State Institute for Nature Protection

Report on the state of the wolf population in Croatia in 2014

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Report compiled and edited by:

Jasna Jeremić, Ana Štrbenac (State Institute for Nature Protection)

Authors:

Jasna Jeremić, Sonja Desnica, Ana Štrbenac, Daniela Hamidović (State Institute for Nature Protection)

Josip Kusak, Đuro Huber (Faculty of Veterinary Medicine, University of Zagreb)

Collaborators:

Guillaume Chapron (Grimso Wildlife Research Station, Swedish University of Agricultural Sciences Riddarhyttan, Sweden)

Goran Gužvica (OIKON d.o.o. – Applied Ecology Institute)

Lidija Šver (Faculty of Food Technology and Biotechnology, University of Zagreb)

Hubert Potočnik, Tomaž Skrbinšek (Faculty of Biotechnology, University of Ljubljana, Ljubljana, Slovenia)

Technical document processing:

Ivana Ilijaš (State Institute for Nature Protection)

English translation:

Zanella Translation Services, Zagreb

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DIRECTOR

Matija Franković, PhD

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1. Introduction

The wolf population in Croatia is part of the larger Dinaric/Balkan population that inhabits the territories of Slovenia, Croatia and Bosnia-Herzegovina, and continues to the south of the Dinarides mountain range. This entire population is estimated to contain approximately 3900 wolves, and has been predominantly stable over the past six years (Kaczensky et al., 2013). In Croatia, the wolf is permanently present throughout the Dinarides, from the border with Slovenia to the border with Montenegro. According to the distribution map from 2013 (Figure 1), the wolf in Croatia is permanently present in 18,213 km^2 and occasionally present in an additional 6,072 km^2 of territory. The distribution of the Croatian wolf population is distributed over nine counties: Sisak-Moslavina, Karlovac, Lika-Senj, Primorje-Gorski Kotar, Istria, Zadar, Šibenik-Knin, Split-Dalmatia and Dubrovnik-Neretva. There were no changes in the distribution range in 2014 as compared to 2013.

Changes in the size of the distribution area are due to changing dynamics within the Dinaric wolf population, and also due to better knowledge of the population in Croatia. The dynamics of the Dinaric wolf population depend on the approaches taken in wolf management in each of the countries sharing this population.

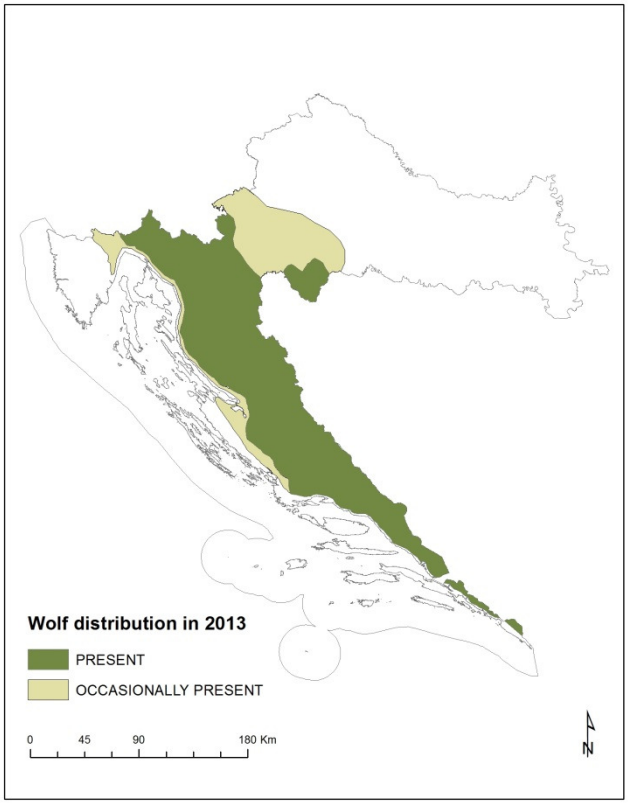

Figure 1. Distribution of the wolf population in Croatia (from: Kusak, 2013)

The **wolf** (*Canis lupus*) is a strictly protected species in the Republic of Croatia pursuant to the Nature Protection Act (OG 80/13) and the Ordinance on strictly protected species (OG 144/13). All forms of intentional capture, killing or intentional disturbance are prohibited by law, particularly during the mating and young raising periods. Damaging or destroying mating areas or wolf resting areas is also strictly prohibited. The keeping, transport, sale, exchange or offering for sale or exchange of live or dead individuals from nature is also prohibited. The Ministry of Environmental and Nature Protection may permit derogations from these prohibitions only if there is no other suitable possibility, and if it will not harm the sustainability of the wolf population in a favourable state in their natural distribution range. All persons are obliged to report cases of captured and/or killed strictly protected animals to the State Institute for Nature Protection.

The Republic of Croatia is a signatory to all the relevant international agreements in the area of nature protection. Significant acts for the protection of the wolf are the Act on Ratification of the Convention on Biological Diversity (OG-International Agreements 6/96), Act on Ratification of the Convention on the Protection of European Wild Taxa and Natural Habitats (Bern Convention) (OG-International Agreements 6/00) and the Act on Ratification of the Convention on International Trade in Endangered Animal and Plant Species (CITES) (OG-International Agreements 12/99).

The European Parliament passed the Resolution (Doc. A2-0377/88, Ser. A) of 24 January 1989, calling European nations to urgent action to conserve the wolf, and adopted the Proclamation on the protection of wolves, inviting the European Commission to extend its support to wolf conservation.

The main framework for conservation of the wolf in the European Union is provided by Directive 92/43/EEC on the protection of natural habitats and wild plant and animal taxa (SL L 206, 22.7.1992) (hereinafter: Habitats Directive). The fundamental objective of this Directive is to ensure the favourable conservation status of species and habitat types from the Directive annexes within the territory of the European Union, through mechanisms such as the strict system of species protection, the Natura 2000 ecological network (establishment and management), appropriate assessments of the impact on the ecological network and general measures for preserving species throughout the entire territory of Member States. The wolf is listed on Annexes II and IV of this Directive, indicating that it is a strictly protected species, and a species for which the Member States are required to designate areas into the Natura 2000 ecological network. This is also a priority species, i.e. a species for whose conservation the European Union is specifically responsible, given the scope of its natural distribution range within the of European Union territory. Furthermore, pursuant to Article 11 of the Habitats Directive, Member States are obliged to monitor the conservation status of species listed in Annexes II, IV and V of the Directive in their entire national territory, and pursuant to Article 17 of the Habitats Directive, those states are

required to report on the conservation status of these species every six years, according to the strictly defined instructions of the European Commission.[1] The Directive provisions have been transposed into the Croatian legislation via the Nature Protection Act and the subordinate legislation adopted pursuant to it.

The provisions of the Bern Convention have been transposed into the Nature Protection Act, and at the European Union level into the Habitats Act. The Convention is implemented via resolutions and recommendations. The provisions of the Convention on the International Trade of Endangered Species of Wild Animals and Plants (CITES) at the European Union level is implemented through a series of EU Wildlife Trade Regulations: Council Regulation (EC) No 338/97, Commission Regulation (EC) No 865/2006, Commission Regulation (EC) No 100/2008, Commission Implementing Regulation (EU) No 888/2014, Commission Regulation (EU) No 791/2012, Commission Implementing Regulation (EU) No 792/2012 and Commission Regulation (EU) No 750/2013, which regulate the international trade of wild taxa. The wolf is listed in Annex A of Council Regulation (EC) No 338/97 and the trade and transport of specimens of these species, their parts and derivatives are strictly regulated. The Act on the Cross-border Transport and Trade in Wild Taxa (OG 94/13) ensures the implementation of these regulations in the Republic of Croatia, and prescribes penalties for violations.

Furthermore, the Republic of Croatia has adopted the Regulation on the ecological network (OG 124/13). In line with scientific and expert criteria, Croatia has proposed 12 Sites of Community Importance (Figure 2) for the wolf as part of the Natura 2000 ecological network, with a total surface area of 6231 km^2, as follows:

- HR2000447 Nacionalni park Risnjak
- HR2000605 Nacionalni park Sjeverni Velebit
- HR2000871 Nacionalni park Paklenica
- HR2000922 Svilaja
- HR2001058 Lička Plješivica
- HR2001352 Mosor
- HR2001356 Zrinska gora
- HR5000019 Gorski Kotar i sjeverna Lika
- HR5000020 Nacionalni park Plitvička jezera
- HR5000022 Park prirode Velebit
- HR5000028 Dinara
- HR5000030 Biokovo

[1] http://ec.europa.eu/environment/nature/knowledge/rep_habitats/index_en.htm

Details of each individual area are available via the website of the State Institute for Nature Protection (SINP): (http://natura2000.dzzp.hr/natura/), and the official website of the European Commission (http://natura2000.eea.europa.eu/).

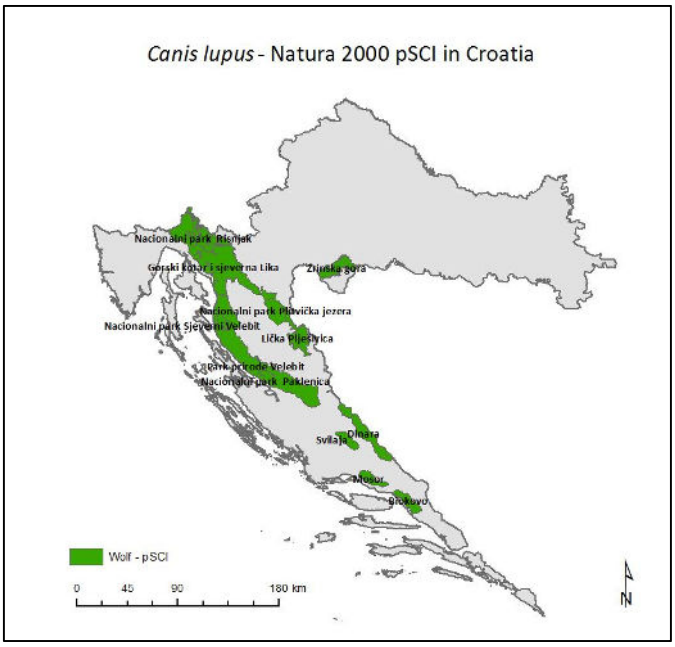

Figure 2. Proposed Sites of Community Importance (pSCI) for the wolf, as part of the Natura 2000 area (source: SINP, compiled by D. Hamidović, 2014)

For the purpose of preserving the ecological network, it is prescribed that each plan, programme and project that could negatively impact the conservation objectives of the ecological network must be subjected to the assessment procedure as stipulated by the Nature Protection Act, Ordinance on the acceptability assessment of plans, programmes and projects to the ecological network (OG 118/09) and also incorporated in the Regulation on the environmental impact assessment (OG 61/14) and the Regulation on strategic environmental impact assessment for plans and programmes (OG 64/08).

The wolf population is managed pursuant to the Wolf Management Plan in Croatia, the first planning document drafted in cooperation and with the active participation of all interest groups. The plan was adopted as an official document by the then Minister of Culture on 7 December 2004, and represented a document on the activities to be carried out in order to ensure the long-term conservation of the wolf and the most harmonious possible cohabitation of wolves and humans in Croatia. In 2010, the drafting of the Wolf Management Plan in the Republic of Croatia for the period 2010–2015 was completed. The plan was the result of a two-year revision process that included representatives of various interest groups (representatives of the relevant ministries, members of the Committee for monitoring large carnivore populations, scientists, hunters, foresters, non-governmental organisations, etc.) through a series of joint workshops. On the basis of the workshop results, collected data and data analyses conducted by a small group of experts coordinated

by the State Institute for Nature Protection, the proposal of the Wolf Management Plan in the Republic of Croatia for the period 2010–2015 was drawn up. The then Ministry of Culture conducted additional consultations with other ministries, and on 15 July 2010, the Minister of Culture passed the Decision on adoption of the Wolf Management Plan in the Republic of Croatia for the period 2010–2015, pursuant to Article 96, paragraph 2 of the valid Nature Protection Act (OG 70/05 and 139/08). The management plan called for annual drafting of a Report on the status of the wolf population, as the foundation for considering possible interventions in the wolf population.

This year's Report on the status of the wolf population is based on the processing of data collected in the period from 2013 to early September 2014. The assessment of the wolf population in Croatia was performed using a combination of methods, in the same manner as the assessment of the previous year. Data used include those on damages to domesticated animals, data on the permitted legal culling quota for 2012/2013 and its execution, and other records of wolf mortality, in addition to the results of scientific research and assessor estimates.

2. Overview of the Report, assessments and interventions

2.1. Methodology

Over the past ten years, the State Institute for Nature Protection (SINP), in cooperation with scientists from the Faculty of Veterinary Medicine, University of Zagreb (FVM), has been drafting the annual Report on the status of the wolf population, for the purposes of implementation of the Wolf Management Plan. The assessment of the abundance of the wolf population includes all available data on the wolf (damages incurred to livestock, results of telemetric research, photo-trap monitoring, genetic research, etc.), the results of monitoring snow tracks, in addition to assessor estimates. The experts of the Ministry of Environmental and Nature Protection authorised to assess damages incurred by strictly protected animal species, scientific associates, protected area rangers, and members of the wolf and lynx intervention teams map their sightings of wolf pack locations and assumed numbers of individuals in packs. They enter the number and name of the pack with regards to location on a specific form, and list the general wolf population trends in that area (declining, stagnant, increasing) and other important remarks. The statements of the assessors are then aligned with the telemetrically defined territory sizes of the wolf packs and the number of individuals that may inhabit an area, in which the other available data is also taken into consideration.

Based on the data provided in the Reports for 2005 to 2012, the Committee for monitoring large carnivore populations (hereinafter: Committee) proposed interventions into the wolf population. In 2013, due to a decline in the wolf population, no interventions (culling) were proposed or approved by the Committee.

To assess pack size in 2014, an analysis was also conducted of the spatial and temporal occurrences of wolf attacks on domestic animals. Every recorded attack on domesticated animals in the period from 15 September 2013 to 15 September 2014 was entered into the Database of damages incurred to livestock, kept by the Ministry of Environmental and Nature Protection, Nature Protection Directorate (hereinafter: Damage database), and entered into the geographic database (GIS). Cases of predation were grouped in weekly intervals that can then be observed in temporal series. Simultaneous appearances of predation at different locations indicate the presence of different packs. Around each attack site, a circular buffer area covering an area of 100 km^2 was designated, representing one-half the average territory inhabited by a pack in Dalmatia or Lika (according to telemetric data). Each such buffer area, or collection of buffer areas overlapping by more than 50%, were pooled into a larger circular area of 200 km^2 area, to correspond to the estimated pack area for Lika and Dalmatia. Buffer areas of individual attacks (100 km^2) must overlap by more than 50% to be attributed to the same pack, considering that in conditions of livestock concentration, individuals from different packs can hunt prey relatively near one another in

such a small area (Kusak, 2002). Each new buffer area around the attack site (100 km^2), that is more than 50% outside the existing pack circles, is assigned to a new pack circle (200 km^2, new pack). This method of obtaining pack numbers and the estimated average number of individuals in the pack (telemetry, photo-traps, assessor statements, howling surveys, snow tracks, other data observing wolf presence) was used to determine the abundance of that part of the wolf population in Croatia.

In addition, this year's assessment also used data submitted by individual hunting rights holders, hunting associations and/or hunting grounds managers.

Dr. Guillaume Chapron from the Grimso Wildlife Research Station in Sweden drafted a report for Croatia using a mathematical model to assess the likely impact of culling quotas on the future population trends (growth). The same model to assess the impact of culling quotas and additional mortality was applied to Swedish and French wolf populations, at the request of the competent authorities in those countries (Liberg et al., 2011).

Due to the presence of a large number of border packs, the pack assessment in Croatia was conducted in such a way that the number of individuals in border packs was divided in half, due to the regular crossing of the state border and time spent in other countries, and this figure was added to the abundance assessed for the rest of Croatia. This method of assessment further confirmed the previously stated analysis and research.

2.2. Assessment of the status and trends in the period from 2005 to 2013

The assessed abundance ranged from 160–220 individuals, divided into some 40 packs in 2005, to 162–234 individuals in some 50 packs in 2012, or an average of 206 wolf individuals in 50 packs for the overall period. The average trend, with certain derogations, was stable. The wolf population has expanded spatially into the territories of Sisak-Moslavina, Karlovac and Istria Counties. In 2013, the abundance of wolf individuals declined in comparison to 2012, and was the lowest since 2005, since this methodology has been applied and these estimates made.

Table 1. Assessed size of the wolf population in Croatia in the period from 2005–2013

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
Assessed of abundance of the wolf population	160 - 220	180 - 240	180 - 230	175 - 244	180 - 250	198 - 262	168 - 219	162- 234	142- 212
Average abundance of the wolf population	190	210	205	209	216	230	194	198	177
Assessed number of packs (approximate)	40	40-50	50	50	60	60	50	50	49

A detailed overview by year shows that the assessed abundance in **2005** gave a range of 160 to a maximum of 220 individuals, with an **average of 190** individuals, distributed in some 40 packs. The opinion of the local assessors was that the wolf population abundance was unchanged in comparison to previous years, except in the area of Šibenik-Knin County, where abundance was believed to have increased due to an increased number of damaging incidents on livestock, and in Dubrovnik-Neretva County, where assessors estimated a sudden and dramatic decline in the abundance (Desnica & Štrbenac, 2005).

In **2006**, the abundance of the wolf population was assessed at an **average of 210** individuals, with a range of 180 to 240 individuals, divided into 40–50 packs. The most obvious change in 2006 in comparison to one year earlier was the appearance of the wolf in the area of Sisak-Moslavina and Istria Counties (Desnica & Štrbenac, 2006).

The result of the population size assessment performed in **2007** gave an approximate range of 180 to 230 individuals, with an ***average of 205*** individuals distributed in some 50 packs. Though the total assessed population size was virtually identical to the previous year, there were some changes in the assessed number of individuals by county (Desnica et al., 2007).

An analysis of the collected data in **2008** gave an assessment that the wolf population in Croatia is stable, with an abundance ranging from 175 to 244 individuals, with an ***average of 209*** individuals distributed in some 50 packs (Oković & Štrbenac, 2008). In terms of the general trends of the wolf population, a slightly positive trend was observed by experts in the Karlovac, Sisak-Moslavina and Primorje-Gorski Kotar Counties.

The collected and processed data for **2009** showed that the wolf population in Croatia ranged from 180 to 250 individuals, or an ***average of 216*** individuals, divided into almost 60 packs. Of these, 38% were border packs. The largest number of individuals was assessed to inhabit the areas of Lika-Senj and Split-Dalmatia Counties (Oković & Štrbenac, 2009).

The processing of all collected data during **2010** showed that the wolf population ranged from 198 to 261.5 individuals (rounded to 200 to 260). ***On average,*** this was ***230*** individuals distributed into 60 packs. Of these, 39% were border packs. The highest number of individuals was assessed in the area of Split-Dalmatia and Lika-Senj Counties (Oković & Štrbenac, 2010).

The data collected for **2011** indicated that the wolf population in Croatia ranged from 168 to 219 individuals, or an ***average of 193.5*** individuals distributed in some 50 packs. Of these 50 packs, 24 (48%) were border packs (Jeremić & Kusak, 2011).

All the data collected and processed during **2012** showed that the Croatian wolf population ranged from 162 to 234 individuals, which is ***an average of 198*** individuals. These individuals

are distributed in almost 50 packs. Of these, 24 packs (48%) were border packs (Jeremić & Kusak, 2012).

The data processed for **2013** showed that the Croatian wolf population ranged from 142 to 212 individuals, or an ***average of 177*** individuals. These individuals were distributed in 49 packs, of which 23 packs (47%) were border packs (Kusak & Jeremić, 2013).

2.3. Deciding on and executing legal interventions (culling) in the wolf population

Expanded meetings of the Committee for monitoring large carnivore populations in the Republic of Croatia were held in mid-September every year from 2005 to 2012 to discuss annual legal interventions in the wolf population. At each meeting, the Report on the status of the wolf population for the previous year was presented. In addition to the Committee, representatives of interest groups also participated in the discussions on legal culling. Each year, the legal quota was decided on at the proposal of the Committee, in such a manner that 10–15% of the assessed population abundance was taken and then reduced by the total known mortality to that point for that year, and the different approved for the legal culling for that season. In the period from 2005 to 2012, culling was permitted for 113 individuals, with a total of 77 culled (68.1% of quota). The largest cull was approved for the Dalmatia region, where the highest damages to livestock were recorded. The most culls were approved in 2010, and the quota best met in 2011. In all years, the quota was best met in the area of Gorski Kotar (Figure 3).

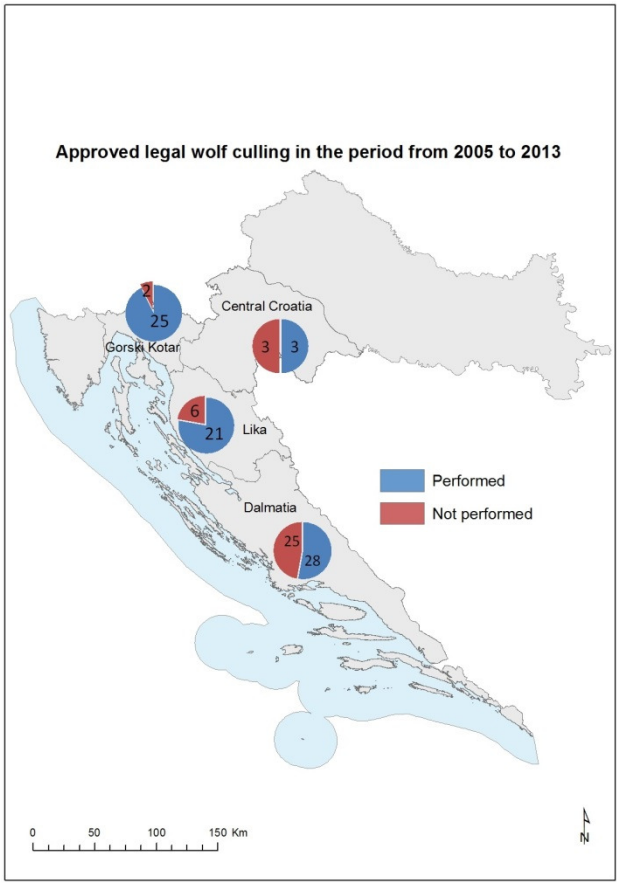

Figure 3. Actual approved legal wolf culling in Croatia in the period from 2005 to 2013 (Source: SINP; compiled by: P. Gambiroža & I. Ilijaš, 2014)

It should be noted that until 2008, culling was permitted in the period from 1 October to 31 December of the current year, while in 2008, that period was extended to the end of February of the following year. No culling was permitted in 2013.

