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Action Plan for Grey Wolf *Canis lupus* Conservation and Management

Plan is elaborated for the period from 2018 to 2028

Developed by the Latvian State Forest Research Institute "Silava"
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Contents

List of used abbreviations and glossary

The Baltic population of the grey wolf – the population of wolves living in the territories of Latvia, Estonia, Lithuania, Belarus, the north of Poland, the north-western part of Ukraine and the Russian Federation regions adjacent to the Baltic States.

Biological (ecological) carrying capacity – the maximum sustainable population size of a given species that can be supported in a habitat without causing significant changes to the ecosystem concerned.

Coexistence – the ways and means to reduce and find solutions to the conflict of interests of people with the presence of large carnivores in their commonly inhabited environment.

Methods of non-invasive research – wildlife research techniques without the need to kill, capture or even observe animals directly (e.g. observation of animal tracks and other records of activity/evidence of presence, use of automatic cameras, etc.).

Non-consumptive use – activities related primarily to outdoor recreation, nature tourism (such as observation and photography of wild animals, nature trails), excluding the direct use of wildlife or other natural resources.

Social carrying capacity – the maximum number of individuals affecting the society (in terms of both wild and domesticated animals, in the context of this plan – wolves or livestock, as well as people, such as tourists or immigrants) in a specific area that does not cause significant dissatisfaction or conflict to local inhabitants, or degradation of quality of life, including psychological stress. See also *Wildlife acceptance capacity*.

CITES – Convention on International Trade in Endangered Species of Wild Fauna and Flora

CLC – CORINE Land Cover

IUCN – International Union for Conservation of Nature

NCA – Nature Conservation Agency

SFS – State Forest Service

SPNA (NR, NP, RA) – Specially protected nature area (nature reserve, national park, restricted area)

Summary

Today, the wolf is recognized as an integral part of wildlife, and in many countries, under favourable legislation and improvement of ecological conditions, this carnivore has begun to recover after centuries of persecution. Excepting islands, wolves are found in all European regions, recently even entering Benelux. Currently there are 10 grey wolf populations in Europe. Wolves found in Latvia belong to the so called Baltic population. In Europe, all wolf populations have developed as a result of natural dispersal, because there have been no reintroduction attempts of wolves in Europe.

At the European level, the grey wolf is a threatened species. According to the Directive 92/43/EEC on the conservation of natural habitats, wild fauna and flora, Latvia has the so-called geographical exception – the wolf is included in Annex V, which means that individuals can be obtained, but the state must provide a favourable population status, monitor the species and prohibit the hunting techniques listed in Annex VI of the Directive. In Latvia, the wolf is listed among the specially protected species whose use is limited. According to the criteria of the International Union for Conservation of Nature (IUCN), the species in Latvia and within the Baltic population as a whole corresponds to the category of 'least concern'. In accordance with the report of Article 17 of Directive 92/43/EEC in 2013, the species status (population size, distribution, amount of suitable habitats and future prospects) is deemed favourable in Latvia. Available information on species history shows that wolves in Latvia currently have the widest distribution over the last 50 years.

The purpose of the renewed Action Plan for Grey Wolf *Canis lupus* Conservation and Management in Latvia (referred to hereafter as the Action Plan) is to maintain a favourable status for the wolf population in Latvia for an unlimited period of time and to promote the maintenance of a favourable status of the Baltic wolf population without specifying the maximum number of individuals and habitats, while ensuring the presence of wolves as a united and functional component of the wildlife environment in man-made and managed landscapes, respecting and promoting the quality of life and wellbeing of a diverse society. The updated Action Plan maintains a regional perspective and emphasis on conservation measures in Latvia in relation to the situation at the Baltic population level, as well as paying attention to the kinship structure and genetic indices.

The Action Plan describes actions and measures required to ensure the conservation and management of the species in legislation, species research and data collection, information, education and training, as well as organizational and planning actions.

The Action Plan was developed by the Latvian State Forest Research Institute “Silava” within the project “Renewal of the grey wolf *Canis lupus* conservation plan” (No. 1-20/117) supported by the Latvian Environmental Protection Fund.

Introduction

The wolf is a representative of the Eastern Baltic mammal fauna that has entered the territory of Latvia at the end of the last ice age – about ca. 9,000 years ago (Tauriņš 1982, Timm et al. 1998). Ever since prehistoric times, men have considered wolves to be their competitors in hunting wild ungulates (Бибиков и др. 1985a). This conflict intensified even more when people began to engage in livestock farming (Fritts et al. 2003). Attacks on livestock have been the main reason for the extermination of wolves, although wolf pelts and meat were used in ancient times (Сабанеев 1988). The relationship between humans and wolves became even more aggravated by episodic attacks on people, especially on children (Корытин 1990, Павлов 1990, Jhala and Sharma 1997, Linnell et al. 2002).

The earliest data on wolf in Latvia, useful for scientific research, date from the 19th c., when the number of wolves was high (Kalniņš 1943). By the end of the 19th century most wolves were hunted to extinction. Wolves increased in number during the First World War, but by the beginning of the Second World War, only 17 wolves were left in Latvia. After the war, the number of wolves rapidly increased, exceeding 1000 individuals. According to hunting statistics in the 1960s, wolves in Latvia again came to the verge of extinction, but in the second half of the 1970s the population gradually recovered. During the 1980s, the number of wolves in Latvia stabilised, and they were found in a large part of the territory, unlike in Western Europe where wolves only survived in Spain and Italy. At the beginning of the 1990s, control of wolf numbers in Latvia was not conducted for several years due to political changes. In addition, a high number of ungulates in the late 1980s and early 1990s provided carnivores with a rich dietary base. As a result, the number of wolves again increased rapidly, reaching almost 1000 individuals (Ozoliņš et al. 2001). The 1990s also marked an increase and expansion in the number and distribution of wolves at the European scale. Due to natural dispersal, wolves appeared even where they have not been present for more than a century – for example in Switzerland, France, Austria, etc. (Boitani 2000).

Today the wolf is recognized as an integral part of the wild fauna, and many countries contribute to the return of these carnivores. Wolves are able to live even in remarkably transformed and densely populated landscapes (Fritts et al. 2003), but under such circumstances the idea of conservation is overshadowed by conflicts, stemming from today's unwarranted, but genuine fears for human security (Linnell et al. 2002) and significant loss to livestock farming (Boitani 2002). Today a stable and successfully protected wolf population is a symbol, not so much for wilderness but rather for a well-established and successfully managed nature conservation system and a demonstrated willingness of local people to coexist with large carnivores. Such a system is not

based on a network of protected areas, which, in the case of large carnivores, cannot provide sufficient space for the population, but rather facilitates the coexistence of people and wolves. The management of large carnivores is not only a biological but also a social and political issue, moreover the public opinion and attitude towards carnivores and their place in nature has great importance (Bath 1996). In Latvia a system comprising of legislation and species management, which aimed to reduce or stop wolf hunting if threats to the long-term survival of their populations emerged, was established in 2004.

The study of wolves in Latvia began in the late 1990s (see Chapter 1.5). The knowledge gained in the research, along with the information from other countries, became a prerequisite for scientifically based conservation measures. The first draft of the Action Plan on wolf conservation was developed in 2000. On the 28th of April 2003 the Minister of the Environment confirmed a supplemented version of this document (Ozoliņš and Andersone 2002) by order No. 121 and the introduction of measures was immediately commenced. As a result of timely development and successful implementation of the Action Plan, a system for inventory and research of hunted wolves has been established in Latvia. After joining the European Union on the 1st of May 2004, Latvia became a so-called geographical exemption for the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, transposing the species from Annexes II and IV to Annex V, which means that hunting for wolves may be conducted in a country by means not prohibited by the Directive, on the condition that population monitoring and a favourable conservation regime is ensured. A renewal of the Action Plan was planned in 2005, but due to its successful implementation and the effective functioning of the conservation system the document remain unchanged until 2008. Due to similar considerations, it was possible to postpone the update of the next Action Plan from 2014 to 2017.

A major challenge in the renewed Action Plan has been to find a balance between the needs of carnivores and humans in the territory of Latvia, without deterioration of the overall species status within the Baltic population. It is also necessary to comply with international legislation, initiatives and guidelines on issues of species conservation and management. It is important to recognise that the conservation of carnivores does not necessarily imply a strong protection regime and a sustainable use of wild species in hunting does not contradict their conservation (Sutherland 2000, Linnell et al. 2008). Currently, the document summarizing the activities, management methods and measures planned to monitor the species conservation status is called the Species Conservation Plan, but, according to the principles mentioned in the EC Directive 92/43/EEC, it would be more appropriate to refer to it as the Action Plan for Species Conservation and Management.

The aim of the renewed Action Plan for Grey Wolf *Canis lupus* Conservation and Management is to maintain a favourable status for the wolf population in Latvia for an unlimited period of time and to promote the maintenance of a favourable status of the Baltic wolf population without specifying the maximum number of individuals and habitats, while ensuring the presence of wolves as a united and functional component of the wildlife environment in man-made and managed landscapes, respecting and promoting the quality of life and well-being of a diverse society. The updated Action Plan maintains a regional perspective and emphasis on conservation measures in Latvia in relation to the situation at the Baltic population level, as well as paying attention to population structure and genetic indices.

1. Species characteristics

1.1. Taxonomy and morphology

The wolf *Canis lupus* belongs to the dog genus *Canis,* family Canidae, order Carnivora, class Mammalia, phylum Chordata. Several wolf subspecies are recognised, based on the relatively high morphological diversity within the species in different parts of its range (body size, pelt colour, skull condylobasal length). Statistically significant differences in these phenotypic characteristics are indicated by 11 subspecies. In Latvia, the nominal subspecies is found – *Canis lupus lupus* Linnaeus, 1758. Specimens of this subspecies are of average size, with a pelt colour of dark grey with an admixture of red (Соколов 1979).

The wolf is the largest member of the dog family (Смирин 1985). The size of the animal varies in different geographic areas with wolves in the north usually being larger than in the south. Males are bigger than females. The body length varies from 105 to 160 cm, the tail length is 35–50 cm, and the height of the withers is up to 1 m (Соколов и Россолимо 1985). The average weight of males and females is 34–49 and 30–42 kg, respectively (Новиков 1956). In Latvia, the average body length of male and female wolves is 118.0 and 109.4 cm, and the average weight is 37.6 kg and 34.0 kg, respectively (Andersone and Ozolins 2000b). Average measurements of the Estonian wolf population were slightly higher than in Latvia (Männil and Kont 2012).

In appearance, the wolf resembles a big dog. However, unlike the latter, its withers are higher, with longer hair, the muzzle is shorter and snub-like, the forehead is broader and the neck is shorter and thicker (Tauriņš 1982). The front part of its thorax is laterally flattened and looks narrower than that of a dog. The eyes are normally yellow or greenish, but can also be dark brown, situated more sideways and slanted. Its tail is usually pointing down. Contrary to a dog, an adult wolf never has its tail coiled up and is never lop-eared. Its pelt colour may vary from fair (nearly

white) to completely black (wolves of such colour are common in North America). The lower part of the muzzle and neck are usually lighter, eyes may be encircled by rings of fair colour with a dark stripe extending from the eye corner to the ears. The back and front paws may show distinctly dark stripes (Смирин 1985). In Latvia, the majority of wolves are grey or fawn coloured, occasionally showing a tint of red (Andersone 2002).

The most typical gait for a wolf is an easy trot. When running, its movements are vigorous, yet not as fast as those of a dog. The wolf often moves in a special easy gallop, with its back remaining straight (Смирин 1985). It can develop a speed of 40–50 km/h, and over shorter distances – up to 65 km/h (Павлов 1990).

The wolf is a very cautious animal, therefore, direct observations are very unlikely. When persecuted intensively, wolves are active mainly at night or at dawn/dusk that is why they can be encountered early in the morning or late in the evening (Mech 1970). Occasionally wolves can also be seen in the daytime, usually on forest roads or clearances (Autors' obs.).

The presence of the species cannot be detected solely on the basis of occasional observations, and indirect signs should also be taken into account. Wolf footprints, best seen in the snow, are the most common indicators of its presence (Fig. 1). The footprint of the front paw is bigger than that of the hind paw, its length varies from 8.5 to 13.5 cm, with a width of 8 to 12 cm. Most often, though, the print of the hind paw totally covers the footprint of the front paw which should be taken into consideration. It has clearly four fingers and contrary to dog footprints of the same size, wolf prints are extended longitudinally so that a straight line may be drawn between the lower edge of the footpad of the 2nd and 3rd toe and the outer edge of the 1st and 4th toe. However, this is not always visible in the field (Fig. 1) and in reality it is very difficult to distinguish between a wolf track and that of a dog of similar size. It is typical for wolves that their footprints almost fall in line. Furthermore, animals walk in step with each other, therefore it is often impossible to tell how many individuals there are in a pack. In order to be able to determine this, one must follow their tracks to a place where the animals disperse for some reason (Sidorovich and Vorobej 2013).

Despite the above-mentioned problems, snow-tracking is the main method of wolf census and one of the most common hunting methods in Latvia.

Figure 1. Wolf footprint on the left and footprint of a known dog on the right – there are almost no differences. Photo by J. Ozoliņš.

1.2. Species ecology

Habitat, behaviour and individual territories

The wolf is a generalist species, whose natural distribution range includes not only the forest zone, but also tundra, steppe and desert. Availability of food and safe hiding places for resting and making dens are the main requirements. The proximity of water is also of great importance for wolves. That is why their dens are often next to rivers or bogs (Сабанеев 1988, Павлов 1990).

Today, forests are the main wolf habitat in Europe because carnivores feel safe there. The fact that wolves have become typical forest dwellers is secondary (Сабанеев 1988). About one thousand years ago wolves lived primarily in an open landscape. Vast forest areas were not inhabited by wolves. For example, wolves entered the taiga only when humans started to use this area by building roads and cutting forests. Bogs are not among the habitats favoured by wolves, although they often choose small islands on mineral soils as sites for safe dens due to their difficult access for humans. Such places are also often chosen by wolves in Latvia (Authors' obs.). Wolves also occur in farmlands, provided that they are interspersed with forest patches and other suitable hideaways. In such places, synanthropic wolf packs can form, which depend on humans for food and feed on livestock as well as their carcasses at dump sites (Salvador and Abad 1987, Meriggi et al. 1991, Boitani 1992, Papageorgiou et al. 1994).

Wolves live in packs usually consisting of related individuals (Mech 1970). Each pack inhabits its own territory which is marked and protected from neighbours (Jedrzejewska and Jedrzejewski 1998). Home range size varies from 30 to 1000 km^2 (Bibikov et al. 1983). There are also non-territorial animals but usually such individuals comprise less than 10–15% of the

population (Fuller et al. 2003). Between home ranges of different packs there is a so-called buffer zone where conflicts can occur between neighbouring pack (Бибиков и Филимонов 1985). The home range size varies depending on food availability which can be influenced both seasonally and geographically. For example, home ranges are typically bigger in winter than in the summer and are also bigger in the north than in the south of the species distribution range (Линейцев 1983, Кудактин 1984, Bibikov et al. 1983, Бибиков и Филимонов 1985). In the forest zone, home range size varies from 100 to 300 km^2 (Jedrzejewska and Jedrzejewski 1998). In Estonia the home range is around 250–500 km^2 (Männil and Kont 2012). In Latvia such studies have not yet been conducted.

Research data show that wolf density varies from 0.6–1 to 3.6–10.4 individuals per 100 km^2. In heavily exploited populations it can be even less than 0.1 individuals per 100 km^2 (Осмоловская и Приклонскй 1975). In North America, wolf density is 0.3–4.3 individuals per 100 km^2, whereas in Europe it is from 1 to 3 individuals per 100 km^2 (Boitani 2000). Wolf population density is affected by food resources, habitat characteristics and the level of persecution by humans (Бибиков и Филимонов 1985, Boitani 2000). Studies on wolf population density in Latvia have not been conducted, but taking into account the estimated number of wolves in recent years, the average population density may reach as much as 1.7 animals per 100 km^2.

Diet

The wolf diet is the most important ecological aspect, and is most closely associated with species conservation problems. Wolves are carnivores that consume up to 5 kg of food per day, mainly meat (Павлов 1990). The weight of stomach contents usually does not exceed 2 kg. In Latvia, the results from stomach content investigations showed that it was mainly below 1.5 kg and weighed ca. 800 g on average (Žunna et al. 2009). However, it should be noted that wolves have a very quick digestion and under favourable conditions they can eat twice a day (Mech 1970). Taking into account inevitable fasting periods, a wolf consumes from 500 to 800 kg of food per year (Руковский 1985). As an opportunistic predator, wolves prefer the most accessible and most abundant prey, therefore in Europe, red deer is one of their most favourite prey species (Jedrzejewski et al. 1992, Okarma 1995, Okarma et al. 1995, Jedrzejewska et al. 1997). Where red deer is scarce, wolves predate on roe deer and wild boar (Valdmann et al. 1998) as well as elk (Peterson and Page 1983). There are indications that wolves are selectively hunting for wild boar, i.e. their proportion in the wolf diet is disproportionately high compared to their abundance in the ungulate community in general (Jedrzejewski et al. 1992, Andersone 1998b). This is most likely caused by the selective hunting of piglets as the wild boar proportion in the wolf diet increases in the summer (Jedrzejewski et al. 1992). Ungulates usually comprise about 50 to 90% of the animals

consumed (Kohira and Rexstad 1997, Jedrzejewski et al. 2002, Kübarsepp and Valdmann 2003, Capitani et al. 2004, Darimont et al. 2004). In the northern parts of the wolf distribution range and in parts of Europe, wolves often hunt hares. In some areas, hares can constitute as much as 70–90% of the wolf diet. Quite often various rodents are found in the wolf diet – mice and voles, marmots, coypus, muskrats etc. Rodents usually constitute from 2–3% up to 10% of the wolf diet, and they can be more often found in the diet of young wolves (Руковский 1985). Often, especially in North America, wolves prey on beavers (Landry and Van Kruiningen 1979; Павлов 1990, DelGiudice 1998). Their proportion in the diet can reach from 14 % (Belarus) (Павлов 1990) up to 63% (Canada) (Руковский 1985). Given the chance, wolves will eat fish, and they are also known to eat amphibians, reptiles, insects and plants – grass, berries and fruit (Новиков 1956, Формозов и Голов 1975, Павлов 1990).

Wolf diet studies in Latvia indicate that wolves mainly prey on wild ungulates (cervids and wild boar) – they constitute about 75–85% of the wolf diet (Žunna et al. 2009). At the end of the 1990s, beaver was a common food object as well (14–30%) (Andersone and Ozoliņš 2004a), but in recent years their occurrence has decreased below 10% (monitoring data). As in other parts of their distribution range, Latvian wolves also eat hares, rodents, insectivores, small carnivores, birds, reptiles, insects and plants (Andersone 1999, Andersone and Ozoliņš 2004a, Žunna et al. 2009).

The wolf diet varies depending on the season. In winter, wild ungulates predominate (Reig and Jedrzejewski 1998) while a more diverse diet is typical for the summer, including birds, small mammals, berries, fruit etc. (Руковский 1985). In winter, livestock carcasses used by hunters as bait can be a significant part of the diet (Lesniewicz and Perzanowski 1989, Smietana and Klimek 1993, Authors' obs.).

In landscapes transformed by humans (such as farmland), where wild ungulates are scarce or absent, wolves can increase their attacks on livestock (Формозов и Голов 1975, Salvador and Abad 1987, Meriggi et al. 1991, Papageorgiou et al. 1994, Poulle et al. 1997, Sidorovich et al. 2003) as well as feed at dump sites (Boitani 1992). The frequency of attacks on livestock depend not only on wildlife prey abundance, but also on the livestock protection measures put in place, landscape characteristics and the proximity of forests to pastures (Rigg et al. 2011). Moreover, attacks on livestock are much less frequent in the northern forested regions of the distribution range than in the southern areas (Руковский 1985). It was also observed that attacks were more frequent in places with high wolf densities residing in small forested areas (Jędrzejewski et al. 2004), whereas, as the number of wolves decrease, possibly selection is enhanced towards individuals that are likely to specialize on livestock (Приклонский 1985). It is possible that wolf-

dog hybrids attack livestock more often as they are less afraid of humans and more easily adapt to the synanthropic lifestyle (Рябов 1988). There is also a view that solitary, non-territorial wolves attack livestock more often (Бибиков и др. 1985c), while stray dogs could account for a proportion of attacks (Andersone et al. 2001).

