provided by the members of the Large Carnivore Initiative for Europe (Species Survival Commission, IUCN).

- The second is based on information received in response to the European Commission's data collection exercise launched on 4 September 2023, inviting local communities, scientists and all interested parties to submit up-to-date data by 22 September 2023 on wolf population and their impacts. Over 19,000 emails were received in response to the call. Over 98% of those who sent an input wanted to express an opinion on the subject, rather than submit data. The remaining 2% provided some data on wolf populations and their impact on national, regional or district level and were analysed in detail (see Annex 1).
- Finally, data from regional and national authorities, in addition to other reliable information collected on official web pages (see section 4.4), through scientific and technical literature and consulting national experts were used.

On 17 November 2023, the information gathered from the above was sent to the Ministries of Environment of the Member States for review. Their comments and corrections have also been incorporated in Tables 2.4.1 (wolf numbers) and 3.3.1 (damage to livestock). **The latest information on wolf population in EU Member States is presented in table 2.4.1.**

As can be seen, in 2023, wolves are found in the 24 continental countries of the EU, i.e., all except Ireland, Cyprus and Malta. In all 24 countries except Luxembourg, breeding packs have been detected in 2023. Across the EU, a total of about 20,300 wolves have been estimated with the information available in 2023 (Table 2.4.1). This figure is slightly higher than the 19,400 wolves estimated by Boitani et al. (2022) and significantly higher than the 11,193 wolves estimated in 2012 (Boitani et al. 2015).

The countries with the most wolves in the EU are Italy (3,307), Romania (2,500-3,000), Spain (>2,100), Poland (1,886), Germany (1,400) and Greece (1,020). Wolf numbers in Bulgaria are uncertain. Although the official data is 2,712 wolves (Table 2.4.1), Boitani et al. (2022) suggested that this high number is likely the result of very imprecise estimates. The figure reported by the Bulgarian government to the EC in the period 2013-2018 (800-1,200 wolves) seems to be more plausible even if the precise number is unknown.

Wolf trends.

The column on wolf trends (table 2.4.1) reflects expert judgement based on information provided by the Member States competent authorities. It is important to note however that there is no consistent or common approach towards assessing trends in wolf populations across the EU. This is because assessing wolf numbers is both difficult and expensive. Some Member States assess wolf numbers every year (section 2.1), others do it every 10 years, others do it when they have the opportunity to, while still others have never undertaken a full, detailed survey of their population. As a result, the period over which the trend in wolf populations is assessed also varies considerably from one country to another and is not the same for each Member State.

Because of this diversity of circumstances across the European Union, it is difficult to establish the overall trends. This can vary depending on the period over which it is assessed as well as other factors such as how the assessment is done. In Member States where wolves are not regularly surveyed each year, the population trend is generally based on expert opinion only. In many Member States, whilst it is not known exactly how many wolves are present, there are clear signs that they are increasing because their range is expanding and new packs are settling in areas where wolves have long been absent.

Table 2.4.1. WOLF POPULATION IN THE EU MEMBER STATES.

MEMBER STATE	Packs/pairs	N. of wolves	Year	Trend	Source
Austria	7 packs	58 wolves genotyped and at least 70-80 estimated	2022	Increasing	Federal Min. Environment, EC data collection
Belgium	4 packs	[28]*	Sept 2023	Increasing	http://biodiversite.wallonie.be/fr/actualites.html?IDC=6489 Wolf Fencing Team Belgium, EC data collection
Bulgaria		2712	2021	Increasing	Boitani et al. 2022. https://rm.coe.int/inf45e-2022-wolf-assessment-bern-convention-2791-5979-4182-1-2/1680a7fa47
Croatia	43 packs	243	2023	Fluctuating	Ministry of Economy and Sustainable Development Kusak, J., D. Hipolito, D. De Angelis, L. Šver, G. Gužvica (2023): Procjena parametara potrebnih za ocjenu stanja očuvanosti vuka i revizija referentnih vrijednosti. Veterinarski fakultet Sveučilišta u Zagrebu, 96 str.
Czech Republic	29 wolf territories	120-150	March 2023	Increasing	Min. Environment, EC data collection ¹
Denmark	2 packs, 4 pairs	30 wolves in spring 2023 + 14 pups born in 2023	Nov. 2023	Increasing	Sunde et al. 2023 https://dce.au.dk/fileadmin/dce.au.dk/Udgivelser/Notater_2023/N2023_41.pdf Peter Sunde (LCIE), pers. comm.
Estonia	33 packs	300-330	Nov 2022	Increasing	Game monitoring report 2023 compiled by Environment Agency. Keskkonnaagentuur (keskkonnaportaal.ee)
Finland	42 packs (40-46), 19 pairs (16-23)	310 (291-331)	March 2023	Increasing	Heikkinen S et al. (2023). Susikanta Suomessa maaliskuussa 2023. https://jukuri.luke.fi/handle/10024/553603

MEMBER STATE	Packs/pairs	N. of wolves	Year	Trend	Source
France	157 packs	1104 (1000-1210)	2023	Increasing	Office Français de la Biodiversité (OFB). https://www.caminteresse.fr/animaux/combien-y-a-t-il-de-loups-en-france-11189169/
Germany	184 packs, 47 pairs, 22 territorial individuals	[1404]*	2022/2023	Increasing	Map of territories - DBBW-E (dbb-wolf.de)
Greece	186 packs	1020	2014	Increasing	Boitani et al. 2022. https://rm.coe.int/inf45e-2022-wolf-assessment-bern-convention-2791-5979-4182-1-2/1680a7fa47
Hungary		60-70	2021/2022	Increasing	National Parks directorates and Min. Agriculture
Italy		3307 (2945- 3608)	2020/2021	Increasing	Italy. First National Wolf Monitoring. https://www.isprambiente.gov.it/it/attivita/biodiversita/monitoraggio-nazionale-del-lupo
Latvia		700	2020	Fluctuating	Boitani et al. 2022. https://rm.coe.int/inf45e-2022-wolf-assessment-bern-convention-2791-5979-4182-1-2/1680a7fa47
Lithuania	91 packs	728	2023	Increasing	Ministry of the Environment of the Republic of Lithuania, EC data collection. https://vstt.lrv.lt/uploads/vstt/documents/files/Vilk%C5%B3%20tyrimai/Galutine%20ataskaita%202022_23%20nuasmeninta%20fin.pdf
Luxembourg		0-2	2023	Increasing	https://www.sr.de/sr/home/nachrichten/vis_a_vis/wolf_im_osten_luxemburgs_nachgewiesen_100.html
Netherlands	9 packs with 39 pups	[63]*	Sept 2023	Increasing	https://www.bij12.nl/onderwerpen/faunazaken/diersoorten/wolf/ https://www.dutchnews.nl/2023/09/the-netherlands-is-now-home-to-nine-wolf-packs-and-39-cubs/
Poland		1886	2021	Increasing	Boitani et al. 2022. https://rm.coe.int/inf45e-2022-wolf-assessment-bern-convention-2791-5979-4182-1-2/1680a7fa47

MEMBER STATE	Packs/pairs	N. of wolves	Year	Trend	Source
Portugal	50-60 packs	300	2023	Stable	Pimenta V et al. (2023) Canis lupus lobo. https://www.icnf.pt/imprensa/livrovermelhodosmamiferosdeportugalcontinental2023
Romania		2500-3000	2019	Stable	Min. Environment, Waters and Forests- EC data collection.
Slovakia		400-600	2023	Increasing	State Nature Conservancy of the Slovak Republic
Slovenia	17 packs (5 shared with Croatia)	116**	2022/23	Stable	Ministry of National Resources and Spatial Planning of Slovenia
Spain	>300 packs	[>2100]*	2022	Stable/ Slightly increasing	Min. Environment. (MITECO, considering partial updates to the 2012-2014 national survey. EC data collection ²
Sweden	46 packs (6 shared with Norway), 32 pairs (3 shared with Norway)	450 (356-585)	Winter 2022-2023	Increasing/ Stable	Svensson L et al. (2023). Inventering av varg vintern 2022-2023 . Bestandsovervakning av ulv vintern 2022-2023. Bestandsstatus for store rovdjur i Skandinavia. Bestandsstatus för stora rovdjur i Skandinavien 1-2023. 65s.
Total EU		20,356 wolves			

[]* Some MS estimate only the number of packs/pairs but do not provide figures on wolf numbers. For practical purposes, we have estimated the number of wolves in Belgium, the Netherlands, Germany and Spain by multiplying the number of packs by 7 (according to Boitani et al. 2022) and the number of pairs by 2.

**After correcting for transboundary wolves

¹ The Ministry of Agriculture estimates wolf numbers in Czech Republic at 986 individuals but it goes on to explain that, “the number of wolves stated in the table is the number of wolves reported by hunters based on the statistical counts annually. It is important to mention that hunters report number of wolves from their hunting grounds. Wolf home range is roughly about the size of 2-4 hunting grounds therefore some wolves could be counted multiple times”. The figures from the Ministry of Environment were therefore used for the In-depth Analysis Report as they are based on a more robust monitoring methodology.

² The Ministry of Environment and the Autonomous Regions have announced that they intend to carry out a national wolf survey in 2024

SOURCES AND FOOTNOTES REGARDING TRENDS

Austria: Extirpated at the mid of the 19th century. Since 2009, wolves immigrate regularly from neighbouring populations. <https://www.lifewolfalps.eu/en/the-wolf-in-the-alps/the-wolf-in-austria/>

Belgium: Wolves reproduced in Belgium in 2020 for the first time in more than a century. https://www.zoogdiervereniging.nl/sites/default/files/2021-10/Lutra%2064%281%29_Van%20Der%20Veken%20et%20al_2021.pdf

Czech Republic. After being exterminated in the 19th century, first wolves settled around 2014. <https://wolf.org/wow/europe/czech-republic/>

Denmark. The first pair of wolves in the last 200 years was detected in 2017. <https://www.newsweek.com/wolves-denmark-200-years-594538>

Finland. The number of packs increased from less than five in 1990 to more than 40 in 2023. Pages 10-11 in <https://jukuri.luke.fi/handle/10024/553603>

France. See Fig. 2.1.2.

Germany. See <https://www.dbb-wolf.de/Wolfsvorkommen/territorien/karte-der-territorien>

Hungary. In 2005, only 3–6 single wolves were estimated in Hungary. <https://link.springer.com/article/10.1007/s42991-022-00287-7>

Italy. About 100 wolves were estimated in the early 1970s.

[https://www.jstor.org/stable/2641574#:~:text=In%20Italy%20the%20population%20is,\(Zimen%20%26%20Boitani%201975\).](https://www.jstor.org/stable/2641574#:~:text=In%20Italy%20the%20population%20is,(Zimen%20%26%20Boitani%201975).)

Luxembourg. First wolves were detected in 2017 after becoming extinct in 1893. [https://www.degruyter.com/document/doi/10.1515/mammalia-2020-0119/html#:~:text=The%20wolves%20detected%20near%20Garnich,evidence\)%20\(Schley%20et%20al.](https://www.degruyter.com/document/doi/10.1515/mammalia-2020-0119/html#:~:text=The%20wolves%20detected%20near%20Garnich,evidence)%20(Schley%20et%20al.)

The Netherlands. The first wolf territory was established in 2018. <https://www.authorea.com/doi/full/10.22541/au.169624987.70372590/v1>

Poland. In western Poland, the population increased from a few wolves in 2001 to 95 packs in 2019.

https://d1jyxxz9imt9yb.cloudfront.net/resource/672/attachment/original/Recovery_of_wolves_and_their_ecology_in_Western_Poland_in_2001-2019.pdf

Spain. Since 2014, the range of the breeding population has barely expanded, although the number of packs has increased at least in some peripheral areas.

Sweden. Increase in the long term, stable during the last decade (see Fig. 2.1.1).

The trend of the wolf population can also change depending on the period considered. For example, in Sweden (Fig. 2.1.1), the wolf population trend estimated from the 1990s to the present is clearly increasing; however, if one looks only at the last decade, the trend is more or less stable; and, if one looks just at the last two years (Table 2.4.2) one could think that the population is decreasing, although the small reduction from 460 to 450 wolves is not a good indicator of overall trends, especially considering the wide confidence intervals of the estimates.

While recognizing that wolf figures are approximate because, in some Member States, wolf surveys can be imprecise and because double counting of transboundary packs has not been corrected, an overall increase of the wolf population in the EU is clear. In 17 of the 24 EU Member States with wolves, populations are increasing whereas, in the remaining EU countries, there is no obvious change in the population or they are fluctuating. The increase of wolves across Europe in the last 40 years was shown by Chapron et al. (2014). In the last decade only, an increase of over 25% of wolf range has been reported in Europe (Cimatti et al. 2021, in Boitani et al. 2022), and this positive trend is confirmed by the present analysis

The country where wolves have increased the most is Germany, where from 2000 (one pack) to 2015 (47 packs) wolves experienced an annual increase of about 36% (Reinhardt et al. 2019), but the growth has been slowing down steadily to 14% for the period 2018-2020 (Singer et al. 2023). In 2022, 184 packs were detected in Germany (Table 2.4.1). Since 2017, some breeding packs have been established in small Western European countries which are densely populated, such as Denmark, the Netherlands and Belgium (Table 2.4.1). Table 2.4.2 shows wolf population data in the last two or three years in some countries where they have been annually monitored and numbers are comparable.

MEMBER STATE	Boitani et al. 2022 (year)	This report (year)
Belgium	2 packs (2022)	4 packs (2023)
Czech Republic	100 wolves (2021/22)	120-150 (March 2023)
Denmark	14 wolves (2021)	44 wolves (2023)
Estonia	240 wolves (2021)	300-330 (2022)
Finland	290 wolves (2022)	310 wolves (2023)
France	783 wolves (2021)	1104 wolves (2023)
Germany	158 packs, 27 pairs (2021/2022)	184 packs, 47 pairs (2022/2023)
Lithuania	504 wolves (2021)	728 wolves (2023)
Netherlands	15 wolves (2022)	9 packs* (2023)
Sweden	460 wolves (2022)	450 wolves (2022/23)

* Around 63 wolves (9x7)

Table 2.4.2. Wolf population data in recent years in some EU Member States

2.5. Threats and mortality

Europe is a densely populated continent, and wolves are subject to a lot of pressure from people, whether through legal hunting/culling, poaching, or traffic mortality. In addition, wolves may have genetic problems by hybridization with dogs (Salvatori et al. 2019), due to inbreeding, which is especially important in the Fennoscandian population (Liberg et al. 2005; Laikre et al. 2016), or due to the loss of genetic diversity caused by fragmentation or as a result of past persecution (Salado et al. 2023). In this section, the actual and potential threats to wolves in the European Union are reviewed using best available information. Part of this information is based on the expert judgment of specialists and part is collected from technical documents and scientific papers published in recent years. Many of these point out the great impact of poaching and the difficulties experienced in detecting it.

Threats of wolves deduced from expert judgement

In 2015, the Large Carnivore Initiative for Europe (LCIE) published a report in which the main problems of the nine biological populations of wolves were considered. The main threats identified by the European experts were “low acceptance, habitat loss due to infrastructure development, persecution, hybridization with dogs, poor management, structures and accidental mortality” (Boitani et al. 2015). The most important threat was the low acceptance of wolves by some parts of the society (mainly caused by the widespread attacks on livestock) which is likely to be the primary cause of most legal and illegal killing of wolves in Europe.

In 2022, LCIE carried out a further assessment of the threats to wolves in geographic Europe according to IUCN classification, which was again done using qualified expert judgment (Boitani et al. 2022). According to this assessment, “roads, illegal killing and disturbance from tourism-related activities are all reported in more than a quarter of all countries followed by other disturbances due to housing, industrial development and forestry. However, threats vary in strength and persistence depending on local conditions” (Fig. 2.5.1.)

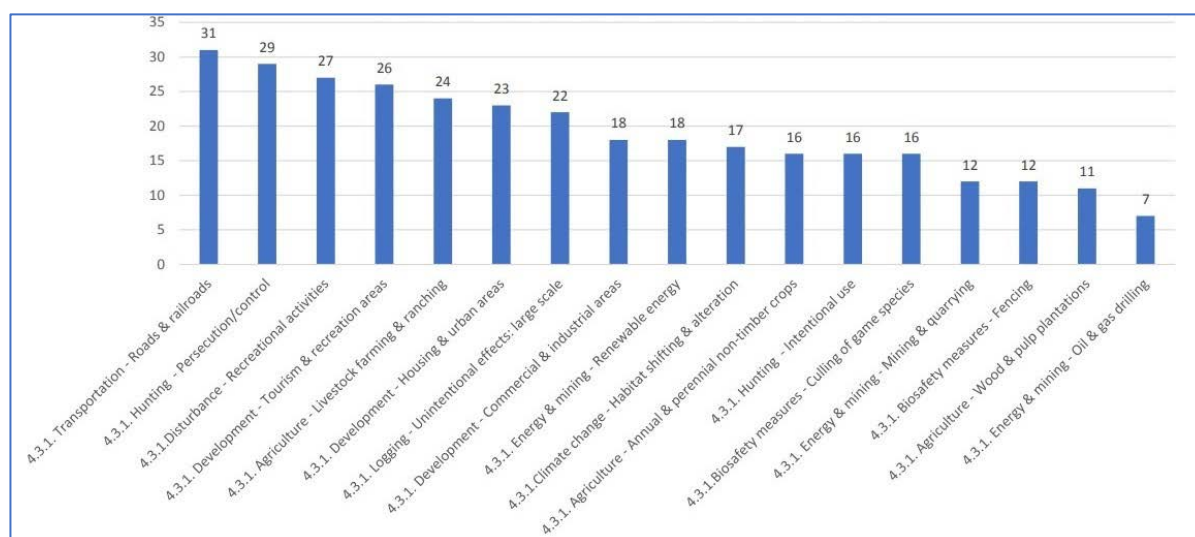


Fig. 2.5.1. Most common threats to wolves in geographic Europe, from Boitani et al. (2022). Figures represent the number of countries where the threat was detected.

Pressures and threats identified by Member States in Article 17 reports of the Habitats Directive

The Article 17 reports under the Habitats Directive also record and rank the key Pressures (current impacts) and Threats (future impacts) that affect the listed species and habitats¹⁶. In the case of the wolf, these have been analysed at the level of each biogeographic zone in each MS, considering only those classified as High importance/impact and those that appear in at least two different reports.

In total, nine types of such pressures and threats have been reported (Fig. 2.5.2).

The most frequently reported pressure is “illegal shooting/killing” which is further supported by the pressure “Poisoning of animals”, in fourth place since both are linked to the problem of wolf poaching. The “impact of roads, paths, railroads and related infrastructure” is in second place, both for the direct mortality caused by traffic accidents and for the fragmentation they can produce across populations. The “interactions with agricultural activities” (i.e., damage to livestock) occupy the third place (Fig. 2.5.2).

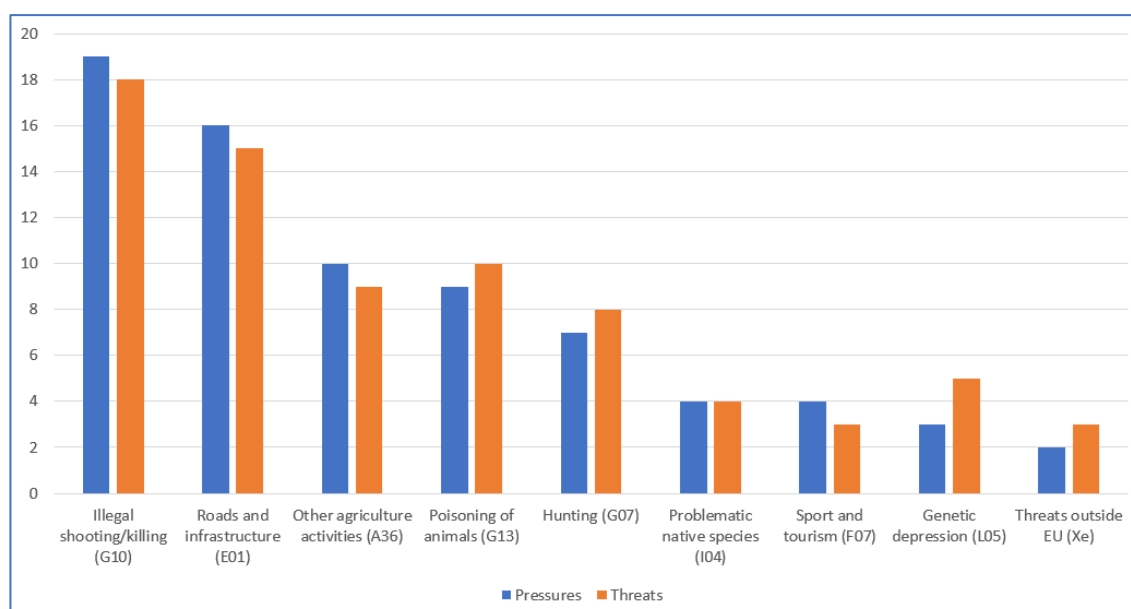


Figure 2.5.2. Frequency (number of MS) of high importance/impact Pressures and Threats reported by MS (2013-2018).

Some Member States consider G07- Hunting (as a legal activity) as a high Pressure for the wolf. This is the case, for instance, in Spain and Slovakia, where national governments have recently forbidden the legal hunting of wolves even though it is listed in Annex V of the Habitat Directive (except for the small Spanish population south of the Duero River, which is in Annex IV).

There are also seven Pressures and Threats that have only one vote each. Among those, it is worth highlighting “Closure or restricted access to site/habitat”, considered as a Threat by Latvia in relation to the building of a fence along the Russian and Belorussian border to control immigration. It should be noted that several fences are currently being built between different European countries to control the movement of people, which pose a fragmentation risk for populations of wolves and other mammals (Linnell et al. 2016; Trouwborst et al. 2016; Jakes et al. 2018).

¹⁶ https://cdr.eionet.europa.eu/help/habitats_art17

A review of wolf mortality extracted from scientific papers and technical reports

A review of causes of mortality across the EU, extracted from scientific papers or from official data also reveal several general patterns, which largely reflect those already mentioned above.

While all conclude that humans directly or indirectly are the main cause of wolf mortality in Europe (as it also happens in North America, Hill et al. 2022), the causes of mortality often depend on the method used. In studies based on the collection of ‘found-dead’ wolves, mortality from legal hunting/culling or traffic is much more frequent because it is more easily detected than poaching. The high importance of poaching is, on the other hand, only revealed in radiotracking studies. In these studies, poaching emerges as an important cause or as the most important cause of mortality, sometimes also in countries where hunting/culling is allowed.

A summary of the information collected in field studies across the EU (Table 2.5.1) shows that legal killing is the most frequently detected cause of mortality in the Member States where hunting or culling are legal. This is the case for example of Spain (where hunting and culling were allowed until September 2021) or Sweden.

Traffic accidents are usually the main cause of detected mortality in countries where wolves are not hunted or culled and/or where they live in densely population areas, as in Germany.

Cause of death	Alps	Spain	Italy	Germany	Poland	Sweden	Finland
Legally killed	14.0	68.0	0	1.3	27.8	66.9	3.8
Illegally killed	38.4	7.6	35.4	9.3	24.1	13.0	57.2
Traffic	36.0	15.4	49.0	74.3	38.9	5.2	4.4
Natural	3.5		9.9	8.9	7.4	14.9	1.1
Others		0.5					5.5
Unknown	8.1	8.5	5.7	6.2	1.9		
TOTAL NUMBER	86	644	212	891	54	154	91

Table 2.5.1. Causes of wolf mortality (percentages) in several EU Member States and areas. Total numbers include dead wolves in both types of studies mentioned: ‘found-dead’ wolf studies and radiotracking projects.