Table 2. Approved and performed legal culling in the wolf population in Croatia in the period from 2005 to 2013

Culling/Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
Approved legal culling	4	7	7	10	21	24	22	18	0	**113**
Performed legal culling	0	2	4	9	7	19	21	15	0	**77**
Percentage of culling performance	0	28.6	57.1	90	33.3	79.2	95.5	83.3	0	**68.1**

A detailed overview (Table 2) shows that the first decision by the Ministry of Culture on interventions in the wolf population (culling), adopted in **2005**, approved the culling of a total of 4 wolf individuals: 2 in the Dalmatia area and 1 each in the Lika and Gorski Kotar areas. After the completion of the period from 1 October to 31 December in which that culling was permitted, it was established that no culling was officially performed. In the following year, **2006,** culling was approved for 7 wolf individuals: 3 in Dalmatia, and 2 each in Gorski Kotar and Lika. In that year, 2 wolf individuals were culled and reported, both in the Gorski Kotar area. The third year, **2007**, also had approval for the culling of 7 wolf individuals: 3 in the Dalmatia area and 2 each in Gorski Kotar and Lika. In a very short period after the passing of the Decision, the permitted culling was carried out in the areas of Gorski Kotar and Lika. On the contrary, the permitted culling of 3 wolf individuals in the Dalmatia region was not successfully carried out until the end of the permit period, even though the period was extended to the end of February 2008. The culling of 10 individuals was authorised for **2008**: 3 in the Dalmatia region, 3 in the Lika region and 4 in the Gorski Kotar region. By the end of 2008, 7 individuals had been culled, all 3 permitted in the Dalmatian region, 2 in the Lika region and 2 in the Gorski Kotar region. In early 2009, one individual was culled in Lika and one in Gorski Kotar. 2008 was the first year in which culling was successfully performed in Dalmatia. At the meeting held in September 2009, the decision was made to cull 21 wolf individuals from the population. Permits were granted for the culling of 4 individuals in Primorje-Gorski Kotar County, and 1 individual from the area of Karlovac County. The culling of 5 individuals was authorised for each of the following areas: Lika-Senj County, Šibenik-Knin County and Split-Dalmatia County. The final individual was approved for Zadar County, and more specifically to the Posedarje municipality, where damages from wolves had occurred frequently. Of the 21 individuals permitted to be culled, at the end of 2009, 3 were culled in Primorje-Gorski Kotar County and 1 in Lika-Senj County. By the end of the culling period, one additional individual was culled in Primorje-Gorski Kotar County, thus meeting the quota for that area, while in early 2010, another 2 individuals were culled in Lika-Senj County. According to the official data, not a single individual was culled in the Dalmatia region. At the meeting held in September 2010, the Committee for the monitoring of wild carnivore populations proposed the culling of 24 wolf individuals to the then Ministry of Culture. Culling permits were granted for 5 individuals each in the Primorje-Gorski Kotar, Lika-Senj, Šibenik-Knin and Split-Dalmatia Counties, and 1 individual each in the Sisak-Moslavina, Karlovac, Dubrovnik-Neretva and Zadar Counties (municipalities Poličnik, Posedarje and Ražanac). Of the permitted culling of 24 individuals, 19 wolves were culled in the period from 1 October 2010 to 28 February 2011 (5 individuals in Primorje-Gorski Kotar, Lika-Senj and Split-Dalmatia Counties; 3 individuals in Šibenik-Knin County and 1 individual in Sisak-Moslavina County). The culling of the additional 5 wolf individuals was not performed (2 individuals in Šibenik-Knin County, and 1 each in Karlovac, Dubrovnik-Neretva and Zadar Counties (municipalities Poličnik, Posedarje and Ražanac)). In early February 2011, the Committee received information on the culling of an additional wolf individual in Sisak-Moslavina County which was excessive, but properly reported within the period of permitted

culling, and was included among the illegal kills. In Šibenik-Knin County, the culling of a fourth individual was performed, though outside the legally permitted period (in March 2011) and this individual was also included among the illegal kills. At the extended meeting held in September 2011, the Committee proposed to the Ministry of Culture that culling of 22 individuals be authorised. Culling was approved as follows: 5 individuals each in Primorje-Gorski Kotar County, Lika-Senj County and Split-Dalmatia County; 4 individuals in Šibenik-Knin County; and 1 individual each in Sisak-Moslavina County (municipality Dvor), Karlovac County, and Zadar County (municipalities Poličnik, Posedarje and Ražanac). Of the permitted 22 individuals, 21 wolves were culled in the period from 1 October 2011 to 29 February 2012. Only one wolf in Karlovac County was not culled. At the extended meeting held in September **2012,** the Committee proposed the Ministry of Culture permit the culling of 18 wolf individuals. Culling was authorised as follows: 4 individuals each in Primorje-Gorski Kotar County, Lika-Senj County, Split-Dalmatia County and Šibenik-Knin County, and 1 wolf each in the area of Sisak-Moslavina County and Zadar County (municipalities Poličnik, Posedarje and Ražanac). Of the permitted culling of **18** wolf individuals in the period from 1 October 2011 to 29 February 2012, a total of **15** wolves were culled. The permitted culling of 3 wolf individuals (one wolf each in the areas of Zadar, Lika-Sinj and Šibenik-Knin Counties) was not carried out. In the season 2012/13, 83.3% of the approved culling was successfully carried out.

The unexecuted culling in the period 2005–2013 was 36 wolves, or 31.9% of the total approved number of individual authorised for culling in that period (Table 2)***. Though the approved quotas were not fully met, there were frequent requests for an increase in the approved culling quota. Meanwhile, illegal wolf kills were recorded in every year.***

As previously mentioned, considering that the abundance of wolf individuals was significantly reduced in **2013** in comparison to 2012, and was less than the level in 2005 when the same methodology was introduced for assessing abundance, no interventions in the wolf population were considered or approved for the 2013/14 season.

3. Analysis of the status of the wolf population 2013/2014

3.1. Damages to domesticated animals and impacts on livestock

In the Dalmatia region, where animal husbandry is primarily of an extensive character, and where the availability of natural prey is limited, wolves often incur damage to livestock. In the hilly and mountainous regions of Gorski Kotar, Velebit and Lika, wolves have a lesser impact on livestock, due to the availability of sufficient natural wild prey (deer, wild boar).

For the purpose of researching the dietary habits of wolves, a total of 147 scat samples and 10 stomach content samples were collected in the period from 1999 to 2002 in the area of Gorski Kotar and Dalmatinska Zagora. On the basis of the collected samples, the frequency of occurrence (%) of certain categories of finds and animals types was determined separately for each region. In the area of Dalmatinska Zagora, the majority of the wolf diet (73.4%) was comprised of domesticated animals. In the collected samples, goat hair accounted for 36%, cattle hair for 22% and a relatively frequent find of canine hair of 32.6% was found. It should be noted that not all finds originated from domesticated animals slaughtered by the wolves, but that a certain portion was from slaughterhouse waste and/or previously deceased cattle. In contrast, the main prey in Gorski Kotar were wild ungulates (red deer, roe deer, wild boar), which accounted for 84.21% of the diet.

3.1.1. Damages to domesticated animals

The damage database (see Section 2.1) was created on the basis of witness accounts. Reports of damages are filled out in the field by the authorised experts for determining damages caused by wolf. Though the wolf is responsible in the majority of cases, for each damage claim, the authorised expert is required to conduct a review of the scene and determine whether the damage was caused by a strictly protected animal, or by some other animal. In line with this, the number of reported cases of damage does not correspond to the actual number of damages caused by the wolf. Each year, an analysis of damage events is carried out for the needs of the Report. When drafting the Report, data from the damages database are taken from September of the previous year to September of the current year, and it can occur that damage events are entered into the register later, because the experts submit their reports at a later date or do not fill in all the information. For this reason, each year, the data for the preceding period are reanalysed. For the needs of the 2014 Report, the data from the Damages database were reviewed for the previous five-year period. Also, each year the Croatian Agriculture Agency submits data on the number of domesticated animals in Croatia from its official database for the purpose of the Report. Analysis of damages is only one of the methodology parameters for assessing the status of the wolf

population, and this gives a direct look at the status of animal husbandry within the wolf distribution range.

3.1.1.1. Livestock abundances in the wolf distribution range

The list of livestock held by the Croatian Agriculture Agency (CAA) for 2013 contains only that livestock which is registered, and for which a subsidy is granted. This year, unlike previous years, the number of registered donkeys and horses was also available. According to these data, a large portion of the population engaged in livestock farming in the current wolf distribution area, particularly in Sisak-Moslavina County, Lika-Senj County and the counties in the Dalmatian region. Livestock owners in nine counties within the wolf distribution range represent 41% of all livestock owners in Croatia in 2013 (Table 4). The most common livestock raised are sheep, goats and cattle.

As in previous year, the counties with the highest numbers of registered sheep in **2012** were Zadar, Lika-Senj and Šibenik-Knin Counties (Table 3), with a total of 257,623 individuals, or 39% of all the sheep in Croatia and 60% of all the sheep within the wolf distribution range in Croatia. In comparison to 2011, an increase of 24% in the number of sheep was recorded. In 2012, goats were most abundant in the Zadar, Split-Dalmatia and Šibenik-Knin Counties, with a total of 33,418 individuals or 49% of the total number of goats in Croatia, and 73% of goats within the wolf distribution range. In comparison to 2011, an increase of 36% was recorded in the number of registered goats.

In **2013,** the counties with the highest number of registered sheep were again Zadar, Lika-Senj and Šibenik-Knin Counties (Table 4), with a total of 228,058 sheep, or 40% of all the sheep in Croatia and 59% of all the sheep in the wolf distribution area in Croatia. In comparison to 2012, a slight decrease of 13% was recorded for total sheep numbers in Croatia, and a decrease of 10% was observed within the wolf distribution range. In 2013, goats were again most numerous in the Zadar, Split-Dalmatia and Šibenik-Knin Counties, a total of 31,618 goats, or 49% of the total number in Croatia and 74% in the wolf distribution range. In comparison to 2012, a slight decrease of 10% was observed in the total number of goats registered in Croatia, and 6% within the wolf distribution range.

Table 3. Numbers of animal owners and livestock raised in the wolf distribution range for 2012

County	No. of OWNERS	CATTLE	GOAT	SHEEP	TOTAL
DUBROVNIK-NERETVA	537	1,845	1,902	4,971	8,718
ISTRIA	1,530	10,122	2,636	17,850	30,608
KARLOVAC	2,780	16,668	1,433	21,925	40,026
LIKA-SENJ	2,759	9,817	1,913	78,392	90,122
PRIMORJE-GORSKI KOTAR COUNTY	1,031	1,961	1,265	36,982	40,208
SISAK-MOSLAVINA	4,154	35,098	2,978	39,792	77,868
SPLIT-DALMATIA	2,719	7,758	12,575	49,472	69,805
ŠIBENIK-KNIN	1,956	4,524	6,181	69,865	80,570
ZADAR	2,233	4,510	14,662	109,366	128,538
Total (wolf distribution range)	**19,699**	**92,303**	**45,545**	**428,615**	**566,463**
Total (Croatia)	**50,802**	**493,110**	**71,715**	**662,922**	**1,227,747**

Table 4. Number of animal owners and livestock raised in the area of the wolf distribution range for 2013

County	No. of OWNERS	CATTLE	HORSES	DONKEYS	GOAT	SHEEP	TOTAL
DUBROVNIK-NERETVA	574	1,798	107	229	1,293	4,255	7,682
ISTRIA	1,894	8,619	1,012	288	2,312	15,867	28,098
KARLOVAC	3,176	16,287	445	33	1,565	20,137	38,467
LIKA-SENJ	3,921	12,545	627	53	1,986	70,411	85,622
PRIMORJE-GORSKI KOTAR	1,286	1,529	1,604	63	1,045	34,212	38,453
SISAK-MOSLAVINA	5,101	32,121	5,265	39	2,953	36,929	77,307
SPLIT-DALMATIA	3,555	6,781	472	643	12,017	46,169	66,082
ŠIBENIK-KNIN	2,475	4,401	86	220	6,700	62,610	74,017
ZADAR	2,791	4,703	88	302	12,901	95,037	113,031
Total (wolf distribution range)	**24,773**	**88,784**	**9,706**	**1,870**	**42,772**	**385,627**	**528,759**
Total (Croatia)	**59,808**	**458,282**	**20,057**	**2,246**	**64,721**	**576,626**	**1,121,932**

3.1.1.2. Damage events and attacks on livestock

During the analysis of damages to domesticate animals, the records of authorised experts for the assessment of damages by strictly protected species on domesticated animals received by the Ministry of Environmental and Nature Protection, Nature Protection Directorate were used. The data listed in the records were entered into the Damages Database, and then processed, in order to obtain better insight into the numbers, trends and

spatial distribution of damages to livestock. This Report covers the data for 2013 and most of 2014 (to 15 September). Considering that a portion of the received cases have not yet been concluded and archived, they remain unofficial. However, the practice in recent years has shown that the derogations after official processing are negligible, and therefore, the results listed in this Report can be considered reliable.

In **2012,** a total of 1743 requests for compensation of damages by predators were received. Of these, 94% (1635) were concluded to be certainly or very likely due to wolf (Table 5). A comparison with data from previous years shows that the highest number of damages again occurred in Šibenik-Knin (783) and Split-Dalmatia Counties (483), where 77% of all wolf damages were recorded. Zadar County was in third place with 267 damage events (16%).

The total number of damage events by wolves in 2012 was in slight decline, while the ratio of damages changed in certain counties. There were no damages in 2012 in Istria County, while damages were recorded in Bjelovar-Bilogora County, where none had previously been recorded. The damages increased slightly in Šibenik-Knin County (by 9%), while there was a marked reduction in damages in Split-Dalmatia County (by 18%), Lika-Senj County (by 31%) and Karlovac County (83%) (Table 5a). The possible causes for these changes are the gradual abandonment of extensive practices in livestock breeding, the non-reporting of damages, or a drop in the wolf population.

In **2013,** a total of 1619 requests for compensation of damages by predators were received. Of these, 95% (1535 requests) were concluded to be certainly or very likely due to wolf (Table 6a). The total number of damages declined by 6% in relation to 2012. Also, a comparison with data from previous years showed that again the highest number of damage events occurred in Šibenik-Knin County (648) and Split-Dalmatia County (526), where 77% of all wolf damages were recorded. Zadar Count was in third place with 261 damage events (17%).

The total number of damage events by wolves in 2013 was in slight decline, while the ratio of damages changed in certain counties. There were no damages in 2012 in Istria County or in Primorje-Gorski Kotar County in 2013. The damages increased slightly in Split-Dalmatia County (by 8%), while there was a marked reduction in damages in Šibenik-Knin County (by 17%), and Sisak-Moslavina County (by 68%) (Table 5a).

A possible cause for these changes is a gradual abandonment of extensive practices in livestock breeding, the non-reporting of damages, or a drop in the wolf population.

Table 5. Distribution of reported damages to livestock, by assessed predator species, by county for 2012

County/ predator	Wolf	Dog	Jackal	Bear	Unknown	Cannot be ascertained	Other*	Total
Lika-Senj	20	1	0	0	0	0	0	21
Split-Dalmatia	483	3	0	0	0	28	4	518
Zadar	267	1	0	0	0	3	0	271
Šibenik-Knin	783	7	1	0	1	44	9	845
Dubrovnik-Neretva	60	1	0	0	0	0	0	61
Primorje-Gorski Kotar	3	0	0	0	1	0	0	4
Karlovac	1	0	0	2	0	0	0	3
Sisak-Moslavina	16	0	0	0	0	2	0	18
Bjelovar-Bilogora	2	0	0	0	0	0	0	2
Total	**1,635**	**13**	**1**	**2**	**2**	**77**	**13**	**1,743**

*Damages not caused by a strictly protected carnivore or not the consequence of an attack.

Table 5a. Number of damages by wolves in the distribution range from 2010 to 2013

County	2010	2011	2012	2013
DUBROVNIK-NERETVA	27	56	60	68
BJELOVAR-BILOGORA	0	0	2	0
ISTRIA	0	2	0	0
KARLOVAC	2	6	1	1
LIKA-SENJ	41	29	20	26
PRIMORJE-GORSKI KOTAR	1	4	3	0
SISAK-MOSLAVINA	10	11	16	5
SPLIT-DALMATIA	549	589	483	526
ŠIBENIK-KNIN	566	712	783	648
ZADAR	177	262	267	261
Total	**1,373**	**1,671**	**1,635**	**1,535**

Table 5b. Number of livestock (sheep, goats, cattle) in the wolf distribution area from 2010 to 2013

County	2010	2011	2012	2013
DUBROVNIK-NERETVA	5,904	6,383	8,718	7,346
ISTRIA	18,861	22,609	30,608	26,798
KARLOVAC	24,869	32,939	40,026	37,989
LIKA-SENJ	69,168	72,673	90,122	84,942
PRIMORJE-GORSKI KOTAR	29,941	34,996	40,208	36,786
SISAK-MOSLAVINA	47,539	60,316	77,868	72,003
SPLIT-DALMATIA	55,059	57,996	69,805	64,967
ŠIBENIK-KNIN	70,635	68,298	80,570	73,711
ZADAR	104,996	101,460	128,538	112,641
Total	**426,972**	**457,670**	**566,463**	**517,183**

With regard to the abundance of livestock in counties where the most damages were recorded (Split-Dalmatia, Šibenik-Knin and Zadar), these data (Table 5b) show that there has been a significant increase in the number of registered livestock in recent years, with a reduction in these figures for 2013. The number of livestock was decreased by 8.5% in Šibenik-Knin County, by 7% in Split-Dalmatia County and by 12% in Zadar County.

To 15 September 2014, the Damages Database for **2014** included a total of 814 reports and claims for compensation of damage. Of the total 814 claims received, it was concluded in 95% (776) of cases that the damages were certainly or very likely caused by wolf (Table 6). This percentage has not changed significantly over the past few years.

Table 6. Reported damage to livestock by assessed predator species and by county, from 1 January to 15 September 2014

County	Not entered	Wolf	Dog	Cannot be ascertained	Other*	Total
Lika-Senj	0	3	0	1	0	4
Split-Dalmatia	0	262	0	12	1	275
Zadar	1	133	1	0	0	135
Šibenik-Knin	1	356	1	18	1	377
Dubrovnik-Neretva	0	15	0	0	0	15
Sisak-Moslavina	0	6	0	1	0	7
Slavonski Brod-Posavina	0	1	0	0	0	1
Total	**2**	**776**	**2**	**32**	**2**	**814**

* Damages not caused by a strictly protected carnivore or not the consequence of an attack.

Table 6a. Reported damage to livestock, by assessed predator species, by year, from 2010 to 2014

Year	Not entered	Wolf	Jackal	Dog	Unknown	Bear	Lynx	Cannot be ascertained	Other*	Total
2010	2	1,373	1	6	54	0	2	9	0	**1,447**
2011	4	1,671	0	5	13	0	0	59	12	**1,764**
2012	0	1,635	1	13	2	2	0	77	13	**1,743**
2013	0	1,535	0	4	2	2	0	69	7	**1,619**
2014 (to 15 September)	2	776	0	2	0	0	0	32	2	**814**
Total	**8**	**6,990**	**2**	**30**	**71**	**4**	**2**	**246**	**34**	**7,387**

* Damages not caused by a strictly protected carnivore or not the consequence of an attack.

During **2012,** damages (wounding or death) of a total of 2928 individuals of domesticated animals were reported, in the total of 1635 damage events caused by wolf (Table 7). Most reports concerned sheep (72%) and goats (15%). ***The average number of affected livestock per damage event in 2012 was 1.8 individuals, which was a slight reduction in the number of affected individuals per damage event in comparison to 2011 (1.9).***

During **2013,** damages (wounding or death) of a total of 2608 individuals of domesticated animals were reported, in the total of 1535 damage events caused by wolf (Table 8). Most reports concerned sheep (68%) and goats (18%). ***The average number of affected livestock per damage event in 2013 was 1.7 individuals, which was a slight reduction in the number of affected individuals per damage event in comparison to the previous two years (Table 10).***

The trend in the reduction of the number of affected livestock per damage event began in 2009/2010. We believe that this was partially due to better protection of livestock (use of herd dogs and electric fences) arising from the education implemented in the field and the donation of dogs and electric fences that began in 2003, and also due to the raising of awareness of livestock owners to increase the care and supervision of animals.

In some areas where wolves are present, livestock owners did not want to participate or rejected the donations of electric fences or Tornjak shepherd dogs. Furthermore, where these campaigns were carried out, among livestock owners who abided by the recommendations and management practices, damages were dramatically reduced or

eliminated. However, it was also observed that with a stagnation of donations and education of livestock owners, the animosity towards predator species increased.

Table 7. Number of individual species of domestic animals attacked by wolves, by county, in 2012

County	Goat	Dog	Sheep	Cattle	Donkey	Horse	Total
Bjelovar-Bilogora	0	0	0	0	1	0	1
Dubrovnik-Neretva	5	2	47	28	1	4	87
Karlovac	0	0	4	0	0	0	4
Lika-Senj	8	0	44	3	3	0	58
Primorje-Gorski Kotar	0	0	9	2	0	0	11
Sisak-Moslavina	2	0	57	0	0	0	59
Split-Dalmatia	129	111	495	65	21	4	825
Šibenik-Knin	133	59	904	62	6	2	1.166
Zadar	168	2	537	2	0	8	717
Total	**445**	**174**	**2,097**	**162**	**32**	**18**	**2,928**

Table 8. Number of individual species of domestic animals attacked by wolves, by county, in 2013

County	Goat	Dog	Sheep	Cattle	Donkey	Horse	Pig	Total
Dubrovnik-Neretva	17	1	46	24	0	8	0	96
Karlovac	0	0	1	0	0	0	0	1
Lika-Senj	12	0	49	4	3	1	0	69
Sisak-Moslavina	0	0	19	0	0	0	0	19
Split-Dalmatia	188	101	427	54	9	7	0	786
Šibenik-Knin	106	27	730	76	9	2	2	952
Zadar	146	1	523	7	0	6	2	685
Total	**469**	**130**	**1,795**	**165**	**21**	**24**	**4**	**2,608**

In the first half of **2014** (data entered into the Damages Database to 15 September), damages (wounding or death) of a total of 1632 individuals of domesticated animals were reported, in the total of 776 damage events caused by wolf (Table 9). Also in this year, the most reports concerned sheep (76%) and goats (16%) in comparison to other animal species. ***The average number of affected livestock per damage event was 2.1 individuals.***

Table 9. Number of individual domestic animals species attacked by wolves, by county, in 2014 (data to 15 September)

County	Goat	Dog	Sheep	Cattle	Donkey	Horse	Mule	Total
Slavonski Brod-Posavina	0	0	2	0	0	0	0	2
Dubrovnik-Neretva	5	1	15	1	2	1	2	27
Lika-Senj	0	0	4	0	0	0	0	4
Sisak-Moslavina	1	0	16	3	0	0	0	20

Split-Dalmatia	109	42	406	36	5	0	0	598
Šibenik-Knin	73	17	477	14	6	3	0	590
Zadar	69	0	314	4	0	4	0	391
Total	**257**	**60**	**1,234**	**58**	**13**	**8**	**2**	**1,632**

Table 9a. Number of individual domestic animals species attacked by wolves in the period from 2010 to 2014

Year/	Goat	Dog	Sheep	Cattle	Donkey	Horse	Mule	Pig	Total
2010	488	86	2,184	164	23	17	1	0	**2,963**
2011	643	117	2,127	152	54	12	0	0	**3,105**
2012	445	174	2,097	162	32	18	0	0	**2,928**
2013	469	130	1,795	165	21	24	0	4	**2,608**
2014 (to 15 September)	257	60	1,234	58	13	8	2	0	**1,632**
Total	**2,302**	**567**	**9,437**	**701**	**143**	**79**	**3**	**4**	**13,236**

Table 10. Average number of damaged individuals of livestock per damage event

Year	Number of reported damages by wolves	Number of affected head of livestock	Average number of affected head of livestock
2010	1,373	2,963	**2.2**
2011	1,671	3,105	**1.9**
2012	1,635	2,928	**1.8**
2013	1,535	2,608	**1.7**
2014 (to 15 September)	776	1,632	**2.1**

In the spatial perspective, the greatest extent of damages continues to be in Šibenik-Knin and Split-Dalmatia Counties, followed by Zadar County.