Under-guarded livestock that are left unattended, either overnight or tethered, are more likely to suffer from carnivore attacks (Павлов 1990, Blanco et al. 1992, Boitani 2000, Balčiauskas et al. 2002, Rigg et al. 2011). Attacks on livestock are reduced by taking appropriate precautions. For example, keeping livestock in sheds overnight, guarding by shepherds and dogs, as well the use of electric fences, deterrents, and other methods (Blanco and Cortes 2000, Gilady 2000, Balčiauskas et al. 2002, Moberly et al. 2003, Musiani et al. 2003, Štrbenac 2005, Rigg et al. 2011). Data on damages caused by wolves in Latvia have been collected by the State Forest Service (SFS) since 2001. Analysing reports of wolf attacks on domestic animals over 12 years, it was found that the most predated livestock are sheep (82.1%), with cattle (8.2%), goats (5.9%) and dogs (3.8%) killed less often (Fig. 2a). Sheep are also injured most frequently (91.4%; Fig. 2b). Calves are the most attacked among cattle. For comparison, in the previous research period sheep were killed less often (57.6%), while other species were killed more often: cattle (18.6%), goats (16.9%) and dogs (6.8%) (Ozoliņš et al. 2008a).

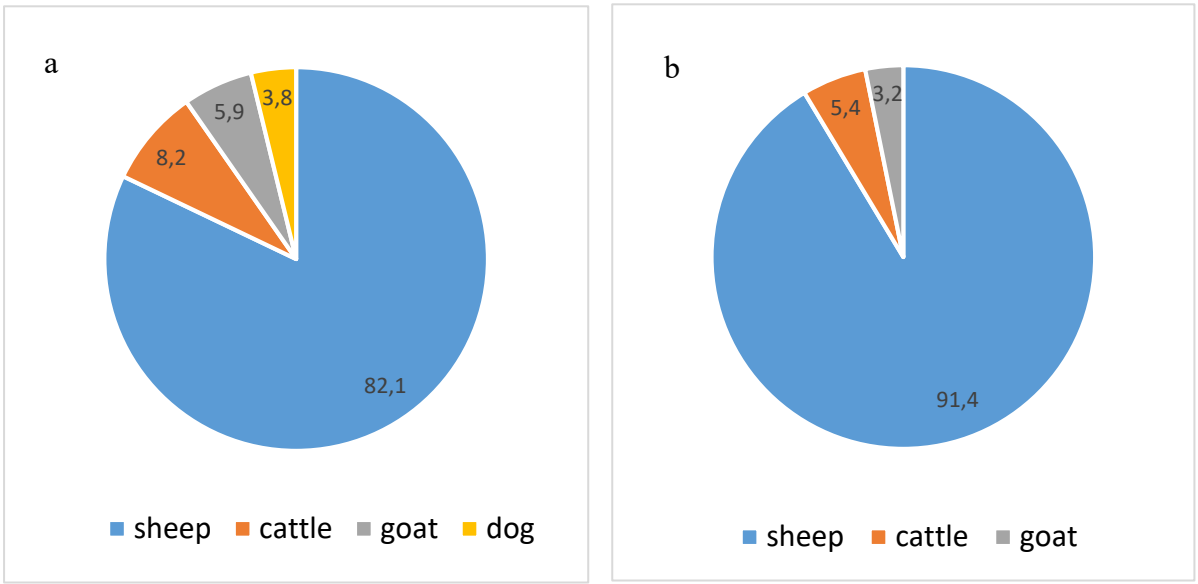

Figure 2. The proportion of killed (a) (n=118) and injured (b) (n=38) livestock in attacks from 2005 until 2016 (data from SFS, see also Table 5 in Ch. 4).

In Estonia and Lithuania livestock mortality patterns are similar. Sheep are also attacked most often, whereas cattle, goats and dogs are less frequently attacked (Männil and Kont 2012, Kaczensky et al. 2013). This has also been found in other countries such as Russia (Формозов и

Голов 1975), Slovenia (Adamič et al. 2001), Spain (Blanco and Cortes 2000), Croatia (Štrbenac 2005), and Poland (Gula 2008), and is most likely related to the ability of these animals to protect themselves. In Estonia, 1655 animals were killed within four years (2007–2010). Also, several dogs were attacked in 2003–2005. Most likely these attacks were carried out by individuals specializing in hunting dogs, as evidenced by the fact that after the suspected wolf individuals were killed, the frequency of attacks on dogs decreased. In Estonia, compensations have been paid for killed livestock since 2007 (Männil and Kont 2012). In Lithuania, around 1550 animals have been killed in three years (2014–2016), and the State compensates for lost animals (L. Balčiauskas, pers. com.). The majority of attacks occurred between May and November, with 50.2% of attacks occurring in August and September (Fig. 3). During the winter months, attacks were infrequent or non-existent (2%). Similar tendencies of attacks per month were also observed in Latvia in previous years (Ozoliņš et al. 2008a). In other countries most attacks also occurred in summer and early autumn (Формозов и Голов 1975, Прусайте и др. 1985, Andersone 1998c, Balčiauskas et al. 2002, Štrbenac 2005).

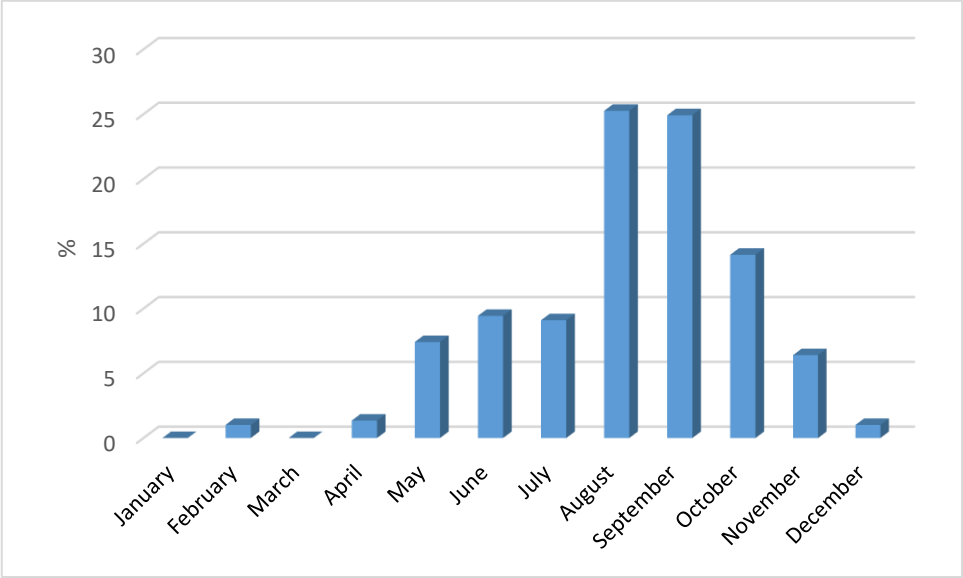

Figure 3. The distribution of wolf attacks (n=297) on livestock per month during years 2005–2016 (data from SFS).

The majority of attacks occur at night. In recent years, livestock are kept in fenced areas more often, but the use of such preventive measures was largely inadequate to protect animals from wolf attacks; for example, due to the use of not sufficiently high fences or a single electric wire, when an electric fence would be needed.

In Latvia, no compensation system or direct support for the implementation of preventive measures has been implemented yet, except for the available financial support for the Latvian

Rural Development Program in 2014–2020, under the measure " Investments in tangible assets ", when, together with various construction projects, it is possible to install agricultural fences or pasture/shed lighting fixtures, etc. There are various ways of developing a compensation system. For example, in some countries losses are only compensated for owners who have taken livestock protection measures, thus developing the use of preventive measures, as well as promoting compulsory livestock insurance (Boitani 2000, Balčiauskas et al. 2002). In other countries, the purchase of equipment necessary for livestock protection is financially supported instead of compensation for predation losses (Gilady 2000), or farmers are provided with puppies of special watch-dog breeds (Štrbenac 2005). If wolf damage is compensated, trained specialists, who investigate the attacks and determine the carnivore species, are required (Boitani 2000).

Population structure, reproduction and demographic parameters

Wolves usually live in packs consisting of family members – parents, pups and 1–2 year old subadult individuals. On rare occasions, non-related individuals are accepted into a pack. Young animals usually leave the pack after reaching 1–2 years of age, in some rare cases after the age of three. The pack has a determined social hierarchy that reflects the pack's age, sex and reproductive structure. The main (parental) pair, alpha-male and alpha-female, has the highest rank. Other animals take accordingly lower ranks. Usually, only the alpha-pair breeds in a pack, very rarely there are packs with several breeding pairs (Mech 1970). In Europe, wolf populations are significantly impacted by hunting and large packs are rare (Boitani 2000). The pack reaches it maximum size in autumn and winter when young animals still remain with their parents (Mech 1970, Калецкая и Филонов 1987). The pack size depends on both ecological and social factors – wolf numbers required for successful hunting, the size of the main prey (big packs hunt larger animals), social contact between animals, internal competition. It is believed that social factors are the most crucial ones, because they start to operate even before the amount of prey decreases (Zimen 1976).

In the temperate zone the wolf mating season is January – February, with pups being born in the end of April – May (Новиков 1956, Tauriņš 1982). A female can give birth to up to 13 pups (usually no more than 5–6). In Russia, on average 6 to 8 pups were found in selected regions (Формозов и Голов 1975, Рябов 1988), while in south-eastern European countries 4 to 6 pups (Adamič et al. 2001), in Poland – an average of 6 pups (Jędrzejewska and Jędrzejewski 1998), in Lithuania and Finland – an average of 5 pups (Balčiauskas 2002, Kojola 2005) were reported. The litter size is related to population density, nutritional conditions and to the level of persecution by humans. The sex ratio among pups is usually close to 1:1. In places where there are few wolves, there is often a slight prevalence of females, while in the case of a very large number of wolves,

more males are born (Данилов и др. 1985). However, pup mortality is high – 50% die within the first 3 months, and 65% within the first year (Jedrzejewska et al. 1996).

Cubs are born in dens, usually prepared in burrows. Newborn pups are blind and deaf. Their eyes open at 11–15 days of age. At the age of three weeks, they start to venture from the den and leave it at the age of about 8–10 weeks. At about one month of age, pups start eating meat – at first partially digested food that is regurgitated by their parents or other members of the pack. At the age of 10–12 months, the young wolf has reached the size and appearance of an adult animal (Mech 1970). Young animals learn to hunt with adults until they leave the pack or are at least 9 months old (Packard 2003). If young wolves lose their parents early, they have not yet gained sufficient skills to independently hunt ungulates, and thus they can become problematic by attacking livestock. To avoid this, it is not recommended to hunt wolves before the young animals reach the age of 6 months (Brainerd et al. 2008).

According to research data from Latvia over 10 years, the sex ratio of hunted wolves was 1:0.97, with slightly more females than males, but this difference was not statistically significant. On a long-term scale, the average number of embryos per female was 6.0 (n=82). As many as 57% of adult females participated in reproduction (monitoring data). This value varies from year to year (Fig. 4), though it is not possible to collect enough data each year in order to have statistically significant differences. It was also found that some females began to mate in the second year of life, which is usually only observed at high hunting pressures and in particularly favourable living conditions, as well as in the arrival at new and vacant territories. The hunting load also affects the proportion of females involved in reproduction – in uncontrolled, stable wolf populations the proportion of reproductive females is usually less than in managed populations (Mech et al. 2016). In recent years, the proportion of reproductive females in the population is relatively high in Latvia, but the average litter size is smaller (Fig. 4). One explanation could be a decrease in the age of reproductive females – younger females usually give birth to smaller litters (Kojola 2005, Mech et al. 2016).

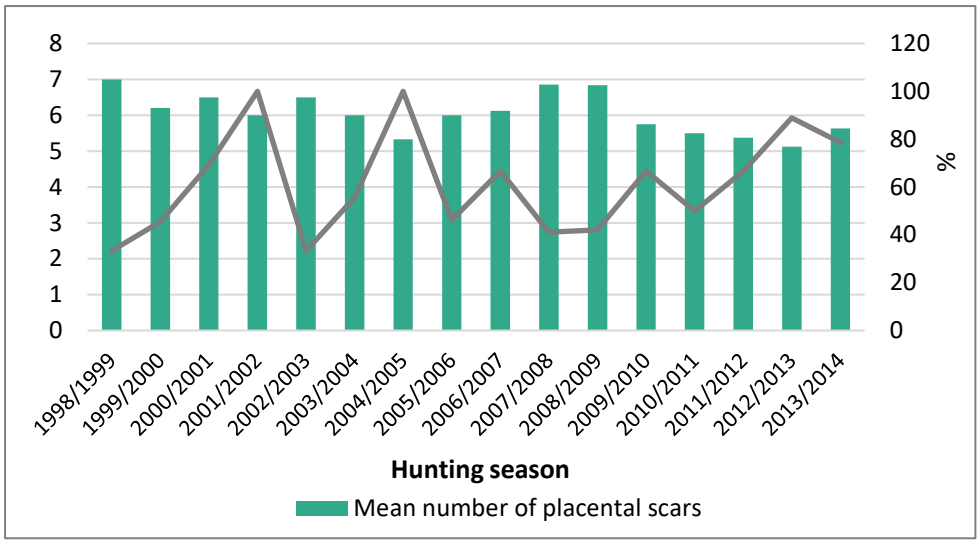

Figure 4. The average litter size for female wolves hunted in Latvia determined by the number of placental scars, (after Туманов 2003) and the proportion of adult females that had offspring in the year they were hunted (if the carcasses were collected from March until December) or were in heat (if the carcasses were collected from January until March).

Both the dynamics of the number and the age structure of the population are influenced by anthropogenic factors – mainly wolf hunting (Смирнов и Кориытин 1985). Adult wolves give the most offspring at the ages of 4 to 8, but with rigorous hunting the animal rarely reaches the age of 8–9 years (Павлов 1990, Туманов 2003). Hunting also affects the average age of the population (Fuller et al. 2003) and increases the proportion of young animals, which can exceed even 50% of the population (Данилов и др. 1985). In Poland, the oldest hunted animal in the 1990s was 5 years old, suggesting a decrease in the average age of the population and indicating a high hunting load (Jędrzejewska and Jędrzejewski 1998). The maximum age that wolves can reach in the wild is 15–16 years (Новиков 1956).

In Latvia, an impact of intense hunting loads on the wolf age structure has been observed, with the average and maximum age of hunted wolves tending to decrease with time. In recent years, the average age of animals did not reach 4 years (Fig. 5). The oldest hunted wolves were 12 and 13 years old in the 1990s, but in the previous 10 years the oldest hunted animals were 8 and 9 years old (Fig. 6).

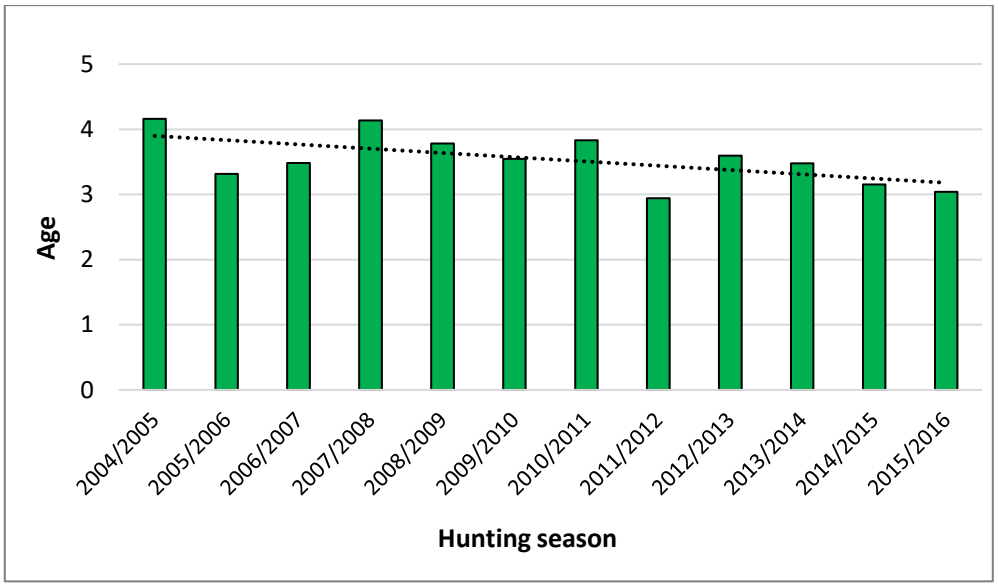

Figure 5. Average age of hunted wolves (calculations include individuals over two years of age).

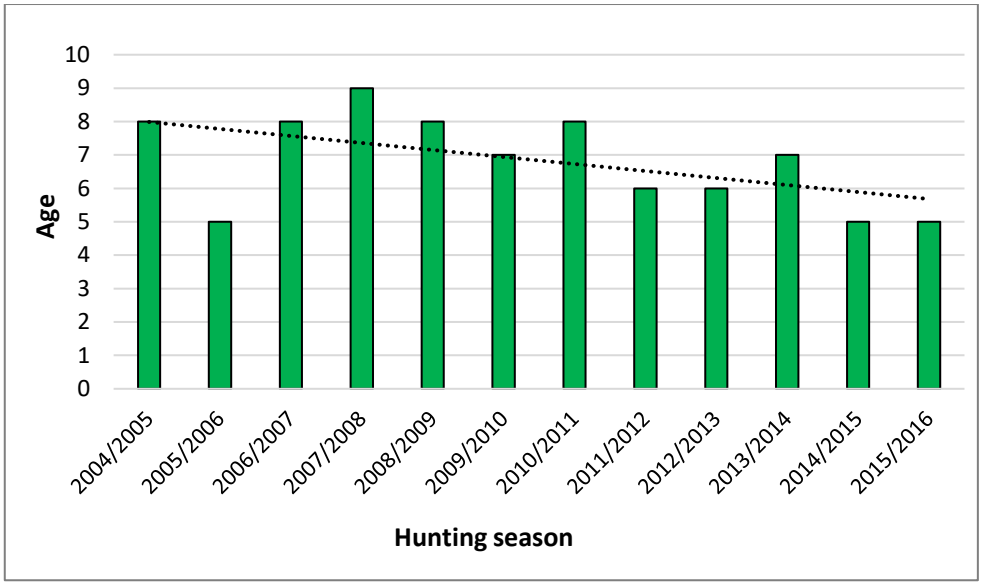

Figure 6. Maximum age of hunted wolves (calculations include individuals over two years of age).

The sex and age structure of the population indicates compensation for the losses caused by high hunting pressure, especially during the previous 10 years. In addition to the relatively large proportion of females involved in reproduction and the participation of young females, changes in the age group distribution of hunted wolves has also occurred. Compared to the sex and age structure pyramid of the previous research period (Fig. 7; Ozoliņš et al. 2008a), the latest data on hunted wolves indicates a higher proportion of animals under the age of one year, as well as a significant decline in wolves of one and two years of age (Fig. 8).

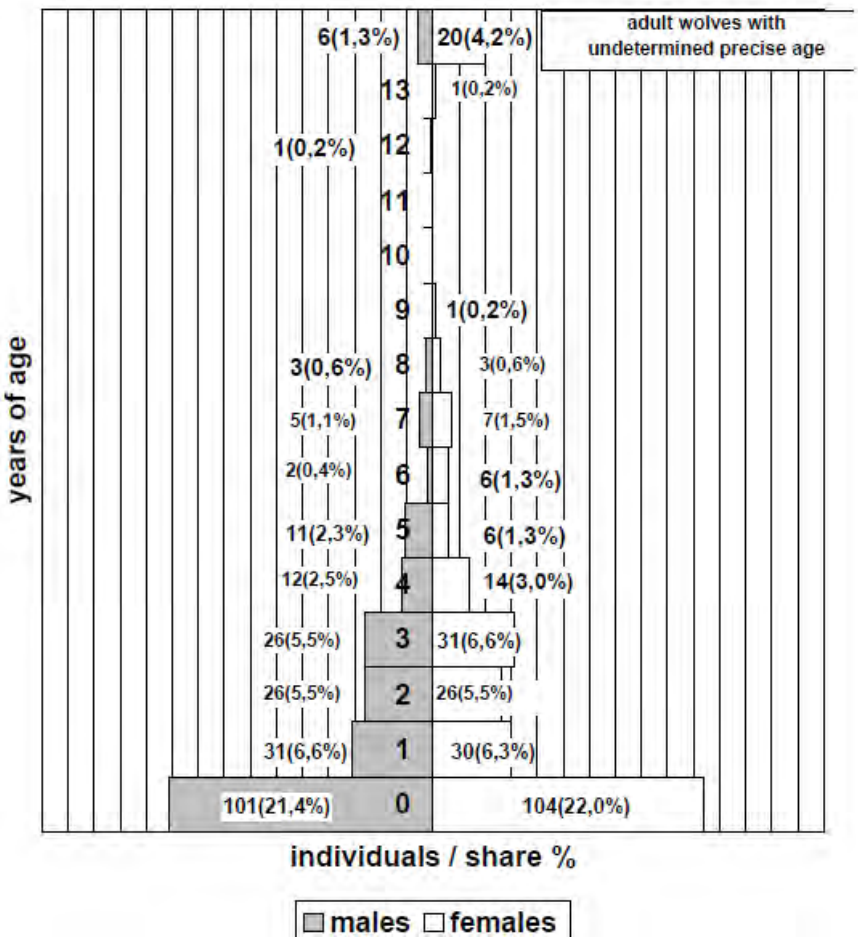

Figure 7. Wolves harvested in Latvia (from 1998 to 2007; n=473) that had their sex and exact age determined during the large carnivore monitoring programme (Ozoliņš et al. 2001).