*Source: **Spain:** data from Junta de Castilla y León (2016, 2017); Principado de Asturias (2023); Blanco y Cortés (2007); Blanco et al. (2021a). From 1997 to 2022. Most of the data (635/664) corresponds to wolves found dead and only 9 to radiotracking data. Disaggregated information is shown in Table 2.5.2. **Alps:** Léonard et al. (2010); wolves found dead from 1987-2010 in France (43 wolves), Italy (34) and Switzerland (9). **Italy:** Musto et al. (2021). Wolves found dead from 2005 to 2021 in Tuscany and Emilia-Romagna regions. **Germany:** official statistic (<https://www.dbb-wolf.de/wolf-occurrence/dead-wolf-finds/statistics-on-causes-of-death>). Wolves found dead from 1990 to 12 April 2023. **Poland:** Nowak et al. (2008, 2021a); Nowak & Myslajek (2016). From 1996 to 2020; mainly wolves found dead (46/54), but also radiotracking data (8/54). **Sweden:** Liberg et al. (2020). Radiotracking data from 2000 to 2017. The mortality information shows only verified causes (see Poaching section); **Finland:** Suutarinen & Kojola (2017); radiotracking data from 1998 to 2013.*

Tables 2.5.2 and 2.5.3 also show that there are important differences in mortality between Member States depending on wolf management regimes. These differences are also obvious when comparing the regions of the same country. For example, in Table 2.5.2 we can see the differences in the causes of mortality in the regions of Castilla y León (hunting and culling allowed during the study period),

Asturias (culling allowed during most of the study period) and Madrid, where wolves have never been hunted or culled.

In the same way, in Poland the causes of wolf detected mortality have changed with different management regimes. When hunting was legal, most (83%) known mortality was due to hunting and only 11% was caused by traffic (Table 2.5.3). After being protected in 1998, the main causes were traffic (65%) and poaching (25%) (Table 2.5.3).

Cause of death	Castile and Leon (1)	Asturias (2)	Madrid (3)	Radiotracking in Castile and Leon (4)
Legally killed	77.5	66.9	0	11.1
Illegally killed	4.5	8.7	9.5	44.5
Traffic	14.3	11.9	81.0	33.3
Other			9.5	11.1
Unknown	3.7	12.5		
TOTAL NUMBER	245	369	21	9

Table 2.5.2. Disaggregated information on wolf mortality in Spain.

Legend (1). Wolves found dead in Castile and Leon region in 2016 and 2017 (Junta de Castilla y León 2016, 2017). Hunting and culling were allowed in the study period. (2). Wolves found dead in Asturias region from 2001 to 2022 (Principado de Asturias, 2023). Culling to prevent livestock damage allowed in most of the study period. (3). Wolves found dead from 2008 to 2022 (Blanco et al. 2021a and pers. comm.). Wolves fully protected. (4). Radiotracking data in Castile and Leon from 1997 to 2006 (Blanco and Cortés, 2007). Hunting allowed in most of the study area.

Cause of death	Hunting legal (1)	Fully protected (2)	Radiotracking data (3)
Legally killed	83	0	0
Illegally killed	0	25	75
Traffic	11	65	12.5
Natural	6	7	12.5
Other			
Unknown		3	
TOTAL NUMBER	18	28	8

Table 2.5.3. Disaggregated information on wolf mortality in Poland.

Legend: Wolves found dead in western Poland (1) when hunting was legal (1996-2003)(Nowak et al. 2008) and (2) when no hunting was authorised (2001-2012) (Nowak & Mysłajek et al. 2016); (3) data from radiotracking in western Poland when no hunting was authorised (Nowak et al. 2021a).

The rate of mortality can only be reliably estimated with radiotracking studies. Rates detected using “dead-found” wolves are underestimated because only some of the dead wolves are found. In Spain, the mortality rate was estimated at 18% per year in an area with few conflicts in the early 2000s, when wolves were obviously increasing (Blanco & Cortés 2007). In 2016 and 2017 (population trend unknown), 123 wolves per year were killed in Castilla and Leon (179 packs), i.e., around 10% of the total population. In Asturias region, 17.6 wolves were found dead per year from 2001 to 2021 (30-40 packs, increasing), i.e., <10% of the total population.

From 1987 to 2010 the mortality rate was estimated between 10% and 25% of the total population in the French Alps, depending on the detectability of dead wolves (Léonard et al. 2010). In recent years, the rates of culling to prevent livestock depredation is increasing in France, where 97 wolves were legally killed in 2020 (Grente, 2021).

Poaching, an important cause of mortality, but difficult to detect

Poaching is difficult to detect. Opportunistic collection of wolf carcasses can be biased and usually overestimates the rate of mortality caused by traffic and legal culling/hunting, but underestimates poaching and natural mortality, as has been deduced from research comparing the mortality of radio-collared wolves with opportunistic samples from the same population (Stenglein et al. 2015; Suutarinen and Kojola 2017).

For example, in Spain, the main cause of mortality deduced from “dead-found” wolves was legal hunting/culling (68.0%), while poaching represented only 7.6%. But, in a radiotracking study, the mortality by poaching increased to 44.5% and legal hunting dropped to 11.1% (Tables 2.5.2 and 2.5.3). In Poland, 75% of wolves dead in a radiotracking study were poached, a rate much higher than in studies using “dead-found” wolves (0-25%) (Table 2.5.4). Nowak et al. (2021a) estimated that the number of wolves illegally shot annually in Poland exceeded 147 individuals, which is 16-times higher than mean number of shot wolves discovered during 2017-2020 (9.3 wolves per year). This demonstrates again how high the “cryptic poaching” of wolves is and that collected data on illegal killing underestimates the actual number of kills.

But poaching is also difficult to detect even in studies with radio-collared wolves. In Scandinavia, 154 wolves radio-collared from 2000 to 2017 died during the study. Verified poaching accounted for 13% of the detected mortality, but most of the radio-collared wolves ($n = 189$) disappeared without known cause. Liberg et al. (2012b, 2020) showed that poaching was the most likely reason for the majority of these disappearances, accounting for approximately half of the total mortality. Therefore, more than two-thirds of total poaching remained undetected by conventional methods.

Poaching is probably the main cause of wolf mortality in many EU countries, and it is hindering wolf recovery in some of them. For example, simulations suggested that in Scandinavia, without poaching, the wolf population would have been almost four times as large in 2009 (Liberg et al. 2012b). In Finland, Suutarinen and Kojola (2017) showed that the poaching rate varied between years, from less than 9%–13% up to 31%–43%, with illegal killing being the primary cause of death, followed by legal hunting.

Wolves recolonized Denmark from Germany in the previous decade and reproduced for the first time in 2017, but after the breeding female of the pack was shot dead in 2018 most wolves disappeared from that country (in 2023, wolves are breeding again in Denmark: Table 2.4.1). Sunde et al. (2021) studied the mortality and disappearance rates of 35 wolves (of which three emigrated, nine died and 14 disappeared by 1 January 2020) by genetic monitoring in the heavily cultivated and densely populated Jutland peninsula. They concluded that traffic was the main cause of wolf mortality (37%) in Schleswig-Holstein, Germany, and illegal killing was the main cause in Denmark (46%).

This high mortality rate caused the decline of the population. Despite successful reproductions, the region is a wolf population sink, primarily driven by cryptic mortality, most likely illegal killing. The annual rate of disappearances and illegal killings in Denmark (most conservative estimate, 42%) exceeds the highest measured rates in Sweden (24%) (Liberg et al. 2020) and equals the highest rates measured in Finland (31%–43%) (Suutarinen & Kojola, 2017), levels which, in both countries, resulted in population declines.

2.6 Wolf-Dog hybridization

Dogs were domesticated from wolves and hybridize with them producing fertile offspring. Interbreeding between wolves and dogs has probably occurred repeatedly throughout the history of the dog's domestication, but probably to a much lesser degree than at present. Hybridization between wolves and dogs is facilitated by the large numbers of stray dogs sharing the wolf range (Salvatori et al. 2020a).

Hybridization can affect wolf populations in several ways, most of them negative. The wolf-dog hybridization may cause the introduction of non-adaptive genes in the wild wolf population and can modify the genetic identity, the ecology, morphology, behaviour and adaptations of wolves. The disruption of the genetic integrity may cause the disappearance of alleles, decreasing fitness or even threatening the existence of the parental species. Hybrids usually thrive in similar conditions as their parental species, so they are a source of competition for food and space, as has been documented in wolf dog hybridization studies (Bassi et al. 2017). If there is no selection against hybrids, these can dominate the parental species, leading to a decrease in the number of pure individuals or even extinction. Hybrids can also worsen people's perception of the wolf, reducing their societal acceptance (Leonard et al. 2015; Salvatori et al. 2020a; Dziech 2021).

Wolf-dog hybridization has been considered a conservation problem for the wolf in different European assessments (Boitani et al. 2015, 2022), and also by the Council of Europe (The Bern Convention Recommendation No. 173, 2014)¹⁷ and the European Commission. In 2021, the European Commission acknowledged that “as a type of anthropogenic hybridisation, wolf-dog hybridisation is not a natural evolutionary process where the hybrids should be subject to conservation measures. Rather, as a threat to the genetic integrity of wolf populations, wolf-dog hybridisation is an issue of high conservation concern and should be addressed through appropriate management plans and tools” (Commission Notice C(2021) 7301)¹⁸.

Hybridization in the European Union

Studying the wolf-dog hybridization is not an easy task, and many researchers have warned that results obtained by different laboratories are not automatically comparable since the proportion of hybrids, and consequently the perception of how severe the hybridization is, depends on the complex and fast-evolving methodological processes, including the detection power of the marker set and the threshold selected for assigning genotypes (e.g., Lorenzini et al. 2014; Salvatori et al. 2020a).

In order to identify signatures of admixture, Pilot et al. (2018) carried out a comprehensive analysis spanning the canid genome in wolves from across Eurasia and North America and compared that data to similar data from dogs. The analysis unambiguously defined wolf and dog genetic clusters without any prior information about individuals' origin, which confirms that Eurasian wolf populations are not hybrid swarms. On the other hand, 62% of genotyped wolves carried small chromosomal blocks that were inferred to originate from dogs. This suggests that most Eurasian wolves show some level of admixture with dogs, suggesting that introgressive hybridisation has occurred in distinct regions of Eurasia on a variety of timescales and is not solely a recent phenomenon.

Salvatori et al. (2020a), through a literature review and a structured questionnaire to 32 European wolf experts, found that wolf-dog hybridization is reported in all nine extant European wolf populations, and in 21 out of 28 countries for which they received information. Reports of wolf-dog hybridization have increased over the past two decades, mainly based on genetic analyses of invasive or non-invasive biological samples. However, Salvatori et al. (2020a) neither concluded nor excluded that wolf-dog hybridization is indeed increasing within and among European wolf populations.

¹⁷ <https://rm.coe.int/0900001680746351#:~:text=Take%20adequate%20measures%20to%20monitor,2>

¹⁸ [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=PI_COM:C\(2021\)7301](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=PI_COM:C(2021)7301)

Rather than (or in addition to) wolf-dog hybridization *per se*, it is its detection that might have increased in recent years, mainly due to the increasing availability of reliable tools for the genetic identification of hybrids. Nevertheless, several authors (Galaverni et al. 2017; Donfrancesco et al. 2019) think that wolf-dog hybridization may have increased in parts of Europe during the past half century because of the recent recovery of wolf populations in Europe and their expansion into anthropogenic landscapes where densities of free-ranging dogs are higher, coupled with locally high levels of human related wolf mortality.

In 2022, the members of the LCIE were asked about wolf-dog hybridization in their countries (Boitani et al. 2022). In the 24 EU countries with wolves, 10 experts responded that they did not have wolf-dog hybrids, including those from four countries with hundreds or even thousands of wolves (Sweden, Slovakia, France, Romania). Sporadic hybridization had been detected in 10 countries, including three with more than 1,000 wolves (Bulgaria, Poland, and Germany). Finally, in four countries there was concern about the high percentage of wolf-dog hybrids detected, all of them from southern Europe (Greece, Croatia, Italy and Spain).

Member States with high hybridization rates

In Greece, the hybridization rate was unknown but expected to be >10% in periurban areas (Boitani et al. 2022) and in some agricultural areas (Iliopoulos 2023). In Croatia, Kusak et al. (2018), on the basis of phenotype of 176 wild canids, categorized 19 (10.8%) as suspected hybrids. On the basis of the Bayesian admixture tests and phenotype together, five (2.8 percent) animals were classified as wolf-dog hybrids, four of them as backcrosses with wolves, and one as a backcross with a dog. Mitochondrial DNA suggested that all hybrids originated from the mating of female wolves and male dogs. All hybrids were found in Dalmatia, where wolves settled recently and live close to humans, with a high rate of human-caused mortality.

In Spain and Portugal, Godinho et al. (2011) found 4% of hybrids, but as a disproportionate effort was devoted to locating putative hybridization events, they did not know how representative this frequency was for the whole Iberian population. They showed that Iberian wolves and dogs form two well-differentiated genetic entities, suggesting that introgressive hybridization is not a widespread phenomenon shaping both gene pools. Hybridization was apparently restricted to more peripheral and recently expanded wolf populations and they found that hybridization in wolf populations is mediated by crosses between male dogs and female wolves. Subsequently, Pacheco et al. (2017) collected wolf-like scats in Galicia (Spain) in a single breeding/pup-rearing season and found a 5.6% rate of dog introgression into the wolf population. Despite this high percentage, they found a clear maintenance of wolf genetic identity, as evidenced by the sharp genetic identification of pure individuals, suggesting the resilience of wolf populations to a small amount of hybridization.

The highest rates of wolf-dog hybridization have been found in Italy. During the national wolf survey conducted in Italy from October 2020 to September 2021, 16,000 wolf scats were collected and 1,500 of them were genetically analysed. Of the 513 wolf individuals identified in the peninsular area, 72.7% showed no genetic signs of recent or ancient hybridization with domestic dogs, 11.7% showed signs of recent hybridization and 15.6% of older hybridization (backcrossings of hybrids into the wolf population more than approximately three generations in the past)¹⁹.

In Italy, the highest rates of hybridization have been found in the Province of Grosseto. In a study carried out in 2012–2014, Salvatori et al. (2019) found a minimum proportion of admixed individuals of 30.6%, comprising 8 out of the 13 surveyed packs; however, they suspected that the rate of recent admixture could be closer to 50%. Their results showed a widespread occurrence of admixed

¹⁹ <https://www.isprambiente.gov.it/it/attivita/biodiversita/monitoraggio-nazionale-del-lupo/risultati>

individuals of older generations of backcross, and they concluded that this high level of admixture raises serious wolf conservation concerns and exemplifies the expected dynamics of wolf–dog hybridization if left unmanaged in human-dominated landscapes.

Dealing with the hybridization problem

Both the European Commission (Commission notice C(2021) 7301) and Council of Europe (The Bern Convention Recommendation No. 173, 2014) recommend removing wolf-dog hybrids from the wild, but the removal must be conducted exclusively in a government-controlled manner.

Nevertheless, the removal of hybrids is not an easy task. Donfrancesco et al. (2019) surveyed the opinion of European experts on wolf-dog hybridization on how to address the issue. To mitigate hybridization, experts agreed on adopting preventive, proactive and, when concerning small and recovering wolf populations, reactive interventions. Overall, experts' consensus waned as the issues addressed became increasingly practical, including the adoption of lethal removal. Salvatori et al. (2020a) stress that poor implementation of European recommendations of removing hybrids from the wild may be due to lack of means (e.g., resources for nationwide genetic assessment), lack of technical specificity (e.g., what is a hybrid), or the political difficulty of addressing an issue that is highly controversial on social and ethical grounds.

3. ROLE OF THE WOLF IN ECOSYSTEMS AND IMPACTS ON SOCIETY

3.1. Role in ecosystem's functioning/health/balance

This chapter reviews examples from scientific literature on the role of the wolf in ecosystems. The wolf has a clear ecological role to play as it is the largest regular predator in Europe and in many ecosystems in the northern hemisphere (Mech 1981). Over the last century, large carnivores have declined around the world, causing the loss of the ecological functions they performed, but the recent recovery of the wolf and other large carnivores in Europe (Chapron et al. 2014) may partially restore these functions if they reach ecologically effective densities (Estes et al. 2011; Ripple et al. 2014a). The main effects attributed to wolves – the reduction of herbivores and mesocarnivores – for instance, have been recorded after their removal from the environment or their reintroduction (Ripple et al. 2012; 2014b).

Trophic cascades in North American national parks

In North America, the ecological role of the wolf has been underlined on numerous occasions, creating trophic cascades following its reintroduction in Yellowstone National Park (USA). Its re-introduction seems to have reduced coyotes (*Canis latrans*) and elk (*Cervus elaphus canadensis*). The reduction in elk, led, in turn to a reduction in overgrazing, thereby creating a cascade effect on other species: natural vegetation on the banks of rivers and streams recovered leading to an increase of beavers (*Castor canadensis*) and passerines; berry-producing plants also recovered with a consequent increase in bears (*Ursus* spp.), also favoured by carrion left behind by wolves, as well as a number of other changes in the ecosystem (Beschta 2005; Beyer et al. 2007; Painter et al. al. 2015; Beschta & Ripple 2016). Most of these effects have also been demonstrated in other national parks of North America (Hebbelwhite et al. 2005).

The trophic cascades experienced in some American national parks have been possible thanks to density-mediated effects (i.e., elk reduction of densities) and to behaviourally-mediated effects in which wolves seem to have an indirect positive effect on the survival rate and growth of some bushes and trees by altering the foraging patterns of the moose and other prey species (the landscape of fear: Fortin et al. 2005; Gaynor et al. 2019).

The ecological role of wolves in ecosystem structure and functioning is becoming increasingly recognized but is often over-emphasized (Mech 2012, Allen et al. 2017). This has created strong scientific debates, which are sometimes very polarized and oversimplified. Peterson et al. (2014) conclude that the debates about whether trophic cascades exist in Yellowstone and other American national parks cannot lead to simple, precise or definitive answers. The existence of a trophic cascade largely depends on how it is defined. The main intellectual contribution of this concept is to remind us of a basic principle of ecology, which is that most species are connected to each other through a food web that, although weak, has complex indirect effects.

The ecological role of wolves in Europe

In most of Europe, humans have taken over the role of top predators in regulating both prey numbers and behaviour (Kuijper et al. 2016; Mols et al. 2021). Human effects on antipredator behaviour of prey can be stronger than those of other natural predators. For example, effects of human hunting and

disturbance on the vigilance, movement rate and grouping patterns, as well as on the circadian rhythm and stress levels of cervids is significantly greater than the effects of large carnivores such as wolves (Mols et al. 2021). In the Bavarian Forest, it was found that humans rather than Eurasian lynx (*Lynx lynx*) shape browsing patterns (van Beeck Calkoen et al. 2022).

In a study conducted in Romania, wolves and bears exerted high pressure on deer (*Cervus elaphus*) and less on roe deer (*Capreolus capreolus*), but the direct and indirect impact of humans prevailed over natural processes (Dorresteijn et al. 2015). Using data on red deer density in 492 study sites across 28 European countries, van Beeck Calkoen et al. (2023) showed that a reduction in deer density only occurred when wolf, Eurasian lynx and bear co-occurred within the same site, and the strongest large carnivore effects (all three carnivore species present) on red deer occurred at sites with low human land-use activities. Moreover, hunting by humans had a stronger effect than the presence of all large carnivores in reducing red deer density.

In several Mediterranean ecosystems, the abundance of free-ranging livestock confounds the ecological role of the wolf. Free roaming livestock, on the one hand, competes with wild herbivores and, on the other, provides abundant food for wolves, altering their population dynamics and the pressure they cause on natural prey (Lagos and Bárcena 2018; Pimenta et al. 2018; Figueiredo et al. 2020). Researchers have failed to find these ecological effects in other European areas, such as in the intensively managed boreal forests of Sweden (Ausilio et al. 2021), showing again that the ecological effects of wolves in anthropogenic landscapes and the potential for trophic cascades are very much context-dependent.

Nevertheless, some studies have demonstrated that wolves can reduce the rates of increase of red deer in natural habitats in Poland (Jedrzejewski et al. 2002) and of wild boar in northwestern Spain (Tanner et al. 2019). In Białowieża Primeval Forest (Poland), the densities of red deer, especially in the case of females, were lowest in parts of the landscape intensively used by wolves (Bubnicki et al. 2019), and wolves were also found to affect the spatial patterns of ungulate browsing (Kuijper et al. 2013). In addition, wolves provide carrion for scavengers (Selva et al. 2005) and may reduce densities of golden jackals (Krofel et al. 2017).

Wolf contribution to the regulation of wild ungulates as an ecosystem service

Despite their strong influence, humans cannot always replicate in nature the indirect effects caused by wolves, and their ecological roles are not easily interchangeable. This partly explains why humans often fail to prevent or reverse some of the impacts caused by the proliferation of wild ungulates, such as overgrazing, vegetation damage, and associated biodiversity loss (Dorresteijn et al. 2015).

In recent decades, wild ungulates have dramatically recovered in Europe. Although their presence is essential for restoring ecosystem processes, wild ungulates have reached densities that probably surpass those from historical times in many parts of Europe. This is, among other reasons, because of high access to anthropogenic food sources (from agriculture, forestry, and supplementary feeding) (Linnell et al. 2020).

High-density ungulate populations have been widely shown to cause damage, particularly to crops and forestry, as well as negatively influence biodiversity, mainly through overgrazing and overbrowsing. They can also transmit disease to livestock and cause material damage, for example, traffic collisions (Carpio et al. 2020; Pascual Rico et al. 2021). Wild boar is one of the species that most often causes damage to crops and is estimated to generate an economic loss of more than 30 million euros annually in the agricultural and forestry sector in Italy and France alone (Apollonio et al. 2010).

Forestry is an important part of the national economy in Scandinavia. An increase in the moose population size can cause extensive browsing damage to young forest stands that may lead to severe economic loss for forest owners. Management objectives in Sweden includes to keep browsing damage

on commercially valuable tree species at an acceptable level, while at the same time limit the moose population by harvesting at a level which results in a sustainable yield that is acceptable to hunters. The recolonization of wolves in Scandinavia has further accentuated the challenge of combining the interests of foresters, hunters and conservationists (Wikenros et al. 2020).

Wolves can reduce disease transmission and traffic collisions

Trophic cascades are only one of the ecological effects that wolves can have on the ecosystem. By selecting the most vulnerable prey - such as sick individuals (Mech et al. 2015)-, wolves may also reduce the incidence of diseases that wild ungulates transmit to livestock. Tuberculosis (TB) stands out among the diseases transmitted by wild ungulates to cattle. In the south of Spain (where wolves are extinct), several studies have shown the difficulty of dealing with the problem of tuberculosis in cattle because of the high infection rate in wild ungulates.

Wild boars from wolf-free areas in southern Spain have high rates of tuberculosis infection (52% in Doñana National Park and 58% in Sierra Morena, reaching 94% in some fenced hunting estates). In contrast, in Galicia and Asturias (northwestern Spain), where there are dense populations of wolves and much lower densities of wild ungulates, the prevalence of tuberculosis in wild boars was only 2.6% (Blanco, 2018).

A study that combined model results with field data for a system of wolves that prey on wild boar (*Sus scrofa*) in Asturias region found that wolf predation can lead to a marked reduction in the prevalence of infection without leading to a reduction in host population density since mortality due to predation can be compensated by a reduction in disease induced mortality. In Asturias, where there is a high density of wolves and a low prevalence of TB, the annual cost of compensation paid to farmers due to wolf attacks on their livestock is a quarter of the annual expenses of the cattle TB eradication scheme (Tanner et al. 2019).

In the same way, the African swine fever (ASFV) has spread among populations of wild boars and pigs in countries of Eastern and Central Europe, causing huge economic losses. It has been speculated that carnivores which are known for high daily movement and long-range dispersal ability, such as the wolf, may be indirect ASFV vectors. Nevertheless, results of field and laboratory research have shown that when wolves consume meat of ASFV-positive wild boars, the virus does not survive the passage through intestinal tract, and wolves may limit ASFV transmission by removing infectious carrion (Szewczyk et al. 2021).