In **2012,** a total of 1166 animals (40% of all affected livestock) were affected in Šibenik-Knin County, followed by 825 animals (28%) in Split-Dalmatia County.

During **2013,** 952 animals (37% of all affected livestock) were affected in Šibenik-Knin County, followed by 786 animals (30%) in Split-Dalmatia County.

The total number of affected animals in relation to the preceding year 2012 was reduced by 320 animals, or by 11% (Table 9a).

3.1.1.3. Impacts of wolves on livestock

The impacts of wolves on livestock are evident from the share of sheep and goats attacked by goats in the total number of sheep and goats in that area. The data on livestock numbers, as previously stated, was provided by the Croatian Agriculture Agency (CAA). Ratios were calculated by county to simplify interpretation (Tables 11 and 11a).

An analysis of data for 2012 showed that wolf attacks affected a total of 0.51% of sheep and 0.9% of goats of all the registered sheep and goats in those counties where damages to animals were reported. The analysis for 2013 showed that these attacks affected a total of 0.46% of sheep and 1.09% of goats of the total number of registered sheep and goats in counties where damages were reported.

It should again be stated that the data received are not fully complete, as these data on the numbers of livestock obtained from the CAA pertain only to registered individuals, i.e. to those for which a subsidy was granted, and therefore the total number of livestock is even higher. From the above, it can be stated that the share of livestock attacked by wolves in the total number of livestock is less than shown here, as this was calculated from the available data.

Table 11. Share of sheep and goats attacked by wolves in the total number of registered sheep and goats, by county, in 2012

County	Sheep		Goats	
	Registered with CAA	Share attacked by wolves (%)	Registered with CAA	Share attacked by wolves (%)
Dubrovnik-Neretva	4,971	0.95	1,902	0.26
Karlovac	21,925	0.02	1,433	0.00
Lika-Senj	78,392	0.06	1,913	0.42
Primorje-Gorski Kotar	36,982	0.02	1,265	0.00
Šibenik-Knin	69,865	1.29	12,575	1.06
Sisak-Moslavina	39,792	0.14	2,978	0.07
Split-Dalmatia	49,472	1.00	12,575	1.02
Zadar	109,366	0.49	14,662	1.15
Total	**410,765**	**0.51**	**49,303**	**0.90**

Table 11. Share of sheep and goats attacked by wolves in the total number of registered sheep and goats, by county, in 2013

County	Sheep		Goats	
	Registered with CAA	Share attacked by wolves (%)	Registered with CAA	Share attacked by wolves (%)
Dubrovnik-Neretva	4,255	1.08	1,293	1.31
Istria	15,867	0	2,312	0
Karlovac	20,137	0.004	1,565	0
Lika-Senj	70,411	0.07	1,986	0.6
Primorje-Gorski Kotar	34,212	0	1,045	0
Šibenik-Knin	36,929	1.97	2,953	3.58
Sisak-Moslavina	46,169	0.04	12,017	0
Split-Dalmatia	62,610	0.68	6,700	2.80
Zadar	95,037	0.55	12,901	1.31
Total	**385,627**	**0.46**	**42,772**	**1.09**

3.2. Telemetry studies

Telemetry studies are important in determining the state of the wolf population, as they provide data on the locations of monitored packs and the number of individuals in those packs, and information on the average territory size for packs, the possible number of individuals per unit areas, spatial use within the pack territory and the daily movements of territorial wolves and those in dispersion. Considering that this is a scientific method, these findings also serve as a premise for determining the territory size and number of individuals in the assessed packs, and the interpretation of data collected by assessors. Telemetry research in Croatia is conducted by the Faculty of Veterinary Medicine (FVM), University of Zagreb, and by the OIKON Applied Ecology Institute.

3.2.1. Collaring and monitoring of wolf individuals

The signal/trace was lost for wolves recorded during 2010 (4 individuals) or earlier by FVM researchers, and as such these wolves were lost to monitoring. No wolves were captured and collared during 2011. In 2012, three wolf individuals were captured, of which two females were collared, and one was a pup (9 kg) and was not collared. During 2013, no wolves were captured or collared despite researchers' efforts and multiple field surveys in the Gorski Kotar and Velebit areas. In autumn 2014, the FVM researchers, in cooperation with the Public Institute of Plitvice Lakes National Park, captured two wolves from two neighbouring packs that inhabit the general area of the park. These wolves were fitted with

GPS collars. These are the young female W30-Ivanka (age 0.5 years, mass 21 kg) and young male W31 Anđelko (age 0.5 years, mass 23 kg) (Figures 4 and 5).

Figure 4. Young female W30-Ivanka (Photo: J. Kusak, 2014)

Figure 5. Young male W31-Anđelko was fitted with a GPS collar. Photo shows (next to wolf): Josip Kusak (FVM), Anđelko Novosel and Nikola Magdić (Public Institute of Plitvice Lakes National Park) (Photo: J. Kusak, 2014)

3.2.1.1. Detailed overview of the collaring and monitoring activities in the period 2009–2014

The female **W25-Nika** (2.5 years old, 31 kg) captured in the territory of the *Suho pack*. Though her affiliation to the Suho pack was not confirmed, she remained in that area during August, and her signal was lost during September 2010. She was not subsequently found on either the Croatian or Slovenian sides, despite efforts by FVM scientists and researchers

from the Biotechnical Faculty of the University of Ljubljana. Unfortunately, the data from her collar were not downloaded. On 16 July 2012, in the territory of the Suho pack, a wolf pup named **WP08**. The pup was captured at an age of only three months and weighed only 9 kg, and therefore could not be collared. In that same area, on 24 August 2012, a female named **W29-Ajša**, aged 5 months, was captured and collared. During the summer and early autumn, Ajša was with the Suho pack, and the signal from her collar was lost on the Croatian side of the Suho pack territory in October. It is assumed that she went over to the Slovenian side of the pack. Namely, according to Slovenian research Miho Krofel, a large male, likely the reproductive male of the Suho pack, was shot in the Zemon area near Ilirska Bistrica (Slovenia). It was thus presumed that the Suho pack was on the Slovenian side, including Ajša. Since then, Ajša has not been monitored further, as her signal is not accessible.

In early September 2010, in the territory of the *Snježnik pack,* the male wolf **W26-Karlo**, aged 3.5 years, was captured and collared. During 2010, the Snježnik pack did not reproduce, and all traces of the wolf W26 were lost during winter 2010/11. On 31 October 2010, the wolf **W27-Šaki,** aged 8 months, was rescued from a dry well (4 m deep) in the village Pađene near Knin. He was fitted with a GPS-GSM collar. However, that wolf was killed just 10 days later when it was hit by a car on a local road. On 18 July 2012, the female wolf **W28-Tona,** aged 3.3 years, was captured and collared. She was monitored for two weeks before her signal was lost. Slovenian researchers were contacted for help in locating the wolf. She was located in April 2013 in the territory of the *Risnjak pack* in the company of three other wolves, and at that time the data were downloaded from her collar. From July 2012 to April 2013 (273 days), 1805 locations were recorded and it was found that Tona had spent most of her time in Slovenia, and her movements covered the territories of three known packs (two in Croatia and one in Slovenia). Her range of movement was 1169.8 km^2. In August 2013, her collar was found to have fallen off near Crni Lug.

At the end of July 2009, the staff of OIKON Applied Ecology Institute collared a male they called **Matan** on Mt. Kozjak in the Dalmatia region. The *Vučevica/Kozjak pack* was monitored by FVM scientists from 1999 to 2001, when it was called the *Vučevica pack*, and it is listed under this name in the abundance assessment tables for 2011–2013. A second wolf, the female **Manda,** aged 3.5 years, was collared by scientist Goran Gužvica from OIKON on 13 July 2011 on the between Gospić and Udbina, in the Vrebac hunting ground. Her collar was found hanging from a tree near Pavlovac Vrebački at the end of September 2011 and was damaged (with a hole). The collar was found by shepherds who thought it belonged to a hunting dog and inform the hunting grounds manager, Mr. Milan Zalović, who kindly returned the collar. This finding undoubtedly suggests that the wolf was illegally killed, and it was included in the wolf mortality figures for 2011/12.

3.3. State of individual monitored packs for the period 2009–2014

With telemetric studies, the state of individual monitored packs was assessed using photo-traps, monitoring signs of animal presence, and responses during howling surveys, which can be used to establish the presence of territorial packs and pups.

Gorski Kotar

Though in 2014 there were no attempts to collar new wolves in the Gorski Kotar region, efforts were made in seeking wolf tracks of previously monitored packs (Figure 6). The territories of the four previously monitored packs north of the motorway, and a part of the area south of the A6 motorway Zagreb – Rijeka was searched. The most tracks were found in the area of the Risnjak pack, and howling surveys confirmed that the pack had a litter. Tracks were also found, confirming the presence of wolves, in the areas of the Snježnik and Suho packs, though reproduction was not confirmed. New data from Slovenian colleagues (Dr. Hubert Potočnik) involve the observation of five wolf individuals in the Suho pack during the summer months of 2014. Also, south of the motorway, in the area of the Mrkopalj pack, a wolf litter was confirmed.

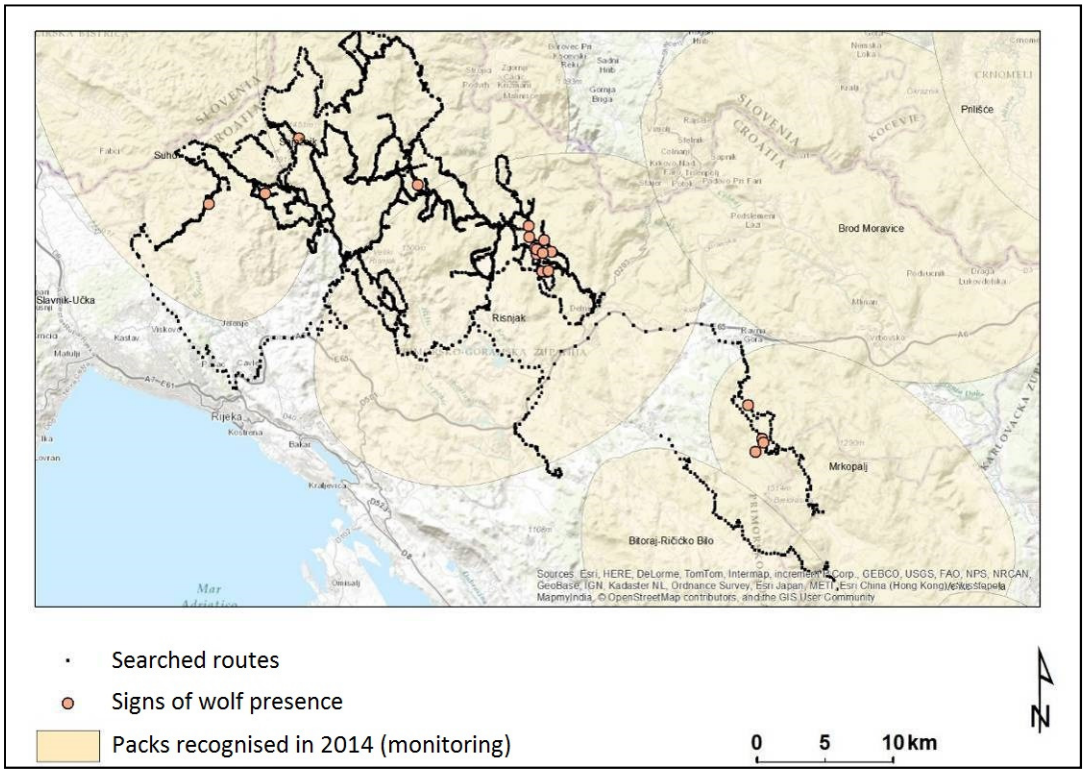

Figure 6. Investigated routes (transects) in Gorski Kotar during 2014 and traces of wolves found (Source: J. Kusak, 2014)

Risnjak pack – during April 2009, the collar of the wolf W19-Rina, a member of the *Risnjak pack* (which was collared in October 2007), stopped working and the signal was lost. The same wolf was again captured on 19 September 2009 and her old collar was replaced by a new GPS-UHF-VHF collar, which ensured further monitoring of the Risnjak pack. The final position of Rina was received on 6 August 2010, and the signal was lost on 23 October 2010 in the Lokve region, and not found again. This was likely a case of illegal culling. During 2010, the range area of W19-Rina and the territory of the Risnjak pack was 368.8 km^2 and reproduction was also recorded that year. During winter 2010, the traces of 5–6 wolves in the pack were recorded, and the wolf density was calculated at 1.63 wolves per 100 km^2. During winter 2011/12, five wolves were recorded in the Risnjak pack, while no signs of wolf tracks were found during August 2012. In April 2013, the wolf E28-Tona was found in the territory of the Risnjak pack in the company with three other wolves, and the data were retrieved from her collar. It was established that Tona had spent the majority of her time in Slovenia, and her movements covered the territories of three known packs (two in Croatia and one in Slovenia). Her range of movement was 1169.8 km^2. In August 2013, her collar was found to have fallen off near Crni Lug. Reproduction was confirmed in the pack in 2014.

Snježnik pack – The female wolf W05-Hilda is the longest monitored wolf to date: she has been monitored for 3269 days, or 8.9 years. After collaring of W26-Karl and the comparative monitoring of both wolves, it was found that during all of 2010, Hilda remained isolated from the remainder of the pack and stayed at the edges of the pack territory, indicating that she was no longer reproductive. Also, no reproduction was confirmed in that year. During winter 2010/11, in the area of the Snježnik pack, the tracks of only three wolves were found, with two wolves appearing together and the third (Hilda) was alone. Hilda remained in the area of the Snježnik pack until June 2011, when the signal from her collar was lost. In early 2010, two collared members of that pack (W22-Drago and W21-Luka) were culled in Slovenia within the legal quota, which represented a great loss for the pack. No reproduction was confirmed in the pack during 2010. On the basis of the locations obtained from the monitored members of that pack, their movement range during 2010 was 759.8 km^2 (including extraterritorial movements), and the wolf density was 0.92 wolvers per 100 km^2. In 2012, researchers found only seven signs of wolf presence in the area of the Snježnik pack. Tracks were not found in the usual wolf gathering places, suggesting that these were wandering individuals in dispersion. In July 2012, the female W28-Tona was captured and collared, though her signal was lost only two weeks later. From this, it would appear that this pack no longer exists. As this is in the border area with Slovenia, and the fact that wolves in dispersion were found in passing, the pack has remained in the interpretation of the pack distribution for 2012, while the findings for 2013 were somewhat more positive. In 2014, Slovenian researcher (Dr. H. Potočnik) recorded an observation of four individuals, though no evidence of reproduction was found.

Suho/Gomance pack – during 2010, some signs suggested that this border pack had reproduction. The collared female W25-Nika disappeared during 2010, and the data from her collar were not retrieved. During winter 2010/11, the traces of three wolves were recorded, and during August 2011, four wolves were spotted in the Mlaka area. During winter 2011/12, at least five wolves were recorded in the area of the Suho pack. In 2012, researchers found most signs of wolf presence in the territory of the Suho pack. The capture of the male pup WPO8 aged 3 months and the female W29-Ajše aged 5 months confirmed that this pack had a litter in 2012. During summer and early autumn 2012, Ajša was with the Suho pack, while in October, the signal from her collar was lost on the Croatian side of the Suho pack territory. It is assumed that she moved to the Slovenian side of the pack, which was documented with the cull of a large male (likely the reproductive male of the Suho pack) near Ilirska Bistrica in the Zemon area, which is also covered by the Suho pack. This event was reported on 12 November 2012 by Slovenian researcher Miha Krofel, and that the Suho pack, including Ajša, was in Slovenia at that time. Since then, Ajša has not been monitored. New data from Slovenian colleagues (Dr. Hubert Potočnik) reported the observation of five wolf individuals during 2014, though no signs of reproduction were observed.

Učka/Slavnik pack – In Slovenia, researchers involved in the LIFE+ SloWolf project collared a male during autumn 2011 and named it *Slavc.* The *Slovenian Slavnik pack* has part of its territory in the area of Mt. Učka, though it spends the majority of its time in the area of the Slovenian karst. It is interesting that during 2012, the wolf Slavc went into dispersion and wandered through Slovenia and Austria before reaching Italy and the Trenta region, where he took over a new territory in the Lessinia Regional Park and formed a pack with the female Julija (which according to genetic analysis is from the Apennine population and is also an 'immigrant' to this territory). The Italian researchers reported reproduction of this pack in 2013. This is the first documented case of mating between wolf individuals from the Italian and Dinaric/Balkan populations. In the area of the territory of the Slovenian pack Slavnik there was an assessment of four wolf individuals in 2012, and in 2013 there was a report of a response of young wolves during howling surveys in that area. During 2014, seven individuals were observed (Dr. H. Potočnik).

On several occasions **during 2014**, the experts of the FVM visited the Gorski Kotar region. In one area, fewer traces of wolf presence were detected than in previous years. This was the case, in particular, for the Snježnik and Suho packs, in which only two traces of wolf presence were found. More information was found for the Risnjak and Mrkopalj packs, where in addition to traces of presence, reproduction was also recorded. The data of experts from Slovenia also indicated that there was from 8 to 11 individuals in that border area. The Slovenian researchers, in addition to assessing the size of the population in Slovenia and the bordering areas with Croatia, also performed a reconstruction of pedigrees and an assessment of the population dynamics and the linkages of the populations along the Dinarides. Their results suggested intensive gene flow along the Dinarides, which is very

positive for the conservation of the wolf population, while also warning of the necessity for cooperation between Croatia and Slovenia in managing the population.

Lika

During 2014, the researchers of FVM, in cooperation with the staff of Velebit Nature Park and Plitvice Lakes National Park invested significant efforts in searching for signs of the presence of wolf of the border pack Plješevica (Figure 7) in the area of northern Velebit, in and around Plitvice Lakes National Park, and even in the area of Una National Park in Bosnia and Herzegovina. In addition to searching for the usual signs of wolf presence, photo traps were also used (automatic cameras).

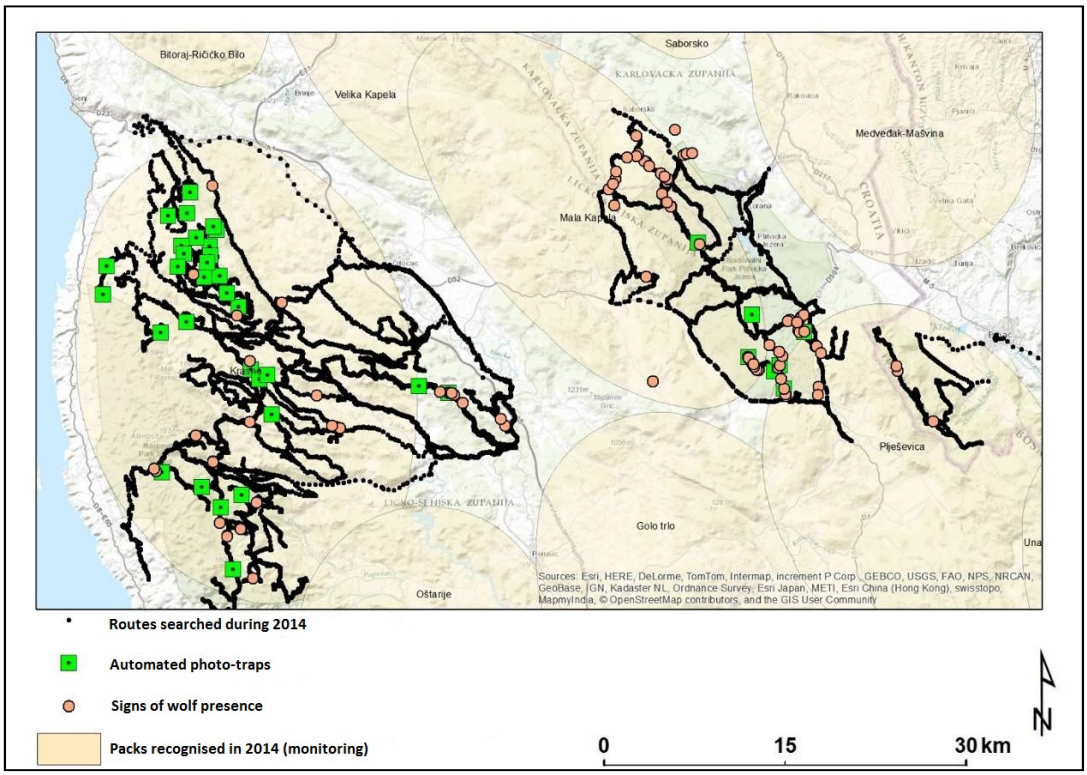

Figure 7. Searched routes (transects) in the area of northern Velebit (Northern Velebit National Park, Velebit Nature Park and the broader area), and the area of the Plitvice Lakes National Park and the Una National Park (BiH), with detected signs of wolf presence (Source: J. Kusak, 2014)

Despite the significant effort in searching for signs of wolf presence during 2014, throughout the entire northern Velebit area, only sporadic signs of presence were found, and the most found simultaneously indicated the presence of two wolf individuals together, and the occasional appearance of one wolf in the edge areas of the search area, near the motorway. No reproduction of wolves in this area was confirmed. From this, it is possible to conclude

that the Krasno pack did not exist as a pack in 2014, and the observed wolves have not yet succeeded in renewing that pack.

In addition to seeking and recording signs of wolves, the FVM researchers also exerted great efforts to capture and collar at least one wolf in that area, but where unsuccessful. This confirmed that there were virtually no wolves present in the northern Velebit area during 2014.