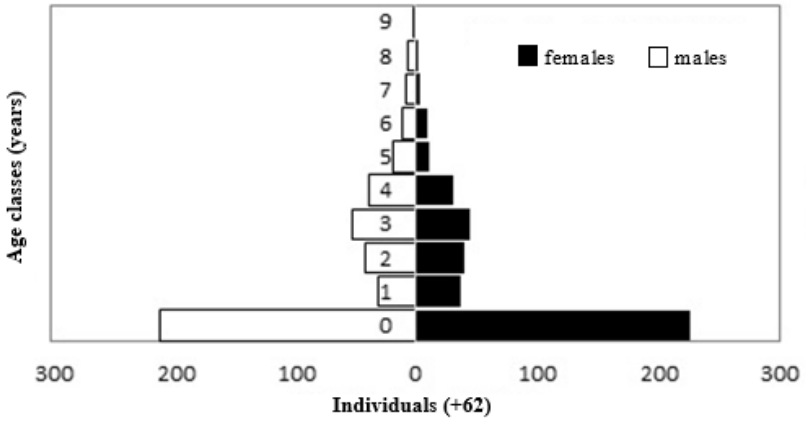

Figure 8. Sex and age structure of wolves hunted from 2004 to 2014. The sample consisted of 436 wolves younger than one year of age, 67 one year old and 379 adult individuals (number of adult wolves of unknown age indicated by "+" in parentheses below the graph).

Of wolves hunted during the hunting season, individuals who have not reached one year of age comprise about half of the total number of hunted individuals (on average ~53%) in the last

10 years (Fig. 9), while the proportion of one-year-old wolves has been below 10%. In Estonia, the average proportion of wolves younger than one year was 56% (37–67%) and the proportion of one-year-old wolves was 18.6% (Männil and Kont 2012). In Russia, it was found that the animals younger than one year accounted for 51% , but one-year-olds only constituted around 15% of hunted wolves (Смирнов и Кориытин 1985), in Finland, these proportions are 42% and 28%, respectively (Kojola 2005). The hunted wolves' age structure pyramid may not precisely reflect the age structure in nature, and there may be several explanations for the lack of one-year-old individuals among hunted wolves. One reason may be an over-intensive exploitation of the population and immigration of three year old animals to Latvia from areas where hunting is less intense or non-existent. The second reason may be the lifestyle of one and two year old wolves, in that when they leave the pack they are solitary and are more difficult to be observed and hunted. It is likely that the reason may be a combination of the two processes mentioned above.

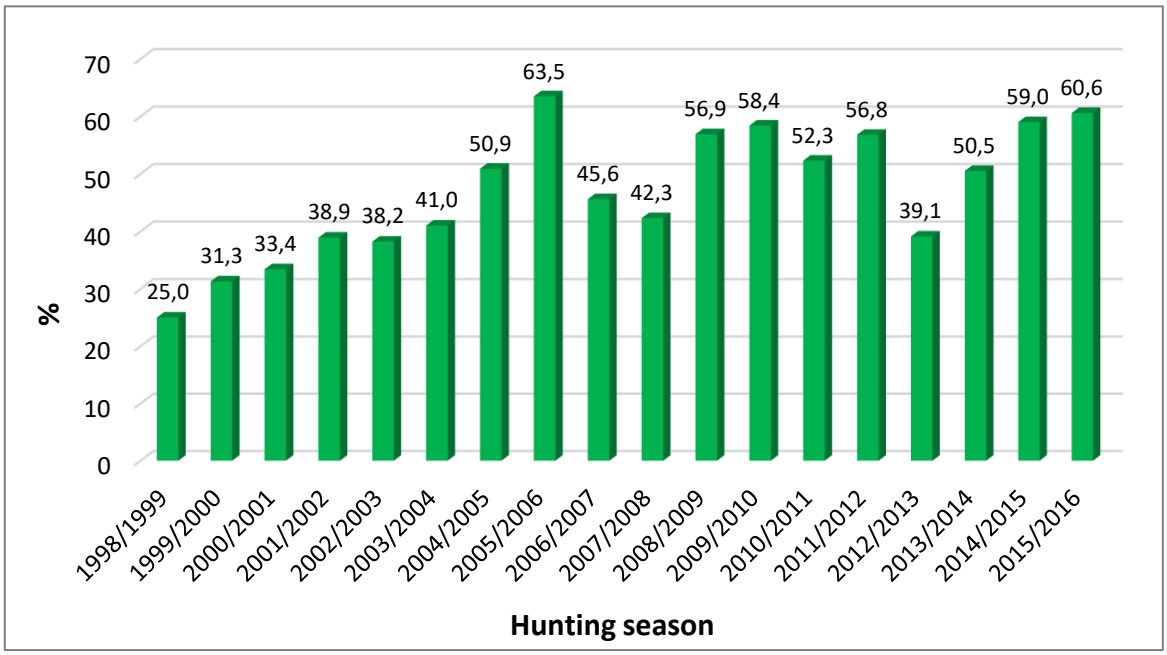

Figure 9. The proportion of wolves younger than one year of age among the harvested sample in Latvia.

1.3. Species distribution and population size

In the 1980s, the wolf distribution range in Europe reached its minimum. However, in the last 15 years there has been an increasing trend both for the range and population size (Chapron et al. 2014). Due to natural dispersal, wolves are returning to France, Switzerland, Austria and Germany (Fig. 10). In many areas, e.g., in France and Switzerland, populations have been re-established in sheep farming territories where they can cause severe conflicts between economic

interests and nature conservation (Poulle et al. 1997), which have only continued to intensify (Kaczensky et al. 2013). Currently, wolves in Europe are widespread in nearly all countries, except for islands, Belgium and the Netherlands. Some individuals have entered Hungary (Boitani et al. 2015) and Luxembourg (https://www.wort.lu/en/luxembourg/welcome-back-first-official-proof-of-wolf-in-luxembourg-since-1893-59a94f1f56202b51b13c287c#). In Austria in 2016 (Linnell 2016) and in Denmark in 2017 (http://mst.dk/service/nyheder/nyhedsarkiv/2017/jul/ulvepar-med-hvalpe-fanget-paa-vildtkamera/) the first cases of wolves breeding were detected.

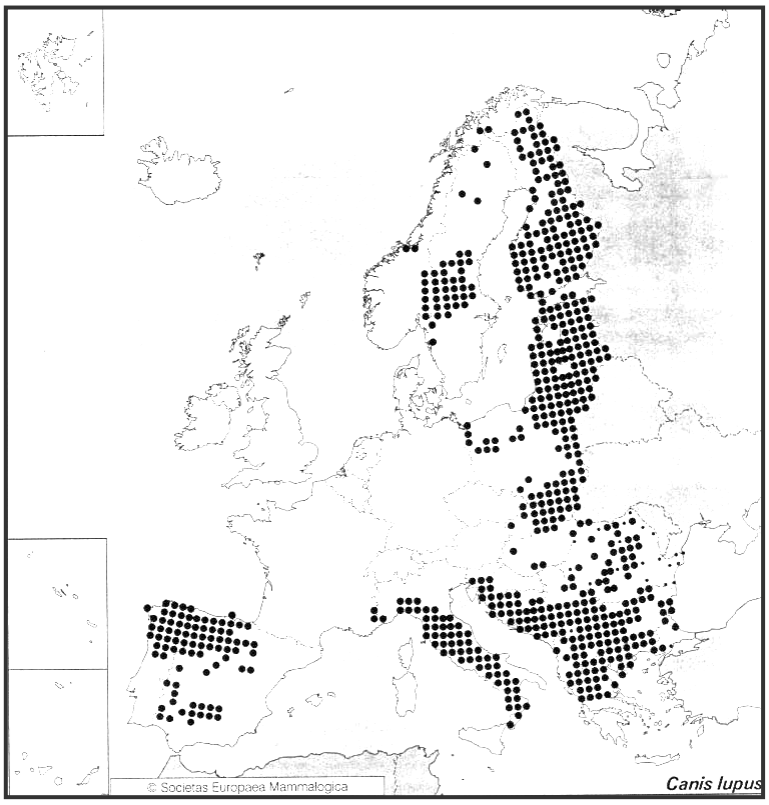

Figure 10. Wolf distribution in Europe according to 50x50 km UTM squares in the Atlas of European Mammals, excluding the CIS countries (Mitchell-Jones et al. 1999).

According to social, ecological and national political factors, 10 wolf populations have been identified in Europe (Fig. 11, Table 1). Information on the species and population characteristics and distribution is regularly updated through international cooperation of wolf experts. The latest update was conducted in 2012, which was commissioned by the EC and implemented by the European Large Carnivore Initiative (IUCN SSC LCIE). According to the latest update (Kaczensky et al. 2013), the Baltic population consists of about 900–1400 individuals, namely wolves inhabiting the Baltic countries (Table 2), NE Poland and Belarus. Together with wolves from N Ukraine, and some regions in the Russian Federation (Leningrad,

Novgorod, Pskov, Tver, Smolensk, Bryansk, Moscow, Kaliningrad, Kursk, Belgorod and Orel) the wolf population consists of ca. 5000 individuals.

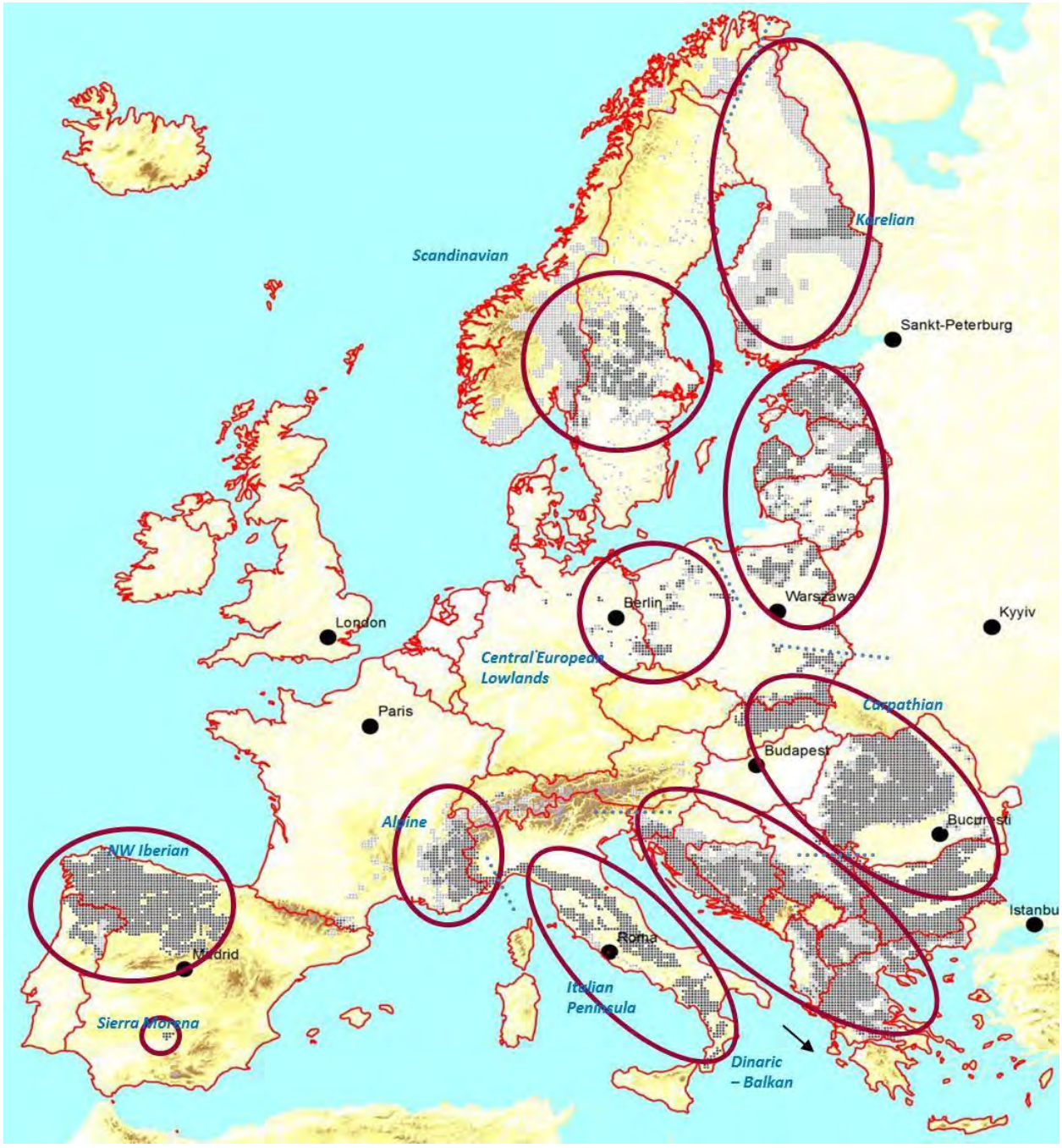

Figure 11. Wolf populations in Europe (Boitani et al. 2015).

Table 1.
Wolf populations in Europe (Boitani et al. 2015).

Name of the population	**Countries**	**Number (up to 2010)**	**Trend**
Scandinavian	Norway, Sweden	250–300	Increasing
Karelian	Finland	150+	Decreasing?
Baltic	Estonia, Latvia, Lithuani, Poland	900–1400 (5000, including part of Belarussian and Russian population)	Stable
Central European lowland	Germany, Poland	300	Increasing
Carpathian	Slovakia, Czech Republic, Poland, Romania, Hungary, Serbia	3500	Stable
Dinara-Balcan	Slovenia, Croatia, Bosnia & Herzegovina, Montenegro, Macedonia, Albania, Serbia (including Kosovo), Greece, Bulgaria	4000–5000	Stable
Apennine	Italy	800	Stable
Alpine	Italy, France, Switzerland, Austria, Slovenia	>160	Increasing
NW Iberian	Spain, Portugal	2500	Stable
Sierra Morena	Spain	1 pack	Decreasing

The worst conditions for wolves in the Baltic population are in Poland, where they are affected by forest fragmentation and population isolation. A gap in the wolf distribution in central Latvia is also a cause for concern (Kaczensky et al. 2013). The northern part of the Latvian wolf population is linked to the Karelian population of about 150 individuals, which are separated by a

geographic barrier – the great Karelian lakes. Some weak links possibly exist with the Carpathian population in SW Poland.

Table 2.
Summary of the wolf population in three Baltic States (Männil and Kont 2012, Kaczensky et al. 2013).

	Estonia	**Latvia**	**Lithuania**
Area (thousand km^2)	45227	64589	65200
Human population (million)	1.31	1.97	2.87
Forest cover (%)	51[1]	52[2]	33[3]
Wolf population according to expert opinion (2010–2012)	~230	≥300	200-300
Annual harvest of wolves (2015–2016)	100–115[4]	270–280[5]	55–60[6]
Hunting season	01.11.–28.02.	15.07.–31.03.	15.10.–01.04.
Estimate basis	Number of breeding pairs	The sex-age structure of the harvested sample	Snow-tracking (number and distribution of tracks)

[1] in 2016 - http://www.keskkonnaagentuur.ee/sites/default/files/mets2016_08.08.pdf
[2] in 2015 – data from State Register of Forest
[3] in 2012 - http://www.gmu.lt/forest_resources/
[4] http://www.keskkonnaagentuur.ee/sites/default/files/mets2016_08.08.pdf
[5] data from SFS
[6] http://www.am.lt/VI/index.php#r/966

The inventories conducted by the SFS and previous forest administration institutions indicate trends in the wolf population size since the 20th century (Fig. 12). In Latvia during the 20th century, the number of wolves strongly fluctuated depending on hunting intensity. The number increased after the First World War, reaching several hundreds, but over the next 20 years, after the establishment of an independent state, wolves almost went extinct, and in the 1940s only 17 wolves were listed. After the Second World War the population recovered, but in the 1960s lethal control of the wolf was again reinforced throughout the territory of the former USSR, and in Latvia the number was reduced to a few individuals. It was only in the 1970s that the population began to recover, reaching the second peak of the post-war period in the mid-1990s. In later years, as hunting intensity increased, the number of wolves declined significantly, but since 2004 when hunting quotas and closed seasons were introduced, the number of animals has increased.

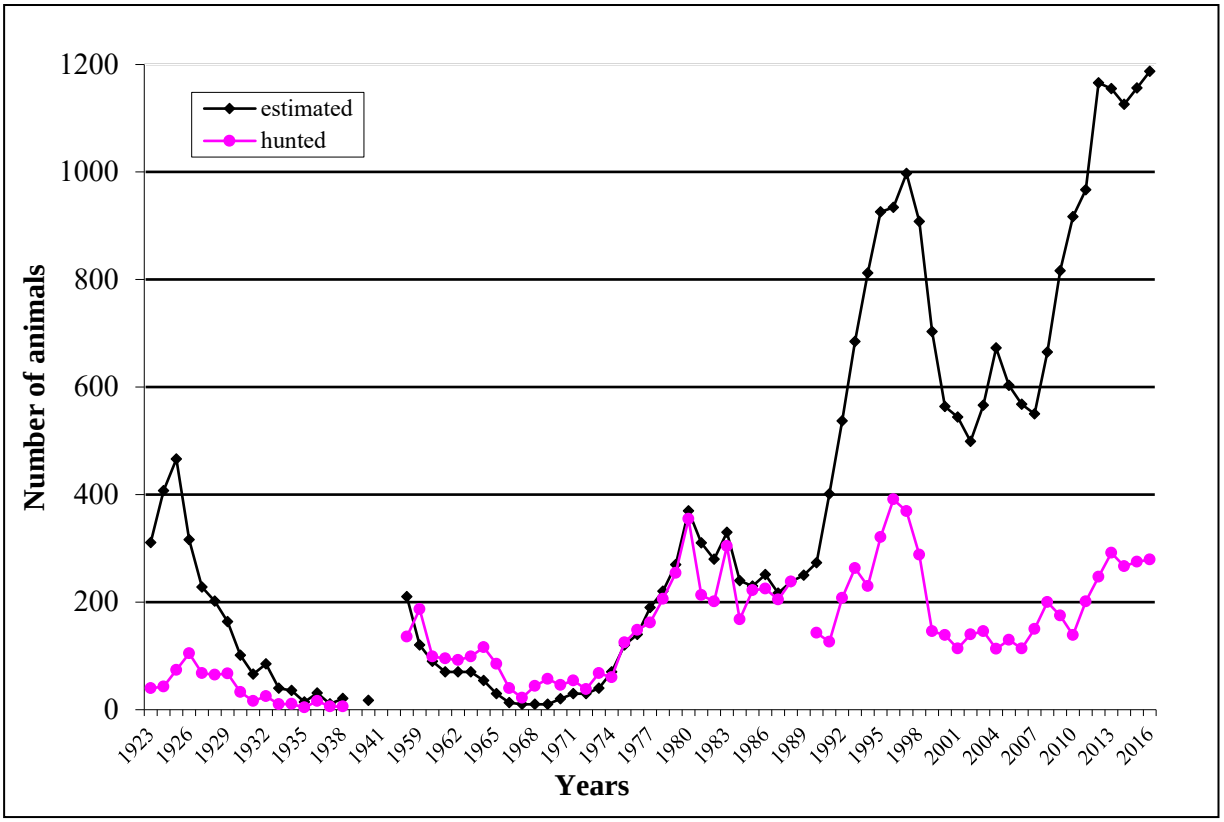

Figure 12. Population dynamics of wolf numbers in Latvia. No data are available for the period of the Second World War and following years, as well as for 1989 (SFS statistics).