Although up-to-date statistics are hard to find for the whole Europe, Linnell et al. (2020) showed that for some selected countries, more than half a million collisions with ungulates are recorded every year. A recent study has quantified the effects of restoring wolf populations by evaluating their influence on deer-vehicle collisions (DVCs) in Wisconsin (Raynor et al. 2021). The authors showed that, for the average county, wolf entry reduced DVCs by 24%, yielding an economic benefit of \$10.9 million per year in aggregate across the 29 wolf counties which is 63 times greater than the costs of verified wolf predation on livestock.

Most of the reduction is due to a behavioural response of deer to wolves rather than through a deer population decline from wolf predation. This finding supports ecological research emphasizing the role of predators in creating a “landscape of fear” and suggests that wolves control economic damages from overabundant deer in ways that human deer hunters cannot replicate.

3.2. Predation on wild ungulates and implications for hunting

Hunters perceive carnivores as competitors for prey species and in some events, predation can sustainably influence traditional game harvests (Boitani et al. 2015). The competition between wolves and hunters for game species has probably been the main cause of the extinction of the wolf population in Sierra Morena since hunters perceived that wolves were incompatible with the intensive hunting of red deer in the private, fenced estates of southern Spain (López Bao et al. 2015). However, the impact of wolves on big game species is largely offset by the dramatic recovery of wild ungulates in Europe in recent decades (Linnell et al. 2020).

Wolf predation on wild ungulates is highly variable across Europe. Wolves known for their notable plasticity in diet. There is a significant positive relationship between species richness of the local ungulate community and feeding niche breadth of wolves. The degree to which wolves select a given species may depend not only on the relative abundance of that species but also on available alternative prey. For example, in central and eastern Europe where moose and/or red deer predominate, wolves notably avoid preying on wild boar.

Conversely, in southern Europe where large cervids are absent or rare, wolves often rely on wild boar and prefer it to the more numerous roe deer. Because wolves balance difficulty in killing prey with the reward in food biomass obtained, red deer was shown to be the optimal size prey for typical central European packs of 4–6 wolves (Jedrzejewski et al. 2012). Wild ungulates help reduce conflicts between predators and livestock producers as high livestock depredation rates are often linked to low wild prey densities (Linnell et al. 2020; Gervasi et al. 2021).

In any event, unlike predation on domestic livestock, predation on wild ungulates cannot be prevented or mitigated, as it is part of the natural processes that biodiversity policy aims to restore and preserve (Commission Notice C(2021) 7301)²⁰.

Wolves kill fewer wild ungulates than hunters

Although wolves and hunters can compete for large ungulates, at a global level ungulate mortality caused by hunting is almost twice as large as the mortality caused by all terrestrial predators combined (Darimont et al. 2015). Research conducted in Europe show that wolves kill far fewer wild ungulates than hunters. In wild boar (*Sus scrofa*) and roe deer (*Capreolus capreolus*) in Italy, losses due to hunting resulted to be eight to nine times higher than those due to wolf predation and the combined removal by hunters and wolf predation did not exceed the recruitment of both ungulate populations (Bassi et al. 2020). In a study carried out across Europe, hunting by humans had a stronger effect in reducing red deer density than the presence of wolves, Eurasian lynx and bears together (van Beeck Calkoen et al. 2023).

In Białowieża Primeval Forest, daily wolf kill rate averaged 0.116 ungulates per capita (42.3 per year (Jedrzejewski et al. 2002). Multiplying this figure by the total number of wolves in Europe (20,300) it was estimated that European wolves kill a maximum of 0.86 million wild ungulates per year, far less than the more than 7.3 million wild ungulates that are harvested per year in the continent (Linnell et al. 2020).

For most ungulate species, human harvest has a larger impact on population growth compared to predation (per capita kill) as hunters generally select adult animals at a higher rate than large carnivores. Wolves usually select ungulate calves which generally have a much lower reproductive value than adults. For example, in Italy, wolves targeted the intermediate weight class (10–35 kg) in wild boar and

²⁰ [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=PI_COM:C\(2021\)7301](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=PI_COM:C(2021)7301)

showed no preference for a specific class of roe deer, while hunters targeted the largest classes in both species (Bassi et al. 2020).

The increased wolf impact on wild ungulates may require adjusting harvest strategies

The wolf return may affect hunting activities in some circumstances. For example, in the absence of wolves in Sweden, and with the introduction of stand forestry practices and hunting regulations throughout the twentieth century, the Scandinavian moose (*Alces alces*) population has shown a tremendous growth and been one of the most heavily harvested ungulate populations in the world. However, after the wolf's recovery, harvest density was 51% lower in areas containing average-sized wolf territories than in areas without wolves (Wikenros et al. 2020).

The increased impact on ungulate mortality may require adjusted harvest strategies to avoid overexploitation and secure a sustainable yield. Moose management in Sweden aimed to increase productivity in the moose population, in order to compensate for the increased mortality caused by wolves. Several theoretical studies have evaluated various possible harvest strategies for moose and how harvest, for a given density, can be adjusted to reach different types of management goals such as maximizing the amount of meat, total number of harvested animals, or large males.

An alternative to reducing total moose harvest may be to change the age and sex composition of harvested animals to compensate for the increase in mortality caused by wolf predation. To harvest individuals with low reproductive value, i.e., those who have a low probability of producing calves next year, also promote high growth in the population. In general, maximizing the number of harvested animals means that harvest should mainly be directed toward calves, and this strategy also holds true in the presence of wolves. The proportion of females in the adult harvest was strongly reduced in Sweden as a response to increased wolf territory density.

3.3. Predation on farm and domestic animals

Predation on livestock has been the main cause of wolf persecution throughout history and is currently the main source of conflict between wolves and people in Europe and in most of its global range. Wolves mainly kill vulnerable wild ungulates. Since domestic livestock is vulnerable when unprotected, the wolf follows its natural tendency and kills them (Mech 1981).

Damage to livestock goes beyond a purely economic issue. In some areas, extensive livestock play a key role in the maintenance of high biodiversity grasslands, and in Mediterranean landscapes they can prevent forest fires. In addition, predation on pets, such as riding horses or hunting dogs, although is less common than damage to livestock, has a strong and growing emotional importance on the owners and the wider general public.

The resolution of the European Parliament of 24 November 2022²¹ stressed that good monitoring of trends in damage occurrence for livestock breeders is a basic prerequisite for successful policies, and underscored the importance of standardised reporting formats. Monitoring of livestock damages is still very variable across the EU as gives important caveats to the info presented below.

Knowledge on livestock damage is normally derived from compensation data. But in some countries wolf damage is only partially compensated, and in other countries, it is not compensated at all. Increasing or decreasing the coverage of compensation may cause apparent, but not actual, changes in livestock damage. Damage figures from different sources sometimes do not match and comparisons

²¹ https://www.europarl.europa.eu/doceo/document/TA-9-2022-0423_EN.html

from different countries not always are easy. Despite these challenges, the available data can provide a good overview of wolf depredation on livestock in the EU.

The most updated publication on the amount of damage caused by wolves has been prepared by Boitani et al. (2022) who collected the most recent available data on European countries provided by the members of the LCIE for a report submitted to the Bern Convention. A recent compilation of wolf damage on livestock in geographical Europe (Singer et al. 2023) gives fewer details on the EU countries but provides interesting complementary information. In addition, the Discussion paper on livestock depredation prepared in 2023²² by the EU Platform on coexistence between people and large carnivores also provides useful data.

Livestock damage overview in the EU

This section presents the most recent information available on wolf damage to livestock and pets in the EU, based on several sources of information. In addition to the aforementioned publications, the results are based on information received in response to the European Commission's data collection exercise launched on 4 September 2023 (see section 2.4). Furthermore, data from regional and national authorities, reliable information collected on official web pages, through scientific and technical literature and by consulting national experts were used.

On 17 November 2023, the information gathered through the above was sent to the Ministries of Environment of the MS for review. **The resulting information on latest wolf damage to livestock in EU Member States is presented in table 3.3.1.**

In the EU, information is missing from Bulgaria and Hungary, where compensation for wolf damage is not paid, and from Romania, where only partial data are available. In table 3.3.1, disaggregate data are also lacking for a few Member States, such as France and the Netherlands. The disaggregated data in France in 2022 was estimated by applying the rates of each type of livestock killed between January and November 2023 (data from the French Ministry of Ecological Transition). In the Netherlands, we assume that most livestock killed in 2022 (973 heads) were sheep.

According to information from Table 3.3.1, in the EU wolves kill annually at least 65,500 heads of livestock, 73% of them are sheep and goats, 19% cattle and 6% horses and donkeys, most of them horses bred for meat. Semi-domestic reindeer are also killed in Finland (1,261 in 2022) and in Sweden (unknown). These figures are higher than those shown by Boitani et al. (2022) (53,530 heads of livestock). The increase of livestock killed in Spain (from 11,210 heads in 2020 to 14,309 in 2022) may be due to the expansion of damage compensation coverage following wolf protection in 2021, to an actual increase of damage or both. In any case, the results show that damage to livestock is increasing in the EU.

²² <https://circabc.europa.eu/ui/group/3f466d71-92a7-49eb-9c63-6cb0fadf29dc/library/410c2e7b-0ce8-425e-8ac2-c1c65203b476/details>

Table 3.3.1 WOLF DAMAGE ON LIVESTOCK IN THE EU MEMBER STATES

Country	Year of depredation	Sheep & goats	Cattle	Horses/ donkey	Semi-domestic reindeer	Dogs	Others	TOTAL heads	Year of compensation	Amount of compensation (€)	Source
Austria	2022	860	11	0	0	0		871	2022	350,000	Federal Min. Environment, EC data collection.
Belgium ¹	2022	196	9	3	0	0	36	208	2022	50,900	Flanders: Agenschap Natuur & Bos Wallonia: Service Public de Wallonie- Agriculture, Ressources Naturelles & Environnement
Bulgaria										0	No compensation. No data on wolf damage
Croatia	2022	2777	625	61	0	48	5	3516	2022/2023	460,155	Ministry of Economy and Sustainable Development, Nature Protection Directorate
Czech Republic	2022	701	50	0	0			751	2022	390,038	https://www.navratvlku.cz/ Ministry of Environment; Min. Agriculture, EC data collection
Denmark	2022	159	2	0	0	0		161	2022	51,093	Danish Environmental Protection Agency
Estonia	2022	966	26	0	0	10	0	1002	2022	160,494	Environmental Board of Estonia

Country	Year of depredation	Sheep & goats	Cattle	Horses/ donkey	Semi-domestic reindeer	Dogs	Others	TOTAL heads	Year of compensation	Amount of compensation (€)	Source
Finland	2022	518	0	0	1,261	<50		1829	2021	2,997,413 € (semi-domestic reindeer 2,746,800 €)	2021: Boitani et al. 2022. https://rm.coe.int/inf45e-2022-wolf-assessment-bern-convention-2791-5979-4182-1-2/1680a7fa47 2022: https://www.luke.fi/fi/uonnonvaratieto/tiedetta-jatietoa/suurpedot/susi-0
France ²	2022	11,981	443	23	0	79		12,526	2022	4.1M €	Office Français de la Biodiversité (OFB), EC data collection
Germany	2022	3869	260	30	0	3		4162	2022	616,413 €	Dokumentations- und Beratungsstelle des Bundes zum Thema Wolf (2023): Wolfsverursachte Schäden, Präventions- und Ausgleichszahlungen in Deutschland 2022. 44 S
Greece	2022	2660	3474	529	0	0		6663	2022	2,301,650	Greek Agricultural Insurance Organization (ELGA) 2022
Hungary	2021	63	0	0	0	0		63	2021	0	National Parks directorates and Ministry of Agriculture
Italy ³	2019	8480	1432	318	0	0		10,289	2019	1,918,566	Gervasi et al. 2022. Stima dell'impatto del lupo sulle attività zootecniche in Italia. Analisi del periodo 2015 – 2019. https://www.isprambiente.gov.it/public_files/StimalmpattoLupoAattivitaZootecniche.pdf

THE STATUS OF THE WOLF (*CANIS LUPUS*) IN THE EUROPEAN UNION

Country	Year of depredation	Sheep & goats	Cattle	Horses/ donkey	Semi-domestic reindeer	Dogs	Others	TOTAL heads	Year of compensation	Amount of compensation (€)	Source
Latvia	2021	45	2	0	0	4		51	none	none	Boitani et al. 2022. https://rm.coe.int/inf45e-2022-wolf-assessment-bern-convention-2791-5979-4182-1-2/1680a7fa47
Lithuania ⁴	2022	1269	137	1	0		52	1459	2022	290,571	Ministry of the Environment of the Republic of Lithuania. EU Consultation
Luxembourg	2021	0	0	0	0	0		0	2021	0	Boitani et al. 2022. https://rm.coe.int/inf45e-2022-wolf-assessment-bern-convention-2791-5979-4182-1-2/1680a7fa47
Netherlands ⁵	2022-2023	973 ³			0			973	2022	235,188	https://www.bij12.nl/onderwerpen/faunazaken/diersoorten/wolf/ : Damage from 10.07.2022 to 09.07.2023. Alle-schademeldingen-wolf-en-geen-wolf-25-augustus-2023.xlsx (live.com).
Poland	2019				0			993	2020	351,000	Boitani et al. 2022. https://rm.coe.int/inf45e-2022-wolf-assessment-bern-convention-2791-5979-4182-1-2/1680a7fa47
Portugal	2017	2064	593	395	0	7		3059	2017	332,387	Boitani et al. 2022. https://rm.coe.int/inf45e-2022-wolf-assessment-bern-convention-2791-5979-4182-1-2/1680a7fa47

Country	Year of depredation	Sheep & goats	Cattle	Horses/ donkey	Semi-domestic reindeer	Dogs	Others	TOTAL heads	Year of compensation	Amount of compensation (€)	Source
Romania	2020				0			528	2021	127,580	2020: Ministry of Environment, Water and Forests, EU data collection. 2021: Boitani et al. 2022
Slovakia	2022	1081	77	0	0	0	0	1158	2022	453,792	Ministry of the Environment of the Slovak Republic, 2022
Slovenia	2022	602	31	9	0	1	2	645	2022	121,073	Ministry of Natural Resources and Spatial Planning of Slovenia
Spain	2022	6863	5200	2273	0			14,309	2022	3,225,845	Ministry of the Environment (MITECO). EC data collection
Sweden	2022	255	5	0		22	1	283	2022	164,000 (including compensation for dogs)	Frank J, Levin M, Månsson J, Höglund L, Hensel H (2023). Viltskadestatistik 2022. Skador av stora rovdjur och stora fåglar på tamdjur, hundar och gröda. Rapport från SLU Viltskadecenter 2023-3
TOTAL⁶		46,382	12,377	3,642	1,261	224	94	65,499		18,698,158€	

¹ Some domestic species are not listed separately: 7 alpacas, 17 ponies and 12 captive fallow deer with additional amount of compensation of 10.688,79 euros.

² The disaggregated data in France in 2022 was estimated by applying the rates of each type of livestock killed between January and November 2023

³ The regional administrations of Lombardy and Trento provided more up-to-date data than in the ISPRA report, it is difficult to integrate the figures with the rest of data from the other 20 regions, given that these regions have limited territories.

⁴ Other includes captive fallow deer and sika deer

⁵ Disaggregated data are unknown in the Netherlands. For statistical purposes, we assumed that all livestock killed were sheep. Compensation is from November 2021 to October 2022

⁶ The sum of the different types of livestock is 63,980 because disaggregated data is not available in some MS

The highest damage to livestock according to available data occurs in Western European countries, but there is no complete information from some countries of Eastern Europe with large wolf populations, such as Bulgaria and Romania. Spain (about 14,000 heads killed annually), France (12,000) and Italy (10,000) represent half of all livestock damage in the EU. Considering that the number of wolves in Spain (more than 300 packs) and in Italy (about 3,300 individuals) is much higher than that of France (about 1,100 wolves in 2023), this country is the one with the highest rates of livestock killed per wolf in the European Union. Other countries, such as Germany, Greece and Croatia, also show important damage to livestock.

The different types of livestock affected

Sheep are more vulnerable to wolf attacks and are also the most depredated type of livestock. France is the country where wolf depredation on sheep is highest. Around 12,000 sheep were killed in 2022 (Table 3.3.1), which represents circa 11 sheep/wolf/ year. These large numbers are probably due in part to the many free-ranging sheep in alpine pastures. Portugal, Greece, Croatia and Italy also stand out as hot spots for wolf depredation on sheep. This is probably due to a range of factors that include husbandry, but in some cases are also associated with many areas that have low densities of wild ungulates such that wolves have no alternative prey sources (Linnell and Cretois 2018).

Cattle damage reaches its maximum in Spain. This is because in many areas of the Cantabrian Mountains sheep and goats, which were the predominant type of livestock until about 30 years ago, have been replaced by free-ranging beef cattle, which spend several months of the year in the field. Cattle are less vulnerable to predation by wolves and bears than sheep and goats (mainly calves are killed) and require less dedication, so farmers can make them compatible with other activities, such as tourism, which have become increasingly important in the economy of these areas. In addition, since the year 2000 wolves have recolonized some areas of central-western Spain, such as Ávila province, where there are huge densities of extensive beef cattle and low densities of wild ungulates. Free-ranging cattle are difficult to protect with preventive methods. Since free-ranging cattle are scattered in the field, they cannot be protected with fences, and it is not always easy to protect them with guarding dogs. In Ávila province alone, wolves kill more than 1,600 calves each year (Blanco et al. 2021b).

Damage to horses bred for meat is also widespread in northwestern Spain (2,273 killed in 2022), Portugal (395 in 2017) and Italy (317 in 2019) (Table 3.3.1), where small-sized horses (<300 kg) are raised for meat production under free-roaming systems and thus accessible to wolves, which mainly kill foals. In many of these areas, horses are more abundant than wild ungulates, which are locally scarce, and are more accessible than other livestock which are confined at night. In some studies, horses comprised >70 % of wolf diet and were positively selected in relation to other wild and domestic prey, meaning that wolves consumed horses in a higher proportion than their local availability. In Italy, wolf attacks on free-ranging horses are mostly limited to Apennine Mountain range, where they can locally reach 40% of wolf diet (Freitas et al. 2021).

Semi-domestic reindeer represent a very specific case of livestock depredation. They are grazed by Sami people in Sweden and Finland (as well as in Norway and Russia, outside of the EU). In Sweden and Finland, reindeer herding is conducted across approximately the northern 40% and 33% of the countries, respectively. Semi-domestic reindeer are free-ranging throughout the year and in most of the northern parts of the reindeer herding districts there are very low densities of alternative prey, so wolves and other large carnivores are virtually dependent on their access to reindeer as prey (Linnell and Cretois 2018). Even if wolves are not tolerated in the reindeer herding districts of Sweden and Finland, they cause significant damage. In 2022 more than 1,200 semi-domestic reindeer were killed by wolves in Finland (Table 3.3.1). In Sweden, damage statistic is unknown because the compensation system is based on paying for the risk associated with large carnivore presence and does not require documenting losses (Linnell and Cretois 2018).

Seasonal distribution of damage

The seasonal distribution of wolf-caused incidents in Europe was studied by Singer et al. (2023). Across all livestock species, incidents peaked between July and October with 48.7% of total incidents falling within these months. This pattern was particularly visible for sheep (55.2%), and for cattle (43.4%) and goats (40.9%), albeit less pronounced. In contrast, incidents involving horses peaked between April and July (51.8%) and those involving reindeer between September and December (67.5 %).

Livestock damage trends

Data from this report shows that damage is increasing in recent years in the EU. At a national level, the trend in damage has been studied in some countries where wolves have been increasing. In France, wolves were exterminated more than one century ago, and livestock breeders and herders were unprepared when wolves arrived from Italy in 1993. In 2019, 580 wolves, whose numbers are growing very fast, were present in over one third of France. According to Meuret et al. (2020), livestock deaths from wolves have grown linearly from 3,215 in 2009 to 12,451 in 2019, despite France implemented extensive damage protection measures (Fig. 3.3.1). Nevertheless, in the 2020-2022 period (not covered by the study of Meuret et al. 2020), damage has slightly decreased or stabilized but back up in 2023 (2020: 11,746 heads killed; 2021: 10826; 2022: 12,526)²³.

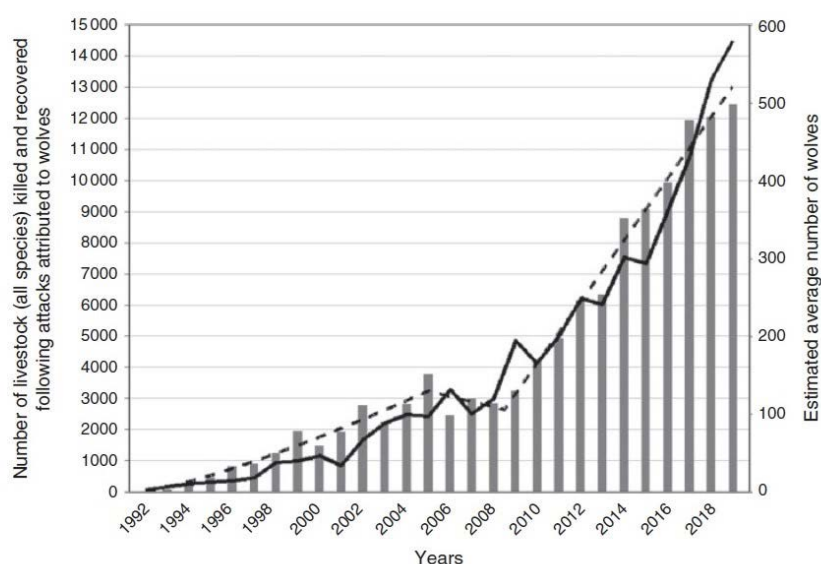


Fig. 3.3.1. Number of livestock killed by wolves in France (grey bars); number of wolves (solid line); model prediction of livestock killed by wolves (dashed lines). From Meuret et al. (2020).

In Germany also, damage to livestock has increased as the wolf population has grown (Khorozyan & Heurich 2022). Nevertheless, while the number of attacks increased in 2021 by 3.5% across Germany compared to the previous year, the number of livestock killed or injured fell by 15% (Fig. 3.3.2). The trend of the damage figures in the individual federal states was very different. In some of the federal states with the most wolves (more than 10 wolf territories in 2020), the number of wolf-caused attacks decreased significantly (e.g., Mecklenburg-Western Pomerania, Lower Saxony) or changed only moderately (Saxony, Saxony-Anhalt) while they increased significantly in Brandenburg. These data suggest that preventive measures may have been successful to reduce wolf attacks (DBBW 2022).

²³ <https://www.loupfrance.fr/>

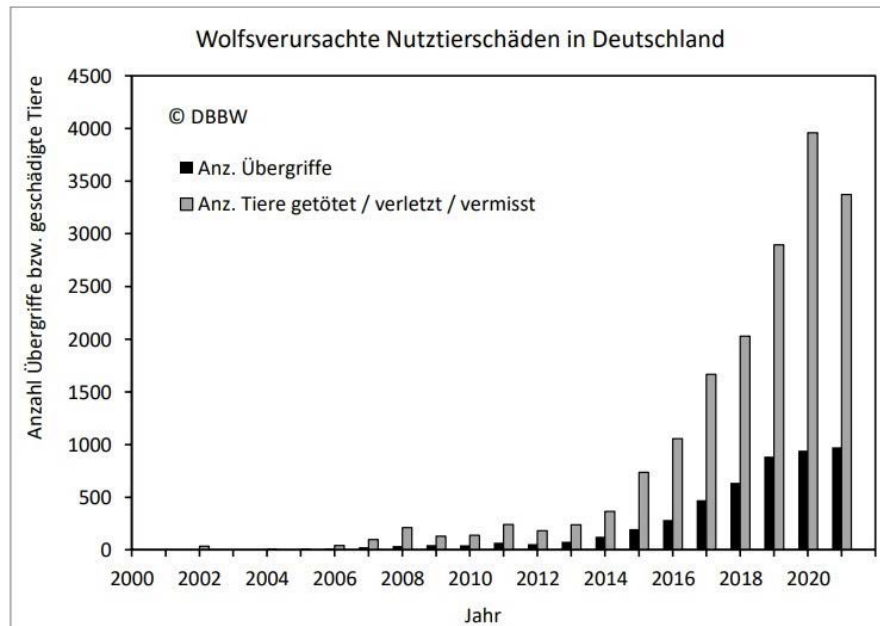


Fig. 3.3.2. Livestock damages caused by wolves in Germany 2002-2021 (black= number of attacks; grey= number of animals killed/wounded/missing). From DBBW (2022).