Krasno pack

Since 2009, the female wolf Ira has been monitored in the territory of the Krasno pack. During 2010, she was observed to begin to separate from the pack. In June 2011, her collar was found after it fell off after one year of monitoring. According to the data obtained through telemetric monitoring of the Krasno pack in the Velebit area, the significant finding was that the territory of that pack covered twice the area than in Gorski Kotar, i.e. the wolf density was half. **As such, the wolf pack territory size in Gorski Kotar was approximately 350 km^2, while on Velebit it was 736 km^2.**

In late August and early September 2012, signs of wolf presence were sought and photo traps set up in the Velebit area within the Krasno pack territory. Several images were obtained that recorded the presence of a single wolf, while a total of 31 signs of presence were detected. Capture was not successful for the reason that forestry works began at that time, and one of the capture traps was damaged. During 2013, monitoring continued using photo traps and the collection of all other signs of presence.

Since the pack is located in a protected area, the population is monitored year round both by scientists and by the ranger services of the Public Institute of Velebit Nature Park. The images obtained showed the individual movements of two wolves, and in early February 2013, four traces were found. With the remaining traces (scats, tracks, remains of prey, sightings and howling surveys) which were much more common in previous years, a negative trend has been observed it the past two years. All the data collected to date indicate that the Krasno pack has had a significant drop in numbers (the assessment is a maximum of four to five individuals in the pack). In the season 2013/14, intensive monitoring by experts of the FVM and ranger services of the Velebit Nature Park and Northern Velebit National Park did not give any better results.

In addition to the reduced number of signs of presence and the sporadic sightings of individuals, no reproduction was confirmed, and it was assessed that the Krasno pack did not actually exist as a pack in 2014, and the observed wolves have not succeeded in renewing that pack.

Mala Kapela pack

With the find of numerous signs of wolf presence during 2014, and the capture of a young pup (W30 – Ivanka), the existence of a fairly large pack in the area of Mala Kapela mountain and the Plitvice Lakes National Park was confirmed.

Plješevica pack

The finding of numerous signs of wolf presence during 2014, and the capture of a pup (W31-Anđelko) confirmed the presence of a relatively large pack in the area of Plješevica and Plitvice Lakes National Park.

The first monitoring of the collared individuals showed that they are members of two neighbouring packs, each of which uses one part of Plitvice Lakes National Park. The female W30-Ivanka belongs to a pack that, in addition to the pack, also inhabits the area north of the settlements Saborsko and Lička Jesenica. According to the monitoring data, this pack has been named Mala Kapela and in 2014 it was assessed to have an average of 6.5 wolf individuals.

The male W31-Anđelko moved through the southern parts of Plitvice Lakes National Park, crossed the main road and entered into the area of Mt. Plješevica (Figure 8). Based on the monitoring, this pack was named the Plješevica pack and, like the border pack with BiH, it was assessed to have an average of 3.5 individuals in the Croatian area of the pack during 2014.

Telemetric monitoring and counts using snow tracks could provide the first data on the size of this wolf pack territory, and on the wolf density in central Lika.

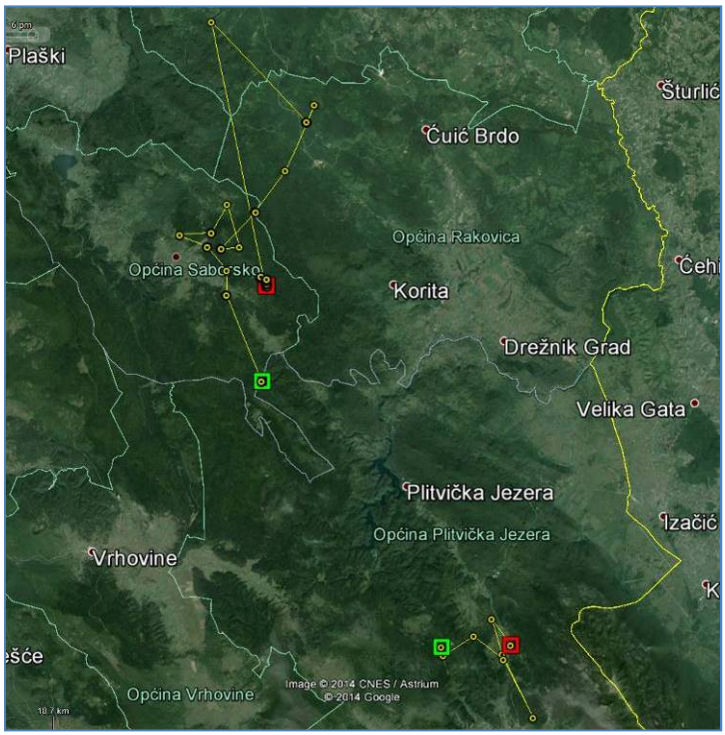

Figure 8. Overview of the movements of the collared wolves W30-Ivanka (northern) and W31-Anđelko (southern) within Plitvice Lakes National Park (Source: J. Kusak, 2014)

Dalmatia

Vučevica/Kozjak pack – after the collaring of the male Matan in 2009, images obtained from photo-traps confirmed that this pack had at least eight individuals. During monitoring (by Goran Gužvica, OIKON), it was observed that by the end of May 2010, Matan moved through an area of 1410.5 km^2, which indicates that this wolf was in dispersion. It is not known just how much time Matan spent with the pack, nor when he separated from the Vučevica/Kozjak pack.

Numerous crossings of the motorway were also recorded. Researcher Goran Gužvica established on the basis of data from photo-traps in 2011/12 that the number of individuals in the Vučevica/Kozjak pack was declining. The pack was found to use the Osmakovac green overpass. Monitoring established that there were no wolf crossings in 2013 (Gužvica & Šver, 2013), and only a single wolf used the crossing in 2014 (Gužvica & Šver, 2014).

Based on the results of previous telemetry monitoring, scientists of the FVM assessed that **packs in Dalmatia had territories from 150 to 200 km^2** depending on the quality of the habitat and the availability of prey.

During 2013, intensive wolf monitoring began in the area of Biokovo Nature Park, in cooperation with the expert services of the Public Institute of Biokovo Nature Park, and with expert Gužvice from Oikon. The preliminary results for 2014 indicate the observation of one to a maximum of four wolf individuals in that area.

Figure 9. Telemetric monitoring of packs (Risnjak, Suho, Snježnik, Krasno and Vučevica/Kozjak)

Border packs

Due to the specific shape and length of the border with neighbouring states, there are a large number of **border packs** that only spend part of the year in Croatia. There are numerous examples of such packs and individual wolves, such as the previously mentioned ***Suho pack***, which is monitored in the northwestern part of Gorski Kotar, and which has 50% of its territory in Slovenia. It is known that one wolf from that pack was shot on the Slovenian side on 23 December 2006, as part of the Slovenian culling quota (additional culling). Also, the young female W23-Taša, a member of the Suho pack that was collared in August 2009 disappeared in Slovenia on 17 October 2009, just seven days after entering Slovenian territory. It is assumed that this female was illegally killed, as she had been fitted with a new collar that could not be expected to stop working after such a short period of time. Two additional males, W21-Luka and W22-Drago, were killed in Slovenia in February 2010 as a part of the legal culling quota, though according to the data obtained by telemetry, they had spent just seven days in Slovenia before their deaths. The last record of a death was when the female W20-Tvigi left her pack and moved into the area of Ljubljanski vrh, where she attempted to form her own pack. She lived until 7 March 2011 when she was

hit by a car near Cerknica in Slovenia. In Slovenia, researchers on the project LIFE+ SloWolf captured and collared a male wolf and named it *Slavc*. Slavc is a member of the Slovenian ***Slavnik pack*** that is found on the territory of Mt. Učka. It is interesting that during 2012, this wolf went into dispersion and travelled through Slovenia and Austria before arriving to the Trento area in Italy, where together with the female Julija it took over the territory and in 2013 they had their first litter.

The female W12-Sara from the Croatian ***Snježnik pack*** was also culled as part of the Slovenian culling quota in winter 2007, right on the Croatian-Slovenian border. In that same year, the male W18-Max was also found to be taking long 'trips' in various directions. His movements were recorded in the territory of the Snježnik pack, with 271 locations (8.6%), in the Risnjak pack (956 locations; 30.5%) and in the territory of the Slovenian pack (164 locations; 5.2%).

The female W11-Eva was also found to use both sides of the border after she was captured and collared in Dalmatia in February 2005. Over a period of five months, her locations were recorded 541 times, of which 48% of locations were in Croatia and 52% in neighbouring Bosnia and Herzegovina, where she was killed.

Researchers on the LIFE+ SloWolf project assessed after the first two monitoring seasons (2010/11 and 2011/12) that there were 10 to 12 packs in Slovenia, of which 4 or 5 bordered with Croatia. Figures 10 and 11 show their spatial distribution, and the border packs were monitoring using telemetry methods in combination with the results of genetic analysis.

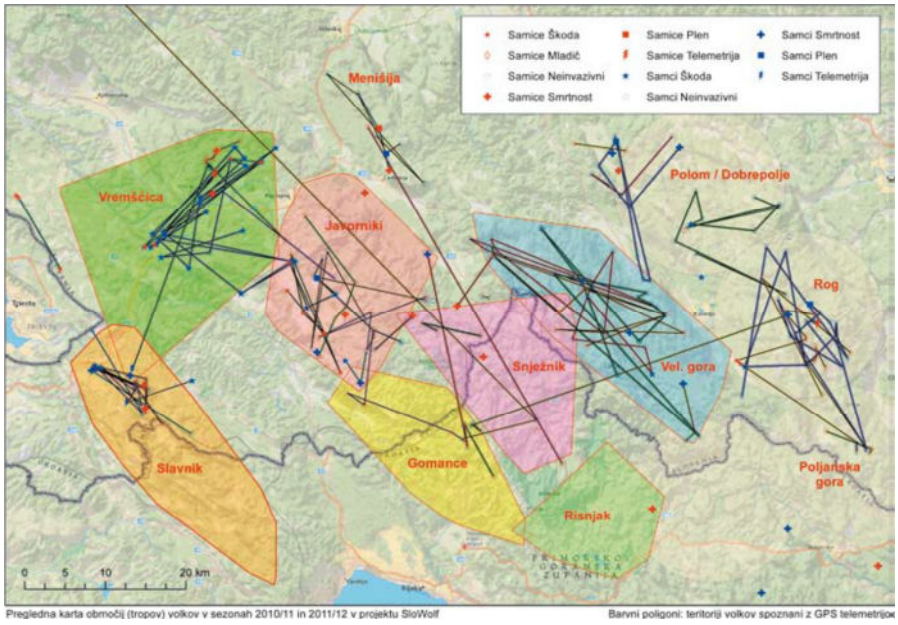

Figure 10. Map of packs in the first two years of monitoring during the project LIFE+ SloWolf. Blue dots indicate male samples found, red dots indicate female samples. The lines connect the samples obtained from the same wolf individuals. Polygons mark the known territories of telemetrically monitored wolves in Slovenia and Croatia (Source: project LIFE+ SloWolf, T. Skrbinšek, 2013)

After the third monitoring season (2012/13), researchers on the LIFE+ SloWolf project added in previous data from 2009 and the data collected from Croatian researchers (J. Kusak and Đ. Huber) in order to develop the wolf distribution map (Figure 11). It was assessed that 46 wolf individuals inhabited Slovenia, and including the Croatian border areas, this figure was increased to 54 individuals.

These were the first real assessments of their populations made on the basis of systematic monitoring in the period 2010–2013, which showed that previous assessments were largely overestimated. It is believed that the wolf population was stable in this period, though the numbers of individuals varied during some years.

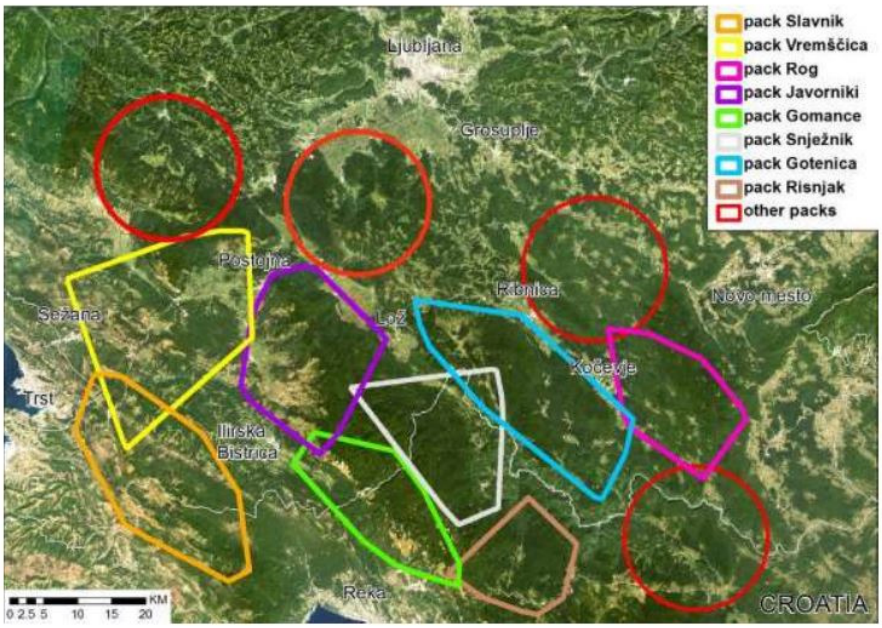

Figure 11. Map of the spatial distribution of wolf packs on the basis of data in Slovenia (three monitoring seasons within the project LIFE+ SloWolf and earlier data) and in Croatia (monitoring by J. Kusak, FVM). Coloured polygons indicate telemetrically monitored packs. Red polygons indicate approximate locations of other packs in that area that are not monitored telemetrically, but with other methods. The size of these shapes corresponds to the average size of the pack monitored by telemetry. From left to right, these are the packs named: Trnovski gozd, Menšija, Suha krajina and Poljanska gora (source: project LIFE+ SloWolf, 2014)

Dr. Hubert Potočnik reported that four border packs were monitoring in Slovenia: Slavnik/Učka, Gomance/Suho, Snježnik and Poljanska gora (in Bela krajina). In the season 2013/14, there was no systematic monitoring, though data collected and the observation of wolf presence by the experts of the Biotechnical Faculty and the Department for Forestry of Slovenia indicated that the wolf distribution area did not change significantly in Slovenia, nor did the distribution of the border packs.

The pack ***Slavnik/Učka*** was monitored telemetrically through two wolves. In the season 2010/11, there were 7 individuals, which was reduced to 6 individuals in 2011/12, while the snow tracks indicated only 4 individuals during winter 2012/13. It was established that 5 wolves had died during the season 2012/13, while one wolf (Slavc) had dispersed into Italy. The pack inhabited a territory of 423 km², of which 188 km² is in Croatia. During 2014, reproduction was recorded.

To the end of 2012, three wolf individuals were confirmed in the ***Snježnik*** pack (genetically 'captured' and individuals genotyped), however, one individual was shot, and another

dispersed into the Menišija pack (pack south of Ljubljana). During 2014, four wolf individuals were observed.

In the territory of the ***Gomance/Suho*** pack, only one wolf individual was recorded (perhaps due to poorer genetic sampling). During 2014, five wolf individuals were observed.

In the ***Poljanska gora pack*** (Bela krajina), a pair of wolves was observed. This pair had a litter in 2010/11, though no young were recorded in 2012. As it is unknown to where their territory extends into Croatia, their territory is marked with a question mark on the map (Figure 12). During 2014, no reproduction was recorded, though the presence of two wolf individuals was observed.

Additionally, a pack of five individuals that could be border individuals was recorded in the area of ***Loški potok – Racna gora – Sodražica.*** During 2014, this pack had a litter. Two of the young were found dead, while another two were killed in illegal culling. One case of illegal culling (Loški Potok hunting society) is still under investigation, while the second (Sodražica hunting society) was immediately reported and court proceedings are ongoing.

According to the collected data, during the period 2010–2012, the number of packs varied from 8 to 11. In addition to the poaching of a reproductive female, and another killed reproductive and gravid female, the trend in 2013 was found to be declining in comparison to the seasons 2010/11 and 2011/12. The last season of monitoring 2012/13, whose results were released in 2014 and analysed together with the data collected to date, indicated that the population in Slovenia was stable during the intensive monitoring period, despite the variation in the numbers of individuals in individual years. The last assessment was that there are approximately 46 individuals in the Slovenian territory, with an average of eight wolves inhabiting the border regions.

The area of permanent wolf presence in Slovenia was assessed at 3250 km², which would mean a density of 1 wolf individual per 80 km² or 1.25 wolf individuals per 100 km². This figure pertains only to adult individuals (over 12 months of age). The average size of the territory inhabited by a pack was 400 km².

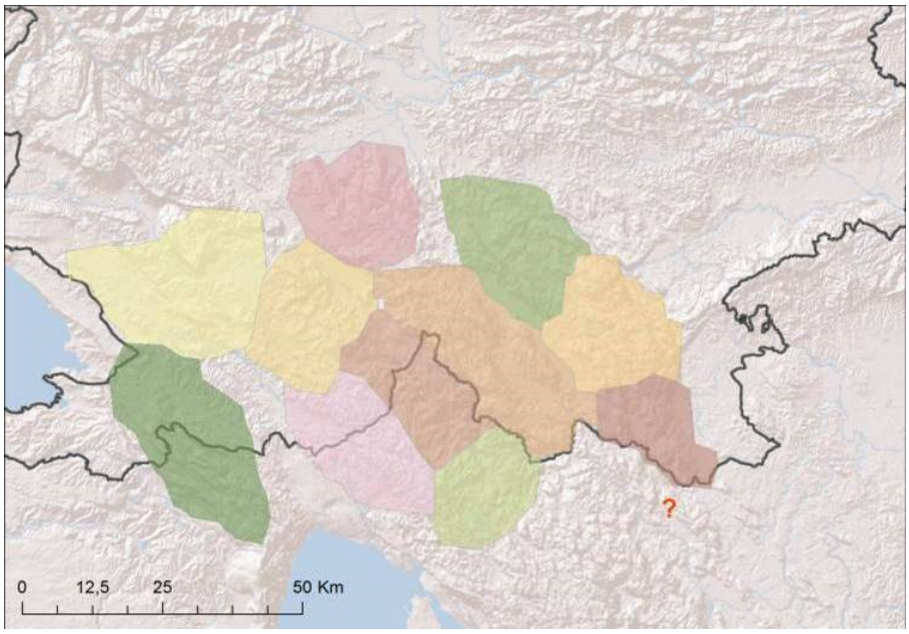

Figure 12. Overview of the monitored wolves in Slovenia (border and Slovenian packs) (source: project LIFE+ SloWolf, H. Potočnik, 2013)

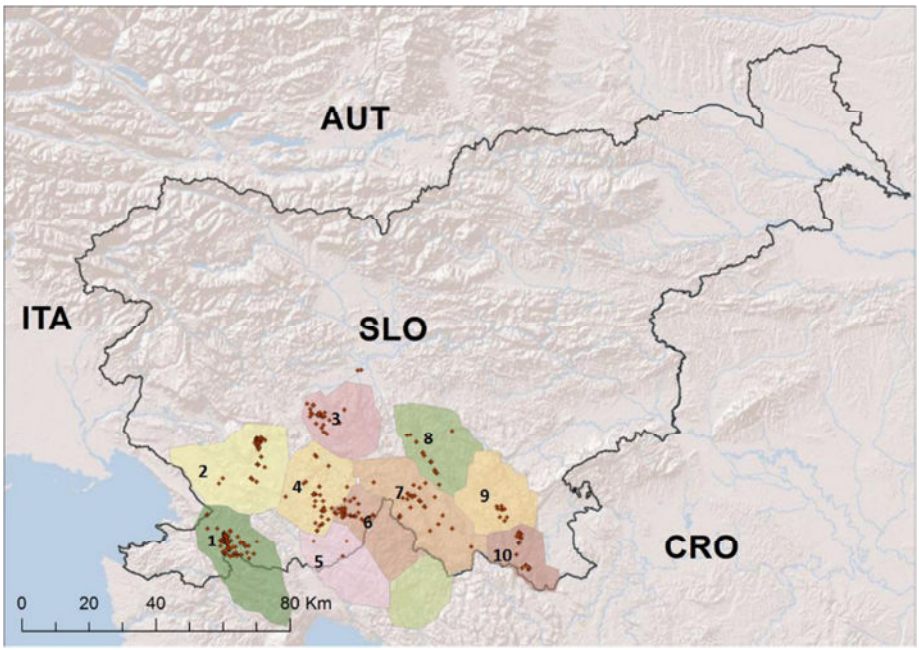

Figure 13. Distribution of samples taken, by wolf territory: 1-Slavnik; 2-Vremščica; 3-Menišija; 4-Javorniki; 5-Gomance; 6-Snježnik; 7-Gotenica; 8-Suha krajina; 9-Rog; 10-Poljanska gora (source: project LIFE+ SloWolf, 2014)

Monitoring packs and the division of packs by regions in Slovenia: Kočevska region – Rog, Gotenica, Poljanska Gora and Suha krajina, Notranjska region – Snježnik, Javorniki, Menišija and Gomance and Coastal region – Slavnik and Vremščica (Figures 12 and 13).

Due to the large number of border packs, as previously stated, the assessment of packs in Croatia was conducted in such a way that the number of individuals in the border packs was divided in half, due to the constant crossing of the border and time spent in both countries, and as such was added to the assessed numbers for the rest of Croatia.

3.4. Large carnivore population snow track monitoring campaign in the period from 2009 to 2014

The large carnivore snow track monitoring campaign began in the season 2006/07. The State Institute for Nature Protection, in cooperation with FVM, held lectures for the organisation and implementation of the snow track monitoring campaign, and participants received written instructions and the accompanying forms. The task of those involved was to make field observations in the area of their jurisdiction (hunting grounds and protected areas) on the morning after the first snow, on several occasions during the campaign, and to report any traces of wolf presence found. They were required to draw in all found and monitored traces on the map, and to record data on the time and place of finding the traces, animal species, length and direction of the monitored tracks and the number of animals in the tracks (the track should be followed for as long as necessary to determine the number of animals leaving tracks).

During the campaign in **2009/10**, the Directorate for Hunting of the then Ministry of Regional Development, Forestry and Water Management was included, and sent out invitations to hunting grounds and the necessary materials for conducting the survey. In cooperation with the county hunting associations, the Directorate also selected coordinators for implementation of the campaign. Materials were sent to 142 hunting grounds and 5 protected areas. Of these 142 hunting grounds, 26 (18%) participated in the campaign and covered 14% of the potential area, or 1584 km^2. A total of 38 surveyors participated, and recorded 53 signs of wolf presence.