Although in recent years the wolf population, according to official statistics, has been evaluated at about 1000 individuals before the birth of pups, at the end of the hunting season, according to experts, there are no more than 200–300 wolves in Latvia. Differences in estimates result from different methods used. The official methodology is subject to a greater overestimation of the animal number. Expert judgment is based on analysing data of hunted animals and subsequent changes in population structure. The population size can also be estimated by using the virtual population analysis from the age structure data obtained from sampling hunted animals (Fry 1957, Skalski et al. 2005). Using this method, it is estimated that the Latvian wolf population has increased from 350 to 670 individuals (before hunting) since the introduction of hunting restrictions (Fig. 13). By contrast, as the hunting quotas have been raised, the number of carnivores after each hunting season was actually up to two times lower than the estimated values.

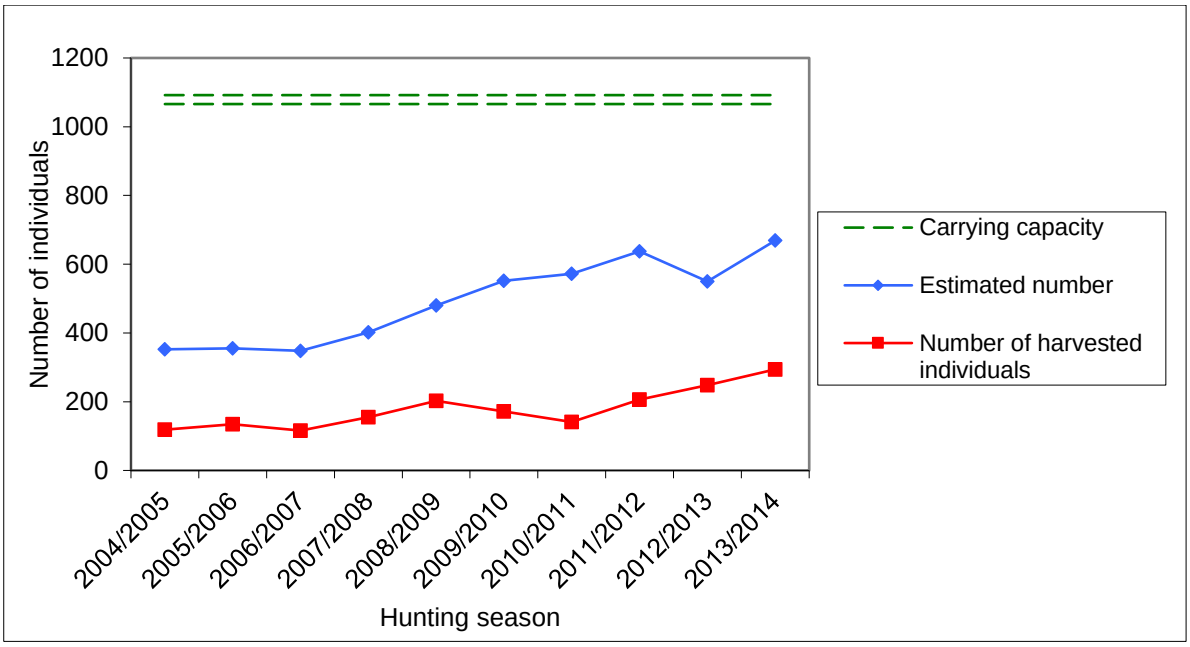

Figure 13. Carrying capacity (according to Kawata 2008), estimated number and hunting dynamics of wolves in Latvia.

Although the population has been regarded as stable in recent years, the area inhabited by wolves in Latvia has had a tendency to become more fragmented. There are two main regions of higher wolf density – Kurzeme and East Vidzeme in Latgale. The Zemgale plain with a small proportion of forests and the intensively urbanized vicinity of Riga may hinder migration of animals from east to west (Hindrikson et al. 2013). Maintaining the connectivity among these groups is of paramount importance as it guarantees the unity of the entire Baltic population, the centre of which lies within Latvia. In the long term, if ecological corridors are not provided, this can lead to an increase in isolation between these two subpopulations and ultimately to a decrease in genetic diversity (Randi 1993). Although current genetic studies do not give reason for concern about the decline in genetic diversity (Ruņģis et al. unpubl. data), the isolation risk of subpopulations still exists. Morphometric data of skulls from the 1990s indicated that animals of the same age from the eastern part of the population were larger than their western neighbours (Andersone and Ozoliņš 2000a), but these differences can be explained by increased wolf immigration from Russia at that time.

In order to determine the distribution of wolves in Latvia, a census of fresh tracks in snow was simultaneously conducted throughout the country in February 2007 by the SFS. The census showed that wolves were unevenly distributed in Latvia (Fig. 14). A similar impression is reflected by the distribution data of hunted wolves (Fig. 15), which means that the status of wolf distribution has not changed significantly over the last ten years.

Figure 14. Distribution of fresh wolf tracks, registered during simultaneous census throughout Latvia in March 2008, after 150 wolves were hunted in hunting season of 2007/2008.

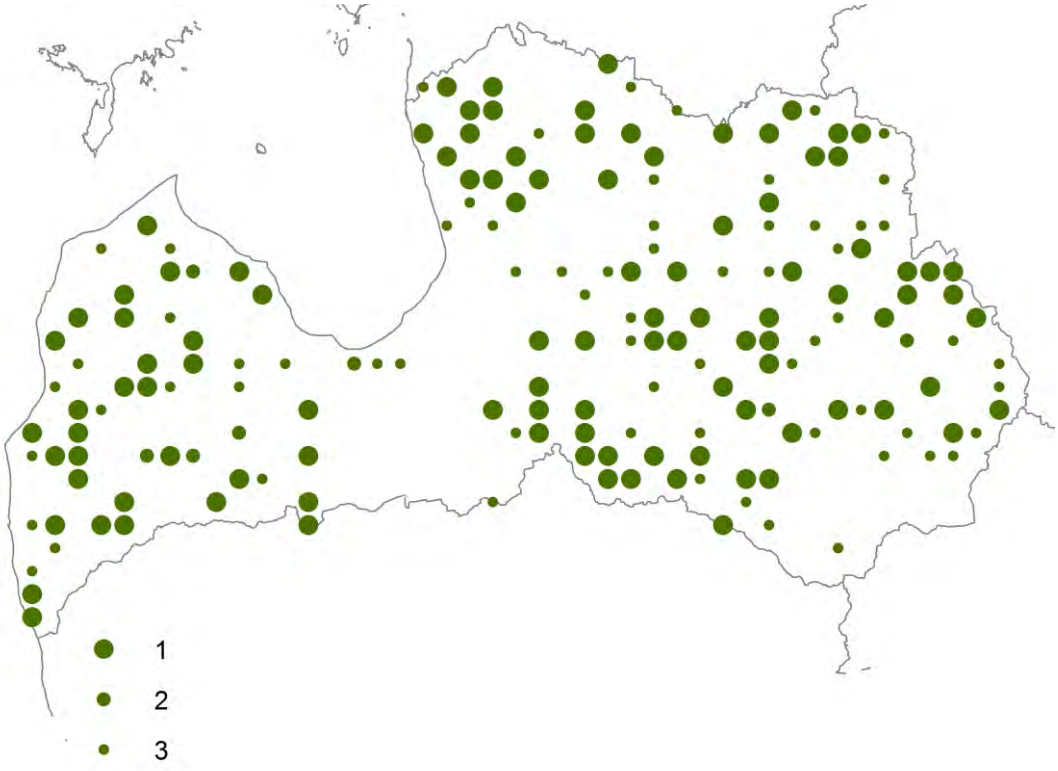

Figure 15. Distribution map of wolves after hunting results in 2012–2016.

1 – sites, where hunted wolves confirm reproduction in a nearby vicinity of 100 km^2 during the last three years. 2 – sites, where wolves have been hunted in at least 3 out of 5 recent years in a nearby vicinity of 100km2, but reproduction has not been confirmed during the last three years. 3 – sites, where at least one wolf has been hunted in the last 5 years, but no evidence of reproduction has been found.

Maintaining genetic diversity is an essential component of species conservation. A decline in genetic diversity negatively affects the existence and development of the population and individual adaptation of the animals (Garner et al. 2004). Genetic analysis methods have only relatively recently been utilised for investigation of carnivore populations. They can provide information on genetic diversity, inbreeding depression, and gene flow of populations. By linking genetic data of the kinship structure of the population with information on the lifespan of the concerned individuals and dispersal distances from the area of origin, it is possible to estimate population and generational dynamics, and spatial structure more accurately. Identification of groups of related individuals in the wolf population as well as investigation of their lifespan, dispersal distances and ratio to hunted unrelated individuals provide additional information for monitoring of the population status.

Samples from wolves hunted in Latvia have been analyzed in several studies on genetic structure, diversity and phylogenetic processes of wolf populations (Pilot et al. 2006, Hindrikson et al 2013, 2016, Stronen et al. 2013).

Current local genetic studies on wolves, which were hunted between 2009 and 2014 (Ruņģis et al. unpubl. data), indicate a very close relatedness among wolves inhabiting the territory of Latvia. The analysis showed 64 groups of related individuals (Fig. 16). In separate groups, loss of breeding individuals due to hunting was found. The genetic diversity of the population was relatively high. This was confirmed by parallel studies, using samples from wolves hunted in Latvia (Hindrikson et al. 2013, Stronen et al. 2013). High genetic diversity was also confirmed for the wolf populations of the other two Baltic States (Baltrūnaite et al. 2013, Hindrikson et al. 2016), as well as for the wolf population in Poland, Białowieża Forest (Jedrzejewski et al. 2005). In the latter case, the observed high genetic diversity may have resulted from high hunting pressure, and subsequent influx of unrelated animals from neighbouring areas when existing pack members are lost.

Although the research conducted in Latvia did not show significant genetic differentiation within the population, a study in Estonia, in which genetic samples from wolves hunted in Latvia and Estonia were analysed, four distinct genetic groups in both countries were identified (Hindrikson et al. 2013). The most likely cause of such genetically-disrupted groups is the high hunting intensity. In a moderately harvested wolf population, such population structure is generally not observed, as stable social structure and unhindered movements of individuals between the packs do not create a foundation for genetically disassociated groups.

It is known that hunting affects the genetic diversity, gene flow, genetic and spatial structure of populations, disrupts the social structure and increases the risk of hybridization, but

there is still a lack of complete information on genetic and ecological consequences of hunting (Hindrikson et al 2016).

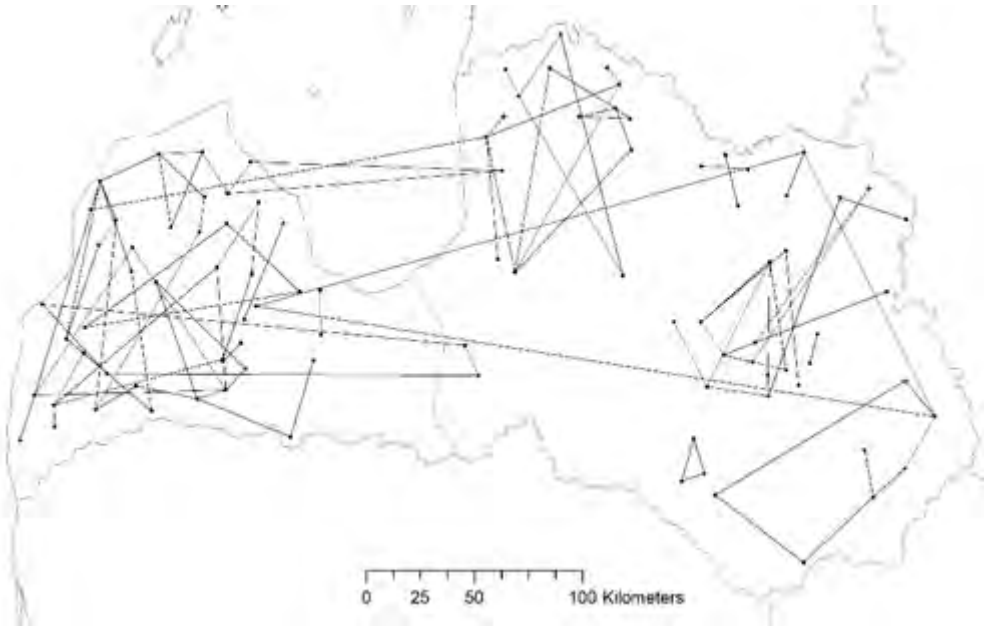

Figure 16. Distribution of related wolves hunted in 2009–2014 (lines connect hunting localities of interrelated individuals from 64 groups).

1.4. Threats and conservation status

On a global scale and according to the IUCN criteria, in 2001 the species was moved from the category 'Vulnerable' (which means that the number of individuals and the species range is steadily declining and the species requires population dynamics monitoring and special protection) to 'Least Concern' which is relevant for species that are widely distributed and are not threatened (Linnell et al. 2008).

On the European scale, the species is regarded as more endangered. In the Bern Convention, the species is included in Annex II (strictly protected species of fauna with a ban on capturing and killing, destroying resting and denning sites, disturbance as well as trade of live or dead individuals). Latvia ratified the Bern Convention on 01.05.97 with the clause that the wolf will not be protected. The EC Directive 92/43/EEC mentions wolf in Annex II (its habitats should be made specially protected areas) and Annex IV (exploitation ban). Latvia has a geographic exemption in that the wolf is an Annex V species which means that it can be hunted using methods that are not banned by the Directive provided there is population monitoring.

On the Baltic scale, the species status varies. In 1993, however, a joint document (Ingelög et al. 1993) acknowledges the wolf as a rare species only in Finland, Poland and Sweden. Since then, the population status has improved in these countries also.

The wolf is not included in the Latvian Red Data book and according to the IUCN criteria it would correspond to the category of 'Least Concern' (Linnell et al. 2008).

1.5. Previous research

Wolf research in Latvia began in 1997 when a 3-year project ("The ecological background of wolf control") was commissioned by the SFS to the State Forest Inventory Institute. During that project, background data were obtained on species ecology in Latvia, population spatial and demographic structure and morphometrics. Some observations of presumable wolf damage to game species were reported previously (Gaross 1994, 1997), but these were made in limited areas and could not be extrapolated to the entire country.

In 1998 the first MSc thesis was completed at the Faculty of Biology of the University of Latvia. In total, three MSc theses (Andersone 1998c, Žunna 2005, Mihailova 2013) as well as two BSc theses (Priekulis 2006, Mihailova 2011) have been completed. In 2002, one PhD thesis (Andersone 2002) was defended and another PhD thesis is currently in preparation (A. Žunna). The relevant studies have been conducted within a framework of projects funded by the Fund for Environmental Development (1998–1999), the Danish Environmental Protection Agency (1999–2000), the grant of the Latvian Council of Science (2001–2008), Fund for Hunting Development of the Ministry of Agriculture (since 2005), the Norwegian Council of Science (2003–2005) and the European Social Fund (2014–2015).

In 1998–1999, The Fund for Environmental Development financed a project "Biological and socio-economic prerequisites of the long-term existence of wolves and lynx in Latvia" in the North Vidzeme Biosphere reserve. The project supported the collection of scientific data in this region and published a pamphlet on wolves.

In 1999, a joint project between the Estonian and Latvian Funds for Nature, "Conservation planning of wolves in the Estonian-Latvian cross-border region", was started in co-operation with Latvian and Estonian border guards. During two winter seasons, transboundary movements of wolves across the Estonian–Latvian, Latvian–Russian and Estonian–Russian borders were registered. The study indicated that there was a relatively intensive cross-border movement of wolves between the neighbouring countries, but without marking of individuals it was difficult to assess the extent of this process and its significance for the Latvian wolf population. Studies and data collection on wolves along the northern border of Latvia also occurred in 2003–2005 within the PIN–Matra funded project "Integrated Wetland and Forest Management in the Transborder Area of North Livonia" (Ozoliņš et al. 2005).

In 2003–2005, the Norwegian Research Council funded a cooperation project where partners from the Norwegian Nature Research Institute (NINA), Estonia, Lithuania and Poland participated. Within this project, wolf research data were compared and published throughout a wide area from Norway to Poland (Andersone and Ozolins 2004b, Linnell et al. 2006).

Since the beginning of the 2000s a study on Latvian wolf genetics was initiated in collaboration with researchers from other countries, including the course and intensity of the wolf/dog hybridization process (Andersone et al. 2002, Hindrikson et al. 2012, 2013, 2016). In 2014–2015 the establishment of a genetic monitoring system of wild species for large carnivores was launched with the project of the Human Resource Excellence for Research of the European Social Fund

Research on wolf diet began at the end of the 1990s (Andersone 1998a, 1999, Andersone and Ozoliņš 2004a, Valdmann et al. 2005, Žunna et al. 2009). Such studies are continued within the framework of the species monitoring program. Research on wolf parasite fauna is based primarily on parasitic worms (Bagrade et al. 2009). Craniometric data of wolves have been collected by Andersone and Ozoliņš (2000a). Species dynamics, distribution and reproductive success have been published in several scientific papers (Kawata et al. 2008, Jedrzejewski et al. 2010, Ozoliņš et al. 2011, 2014). Wider attention is paid to the evaluation of species conservation and management issues (Ozoliņš 2001, Ozoliņš et al. 2001, Andersone-Lilley and Ozolins 2005, Ozoliņš 2006, Kawata 2008, Ozoliņš et al. 2011, Bischof et al. 2012, Chapron et al. 2014, Ozoliņš et al. 2014, 2016).

Public opinion on wolves has been studied twice, once in 2001 (Andersone and Ozoliņš 2004b) and then again in 2004 within the project "Large Carnivores in the Landscapes of Northern Europe: an Interdisciplinary Approach for Regional Species Conservation" funded by the Norwegian Council of Science (Linnell et al. 2006, Ozoliņš et al. 2008a). A new inquiry of public opinion was conducted at the time of the current Action Plan renewal (A. Žunna et al., unpublished data).

As part of the wolf monitoring currently conducted in Latvia, a portion of hunted animals from the annual harvest (Fig. 17) are collected for research purposes to determine sex, age, female fecundity, as well as assessing dietary components, parasitological status and kinship structures in the wolf population (by DNA analysis). Data for population monitoring are ensured by both official game statistics provided by the SFS as well as results provided within the framework of research projects performed by the LSFRI "Silava". Methods for monitoring wolves, including methods used in Latvia (http://biodiv.daba.gov.lv/fol302307/fol634754), are collected and

published by Linnell et al. (1998). Most of them have also been tested and implemented in North America.

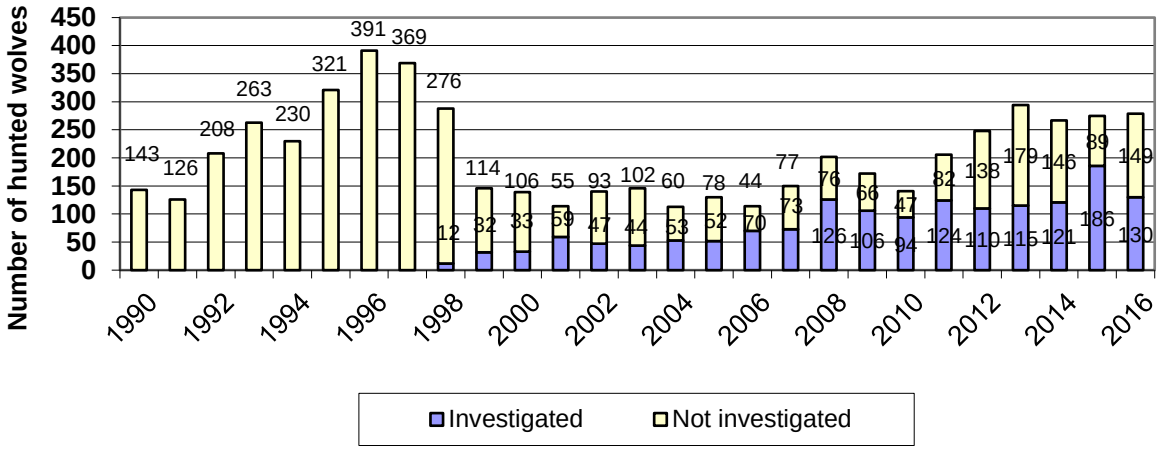

Figure 17. Number of wolves hunted and collected for examination in Latvia.

The Large Carnivore Initiative for Europe of the IUCN combines and co-ordinates wolf experts from all of the relevant European countries and regions. Information about projects, international co-operation and results can be obtained on their website: www.lcie.org.

The Action Plan for wolf conservation and management in Latvia has been developed and updated since 2002.