Dalerum et al. (2020) used a 20-year data set on wolf and three other species of large carnivores and their damages in Sweden to evaluate if temporal variation in carnivore densities has caused an equivalent variation in the number of damages to livestock. They found that wolf densities appeared to have been positively related to the number of damages more often than bear and lynx densities. Their results highlighted that large carnivore damages can be highly context dependent, and that other factors than the size of local or regional carnivore populations may be more important damage determinants. Such an interpretation implies that population reduction may not necessarily be an effective method for limiting large carnivore damages, and highlight that damage mitigation strategies need to be flexible over time and space.

Some concluding remarks

On a large scale, the impact of wolves on livestock in the EU is very small. Considering that there are 60 million sheep in the EU (Eurostat 2022), the level of sheep depredation by wolves represents an annual killing of 0.065%, a very similar figure to that previously estimated by Linnell and Cretois (2018).

Nevertheless, as Boitani et al. (2022) highlighted, although damage to livestock may be tolerable at country level, their concentration at a local level may reveal strong pressure on certain areas. Wolf attacks on livestock can also cause indirect economic losses, which are difficult to quantify, and they also have considerable emotional consequences for their owners. In some areas, recurrent damage to livestock can have a negative impact on pastoralism, the cultural heritage and the way of living of rural communities.

Throughout the European Union, a series of common characteristics related to damage to livestock have been found (see Gervasi et al. 2021 and Singer et al. 2023 for a review).

- Free-ranging livestock are more difficult to protect and account for the majority of predation by wolves.
- There is a positive relationship between wolf distribution and the number of killed sheep at a European scale.

- Depredation levels are lower in the areas where large carnivore presence has been continuous compared to areas where they disappeared and returned in the last 50 years.
- In the EU, there are many fine scale differences. A few large carnivores can produce high damage when the environmental, social, and economic systems predispose for it, whereas large populations can produce a limited impact in different circumstances.
- The availability of natural prey, landscape characteristics and the use of protection measures also shape the incidence of damage to livestock.

3.4 Attacks on hunting dogs and other pets

In addition to the attacks on livestock, wolves can also attack other animals that are considered pets. The cases are very diverse and can go from extremely rare attacks on pet wallabies²⁴, to the more common attacks on hunting dogs. Although the death of pets is much more uncommon than livestock depredations, they can trigger strong emotions.

This happens for instance when riding horses are attacked by wolves. In Lower Saxony, a state with high affiliation to horse keeping and breeding, the first incidents of horses allegedly injured or killed by wolves were also in 2015. A total of 43 alleged incidents of wolf attacks on horses were officially registered in Lower Saxony in 2007– 2019, and wolf involvement was confirmed in at least four cases. In 2020, 13 alleged wolf attacks on horses were reported in Lower Saxony, and seven cases, in which six horses were killed and four injured, were verifiably caused by wolves. Genetic analysis showed that a resident wolf pair experienced in attacking and killing cattle was responsible in some cases. In 2013 – 2019 a Horse & Wolf working group, comprising horse owners, biologists and members of NGOs was formed in Lower Saxony in order to help farmers and equestrians adapt their husbandry to the presence of wolves (Solmsen et al. 2021).

Wolf attacks on hunting dogs

Although the number of dogs killed by wolves may be statistically insignificant relative to other livestock predation, it can have a dramatic impact on people's perceptions and attitudes to wolves. In some cultures, humans and dogs have strong social and emotional links, and dogs are treated as family or team members. Good hunting and livestock guarding dogs are valuable and cannot be replaced quickly.

The loss of such animals triggers strong emotional responses of grief. In addition, the fact that wolves often enter villages and farmyards to take dogs close to houses may induce fear because of the threat that they also pose to human life. These incidents increase animosity toward wolves and decrease community and political support for their conservation (Butler et al. 2014).

Most commonly, wolves perceive dogs as both competitors and prey, and will kill them usually in two types of circumstances. The first is when hunting dogs are running free in wolf habitat. Wolves treat baying, free-running hunting dogs in pursuit of wild ungulates as competitors for a shared prey. Wolves are very aggressive toward other wolves that invade their territories, and they likely perceive and respond to hunting dogs in a same manner. The second one is where dogs are killed in villages or yards, often when chained to a building, suggesting that the wolf actively sought out the dog and killed it without provocation. In addition, livestock guarding or herding dogs are sometimes killed during a wolf attack on livestock. In all cases, dogs may be partially or totally consumed by wolves (Butler et al. 2014; Tikkunen 2023).

²⁴ <https://www.euronews.com/2019/12/26/wolf-suspected-of-eating-pet-kangaroo-as-christmas-meal-in-belgium>

In Croatia, the majority (64%) of dogs were killed during drive hunts on wild boar (Bassi et al. 2021), and in Finland 91% of the attacks were directed at hunting dogs during the hunting season (Tikkunen and Kojola 2020). In Poland, hunting with a dog poses a seven times greater risk of interaction with wolves compared to recreational walking (Haidt et al. 2021)

Number and trend of dogs killed by wolves

The wolf-dog conflict is more obvious in northern countries, where valuable dogs are used in moose hunting. In Finland, during 2010–2017 wolves killed an average of 38 dogs (range 24–50) per year (Tikkunen and Kojola 2020), and from 2018 to 2022, this figure increased to 45.4 dogs (Tikkunen 2023).

In Sweden, 11 dogs were killed and 11 injured by wolves in 2022, most of them, hunting dogs (Frank et al. 2023). During 2003–2018, an annual average of 29.2 dogs was killed/injured by wolves In Sweden (Dalerum et al. 2020), and damages did not show any distinct trends over time. At the national scale, the number of attacked dogs was positively related to wolf density, although the relationship was not statistically significant.

In Poland, wolves killed an average of 61 domestic dogs annually on hunting grounds from 2006 to 2011, primarily in regions where wolves are residents and live in stable packs (Wierzbowska et al. 2016). In Greece, losses averaged approximately one dog per decade and hunter, showing a positive trend (Iliopoulos et al. 2021). In Croatia, 34 dogs were killed and 14 were wounded by wolves in 2022 which is an insignificant part of the 3,516 domestic animals killed and wounded by wolves that year (Table 2.4.1). According to official statistics the number of dogs killed by wolves in Croatia is decreasing (from 154 in 2012 to 34 in 2022).

Factors influencing wolf attacks on dogs

Knowing the circumstances that determine the attacks of wolves on dogs can help to design prevention measures. The risk of interaction between wolves and a dog that is with a human depends on the distance between the dog and its owner, the number of wolves and the size of the dog. In Croatia, most of the attacked dogs were smaller than 20 kg and 86% of these attacks were fatal. In Sweden, only moose hounds heavier than 25 kg were more often injured than killed. The dog breed is also important. In Croatia, hounds that are more likely to be attacked by wolves have energetic and sometime aggressive character, while pointers, which are more vigilant, had lower risk for being attacked (Bassi et al. 2021; Haidt et al. 2021).

In Greece, dogs were more vulnerable during hare hunting and during wolf post-weaning season or in wolf territories with reproduction (Iliopoulos et al. 2021). In north-eastern Europe, wolf attacks on dogs are also linked to the scarcity of prey. In Finland a highly significant negative relationship was found between the number of dogs killed and the population density of white-tailed deer (*Odocoileus virginianus*) and the total ungulate biomass per unit area. In years when roe deer and wild boar populations are down, the risk of wolves attacking dogs in house yards was higher in Estonia. In Croatia, more dogs were attacked in counties with more livestock and fewer wild prey, but correlations were not significant (Tikkunen and Kojola 2019; Kojola et al. 2022; Bassi et al. 2021). These data suggest that wolves likely perceive dogs as potential prey.

In addition, the attacks on dogs take place near territory boundaries much more often than expected based on the position of GPS-collared territorial wolves. This pattern supports that intraguild competition is also an important motivator for wolves to kill dogs (Kojola et al. 2023).

Wolf attacks on dogs in perspective

Hunting dogs attacked by wolves account for a small part of the casualties suffered by hunting dogs from various causes. According to the report from the major insurance company Agria (40% market share) related to accidents with hunting dogs in Sweden, in 2021 238 dogs were killed/injured in traffic accidents, 9 were shot and 12 drowned. In addition to the 30 dogs killed/injured by wolves, 197 were attacked by wild boars, 17 by lynxes, 3 by bears, 4 by European adders and 2 by wasps (Frank et al. 2022; Agria Statistics).

3.5 Considerations about public safety

In the last 40 years, despite the large number of wildlife biologists collecting reliable information on large carnivores, there has not been a single verified record of a fatal wolf attack on humans in Europe and only two fatal attacks have been recorded in its wide American range (Linnell et al. 2002, 2021). In spite of this, many people who live in wolf range report that they are afraid of wolves, perhaps because of the traditional bad reputation of wolves in many cultures. This fear is also frequently used as an argument by anti-wolf advocates in efforts to undermine conservation legislation and reduce the current level of legal protection offered to wolves (Linnell and Alleau 2016).

After reviewing a vast amount of historical and current information coming from the whole wolf range, Linnell et al. (2002, 2003, 2021) concluded that there is indeed evidence that people have been killed by both healthy and rabid wolves during the last centuries, attacks in general are unusual but episodic, and humans are not part of their normal prey. In historic times, the number of cases probably was very small, but the incidence of attacks appears to have dropped dramatically during the 20th and 21st centuries.

In those extremely rare cases where wolves have killed people, most attacks have been by rabid wolves. Some predatory attacks aimed mainly at children have also been recorded in areas with an intense human pressure on the landscape, and with relatively little forest and little wild prey. Livestock (in addition to carrion and garbage) was the main prey of wolves and was only defended by unarmed child shepherds in fragmented landscapes with dispersed settlements (Linnell and Alleau 2016). When the frequency of wolf attacks on people is compared to that from other large carnivores, wolves are among the least dangerous species for their size and predatory potential.

The conditions that allowed wolf attacks in the past do not exist in Europe today, as rabies has been almost completely eradicated and children under 12 do not work as shepherds anymore. Although the risk of people being attacked by wolves is incredibly low in the modern world, the risk is not zero (Linnell and Alleau 2016).

In order to reduce even more this risk, Linnell et al. (2002) proposed to keep wolves wild by responding properly to wolves that act in an aggressive manner or have lost their shyness (see “Recommendations to address bold wolves” in section 4.7), to maintain or improve wild prey populations for wolves, and to control rabies in the countries where this is still a problem (not in most of Europe).

The current tolerance of the modern society toward wolves has allowed the emergence of fearless wolves, whose behaviour is reinforced when they obtain food from humans or are even fed on purpose. Fearless and food-conditioned wolves may be dangerous. In fact, one of the only two known lethal attacks by wolves on humans in North America was caused by food-conditioned wolves in Saskatchewan (Linnell et al. 2021).

Other documented non-lethal wolf attacks over recent decades from North America were also caused by fearless and/or conditioned wolves (Linnell et al. 2021). These fearless/bold wolves which have

appeared in some countries of Europe may lead to potentially dangerous situations, as occurs with the cases of bold wolves described in Germany by Reindhart et al. (2020) or the low intensity attacks in Poland, where two wolves bit several people on the legs, hands and the buttock causing minor injuries (Nowak et al. 2021b).

These attacks were caused by yearling wolves from local packs, which appeared near households several months prior to incidents. Both individuals were positively food-conditioned and showed increasing habituation caused by irresponsible behaviour of people such as long-lasting intentional feeding or illegal keeping. Despite prolonged observations of these wolves less than 30 m to human settlements, no mitigation actions were undertaken until the attacks, after which both wolves were killed.

In the International Conference on Bold Wolves promoted by the Life project Wolf Alps on 29 April 2022²⁵ their presence was confirmed in Italy (23 cases over the last ten years), Slovenia (three cases from 2006 to 2022), Germany (two cases required management intervention in 22 years), and France (out of 3280 encounters from 1993 to 2000, one case of aggressive, non-defensive, behaviour without attack). More recently, a pure wolf female (DNA confirmed)²⁶ of central Italy, lightly bit several people on the beach or walking near the coast near the city of Vasto in summer 2023. The wolf, apparently fearless, was captured in September 2023. In these cases, the implementation of the bold wolves' protocols described in Chapter 4.7 can further minimize the risks that they pose to humans.

While previous actions focus on the real risks posed by wolves, the far greater challenge lies in managing the fear of wolves (Linnell and Alleau 2016). Apart from the propaganda of anti-wolf groups, information based on false or unconfirmed data is frequently disseminated, as demonstrated by the alleged wolf attacks that seriously injured a man in northern Italy (Caniglia et al. 2016) and killed a woman in Greece (Iliopoulos et al. 2022), which were actually caused by dogs. It is important to debunk fake news about wolves that prey on people by scientifically credible organizations.

²⁵ <https://www.lifewolfalps.eu/en/lupi-confidenti-sintesi-della-conferenza-internazionale-2022/#:~:text=On%2029%20April%2C%20at%20the,Germany%2C%20and%20the%20management%20guidelines>.

²⁶ <https://www.isprambiente.gov.it/it/news/le-analisi-genetiche-di-ispra-confermano-che-lanimale-responsabile-degli-attacchi-a-vasto-e-una-femmina-di-lupo>

4. AVAILABLE MEASURES TO IMPROVE COEXISTENCE

4.1. Prevention measures and livestock protection

The best way to reduce livestock losses after wolf recolonization is to apply measures to prevent wolf depredation. In some cases, preventing wolf attacks on livestock is a simple task requiring only inexpensive materials and minor husbandry changes. But most of the time, livestock damage prevention may imply profound modifications of husbandry practices and a corresponding increase of labour intensity (Linnell and Cretois 2018). In other cases, mainly when livestock is free-ranging and scattered over wide areas, to implement preventive measures is extremely difficult. Adopting new protection measures can be challenging for many producers, especially in countries with high labour costs.

Nevertheless, the benefits of protecting livestock become clear when comparing the different Swedish and Norwegian models of livestock and predator management (Swenson and Andrén 2005; Linnell and Cretois 2018). In Norway, sheep are free-grazed in forested and alpine-tundra habitats with very low levels of supervision, in the same way than in the past, and the recovery of large carnivore populations has not changed the husbandry system. Hence, per capita depredation rates (i.e., the number of livestock killed per large carnivore individual) in Norway and Sweden are 34 vs 0.85 for wolves, 20 vs 0.01 for bears, and 16 vs 0.1 for Eurasian lynx. The key difference is that Swedish sheep are kept behind fences (often electrified) while Norwegian sheep graze freely and unprotected. In addition of having the highest depredation rates in Europe, Norway has very small populations of large carnivores compared to Sweden (Linnell and Cretois 2018).

Information on wolf damage prevention to livestock

Every livestock's exploitation has its own needs and circumstances, and it is not possible to prescribe recipes that work for all of them. Nevertheless, dozens of papers and reports have been published in recent years on this topic, there is a journal specifically devoted to large carnivore damage prevention²⁷ and a lot of resources and manuals have been produced mainly by LIFE projects. Linnell and Cretois (2018) listed the main available web resources on livestock protection measures in Europe. In addition, Oliveira et al. (2021) reviewed 135 LIFE projects dealing with large carnivores between 1992 and 2019 to provide an overview of the use of damage prevention methods and their effectiveness.

The largest number of projects focused on wolves and brown bears in the Mediterranean countries and in Romania. Besides dissemination of information, carnivore-proof fencing and livestock guarding dogs were the more frequently used methods. Other methods are also efficient but demand important husbandry changes, such as changing livestock species, or moving from very vulnerable small stock (sheep and goats) to large stock (cattle, horses for meat), as has been done in many areas of the northwestern Iberian Peninsula (see section 3.3) and other parts of Europe; this change may also modify the landscape as small stocks have different grazing patterns than large ones.

Using shepherds is also a very efficient measure, because wolves are usually scared by human presence, but the cost of hiring shepherds can be challenging for many producers. Expert advice to solve problems in the early phases of the implementation of the measures is crucial to ensure their effectiveness. In the review of Oliveira et al. (2021), electric fences were reported as the most successful method for reducing damages by large carnivores, but most of the non-lethal methods used showed at least moderate effectiveness.

²⁷ [CDPNews \(protectiondestroupeaux.ch\)](https://cdpnews.protectiondestroupeaux.ch)

Effective prevention is particularly difficult in the case of free-ranging livestock, like sheep in alpine meadows, free-ranging horses for meat production in northwestern Iberian Peninsula or in Italy, or free-ranging beef cattle in some regions of Spain. This type of livestock spends much or all the year scattered in the field, so they cannot be defended with fences and it is not always easy to protect them with guarding dogs. In addition, the use of prevention methods may require significant economic investments or more labour time, which can cause costs to exceed the value of livestock not preyed on by wolves (Blanco et al. 2021b). A particular case is that of the semi-domestic reindeer in Sweden and Finland. There are few practical protection measures, and management currently rests on the strategy of using lethal-control to regulate carnivore populations and the economic compensation for losses (Linnell y Cretois 2018).

Cost and effectiveness of damage prevention in some EU countries

Some EU countries, such as France or Germany, spend a large amount of money for the prevention of damage to livestock. For example, 32.7 million euros on damage prevention and 4.1 million euros on damage compensation were spent in France in 2022²⁸. France intends to spend 175M€ of CAP funds over the 2023-2027 funding period (EU LC Platform 2023). In Germany, expenditure on livestock protection measures in 2021 was €16,639,800, more than 30 times higher than expenditure on compensation payments for damage incurred (€498,433) (DBBW 2022).

In spite of the massive investment in protection measures, some French researchers are pessimistic about the outcomes of these measures. According to Meuret et al. (2020), from 2009 to 2019, the number of predated livestock increased linearly with the number of wolves, from 3215 in 2009 to 12 451 in 2019 (Fig. 3.3.1), despite France implementing extensive damage protection measures since 2004, including reinforced human presence, livestock guarding dogs, secured pasture fencing and electrified night pens. From 2009–2017, if the mean number of victims per wolf was slightly lower than during 1992–2005, the rate of increase was identical.

In the period 2009-2017, most of the increase in damages came from the historically predated area of France, invalidating the hypothesis that main damages were caused in other areas of France recently recolonized by wolves where farmers were not prepared yet to protect the livestock. In addition, in the most predated area, the majority of wolf attacks (>92%) affected the producers who had subscribed to an effectively implemented protection contract. These data allow Meuret et al. (2020) to conclude that damage prevention methods have failed. Nevertheless, in the last three years (not covered by the study of Meuret et al., 2020), damage has slightly decreased or stabilized in France (see section 3.3.) while wolves have kept increasing. This suggests that damage prevention procedures could be yielding some positive results.

In Germany, the evaluation of the results of damage prevention is more optimistic than in France. Damage to livestock has increased as the wolf population has grown, but, while the number of attacks increased in 2021 by 3.5% across Germany compared to the previous year, the number of livestock killed or injured fell by 15%, suggesting that preventive measures may have been successful to reduce wolf damage (Fig. 3.3.2, section 3.3). Sheep losses are related to the expansion of wolf population but not to increasing wolf numbers. This decreasing trend suggests that mitigation is possible, even if the number of attacks is high. Attacks on farm animals occur primarily where sheep and goat keepers have not yet adjusted to the presence of wolves and have not taken protective measures.

On the one hand, these are areas in which wolves have recently settled and established new territories. However, there are still attacks even in areas where wolves have been present for several years. A

²⁸ <https://www.auvergne-rhone-alpes.developpement-durable.gouv.fr/IMG/pdf/infoloup40-vf-comprimee.pdf>

systematic and professional application of livestock protection measures in wolf areas has not yet been achieved (Bruns et al. 2020; DBBW 2022; Khorozyan & Heurich 2022; Singer et al. 2023).

A study carried out in the Iberian Peninsula illustrates the potential for prevention measures to contribute to mitigating wolf-human conflicts in the long-term. LIFE Coex (LIFE04 NAT/IT/ 00144) was implemented from 2004 to 2008 in five European countries. In Spain and Portugal, measures were focused on reducing losses of livestock to wolves at 144 holdings. These holdings were surveyed ten years after the end of the project, and 83 % were still using prevention measures at the time of the survey or had used them until ceasing farming activity. Conventional fences (93% still in use) and large guarding dogs (87%) had greater longevity than electric fences (61%). Most measures were still being used a decade after they were implemented, damage remained low and farmers continued to be satisfied (Cortés et al. 2020).

In some cases, the implementation of prevention measures may not seem satisfactory due to their high economic cost and because they do not reduce the damage sufficiently. However, the measures used to protect livestock against large carnivores will also protect them against smaller predators and theft, while the more intensive surveillance will allow earlier reaction to accidents, diseases and parasite infections. It is therefore very likely that both animal survival and welfare will be enhanced in well protected flocks (Linnell and Cretois 2018).

In most cases, there is no other alternative to prevention methods than paying large amounts of money in compensation or killing all or most of the wolves in the area, which contravene the Habitats Directive and is outrageous to a large part of society. Seeking the necessary technical, administrative, and economic improvements to make prevention measures more effective is more useful than not using prevention methods.

Preventing attacks on horses and hunting dogs

Hunting dogs, riding horses and other pets are sometimes killed by wolves. Solmsen et al. (2021) published some recommendations to prevent damages to riding horses Germany, and several studies have been carried out addressing the safety of hunting dogs.

Preventing wolf attacks on hunting dogs may lead to an increased acceptance of wolves, mainly in Finland and Sweden, where they are used for hunting moose (Tilkkunen and Kojola 2020). The studies cited in the section 3.3 (Predation on farm and domestic animals) recommend keeping hunting dogs on a short distance from hunters, using dogs heavier than 25 kg in wolf areas, or releasing multiple dogs at the same time. In addition, protective vests and other means that protect dogs from wolf bites can be functional (Fedderwitz 2010). In 2021, SEK 626,000 (€55,391) was paid in Sweden to prevent wolf damage to hunting dogs, which was mostly used by hunters to purchase protective vests for dogs (Frank et al. 2022).

In Finland and other European countries, dogs are more frequently attacked by wolves when wild ungulates are scarce (Kojola et al. 2023), so abundant wild prey would decrease the risk of attacks. Nevertheless, it must be considered that higher densities of wild ungulates could increase the risk of traffic collisions and browsing damages in forests. In addition, one of the main wild prey of wolves in Finland, the white-tailed deer (*Odocoileus virginianus*), is an alien species.

The most effective protection measure is to avoid releasing hunting dogs in hunting grounds that are being used by wolves. To obtain this information, hunters scout for wolf tracks and signs or are informed about wolf presence through social networks. To help moose hunters, the Natural Resources Institute of Finland (Luke) made accessible to the public positions of GPS-collared wolves during several hunting seasons (see chapter 3.3). This information decreased the risk, but did not completely protect dogs from wolf attacks. The negative side of this initiative is that it may increase the risk of wolf poaching in some cases (Tilkkunen and Kojola 2020).

4.2. Compensatory measures

In most of the EU countries, the damage caused by wolves to livestock is compensated to the producers by the regional or national governments to alleviate the economic burden of coexisting with wolves, increase tolerance toward them and avoid retaliatory poaching. Compensation is paid by different agencies in different countries, and the compensation systems are also diverse. There are three main methods:

The classical ex post facto system is the most widespread in the EU. This system usually requires documenting losses, and producers have to face the challenge of finding fresh carcasses for examination. In some cases, compensation is only granted when at least some damage prevention measures are implemented (Boitani et al. 2010; Marino et al. 2016).