Considering the poor cooperation of hunting grounds in the 2009/10 winter campaign, and the lack of interest for further cooperation, despite the fact that each hunting ground is required to state the number of predators (wolf, bear, lynx) present in the hunting ground in the hunting management plan, no systematic national campaign was organised for the winter **2010/11**. However, counts were carried out in part of the wolf distribution areas, throughout the broader Velebit area. The organisation and coordination of the campaign was entrusted to Josip Tomaić of the Public Institute of Velebit Nature Park and a member of the Intervention team for wolf and lynx. This campaign included the participation of the staff of the public institutes of Velebit Nature Park and Northern Velebit National Park, the staff of Croatian forests and hunting grounds managers. The Institute drafted maps and forms for surveyors. A total of 13 surveyors participated and searched 41.8 km of forest roads, and found 17 signs of wolf presence. The compilation and analysis of these data determined that

there is one pack in northern Velebit, the Krasno pack, which corroborated the telemetry data from previous years. During the campaign, tracks of a lone wolf were also found. There is a second pack in the northern Velebit areas, which had six members in winter 2011/12.

In the season 2012/13, SINP and FVM held four lectures for the organisation and implementation of a Snow tracks monitoring campaign, and all participants received written instructions and the accompanying forms, while hunting societies provided maps of their areas. The following lectures were held:

- 28 November 2012: Plitvice Lakes National Park; attended by the expert and ranger staff of the Public Institute of Plitvice Lakes National Park, representatives of the military polygon E. Kvaternik from Slunj and the staff of Una National Park and the Biotechnical Faculty from BiH;
- 29 November 2012: in cooperation with Karlovac College (Vedran Slijepčević) and the secretary of the county hunting association in Petrinje, the lecture was held in the premises of the Fazan Hunting Society for hunting grounds managers from the Zrinska Gora area, and staff of the Public Institute for the Management of Protected Natural Areas in Sisak-Moslavina County;
- 13 December 2012: at Krka National Park, with the expert and ranger services of that park;
- 14 December 2012: in cooperation with the Public Institute of Biokovo Nature Park, the lecture was held in Makarska at the premises of the Biokovo Hunting Society for the park ranger services and local hunting grounds managers.

Despite the fact that the culling of wolf individuals is permitted, with the note on the compulsory participation in the monitoring campaign, in reality, there was no participation by those hunting grounds where wolf individuals had been culled. Therefore, in 2012, the line ministry prescribed this obligation by virtue of a Decision. Pursuant to the provisions from point 2 of the Decision of the Ministry of Environmental and Nature Protection for the extraction of wolf individuals, class no: UP/I-612-07/12-48/39, reg no:17-07-1-1-12-01 of 1 October 2012, hunting grounds managers participating in the culling of wolves are obliged to participate in the large carnivore population monitoring campaign by snow tracks, and to report on all conducted activities to the State Institute for Nature Protection and the Ministry of Environmental and Nature Protection.

In the season 2012/13, the following hunting grounds participated in the campaign and submitted reports:

1. Hunting ground XVII/9 'Mosor', managed by the company Dalmacijalov d.o.o., surveyor Ćiro Mijanić;
2. Hunting grounds VIII/3 'Cetin Gložac', VIII/12 'Litorić', VIII/118 'Jelenski Jarak', managed by the 'Jelenski Jarak' Hunting society, Vrbovsko, surveyors Milojko Jakšić, D. Škorić and D. Kalčić;
3. Hunting ground VIII/111 'Kupički vrh', managed by 'Tetrijeb' hunting society – Gerovo, surveyors – hunting ground managers Ivan and Mladen Šoštarić, Mario and Matija Malnar and Antun Klepac;
4. Hunting ground IX/2 'Golo Trlo' , managed by 'Lane' hunting society, Perušić, surveyor Mladen Krpan;
5. Hunting ground IX/6 'JABLANAC', managed by ŠLJUKA d.o.o. – Omišalj, surveyor Davor Dundović;
6. Hunting ground III/29 'Prolom', managed by Faculty of Agronomy, University of Zagreb, surveyors Štefan Pentek and Franjo Blašković;
7. Hunting ground XV/6 – 'DINARA', managed by DINARA hunting society, Knin;
8. Hunting ground III/125 'Grmušani', surveyors Ivan Martinec and Željko Pleša;
9. Hunting ground IX/106 'Otočac', surveyor Krešimir Burić.

Considering that there was not sufficient snowfall in the period from 1 October 2012 to 28 February 2013, the snow tracks monitoring campaign could not be implemented in the hunting grounds XVII/142 'Podmosorje', XVII/130 'Proložac', XV/5 'Trtar', XVII/125 'Cista' and XV/129 'Skradin'. Written notification thereof was submitted to the Ministry and the Institute.

The requested data were not submitted and the obligation carried out by the following hunting grounds: IX/23 'VREBAC', managed by IKAM d.o.o., Gospić; VIII/2 'BJELOLASICA', managed by Croatian Forests d.o.o., Zagreb; and XVII/133 'POLJICA-MIJACA', managed by ZAGORA hunting society, Vrgorac.

The data obtained for Lika-Senj and Sisak-Moslavina Counties are shown in Figure 14.

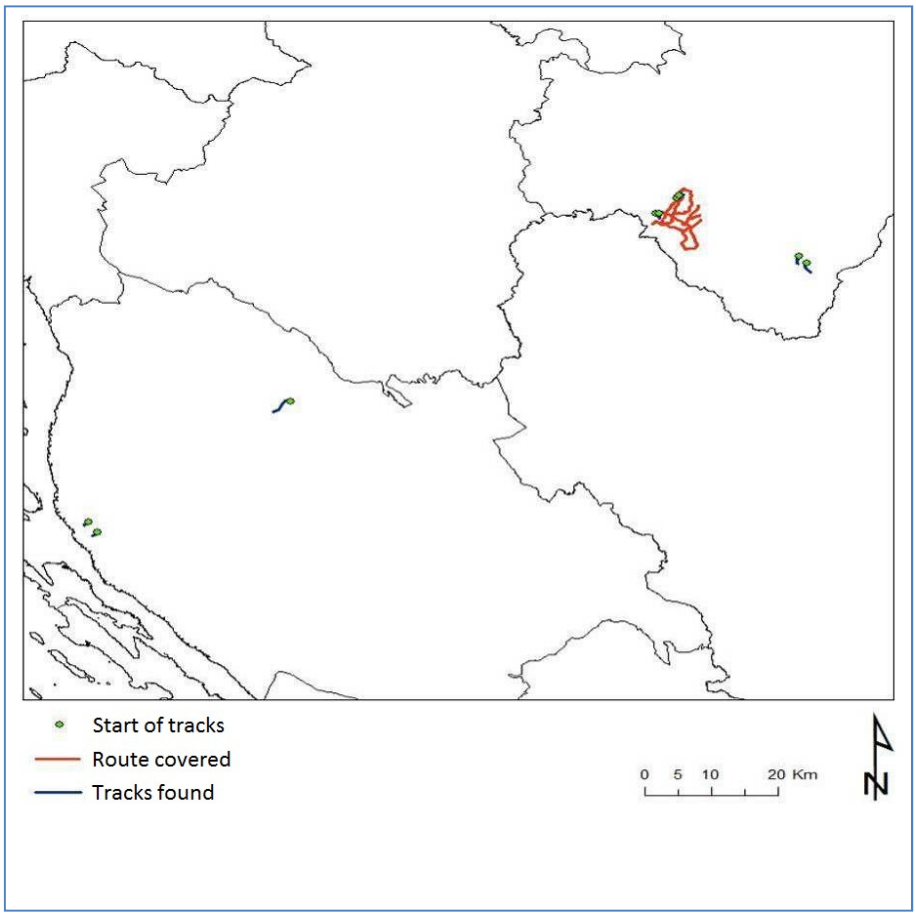

Figure 14. Snow tracks monitoring campaign in the area of Lika-Senj and Sisak-Moslavina Counties in 2012/13 (source: SINP, compiled by: N. Skroza, 2013)

The monitoring campaign, as in previous years, was organised throughout the broader Velebit area, with the participation of the staff of Northern Velebit National Park and Velebit Nature Park. The campaign was again coordinated by Josip Tomaić of Velebit Nature Park, with the cooperation of eight surveyors: Adam Rukavina, Ivica Krmpotić, Josip Frketić, Milan Vukelić, Tomislav Rukavina, Goran Jurković, Vlado Karamarko and Tihomir Devčić.

In line with the implemented campaign, coordinator Josip Tomaić reported that the wolf population trends in the surveyed area were negative, which could also be said for the previous period from 2010. Before that period, the trend had been positive or in stagnation. This conclusion was made based on the found snow tracks, on the year-long monitoring and data collection activities (scat, snow tracks, prey remnants, sightings, howling surveys and photo-traps). Over the past two years, the number of tracks has been reduced, despite a higher effort of surveyors. The data indicate that the Krasno pack has been significantly weakened, down to 4–5 individuals, unlike the former numbers of 8 or more individuals. In comparing the data obtained from photo-traps and data from scats, it was determined that in most cases, the wolves travelled in pairs or individuals, and in early February 2013, the movements of a maximum of four wolf individuals were tracked (Figure 15).

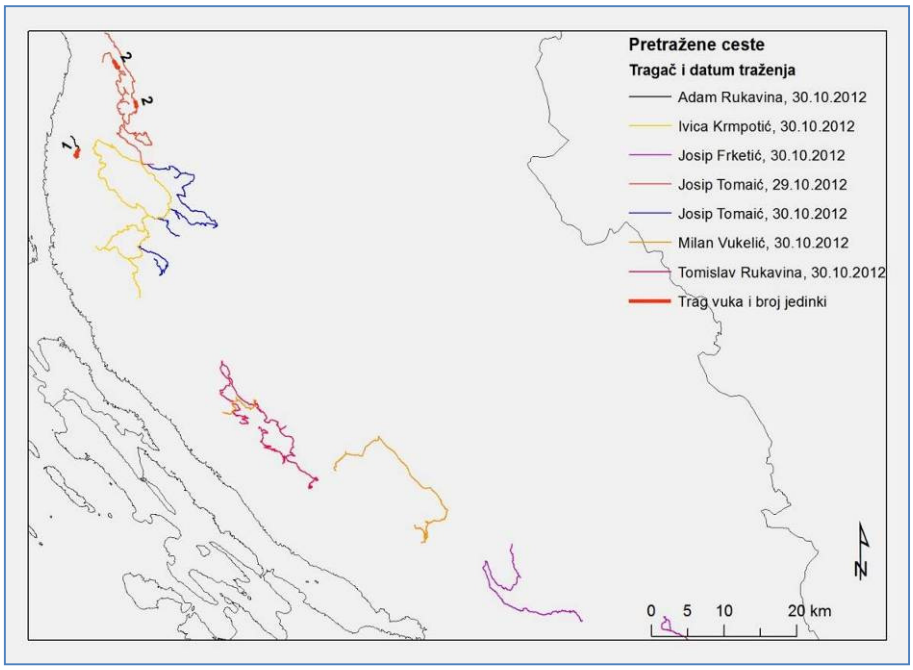

Figure 15. Wolf presence monitoring by snow tracks in the area of Northern Velebit National Park and Velebit Nature Park 2012/13 (drafted by: J. Kusak, 2013) (Legend: searched roads, surveyor and date; red line: wolf tracks and number of individuals)

No snow track monitoring campaign was organised in the season **2013/14**. Individuals reported that it was not possible to implement proper monitoring due to the unfavourable weather conditions, though sporadic observations of snow tracks by individual surveyors were used in the assessment of the status of packs in this year.

3.5. Collection of additional data on wolf observations

In May 2014, the intersectoral *Working group for the organisation and implementation of monitoring the status of wolf in Croatia* was established, through the cooperation of the Nature Protection Directorate of the Ministry of Environmental and Nature Protection, and the Directorate for Forestry, Hunting and Wood Industry of the Ministry of Agriculture. The working group was created with the aim of improving cooperation between the sectors of nature protection and hunting in the collection of recent and high quality data from hunting grounds. The working group included representatives of the ministries, experts and scientists from the State Institute for Nature Protection, Croatian Forests, Faculty of Veterinary Medicine and the Faculty of Agronomy of the University of Zagreb, Karlovac College, OIKON and the Croatian Hunting Association.

The draft version of the ***Data collection form for observation of signs of wolf presence*** (Appendix 1 of the Report) was drafted in cooperation between SINP and FVM. This form

was discussed at the meeting of the Working group and the Committee, and was simplified and adapted. During July 2014, the form was distributed via the ministry directorates to the Croatian Hunting Association, hunting rights holders within the wolf distribution range, experts for the assessment of damages by wolf and lynx, and public institutes for the management of protected areas. The filled-out forms with data on the observation of signs of wolf presence were to be submitted to the SINP, with a note that all forms submitted to 1 September 2014 would be processed and included in the Report on the State of the Wolf Population in 2014, and forms submitted later would be processed for the report for the following period. Also, these persons were asked, within the framework of their capacities, to stimulate the submission of data on wolf presence recorded on photo-traps in the period after 1 October 2013. In addition to post, submission of the data and images was made possible to the permanent e-mail (velikezvijeri@dzzp.hr) year round.

By September 2014, SINP had received data from 13 hunting grounds that had been collected by 40 hunters/surveyors. The list of all hunting grounds and surveyors is included in Appendix 2 of this Report.

Also, data were received from 13 authorised experts for the assessment of damages from wolf and lynx, and all protected areas that are found within the wolf distribution area.

All the data received were processed in GIS and were compiled with the remaining data in the assessment of the state of the wolf population.

3.6. Monitoring using photo-traps in the period from 2011 to 2014

Monitoring using photo-traps is a non-invasive monitoring method that is suitable for the study of large carnivores. This method gives data on the presence of individual species of large carnivores in an area, and on the possible number of individuals. Photo-traps are set up in places known previously to be sites where animals regularly pass and mark the terrain, and are activated with a sensor. The abundance of the observed population is determined by modelling the obtained results.

From January to September **2011**, FVM in cooperation with the Priroda Public Institute set up eight photo-traps, which were used at 11 different sites in the area of Mt. Obruč in Primorje-Gorski Kotar County. At some sites, two cameras were set up simultaneously in a given time period. The primary intent was to determine the presence and numbers of lynx in these areas, while also analysing spatial use and activity of other large mammals (ungulates, bear and wolf), smaller mammals (fox, badger, wild cat) and humans in the same area.

During the monitoring period, sites were visited from 2 to 13 times. The shortest monitoring interval was 13 days, the longest 226 days. Cameras recorded a total of 1664 events. Those

images that included testing the camera, double shots and improper camera function were excluded, resulting in a subset of 1579 events that were analysed. The most common images were of red deer (375 images; 54%), while roe deer was recorded only 18 times (2.6%) and wild boar 20 times (2.9%). Of the large carnivores, bear was recorded 34 times (4.9%), lynx 4 times (0.6%) and wolf 3 times (0.4%). In general, the wolf density in Gorski Kotar is 2.5 times higher than the lynx density, though these data suggest that other ratios can also be detected locally, which is in line with the maps of the probability of the presence of lynx and wolf in the Obruč area drafted in 2009 by the FVM. Monitoring continued in the season 2013/14, and the collected data were used to assess wolf packs and the number of individuals.

At the end of 2011, SINP obtained 25 photo-traps. In cooperation with Karlovac College (researcher Vedran Slijepčević), 18 were set up in the Gorski Kotar area in **2012**, primarily for the purposes of monitoring the lynx population within the framework of implementation of the project "Monitoring the population of the Eurasian lynx using photo-traps in Gorski Kotar". The remaining seven photo-traps were set up in the Zrinska Gora area in 2012, in cooperation with the Public Institute for the Management of Protected Areas in Sisak-Moslavina County, and Mr. Branimir Leskovar, Secretary of the county hunting association and the Veteran Hunting Society, who participated in the survey and visited the photo-traps on Zrinska Gora, changing the batteries and downloading images. In the season 2012/13, photo-trap images in the Zrinska Gora area documented the movements of one pack of wolves, with 5 to 6 individuals. Though it is not possible to differentiate wolf individuals using photo-traps (unlike for lynx, where this is possible), several individuals images of a single wolf and images of one to three wolves cannot be interpreted as an individual pack, though it is very likely that these are individuals that belong to the photographed larger pack. Also, two individuals were photographed in the area of Vučković brdo. All the collected images are currently being processed as part of the graduate thesis of student I. Kajgana.

Within the framework of this lynx monitoring project, in **2013**, the presence of wolf was recorded in the area of the Bjelolasica hunting grounds on four occasions. The photographs of the wolf were taken incidentally, and it is not possible to differentiate the animals in the photograph. However, it certainly can confirm the presence of wolf in that hunting ground. While tracks of the presence of wolf have been observed in the Bjelolasica hunting ground on several occasions, the same cannot be said for the northern parts of Gorski Kotar, where researchers in months of field work in 2013 found only two certain signs of wolf presence (1 urine samples and 1 fresh scat sample).

Figure 16. Images of a single wolf and of two wolves captured using photo-traps in the Šamarica area during 2014 (source: Public Institute of Sisak-Moslavina County, 2014)

During **2014,** images were received from the Public Institute for the Management of Protected Natural Areas of Sisak-Moslavina County that had been processed by the staff of the institute (Sandra Kalabić and Franjo Šklempe). Four images captured two individuals and two images each showed a single wolf (Figure 16). These photographs were taken in the Šamarica area in early spring. In Biokovo Nature Park, expert Goran Gužvica recorded the appearance of a single wolf using a photo-trap, while photographs capturing one to two wolf individuals were obtained by the ranger and expert services of Paklenica National Park.

The ranger and expert services of Velebit Nature Park and Northern Velebit National Park reported that images captured in the northern Velebit region were analysed during August 2014. A total of 15 photo-traps were placed in 45 different locations and were active for 2 to 300 days. A total of 10,300 events were recorded, though only 15 of these included wolf. Wolves were recorded at seven different locations, with two individuals in three images, while the remaining 12 images showed only a single wolf.

Three images captured using photo-traps in November 2013 and April 2014 were obtained from Karlo Oršanić, head of the Gacka Hunting Society in Otočac. Two images captured a single wolf, while one image showed two wolves (Figure 17), with the note that the date on the camera was not aligned with the observation (photograph) date.

Figure 17. Image of two wolf individuals in the hunting grounds area of the Gacka Hunting Society, Otočac (source: Gacka Hunting Society, Otočac, 2014)

3.7. Monitoring using photo-traps on green bridges

The systematic monitoring of the wild animal crossings, called green bridges, on the A1 motorway, using photo-trap method has been implemented by the company OIKON d.o.o. since 2008. Photo-traps that capture photographs and video are used, which allows for very precise counts of animal species that live in groups, such as the wolf (Figure 18), that use the green bridges to cross the motorway. Monitoring of crossings is carried out at eight green bridges (Ivačeno brdo, Rasnica, Medina gora, Varošina, Osmakovac, Rošca, Konšćica and Vrankovića ograda), and wolf crossings in the season 2012/13 were recorded at seven green bridges (only Vrankovića ograda did not record any wolf crossings). Systematic monitoring has enabled an analysis of the trend of wolf crossing frequencies in a period of longer than five years. At six of the seven green bridges with recorded wolf crossings, a continuous decline in the frequency of wolf crossings has been observed in the period from 2008 to 2013. On the basis of these results, it is possible to assume that the obtained results are a consequence of a reduction in the size of the wolf population in Croatia (Gužvica & Šver, 2013).

More recent monitoring results for the season 2013/14 (to February 2014) indicate an additional reduction in the use of green bridges by wolves. Of the eight monitored green bridges, no wolf crossings were recorded at four bridges in that season (Ivačeno brdo, Rasnica, Varošina and Vranković ograda) (Gužvica & Šver, 2014).

Figure 18. Image recorded by a photo-trap on a green bridge (source: G. Gužvica, 2014)

Meanwhile, the frequent use of green bridges by humans has been recorded, particularly by hunters, hikers or shepherds, and occasionally with the use of motorcycles or vehicles (Figure 19).

Figure 19. Images recorded by photo-traps on the green bridges Konšćica and Lendići (source: G. Gužvica, 2014)

3.8. Genetic research of wolves in Croatia and Slovenia

During 2011, the FVM cooperated with the Laboratorio di Genetica ISPRA in Italy to perform initial analyses of 12 microsatellites from 150 tissue samples from wolves from **Croatia** and Italy. This research is not yet completed or published.

In the study to determine the existence of hybrids, a total of 203 different animals were analysed which, based on their phenotype, were categorised into three groups: wolf, dog, and suspected hybrid. Of the 10 animals suspected of being hybrids, three were confirmed

as such, while the remaining seven were wolves. In the wolf category, two hybrids were found, despite having a true wolf phenotype. All five hybrids found in nature were crosses with the combination mother wolf and father dog, while the only hybrid found in captivity was the cross of a male wolf and female dog. Of the five crosses in nature, four were from Dalmatia and one from Lika.

The appearance of hybrids (3%) in Croatia, particularly in Dalmatia, warns of the eroded social structure of that part of the wolf population in Croatia. The high mortality rate has the result of a large "turnover" of individuals in the population, the constant disintegration and formation of packs, and the lack of true partners for forming packs. The existence of a significant number of dogs in the same area has resulted in the appearance of hybrids. Faced with the lack of a partner, wolves can mate not only with dogs but also among related individuals (brother/sister, parent/offspring), which can lead to the emergence of anomalies such as albinism. Two albino wolf individuals were confirmed in the Mosor pack.

During 2012 (end of June), another 51 samples of wolf tissue were collected for genetic analysis. The genotyping of mitochondrial DNA (mtDNA) was conducted in Croatia, while cellular DNA (microsatellites) was analysed in Italy and Slovenia. The results of these analyses were compiled and interpreted together with the earlier data, and served to perform an analysis of the populations and to compare the Dinaric and Apennine wolf populations, and to determine the level of hybridisation between wolves and dogs in the Dinaric population.

The results of the study conducted by the team of experts as part of the LIFE+ SloWolf project gave the most objective overview of the cross-border dynamics of the wolf population. Namely, within the framework of this project, monitoring the state of the wolf population in **Slovenia** is carried out regularly, and includes genetic research. A part of the laboratory material for DNA analysis was obtained by SINP during 2011/12, and from the FVM during 2012/13, while the experts from the Biotechnical Faculty of the University of Ljubljana volunteered their time to process the samples collected in Croatia by the large carnivore researchers from FVM.

The first season of collecting samples for genetic research (2010/11) took place in the period from 26 June 2010 to 30 June 2011, and in the second season (2011/13) from 1 July 2011 to 30 June 2012, where significant efforts were invested in sample collection, with the participation of more than 100 people. The results of the third season (2012/13), for which the samples were collected in the period from 1 July 2012 to 30 June 2013, were processed and reported in the final report of the project in early 2014.

In the first season, 571 samples were collected (145 saliva, 117 urine and 309 scat samples). Of these 53 samples were collected in the Gorski Kotar area. A total of 449 non-invasive

genetic samples were processed. The analysis included the tissue samples of 12 wolf individuals killed in Slovenia, and one individual killed in the territory of the border packs in Croatia.