Gaps in knowledge and approach to species research

In order to improve the assessment of the impact of hunting on the wolf population in Latvia and within the Baltic region, there needs to be regular information collected on the hunting effort, i.e. how many hunters participate and how many days per year are devoted to wolf hunting and mammal hunting in general, during which wolves may also be hunted. There is currently no information about a) wolf migration between neighbouring countries, in order to assess the structure and genetic characteristics of the Baltic population; b) interaction with other carnivores (lynx, golden jackals). It is necessary to supplement species monitoring with non-invasive methods and to ensure comparability of species research data throughout the Baltic region.

2. Key factors affecting species status

2.1. Factors affecting species survival

The wolf is a species that can survive under various conditions. Today, however, its distribution is determined by anthropogenic factors. The main factor limiting wolf numbers in Latvia and almost all over its distribution range is direct persecution (Männil and Kont 2012,

Kaczensky et al. 2013). Other factors threatening the species, such as low population density and fragmented distribution, low genetic diversity, hybridisation with dogs etc., are all direct consequences of the primary factor.

In Latvia, wolf hunting was not limited in any way until 2003. There was no hunting quota, no closed season and up to 1999 there was a bounty system. However, wolves were never totally extirpated within the country. Although wolf populations can tolerate very high hunting pressure, it is believed that the numbers start reducing after more than 30–40% of the biologically determined population is killed (Ballard et al. 1987). Though precise data are not available, by taking into account the population trend, it can be estimated that in the mid-1990s, when more than 300 wolves were killed during one hunting season (Fig. 12), the population size at the beginning of the hunting season must have been around 900 individuals. This estimate is almost the same as the official figure, though one should remember that the official census has always been conducted by the 1st of March, i.e., at the very end of the hunting season when there is still snow on the ground. Therefore, the population was most likely assessed without taking into account harvested individuals. From 1998, the official statistics show a decline in the wolf population followed by a period of relative stability. Since 1999, on average about 130 wolves are hunted annually, while the census data ranges from 500 to 700 individuals. According to Mech (1981), if a population is stable, then the number of wolves killed per year should be about the same as the number of wolves younger than one year. In Latvia, the proportion of young wolves is 50–60% (Fig. 9), therefore, it can be assumed that during the last 10 years, about 50–60% of the population is harvested annually (this assessment applies only to the part of population that inhabits the territory of Latvia, and not to the total Baltic wolf population). This, in turn, means that there are only about 500 wolves at the beginning of the hunting season. Hunters find it difficult to accept such an estimate as they consider wolf hunting much more energy-consuming and less efficient than hunting for other species. Most wolves in Latvia are shot when hunters are waiting for other animals. In contrast to lynx, where most of the quota is reached within the first month after the hunting season is open (Ozoliņš et al. 2008b), wolves are hunted relatively evenly throughout the hunting season (Fig. 18). Targeted wolf hunts are organised mainly in February and in the beginning of March when snow conditions are favourable and the hunting season for other species is over. However, by that time, about 70% of the quota has already typically been fulfilled. Therefore, it can be inferred that the sample of harvested animals is primarily the result of accidental encounters between hunters and wolves and as such it is reflective of the natural age and sex structure, unlike for other species where hunting selection is much stronger.

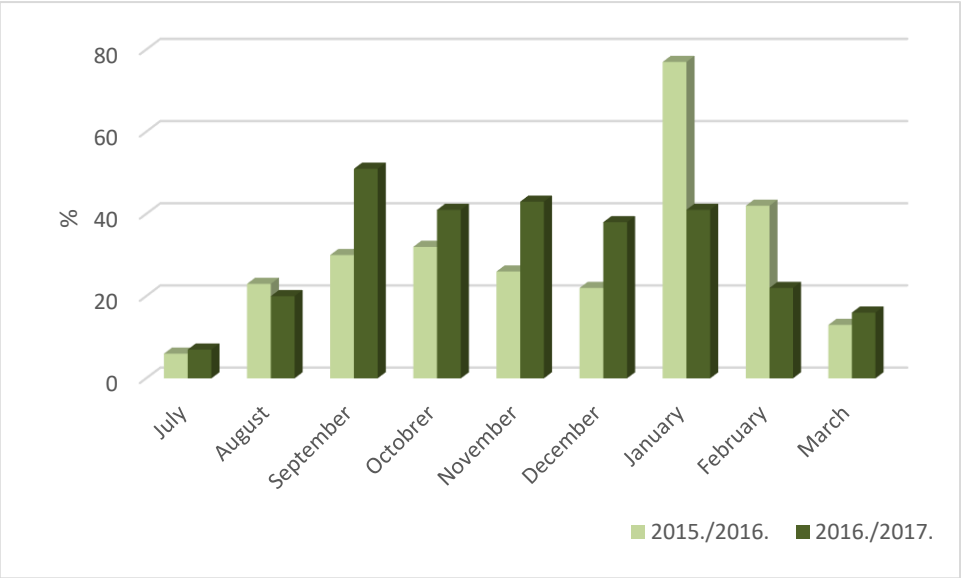

Figure 18. Distribution of hunting bag throughout the year in hunting seasons 2015/2016 and 2016/2017 (n=279, data from SFS).

The main motivation behind intense wolf hunting in Latvia is a deeply rooted belief among hunters that the wolf is their competitor for wild ungulates, as well as for protection against attacks on livestock (Andersone and Ozoliņš 2004b). Reported damage to livestock is very limited and localised, and targeted hunting to prevent damage has rarely been successful. Damage would be more effectively reduced through educating farmers and providing information on measures to avoid such conflict situations, as well as establishing a financial support system for livestock protection measures.

There are several other arguments promoting wolf hunting. Most likely, these reasons do not affect the hunting bag very much, but they have to be taken into account when collecting data for population monitoring:

- wolf pelts and skulls are assessed at hunting trophy exhibitions according to international standards (International Council for Game and Wildlife Conservation (CIC));
- the wolf has always been a relatively rare trophy and killing one increases the social rank of the hunter;
- in the last few years, there has been an increased demand for taxidermied wolves as an interior design feature;
- the opportunity to kill a wolf while hunting for other species is tempting for foreign hunters in whose home countries wolf hunting is banned.

All this indicates that wolf hunting is not only a management procedure to limit carnivore populations but also a tradition in itself. In such a situation it is essential to choose the right arguments for restricting wolf hunting without conveying the impression that hunting traditions are endangered. Quite the opposite, hunting traditions (i.e., a wish to hunt the species in a sustainable way) can be used as a regulating instrument in wolf conservation that would reduce disagreements regarding the upper limit for the wolf population and its influence on populations of other species.

Since 2004, there has been a hunting quota and a restricted hunting season lasting from the 15th of July until the 31st of March. When planning the initial quota for the hunting season in 2004–2005, the average hunting bag from the previous years (150) was chosen as a reference point by the SFS. Because this quota was not reached, the next two years had a reduced quota of 130. The same quota was set also for the hunting season of 2007–2008, when it was already filled in mid-February. Due to the reports of attacks on livestock and a case of rabies in wolves, the SFS immediately set an additional quota of 20 individuals in W Latvia. This quota was reached by the end of the hunting season. From 2010, according to official census the number of wolves began to increase, and the hunting quota was increased (Table 3).

Another reason for the negative attitude and a perceived need to control wolf numbers is also a fear of carnivores and opinions on the danger of wolves to humans (Andersone et al. 2001, Linnell et al. 2002, Fritts et al. 2003, Roskaft et al. 2003). Often these beliefs are supported by various legends, tales and false stories (Boitani 2000, Randveer 2001). Usually wolves avoid humans, but there have been some cases when they have attacked people, mostly children and women (Осмоловская и Приклонскй 1975, Павлов 1990, Rootsi 2001, Linnell et al. 2002). Most attacks in Europe occurred in the 19th century and after World War II, when wolf numbers were high (Павлов 1990). Most commonly people have been attacked by rabid wolves (Новиков 1956, Павлов 1990), but animals feeling endangered, provoked (Linnell et al. 2002), old, injured and inferior (Осмоловская и Приклонскй 1975, Павлов 1990, Rootsi 2001) can also attack. Wolves that have lost their fear of humans can become dangerous, hence controlled hunting may in some cases help maintain a cautionary fear towards humans (Linnell et al. 2002). It is known that wolf-dog hybrids have attacked people, which often show greater aggressiveness and less fear of humans (Рябов 1985, Швейцария 2001). In Europe today, wolf attacks on humans are rare and casualties have not been reported in recent decades. In the Baltic States, people have been mostly attacked by rabid animals. The last such case in Latvia was registered in 2001 in Latgale (Linnell et al. 2002).

There is very little information in Latvia on wolf mortality that is not a result of hunting. According to the data from the territorial units of the SFS, in the last few years 3–4 wolves have died on the roads, which is a new but probably growing mortality factor in Latvia.

Table 3.

Number of hunted and accidentally killed wolves in 2004–2017.

Season	**Quota**	**Number of hunted and accidentally killed wolves**
2004/05	150	119
2005/06	130	134
2006/07	130	116
2007/08	150	155
2008/09	200	202
2009/10	180	172
2010/11	140	141
2011/12	200	206
2012/13	250	248
2013/14	300	294
2014/15	300	267
2015/16	275	275
2016/17	300	279

According to the data from the Food and Veterinary Service of the Ministry of Agriculture, in 1987–1998, there was on average one case of rabies in wolves per year. Recently, the occurrence of rabies in wolves has decreased and is on average found once every two years. In 2008, one case of rabies was confirmed, but since 2010 no wild animal infected with rabies has been detected in Latvia.

Sarcoptic mange is a disease that can cause epizootics in wolves. It has been found in Estonian and Scandinavian wolf populations (Männil and Kont 2012). In Latvia, sarcoptic mange has already been found in a small number of hunted wolves since the late 1990s, and since then the scale of the disease has grown. Some lethal cases have also been found (SFS reports).

Wolves have diverse parasite fauna – in Latvia, 17 parasite species were found in wolves (Bagrade et al. 2009), consisting of tapeworms, nematodes and trematodes. The most common species are the trematode *Alaria alata* (85.3%) and nematode *Trichinella* spp. (69.7%), as well as

tapeworms *Taenia multiceps* (47.1%), *T. hydatigena* (41.2%) and nematodes *Pearsonema plica* (41.4%) and *Uncinaria stenocephala* (41.2%). All examined wolves were infected by at least one parasite species (maximum 8 species). Recent studies indicate that the level of infestation by parasites does not increase with the animal's age, thus, it is unlikely that parasites can significantly influence the status of the population in general.

Wolves almost have no natural enemies throughout their range, though there have been reports of conflicts with bears (Матюшкин 1985). In Latvia, it was observed that a golden eagle *Aquila chrysaetos* was feeding on a young wolf (U.Bergmanis, pers. comm.). Wolves can die when hunting large ungulates such as elk which can effectively protect themselves and even kill wolves (Сабанеев 1988). However, such cases are rare and do not have a significant impact on the wolf population. In various parts of the range, wolves live together with several carnivores, such as lynx, bears, foxes and raccoon dogs (Матюшкин 1985). A small proportion of carnivorous animals are found in the wolf's diet (Руковский 1985, Kohira and Rexstad 1997). It has been found that foxes and raccoon dogs are sometimes killed, but not eaten by wolves (Павлов 1990, Jędrzejewska and Jędrzejewski 1998). Most competition occurring between wolves and other carnivores is for food resources, but usually this only happens in circumstances when numbers of prey species are low and insufficient (Матюшкин 1985).

In the temperate zone, the lynx may be considered as the wolf's main competitor. However, the data on the distribution of both species in Latvia does not support this idea. The relationship between wolf and lynx will vary between regions. They may quietly coexist in some areas whereas wolves may also affect the number of lynx in others. There are known cases when wolves have attacked and eaten lynx. It has been observed that in areas where the number of wolves decreases, the number of lynx increases (Матюшкин 1985). It is likely that wolf can outcompete lynx due to its social structure (pack) and greater demand for food. Both species select similar prey, but lynx predominantly hunts small ungulates (roe deer) while wolves prefer larger species (Jedrzejewska et al. 1997).

Competition for food is possible not only with other carnivores, but also, for example, with wild boar that willingly consumes remnants from wolf kills, and therefore indirectly competes with carnivores (Матюшкин 1985). At the same time, wild boar is an important prey item for wolves (Andersone and Ozoliņš 2002) and a large wild boar population can be regarded as a favourable factor.

Wolves have a positive effect on scavengers, leaving them remnants of their prey (Wilmers et al. 2003, Selva 2004). Foxes, raccoon dogs, badgers and various birds tend to feed on wolf leavings (Матюшкин 1985, Jędrzejewska and Jędrzejewski 1998).

Stray and feral dogs can be a threat to wolf populations, and there is a trend to keep wolves and wolf-dog hybrids as pets (Boitani 2000, Fritts et al. 2003). Hybridisation between wolves and dogs is quite common in some regions and has been observed in North America, Italy, Eastern Europe (Randi et al. 2000, Štrbenac 2005), Krasnodar, Krasnoyarsk, Voronezh regions in Russia as well as in Asia, Moldova as well as in other regions (Гурский 1975, Рябов 1985). Such interbreeding threatens the genetic integrity of the species and is particularly dangerous for endangered species (Vilà and Wayne 1999). It is believed that hybrids are not a threat to a viable wolf population as they do not typically cross-breed with wolves in further generations. From the ecological point of view, hybrid populations can compete only with wolf populations that have been weakened by some other factors (Zimen 1990). Hybridization is facilitated by a decrease in wolf numbers and the disruption of the social and sexual structure of the population as a result of human activity (Рябов 1985). To some extent, this interbreeding can be considered as an adaptive reaction – as the population size decreases, the animals attempt to restore their number (Гурский 1975). Wolves occasionally make contact with dogs when there are high densities of dogs, but usually the wolves are inferior, injured individuals, solitary females or wolf-like hybrids (Рябов 1985).

Wolf and dog hybridisation in the wild also happens in Latvia as it was confirmed by a hybrid litter from Silene (Кронит 1971).Genetic confirmation of hybridisation was also obtained in March 1999, when a litter of seven pups was found in the Aloja forest district. After blood sample analysis, it was determined that the mitochondrial DNA was typical for wolves (Andersone et al. 2002). The latest hybridization confirmed by genetic analysis was found in November 2008. In Dikļi, two young female wolves that were hunted from the same pack had a pelt colour and structure untypical for wolf (Hindrikson et al. 2012). In this case, a female dog had interbred with a wolf male, which is a rare case, since hybridization between female wolves and male dogs is more commonly found. Each of these hybridisation cases were found in sites with low wolf densities (Andersone et al. 2002). Hybridization cases by genetic analyses have been confirmed in Estonia, but have not been detected in Lithuania (Baltrūnaitė et al. 2013, Hindrikson et al. 2016).

In nature, wolf-dog hybrids occupy the same ecological niche as wolves, but their behaviour may vary in different circumstances. Usually these animals live closer to human settlements, are active during the day, are more likely to attack livestock (even in the presence of humans), are less cautious and display a greater aggressiveness than wolves (Осмоловская и Приклонскй 1975, Рябов 1985).

Stray dogs are found in several countries, especially where there are no wolves. These animals, while occupying the niche of a wild carnivore, often cause more damage than wild

carnivores, attack livestock, carry diseases, and interbreed with wolves (Осмоловская и Приклонскй 1975, Рябов 1985, Boitani 1992). A large number of stray dogs are also found in Latvia, mainly due to the irresponsible behaviour of dog owners (Andersone et al. 2002). Reducing the number of stray dogs depends on changing people's behaviour and attitude towards their pets. It is necessary to establish appropriate legislation and to reduce the number of stray dogs in order to reduce interbreeding between wolves and dogs and prevent the development of wild dog populations (Рябов 1985, Boitani 2000, Randi et al. 2000).

2.2. Factors affecting species habitat

Availability of suitable habitats is one of the key factors for species conservation. Landscape fragmentation, which results mainly from human activities, often restricts the movement of animals and threatens populations. One of the most important influences is the development of infrastructure (Jedrzejewski et al. 2010).

In Latvia, no significant impact of existing roads on wolf movements has been observed so far, but the construction of the *Rail Baltica* could change this. Within the framework of the *Rail Baltica* project, an assessment has been made on the potential impact of the railway line on the migration corridors and habitats of wild mammals. Providing wild mammals (including wolves) the opportunity to cross the *Rail Baltica* corridor, mitigating measures are planned to prevent the fragmentation of wild mammal populations and their possible gradual disappearance from certain places (for more information: http://edzl.lv/, section Environmental Impact Assessment).

In Latvia, forests and raised bogs are the main habitats for wolves, but there is no strong correlation between wolf numbers and forest cover (Fig. 19). There is a certain trend, though, when comparing both statistical parameters retrospectively (Table 4) which can be explained by the political and social changes in the country that influenced both forests and the wolf population. In the first half of the 20th century, agriculture became a priority which caused a decline in forest areas and intensive extermination of wolves. After WWII, forest areas started to increase (Matīss 1987, Priedītis 1999) but the Soviet government supported large carnivore extermination campaigns because wolves in the former USSR's area caused serious losses to livestock husbandry and hindered the development of professional game management which had a defined place in the state's economy. Also, in the Soviet Republic of Latvia, there were certain elements of the professional game management system (e.g., various state plans to supply game produce) which did not promote tolerance towards large carnivore presence within hunting grounds. However, in the 1980s the wolf population increased, which can be explained only by the increasing quality of

habitats that reduced competition between hunters and carnivores. During that time ungulate and beaver populations significantly increased in Latvia (Andersone-Lilley and Ozoliņš 2005).

An increase in forested areas and prey density are positive factors that ensured the existence of the wolf population until today. It must be concluded that forest cover is not the main factor determining wolf density, but forests and favourable feeding conditions have a positive impact on the renewal of the wolf population after a decline caused by direct persecution.

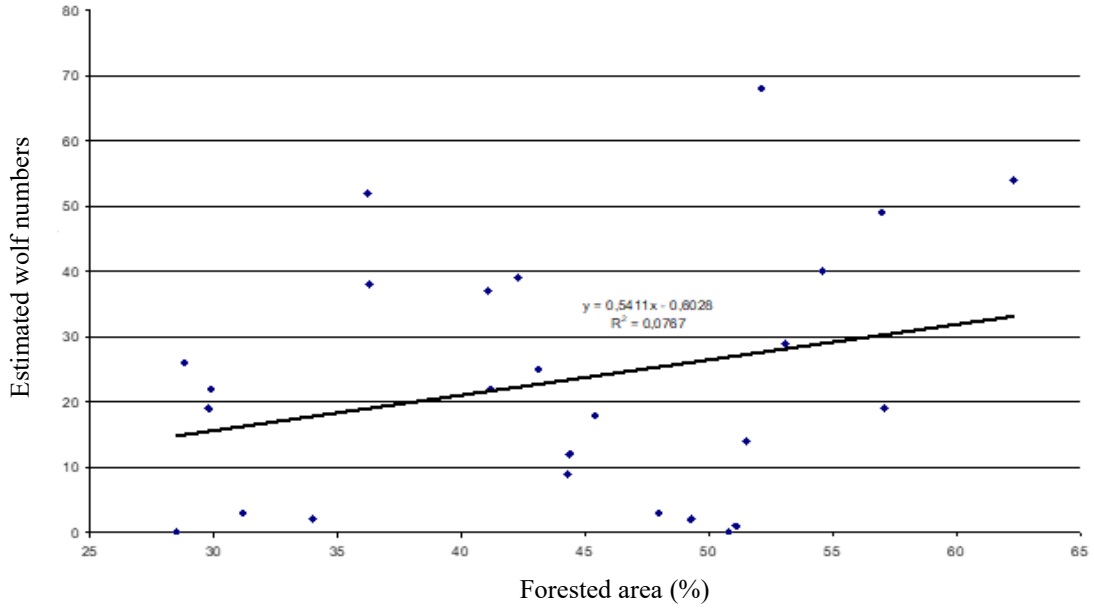

Figure 19. Correlation between the wolf number and forest cover in Latvia in 2005.

Table 4.

Changes in forested areas and wolf number in Latvia ((Kalniņš 1943, Kronītis 1987, Matīss 1987, Priedītis 1999, Strods et al. 1999, SFS data)

Year	Total forest cover (ha)	Number of wolves
1924	1780400	407
1929	1659200	164
1935	1747100	14
1961	2439500	70
1973	2578900	40
1983	2782300	330
2006	2950267	568
2014	3260000	1126

3. The present conservation of the species, effectiveness of the actions

3.1. Legislation

International obligations:

Convention on Biological Diversity (Rio, 1992). Latvia took part in signing the document and ratified it in 1995. Rather than containing any species lists or annexes, it provides general guidelines on the conservation of biological diversity, research and public awareness, which the parties within the agreement follow according to their capabilities and needs. The grey wolf is listed under Article 8 '*In-situ* Conservation'. Its enforcement in Latvia is implemented by the Law *On the Convention on Biological Diversity (Rio, 5 June 1992)* (adopted on the 31st of August 1995, enforced since the 8th of September 1995).

Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979). Wolf is listed under Annex II 'Specially protected fauna species'. Its enforcement in Latvia is implemented by the Law *On the Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979*) (adopted on the 17th of December 1996, enforced since the 3rd of January 1997). When ratifying the document, Latvia has reserved the right to stipulate a strict protection of wolves and can organize species exploitation with restrictions (closed season, means and methods of hunting), as well as regulating trade of the animals and their body parts.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES; Washington, 1973, in force since the 1st of July 1975). Wolf is listed under Appendix II as potentially threatened. This means that international trade with wolves is limited and may only occur under strict control. Its enforcement in Latvia is implemented by the Law *On the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington, 1973)*, adopted on the 17th of December 1996, enforced since the 3rd of January 1997, and by the European Council regulations, which are directly enforced in Latvia.

The wolf is included in Annex A of the Council's Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein, and its actual redaction while updating the Action Plan for this species is decreed by the Commission Regulation (EU) No 2016/2029 amending Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein. This regulation decrees a strict process, implemented by a system of special permits and certificates, on how individual wolves or their products can be imported or exported to or from the European Community and used within the borders of the European Community. It also regulates species' exploitation in local trade.

The European Council's Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. Wolf is listed under Annex II (wolf habitats have to be designated as strictly protected areas) and Annex IV (need of strict protection). Upon joining the European Union on the 1st of May 2004, Latvia has the so-called geographical exemption – the wolf is included in Annex V, which means that individuals can be obtained, but the state must provide a favourable population status, monitor the species and prohibit the hunting techniques listed in Annex VI of the Directive. The Directive's claims are implemented by all national legislation (laws, regulations issued by the Cabinet of Ministers, decisions of responsible institutions, decrees) concerning conservation and exploitation of wild species and natural habitats.

The role of international obligations in securing legislation:

International obligations, which the state has undertaken during the previous 20 years, play a substantial role in maintaining a species' favourable conservation status. There are additional recent requirements not covered by legal acts. These requirements are related to population recovery, preservation of current status or sustainable exploitation in situations where one biological population extends over the borders of two or more countries. The Baltic population of grey wolves meets such conditions. Scientists and species conservation experts have developed conceptual guidelines, which meet the requirements of international obligations as well as enhance collaboration between countries in practical population level conservation and management of large carnivores (Linnell et al. 2008, Boitani et al. 2015). They serve as explanatory and recommendatory documents for the achievement and conservation of a favourable wolf population status. Compliance with the guidelines will depend on the future ability of the Member States to cooperate at the international level and the desire to reconcile their national interests with the requirements of species conservation. The documents will also serve as a basis for assessing good practices in the management of large carnivores, including wolves.

National legislation:

In Latvia, according to the Law on the Conservation of Species and Biotopes (16/03/2000, latest amendments 08/10/2015) and Annex 2 of the Regulation No. 396 *List of the Specially Protected Species and the Specially Protected Species Whose Use is Limited* (Cabinet of Ministers, 14/11/2000), the wolf is classified as a specially protected species whose exploitation is limited.

The Law on Animal Conservation (09/12/1999, latest amendments 15/06/2017) permits the killing of wolves as a game animal in cases specified by law, but forbids cruel treatment of animals of all species as well as purchase, keeping in captivity, confiscation, offering for trade, keeping for sale or exchange of carnivores, except for zoos and registered wildlife breeding sites.

Exploitation of wolves occurs in accordance with the Hunting Law (08/07/2003, latest amendments 26/11/2015) and according to Regulation No 421 *Hunting Regulations* (Cabinet of Ministers, 22/07/2014, latest amendments 08/09/2016), wolf is listed among game animals. Wolf hunting is allowed from the 15th of July until the 31st of March in accordance with the quota set by the SFS. These regulations also determine the procedures for handling dead wolves, if the cause of death is not hunting.

The fines for illegal killing of wolves are 5 minimum wages if the killing occurred during the hunting season or 10 minimum wages if it occurred during the closed season according to Cabinet of Ministers' Regulation No. 1482 *Compensation of Losses Incurred via Breaking Hunting Jurisdiction as well as Compensation for the Illegal Game Products* (17/12/2013).

In turn, if the wolf has caused damage to agriculture (damage to livestock), the amount of damages is determined by the Hunting Coordination Committee, which is organized by the municipality of the relevant territory. The procedures of this process are laid down by Regulation No. 269 *Regulations on Hunting Coordination Committees and Determination of Damages Caused by Game Animals* (Cabinet of Ministers, 26/05/2014). Compensation, if protective measures have been enacted, is the responsibility of the user of the hunting rights in accordance with the Hunting Law.

In accordance with Regulation No. 1055 *Regulations for the list of animal and plant species of importance in the European Community requiring protection and the list of individuals of animals and plants that may be subject to conditions of restricted exploitation in the wild* (Cabinet of Ministers, 15/09/2009), issued according to the Paragraphs 15 and 16 of Article 4 of the Law on the Conservation of Species and Biotopes, wolf is listed among animal and plant species of importance to the European Community which require protection.

The procedure for international trade, storage, registration, capture, marking, marketing and certificate issuance of wolves is determined by Regulation No. 1139 *Procedure for the storage, registration, keeping in captivity, marking, trade and certificate issuance for international trade of endangered species* (Cabinet of Ministers, 06/10/2009).

Application of Latvian legislation in species protection and management

The legal protection of wolves in national legislation provides for practically all aspects related to maintaining a favourable species conservation status:

- Population status assessment.
- Possibility of limiting the amount of harvest and supervising its progress.
- Procedures concerning individuals that have been accidentally killed or found dead.

- Keeping and breeding conditions in captivity.
- Trade, import/export, storage and transportation of individuals and products.
- Penalties for unlawful killing.
- Liability for damage to agriculture and procedures for determining the extent thereof.

The hunting regulations, indicating that wolf is a game animal, provide for actions that are compatible with the status of a species of importance in the European Community that requires protection. *In general, national legislation provides for stricter supervision of the species' limited exploitation than it is formally derived from international law. The wolf is the only species listed in the Annex V of the European Council's Directive 92/43/EEC (which lists also beavers, mountain hares, pine martens, polecats), whose hunting is limited in Latvia and management is conducted in accordance with a previously elaborated Action Plan.* However, in deciding on wolf protection and management, the responsible authorities must follow a large number of legal documents with a complex delegation structure and a reciprocal hierarchy. As a result, there is a risk that, when making amendments and additions to legislation, as well as in individual cases and non-standard situations there are increasing difficulties in complying with legal protection requirements in the administrative process. Past practices indicate a number of risks.

In one case, an enquiry was made about the possibility of keeping wolves in a restricted area in circumstances similar to the wild (SFS, pers. com.), and the SFS is entitled to issue an authorization for the keeping of game animals in such areas without coming into conflict with the Law on Animal Conservation. However, in this situation, the regulation on the CITES species is binding, which is monitored by the Nature Conservation Agency (NCA).

The SFS, pursuant to the requirements of Section 2 of Article 20 of the Hunting Law, and using the methodology specified in Section 3 of Article 20 of this Law, is not able to conduct an assessment of the wolf population status and apply this assessment appropriately to determine the maximum allowable hunting quota, while, following the *Methodology for the assessment of the condition of game animals and the determination of the permissible hunting quota*, approved by the Ministry of Agriculture (02/27/2014) in accordance with Section 3 of Article 20 of the Hunting Law, there is a lack of guidelines for setting a quota for wolf hunting.

In the case of damage to agriculture (livestock) by game animals, the owner of the land or the user of the hunting rights if they have been transferred to another person by agreement is liable for damage. Evaluation of the amount of damage is conducted by the Hunting Coordination Committees, which are coordinated by the relevant municipality. For damage prevention, the SFS is entitled to issue permits for hunting of limited game animals outside of the specified hunting

period and the maximum allowable hunting quota. Such a regulation in the case of damage to livestock is not an adequate solution for wolves, which inhabit a much wider area than agricultural land, individual property or hunting district and usually do not return to the site of their previous attack soon after. According to the Hunting Law, users of hunting rights are responsible for damage. If the sufferer of the loss himself is a user of hunting rights, compensation is not even theoretically possible, moreover, in the case of other game species (not specially protected), users of hunting rights have greater opportunity to engage in the determination of the maximum allowable hunting quota through the municipal Hunting Coordination Committees and to regulate population density in such a way that damages are not incurred. Within the territory inhabited by a single wolf pack, which varies from 100 to 1000 km², depending on the number of individuals, hunting rights may belong to many physical or legal persons. If the wolf causes damage to one property, the determination of the responsible user of hunting rights is not possible, because the wolf inhabits a much wider area. Moreover, the wolf is protected by the state, which restricts the ability to control their number compared to other game mammals that cause damage, such as red deer or wild boar. In the case of wolves, the priority is to maintain a favourable species conservation status, which influences the scale of hunting, the hunting season and techniques. The losses are assessed only if adequate preventive measures are taken in the site of damage. An effective but not absolute protection measure against large carnivores is an electric fence with an appropriate voltage, rather than separate wires with electricity, which are sometimes used by livestock farmers in Latvia to protect livestock. If wolf attacks on livestock are rare, the cost of a fence funded solely by the owner may seem to be disproportionate to the risk of damage. Such a regulation can lead to farmers' dissatisfaction with the requirements of species conservation, when their implementation impedes their business and places different stakeholder groups in unequal situations. Not implementing livestock protection measures can also adversely affect the carnivore species, since access to uncharacteristic food sources changes the behaviour of animals and their role in ecological processes.

As a result, it should be acknowledged that in the area of legislation, specific guidelines for the management of wolves and other carnivores would be useful, which would facilitate the adoption of administrative decisions and the application of future legislative initiatives.

3.2. The role of specially protected nature areas and micro-reserves in species conservation

Wolves are found in many specially protected nature areas (SPNAs), but specific conservation measures are not implemented. In some cases only prohibitions or restrictions on hunting or supplementary animal feeding intended to reduce the overall disturbance of the site are

enacted. Nevertheless, the SPNAs have a major role in protecting habitats for large carnivores, including wolves. In addition to other natural values, these territories contain a higher proportion of environmental structures suitable for hiding places and dens – landslides, steep slopes, wetland shorelines, patches of mineral soils in large bogs etc. Hunting is allowed in most SPNAs that have developed nature conservation plans and individual conservation and exploitation regulations. Hunting of large carnivores, including wolves, is prohibited in Krustkalni Nature Reserve (NR) and Teiči NR. Hunting is prohibited in the nature reserve areas of Gauja National Park (NP) and nature reserve areas and hunting restriction grounds of Ķemeri NP, but in the rest of both NP areas wolf hunting is permitted only in the case of an outbreak or spread of epizootic diseases or if wolves cause significant damage to livestock and wildlife. In such circumstances wolves may be hunted in the landscape protection area and also in the restricted area of Slītere NP. In the severe regime zone of Restricted Area (RA) "Jaunanna", the hunting of wild carnivores with beaters is forbidden from the 1st of March to the 31st of August. In the controlled regime zone of RA "Ovīši", hunting is prohibited from the 1st of February to the 1st of August. In the nature reserve area of RA "Vecumu meži", hunting is prohibited from the 1st of March to the 15th of August. Hunting prohibitions and restrictions usually do not apply to the entire specially protected area, but to one of the functional zones. In general, most of the wolf population in Latvia live outside the SPNAs and micro-reserves, and their individual territories are much wider. Therefore, there is no reason to believe that additional protection of wolf habitats would be necessary in order to maintain a favourable conservation status of the population.

3.3. Previous species conservation actions and measures

The Action Plan for wolf, which was first developed and approved in Latvia in 2002 by the order of the Minister of the Environment, confirmed that the species exploitation complies with the provisions of Article 14 of the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora – wolves are obtained without affecting the favourable condition of the population, and, if deemed necessary, the following measures are to be executed:

- temporary or local prohibition of the taking of specimens in the wild and exploitation of certain populations;
- regulation of the periods and/or methods of taking specimens;
- application, when specimens are taken, of hunting rules which take account of the conservation of such populations;
- establishment of a system of licences for taking specimens or quotas;

- regulation of the purchase, sale, offering for sale, keeping for sale or transport for sale of specimens;
- assessment of the effect of the measures adopted.

According to this Action Plan, the conservation of wolves in Latvia also includes strictly limited hunting, because they have always been hunted and currently their distribution is the most extensive, compared to the previous 50 years. Moreover, the population range and wolf habitats substantially exceed the total area of Natura 2000 sites. A complete hunting ban in such a situation would create unpredictable consequences in public attitude towards the protection of wolves and wildlife, which could in turn also lead to an unpredictable impact on the species status. Representatives of stakeholders and the authorities responsible for wolf conservation and management, who were invited to a joint meeting on the renewal of the Action Plan for the grey wolf on the 17th of January 2017, were involved in the evaluation of the actions and measures recommended by the previous Action Plan. The evaluation was carried out by 35 persons who were asked to evaluate each of the previous planned activities of the Action Plan in a 10-point scale, taking into account their current utility and accomplishments, and the need to maintain them in the renewed plan. It was also possible to use a negative score (-1) if the evaluator did not support the activity at all. The results were summarised and an average rating was calculated for each activity (Fig. 20).

Monitoring of the population status as well as promoting research results and raising awareness received the highest evaluation of the accomplishments and the greatest support for continuation. Inspections of taxidermy workshops and fur processing workshops received the lowest rating. In general, it can be concluded that all activities receive a high level of support as their average score exceeds 5 points. Activities that have not been fully implemented so far were also positively rated, which can be explained as the view that these measures should be implemented as soon as sufficient funding and capability for their implementation is available.

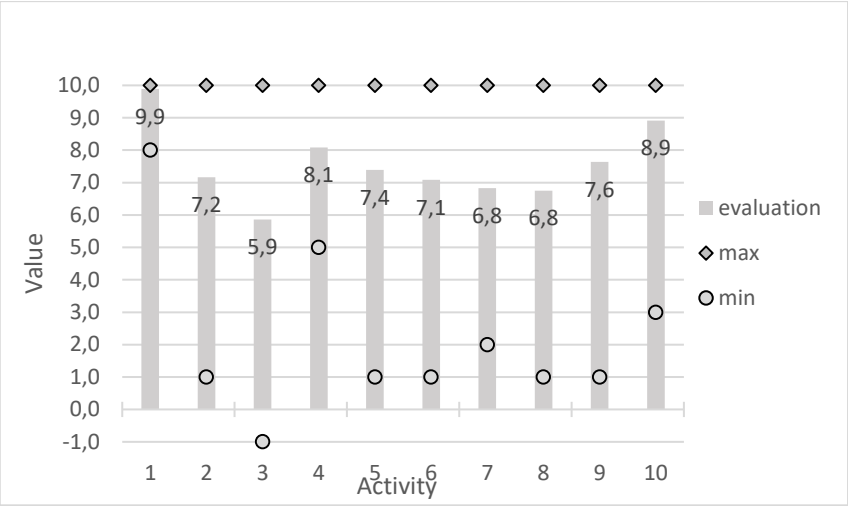

Figure 20. Evaluation of wolf conservation and management activities by the 35 representatives of the responsible institutions and stakeholders. List of activities as numbered in the graph:

1. *Monitoring of population status*
2. *Elaboration of the compensation system for wolf-caused damage where funding would be obtained from structural funds for rural support*
3. *Inspections of taxidermy workshops and fur processing workshops*
4. *Wolf diet research and assessment of wolf impact on prey populations*
5. *Raising awareness on livestock protection from wolf attacks, based on the experience from other countries*
6. *Telemetry project with the aim of investigating the home range and wolf territorial behaviour*
7. *Anonymous hunters' survey about wolf number, non-registered deaths and attitude towards the control system of wolf hunting*
8. *Introduction of a more user-friendly and fault-resistant system for reporting on hunted and dead wolves*
9. *Seminars for specialists from relevant fields on wolf (large carnivore) conservation events in the country*
10. *Public education and raising awareness*

Among other Action Plans for species conservation and management developed in Latvia, the Action Plan for the wolf is closely linked to the Action Plan for the Eurasian lynx (*Lynx lynx*) in terms of the content and implementation of the necessary measures. In the conservation plans for other species and habitats in Latvia, measures for wolf conservation and population management are not included.

4. Assessment of the requirements and capabilities for species conservation

Wolves require large individual and pack home ranges, and sometimes they move long distances in a short period of time. The territory of a single state and the NATURA 2000 network created within the EU, which consists mainly of relatively small protected areas, is not ample enough that countries could maintain a sufficiently large part of the population independently of

each other. Therefore measures for population monitoring, conservation and exploitation should also be coordinated at the regional cross-border level. Failure to do so and deterioration of population status in one country will endanger the species throughout the region. This involves both the relatively rapid dispersal of wolves from more densely populated to less populated areas and the abandonment of an area if hunting has disturbed the social and spatial patterns of the population in a wider territory.

Within the Baltics there is a lack of a unified system which would allow for comparable data on the situation of the Baltic populations at a regional scale, especially in light of recent events whereby hunting intensity increased in Latvia more than in Estonia, but there are almost no data on killed wolves in Lithuania.

The Institute of Applied Ecology in Rome, with the involvement of experts from the Large Carnivore Initiative for Europe, has developed an action plan and submitted a technical report to the European Commission (Boitani et al. 2015), which lists and prioritises the activities required to ensure the conservation of carnivores at the European scale and at the level of populations. The report is based on the latest available information and collegially involving experts from all the European countries and regions. In this document, 11 crucial tasks up to 2020 have been set for the conservation of large carnivores, including wolves. It is expected that most of these tasks will not lose their relevance in Latvia after this period.

Cross cutting actions – across species and populations:

1. Preventing habitat fragmentation and reducing disturbance associated with infrastructure development.
2. Reducing large carnivore depredation on livestock.
3. Integrating large carnivore management needs into wildlife and forest management structures.
4. Evaluating social and economic impacts of large carnivores.
5. Improved transboundary coordination of large carnivore management.
6. Standardisation of monitoring procedures.
7. Managing free-ranging and feral dogs to reduce hybridisation with wolves and other conflicts.
8. Law enforcement with respect to illegal killing of large carnivores.
9. Genetic reinforcement of small populations of lynx and bears.
10. Institutional capacity-building in wildlife management agencies.
11. Developing best practice for large carnivore based ecotourism.

This report mentions seven <u>specific actions for wolf populations in Europe – to elaborate and implement</u>:

1. Standardised census and monitoring of wolf populations.

2. Transboundary cooperation and population-level management planning.

3. Prevention and compensation measures to reduce livestock depredation.

4. Measures against illegal killing and control of poison baits.

5. Control of free-ranging dogs and wolf-dog hybridization.

6. Reducing landscape fragmentation.

7. Education, information and data accessibility.

In addition, specific actions are defined for each of the wolf populations, , taking into account the status of the particular population and the factors influencing it. For the Baltic wolf population, two measures are essential:

1. Establishment of an international working group for large carnivore management in the Baltic region.

The need for such action is determined by the sharp differences in the political, economic and legal systems within the countries of the region, because the formal cooperation agreements among the countries currently do not provide for sufficiently rapid responses to changes at the population level and for flexible adaptation of management measures at the national scale. At least one researcher and one specialist from a decision making authority from each country, should be included in the working group.

2. Impact assessment of different management regimes in countries sharing the population.

The necessity of this measure is related to the different species exploitation and conservation regimes within a single population, ranging from full protection (Poland) to intensive but regulated hunting (Latvia) or unlimited and even financially supported lethal control (Russian Federation). There is a lack of knowledge about the impact of these differences on population structure, demographics, genetic characteristics, ecological functions and economic significance.

The most predictable factor hindering the implementation of both tasks is the constant problems of maintaining contacts with the responsible officials of Belarus and the Russian Federation.

Support for conservation measures within Latvian society has been evaluated by a survey. The survey was conducted within the framework of this project of the Action Plan renewal, distributing 1,000 questionnaires among families of Latvian residents in accordance with repeatedly used methods (Andersone and Ozoliņš 2004b). The questionnaire was also electronically distributed among hunters, involving hunting organizations (Latvian Hunters Society, Latvian Hunters Association), and the editorial personnel of the magazine “Hunting, Fishing, Nature” in selection of recipients. The electronic questionnaire was also sent to 13 farmer

organizations and associations. As a result, responses were obtained from 595 respondents that represent the domestic part of society, as well as from 510 hunters and 17 cattle-breeders. Of the respondents that represented families, 60.4% stated that they live in cities. Among the surveyed hunters this proportion was 54.9%.