Some countries, such as Sweden in the case of semi-domestic reindeer, pay incentives ex ante for carnivore presence rather than paying ex post facto compensation for damage. This system is based on paying for the risk associated with large carnivore presence and does not require documenting losses. Rather, the focus is on documenting the presence of reproducing populations of large carnivores. Such incentive systems encourage depredation prevention rather than documentation and have significantly lower transaction costs than compensation and insurance systems (Linnell and Cretois 2018). This system is not accepted by many farmers, and economic costs can be much higher than ex post payments.

Insurance programs are also used in some countries or regions, where producers pay premiums to insure their stock against losses. Governments can partially subsidise these programs. This system has been used in some regions of Spain, but farmers prefer the ex post facto compensation system (Blanco 2003).

Of the 24 countries of the European Union with wolves, 20 pay compensations for documented losses, some of them (e.g., Croatia, Portugal, Slovakia and Germany) conditioned to the implementation of some protective measures, and in the remaining four countries (Bulgaria, Hungary, Latvia and Luxemburg), damage compensation is not paid or other methods are used for compensation (Boitani et al. 2022).

The cost of compensation

Throughout the European Union (excluding Latvia, Bulgaria and Hungary), 18.7 million euros per year are paid to compensate for wolf damages. The countries that paid the most compensation are France (4.1M euros in 2022), Spain (3.2M euros in 2022), Finland (almost 3M euros in 2021, more than 90% for semi-domestic reindeer), Greece (2.3M euros) and Italy (about 2M euros in 2019) (Table 3.3.1).

The compensation for damage caused by wolves on semi-domestic reindeer is different in Sweden and in Finland. In Finland, the compensation system is based on paying for losses, requiring at least partial documentation of large carnivore kills. In 2021, more than 2.7 million euros were paid for 1,516 reindeer killed by wolves. In Sweden, the system is based on paying for the risk associated with large carnivore presence. This system does not require documenting losses but focuses on the presence of reproducing populations of large carnivores. Although no similar data are available for Sweden, Linnell y Cretois (2018) estimated that compensation payments have been made for the equivalent of between 20,000 and 40,000 reindeer lost by the four species of large carnivores living in the country.

Wolf attacks on dogs are not compensated in many EU countries, so there are no figures to quantify such attacks. But they are compensated in Sweden and Finland. In 2021, 49,670€ were paid as compensation for attacks by large carnivores on 55 hunting dogs in Sweden; 30 of these attacks were

caused by wolves (Frank et al. 2022). In Finland, more than 160,000 euros were paid to the owners of the 52 hunting dogs attacked by wolves in 2022 (Tikkunen 2023).

According to data shown in Table 3.3.1, the average compensation paid annually per wolf in the EU (18.7M euros/ 20,300 wolves) is €920, a lower figure than previous estimations (€2,400: Bautista et al. 2019). This ratio can show huge differences in different EU countries. For example, in France, it is around €3,700 per wolf and year, and in Romania, this figure is as low as €46. In any case, these figures must be taken with reservations because the compensation paid probably does not represent accurately the actual damages caused by the wolves.

Differences in compensation costs among countries are largely related to husbandry practices. In areas with free-ranging livestock, damage caused by wolves and compensation costs escalate (Linnell and Cretois 2018; Bautista et al. 2019; Singer et al. 2023). In addition, previous research has found that the annual compensation cost per individual carnivore is positively related to national economic wealth measured as gross domestic product per capita. This association is not due to differences in the price of livestock or agricultural products across countries. The link between wealth and conservation expenditures has been reported at a European level and globally. In wealthier countries, damage management policies receive more institutional support to cover the costs of damage compensation (Bautista et al. 2019).

The ex-post compensation schemes in several countries of Europe have been criticized because of fraudulent claims, high transaction costs, and because they can discourage the adoption of damage prevention measures thus promoting farmers' perpetual reliance on compensation. On the other side, farmers claim that compensations are sometimes received a long time after the attacks, are only granted when the carcass of the livestock killed is recovered and the predation by the wolf is proved, and do not consider the indirect costs of damage. The challenge for the future is to improve the compensation schemes to optimize their cost-effectiveness, being more proactive and linking compensation with prevention-based policies in an adaptive manner (Boitani et al. 2010; Marino et al. 2016; Linnell and Cretois 2018; Bautista et al. 2019).

4.3. Opportunities for nature-based tourism, education, research

In addition to being an integral part of Europe's ecosystems, the wolf has also shaped the cultural heritage and local identity of many regions and brings educational and research benefits. Alternative income for local communities generated through wolf tourism can lead to increased tolerance toward wolves at the local level.

Moreover, tourism can educate visitors about wolf ecology and coexistence and promoting awareness raising and conservation efforts on an international level. This activity allows urban visitors to learn on the ground some concepts that are much better assimilated during field experiences than through articles or websites. In these experiences, wild ungulates are often observed, which allows tourists to understand the important role that wolves can play in ecosystems, limiting wild ungulate numbers, changing prey behaviour and distribution, and thereby reducing pressure on vegetation (Kavcic et al. 2022).

The wolf-related tourism in Europe is a relatively new activity, but it has been developing for many years in North America, where the economic benefits it entails have been quantified. Different forms of tourism associated with wolves, such as wolf watching, photography, or observing signs of their presence have already been practiced for a couple of decades in North America.

In Montana, wildlife viewing is listed by both visitors and state residents as one of the top activities. The economic contribution of such activities has been studied in detail in certain parts of North America. For example, in 2005, some 94,000 visitors from outside of the three states that surround Yellowstone (Montana, Wyoming and Idaho) travelled to the National Park specifically to see or hear

wolves, spending an average of \$375 per person, or a total of \$35.5 million in the three states (Duffield et al. 2008).

In Denali National Park and Preserve (DNPP, Alaska), a report on the economic value provided by wolves was completed in 2016 (Loomis 2016). The conclusions highlight that wildlife viewing is clearly a source of socio-economic value in the state of Alaska. Wildlife viewing is a driver of tourism for DNPP and the state of Alaska. For example, wildlife viewing activities in Alaska supported over \$2,700 millions' worth of economic activity in 2011 (ECONorthwest 2014). In 1997, non-resident visitors who came to Alaska primarily to view wildlife had average expenditures of \$6,000 per trip. The benefits per trip in excess of their expenditures were on the order of \$700 to \$900. From economic valuation questions found in Alaska wildlife viewing literature, it can be inferred that a non-resident visitor may have an additional value in the range of \$200-\$300 per wildlife viewing trip to Alaska if a wolf is seen on their trip (Loomis 2016).

In Europe, wolves are an important generator of culture, ethnography and tradition, and their presence brings educational and research benefits, income from regional and product marketing, as well as socio-economic benefits from wildlife tourism. Spain is one of the European countries where wolf-watching tourism is most developed. This type of tourism is located mainly in the Sierra de la Culebra Game Reserve (Zamora), in the Montaña de Riaño y Mampodre Regional Park (León) and in the Montaña Palentina Natural Park, the last two in the Cantabrian Mountains. Interestingly, this activity developed from wolf hunting. The baits used to attract and hunt wolves in the Culebra Game Reserve facilitated their observation, and the growing number of naturalists who came informally to observe wolves led to the appearance of several small guide companies to exploit this resource.

This business seems to contribute a significant amount of resources to the area. According to a survey conducted in 2012, wolf-watching tourists represent 46% of overnight stays in rural accommodation in the Sierra de la Culebra, with an average stay of 2.18 days. The minimum cost of accommodation and food could reach 440,000 euros per year, an amount much higher than the income derived from wolf hunting in the area (Talegón 2012), which was legal until September 2021. In the Sierra de la Culebra, an area with few landscape values, wolves are the main tourist attraction, and numerous hotel companies find their main economic resource in observing wolves. In the Riaño and Montaña Palentina parks, with greater landscape and natural resources, there are as yet no data on the contribution of wolf tourism to the total tourism in the area but, already, the evidence that wolves can be a source of income for a non-consumptive activity seems to produce a change in attitude among many locals, who go from considering the wolf as a simple source of nuisance to having an attitude, if not positive, at least neutral of this species (Blanco 2018).

In some areas of Europe, there is also a flourishing tourism around agriculture and livestock production. In these areas, the potential of the wolf as an attraction may complement (and in some cases, clash with) the existing business.

In some wolf-related tourism experiences in the Sierra de la Culebra (Zamora, Spain), tourists interact with producers who use mastiff dogs (livestock guarding dog breed) and other prevention measures, which allow them to understand the wolf-people conflict, to look at the cultural differences between urban and rural environments and to respect local identities. The visit to old stone-made structures intended to capture wolves and other traditional facilities for livestock protection enable tourists to appreciate the rich cultural heritage related to the long history of coexistence between wolves and humans in Europe.

Although tourism can increase the value of the species locally, such activities can also have negative impacts on wolves and their habitat, especially with the growing demand for wildlife tourism. The wolf watching tourism can indeed also have a negative side. The direct impact caused by responsible companies guiding tourists may be low, since they usually take it upon themselves to minimize it in order to avoid losing their permits and make the business sustainable. But the inevitable impact caused

by the disclosure of the locations of dens, rendezvous sites and other sensitive spots, which facilitates the invasion of these usually secret places by photographers, observers and even by poachers, may be much higher.

There are some best practices manuals that can help to prevent such issues. In Spain, the Ministry for the Ecological Transition (2017) published a good practice guide for the observation of large carnivores where some elementary rules of behaviour are recalled²⁹. More recently, Kavcic et al. (2022) have published the Guidelines for responsible wolf tourism, a valuable document developed within the LIFE WOLFALPS EU project, reviewed and endorsed by the Large Carnivore Initiative for Europe (IUCN/SSC Specialist Group).

4.4. Information, advice, awareness raising

The return of large carnivores, as with a number of different topic areas (climate change, vaccinations), is in many countries subject to treatment by the media ranging from sensationalisation of real news to misinformation campaigns. Broad use of social media means that stories are often not fact-checked before reposting and some false stories relating especially to damages caused by wolves have been widely spread (Arbieu et al 2021)³⁰.

In the EU, websites of public institutions of certain Member States provide information on basic aspects of the wolf population, such as distribution, number of wolves or packs and their trends, monitoring methods, and other aspects of interest to the public and professionals. For example, data on the Scandinavian wolf population, collected by a team of Swedish and Norwegian scientists working together, can be found on the webpage of SKANDULV³¹, where technical reports and scientific papers of great interest are also available³². In France, the webpage Le loup en France, managed by the Office Français de la Biodiversité (OFB)³³, performs the same function. In Italy, the webpage of the public agency ISPRA (Italian Institute for Environmental Protection and Research) has provided extensive information on the Italian wolf survey carried out in 2020-2021³⁴.

In Germany, an outstanding public website on wolves³⁵ gives comprehensive information on the distribution of packs and pairs from the year 2000 to the present, including the breeding status of the packs, the minimum number of pups in each pack and other details about wolf management in the Member State. Other EU member states, like Austria³⁶, the Netherlands³⁷ and Czech Republic³⁸ also have official web pages on wolves.

Likewise, the European Commission has its own webpage on large carnivores³⁹ that includes information on conservation status, the dialogue with stakeholders, best practices, publications, etc. The

²⁹ https://www.miteco.gob.es/es/biodiversidad/temas/conservacion-de-la-biodiversidad/bp_oso_lobo_lince_tcm30-441194.pdf

³⁰ News selection and framing: the media as a stakeholder in human–carnivore coexistence. Environmental Research letter <https://iopscience.iop.org/article/10.1088/1748-9326/ac05ef>

³¹ SKANDULV - the Scandinavian Wolf Research Project | Externwebben (slu.se)

³² <https://www.slu.se/centrumbildningar-och-projekt/viltskadecenter/publikationer/inventeringsrapporter/inventeringsrapporter-varg/>

³³ <https://www.loupfrance.fr/>

³⁴ <https://www.isprambiente.gov.it/it/attivita/biodiversita/monitoraggio-nazionale-del-lupo/>

³⁵ <https://www.dbb-wolf.de/>

³⁶ <https://baer-wolf-luchs.at/verbreitungskarten/wolf-verbreitung>

³⁷ <https://www.bij12.nl/onderwerpen/faunazaken/diersoorten/wolf/>

³⁸ <https://www.navratvlku.cz/>

³⁹ https://environment.ec.europa.eu/topics/nature-and-biodiversity/habitats-directive/large-carnivores_en#stakeholder-cooperation

webpage of the Large Carnivore Initiative for Europe (IUCN SSC Specialist Group)⁴⁰ shows updated information on large carnivore distribution in the continent, reports, publications, news, and much other information for the scientific conservation of large carnivores.

Information and advice on damage prevention in LIFE projects

Since 1992, a large number of LIFE projects have focused on wolves and other large carnivores, and most of them have included livestock prevention measures. LIFE projects must include a strategy for the successful replication and/ or transfer of project solutions and results elsewhere. They need to include tasks that ensure the multiplication of the impact of the project's solutions. A clear reporting of the results and a careful evaluation of the effectiveness of prevention measures is crucial to obtain sound information to improve the coexistence between people and wolves in the EU.

Oliveira et al. (2021) reviewed 135 LIFE projects dealing with large carnivores between 1992 and 2019 to provide an overview of the use of damage prevention and their effectiveness (section 4.1). Dissemination of information to the stakeholders was included in 32 of the 34 LIFE projects (92%) on wolves analysed by these authors. The perceived effectiveness of these actions was high or very high in 87% of the cases, and low in 13%. A large number of websites provide information and advice on preventive measures in different parts of the EU collected in LIFE projects (see section 4.1).

Information to prevent wolf attacks on hunting dogs

In some cases, specific information for specific problems has been provided by public agencies. Hunting dogs are attacked by wolves across the EU, but the problem is particularly important in Sweden and Finland, where dogs are very appreciated for moose hunting (see sections 3.3 and 4.1). In Finland, in order to decrease the risk of attacks, the last seven positions (one position per hour) of GPS-collared wolves were made accessible to the public by the Natural Resources Institute of Finland (Luke); the locations had a 5×5 km resolution during the hunting seasons of 2013-2018 (Kojola and Tikkunen 2020). The link was visited more than one million times in 3 of the 4 seasons.

Both the wolf attacks on hunting dogs and visits peaked in September–November, which is the primary hunting season in Finland. The number of daily visits to the website was higher on days when fatal attacks occurred. Kojola and Tikkunen (2020) highlights that the most remarkable benefit of this kind of information service might be the message to the public that management is not overlooking hunters' concerns about wolf attacks on their dogs. Wolves were last radiocollared in the winter of 2019, but hunters have requested that this public service be reinstated (Tikkunen 2023).

Awareness raising by NGOs

The increase of the European wolf population and the subsequent increase of livestock damage have reinforced the negative perception of wolves by some stakeholders. A review of the academic literature that assessed the socioeconomic impact of wolves revealed a bias toward investigations of negative economic impacts (Rode et al. 2021). Positive impacts were underrepresented, in particular benefits from wildlife tourism and commercial activities, benefits from ungulate population control by wolves, cultural heritage and identity, etc. To counteract this trend, awareness raising is being carried out by numerous NGOs in Europe that normally disseminate their products from their websites.

⁴⁰ <https://www.lcie.org/>

4.5. Dialogue with, and involvement of, stakeholders

It is often said that conflicts between wolves and people are in the end conflicts between people and people. Beyond damage to livestock, the main characteristic of the wolf conflict is that it elicits strong mixed opinions among broad sectors of society, which often results in clashes between stakeholders with differing values toward wolves and their management.

These conflicts often disclose unmet social and psychological needs, including status and recognition, dignity and identity, and unveil deeper antagonism between rural and urban areas, between modern and traditional values, or between different political positions. Stakeholder participation processes can be very useful to address these conflicts (Marchini 2014; Madden and McQuinn 2014; Linnell and Cretois 2018; von Hohenberg and Hager 2022).

The EU Platform on Coexistence between People and Large Carnivores

To support implementation of the Habitats Directive on the ground, the Commission has for many years been carrying out a range of measures to encourage and facilitate dialogue and cooperation between stakeholders and to promote best practices on coexistence. In this spirit, the European Commission supported the establishment of the EU Platform on Coexistence between People and Large Carnivores⁴¹ in 2014.

Representatives of different interest groups take part in the meetings, including hunters, land owners, reindeer herders and nature protection NGOs, and all of them have agreed a joint mission: “to promote ways and means to minimise, and wherever possible find solutions to, conflicts between human interests and the presence of large carnivore species, by exchanging knowledge and by working together in an open-ended, constructive, and mutually respectful way”.

The platform collates information and good practice from different Member States and promotes the findings on their website and through their information channels. Promoting and supporting the adoption of damage prevention measures through EU rural development funding and the collection and evaluation of case studies have been long-standing strands of the platform’s work.

The platform communication plan describes the lessons learnt to date. Joint activities are most successful as it is easier to engage with a range of different stakeholders if they feel their interests are represented.

Having international representatives from the platform and the European Commission in the regional events helps both in terms of the subjects covered and in the participants’ feeling that their concerns are being listened to by a wider group. Joint statements are generally agreed after events that set a marker for future events and enable them to build on previous activities.

Regional and local Platforms

The conflicts surrounding wolves and agriculture, and the actions needed to mitigate them, should be viewed within their social, cultural, economic and political context. As these contexts vary dramatically across the EU, the solutions should be tailored at a regional or local scale (Linnell and Cretois 2018).

Since 2018, an EU-Parliament funded pilot project helped establishing regional and local stakeholders’ platforms⁴², following the same model as the EU Platform. Until 2023, projects with regional platforms

⁴¹ [EU Large Carnivore Platform \(europa.eu\)](https://europa.eu/eu-large-carnivore-platform)

⁴² https://environment.ec.europa.eu/topics/nature-and-biodiversity/habitats-directive/large-carnivores/eu-large-carnivore-platform_en#regional-and-local-platforms

have been carried out in six Member States to deal with long-term conflicts with wolves, in five cases, and with bears in one case.

The assessment of the regional platforms (Salvatori et al. 2020b, 2021) concluded that collaboration among different and generally contrasting groups is possible. Even in situations where large-carnivore impacts were seen as unsatisfactorily managed for many years, people were still willing and eager to be involved in alternative discussion processes hoping this would lead to concrete solutions.

Lack of trust between stakeholders and the relevant authorities as well as the lack of genuine communication among stakeholders were the key features that characterized social conflicts related to large carnivores. The support of the competent authorities and the scaling of this process have been important challenges that should be resolved in the very preliminary stages of coming projects. This is a crucial necessity since a consistent message of the stakeholders across all platforms was that support and engagement from relevant management institutions were pivotal for the effective management of conflicts over large carnivores.

Participatory processes with stakeholders are being increasingly used in wildlife management in the EU, as they are expected to increase the level of compliance with management decisions by fostering a sense of ownership among the parties involved in the decision process (Redpath et al. 2013, 2017; Salvatori et al. 2021). For example, in Spain, the wolf conflict has been addressed with participatory techniques by Grupo Campo Grande⁴³, an NGO which since 2021 has collaborated with the regional government of La Rioja in a mediation process between stakeholders. As a result, the *Wolf Management Plan in La Rioja and its coexistence with extensive livestock* was legally approved in April 2023.

4.6. Lethal control/culling of wolves

As established by the European Commission in its Guidance document on the strict protection of animal species of Community interest under the Habitats Directive (Commission Notice C(2021) 7301)⁴⁴, under the current policy and related legislation, the conflicts associated with the conservation of wolves in Europe's multi-functional landscapes cannot be addressed only or mainly through culling/lethal control. Lethal control was widely used in the past, and derogations to authorise lethal control are still a tool for the Member States, but actions to deal with livestock damage or other conflicts generated by wolves can be based on livestock damage prevention methods and other management measures presented in this document.

Wolves in the EU are strictly protected in the Habitats Directive under Annex IV in most member states, but in seven MS they have Annex V status in all or in part of their territories (section 1.2). The prohibition of killing wolves in MS where wolves are in Annex IV may be derogated to prevent serious damage to livestock or in the interests of public safety (*inter alia*), under the terms and conditions of the Directive.

The use of derogations depends on each Member State. Some Member States where wolves are protected under the Annex IV have never used derogations to remove wolves (e.g., Portugal), other Member States use these derogations in a very limited way (e.g. Germany) and some other Member States make use of derogations in a regular way (e.g. Sweden and France). For example, in Germany, 921 wolves are known to have died from 2000 to 6 June 2023, of which only 13 have been legally killed under derogation. Eight of them were killed because of livestock predation, four were removed because of bold behaviour and one because of suspected hybridization with dogs (DBBW, 2023; Ilka Reinhardt pers. comm.).

⁴³ <http://www.grupocampogrande.org/tag/lobo/>

⁴⁴ [https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=PI_COM:C\(2021\)7301](https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=PI_COM:C(2021)7301)

A dedicated online dashboard, on the website of the European Environment Agency, provides detailed information on individual derogations/exceptions, as extracted from the national reports that have been submitted to the European Commission in relation to protected species⁴⁵.

Wolf lethal control in France

France is the EU country that invests the most money in prevention measures (section 4.1; more information, in Meuret et al. 2020). France is also one of the countries with the highest livestock damage in the entire EU (chapter 3.3), perhaps due to the difficulty of protecting free-ranging sheep in alpine meadows.

Lethal measures to protect flocks from wolf depredation are legally applied in France since 2004 (Meuret et al. 2020; Grente 2021). In 2004 the ceiling for derogations was set at 10% of the population size, half of the annual growth (20%) of the wolf population at that time. This ceiling was maintained in the period 2008-2012, and in the period 2013-2017, the method to calculate the ceiling was adapted to take into account the uncertainty about population size and growth rate. The ceiling was set at 24 wolves for 2013-2015, and increased to 36 wolves for 2015-2017, which allowed the stability or increase of the wolf population.

At the end of 2018, the wolf population in France reached 500 individuals (OFB 2019), the threshold above which the population was considered viable, and the ceiling was increased to 19% on an 'experimental basis'. Despite this increase, the wolf growth rate remained at 9% in 2019 and 8% in 2020, so the ceiling was formalised, and even extended in 2021 to 21% for the simple livestock defence culling (it remains at 19% for the other culling classes) (<https://www.loupfrance.fr/>; Meuret et al. 2020; Grente 2021). In 2022, 162 wolves were killed under derogation and at least 7 illegally⁴⁶. The national action plan has set a maximum limit of 174 wolves to be culled in 2023.

Each year, the maximum number of wolves that can be culled is updated, based on the winter estimates of the wolf population size. The lethal measures are implemented by governmental agents, hunters and livestock owners, who target wolves approaching flocks and any wolf in areas with high depredation levels. Several wolves can be culled at the same time, but not with the aim to remove an entire pack (Grente 2021).

Wolf lethal control in Sweden

In Sweden, wolves are in Annex II (requiring the designation and management of Natura 2000 sites) and Annex IV (strictly protected species) of the Habitats Directive. Wolves living in the reindeer husbandry area (the half north of the country) may cause serious damage, but conflicts with other types of livestock south of this area are rather small.

A number of wolves are killed every year under protective hunting (to protect livestock) and under licensed hunting (Table 4.5.1). The aim of the licensed hunting is to limit population growth in order to reduce damage to livestock and the negative socio-economic and psychosocial impact which dense wolf populations can have on people who share the area with wolves (Epstein 2017).