In the second season, 544 samples were collected and processed, including 191 excrement samples (of which 28 were from Gorski Kotar), 96 urine and 257 saliva samples. The analysis also included the tissue samples of 11 wolves killed in Slovenia and two killed in Croatia.

In the third season, a total of 508 samples were analyses, including 200 saliva samples, 181 scat samples from Slovenia and eight scat samples from Croatia, 114 urine samples and four other samples (blood, nasal mucous and hairs). The analysis included 10 tissue samples of dead wolves from Slovenia and four from the border packs area of Croatia. Three foetuses from a wolf hit by a car in Pivška Valley were analyses for their genotype, those they were not included in the population dynamics analysis.

The genotyping of each successfully analysed sample was repeated from two to eight times (average four times) and the maximum likelihood tests were conducted to ensure 99% certainty of the correct genotype for each individual. For individual recognition of individuals, a set of 11 microsatellite markers and loci were used to determine sex, which gave sufficiently high differentiation, such that it was virtually impossible to determine the same genotype in two different individuals (except in the very rare case of identical twins), while also permitting some flexibility in considering the genotyping level of error.

In order to recognise and differentiate the species, a total of 59 wolf tissue samples, 11 fox tissue samples, 29 jackal tissue samples and 47 dog hair and saliva samples were analysed. In this way, the allele frequency was obtained for these reference groups, in order to allow for certain differentiation between species genotypes.

In the first season 2010/11, the wolf genotype was isolated from 192 samples. Of these, 151 could not be determined to the level of the individual, while others could only be determined to the species level. The analysis discovered 42 different wolf individuals. In the first season, the genetic methods 'captured' each animal on average 3.1 times.

In the second season 2011/12, the wolf genotype was isolated from 181 samples, while 170 samples contained the DNA of foxes, dogs or were mixed samples. A total of 44 different wolf individuals were determined, and each of these was 'captured' an average of 3.5 times.

Considering that wolf and dog are closely related species, interspecies mating has been recognised as a very significant threat to wolf conservation. For this reason, 54 reference dog samples and 369 wolf or hybrid samples were analysed. The genotypes of 245 samples were obtained from Croatia (FVM experts). The degree of crossings was estimated by Bayes

groups in the program “Structure”, while the program “Hybridlab” was used to simulate the crossing of 50 pure dog and wolf individuals, in order to obtain the values by which it was possible to differentiate pure dogs, pure wolves and crosses of the first (F1) and second (F2) generations. In order to test how the method recognises wolves belonging to other populations, samples from two wolves from Mongolia and one wolf of unknown origin from captivity in Poland were added and tested against the individuals of the Dinaric populations. The data were spatially processed in GIS.

Despite the very intensive sampling, the genotyping of all wolves cannot be expected. Due to this, the final wolf population size in Slovenia was obtained by statistical modelling of the capture-recapture data, which were used to assess how many individuals were 'missed' in sampling. Several methodologies were employed (Capwire, Huggins, Mh-Chao, Jackknife), with priority given to the more robust models. All methods gave very similar results, and the results of the 'Capwire' method were used for the final assessment.

Abundance assessments were made separately for each monitoring season, and within each season due to the dynamics of natality and mortality in packs. As such, two estimates were made – real and extrapolated. The real assessment was given for the month of October, when the young from the current year can be more easily determined due to their increased mobility. The extrapolated assessment was given for the month of March, when the legal culling period is over, and the young are not yet born. The analysis also included samples from Gorski Kotar, from the territories of the cross-border packs that inhabit both Slovenia and Croatia, which enabled a better assessment.

Blood relations were established on the basis of analysis to determine siblings and parents. The pedigree reconstruction was based on the Bayes method in the program COLONY. Considering that microsatellites are inherited co-dominantly (one allele each from the mother and the father), it was possible to determine certain relations between parents and their offspring, and the relations between siblings. The relations analysis was used to determine the social structure and dynamics in packs, to assess reproduction and immigration (possible to differentiate wolves born in investigated packs in comparison to newcomers) and to assess the unknown mortality/emigration.

After the third research period, additional corrections were made to the assessments of the previous two seasons, which **resulted in a final assessment of population size** as follows:

In October 2010, the areas of Slovenia and Gorski Kotar (maximum abundance – post-reproduction, and prior to loss), a total of 47 wolf individuals (95% confidence interval (CI) 46 to 51). Considering the locations where the samples of recognised were found, it was assessed that of this total number, ***19 individuals live in the cross-border packs; therefore half the individuals (9.5) are counted in the Slovenian populations, and half (9.5) in the***

Croatian population. The total abundance was estimated only for the territory of Slovenia. As such, it was assessed that in autumn 2010, there were 39 wolf individuals inhabiting the territory of Slovenia (34-42; 95% CI).

The assessment was carried out in the same manner in the second season. In ***October 2011, the entire area where samples were collected was inhabited by 51 wolf individuals*** (49-54; 95% CI), with 40 individuals inhabiting the territory of Slovenia (38-45; 95% CI).

In the third season, the same assessment was carried out. In ***October 2012, it was determined that the area where the samples were collected was inhabited by 54 wolf individuals*** (53-62; 95% CI), with 46 wolf individuals only in the territory of Slovenia (45-55). In this season, there were few samples from Croatia, and the sampling effort considerably smaller than in previous years.

The Slovenian experts assessed that the wolf abundance in the research area (Slovenia and part of Gorski Kotar in Croatia) in the three seasons (2010 to 2013) was stable, but that previous assessments had been overestimated (Figure 20).

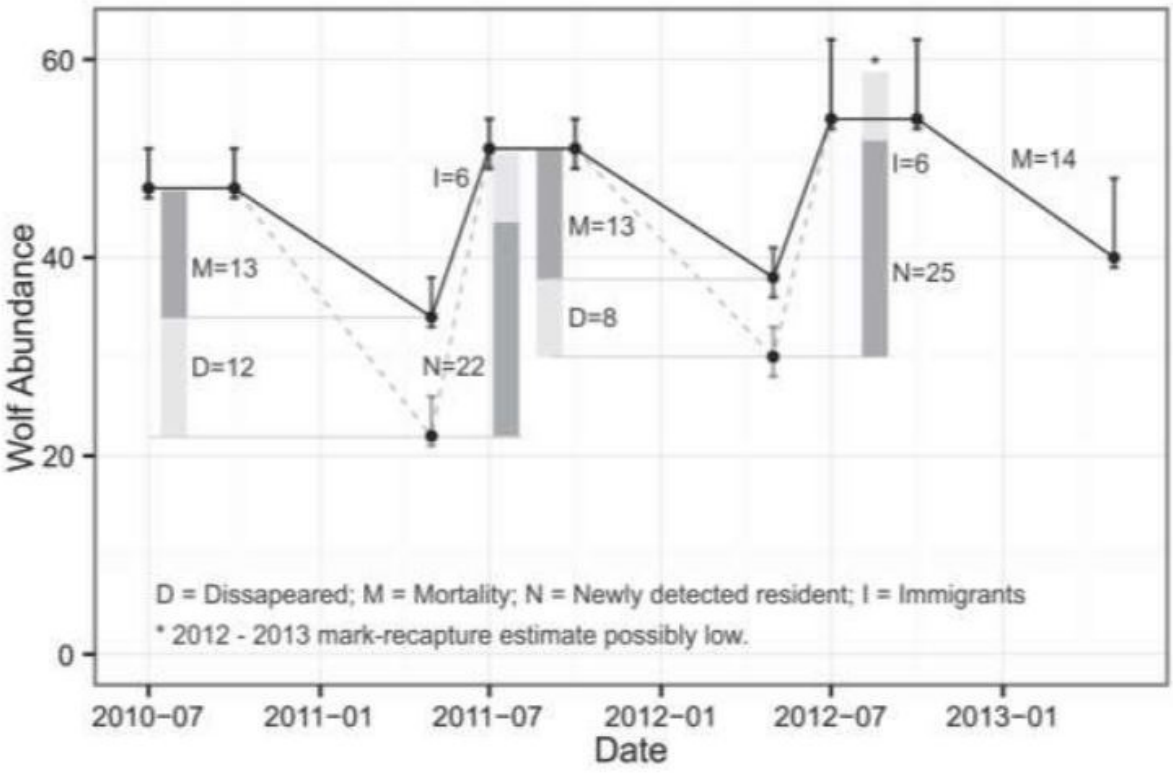

Figure 20. Graph of the trend of the wolf abundance for the entire research areas (Slovenia and Gorski Kotar). Annual population variations were assessed such that the known mortality (full line) and 'missing' wolves that were not found in the following season (dashed line) were subtracted. Considering that only one wolf individual of 110 found in the samples was detected in the first and third research seasons, but not in the second, it

could be concluded that the majority of 'missing' wolves are dead or have left the research areas. Resident wolves and immigrants were distinguished based on parental analysis (source: LIFE+ SloWolf, 2014 project)

It is assessed that 38% of wolves in Slovenia belong to the border packs with Croatia. In addition to the known mortality, which averaged 13.3 individuals/year (26.4%) during the three seasons, wolves also 'disappeared' from the population through emigration and death that remains unknown or unrecorded. The total 'disappearance' of reproductive wolf individuals (mortality, dispersion following loss of the partner) was on average 29% at the annual level.

The results indicate that abundance varies greatly at the annual level, while the level between years was stable. This is expected considering that one of the characteristics of the species is the dispersion of young, which have a very low survival rate, and a high share of mortality that remains unknown/undocumented, while the survival of reproductive individuals is high. Nor should illegal killing be excluded, as this is very important, though in Slovenia is it very difficult to assess as there is virtually never any evidence. The disappearance of reproductive individuals is important, as it results in the loss of reproduction (packs) in certain areas. Such 'gaps' in space are eventually filled. For these reasons, particular caution must be given in setting quotas, as all mortality among low population abundance quickly becomes catastrophic and may lead to local extinction in certain distribution areas.

Blood relation analysis provided insight into the movement of animals and gene flow through the Dinarides area (Figure 21). It is evident that at this time, spatial fragmentation does not present an issue and that gene flow is very intensive.

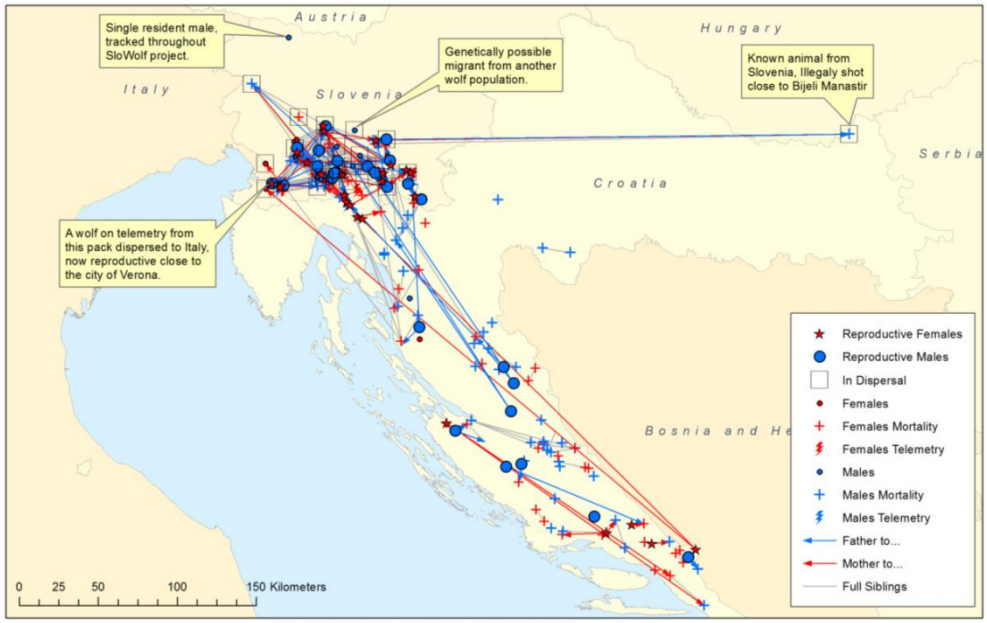

Figure 21. Gene flow along the Dinarides. Long dispersion distances and strong connections are evident. Though sampling took place over a longer time period and with fewer samples from Croatia, direct familial relations were recognised, indicating the constant movement of animals in all directions (Source: LIFE+ SloWolf project, 2014)

All the above further points out the necessity of mutual cooperation between Slovenia and Croatia (and BiH and beyond) in managing the wolf population, as it is very evident that all three neighbouring states share a single, very connected population.

The analysis also provided a very clear differentiation of wolf and dog genotypes, and recognition of the F1 and F2 hybrids. No recrossing of hybrids with dogs was observed, though it was noted that the wolf from another population was recognised as similar to a cross between a hybrid and pure wolf.

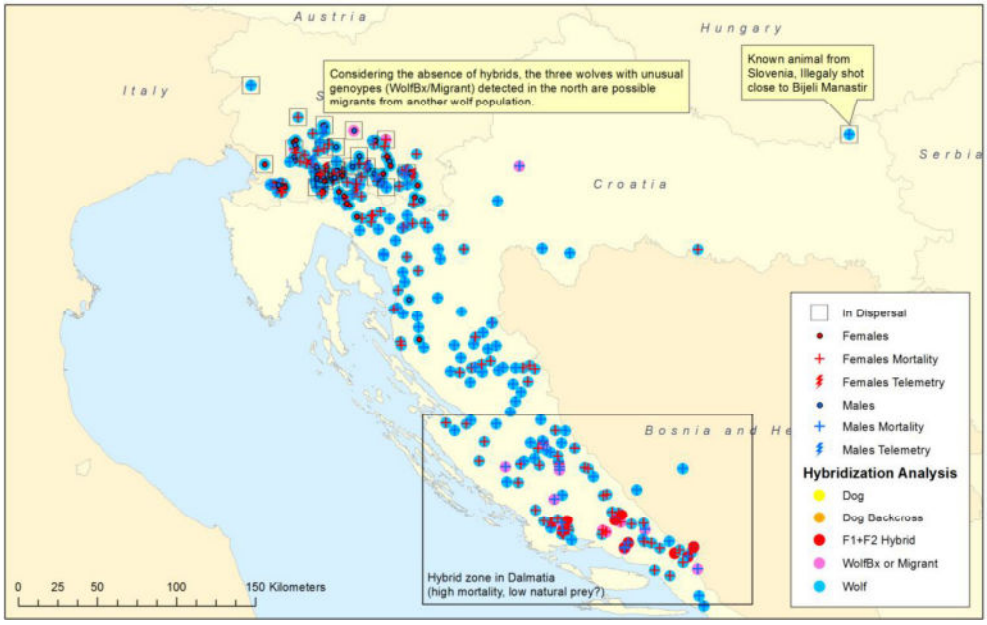

Figure 22. Assessment of hybridisation between wolves and dogs in the Dinarides region. Considering the lack of F1 and F2 hybrid backcrosses, the three individuals with unusual genotypes from the north are likely migrants from other wolf populations or that escaped from captivity. It is clear that there is virtually no hybridisation in the north, while this issue is pronounced in the south, particularly in Dalmatia (source: LIFE+ SloWolf project, 2014)

There were virtually no crosses between dogs and wolves in Slovenia, and only two individuals in Slovenia and three individuals in northwestern Croatia were detected as potential backcrosses between a hybrid and a pure wolf. Considering that no crosses were found in Gorski Kotar and Lika, it can be assumed that these are migrants from other wolf populations. This should once again be confirmed in cooperation with other laboratories. More frequent crossing appears in Dalmatia. In the Dalmatian region, the ecological conditions are different than those areas where the research was conducted (little forest cover, little natural prey). In these areas, damages to domestic animals is common, which in turn creates a very low level of tolerance among the local population, resulting in increased illegal culling and wolf mortality. The interaction of these factors should be the subject of further detailed study (Figure 22).

It was assessed without reservations that the genetic research conducted as part of the SloWolf project was more than successful. Today, there is an objective assessment of wolf abundance in Slovenia, which was a point of contention for many years. Furthermore, a good foundation has been established for the continuation of permanent population monitoring.

4. Assessment of the wolf population size and distribution of packs

4.1. Assessment of abundance for 2013

The analysis of all the data collected, and corrections made with regard to the results of telemetry studies, habitat models and border packs, it was assessed that the Croatian wolf population ranges from a minimum of 142 individuals to a maximum of 212 individuals. **On average, this is 177 individuals distributed in 49 packs**. Of those **23 are border packs** (47%), either with Slovenia, or with Bosnia and Herzegovina. Within the Croatian territory, there are 26 packs inhabiting the territory of nine counties, while some packs have a territory covering the area of two or even three counties. The overall wolf population size in 2013 was significantly reduced in comparison to 2012.

4.2. Assessment of abundance for 2014

The analysis of all data collected and corrections made with regard to the results of the spatial/temporal analysis of damages (STAD), maps of the likelihood of wolf appearances, results of telemetry studies and border packs, resulted in an assessment that the Croatian wolf population ranges from a minimum of 136 (135.5) individuals to a maximum of 199 individuals (Figure 24, Table 12). **On average, that is 168 (167.5) individuals distributed in 48 packs**. Of these, **22 packs are border packs** (46%) – Slovenia and Bosnia and Herzegovina. Within the Croatian borders, there are 26 packs that inhabit the territory of nine counties, while some packs inhabit the territory of two or even three counties. **The abundance of wolf individuals was reduced in comparison to 2013, and the negative trend from 2010 and 2012 is continuing (Figure 23)**.

Over the past 10 years, the assessed abundance and state of the wolf population has been carried out using the same methodology. The assessed abundance in 2014 was the lowest in that period, warning of a continuing negative trend and a drop in the wolf population size in Croatia.

As in 2013, when a significant reduction in the population size was observed, researchers and some assessors again noted significant reductions in the number of individuals in certain packs. The negative trend is ongoing, and this was also seen from the data of Slovenian researchers and the conducted DNA analysis. The main reason for the negative trend is in increased mortality, where population growth does not succeed in overcoming the losses due to mortality.

The evidence and reports of illegal kills of wolves suggest that this is an ongoing issue, despite the culling quotas, and the abolition of the quota in 2013. To date, mortality has been added to the quota, and has not replaced illegal kills, which was the intent of the Wolf Management Plan in Croatia in 2005 and the Plan for the period from 2010 to 2015.

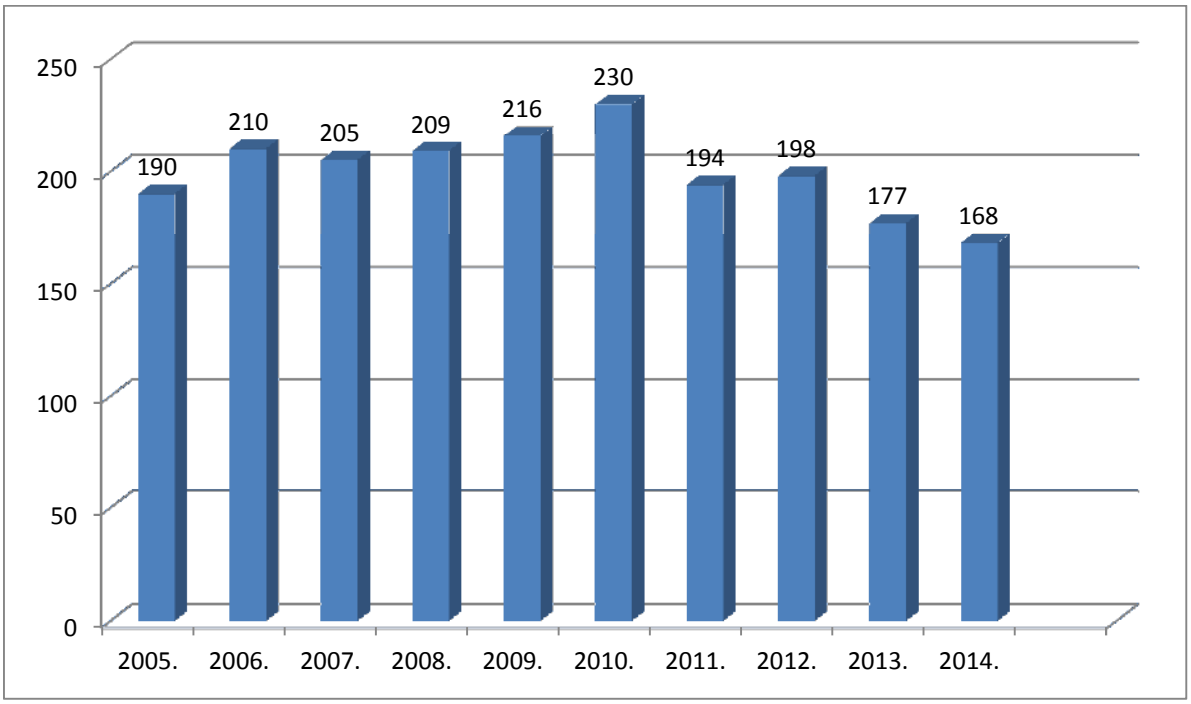

Figure 23. Overview of the average assessed wolf population size in the period from 2005 to 2014 (source: SINP, compiled by: J. Jeremić, 2014)