In the survey it was found that 13.9% of the Latvian population living in families participate in hunting, although only 5.1% of them did so frequently or very frequently. The responses of these respondents were analyzed together with the views of the families, but responses from the hunters obtained through hunter organizations were treated separately as opinions of this specific stakeholder group. Due to a low level of responsiveness, the opinion of farmers was represented by a very small number of respondents. However, surveys received from families and hunters indicate that some of these respondents are engaged in livestock farming. Therefore, some specific issues related to livestock protection and wolf conservation were examined by selecting relevant questionnaires from the all the respondents, bringing together 127 responses from farmers, i.e. 67 from the group of hunter organizations, 43 from the families and 17 from the farmer organizations.

In 2001, the first study on public perception of large carnivores was conducted in Latvia, which was funded by the World Wildlife Fund (WWF). It included 3 local carnivore species – brown bear, lynx and wolf (Andersone and Ozoliņš 2004b). The majority of respondents considered that the number of wolves in Latvia is sufficient. This negative attitude was attributed to losses to livestock and game management caused by large carnivores. Interestingly, the bear was considered to be the most dangerous to people (61.7%), the lynx was ranked as the second (50.0%) and only then the wolf (42.2%). The majority of respondents (70.0%) supported the regulation of wolf numbers, with only 21.7% supporting full protection.

Another survey on public opinion was conducted in 2005 within the project "Large Carnivores in the Landscapes of Northern Europe: an Interdisciplinary Solution for Regional Species Conservation" (see Chapter 1.5.). During the study, 1250 questionnaires were distributed through schools in Rīga, Ventspils and Madona districts, 911 of which were returned (73%). Questionnaires with the same content were also distributed in Estonia, Lithuania, Poland and Norway. The study indicated that the inhabitants of Latvia are more willing to live in areas close to places inhabited by wolves, and that they are prepared to tolerate one of the largest wolf populations in their territory, but at the same time they are more concerned about the safety and income of their families than Estonians and Norwegians.

In the survey of 2017 (A. Žunna et al., unpublished data), 50.8% of the respondents from the family group were satisfied with the current number of wolves, but for members of hunter

organizations this proportion was smaller – 36.5% (Fig. 21). In turn, only 8.1% of the family members and 1.0% of the hunters would like slightly more wolves in Latvia, expressing their opinion that the number of wolves should be reduced – 61.9% of the respondents. A large proportion of the respondents believe that the existing species management system should be maintained (Fig. 22). There is a clear majority among hunters supporting this opinion, despite the difference in opinion about wolf hunting quotas and the duration of hunting season by the respondents from the family group. The most influential media for informing the public on large carnivores is TV and radio (Fig. 23). Also articles in newspapers and magazines are of great importance, especially among hunters' circles, and many respondents favoured the internet as a source of information.

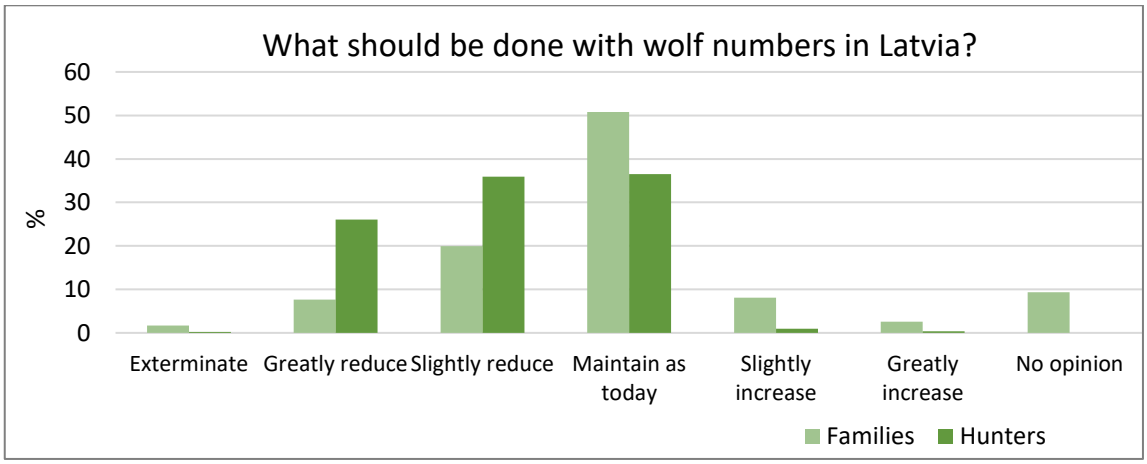

Figure 21. Results of the family and hunter survey on attitude towards wolves in 2017.

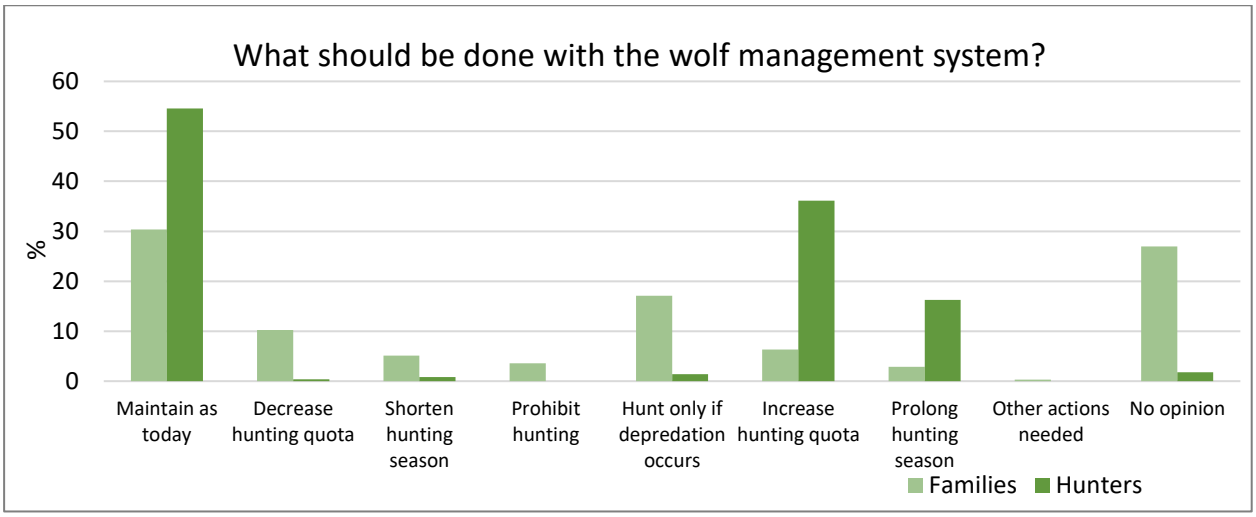

Figure 22. The opinion on current wolf population management, expressed by the families and hunter organizations in a survey in 2017.

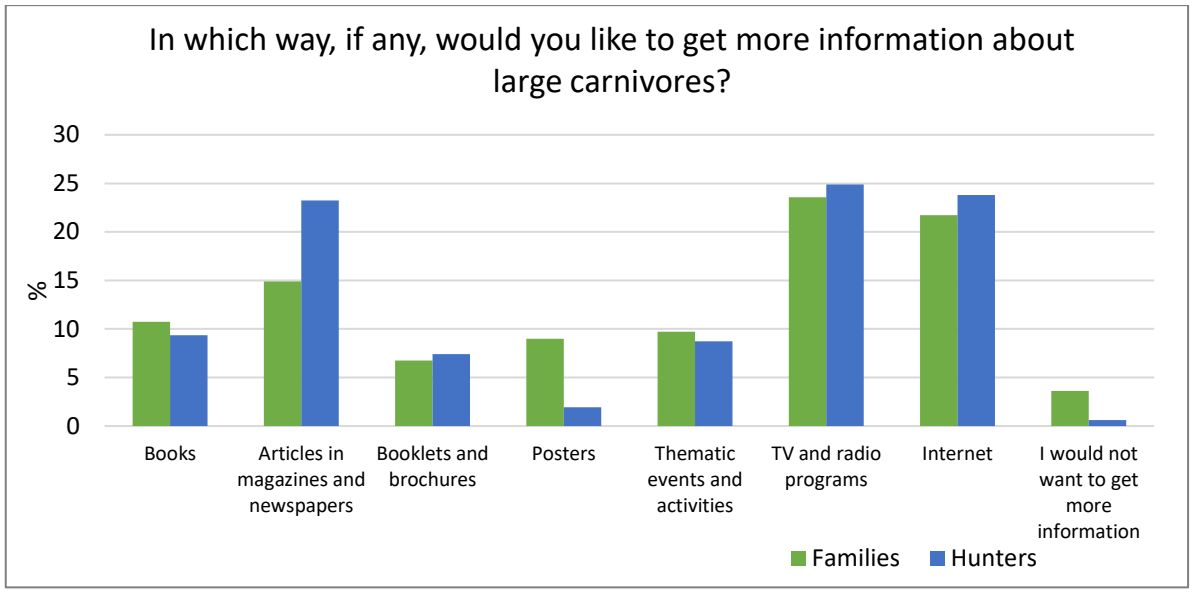

Figure 23. The preferred source of information on large carnivores, expressed by the families and hunter organizations in a survey in 2017.

Livestock farmers face some of the biggest challenges in finding opportunities to coexist with wolves. On the one hand, the total economic losses caused by large carnivores, compared to other countries, are negligible (see Chapter 1.2. and Table 5) and affect only a few farms. On the other hand, there is a risk of losses at the level of individual farms, and strict mitigation activities lead to an attitude that exceeds the individual views of livestock farmers. At the same time, among farmers there is a lack of co-ordinating authorities or organizations unifying opinions, perhaps as a result of their economic competition. There is also a widespread lack of consensus in popular opinion on large carnivore management issues. The common feature is that livestock farmers generally do not choose to take preventive measures against damage caused by carnivores until they have been personally affected. This attitude could be improved through informative, financial and organizational support, as this desire was expressed in responses to the questions already formulated in the questionnaire, as well as in additional comments. The majority of livestock farmers believe that hunting is a necessary tool to prevent carnivores from causing damage.

Table 5.

Reports received by the State Forest Service on wolf and stray dog damage to livestock farming

Year	Sheep			Cattle			Goats			Dogs		
	killed	lost	injured	killed	lost	injured	killed	lost	injured	killed	lost	injured
2005	9	0	3	6	0	1	9	0	1	7	0	0
2006	43	0	14	17	0	4	3	0	0	1	0	1
2007	42	0	1	3	0	0	0	0	0	0	0	0
2008	39	0	1	0	0	0	6	0	0	3	0	0
2009	72	0	15	22	0	1	0	0	0	0	0	0
2010	41	0	29	5	0	6	2	0	0	2	0	0
2011	142	0	31	12	0	2	17	0	8	27	0	0
2012	127	0	26	3	0	2	0	0	0	2	0	0
2013	88	23	41	0	0	0	3	16	1	1	0	1
2014	64	26	29	21	0	1	6	0	1	1	0	0
2015	115	9	62	3	0	0	0	0	0	0	0	0
2016	102	0	34	2	0	0	0	0	0	0	0	0

In general, can be concluded that the current wolf management system is perceived favourably in Latvian society as the majority of the respondents do not show a desire to significantly change the existing management system of the species. This is supported by both the implementation success of the current Action Plan and by the conducted survey. However, on some issues there are strong contrasts among the views of the majority of various stakeholder groups. Differences in opinions can be minimised by information campaigns. Surveys show that the attitude towards wolves has deteriorated in the past 12 years, at least among hunters. When a need for more strict protective measures emerges, attention should be paid as to how they will be justified and explained. The focus should not be only on maintaining the biological status of the population. Diplomacy when dealing with different stakeholder groups should be considered a priority when defining the purpose and objectives for the species conservation.

5. The aim and tasks of the species conservation plan

The purpose of the Action Plan is to maintain a favourable status for the wolf population in Latvia for an unlimited period of time and to promote the maintenance of a favourable status of the Baltic wolf population without specifying the maximum number of individuals and habitats, but ensuring the presence of wolves as a united and functional component of the wildlife

environment in man-made and managed landscapes, respecting and promoting the quality of life and wellbeing of a diverse society. For defining this objective, the previously described situation analysis for the scale of the Latvian and Baltic region (Sections 3 and 4) was used as well as the concept of coexistence of large carnivores and humans, described extensively in the IUCN manifesto for large carnivore conservation in Europe (2013; *https://www.rewildingeurope.com/wp-content/uploads/.../Manifesto.pdf*).

To achieve this goal, general tasks (I Long-term tasks) that have been defined in the previous Action Plan should be continued or initiated and continued throughout the future conservation process, and short-term tasks must be implemented in the nearest future (II Short-term tasks), which, once implemented or completed, will ensure long-term conservation measures.

I. Long-term tasks that constitute the system of species conservation and management.

- Planning infrastructure for economic and recreational purposes in the landscape, establishment of movement corridors for large carnivores and other wild mammals that would maintain dispersal and prevent severe fragmentation of the area.
- Promotion of a positive public attitude towards the presence of wolves at the landscape level and within a context of wildlife diversity, including outside of the SPNAs, to reduce the attitude to this species as an unwanted competitor or an unacceptable obstacle to economic activity. This should increase the possibility of sighting wolves in the wild, evidence of their presence being positively perceived and making information on the wolf population status more widely available.
- Conflicts involving attacks of large carnivores on livestock are to be reduced by providing advisory and financial support to livestock owners, as well as by a convenient system and procedures for detecting and recording damages.
- Restricted wolf hunting as an optional activity for maintaining carnivore and human coexistence is applied only if the population is managed in a way that is not detrimental towards a favourable conservation status and the hunting process complies with conditions that make it relevant to the generally recognized ethical values of society. See Dr. A. Bath review, comment No 13.
- Management of other wildlife species and forests is conducted in a way that wolf functional activities in the ecosystem (foraging, breeding and habitat selection, dispersal) are kept as close to natural as possible.

- Management of the wolf population in Latvia is to be conducted in a way that the actions taken in Latvia would not be an obstacle to improvement of the population status in other parts of the Baltic population, especially in Belarus and Lithuania, which share their borders with Latvia.
- Wolf conservation requirements are to be considered as further changes and additions to the legislation regarding hunting, forestry and environmental conservation are introduced.
- Population status is assessed by applying a monitoring system based on unified methods for collection of mutually comparable data, as well as by implementing and maintaining a common database that is accessible to all interested users in the three Baltic States within the limits of information security requirements. The monitoring system should provide data on species distribution, population dynamics and proportion of reproductive pairs obtained by non-invasive methods.
- Within the monitoring framework, changes in sex, age and kinship structure of the wolf population are to be followed and utilised to predict changes in the population status.
- A convenient damage registration and support and advisory system is to be maintained for owners who have suffered from large carnivore attacks on their livestock. Advisory and financial support is to be focussed on reducing the risk of damage rather than compensating for losses.
- Implementation and application of the latest available technologies (e.g. DNA tests) for investigation of large carnivore attacks and protection of livestock against potential large carnivore attacks.
- Consumptive and non-consumptive exploitation of the species should be organized according to the population status in accordance with the principles of adaptive management, taking into account the needs for environmental, economic and social culture of the local inhabitants (at the county scale). See Dr. A. Bath review, comment No 14.
- Hunting quotas for wolves are to be immediately reduced as soon as the first apparent signs of deterioration in the population status appear.
- Scientific research on wolves is to be continued, with particular emphasis on diet, reproduction, habitat and site selection, genetic diversity and health status of the population (including parasites, diseases, body condition).

- Public education and raising awareness on wolf conservation issues is to be continued. The target audience consists of professionals from state administration authorities, environmental NGOs, education and tourism sectors, as well as hunters and farmers.
- Changes in public attitude are to be monitored, e.g. by surveys on tolerance to large carnivores after the implementation of the planned measures and before the next renewal of the Action Plan.

II. Short-term tasks that serve to support the conservation and management system of the species.

- To develop recommendatory guidelines for administrative decision makers that facilitate navigation of the legislation and ensure wolf conservation and management in accordance with the dynamic situations, the need for a regulatory framework and a place in the overall legislative hierarchy.
- To supplement monitoring methods with the collection of information on the wild population and the proportion of reproductive pairs in it, as well as the total number of hunters and the duration of hunting per year, in which wolves are hunted, planned to be hunted or there is a legitimate opportunity to hunt wolves.
- To participate in the establishment of a working group and the associated rules of procedure for the management of Baltic large carnivores in order to maintain a regular exchange of information and decide on actions for wolf conservation at the population level.
- To improve and upgrade the cooperation framework among institutions that supervise the fulfilment of CITES requirements, control hunting and conduct scientific research.
- To introduce a system for marking of wolf hunting trophies.
- To develop simple procedures for damage prevention and compensation in cases when a wolf has attacked livestock.

6. Recommendations for species conservation

All recommended actions are evaluated by a three-step scale of importance/priorities, where:

I – indicates crucial actions: their non-fulfilment could lead to species extinction from current range and habitats or jeopardize international obligations;

II – indicates important actions: their fulfilment helps to achieve conservation goals within the current reference period of the Action Plan, however omitting these does not endanger species survival within current range or habitats;

III – indicates significant actions that are recommended, yet do not crucially impact population survival at national level.

6.1. Changes in legislation

Priority I

Documentation of wolf hunting efforts (number of hunters and duration of hunts) within the scope of existing Hunting Regulations is possible by several amendments proposed below:

a) Paragraph 25 of the Hunting Regulations is to be supplemented with a sub-paragraph 25.4 in the following wording: "if wolf and lynx hunting is permitted during the hunting season".

b) Annex 2 of the Hunting Regulations "Register of hunted game animals" is to be supplemented, providing for recording the number of participants and duration of the hunt (this change would allow for obtaining the most comprehensive information on the hunting effort for each season).

c) Annex 4 of the Hunting Regulations "Act concerning wolf/lynx hunting" is to be supplemented, providing for recording the number of participants and duration of the hunt.

d) Exchange of information between authorities managing hunting activities and hunters is to be provided electronically, replacing paper forms with data transmission by mobile networks.

Priority I

In order to ensure the monitoring and sufficient amount of data for planning the maximum allowable hunting quota, Paragraph 51.10 of the Hunting Regulations is to be expressed in the following wording: „The initial processing of harvested animals after hunting is to be organised and samples of mammalian species, which are important in the European Community and require their population monitoring, are to be prepared, in addition to samples for veterinary examination regardless of species, if necessary".

Priority I

In order to avoid the risk that the holder of hunting rights in localities where livestock predation has occurred would be more likely to demand permits for wolf hunting, exceeding the allowable hunting quota or the prescribed hunting period, than to assume other responsibilities related to the damage caused, Paragraph 1 of the Article 29 of the Hunting Law should be expressed in the following wording: „The owner or legal possessor of the land is responsible for the damage and losses caused by the game animals in the land owned by him / her if the hunting

rights have not been transferred to another user, except in cases when damages are caused by carnivorous mammals of restricted exploitation and special protection in the European Community.

6.2. Establishment of specially protected nature areas and / or micro-reserves

Not required.

6.3. Measures for population renewal

Not required.

6.4. Measures for species habitat management

Maintaining the current trend in the dynamics of the total forest area (see Chapter 2.2., Table 4), special measures for the restoration or conservation of habitats by limiting forestry are not necessary.

Priority III *

It is essential to take into account the opportunity for movement of wolves and other mammal species when planning and building linear infrastructures in the landscape – not creating fences without interruption for more than 5 kilometres, building green bridges or tunnels where animals can cross motorways, etc. Particular attention should be paid to the progress of the *Rail Baltica* project and impact assessments. * See Dr. A. Bath review, comment No 12.

6.5. Research and data collection

6.5.1. (*Priority I*) Information for the species conservation is to be obtained from hunted or accidently killed individuals, as well as by recording, collecting and analyzing wolf tracks and evidences of their presence in the wild (non-invasive monitoring). Procedures for collecting and analysing information about the wolf population status in Latvia is included in the monitoring programs for monitoring biodiversity, background monitoring within the framework of game mammal monitoring (http://biodiv.daba.gov.lv/fol302307/fol634754/fona-monitoringa-metodikas/ziditajdzivnieki/mon_met_fona_2013_ziditaji_medijamie.doc) and also special monitoring of large carnivores, including methods for inspecting individuals that have been hunted or found dead “Methodology for Special Monitoring of Large Carnivore Population Demographics, namely wolf (*Canis lupus*) and lynx (*Lynx lynx*)” (http: //biodiv.daba.gov.lv/ fol302307/fol634754/speciala-monitoringa-metodikas/mon_met_spec_2013_lielie_pleseji.doc).