⁴⁵ <https://www.eea.europa.eu/data-and-maps/dashboards/derogations-and-exceptions-table>

⁴⁶ <https://www.auvergne-rhone-alpes.developpement-durable.gouv.fr/IMG/pdf/infoloup40-vf-comprese.pdf>

Year ¹	Wolf population size	Number of wolves killed			
		Protective hunting	Licensed hunting	Other causes ²	TOTAL
2014-15	415	21	44	12	77
2015-16	340	20	14	17	51
2016-17	355	15	25	11	51
2017-18	305	24	15	9	48
2018-19	300	9	0	7	16
2019-20	365	21	0	15	36
2020-21	395	23	27	10	60
2021-22	460	8	28	10	46
2022-23	450	23	57	8	88

1. From May to April next year; 2. Traffic, natural causes, poaching, etc.

Table 4.5.1. Wolves killed by protective and licensed hunting in recent years in Sweden. The wolf population size in Sweden, the number of wolves found dead by other causes and the total known number of wolves dead are also shown. Data from reports of Svensson et al. (2015, 2017, 2019, 2021, 2023) and Wabakken et al. (2016, 2018, 2020, 2022). <https://www.slu.se/centrumbildningar-och-projekt/viltskadecenter/publikationer/inventeringsrapporter/inventeringsrapporter-varg/>

Wolf culling in Sweden is controversial for several reasons. First, the Swedish wolf population numbers less than 500 individuals and has remained more or less stable since 2014-2015. In addition, Scandinavian wolves are severely inbred which causes high concern in terms of their long-term viability (Laikre et al. 2022).

Secondly, a relatively large number of wolves are allowed to be killed each year (Table 4.5.1). For example, during the 2022-2023 winter, 57 wolves have been legally killed under licensed hunting, including all or parts of five all-Swedish family groups and two Swedish-Norwegian family groups. In a third Swedish-Norwegian family group, parts of the group were killed during Norwegian license hunting. In Sweden, three territory-marking pairs and a group with offspring without parents were also killed (Svensson et al. 2023).

In relation to the use of derogations to cull wolves, the Commission has opened an infringement procedure regarding Sweden's compliance with the relevant provisions of the Habitats Directive. Sweden performs outstanding population monitoring and has excellent scientific knowledge on the species, which would probably make it possible to quickly detect a deterioration of the state of the population.

Wolf management under Annex V of the Habitats Directive

Wolf populations included in Annex V of the Habitats Directive can be managed as far as exploitation is compatible with their being maintained at a favourable conservation status (Article 14 of the directive). In some of the countries where wolves are in Annex V, they are managed as a game species (i.e., Estonia, Latvia, Lithuania and Bulgaria). In contrast, four MS where wolves are partially or totally included in Annex V have fully protected their populations through national legislation (Poland, Slovakia, Spain and Greece).

In Spain, the wolf is listed in Annex V of the Habitats Directive north of the river Duero (i.e., most of the wolf range) and in Annex IV south of the river Duero. Spain is a decentralized country and the autonomous regions are responsible for wildlife management. In September 2021, wolves were strictly

protected throughout Spain by decision of the central government. Before protection, the different ways of managing the wolf north of the river Duero in the four autonomous regions that harbour most of the Spanish wolves can show the different options of wolf management where they are included in Annex V. More than half of the Spanish wolves (some 179 packs in 2014) live in Castile and Leon autonomous region. They have been managed as a hunting resource regardless of damage to livestock. Before wolf protection in 2021, permits were issued to kill about 140 wolves a year, although fewer animals were actually hunted.

In the autonomous region of Cantabria, with some 13 packs in 2014 and high damage to livestock, wolves were culled by official rangers and they also were hunted as a game species. The goal was to reduce wolf densities throughout the entire region in view of limiting damage to livestock. In 2020, 34 wolves were legally killed in Cantabria. In the autonomous region of Asturias, with some 40 packs in 2022 and high damage to extensive livestock, the wolf was not a hunting species, although official rangers culled about 20 wolves each year in areas where the highest livestock damage occurred. The sole purpose of culling in Asturias was to reduce damage. Finally, in the autonomous region of Galicia, the wolf is nominally a hunting species, but since 2014 no one wolf has been legally killed, so it has been managed *de facto* as a protected species. All the regions had approved management plans which include maximum quotas of culling/harvest.

In addition, in the small part of the Castile and Leon region located south of the river Duero (Annex IV), a few wolves were culled under derogation (7 in 2019 and 2 in 2020) by official rangers in areas where damage to cattle was very high. After being fully protected by the central government in 2021, no wolves have been legally hunted nor culled in Spain at least until December 2023.

Is lethal control useful to reduce damage to livestock? Targeted vs. non-targeted wolf culling

Lethal control is the most controversial aspect of wolf management among the general public and even among conservation professionals (Lute et al. 2018). Lethal control is frequently aimed at mitigating social conflicts by empowering afflicted parties (Woodroffe and Redpath 2015), and the benefits may be mainly social or psychological if it manages to appease livestock producers (Linnell and Cretois 2018). When lethal control is aimed at reducing wolf depredations, at best, only solves conflicts temporarily, unless the wolf population is exterminated or severely reduced over large areas (Bradley et al. 2015; Linnell and Cretois 2018). Where wolves are killed, their territories will usually be rapidly filled by other wolves and it will be necessary to continue killing wolves year after year. For example, in Scandinavia, lost wolf territories were re-occupied in less than one year when wolf population density was high. The re-occupation was faster after legal culling of individuals as compared to territories where both individuals disappeared for unknown reasons (Sand et al. 2022).

There may be benefits of lethally removing wolves that have a particular tendency to kill livestock, but it is very difficult to target these problematic individuals particularly for group-living carnivores (DeCesare et al. 2018; Linnell and Cretois 2018). For example, in Germany 8 cull permits have been granted for special individuals genetically identified from livestock kills from 2000 to May 2023. But 7 out of the 8 wolves shot for this reason were the wrong individual (Ilka Reinhardt, personal communication), showing how difficult is to target the offender wolves.

The results of studies that assess the effect of lethal removal on damage to livestock are sometimes contradictory, and the arguments provided by pro-wolf and anti-wolf sectors are deeply biased, which add a social complexity to a process that already is very complex from an ecological point of view. The contention that killing wolves increases damage to livestock maintained by Wielgus and Peebles (2014) has been discredited by two independent studies that reanalysed their data and found the opposite trend (Poudyal et al. 2016; Kompaniyets and Evans 2017).

Similarly, the studies of Bradley et al. (2015) and DeCesare et al. (2018) in the same area further question the results of Wielgus and Peebles (2014). Fernández-Gil et al. (2017), in a growing population of Asturias (Spain), found that the more wolves were culled during the current or previous year, the more depredations occurred. Nevertheless, the growth in the depredation levels was probably explained by the growth of the wolf population itself, and not by the use of lethal removals (Kompaniyets and Evans 2017). In addition, this is a correlational study and cannot provide a reliable interpretation of the cause-and-effect directionality of the relationship between depredation and removal (Linnell and Cretois 2018; Gentre 2021). The authors interpreted that more wolf lethal removals were causing more livestock depredations, but maybe the opposite is true: more livestock depredations cause more wolf culling, especially in a region such as Asturias where wolves were legally killed only to reduce damage to livestock (see previous section).

In addition, two studies carried out in the west of USA have shown that increasing levels of targeted lethal removal of wolves following depredations reduced the probability of their recurrence (Bradley et al. 2015; DeCesare et al. 2018). In contrast, DeCesare et al. (2018) in North America and Kutal et al. (2023) in Europe found no evidence that removing wolves through public harvest (non-targeted removals) affected livestock depredations by wolves. Anyway, DeCesare et al. (2018) warn that partial pack targeted removals (2.2 wolves killed/pack) were relatively ineffective as a response to wolf livestock depredations compared to the removal of the entire pack (Bradley et al. 2015). And they conclude that “in areas with recurrent conflicts, removing a relatively low number of wolves, whether through targeted control or public harvest, may do little to prevent future depredations” (DeCesare et al. 2018).

Considering these results, it appears that, wolf control has to be targeted at individuals or packs attacking livestock, and the effect of the removal must be evaluated in the long-term (Meuret et al. 2020). In recent years, Grente (2021) analysed the effect of wolf culling on the depredation levels in France using official data and concluded that the effect of culling was highly variable according to contexts. Most of the results involved a reduction of the depredations but could also involve no effect or an increase of the depredations. In summary, there is not a clear answer to the question of the effects of culling in France. Results on depredation in culling events were varied across space and time, whether these variations were linked to the environment, to pastoral practices or to the wolves. According to Grente (2021), “it is hopeless to seek a general and unique tendency of the effect of culling wolves on depredation for the French Alpine Arc, let alone at the global scale.”

In summary, the research on targeted wolf culling carried out in Europe is inconclusive, and non-targeted culling (i.e., hunting) does not seem to reduce wolf depredations on livestock unless it is carried out with such intensity that it effectively reduces the density of wolves over large areas. However, this type of hunting may not be compatible with the Habitats Directive and is socially rejected by much of the public in Europe.

4.7. Recommendations to address “bold wolves”

As shown in the section 3.4, the improvement of social tolerance towards wolves enabled the emergence of fearless or bold wolves, that many times are also food-conditioned wolves. These individuals would have been quickly removed in the past, and their presence is a new challenge to wolf-human coexistence.

A bold wolf is a wolf that repeatedly tolerates recognizable people (i.e., not people in a car) within 30m or even actively approaches people repeatedly within this distance. Sometimes, wolves that are repeatedly seen close to inhabited houses are often perceived as bold. However, it is important to distinguish between wolves approaching /tolerating people at close distance (where the wolf sees the person and knows that the person sees them) and wolves approaching a house (where people are not

visible directly, and where they don't know that they are being seen). Wolves living in proximity to people are not automatically a danger (Reinhardt et al. 2020; LCIE, 2019).

Bold behaviour may become dangerous to humans if it escalates, and at the least requires attention, but can also be deemed serious or critical. Every situation in which a wolf is perceived as bold or is behaving conspicuously needs to be assessed on a case-by-case basis.

To deal with bold wolves, four kinds of actions are needed (Reinhardt et al. 2020; LCIE, 2019):

- Prevent. To avoid habituation and food conditioning of wolves, the two basic principles are "do not approach, do not feed".
- Document every suspected case of bold wolf behaviour, routinely recording and archiving reports of sightings using standard protocols.
- React, removing attractants and implementing aversive conditioning. The last resort is lethal removal.
- Communicate properly to the public the necessity of not feeding wolves, and where appropriate the need for deterrence measures or lethal removal.

The protocol for dealing with bold wolves starts with opening a case file, conducting a field investigation to assess how many and which wolves are involved in the case, confirming reported information and identifying potential attractants. In addition, it is necessary to encourage locals to send reports of sightings and intensify wolf monitoring in the area.

Behavior	Assessment	Recommendation for action
Wolf passes close to settlements in the dark.	Not dangerous.	No need for action. 
Wolf moves within sighting distance of settlements / scattered houses during daylight.	Not dangerous.	No need for action. 
Wolf does not run away immediately when seeing vehicles or humans. Stops and observes.	Not dangerous.	No need for action. 
Wolf is seen over several days <30m from inhabited houses (multiple events over a longer time period).	Demands attention. Possible problem of strong habituation or positive conditioning.	Analyze situation. Search for attractants and remove them if found. Consider aversive conditioning. 
Wolf repeatedly allows people to approach it within 30m.	Demands attention. Indicates strong habituation. Possible problem of positive conditioning.	Analyze situation. Consider aversive conditioning. 
Wolf repeatedly approaches people by itself closer than 30m. Seems to be interested in people.	Demands attention / critical situation. Positive conditioning and strong habituation may lead to an increasingly bold behavior. Risk of injury.	Consider aversive conditioning. Remove the wolf if appropriate aversive conditioning is not successful or practical. 
Wolf attacks or injures a human without being provoked.	Dangerous.	Removal. 

Fig. 4.6.1. Protocol of bold wolves' assessment (Reinhardt et al. 2020; LCIE, 2019).

4.8 Support for large carnivores under the Common Agricultural Policy (CAP)

The following provides a first overview of measures used by various Member States under the second Pillar of the Common Agricultural Policy (CAP) (2023 -2027)

For this analysis, all 27 CAP Strategic plans (SPs)⁴⁷ adopted at the end of 2022 for the period 2023-2027 were examined for measures relating to large carnivores, and wolves in particular. As the Strategic Plans are huge documents the search was done using the following key words “large carnivores, predators, wolf/wolves, guard dogs”. The search using “fencing” was abandoned as it highlighted hundreds of references to ‘ring fencing’ which is not relevant.

Of the 24 Member States with wolf populations, 9 did not have any measures for large carnivores (Bulgaria, Denmark, Estonia, Hungary, Latvia, Netherlands, Poland, Romania, Sweden). This includes a number of countries with significant populations of wolves (Romania, Poland). In the Baltic states, only Lithuania has proposed measures for large carnivores, whereas Estonia⁴⁸ and Latvia have not.

Of the remaining 15 Member States, large carnivores were mentioned in the Strategic Plans of 5 Member States but no schemes were proposed specifically for them. Instead, indirect sub-measures were proposed that could help, amongst others, address the need to protect the grazing herd from wolves even if the overall objective is something different (animal welfare, seasonal grazing).

In particular:

- *Austria and Slovakia* have proposed animal welfare schemes to encourage farmers to put livestock out to pasture for a minimum number of days per year. Under this, AT offers an optional supplement for using livestock guarding dogs to protect the flock. SK compensates for loss of income due to lower yields resulting from grazing in “difficult-to-reach terrains”. Here farmers must ‘protect the flock from predators from grazing’.
- *Spain* has a similar animal welfare measure requiring dogs to protect the flock in traditional grazing systems (but only La Rioja has taken up the measure it seems).
- *Czechia* offers income aid for sheep and goat farming amongst other to improve the profitability of these farms so ‘they can invest in protection from predation’ (but not with CAP funding)
- *Germany* has included an AEEM for management commitments to biodiversity which funds different types of measures, including nature orientated grazing. Within this sub scheme LPR5 offers compensation for “grazing in wolf scenery” but it appears that only Baden-Württemberg has invoked this measure (budget unclear). The CAP also makes clear that national funds are available for protection measures and compensation related to large carnivores (4,600,000€ /yr. federal funds).

Thus, in total, 10 Member States have included specifically targeted interventions for large carnivores/ predators under Pillar II in their CAP Strategic Plans (Belgium, Croatia, Finland, France, Greece, Italy, Lithuania, Portugal, Slovenia, Spain). For three Member States (Belgium, Finland, Portugal) the intervention focus specifically on wolves. For the remainder they cover other large carnivores as well (e.g., bear, jackal, lynx).

⁴⁷ Based on English translations received from DG ENV end 2022

⁴⁸ Estonia mentions the protection of large carnivores as an ‘eligible investment’ under 4.6.1 of the CSP but none of investments measures under Article 73 pick this up.

Agri-Environment-climate measures (article 70)

Six Member States have included Agri-Environment-Climate measures (AECMs) for large carnivores as follows:

Finland has an AECM primarily aimed at supporting the management and restoration of traditional biotopes with grazing and mowing as defined in a management plan. Predator fencing alone is not allowed unless it is part of the management/ restoration works (and then only for one year). Animal welfare also given as reason for anti-predator fencing.

France has an AECM for the reinforced guarding of herds in large carnivore areas. It is an annual payment for additional costs incurred by extra work needed to graze herds in large carnivores' areas (30.75€/day) and to maintain sheepdogs (815€/yr./dog). **The scheme is by far the largest of all Member States at 152,250,000€ for 2023-2029 (total public expenditure).**

Italy has an AECM for specific commitments to encourage cohabitation with large carnivores (4 regions apply it). It offers an annual payment per ha of grazed area in large carnivore areas in compensation for the extra work needed for continued custody (within fencing, night shelters). There is an optional extra for presence of guard dogs (total public expenditure 2023-2029 is 10,113,333 €).

Portugal also has an AECM to support farmers to better protect their herds from wolf attacks but this only covers the maintenance of guard dogs (ca 350€/y per dog – max 2 dogs). 15% extra is offered for support from an NGO for advice on wolf and for training the dogs. Total budget 19,620,000€ for 2023-2029 (total public expenditure).

Spain has no direct AECM for large carnivores. Instead, the two schemes that mention large carnivores are more focused on promoting grassland management through grazing and mowing (6501.3) or preserving traditional agricultural activities (6501.6). 6501.3 can include temporary sequestration of livestock, guard dogs, monitoring, etc. but only Castilla y Leon and Galicia mention use of a large carnivore sub-measure. In case of latter public expenditure budget is 7.500.000€ for 2023-2029 (covering 20,000ha/yr.). For 6501.6, only Navarra seems to use this for activities in areas with a high presence of mammals (including use guard dogs, overnight shelters, geolocalisers, etc.) Total public expenditure budget 1,602,000 € for 2023-2029.

Slovenia has an all-encompassing AECM that covers two relevant sub-measures: “living with large carnivores” and “Maintain pastures”. The former offers an annual payment for using fencing, active shepherding and/or guard dogs (at least 3) provided there is at least 0.2-1.8 LU /ha (overall public expenditure budget 1,378,000€ for 2023-2029). The latter sub measure is for grazing mountain pastures at least 80 days/yr (different rates if done with or without shepherds) (overall public expenditure budget 7,050,000€ for 2023-2029), Slovenia has also included protection of grazing animals in its investment scheme for small farms (provided this is no more than 50% of the total investment).

Non-productive Investments (Article 73)

Nine Member States have proposed investment schemes to protect against predators under article 73/74. Four Member States (BE, HR, EL, LI) offer only investment schemes, while the others offer also Agri Environmental Climate Measures (AECMs) (or only an AECM in the case of FI).

These investments cover one or more of the following expenses:

- Purchase of guard dogs (often requiring a specified breed and certificate of origin) associated costs (Belgium (Flanders), Croatia, France, Greece, Italy, Lithuania, Slovenia)
- Installation of fencing, mostly electric fencing and/or mobile fences (Belgium (Wallonia), Croatia, France, Greece, Portugal, Italy, Lithuania, Slovenia, Spain)

- Shelters for herds (at night) (Belgium (Wallonia), Croatia, Italy, Spain?)

The total annual budget for investments is difficult to estimate as often there is no breakdown of costs (e.g., for Italy) but **France** is investing the most with 22,750,000€ for the period 2023-2029 (total public expenditure). This also includes costs for vulnerability assessments and technical support incl training (which other schemes don't offer.)

Lithuania has a total public expenditure foreseen of €2.3 mil. **Greece** planned also ca 3 mil until 2025. **Croatia** has foreseen a budget of 4.3 mil for majority of which goes to shelters. **Slovenia's** investment budget is more modest at 960,000€.

The large carnivore investment budget for **Spain** depends on the region. It is therefore difficult to estimate as there are lots of sub-measures available and it is up to each region to decide if they want to use them. For Andalucía a total public expenditure of 1,050,000€ is foreseen for 2024-2029.

EU State Aid Guidelines

The European Union Guidelines for State Aid in the agricultural sector⁴⁹ also allows EU Member States to grant full compensation to farmers for damage caused by protected animals, such as wolves. This makes it possible to fully reimburse the costs of investments made to prevent such damage, such as the installation of electric fences, acquisition of guard dogs, and hiring of shepherds.

⁴⁹ : [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022XC1221\(01\)](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022XC1221(01))

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ANNEX

**TARGETED DATA COLLECTION ON THE
WOLF POPULATION AND ITS IMPACTS IN THE EU**

**Launched through the Commission's
Press Release of 4 September 2023**

SUMMARY OF FINDINGS

18 December 2023

TABLE OF CONTENTS

Introduction	3
Overview of emails received	3
Type of data provided	5
Analysis of data provided	6
– <i>Austria</i>	6
– <i>Belgium</i>	6
– <i>Bulgaria</i>	7
– <i>Croatia</i>	7
– <i>Czechia</i>	7
– <i>Denmark</i>	8
– <i>Estonia</i>	8
– <i>Finland</i>	8
– <i>France</i>	9
– <i>Germany</i>	10
– <i>Greece</i>	11
– <i>Hungary</i>	12
– <i>Italy</i>	12
– <i>Latvia</i>	12
– <i>Lithuania</i>	13
– <i>Netherlands</i>	13
– <i>Poland</i>	14
– <i>Portugal</i>	14
– <i>Romania</i>	15
– <i>Slovakia</i>	15
– <i>Slovenia</i>	15
– <i>Spain</i>	15
– <i>Sweden</i>	17
– <i>EU level Organisations</i>	18

INTRODUCTION

On 4 September 2023, the Commission “invited local communities, scientists and all interested parties to submit up-to-date data on the EU’s wolf population and their impacts”⁵⁰. This targeted data collection was launched in the framework of the in-depth analysis on the situation of the wolf in the EU (hereinafter called the “In-depth Analysis”) which the Commission committed to carry out in response to the European Parliament Resolution of 24 November 2022⁵¹.

In total, over 19,000 emails were sent to the Commission’s dedicated email address by the deadline of 22 September 2023. Emails that were not related to the subject, or submitted after the deadline or considered repetitions⁵² were removed, leaving just under 18,500 emails to analyse.

OVERVIEW OF EMAILS RECEIVED

Emails were sent from 24 Member States, 23 of which have a wolf population. No emails were sent from Luxembourg, but 4 emails were sent from Ireland where the wolf is not present.

A further 30 emails were sent from countries outside the EU (including Norway, Switzerland, US, Mexico). For some 360 emails, it was not possible to identify the country of the person because the email was sent from a generic account and the person did not indicate their place of origin in their reply. The majority of these were written in German (218), with some also in English (49), French (25) and Dutch (11). Two thirds were in favour of maintaining the protection status of the wolf, one third were against.

Finally, 20 emails were sent from an EU level or international organisation and were therefore not counted amongst the Member State emails. They are also reported on separately in this report.

Over 90% of the emails came from five Member States (Sweden, Belgium, Germany, Finland and Italy). 42% came from Sweden alone. On the other end of the scale, fewer than 10 emails were sent from each of the following ten Member States (Bulgaria, Croatia, Estonia, Greece, Hungary, Ireland, Latvia, Lithuania, Romania and Slovakia).

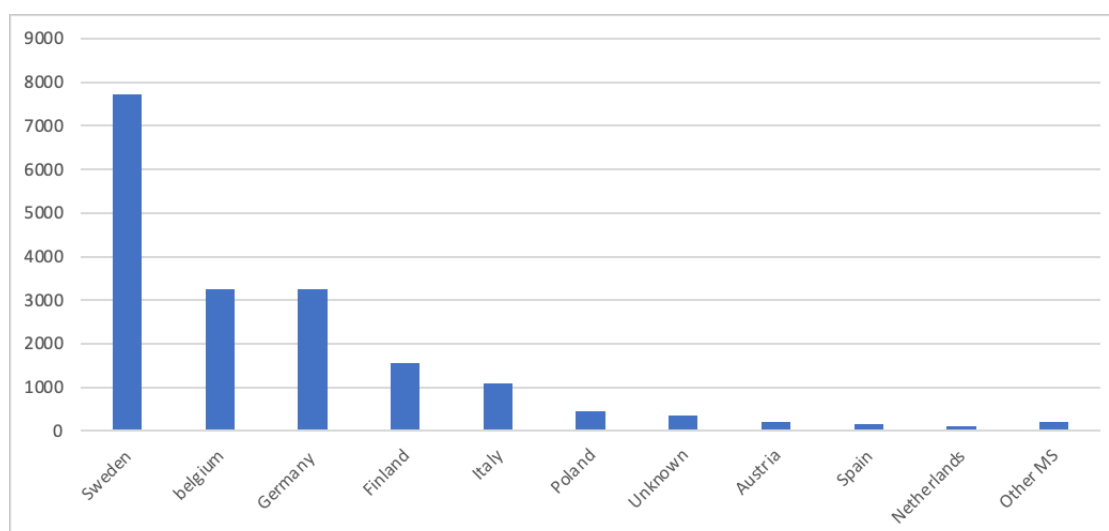


Figure 1: emails received according to Member State

⁵⁰ https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4330

⁵¹ https://www.europarl.europa.eu/doceo/document/TA-9-2022-0423_EN.html

⁵² For instance, the same email was sent two or more times, or was sent once in the original language and a 2nd time in English. Some people also sent several emails with photos, newspaper articles or videos to accompany their first email because they were too big to send in one go. These were all counted as one email.