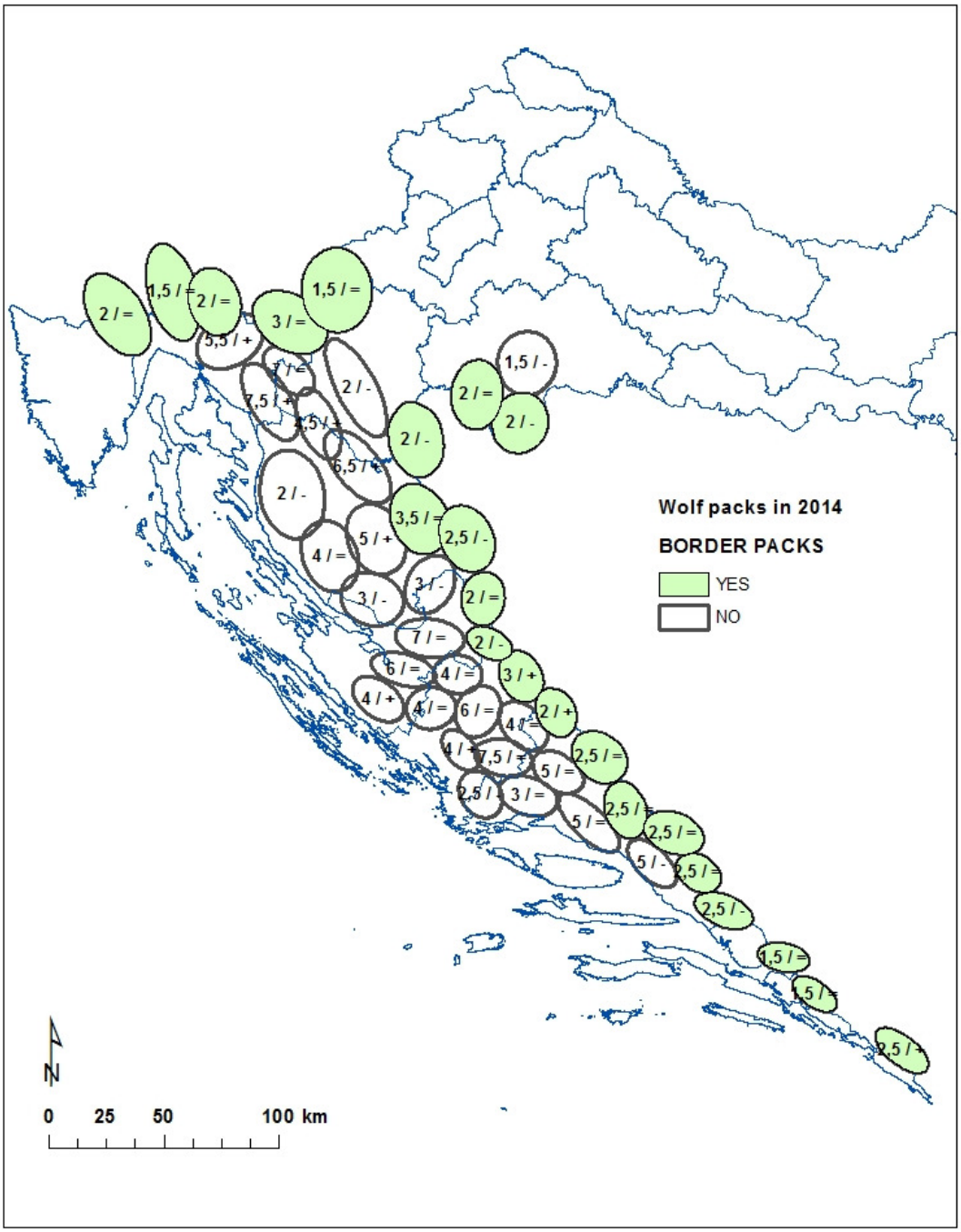

Figure 24. Assessed wolf packs showing the number of individuals and trends (+ increasing, - declining, = no change), border packs shown in green (source: J. Kusak, J. Jeremić, S. Desnica 2014)

Table 12. Assessed wolf packs in Croatia, with the accompanying number of individuals, and assessors providing data; pack names assigned according to territory inhabited (except the packs Snježnik, Suho, Risnjak, Krasno and Kozjak) for easier interpretation. For border packs, numbers have been halved. For those packs for which recent data were not available, data from previous periods were used (compiled by: J. Kusak, J. Jeremić, S. Desnica, 2014)

No.	Region (county/country)	Pack	Border	Min. number	Max. number	Average	Trend	Source*	Data from
1.	Primorje-Gorski Kotar/Slovenia	Suho	YES	1.5	1.5	1.5	=	Kusak	2013
2.	Primorje-Gorski Kotar /Slovenia	Snježnik	YES	2	2	2	=	Kusak	2013
3.	Primorje-Gorski Kotar	Risnjak	NO	5	6	5.5	+	Haswell	2014
4.	Primorje-Gorski Kotar/Slovenia	Brod Moravice	YES	2.5	3	3	=	Medved	2014
5.	Primorje-Gorski Kotar /Karlovac	Mrkopalj	NO	6	8	7	=	Šporer, Medved, Kusak	2014
6.	Sisak-Moslavina	Šamarica	NO	1	2	1.5	-	PI SMC	2014
7.	Sisak-Moslavina/BiH	Zrin	YES	1.5	2	2	-	Bručić	2014
8.	Sisak-Moslavina/BiH	Vratnik	YES	2	2	2	=	Kusak	2013
9.	Karlovac/Slovenia	Prilišće	YES	1	2	1.5	=	Matičić	2014
10.	Karlovac/Lika-Senj/BiH	Medveđak-Mašvina	YES	2	2	2	-	Matičić	2014
11.	Karlovac	Saborsko	NO	1	3	2	-	Matičić	2014
12.	Primorje-Gorski Kotar/Lika-Senj	Bitoraj-Ričićko Bilo	NO	7	8	7.5	+	Šimunić, Dasović	2014
13.	Karlovac/Lika-Senj	Velika Kapela	NO	4	5	4.5	+	Dasović	2014
14.	Karlovac/Lika-Senj	Mala Kapela	NO	6	7	6.5	+	Kusak, Dasović, Plitvice Lakes NP, Golić, Orešković	2014
15.	Lika-Senj	Krasno	NO	1	3	2	-	Tomaić, Vukelić, Haswell, Kusak, Dasović	2014

No.	Region (county/country)	Pack	Border	Min. number	Max. number	Average	Trend	Source*	Data from
16.	Lika-Senj	Oštarije	NO	3	5	4	=	Milković, Lacmanović, Rukavina	2014
17.	Lika-Senj	Golo trlo	NO	3	7	5	+	Milković, Krpan	2014
18.	Lika-Senj/Zadar	Southern Velebit	NO	2	4	3	-	Paklenica National Park	2014
19.	Lika-Senj	Plješevica	YES	2.5	4.5	3.5	=	Milković, Kusak, Krpan, Plitvice Lakes National Park	2014
20.	Lika-Senj/BiH	Una	YES	2	3	2.5	-	Hak, Krnjajić	2014
21.	Šibenik-Knin/Split-Dalmatia/BiH	Vučipolje-Troglav	YES	1.5	2.5	2	+	Kokić, Svilaja Hunting Society, STAD	2014
22.	Šibenik-Knin	Kozjak	NO	3	5	4	=	Kokić, Šupe, Svilaja Hunting Society, STAD	2014
23.	Šibenik-Knin/Split-Dalmatia	Opor	NO	2	3	2.5	-	Bračulj, Šupe, Gužvica, STAD	2014
24.	Šibenik-Knin	Unešić	NO	7	8	7.5	=	Šupe, STAD	2014
25.	Split-Dalmatia	Svilaja	NO	4	6	5	=	Bosiljevac, Kokić, STAD	2014
26.	Split-Dalmatia	Vučevica	NO	2	4	3	=	Bračulj, Bosiljevac, Gužvica, STAD	2014
27.	Split-Dalmatia /BiH	Kamešnica	YES	2	3	2.5	=	Kokić, STAD	2014
28.	Split-Dalmatia /BiH	Umovi	YES	2	3	2.5	=	Bosiljevac, STAD	2014
29.	Split-Dalmatia	Mosor	NO	4	6	5	=	Bosiljevac, Bašić, Sičić, Gužvica, STAD	2014
30.	Split-Dalmatia /BiH	Imotski	YES	2	3	2.5	=	Bosiljevac, STAD	2014
31.	Split-Dalmatia	Biokovo	NO	4	6	5	-	Gužvica, Šver, Šabić,	2014

No.	Region (county/country)	Pack	Border	Min. number	Max. number	Average	Trend	Source*	Data from
								STAD	
32.	Split-Dalmatia /BiH	Kozička Poljica	YES	2	3	2.5	=	Šabić, STAD	2014
33.	Split-Dalmatia / Dubrovnik-Neretva	Rilić - Rujnica	YES	2	3	2.5	-	Šabić, Petković	2014
34.	Dubrovnik-Neretva /BiH	Mlinište - Metković	YES	1	2	1.5	=	Petković	2014
35.	Dubrovnik-Neretva /BiH	Ilijino brdo	YES	1	2	1.5	=	Petković	2014
36.	Dubrovnik-Neretva /BiH	Duba Konavoska	YES	2	3	2.5	+	Petković	2014
37.	Lika-Senj/Zadar	Ličko Polje	NO	2	4	3	-	Proroković, Godeč, Krnjajić	2014
38.	Zadar/BiH	Srb	YES	2	2.5	2	=	Hak, Krnjajić	2014
39.	Zadar/Lika-Senj	Obrovac-Vučipolje	NO	5	9	7	=	Grgas, Hak, STAD	2014
40.	Zadar/Šibenik-Knin/BiH	Zrmanje spring	YES	1.5	2.5	2	-	Ljubičić, STAD	2014
41.	Zadar	Medviđa	NO	5	7	6	=	Grgas, STAD	2014
42.	Šibenik-Knin/Zadar	Ervenik	NO	3	5	4	=	Ljubičić, Hak, STAD	2014
43.	Šibenik-Knin/Zadar	Kistanje	NO	3	5	4	=	Ljubičić, STAD	2014
44.	Šibenik-Knin	Promina	NO	5	7	6	=	Šupe, Ljubičić, STAD	2014
45.	Šibenik-Knin/BiH	Dinara-Orlovac	YES	2.5	3.5	3	+	Ljubičić, STAD	2014
46.	Istria/Primorje-Gorski Kotar/Slovenia	Slavnik-Učka	YES	2	2	2	=	Potočnik, Kulić	2013
47.	Zadar	Benkovac-Ceranje	NO	3	5	4	+	Grgas, STAD	2014
48.	Šibenik-Knin	Laškovica	NO	4	4	4	+	Šupe, STAD	2014
TOTAL:				**135.5**	**199.0**	**167.5**			

* In addition to the data from the listed assessors and observers (authorised experts, staff of the public institutes of protected areas, scientists and experts, members of hunting societies) on the observations of traces of wolf presence (damages, hair, scats, snow tracks, sightings, howling surveys), data from the spatial and temporal analysis of damages (STAD), telemetry, photo-traps, killed animals and genetics were used.

4.3. Wolf mortality

In the period from 15 September 2013 to 15 September 2014, the deaths of **eight wolf individuals** from various causes (Table 13) were recorded at different locations (Figure 26). Considering that there was no culling quota issued in 2013/14, and there was no legal culling, two cases of illegal poaching were recorded.

4.3.1. Wolf mortality caused by illegal culling and other human-based causes

Evidence was found of the illegal culling of two wolves (WCRO248 and WCRO251), five individuals were killed in traffic, while one wolf was killed in a confrontation with a shepherd dog.

As in previous years, there were a substantial number of reports of illegal interventions in the wolf population (illegal culling, poisoning, traps), though this information could not be proven. Due to the lack of evidence, it is impossible to find the perpetrator, even when the wolf carcass is located, and most often, individual reports are submitted after a long period of time.

Table 13. List of wolves perished in the period from 15 September 2013 to 15 September 2014 (cases with material evidence shown)

No	Code	Date of find	Cause	Gender	Find site
1.	WCRO248	15.12.2013	Illegal culling	F	Sinjsko Polje - Brnaze-Turjaci
2.	WCRO249	02.03.2014	Traffic	F	Škrebutnjak cesta
3.	WCRO250	07.03.2014	Traffic	M	Mojanka
4.	WCRO251	12.03.2014	Illegal culling	F	Trilj near petrol station
5.	WCRO252	13.03.2014	Traffic	F	Oštrovica old road, 200 m from toll booth
6.	WCRO253	13.04.2014	Shepherd dogs - Tornjak	M	Ramljani
7.	WCRO254	28.04.2014	Traffic	M	Cista Velika
8.	WCRO255	14.06.2014	Traffic	M	Stubica, near Vrbovsko

In December 2013, the find of wolf carcass WCRO248 near Sinjsko polje was reported. The authorised expert confirmed that this was a carcass only several days old and suspected it was due to illegal culling (Figure 25). The police were summoned to investigate.

Also, for the carcass of wolf WCRO251 found in March 2014 near the petrol station in Trilj, reported to have been killed in traffic, subsequent examination (x-ray image revealed shot in the body) confirmed that this was a case of illegal culling (Figure 25a).

Figure 25. Wolf that perished in illegal culling (WCRO248) (photo: S. Reljić & D. Huber)

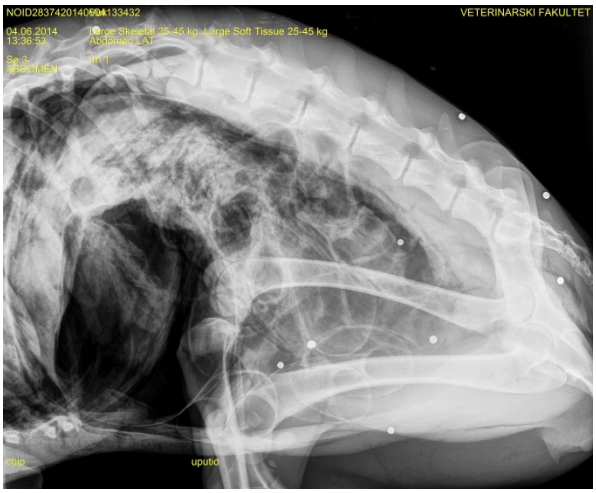

Figure 25a. Wolf perished from illegal culling (WCRO251) (image taken at the Department for Radiology, Ultrasound Diagnostics and Physical Therapy, Faculty of Veterinary Medicine, University of Zagreb)

It should be stated that in this year, one wolf WCRO253 was killed in a direct confrontation with Tornjak sheep dogs, caring for a flock near Ramljani.

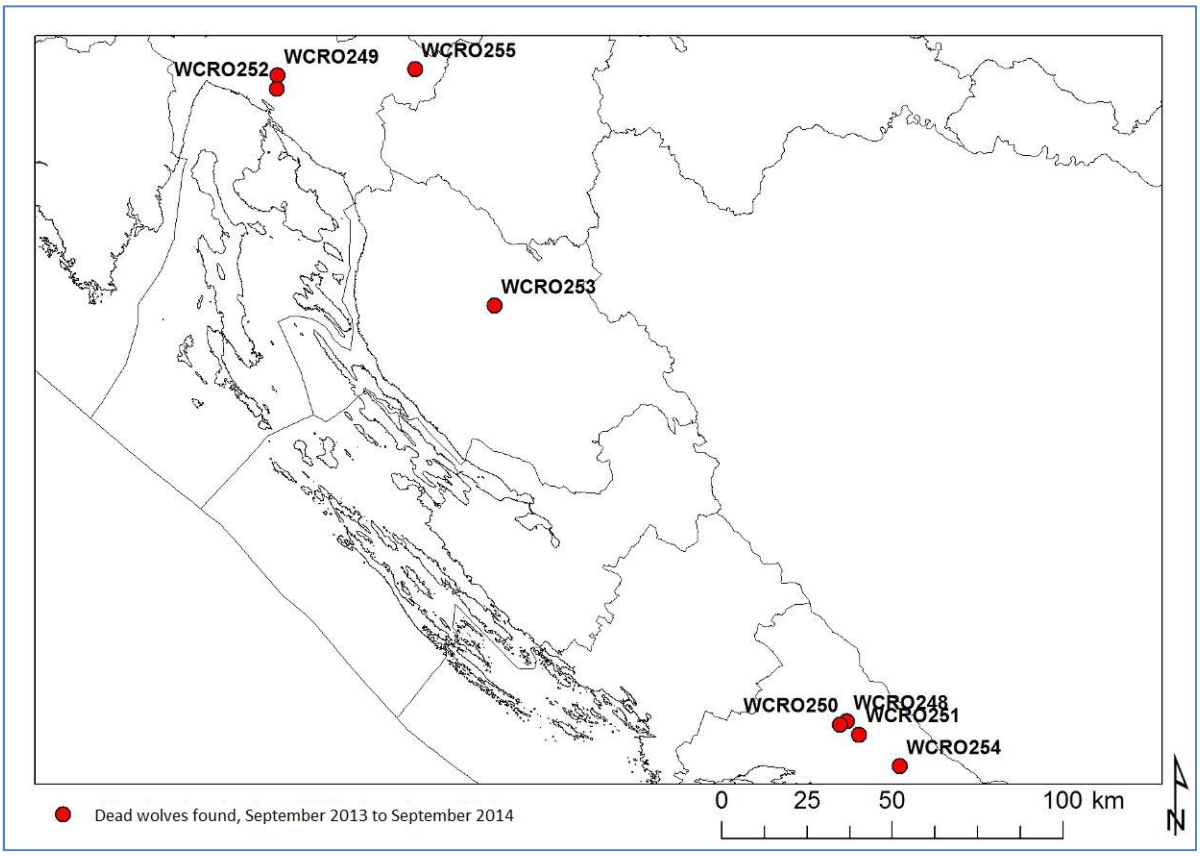

Figure 26. Locations of killed wolves in the period from 15 September 2013 to 15 September 2014 (compiled by: J. Kusak, 2014)

4.3.2. Wolf mortality due to legal interventions in the population

In the season 2013/14, no interventions in the wolf population were permitted, and pursuant to that, there was no legal culling.

Since 2005, when the Wolf Management Plan determined that wolf mortality exists due to a range of causes, and is numerically unknown, and since legal interventions into the wolf population were permitted, the highest culling to day (**95.4%**) was performed in the season 2011/12, while in the last season 2012/13, culling was **83.3%** of the total approved number of individuals for culling.

4.3.3. Total known wolf mortality and trends

The recorded mortality in the period between the two reports, from 15 September 2013 to 15 September 2014, was eight wolf individuals, which is 5% of the assessed average population size of 168 wolf individuals (Table 14). There is a visible declining trend in the number of known mortalities since the season 2010/11 (Figure 27). Over the past ten years, since mortality has been systematically recorded pursuant to the Protocol on handling dead individuals of strictly protected wild carnivores, this is the lowest number of dead animals, suggesting that a portion of the mortality remains unknown.

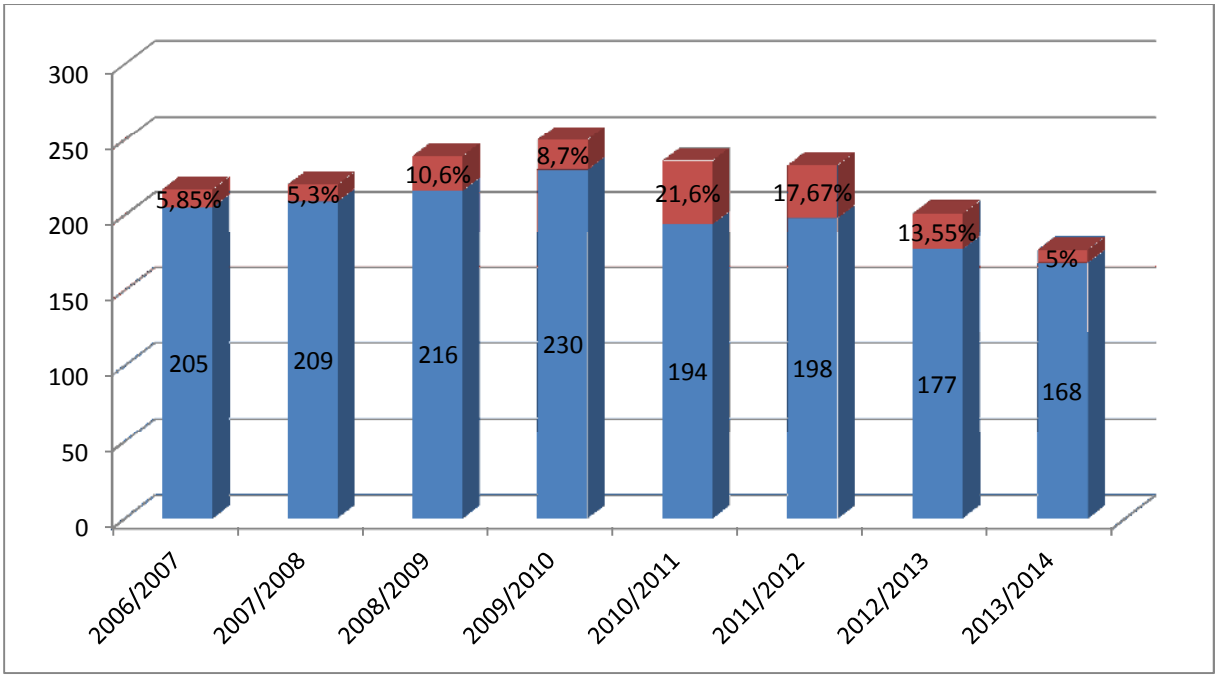

Figure 27. Overview of the assessed average wolf population size, with the share of known mortality in the period from 2006 to 2014 (blue – average population size, red – share of known mortality) (source: SINP, J. Jeremić, 2014)

Table 14. Overview of the total known wolf mortalities in the period from 2006 to 2014 in relation to the assessed average wolf population size

Year	Known number of wolf individuals killed	Assessed average wolf population size	Share of known mortality in the assessed average wolf population size
2006/2007	12	205	5.85%
2007/2008	11	209	5.3%
2008/2009	23 =14+9 (quota)	216	10.6%
2009/2010	20 =11+9 (quota)	230	8.7%
2010/2011	42=23+19 (quota)	194	21.6%
2011/2012	35=14+21 (quota)	198	17.67%
2012/2013	24 =9+15 (quota)	177	13.55%
2013/2014	8	168	5%

5. Assessment of the likely effect of culling quotas on the future trends of the wolf population in Croatia

Dr. Guillaume Chapron of Sweden (Grimso Wildlife Research Station, Swedish University of Agricultural Sciences, Riddarhyttan), a specialist for modelling wild animal populations, drafted the Report on the wolf population dynamic in Croatia, in which a mathematical model was used to assess the likely impact of hunting quotas on the future trend (growth) of the population (Liberg et al., 2011), using data from the annual Reports on the state of the wolf population in Croatia on the known mortality and the assessed population size. The same model for assessing the influence of hunting quotas and additional mortality was applied at the request of the competent authorities for the Swedish and French wolf populations.

The model shows the possible impact of hunting quotas in 2015. Due to the population dynamics, the model cannot predict with certainty a single figure after a given intervention into the population. Table 15 shows the probability that the population will be less than or greater than a certain number for the specific quota. A population size of 170 individual wolves is the initial population size, which includes the known mortality. The value *H* in the column is the number of wolves designated for a certain hunting quota. The remaining columns denote the likelihood that the wolf population will be a certain size after the hunting quota is carried out. For example, the column *<180* denotes the probability that the population will have fewer than 180 individuals. The final column *>230* indicates the probability that the population will have more than 230 individuals. The table is read by selecting a harvest quota from column *H*. For example, if H=5, there will be a 26% probability that after the quota of 5 individuals is met that the population will have fewer than 170 individuals, and a 91% probability that the population will have fewer than 200 individuals in the following year. To determine the probability that a population will be larger than a given number after the quota is carried out, then 1-*p* is calculated, where *p* is the probability value shown in the table. For example, for H=5, the probability that the population will be over 200 individuals is 1-0.91 = 0.09, or 9%.