Current methods need to be complemented so that the obtained information could be used for the local requirements and at the trans-border level. Data on the amount of reproductive pairs and their dynamics should be used for the estimation of population size and regenerative capacity. Users of hunting rights, the SFS, scientific institutions and volunteers are to be involved in the data collection. The results of the monitoring should include:

- reports on observed tracks with precise location and date at least annually regardless of hunting season, for each census unit (within 10x10 km square of the grid);

- collection and analysis of data from automatic camera traps and eye-witness photographs;

- DNA samples from fur/hair found in nature or acquired by non-invasive methods;

- DNA samples from bite wounds/scars (in cases of livestock predation) should be introduced in monitoring methodologies.

Samples from all hunted and accidentally found dead wolves are to be collected, including at least a cuspid root for age determination of individuals older than one year, reproductive organs of adult females and a small (ca. 1 cm^3) muscle sample for DNA analysis. In agreement with the research institute, which performs wolf monitoring, a whole skinned body is to be collected from several wolves, hunted and accidentally found dead, for parasitological examination and diet studies. Updating of monitoring methods and procedures for compiling the results and publishing them in accordance with the National Monitoring Program is determined by the NCA.

6.5.2. *(Priority II)* Analysis of fulfilment of the hunting quota and shortening of the hunting season for wolves, is to be conducted, linking the collected monitoring data on the demographic status of hunted wolves with information on the seasonal distribution of hunting intensity and on the seasonality of damage to livestock farming. The analysis should include 3 situation models: (1) shortening the length of the hunting season, by excluding summer months (justifiable by the creation of conditions when, without adult training, young wolves are more likely to specialize in preying on livestock, as well as by ethical considerations); (2) shortening the season by suspending wolf hunting at the end of January (justifiable by avoiding disruption of reproductive pairs and enhancing hybridization with stray dogs); (3) shortening the season, starting the hunting in November and ending at the end of January (justifiable by minimising impact on the demographic structure of the population and, perhaps, not limiting the number of individuals hunted). The purpose of this study is to evaluate the possibility of allowing unlimited hunting in a significantly shorter period, which is more favourable for species conservation, as an alternative to the current control system for wolf numbers. Additional research should be focused on the relationship between livestock losses, density of wolves, and numbers of wolves killed by hunters.

This research should evaluate the efficiency of wolves hunting as a tool to decrease attacks on livestock (for reference see Dr. A. Bath review, comment No 11).

6.5.3. *(Priority II)* Ecological research of the species should be continued, with particular attention being paid to the dependence on the dynamics of prey species numbers, interaction with other carnivores (lynx, golden jackals) and indicators of population vitality (genetics, parasitology, factors influencing natural mortality).

6.5.4. *(Priority III)* Important information for species conservation is gained by the analysis of societal needs and attitudes. This should be conducted on two levels: involving a comprehensive situation survey at the end of the planned period and prior to the renewal of the next Action Plan, the results of which are at least partially comparable to the results of the 3 previous surveys, and the assessment of particular conservation measures and performance of their implementation (e.g., evaluation of the system for informing farmers of methods to protect livestock against damage and evaluation of the support system for conservation measures). The questionnaires should be as user-friendly as possible and should be conducted with the most appropriate technical means for the target audience.

6.6. Information and education, improvement of professional qualifications

6.6.1. *(Priority II)* A joint training exercise for the identification of carnivore species in the case of damage to livestock should be organized among the responsible specialists, including both identification in the field and sampling for DNA analysis.

6.6.2. *(Priority I)* Involvement of hunter in the monitoring of large carnivores should continue, including data collection on hunted animals and acquisition and implementation of non-invasive monitoring methods.

6.6.3. *(Priority I)* Species identification skills from wolf body parts (for monitoring of CITES requirements) and tracks in the wild (for monitoring, nature tourism) should be improved and propagated among the staff of institutions involved and other associated organizations.

6.6.4. * *(Priority II)* A Code of Hunting Ethics, based on the moral values of society and scientific arguments, should be developed, made public and signed by the leading hunting organizations of the country. * See Dr. A. Bath review, comment No 6 and No 13.

6.6.5. *(Priority III)* The public is to be regularly informed about species status, management strategies and scientific research. The most influential forms of information should be chosen, that are appropriate to the target audience and follow trends information technologies.

6.6.6. *(Priority III)* In the process of developing Action Plans for SPNAs, which are designed to preserve other endangered species and habitats, wolf conservation measures should be carefully assessed, if necessary, so that they would be in line with the aims and tasks contained in this AP.

6.6.7. *(Priority III)* The training for volunteers in the use of non-invasive monitoring methods should be organized.

6.6.8.* (Priority II) Public relations and conflict resolution skills training workshops for interest groups involved in wolf conservation and management activities (hunters, livestock farmers, wildlife managers, decision making authorities, NGOs, etc.) should be organized . *See Dr. A. Bath review, comment No 16 and No 18.

6.7. Organizational, planning and other activities

For further conservation and management of the wolf population, the following organizational actions must be taken.

6.7.1. *(Priority I)* Establishment of a working group for cases when changes in the allowable harvest quota for wolves are required.

The working group is convened in cases when it is necessary to increase the wolf hunting quota above the initially defined limit during the same hunting season (upper limit) or in comparison with the previous season, and if the quota of the previous season is maintained, despite failure to fulfil it by more than 10%. Group coordination is undertaken by the SFS. The group includes specialists and responsible officials from the SFS, the NCA, institutions conducting the species monitoring, organizations of the users of hunting rights, Joint Stock Company "Latvia's State Forests", the Latvian Forest Owners' Association, the Cooperation Council for Farmers' Organizations and the Environmental Advisory Council. Not later than two weeks before the opening of the wolf hunting season, the working group meets and, by examining the best available information on the population status, including results of the appropriate background and special monitoring, decides on the maximum allowable hunting quota (limit), duration of the hunting period and setting areas where wolf hunting is prohibited or restricted. The decision should be based on:

- the planned hunting quotas and their fulfilment in the previous years;
- hunting effort (number of hunters and time spent in hunting) of the season;
- changes in species distribution and abundance;

- population demographics and kinship structure ;
- amount of reproductive pairs and litter size;
- status of genetic diversity;
- status of wild ungulate populations;
- frequency of attacks on livestock and dogs;
- distribution of wolf-dog hybrids;
- wolf conservation status in neighbouring countries and border areas within the Latvian territory.

If all of these indicators indicate a favourable status of the wolf population, the hunting quota should be planned within the range of 40–50% of the estimated population size before opening the hunting season, but not exceeding more than 300 wolves per year, which historically has been confirmed as a limit to which the Latvian wolf population has been able to recover without subsequent deterioration. The duration of the hunting season is to be determined in an annual administrative order the SFS, taking into account current meteorological and phenological conditions, but not exceeding the current deadlines specified in the Hunting Regulations, i.e. from the 15th of July to the 31st of March. If signs of deterioration in the population are detected, which threatens its favourable status, in addition to the reduction of the hunting quota or as an alternative to it, the following options for reducing the hunting effort should be used:

- shortening of the hunting season, preferably with an earlier closure of the hunting season, in order not to disrupt the structure of wolf packs (reproductive pairs) formed in mid winter;
- prohibiting wolf hunting until the 1st of October, if during the hunting process, a female has been found with pups born in the previous spring;
- to divide the total hunting quota of the country among the territorial units (game management units) without the possibility of redistribution;
- to expand areas where wolf hunting is not conducted (around the central part of the country and the national parks);
- to issue fixed-term hunting permits in specific hunting areas;
- to postpone hunting for a year, allowing hunting only for prevention of repeated attacks on livestock.

The decision on the maximum hunting quota for wolves is made public in the form of an SFS administrative order, informing society. If difficult situations arise, an outside facilitator may be required (for reference see Dr. A. Bath review, comment No 19)

6.7.2. *(Priority II)* Engaging in the establishment of an international working group and work on the protection and management of wolves at the Baltic population level. Group establishment is undertaken by representatives of the Baltic States at the IUCN Large Carnivore Initiative for Europe.

6.7.3. *(Priority II)* Coordination of the parties involved in species monitoring and expansion of public participation (in relation to actions referred to in sections 6.6.2 and 6.6.7). Organize training for SFS staff and NCA environmental inspectors in the search and identification of wolf, lynx and brown bear tracks, marks and signs in nature. Develop a volunteer network involving owners of automatic camera traps within the hunting community and broader society.

6.7.4. *(Priority II)* Labelling of wolf game trophies (including those previously legally acquired) according to CITES certificates issued by NCA. With the help of a unique marking (skull mark or electronically readable code on the skin), wolf game trophies are to be linked with their corresponding CITES certificate numbers and registration data base. The possibility of legalizing previous legally acquired trophies is to be organised in accordance with CITES requirements. For requesting and issuing of permits, a user-friendly electronic system must be created, which simultaneously also allows for rapid confirmation for inspection purposes.

6.7.5. *(Priority III)* Developing and supporting non-consumptive initiatives for the species. The Department of Tourism of the Investment and Development Agency of Latvia, in co-operation with the competent authorities, specialists and the tourism association “Lauku ceļotājs” [Country Voyager], creates tour offers for the identification of large carnivores and their habitats in Latvia without causing unacceptable impact for the species.

6.7.6.* *(Priority II)* Developing a convenient system and procedures for recording damages, inspecting and evaluating damages caused by large carnivores and examining applications for support for protection measures and compensation of losses. Advisory and financial support is to be focussed on reducing the risk of damage rather than compensating for losses. The system should provide for a prompt and coordinated response by the responsible authorities, identification of the species that has caused the damage as accurately as possible as well as a relaxed compensation procedure, at the same time avoiding regular compensation of losses for land owners without improvement of preventive measures. The preferred source of funding for measures that reduce the risk of damage is from funds for rural support. Meanwhile, the most desirable source of funding for damages caused by wolves, if they occurred despite the

protection measures taken, are the resources from the Latvian Environmental Protection Fund. The system must be introduced through a trial pilot demonstration project, starting with the areas where frequency and extent of wolf inflicted damage is the highest. * See Dr. A. Bath review, comment No 7.

6.7.7. *(Priority I)* Renewal of the Action Plan. Upon expiration of the planned term of Action Plan activities, performance of the tasks and achievements of the conservation aims are to be assessed. The current requirements of the species conservation are to be considered at the time of the plan renewal.

7. Review of planned actions and events

The actions are arranged in the sequence used in Chapter 6, indicating the order number of the event, the scheduled time for execution and the assessment of the required resources.

Action/event	**Priority**	**Due term (necessary time)**	**Estimated cost (EUR)**
6.1. Changes in legislation a) to ensure documentation of hunting effort (number of hunters and duration of hunt during the season) used for wolf hunting; b) to ensure monitoring and sufficient amount of data for planning the maximum allowable hunting quota; c) to avoid the risk that the holder of the hunting rights would be more likely to intensify wolf hunting rather than to protect livestock against possible damage.	I I II	18 months	Within the budget of the responsible authorities
6.4. Evaluation of the progress and impact of the *Rail Baltica* project on the wolf population status.	III	Continual	Within the expenses of the species monitoring, additional analysis of the obtained data - 3000 per year
6.5.1. Monitoring of the population status: • using material from hunted and accidently killed individuals and supplementing the methodology with	I	Continual	60 000 per year

investigation of relatedness structure (DNA analysis) and recording of hunting effort. • non-invasive monitoring of population status by collecting and analyzing the signs and evidences of wolf presence in the wild in the framework of monitoring of game animals. • supplementing monitoring methods with the collection of data on the population by applying a network of camera traps and an annual analysis of information on the number of reproductive pairs.	I I	Continual 2 years	30 000 per year Within the budget of the responsible authorities. The activity is conducted in conjunction with the background monitoring of game populations 20 000
6.5.2. Evaluation of : • the possibility of unlimited wolf hunting in a much shorter period, but which is more favourable to species conservation; • the efficiency of wolf hunting as a tool to decrease attacks on livestock.	II II	1 year 3 years	3000 7000
6.5.3. Research on species ecology.	II	Continual	15 000 per year
6.5.4. Survey of the needs and attitudes of society on wolf management issues.	III	2 years	30 000
6.6.1. Joint training for the identification of carnivore species in the case of damage to livestock among the responsible specialists, including both identification abilities in nature and sampling for DNA analyses.	II	2 years for improving the system and continual thereafter	10 000 for workshops and training, maintenance of the procedure within the budget of responsible authorities, 1000 per year for DNA analyses
6.6.2. Hunter involvement in large carnivore monitoring, including data collection on hunted animals and acquisition and implementation of non-invasive monitoring methods.	I	Continual	5000 per year for seminars and training
6.6.3. Acquiring species identification skills for wolf	I	2 years for launching and	5000 for development of the procedures, and

body parts (for monitoring of CITES requirements) among the staff of the responsible and involved institutions.		continual thereafter	thereafter within the budget of responsible authorities
6.6.4. Developing a Code of Hunting Ethics.	II	6 months	1000
6.6.5. Informing society on the species status, the course of management and scientific research.	III	Continual	1000 per year
6.6.7. Training for volunteer surveyors in the use of non-invasive monitoring methods.	III	1 year and continual thereafter	15 000 for initial coordination actions, 5000 per year thereafter
6.6.8. Public relations and conflict resolution training for interest groups.	II	Once per three years	2000 for external facilitator per case
6.7.1. Establishing a working group for cases when changes in the maximum allowable harvest quota for wolves are required.	I	If necessary	Within the budget of the responsible authorities
6.7.2. Engaging in the establishment and work of an international working group on the protection and management of wolf at the Baltic population level.	II	2 days per year	2000 per year
6.7.3. Coordinating and training of staff and volunteers involved in the monitoring.	II	1 week per year	5000 per year
6.7.4. Labelling of wolf game trophies (including previously legally acquired previously) according to CITES certificates issued by NCA.	II	2 years for introducing the system and continual thereafter	17 000 for introducing and 3000 per year
6.7.5. Supporting non-consumptive exploitation initiatives of the species.	III	1 year	10 000
6.7.6. Development of a registration and mitigation system for damages caused by large carnivores.	II	2 years for developing and introducing the system and continual thereafter	20 000 for developing and introducing the system, 100 000 pilot project for the prevention of carnivore attacks within areas of increased risk of attacks
6.7.7. Renewal of the Action Plan.	I	1 year	15 000

8. Assessment of the effectiveness of population restoration of the species, habitat management and implementation of other measures

The planned activities are related to the fulfilment of requirements demanded by international legislation. The establishment of a working group on Baltic large carnivore management, promotion of protection measures against damages caused by large carnivores, as well as standardization of the monitoring methods and involving the public in data collection and reporting of the results will form the basis for maintenance of a favourable species conservation status at the Latvian scale and within the Baltic population. Implementation of the Action Plan will help to realise the measures foreseen in the EU "Platform on Coexistence Between People and Large Carnivores" developed by representatives of European Union Member States and signed on the 10th of June 2014 in Brussels, which aims to support the ways and means of minimising and, as far as possible, resolving conflicts between people's interests and the presence of large carnivores through the exchange of knowledge and cooperation in an open and constructive form and with reciprocal dignity. The agreement was signed by the Commissioner for Environment of the European Commission and leading representatives of nature conservation, farmer and land owner and hunting organizations. The success of the Action Plan implementation will be confirmed by the fact that wolf conservation will not have an impact on the economy and the government will not be required to provide additional funding for the continuation of species conservation measures, as the majority of them are part of the functions already provided for in legislation and in the main duties of the responsible institutions.

9. Implementation of species conservation plan

The main activities are arranged in the sequence used in Chapter 6, indicating the year of launch, the institutions involved (the responsible institution underlined), stakeholders and type of cooperation.

Action/event	Start of execution*	Involved institutions	Form of cooperation
Changes in legislation	Together with the consideration of the next amendments in relevant laws	Ministry of Agriculture, Ministry of Environment and Regional Development, State Forest Service, Nature Conservation Agency	Working group, involving public partners
Evaluation of the progress and impact of the *Rail Baltica* project on the wolf population status	Not predictable	State Forest Service, Ministry of Transport, scientific institution responsible for monitoring, users of hunting rights	In the framework of the functions by supervisory authority and contractual work
Monitoring population status by using materials from individuals hunted and found dead	2017	Ministry of Agriculture, State Forest Service, LSFRI "Silava", users of hunting rights	In the framework of the functions by supervisory authority and contractual work

Monitoring of population status by applying non-invasive methods in the framework of game monitoring	2018	State Forest Service, JSC "Latvia's State Forests", users of hunting rights, scientific institution responsible for monitoring, volunteer informants	Exchange of information, functions of the supervisory authority, pilot projects under LIFE and ERAF programs
Evaluation of the possibility of unlimited wolf hunting in a much shorter period, but which is more favourable to species conservation	2020	LSFRI "Silava", Ministry of Agriculture, State Forest Service, users of hunting rights	Within contractual works
Evaluation of the efficiency of wolf hunting as a tool to decrease attacks on livestock	2019-2020	LSFRI "Silava", Ministry of Agriculture, State Forest Service, Latvian Cooperation Council for Farmer Organizations	Research project, discussion platform
Research on species ecology	2017	LSFRI "Silava", university students and PhD students	Within contractual works as well as MSc and PhD theses
Survey of the needs and attitudes of society on wolf management issues	2026-2027	LSFRI "Silava", university students and PhD students	Within contractual works as well as MSc and PhD theses
Acquiring species identification skills for wolf body parts (for monitoring of CITES requirements) among the staff of the responsible and involved institutions	2019	Nature Conservation Agency, State Forest Service, State Border Guard, State Customs, LSFRI "Silava"	Within the framework of the functions by supervisory authorities and pilot projects
Training for the identification of carnivore species in the case of damage to livestock among the responsible specialists, including both identification abilities in nature and sampling for DNA analyses	2019 - 2020	State Forest Service, Nature Conservation Agency, LSFRI "Silava", municipalities	Within the framework of the functions by supervisory authorities and pilot projects
Involvement of hunters in large carnivore monitoring	2017	Ministry of Agriculture, State Forest Service, public organizations representing users of hunting rights	Changes in legislation, framework of the functions by supervisory authorities and pilot projects
Developing a Code of Hunting Ethics	2018	Public organizations representing users of hunting rights, Ministry of Agriculture, society of forest owners, State Forest Service	Working group
Informing society on the species status, the course of management and scientific research	2017	All involved institutions and organizations	Regular release of information on websites, information to the press services
Establishing and supporting (e.g. by public relations training) a working group for cases when changes in the maximum allowable harvest quota for wolves are required	Depending on the need to raise the quota	State Forest Service, Nature Conservation Agency, LSFRI "Silava" or other institution conducting the monitoring, Environmental Advisory Council, JSC "Latvia's State Forests", Latvian Forest Owners' Association, Cooperation Council for Farmer Organizations, public organizations representing users of hunting rights	Working group after SFS initiative

Engaging in the establishment and work of an international working group on the conservation and management of wolf at the Baltic population level	2019	Nature Protection Agency, Ministry of Environment and Regional Development, Ministry of Agriculture, State Forest Service, LSFRI "Silava"	Seminar for representatives
Labelling of wolf hunting trophies (including previous legally acquired) according to CITES certificates issued by NCA	2018	Nature Conservation Agency, State Forest Service	Within the framework of the functions by supervisory authorities and pilot projects
Support for non-consumptive exploitation initiatives of the species	2019	Department of Tourism of the Investment and Development Agency of Latvia, association "Lauku ceļotājs" [Country Voyager]	Consultations, information exchange
Development of a registration and mitigation system for damages caused by large carnivores	2019-2020	Ministry of Agriculture, State Forest Service, Ministry of the Environment and Regional Development, Nature Conservation Agency, Association of Local and Regional Governments, Latvian Cooperation Council for Farmer Organizations, municipalities, LSFRI "Silava"	Establishment of a working group within the framework of the functions by supervisory authorities and pilot projects

* On the initiative of the responsible institution and in agreement with the cooperation partners, the implementation of the measure can be initiated more quickly if possible and necessary.

10. Deadlines for the implementation and review/evaluation of the species conservation plan

The Action Plan is developed for implementation of wolf conservation and management measures for the next ten years (2018–2028). It is advisable to start assessment of the implementation of the current Action Plan in 2025 to prepare tasks and plan the necessary funding for renewal of the Action Plan.

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Appendices

John Linnell Review of the Latvian “Action plan for grey wolf *Canis lupus* conservation and management” revision for period 2018 to 2028; pdf

Alistair Bath Review of the Latvian Wolf Action Plan; pdf