The vast majority of those who sent an input to the targeted data collection (over 98%) wanted to express an opinion on the subject, rather than submit data on wolf populations and their impacts. As illustrated in the graph below, the majority (71%) expressed an opinion in favour of maintaining the existing protection status of the wolf, while less than one third (28%) asked to reduce its protection status. The remainder (less than 1%) made other comments on the data collection exercise or on the wolf in Europe.

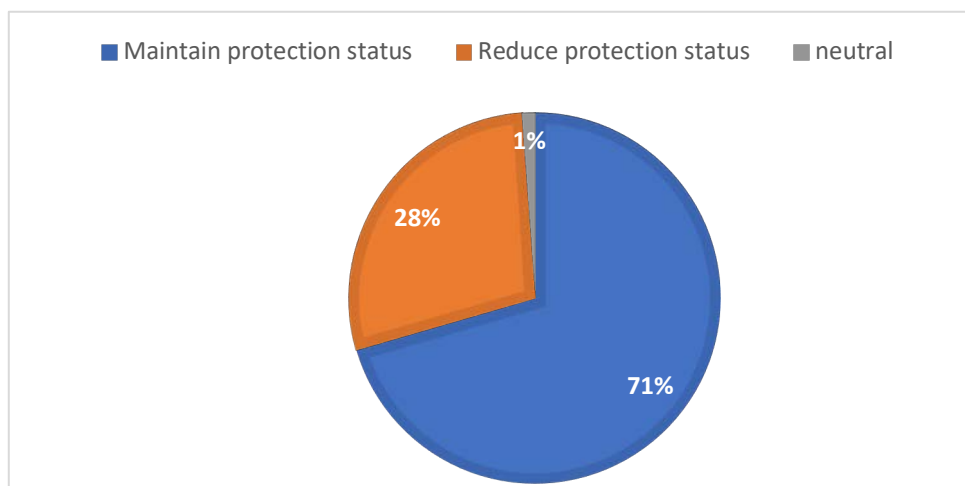


Figure 2: opinion on the protection status of the wolf

The opinions varied significantly according to Member State. Those who sent an input from Belgium, Italy, Poland, Spain, Portugal and France were overwhelmingly in favour of maintaining the protection status of the wolf. By contrast, those who sent an input from Finland, Netherlands, Austria, Czechia and Slovenia were overwhelmingly in favour of reducing its protection status. In Sweden and Germany, the views were more evenly spread, although in both cases more were in favour rather than against maintaining the protection status.

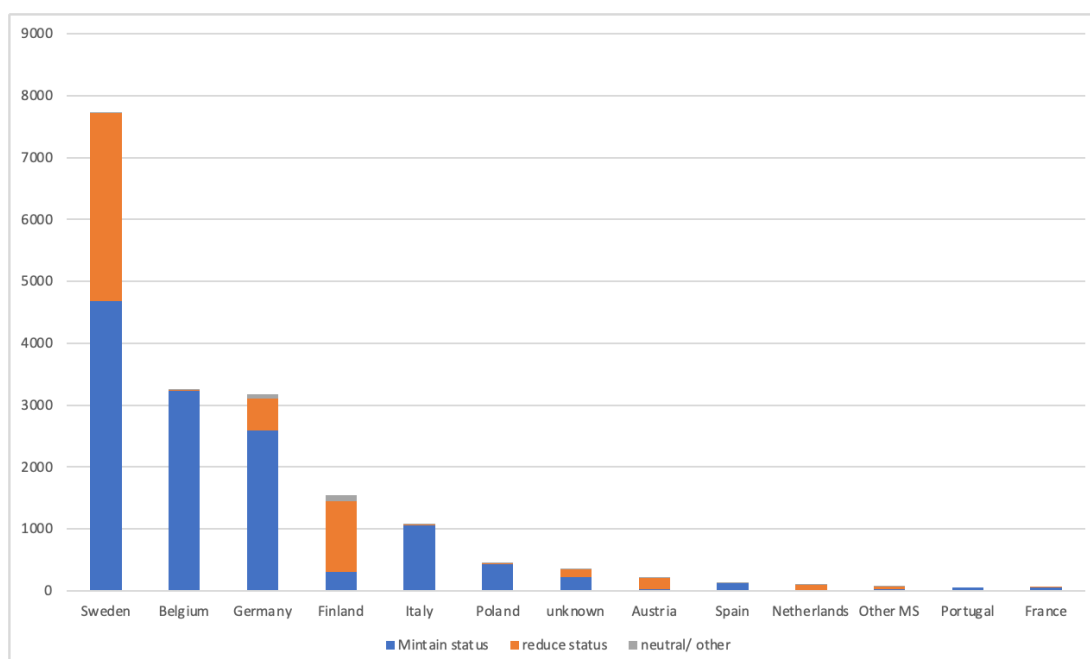


Figure 3: opinion according to Member State

Of the emails expressing an opinion on the subject, three quarters were very similar in content, suggesting that they may have been generated in response to a coordinated national campaign, whether from environmental, hunting or farming organisations or other civil society groups.

Over 90% of the emails from Belgium, Italy, Poland, Portugal and over half of those from Sweden, Germany and Spain had a similar content (but varying from one country to another). All expressed their support for maintaining the protection status of the wolf.

Likewise, most of the emails from those supporting a reduction in protection status used a standardised text. This was especially the case for emails coming from Sweden, Finland and Germany which, together, make up over 90% of the emails calling for a reduction in protection status. In both Sweden and Germany, the text varied depending on whether they came from people with a hunting interest or with farming or other interests.

Finally, for some countries like Austria, Netherlands, Czechia and Slovenia, and to a lesser extent Germany, the emails all varied in content. The majority came from small scale farmers and or hobby farmers (with rare livestock breeds, horses, ponies, alpacas, etc..). In general, they described: a) their farming context, b) any wolf encounters they have experienced or loss/injuries incurred due to predator attacks c) complications in installing protection measures (especially in alpine or coastal areas), d) their fears for their livestock, pets and children and the emotional stress this causes them as well as e) often their concerns over their future capacity to continue farming in the presence of the wolf.

TYPE OF DATA PROVIDED

The Commission's press release invited local communities, scientists and all interested parties to submit **up-to-date data on the wolf population and their impacts**. The Commission webpage on large carnivores further specified that this "data must be based on agreed national monitoring methodologies or other official procedures/ methodologies" and that such "data will also be transferred to the relevant Member States before finalising the analysis." As shown above, while the majority of emails sent gave an opinion on the issue, only **a small percentage of emails (less than 2%) provided data** on the wolf population and their impact (excluding those given personal experiences and sightings at a very local level).

Those emails containing data were analysed in detail and compared to the official data on wolf population and impacts on livestock provided to the Commission by the competent Member State authorities (or identified through other sources of information where official data was not available) and subsequently used for the In-depth Analysis Report (tables 2.4.1 and 3.31).

As stated above, a significant number of the emails contained personal sightings, observations or experiences on the wolf and/or wolf attacks and livestock losses/damages at a local level (eg at farm level, in a conservation area, over a local hunting range or within their local community). While the information gives a clear indication of the problems encountered, the data is at too local a scale to be comparable with the national data on wolf population and impacts included in the In-depth Analysis Report. They are also based on personal observation rather than agreed national monitoring methodologies or other official procedures/methodologies. The experiences were nevertheless reflected in other sections of the In-depth Analysis Report.

Finally, some emails provided links to scientific articles, reports and studies on the wolf in their country or in Europe, or internationally. These were also screened for any new relevant information for the In-depth Analysis.

ANALYSIS OF DATA PROVIDED

The following provides a summary of the emails received per Member State and, more specifically, of those providing data on wolf populations and impacts on livestock.

AUSTRIA

A total of 217 emails were sent from Austria. The majority (80%) were from farmers and farmers' organisations, especially small-scale alpine farmers, sharing their negative experiences with wolf attacks on their livestock. Many also gave explanations for why anti predator measures were considered too expensive and unworkable, especially in mountain areas. Some considered they did not receive sufficient support from the authorities for protection measures and compensation. All were in favour of reducing the protection status of the wolf.

A further 15 emails provided data on wolf populations and/or damages. Two emails from the Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology and the Federal Ministry of Agriculture, Forestry, Regions and Water Management provided the same data on wolf populations and livestock damage which comes from a central data source (<https://baer-wolf-luchs.at/>). This same data source was used in the In-depth Analysis Report.

Three emails from the Provincial Governments of Carinthia, Tyrol and Vorarlberg provided data on wolf numbers within their province. The numbers at provincial level are compatible with the official data used for the In-depth Analysis Report. Two emails from the Provincial Governments of Carinthia and Salzburg also provided data on wolf damage, one for their province and the other for the whole country. In the case of the former, the data matches the official data for 2022 (but is a bit lower than official data for 2023). In the case of the latter, the data provided on wolf populations in whole country is slightly lower than the official data for 2022. The official data remains the most reliable since all provinces must, anyway, submit their data to the same central source (<https://baer-wolf-luchs.at/>).

Four farming associations, one hunting association and one association for the protection of cultural landscapes all provided data of wolf damage in their provinces or for the whole country. Again, these were largely consistent with the official data for 2022. One animal welfare organisation also referred to the official data on wolf damage.

One environmental organisation compared the number of sheep on farms in Austria with the percentage of sheep lost due to the wolf (0,79%). One individual provided a report on the alpine wolf population over 7 countries. The data for Austria for 2021 is very similar to the official data. The person also submitted a number of scientific papers that were screened for any relevant information for the In-depth Analysis.

BELGIUM

A total of 3250 emails were sent from Belgium. All were in favour of maintaining the protection status of the wolf. Three emails provided some data on the wolf population and impacts.

Both emails from an environmental NGO and an equestrian NGO provided data on the wolf population at a regional level which agrees with the figures given in the official data submitted by the competent national authority in the context of the In-depth Analysis Report. In the case of the latter, the information on wolf predation refers to the official data records kept by the Flemish Agency for Nature and Forests which is at a regional level. In the case of the former, the number of attacks on livestock was given for a total of five years with no annual breakdown but is overall lower than the official estimates. This may be because it covers damage recorded in one region only.

A third local professional association considered there are 10 wolves in Belgium after having been re-introduced to the country. This figure is not supported by documentary evidence and does not concord with the official figures. In reality, the wolf was not re-introduced in Flanders, but expanded its range naturally into Belgium from Germany. The figures given for the number of animals killed and injured and over a 5-year period are within the range given by the official data.

BULGARIA

Three emails were received from Bulgaria. Two expressed their support for maintaining the protection status of the wolf. The third, from an environmental NGO, stated that, according to latest reliable data, the wolf population in Bulgaria is approximately 800-900 individuals. This is significantly lower than the data provided by Boitani et al in 2022, but the figures have not been substantiated by documentary evidence. In the absence of reliable data for the wolf population in Bulgaria, the figures provided by Boitani et al have been used for the In-depth Analysis Report. Further, the NGO's comment that there is no official registration of wolf damage in Bulgaria concords with the findings of the Analysis Report. No data was found on wolf damage or information on compensation.

CROATIA

One email was sent by an environmental NGO from Croatia outlining its views on the management of wolf in Croatia and drawing attention to the high level of illegal killing of wolves. It called for a better implementation of the Habitats Directive rather than a reduction in wolf numbers by shooting. The data provided for wolf population agrees with the data sent by the competent authorities within the context of the In-depth Analysis Report.

CZECHIA

17 emails were sent from the Czech Republic, the majority came from individuals (mostly farmers) expressing their support for a reduction in the protection status of the wolf, principally due to its negative impact on small scale (sheep) farming in their regions.

Four emails contained data on wolf population and impacts. The first two came from the Ministry of the Environment and the Ministry of Agriculture respectively. As regards the wolf population, the data diverges significantly between the two Ministries. But, as the Ministry of Agriculture explains, "*the number of wolfs stated in the(their) table is the number of wolfs reported by hunters based on the statistical counts annually. It is important to mention that hunters report number of wolfs from their hunting grounds. Wolf home range is roughly about the size of 2-4 hunting grounds therefore some wolfs could be counted multiple times*". The figures from the Ministry of Environment were used for the In-depth Analysis Report as they are based on a more robust monitoring methodology. As regards wolf damage and compensation, both Ministries provided the same updated figures which were used for the In-depth Analysis.

The remaining two emails were sent from the authority of Hradec Kralove region and an association of municipalities of the Jablunkov region. Both provided data on wolf populations and/or damage at the level of their region or municipalities and expressed their concern over the impact of the wolf on farming in their region. While this information has been noted, the data provided is on too local a scale to be comparable with the national population estimates or compensation levels provided by the Ministry of Environment in the context of the In-depth Analysis Report.

DENMARK

17 emails were sent from Denmark, two thirds were in favour of reducing the protection status of wolves, often because of negative experiences with attacks on their livestock. One third were in favour of maintaining the protection status of wolves and called, in particular, for a reduction in illegal hunting. Two emails from private individuals contained data. In both cases, the data matched the official data submitted by the competent national authority in the context of the In-depth Analysis Report.

ESTONIA

Two emails were sent by environmental NGOs from Estonia, both containing the same data. This data is however less up to date (2021) than the official data submitted by the competent national authority in the context of the In-depth Analysis Report.

FINLAND

A total of 1551 emails were sent from Finland. Almost three quarters (74%) were in favour of reducing the protection status of the wolf, while 20% of emails were in favour of maintaining its protection status, 6% reported personal experiences and sightings or submitted links to reports, newspaper articles etc., but did not give an opinion on the wolf's protection status.

Of the emails supporting a reduction in the protection status of the wolf, almost 80% came from local hunting clubs (Metsästysseura) or Game Conservation Associations (Riistanhoitoyhdistys). The emails generally followed the same overall structure in which they described all or some of the following a) location and characterization of the hunting club's operating area, b) the activities of the hunting club, c) the wolf situation in the clubs area of operation (based mainly on sightings), d) social impact and safety e) hunting stocks and game stocks f) production or livestock damage and/or g) proposals for solutions to the wolf situation to the Commission (inter alia reducing the protection status of the wolf).

While the different observations and concerns provided in these emails have been noted, especially in relation to the danger posed by wolves to hunting dogs, the individual sightings of wolves are at too local a scale to be compared with the overall wolf population data at national level. Such observations cannot be aggregated since the information does not systematically cover the entire range of the wolf in the country and leads to double counting since wolf territories are large and move between different hunting ranges. The figures are also based on observations only which is not in line with agreed national monitoring methodologies.

13 of the emails provided some data on wolf populations and livestock predation. Seven emails provided the same data on the Finnish wolf population as the official data submitted by the competent national authority in the context of the In-depth Analysis Report (291-331 wolves, March 2023). The farming organization and national hunting organization claim that the real time population in Finland is larger after the breeding season. The environmental NGOs point out the severe risk of in-breeding which can further fragilise the wolf population.

Three environmental NGOs provided figures for sheep damage caused by the wolf, estimated at 30-50 sheep each year. These figures are however out of date. The official data submitted by the competent authorities in the context of the In-depth Analysis indicate that the number of sheep damaged by wolves has risen to over 518 in 2021. Four farming associations reported the same official figure of 518 sheep, adding that there are altogether 130,000 sheep in Finland.

Three dog associations and a national hunting organization provided a figure for the number of dogs killed by wolves in 2022-2023. The figure is the same as the one provided by the public authorities (over 50 dogs) and used in the In-depth Analysis Report.

One administration in charge of the management of wild forest reindeer considered that the wolf has been the principal cause of its decline in one region of Finland in the early 2000s.

FRANCE

63 emails were sent from France. Over 80% were in favour of the protection of wolf. Eight emails contained some data on wolf population and/or damage.

Two emails from a national farmers' association and a national federation of hunters both provided data on wolf populations and livestock damage that matches the official data from the Office Français de la Biodiversité (OFB). The former noted, in particular, the sharp increase in damage to bovines over the last 3 years and the high cost of protection measures (29,76 mil€ in 2020.).

Another farming organisation considered that the official data on the wolf population in France are significantly under-estimated (quoting a scientific article from 2013 by mathematicians on "Modèles à variables latentes et modèles de mélange"). It also considered that the official figures for livestock damage should be increased by a third because, according to studies done by "Cerpam", for every two specimens identified a third is not (eg disappeared). These data are however based on extrapolations.

An email from the public authority of the Département of Aveyron provided data on the increase in wolf numbers and livestock damage in its Département. It also provided a figure for the number of wolves in France as a whole, which concurs with the official data used for the In-depth Analysis Report. The data on wolf damage is also from the official OFB website. The email emphasizes the high cost of protecting livestock against wolf attacks in its department (estimated at €22-35 million for one area alone) and their apparent lack of effectiveness according to researchers from INRAE and COADAPHT « Des loups en France depuis 30 ans: quel bilan en élevage et quelle piste de solution? ».

One animal welfare organisation provided data on the wolf population and livestock damage, noting that the number of attacks decreased in 2021 compared to 2020. According to the email, the decrease in attacks were observed in areas where the wolves were long established, and livestock protection methods seemed to be better implemented on the field. The figures for wolf population and livestock damage come from the same official source as for the In-depth Analysis Report. The decrease in damage in 2021 compared to 2020 does not seem to have repeated itself in 2022.

The NGO also considered that shooting measures have not been scientifically proven to be effective when it comes to protecting livestock and preserving wolf populations, as illustrated by various scientific studies.

Another animal welfare foundation also referred to the official data on wolf population and livestock damage from OFB which was used for the In-depth Analysis Report. It noted, however, that the wolf population's growth rate varied from year to year and was much lower in 2020 compared to 2019, also that livestock damage occurred most often in areas where there is a lack of protection or insufficient surveillance.

Regarding the number of wolves for 2023, the NGO criticized the fact that OFB apparently revised its figures upwards (from 906 to 1104) after criticism from agricultural organisations. It considered this revision to have been done arbitrarily. The NGO also criticized the way in which the French authorities have used the derogation system under the Habitats Directive since 2018 to kill a number of wolves based on a percentage of the total population. It considers this is not conform to the provisions of the Directive. According to the NGO, the ceiling for the annual kill of wolves has now been raised to 19-

21% of the wolf population under ‘the Plan National d’Actions 2018-2023 sur le loup et les activités d’élevage’. This is higher than the ceiling recommended by the scientists but, so far, there has been no evaluation of the effectiveness of this annual cull on the wolf population.

A third animal welfare organization gave the same figure on the wolf population in France as used in the In-depth Analysis Report. As with other environmental NGOs, it criticized the annual killing of a percentage of the total wolf population, the efficacy of which has not been proven scientifically.

One regional association for the wolf noted that the wolf had recently been sighted in its region, but is not yet breeding there.

GERMANY

3240 emails were sent from Germany. Over 80% supported the continued protection of the wolf, while 17% supported a reduction in its protection status and 3% offered other types of comments. 71 emails provided information on the wolf population and/or impacts on livestock.

Of the 71 emails, 46 came from authorities at a district level (Landkreise of which there are 294 in Germany). 24 stated that they had no resident wolves in their district. A further nine stated they had one established wolf pack or one lone wolf. Of the remaining 13 emails, several referred to official regional websites or the official Dokumentations- und Beratungsstelle des Bundes zum Thema Wolf (DBBW) (<http://www.dbb-wolf.de/the-dbbw>) for latest data on wolf packs and livestock damage. Others gave figures for wolf populations and/or wolf attacks in their district, but did not support these figures with substantiating evidence. It is not possible to know whether the figures are based on agreed national or regional damage assessment methodologies.

Data on wolf numbers at district level cannot be aggregated since wolf territories are often located across borders in two or more districts. The issue of transboundary territories is instead addressed at regional level and the regional authorities meet regularly to discuss and coordinate their wolf population data precisely to avoid double counting. The damage data of the Landkreise are also summarized at the level of the Bundesländer which is in turn summarised at national level once a year by DBBW.

Of the remaining 25 emails (out of 71 with data), 15 provided data on the wolf population and livestock damage extracted from the DBBW website or the Länders’ official websites and are therefore consistent with the official data submitted by the competent national authority in the context of the In-depth Analysis Report. Some, however, provided data for 2021 which are not the latest figures used for the In-depth Analysis Report (figures for 2022). Others provided data for 2023, but as the year is not complete yet, these data could not be used.

One email from a regional Ministry of Environment of Niedersachsen provided data on the number of packs, pairs and individuals for its region based on data that matches those on DBBW, but then extrapolated this to estimate that there are 400-600 animals in the region. There is however no scientifically agreed method for estimating individual numbers based on wolf territories and pack numbers. Even if a conversion factor of 7 wolves per pack is used this would result in 303 wolves. The projected figures for 2023/2024 are also not substantiated and appear to be based on observations from the regional hunting association which is not in line with agreed monitoring methodologies. On the other hand, the figures on livestock damage match the official figures on DBBW.

One email from a national farming organisation also used the wolf population data on DBBW to estimate that the total Germany population consisted of 1500 -2700 wolves for 2022/2023. As stated above, this extrapolation is not supported since there is no scientifically agreed method for estimating individual numbers. The number of animals in a pack has also been exaggerated (8-14 animals).

Two emails from regional farming organisations and one from a regional hunter's organisation provided data on wolf populations and livestock damage that are higher than the official data for their region. The data appears to be based on wolf observations from a national hunting association which can lead to double counting since wolves cross between different hunting ranges, it is also not in line with agreed monitoring methodologies.

One of the emails also considered that, because 30% of the wolves killed by road traffic could not be assigned genetically to a specific pack, there were more wolves than officially inventoried. This does not take into account that not all wolf packs in Germany are genetically identified. Wolves killed on the roads that could not be genetically assigned to a certain pack are likely to be offspring from those packs that were not genetically identified. In another of these emails, the figures for livestock damage were not consistent with the information on the official website for the Region. No evidence is given for the higher figures provided.

One email from a regional farming organisation provided data on wolf numbers in the region which are lower than the official data but without providing any substantiating evidence. The data on livestock damage matches the official data.

Two emails from a local hunting organisation and a local environmental NGO provided data on wolf population (in the case of the former) and livestock damage (in the case of the latter) for their area. While noted, the data is at too local a scale to be comparable with the official data.

Two environmental NGOs, in addition to referring to the official data on DBBW, also pointed out that according to official reports 70% of attacks happen on unprotected or poorly protected livestock, in one region this went up to 89%.

One individual estimated from an online google map that there are 270 wolf territories in Germany. But this is not otherwise substantiated and appears to be a significant overestimate.

GREECE

Six emails were sent from Greece. One email from the National Environmental & Climate Change Agency referred to the report by Boitani et al 2022 as a source of information and provided links to selected case studies on wolves and their effect on human activities in Greece. The data in Boitani et al was also used for the Analysis Report. The selected case studies were screened for any relevant information for the In-depth Analysis Report.

Four emails come from hunting and livestock associations informed of local wolf sightings in their area and the negative impact this is having on local farmers. The information on wolf sightings is noted, but could not be taken into account for the In-depth Analysis Report as it is at too local a scale, not substantiated and not based on any agreed monitoring methodology as requested.

The final email came from a coalition of Greek Environmental NGOs objecting to the statements made in the Commission's press release and the short period given in which to collect data. It also stated that, instead of re-opening the issue of suitability of the Nature Directives, the Commission should insist more on the effective utilization, by the EU Member States, of tested and verified good practices and financial tools that will contribute to the more effective implementation of the Habitats Directive. It also provided a list of recent works and reports, which it considered useful. These were screened for any relevant information for the In-depth Analysis Report.

HUNGARY

One email was sent from Hungary in support of maintaining wolf protection status. No data was provided.

ITALY

In total, 1101 emails were sent from Italy, over 90% were in favour of maintaining the protection status of the wolf. 13 emails provided data on wolf populations and/or livestock damage. Four of these presented data from the First National Wolf Monitoring 2020-2021 (ISPRA) which is the same source of information used for the In-depth Analysis Report.

The regional administrations of Lombardy and Trento provided up-to-date and documented data on damages and compensation in their regions. While the data is more up-to-date (2022) than the data in the ISPRA report, it is difficult to integrate the figures with the rest of data from the other 20 regions, given that these regions have limited territories.

The public forest administration for the Bolzano region provided an estimate of the wolf population in its region. The accompanying report, however, also stated that there is no detailed technical scientific documentation available on population dynamics in that region. This data has therefore not been substantiated.

One regional farming committee provided data on wolf populations for its region which are higher than the official figures, but they are based mainly on sightings and camera traps which can lead to significant double counting. The data is not in line with agreed monitoring methodologies.

One hunting association provided estimates of the wolf population and livestock damage for the Apennine belt. It considered that the latest data from ISPRA are not complete because the monitoring was only carried out in certain regions and estimates were made in others. Whilst these concerns are noted, the data provided has not been substantiated and is too local scale to be comparable with the official figures.

A regional civil society cooperative and a regional farmers association both provided an estimate of the number of wolves in their province but did not provide substantiating evidence. It is therefore not possible to know if the numbers are based on an agreed monitoring methodology. The figures for wolf damage in both cases are either the same as, or only slightly different from, those provided by the regional authority.

Another regional civil society cooperative provided data for wolf numbers and damage for its region for 2018 and 2019 – this data is both very local and out of date.

One email from a private citizen considered the data for the wolf population in Tuscany from 2016 to be an underestimate. The latest ISPRA monitoring report provides more up-to-date figures which are no longer based on expert-based estimates.

LATVIA

Three emails were sent from Latvia. One email reported data on the wolf population in a National Park. The other two came from environmental NGOs.

The first gave data on wolf predation on sheep (115 a year) which it considered very low compared to the number of sheep dying from diseases etc. The figure of 115 is higher than the figure given in Boitani

et al 2021 (45 sheep) which was used for the In-Depth Analysis Report, but is lower than the figure given by the State Forest Service data (129 sheep). The NGO further pointed out that the authorities do not offer compensation for large carnivore damage or subsidies for predator protection measures. The NGO considered that the killing of 300 wolves every year (even more illegally) is too high and does not justify the government's statement that the wolf has a favourable conservation status in Latvia according to the last Article 17 report (2013-2018).

The second NGO asked the Commission to investigate the reliability of the wolf Baltic population assessment and conservation status in Latvia. According to a recent State Audit report on game management, there is a lack of reliable and unverifiable government data on wolf populations. The NGO also considers that the figure of Latvian wolf population of 700 individuals given in Boitani et al 2022 is questionable because it might be distorted by the figures given in the Article 17 report. According to expert opinion there are no more than 200-300 wolves in Latvia, but this is not substantiated by any supporting evidence.

The information used in Boitani et al 2022 was based on figures by the Latvian State Forest Research Institute Silava, supported by a scientific paper by Suba et al 2021. It remains the most reliable source of wolf population data for Latvia and has therefore been used for the In-depth Analysis Report. The NGO also considers that during the long hunting season (8.5 months), more than 50% of the Latvian wolf population is killed. However, Suba et al 2021 indicates that there is a mean annual culling mortality of 37.3% which is considered to be a moderate hunting pressure by the authors.

LITHUANIA

Two emails were sent from Lithuania. The one from the Ministry of the Environment provided data on wolf population and damage which was used for the In-depth Analysis Report. The second email from a farming organization provided higher figures for the wolf population, but without substantiating evidence. The figures for wolf damage and compensation are the same as those provided by the competent national authority.

NETHERLANDS

A total of 101 emails were sent from the Netherlands. The majority (80%) called for a reduction in the protection status of the wolf due to the threat to livestock and pets, the impact on local farmers, the safety of local communities, and the overall social and economic burdens caused by wolves.

Five emails provided data on wolf populations and/or damage. The email from the Ministry of Agriculture, Nature and Food Quality and the two from Provincial authorities of Drenthe and Gelderland all quote the same source of data that was used in the In-depth Analysis Report.

One environment NGO considered there were only 30-35 wolves in the Netherlands (excluding wandering wolves), but did not provide any substantiating evidence to support this. Regarding wolf damage they quote the same source as was used for the Analysis Report (<http://www.bij12.nl>). Contrary to the NGO's claim, the data does identify the different species of predator (based on DNA sampling).

Another environmental NGO stated, giving reference to a recent study, that over the past nine years, 693 claims for compensation were related to farmers that did not implement wolf fencing measures. Only 9 claims were made by farmers that did implement wolf fencing measures.

The remaining two emails were sent by an organisation responsible for a National Park and an association representing two municipalities in which they inform about local wolf sightings and their impact. While the information is noted, it is at too local a scale to be compared with the national data used in the context of the In-depth Analysis Report.

POLAND

A total of 450 were sent from Poland, over 90% came from people expressing an opinion in favour of maintaining the protection status of the wolf.

A further 8 emails provided some data on wolf populations and/or damage. Three were sent by the local municipalities of Cisna, Usztrzyki and Zary giving reports of local sightings and incidents with wolf and bear in their municipality and expressing their concern at the increase in wolf incidents and the lack of effective procedures for dealing with conflict situations. One organization also provided data on the number of incidents with wolves in the last 5 years in the Subcarpathian province. While their concerns were noted, the data is based on observations only which is not in line with agreed monitoring methodologies and is on too local a scale to be compared with the national data on wolf numbers and impacts.

One hunter and one hunting association estimated the Polish population of wolf to be 2 to 7 times higher than of the official figures. The figures are based on a hunter's census for 2022/2023, and, as the association itself states, it cannot be excluded that animals are counted twice. The data is also not based on agreed national monitoring methodologies or other official procedures/methodologies. Data was given on the number of game species (and mouflon) found killed by wolves during the last hunting season. These are again based on observations only and not further substantiated.

One coalition of environment NGOs considered there were 2000 wolves in Poland which is in a similar range (albeit slightly higher) than the figures used for the In-Depth Analysis Report. They also stated that, according to an analysis done recently, wolf predation on livestock is responsible for the mortality of only 0.08% of cattle, about 0.12% of calves, and a few percent of sheep.

Further, compensation from the State Treasury is paid to livestock farmers for damage caused by five protected species (beavers, bison, bears, lynx, and wolves). In 2020, PLN 32.3 million was paid out but compensation for damage caused by wolves accounts for less than 5% of this amount. The figure for compensation by wolf (ca 370,000 €) is similar to the figure used for the Analysis Report. The figures for mortality of different types of livestock give only percentages rather than real figures and so it not comparable.

Another environmental NGO considered the wolf population in Poland to be made up of 1900 individuals which is consistent with the figures in In-depth Analysis Report. It also considered the share of damages caused by wolves in relation to damages caused by all protected species covered by the compensation system is small. The value of paid compensation for damage caused by wolves is only 3.1% of the total in 2017 to 4.9% in 2021 of the damage caused by all protected species. The amounts paid out ranged from 758,400.00 PLN (177,923.75 euros) in 2017 to 1,676,900.00 PLN (367,177.58 euros) in 2021. These figures concord with those used for the Analysis Report.

PORTUGAL

56 emails were sent from Portugal. All expressed their support for the protection of the wolf. Three letters from Environmental NGOs also provided links to numerous scientific references and studies to support their position in favour of the protection of the wolf. These were screened for any relevant information that could be used for the In-depth Analysis Report.

ROMANIA

A total of 8 emails were sent from Romania, three were in favour of maintaining the conservation status of the wolf, two were against. One email from a County Council raised concerns about the poor implementation of derogations for wolves (in relation to livestock damages) and proposed to establish a preventive quota instead of using individual derogations. Three emails provided data on wolf numbers and livestock damage. The first email came from the Ministry of Environment and provided an update on the wolf population and the compensation paid for damage caused by wolf. These figures were used for the In-depth Analysis Report. Two environmental NGOs also quote the same official data on wolf numbers which were used for the Analysis Report.

SLOVAKIA

Two emails were sent from Slovakia. The Ministry of Agriculture and Rural Development provided up-to-date information on the wolf population in Slovakia and impacts on livestock. Their estimation of wolf population (365-524 individual) was very similar to the figures provided by the Ministry of Environment (400-600) and used in the In-depth Analysis Report. They do however distinguish between winter and summer populations, the latter being higher because of the high number of new wolf cubs every year (135-194). Regarding the livestock damage, the figures for 2022 are somewhat higher than those provided by the Ministry of Environment (1143 sheep, 117 bovine, 75 goats). The figures are derived from Central evidence administration of livestock in the Slovak Republic, state enterprise. The second email from the state enterprise provided the same data.

SLOVENIA

19 emails were sent from Slovenia, all expressed their support for downlisting the wolf to Annex V of the Habitats Directive. Two provided data. The first email from a coalition of farmer organisations provided data on the wolf population that corroborates with the official data provided by the competent authorities and used in the In-depth Analysis Report. The email also stressed that low densities of grazing animals, rugged terrain, steepness, shallow soils and remoteness of pastures make protection against carnivores particularly difficult and, in the vast majority of cases, impossible.

The second email from a farming organisation stated that, according to unofficial data, there are around 200 wolves in Slovenia. This was not substantiated and, as the email itself said, it is based on unofficial data.

SPAIN

167 emails were sent from Spain. 95% supported the continued protection of the wolf. 28 emails provided data on wolf populations and livestock damage.

The Ministry of Environment provided an overview table of the number of known wolf packs per region for the first semester of 2021. They also listed the year in which the data was recorded, the number of shared packs (across two or more regions) and the estimated number of lone wolves. The total number of wolf packs is estimated at 324 (of which 30 are shared packs). However, the Ministry also pointed out that these figures are based on data collected opportunistically using different methodologies and time scales and are not the result of a nationwide survey. Much of this information comes from the national survey carried out in 2012-2014, so it is outdated. In addition, double counting of shared (transregional) packs has not been addressed which could lead to an over-estimation of the total wolf population. The Ministry and the autonomous communities intend to carry out a national survey that will be completed in 2024.

Emails were also sent from ten Autonomous Regions:

The Autonomous Region of Castilla Leon reported that they have located 214 wolf packs in the region in the period 2012-2018, but they cannot confirm that all the packs are present in any specific year. They are currently carrying out an official survey for 2022-2023. The number of wolf packs is higher than the data provided by the Ministry of Environment, but is difficult to use as it is somewhat old and covers a seven-year period. The region also provided detailed information on livestock damage for 2022 (5104 livestock) which matches the figure provided by the Ministry. Since the protection of the wolf north of the Duero in 2021, the level of compensation has increased significantly, and the regional government now receives almost 10 million € a year from the government to pay for livestock damage and for prevention measures. However, the increase in compensation does not necessarily imply an increase in livestock damage over the past 2 years, rather a higher number of claims for compensation since the compensation coverage has been expanded to many areas north of the river Duero where before wolf protection (2021) damage was not compensated.

The Autonomous Region of Rioja reported that there were four packs (18-38 wolves) in 2021/2022 which is one pack higher than the data provided by the Ministry of Environment. 696 heads of livestock were killed by wolves in 2022, most of them (682) sheep, resulting in a total of 105,761€ spent in compensation. This data matches that provided by the Ministry.

The Autonomous Region of Extremadura reported that there was one female in the north of the region in 2021 and one male hybrid in 2022. In the west of the region there was also one wolf on the border with Portugal.

The Autonomous Region of Madrid reported that in 2022 there were 5 wolf packs and 104 attacks on livestock; 55,702€ was spent on compensation. The figures on compensation are lower than the data provided by the Ministry of Environment.

The Autonomous Region of Cantabria reported that there were 20 packs in the region in 2022 which matches the data provided by the Ministry of Environment. The region also reported wolf attacks and livestock damage since 2019. In 2022, livestock damage amounted to 2456 animals which matches that provided by the Ministry.

The Autonomous Region of Castilla-La Mancha provided data for one province only: 4 wolf packs and 81 attacks on livestock in 2022. The data on wolf data is one pack higher than the data provided by the Ministry of Environment. The data on livestock damage is slightly lower than the data provided by the Ministry.

The Autonomous Region of Aragon reported one wolf pair and a few lone wolves in 2023. 16 livestock were killed or wounded in 2022. No data was provided by the Ministry of Environment for this Region.

The Autonomous Region of Galicia carried out a survey in 2020-2021 which identified 93 wolf packs, 21 of which are shared with other Spanish regions or with Portugal. This data is similar to the data provided by the Ministry of Environment although the number of shared wolf packs is significantly higher (21 compared to 7). The region also provided detailed data on damage to livestock: in 2022, this amounted to 2251 livestock, the majority being sheep (1332). The data matches the figures provided by the Ministry of Environment.

The Autonomous Region of Asturias reported the presence of 40 packs, and reproduction in 35 packs, which matches the data provided by the Ministry of Environment. The figures for livestock damage (3225 head for 2022) match the data provided by the Ministry.

The Autonomous Region of Andalusia confirmed that no wolves have been found in recent years.

The province of Barcelona reported that a single male had settled in the area, killing or wounding 15 goats. The data is noted, but is at too small scale to be comparable with the official statistics provided by the Ministry of Environment in the context of the In-depth Analysis Report.

Two national farmers' associations sent a large number of reports on damage to livestock covering most of the Autonomous Regions. This material was derived from statistics provided by the Autonomous Regions and the Ministry of the Environment and is therefore the same as the official data used for the In-depth Analysis Report.

A third national farmer's association also provided data on livestock damage for the different regions. It is largely consistent with the official data submitted by the Ministry of Environment with slight variations and an overall figure that is slightly lower than the official data.

Two environmental NGOs, four regional farmer's associations and one regional research body all refer to the same statistics on wolf populations and/or livestock damage as provided by the Autonomous Regions and the Ministry of Environment.

One hunting organisation and one hunting foundation referred to a report prepared by the Foundation which provides data on wolf populations per region. Overall, they estimate that the wolf population in Spain is in the range of 370-380 herds, although future studies should confirm these figures. The regional figures are based on data collected on pack surveys carried out by the Autonomous Regions and is mostly consistent with the official data provided by the Regions and the Ministry of the Environment, but the overall aggregation is likely to be exaggerated because, as the report points out, the packs shared between Regions and lone wolves are not systematically excluded. The figures are also based on collected data and not derived from any agreed monitoring methodology.

Regarding the figures provided for livestock damage caused by the wolf in Spain (10,000 heads), these are overall lower than the figures provided by the Ministry of Environment (14,300 heads). Also, according to the report 3 million heads of livestock were lost for a variety of reasons over the last six years (ie average 500,000/year).

One local farmer's association sent data on livestock damage for some municipalities within a region, but they are at too local a scale to be compared with regional or national data.

One regional political party provided individual handwritten forms submitted by farmers reporting livestock damage. There is no summary overview. The data is at too local a scale to be comparable with the data submitted by the Autonomous Region and the Federal Ministry of Environment.

One hunting association provided data on wolf numbers for 2007 which is out of data.

One regional farmers union provided data on the wolf population and livestock damage in its region. It estimated that the total population is around 736 to 828 wolves, distributed in 93 groups. Whilst this figure is similar to the data provided by the Region and the Ministry of Environment, it does not take into account the fact that several wolf packs are shared with two or more regions. The data on livestock damage matches that provided by the Region and the Ministry of Environment.

SWEDEN

A total of 7727 emails were sent from Sweden. Two thirds (62%) were in favour of maintaining the protection status of the wolf, while one third (38%) asked for the protection status to be reduced. In the case of the former, the majority estimated the Swedish wolf population to be 450 wolves in the winter of 2022-2023 and stated that 250 sheep were attacked by wolves in 2022. Both figures match the official data provided by the competent authorities which was used for the In-depth Analysis Report.

The emails in favour of protecting the wolf also expressed concern that the wolf population had decreased to 368 wolves by 2023, according to the Swedish University of Agricultural Sciences and that the species had not reached a favourable conservation status in Sweden. Due to its small population size, it was also in danger of genetic inbreeding. Yet, the wolf has a positive effect on Swedish nature and ecology according to several research projects.

The emails requesting a reduction in the protection status of the wolf considered that the Swedish wolf population had reached a favourable conservation status and should no longer be listed as strictly protected. They considered that the wolf had been increasing and expanding in Sweden for forty years and are now spreading into more densely populated areas of the country which is leading to increasing conflicts and higher costs for farmers, as well as fear in local communities.

9 emails contained data on wolf populations and livestock damage. The email from the Swedish Environment Protection Agency submitted official data for wolf population and livestock damage for the Winter 2022/2023 which was used for the In-depth Analysis.

Five emails came from national environmental NGOs. Three provided the same population data as the official data (450 wolves), but all considered that the Swedish population is small, isolated and heavily in-bred, having originated from only three individuals in the 1980s and with little influence from outside immigrants since. They also considered that the population remained in danger due to decisions on licensed hunting (57 wolves - 12% of the population in 2023), illegal hunting, accidents, and natural mortality. The same reference source was quoted claiming that the Swedish wolf population drastically decreased to 368 wolves in the autumn of 2023 according to the Swedish University of Agricultural Sciences.

One of the environmental NGOs considered that the Scandinavian wolf population now only has around 300 individuals (counted in March 2023) before breeding with the correct multiplication factor 7,67 but this latter figure has not been substantiated.

All five emails disagreed that the wolf has reached favourable conservation status as stated by the Swedish authorities and they contest the figure of 300 wolves which was given by SEPA as a favourable reference value. According to 18 scientists this should be higher (600 wolves) in order to fulfill the criteria of ecological viability.

Three emails were sent from a farming organization, hunting organization and business association. All provided the same data for the wolf population and livestock damage as used for the In-depth Analysis Report. All expressed concern over the fact that the wolf is concentrated in the centre of the country and is spreading to more densely populated areas which risks increasing wolf attacks on livestock and affects hunting, especially traditional hunting with dogs. It also creates fear amongst local communities. They consider that preventive measures for protecting livestock are expensive and would be prohibitive if predator repellent fences had to be put in place for all sheep in Sweden.

EU LEVEL ORGANISATIONS

20 emails were sent from organisations operating at EU level or internationally (environmental, animal welfare or youth organisations or farming or hunting organisations). 17 were in favour of maintaining the protection status of the wolf, 3 asked for its protection status to be lowered. All gave explanations for their position, supported by relevant documentation.

In the case of environmental NGOs, the following are some of the key points were raised:

- a) the wolf has not reached a favourable conservation status within the EU and remains vulnerable, the current positive trend can easily be reversed; many populations are still threatened by illegal

hunting (and hunting quotas in some Member States), hybridisation, road accidents and genetic in-breeding;

- b) wolf monitoring is very uneven across the different Member States which gives an unclear overall picture of the EU population and status— it is a priority to improve monitoring standards;
- c) any policy decisions must be evidence- and science-based and not based on anecdotal evidence delivered through an irregular consultation process;
- d) the existing derogation system under the Habitats Directive provides sufficient flexibility to deal with ‘problem’ wolves;
- e) many tools are already available to protect livestock and compensate for losses; these have been shown to work, but are insufficiently and very unevenly applied;
- f) instead of reducing the protection status of the wolf, the focus should be instead on significantly improving the use of existing tools to protect livestock eg by using the exceptions available under State aid rules and funding from CAP;
- g) attacks on humans are extremely rare;
- h) wolves, as an apex species, have an important positive role to play in Europe’s ecosystems;
- i) lethal controls of wolf populations have not been scientifically proven to be effective in reducing livestock depredations;
- j) the overall livestock loss in the EU is very low 0,1- 0.05% of the total sheep stock.

Most of the emails from the environmental NGOs also expressed serious concern at the tone of the press release which they consider misleading and could pre-empt the outcome. The consultation period of 18 days was also considered to be too short and not in line with the Commission’s own better regulation rules.

In the case of the hunting and farming organisations, the following are some of the key points raised:

- a) Increasing wolf populations are leading to increasing conflicts with livestock and threatening the livelihoods of farmers – especially extensive livestock farming (which contributes positively to biodiversity);
- b) the data from the Article 17 Habitats Directive’s Reports do not paint a correct picture of the conservation status of the wolf in the EU; there should instead be a science-based population level assessment of the wolf that more appropriately recognizes their biology and ecology;
- c) listing the wolf in Annex V instead of Annex IV of the Habitats Directive allows for a more active and flexible management of the species;
- d) the present derogation system under the Habitats Directive is too strict and presents a significant bureaucratic burden in many countries. It does not allow for instant and efficient conflict resolution;
- e) the wolf also has a negative impact on wild ungulates and on hunting activities (especially with hunting dogs);
- f) the wolf has changed behaviour and is not as afraid of humans as before;
- g) the cost of protection measures and compensation is exorbitant and will only continue to increase;
- h) the EU platform on coexistence between people and large carnivores should continue to facilitate dialogue between different stakeholders and Member State authorities.

Six emails also provided data on wolf populations and livestock damage.

One environmental organisation and one hunting organisation referred to the assessment made by the Large Carnivore Initiative for Europe in 2022 which stated that there are currently around 19,000 wolves distributed across 27 EU Member States. Two other environmental NGOs referred to the figure of over 17,000 wolves based on figures for 2018 (cf Wildlife Comeback Report, 2022). According to the latest official data collected from competent national authorities or other reliable sources as part of the In-depth Analysis the population is currently estimated at 20,300 wolves for EU-27 (2023).

One environmental organisation also considered that wolves kill between 30,000 and 40,000 European livestock animals annually, of which the majority are sheep. This figure is lower than the latest data

collected from competent national authorities or other reliable sources as part of the In-depth Analysis. According to the latest figures, livestock damage is currently estimated at 65,000 head for EU-27 (2023); this includes not only livestock killed, but also those reported as injured.

Another environmental organisation stated that between 2012 and 2016, the annual number of sheep compensated because of wolf depredation corresponded to 0.05% of the over-wintering sheep stock. Member States presenting higher depredation rates such as Portugal, France, Italy or Croatia, appeared to be countries with husbandry systems that leave livestock unprotected, or where there are low densities of wild prey.

Several hunting organisations provided data on wolf populations and livestock predation at Member State level:

- Germany: the figures quoted by one hunting organisation are based on official data from DBBW and concord with those used in the In-depth Analysis Report. A second hunting organisation provided figures that are lower than the data presented in the In-depth Analysis Report but without substantiating its data;
- Poland: The figure given by one hunting organisation of 2154 wolves for Poland is based on information collected from hunting clubs and corrected for possible double counts. This is higher than the figure of 1886 wolves identified in the In-depth Analysis report (Boitani et al 2022). The organisation's estimation is however based on sightings and, even if corrected, it does not follow agreed monitoring standards;
- Spain: Two hunting organisations provided a figure for the wolf population in Spain of 2800 (400 wolf packs) based on estimation done by a hunting foundation which collected data on pack surveys carried out by the autonomous communities. The data is not consistent with the official data provided by the autonomous authorities in the context of the In-depth Analysis (eg Asturias: 53 wolf packs according to NGO, 40 according to regional government; Cantabria 27 packs according to the NGO, 20 according to the regional government). The overall figure of 2800 is therefore likely to be overestimated. It is also based on collected data and not derived from any agreed monitoring methodology. Regarding the figures provided for livestock damage caused by the wolf in Spain, this varies from one hunting organisation to the other. In one case, the figure (8000 attacks) is lower than the official data provided in the In-depth Analysis (14,300 animals, 2022). The other organisation gives a figure of 10,000 cattle lost in 2022. This is double the official figures for cattle provided in the In-depth Analysis, but it has also not been substantiated (and is possibly meant to say 10,000 livestock);
- Netherlands: the hunting organisation quoted the same official figures for wolf population that were used for the Analysis Report but then goes on to state that, based on observations, the actual numbers appear to be much higher: more like 100. This is however not substantiated and is based on observation only;
- Czech Republic, Belgium, Sweden: The figures provided for wolf population and/or livestock damage match the official figures provided in the In-depth Analysis Report;
- Austria: the figures given for livestock damage caused by the wolf are double the official data available on <https://baer-wolf-luchs.at/> and have not been substantiated.



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