Table 15. Probabilities that the wolf population in Croatia will be less than a certain size in the following year, dependent on the hunting quota (*H*) (Chapron, 2014)

H	<130	<140	<150	<160	<170	<180	<190	<200	<210	<220	<230	>230
0	0	0.01	0.03	0.07	0.17	0.37	0.64	0.85	0.94	0.98	0.99	0.01
1	0	0.01	0.03	0.08	0.19	0.4	0.67	0.86	0.95	0.98	0.99	0.01
2	0	0.01	0.03	0.09	0.21	0.43	0.69	0.88	0.95	0.98	0.99	0.01
3	0.01	0.01	0.04	0.09	0.22	0.46	0.72	0.89	0.95	0.98	0.99	0.01
4	0.01	0.02	0.04	0.1	0.24	0.48	0.74	0.9	0.96	0.98	0.99	0.01
5	0.01	0.02	0.04	0.11	0.26	0.51	0.76	0.91	0.96	0.98	0.99	0.01
6	0.01	0.02	0.05	0.12	0.28	0.54	0.78	0.92	0.97	0.99	0.99	0.01
7	0.01	0.02	0.05	0.13	0.3	0.57	0.8	0.92	0.97	0.99	0.99	0.01
8	0.01	0.02	0.06	0.14	0.33	0.59	0.82	0.93	0.97	0.99	0.99	0.01
9	0.01	0.02	0.06	0.16	0.35	0.62	0.83	0.94	0.97	0.99	0.99	0.01
10	0.01	0.03	0.07	0.17	0.37	0.65	0.85	0.94	0.98	0.99	0.99	0.01
11	0.01	0.03	0.07	0.19	0.4	0.67	0.87	0.95	0.98	0.99	1	0
12	0.01	0.03	0.08	0.2	0.43	0.7	0.88	0.95	0.98	0.99	1	0
13	0.01	0.03	0.09	0.22	0.46	0.72	0.89	0.96	0.98	0.99	1	0
14	0.01	0.04	0.1	0.24	0.48	0.74	0.9	0.96	0.98	0.99	1	0
15	0.02	0.04	0.11	0.26	0.51	0.76	0.91	0.97	0.99	0.99	1	0
16	0.02	0.04	0.12	0.28	0.54	0.78	0.92	0.97	0.99	0.99	1	0
17	0.02	0.05	0.13	0.3	0.57	0.8	0.93	0.97	0.99	0.99	1	0
18	0.02	0.05	0.14	0.32	0.6	0.82	0.93	0.97	0.99	0.99	1	0
19	0.02	0.06	0.16	0.35	0.62	0.84	0.94	0.98	0.99	1	1	0
20	0.02	0.07	0.17	0.37	0.65	0.85	0.95	0.98	0.99	1	1	0

6. State of the population in neighbouring countries

In line with the Guidelines for Population Level Management Plans for Large Carnivores, 2008 of the Large Carnivore Initiative for Europe, the wolf population in Croatia is part of the larger Dinaric/Balkan population that inhabits a broad region from Slovenia to northern Greece, including the entire Dinarides massif that extends through Croatia, Bosnia and Herzegovina, western Serbia and Kosovo, Montenegro, Macedonia, Albania and western and southern Bulgaria.

It is believed that the population is more or less continuous through this region, though the data for some countries is deficient. The population has been roughly estimated to have 3900 individuals, though local densities may vary widely. The above Guidelines were drafted by a group of independent experts as the baseline information for the permanent work of the Operational Commission of the Habitats Directive. The Guidelines were presented in their final form at the Pan-European Congress in Postojna, Slovenia on 10–11 May 2008, with the intent make management based on actual biological units more effective. It was emphasised that instead of monitoring only segments of the population, the population should be monitored as a whole, and that this may be achieved only through the alignment of legislation and good multilateral cooperation.

The data provided in this Report tell of the state of the wolf population in the neighbouring countries with which Croatia directly shares this population (Slovenia and Bosnia and Herzegovina). In line with this, future interventions that take place on one side of the border will undoubtedly have an impact on the state of the population on the other side of the border.

6.1. Bosnia and Herzegovina

Data on the state of the wolf population in Bosnia and Herzegovina were not provided in this Report, similar to previous years, since the state of the population in that country is not monitored systematically and there are no official data available. In line with the Hunting Act of Federation BiH (Official Gazette of Federation BiH 4/06, 8/10 and 81/14), the wolf is protected by a ban on hunting, while in line with the Hunting Act of Republika Srpska (Official Gazette of Republika Srpska 60/09), wolf is only defined as a game species and is not protected by law.

6.2. Slovenia

6.2.1. Distribution and abundance

In early 2010, the previously mentioned four-year project LIFE+ *Narava o volku – Varstvo in spremljanje varstvenega statusa populacije volka (*Canis lupus*) v Sloveniji (2010-2013)* - *SloWolf* began. The project was aimed at collecting more information about the wolf population, for the purpose of improving wolf management in Slovenia. The project leaders was the Biotechnical Faculty of the University of Ljubljana (*Biotehniška fakulteta, Univerza v Ljubljani*), with partner organisations Slovenian Forests (*Zavod za gozdove Slovenije*) and the nongovernmental organisation Dinaricum (*društvo Dinaricum*).

Over three seasons (2010/11, 2011/12, 2012/13), systematic monitoring was performed on the wolf population in Slovenia. The research included the previously described telemetry research, genetic research of samples of scats, urine and saliva taken from wolf prey – primarily killed small prey (sheep, goats), howling surveys aimed at determining the presence of a territorial pack and young, snow track monitoring, analysis of prey and analysis of the state of health via autopsies of dead individuals. The data collected were processed and analysed to assess the distribution, spatial spread and size of packs, and the size of the overall population.

The results of the data collected over three monitoring seasons indicated that the average pack territory size is about 400 km^2 and that there are some 8 to 12 packs appearing in Croatia, of which four are bordering packs shared with Croatia.

The most recent assessments from the third monitoring season (2012/13) indicated that there are on average 54 wolf individuals (53–62) in the entire research area, or 46 individuals (45–55) within the borders of Slovenia. Over the three year study period to monitor the wolf population in Slovenia and in part of Gorski Kotar, it was established that the population was stable during that period. Also, the population size of 70 to 100 individuals assessed in previous years prior to the start of this systematic research was overestimated.

The abundance of individuals varied markedly during the year, but was stable between individual years. This is expected given that the dispersion of young individuals with low survival rates has a high impact on the wolf populations, as the majority of the share of mortality remains unknown. Other impacts on the population are the survival of reproductive individuals, poaching, immigration and emigration. For that reason, particular caution is required in permitting and determining the annual culling quotas.

No systematic monitoring was conducted in 2013/14. However, the data of Dr. Hubert Potočnik (Department of Biology, Biotechnical Faculty, University of Ljubljana) suggest that the wolf distribution in Slovenia has not changed significantly.

6.2.2. Mortality

According to the data and Expert opinion on large carnivores for the period from 1 October 2013 to 30 September 2014 (*Strokovno mnenje za velike zveri za obdobje 1.10.2013. – 30.09.2014.*), an official document of the Republic of Slovenia compiled by Slovenian Forests (*Zavod za gozdove Slovenije*), the total known mortality of wolves to the end of June 2013 in Slovenia was nine individuals, of which eight individuals were killed within the permitted quotas, and one was killed in traffic. The last illegal cull was recorded as two individuals in 1996. Over the past decade, it has been assessed that an average of 1.1 wolf individuals is killed from other anthropogenic impacts (1 to 2 per year). It is assessed that over the past few years, since the systematic monitoring has been in effect, culling and other factors have halted the population growth, though the population remains stable.

Recent data (Dr. Hubert Potočnik) indicate the mortality of six wolf individuals from September 2013 to September 2014, of which two individuals were killed in illegal culling. One case of illegal culling (Loški Potok hunting society) is still under investigation, while the second case (Sodražica hunting society) was immediately reported and judicial proceedings are ongoing.

6.2.3. Management

6.2.3.1. Planning management

During 2011, four workshops were held in Ljubljana as part of the above outlined SloWolf project. The workshops were aimed at drafting an Action Plan for the management of the wolf population in Slovenia. All interest groups from the Republic of Slovenia, and representatives of the Directorate for Nature Protection of the Ministry of Culture, State Institute for Nature Protection, and Faculty of Veterinary Medicine of the University of Zagreb from the Republic of Croatia took part in the workshops. During 2011, the draft Action plan entitled *Akcijski načrt upravljanja populacije volka (*Canis lupus*) v Sloveniji za obdobje 2012 – 2016*, was prepared and submitted to the line ministry.

Following amendments, the Government of the Republic of Slovenia adopted the Action Plan for the management of the wolf population in Slovenia for the period 2013–2017 (*Akcijski načrt upravljanja populacije volka (*Canis lupus*) v Sloveniji za obdobje 2013–2017*).

6.2.3.2. Implementation of management measures

In the Expert opinion on large carnivores, Slovenian Forests gives its proposal for the culling quota. The quota is then approved by the Ministry for Environment and Spatial Planning (*Ministarstvo za okolje in prostor*), with the prior opinion of the Slovenian Institute for Nature Protection (*Zavod Republike Slovenije za varstvo narave*). The decision on the quota is prescribed by the Ordinance on the extraction of individuals of the species brown bear (*Ursus arctos*) and wolf (*Canis lupus*) from nature (*Pravilnik o odvzemu osebkov vrst rjavega medveda (Ursus arctos) in volka (Canis lupus) iz narave*), and is published in the Official Gazette of Slovenia (nos. 46/04, 109/04, 84/05, 115/07, 96/08, 36/09, 102/11, 73/12, 104/13), and is issued by the Minister for the Environment and Spatial Planning.

In planning the quotas in Slovenia, the recommendations and positive effects from culling outlined in the valid Action Plan and the negative consequences of culling that should be reduced to the maximum extent possible, are taken into consideration. The negative impacts of culling may be visible not only in the disintegration of existing packs due to the culling of a dominant individual, but also to the possible local extinction of a population due to intensive culling in a small area. Therefore, the final solution also envisaged additional solutions so as to limit not only the disintegration of packs in an area, and to prevent excessive interventions in the population at the local level.

The proposed and planned quota is distributed intentionally, with spatial limitations to avoid 'overculling'. The quota is spaced out through hunting regions (*Lovsko upravljavska območja – LUO*) in which culling is planned. Individual hunting regions encompass the territory inhabited by a maximum of three packs. In a hunting region, the culling of a maximum of two individuals is permitted, and when the quota is met for a given area, culling stops. If there was to be a case of simultaneous culling of more than two individuals in a given hunting area, the extra culled individuals would be subtracted from future quotas. In the territory where culling is permitted, the border areas with Croatia are exempted, i.e. in some special purpose hunting groups (*Lovišča s posebnim namenom – LPN*) managed by Slovenian Forests, no culling is envisaged or permitted. Namely, these hunting grounds are situated along the border of Slovenia and Croatia, and encompass the territory of three cross-border packs (1005 km^2). The ban and exemption of that border area of the territory from the quota is aimed at ensuring the structure and preservation of cross-border packs to the greatest extent possible, and further at ensuring the connections to the remainder of the Dinaric-Balkan population. Also, it the case that in one culling season the culls of reproductively mature females exceeds 50% of the permitted quota, or if three adult individuals (2 years or older) are shot, the culling is stopped and the quota deemed met. This restriction is further insurance aimed at limiting the impacts of culling on the reproductive capacities of the population, and the quota on females has been carried out since 2010.

The Ordinance on Amendments to the Ordinance on the extraction of individuals of the species brown bear (*Ursus arctos*) and wolf (*Canis lupus*) from nature, published in the Official Gazette of Slovenia no. 104/13 of 13 December 2013, **does not plan wolf culling** in the period from the start of validity of the new Ordinance – 14 December 2013 to 31 January 2014, and from 1 to 30 September 2014. The mortality that is a consequence of the culling of injured animals involved in traffic accidents is classified as a loss and is not calculated in culling. Such cases are treated as an ethical means of preventing the suffering of wounded animals, and no permit is required for extraordinary culling.

7. Status, management and distribution of the wolf in Europe

In March 2013, the European Commission published the *Status, management and distribution of large carnivores – bear, lynx, wolf & wolverine – in Europe,* drafted in cooperation with the IUCN experts and large carnivore specialists gathered in the *Large Carnivore Initiative for Europe*. This document has a separate chapter dedicated to the status of the wolf in Europe, while other sections give an overview of the status of the populations in individual countries.

The wolf is present in all the countries of Europe except the countries of Benelux, Denmark, Hungary and the island nations (Ireland, Iceland, Great Britain, Cypress and Malta). The populations have been categorised into ten populations: Northwestern Iberian, Sierra Morena, Alpine, Italian Peninsula, Carpathians, Dinaric/Balkan, Baltic, Karelian, Scandinavian and Central European lowlands.

Considering that large carnivores require and take up large areas/territories, so their conservation must be planned in such a way that it encompasses broad expanses that are most often intersected by various national and international boundaries. For these reasons, it is very important that conservation campaigns and management are coordinated. This requires the best possible knowledge of the conservation status at the national and population levels.

As previously stated, the Croatian population is part of the larger Dinaric/Balkan population. Unlike the remaining European populations, the Dinaric/Balkan population extends through a territory with the most national (political) borders, and in that way 'suffers' from the greatest differences in management methods and the implementation of monitoring. In terms of connections of this population with others in Europe, it was established that there is no contact with the nearest Alpine population in the north, though some dispersed individuals have been seen in Austria and eastern Italy. To the east, it is possible that there is some exchange (dispersion of individuals) with the large Carpathian population that extends

into northern Bulgaria. More detailed research (monitoring) is necessary to obtain more complete data.

Also, the greatest threats to the wolf population have been classified (Table 16). For the Dinaric/Balkan population, this has been characterised as a low level of acceptance due to livestock damages, poor communication with interest groups, poor management structures, anthropogenic disturbances, poaching, appearance of hybrids, low level of implementation of the legal obligations and development of infrastructure. For the Italian Peninsula population, the threats listed are poisoning, hybridisation, low acceptance and poor management structures, while the threats to the Alpine population are listed as poor acceptance, poaching and poor management structures.

Table 16. Overview of the categories of threat to the wolf populations in Europe (source: Status, management and distribution of large carnivores – bear, lynx, wolf & wolverine – in Europe, 2013)

	Issue ticked off as a threat for wolves (for present time only)									
Threat category (sorted by overall threat assessment for the species)	Alpine (N=3)	Baltic (N=4)	Carpathian (N=5)	Central European Lowlands (N=2)	Dinaric-Balkan (N=7)	Ilalian Penninsula (N=1)	Karelian (N=1)	NW Iberia (N=2)	Scandinavian (N=2)	Sierra Morena (N=1)
Low acceptance	3	4	4	2	7	1	1	2	2	1
Habitat (Infrastructure)	3	3	5	2	6	1	0	2	0	0
Persecution	3	2	4	2	4	1	1	2	2	1
Poor management structure	1	4	4	2	7	1	1	2	0	0
Accidental Mortality	2	1	5	2	7	1	0	1	1	0
Lack of knowledge	2	3	3	0	6	1	1	1	0	1
Change in native fauna	0	4	2	1	5	1	0	2	0	0
Disturbance	1	1	3	2	5	1	0	1	0	0
Harvest	0	3	3	0	4	0	0	1	1	0
Intrinsic factors	1	2	3	2	0	0	0	1	1	1
Habitat (Livestock)	1	0	1	0	6	0	1	0	1	0
Habitat (Forestry)	1	1	2	1	3	0	0	1	0	0
Habitat (Divers)	1	0	2	0	4	0	0	1	0	0
Prey over harvest	0	0	2	0	5	0	0	1	0	0
Habitat (Agriculture)	0	1	1	0	2	0	0	1	0	0
Habitat (Mining)	1	1	0	1	1	0	0	1	0	0
Invasive alien Species	0	0	0	0	4	1	0	0	0	0
Natural disaster	1	0	1	0	2	0	0	0	0	0
Pollution (incl. Climate change)	0	0	1	0	0	0	0	1	0	0

An assessment was also made of the past, current and future threats. It is evident that the main current and future threats are low acceptance of the presence of wolf, poor population management structures, habitat condition, persecution and accidental mortality (Figure 28).

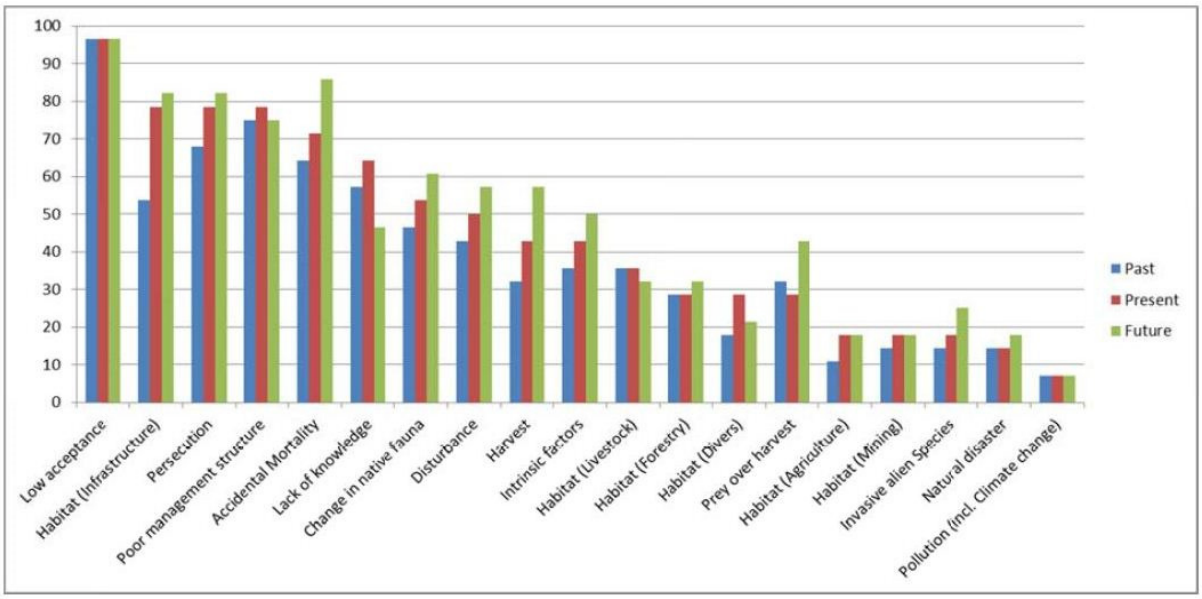

Figure 28. Assessment of the past, present and future threats of the wolf population in Europe. Blue is past, red present and green future threats. (Source: Status, management and distribution of large carnivores – bear, lynx, wolf & wolverine – in Europe, 2013)

The **EU Platform on Coexistence between People and Large Carnivores** was signed in Brussels on 10 October 2014. The Large Carnivore Initiative Europe set up the Platform for the European Commission to create a framework for structured dialogue on the issues and problems ensuing form the coexistence of people and large carnivores. This is a voluntary gathering of a group of organisations that also represent the main interest groups concerning large carnivores. The Platform was signed by the responsible persons of eight international and intersectoral organisations: the International Council for Game and Wildlife Conservation (CIC), the General Confederation of Agricultural Cooperatives/ European Farmers and European Agri-cooperatives (COPA-COGECA), the European Landowners Organisation (ELO), the EUROPARC Federation, the European Federation of Associations for Hunting and Conservation (FACE), Joint representative of Finnish and Swedish Reindeer Herders, International Union for Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF).

All the signatories committed to the following main principles:

1. Work within the framework of the EU legislation: Habitats Directive (92/43/EEC) is an all-encompassing legal instrument for conservation and the sustainable management of large carnivores with regard to the favourable conservation status of populations in the EU.
2. Ensure the necessary knowledge: all management must be based on scientific facts, the use of the best available and reliable data.
3. Recognise the socioeconomic and cultural aspects: the human society has the right to use their natural resources and to preserve the cultural heritage in a sustainable

manner, within the framework of multifunctional landscapes in which the large carnivores are an integral part. It is necessary to recognise the contribution of economic activities to the values of those landscapes. Also, the protection on public safety must be recognised.

4. Obligation of crossborder cooperation: Most large carnivore populations in Europe are spread out over areas that supersede state boundaries. The national solutions will not be effective without purposeful dialogue among various interest groups, including crossborder cooperation within the EU, and where possible, taking into consideration the Guidelines for large carnivore management at the population level.

The signatories also committed to work together to find solutions for conflicts ensuing from the coexistence of people and large carnivores, by sharing experiences and expertise, stimulating listing and discussions among various interest groups with different experiences and standpoints, stimulating dialogue aimed at achieving a consensus and accepting solutions that include compromise, accepting good solutions and practices for the successful coexistence of people and large carnivores, readiness to transfer knowledge and testing good solutions, and ensuring their involvement in the work of the Platform.

8. Assessment of the state of the wolf population in 2014, and achieving the objectives of interventions in the wolf population pursuant to the Wolf Management Plan in Croatia for the period 2010 to 2015

Pursuant to the Wolf Management Plan in the Republic of Croatia for the period 2010–2015, Chapter 6 - Interventions in the wolf population, the specific targets are:

6.1. To maintain the wolf population at a size of 200 to 220 individuals in the existing distribution area,
6.2. To reduce serious threats to domesticated animals and impacts on natural prey,
6.3. To improve the system of resolving cases where urgent intervention is required.

The standardised multiyear methodology of assessing the wolf population size applied in this Report, with the additional temporal and spatial analysis of damages to domesticated animals, the use of genetic and other data from Slovenia, and modelling the wolf population dynamics in Croatia, undoubtedly show the following for 2014:

1. The number of wolves has been in continuous decline over the past four years.
2. In the past four years, the population size is under the target minimum of 200 individuals.
3. The assessed number of wolves in this year was the lowest since the inception of the Wolf Management Plan in Croatia (2005), and even the upper calculation limit of 199 of a possible number of wolf individuals in Croatia is lower than the target 200 individuals.
4. Target 6.1 of the Management Plan has not been met since 2010, and currently, the average number of wolves is about 32 individuals below the lower limit of the desired range.
5. Target 6.2 of the Management Plan has been partially met, as the total extent of damages is not increasing.
6. Target 6.3 of the Management Plan has been met in the form of strictly developed rules for intervention culling (in Appendix 3).
7. Modelling the possible impacts of interventions in the form of a culling quota have shown that the risk to degrading the stability of the wolf population would be unacceptable given all the collected and shown parameters.

9. Conclusions

The data provided in this year's Report give an overview of the distribution, abundance and trends in the wolf population in Croatia. The population size was determined using a combination of methods. Data used included: (1) damages to domesticated animals pursuant to which a temporal and spatial analysis of damages was also made, (2) recorded mortality of wolves, (3) results of scientific research (telemetry, DNA analysis, photo-traps), (4) conducted campaigns of snow track monitoring, (5) data and observations from observers, (6) additional data on wolf observations from hunting associations and other hunting ground managers collected via the form for the collection of data on observations of signs of wolf presence, (7) model for assessing the impact of the quota or additional mortality.

1. With the processing of all collected data, it was assessed that the Croatian wolf population ranges from a minimum of 136 (135.5) individuals to a maximum of 199 individuals. On average, this is **168 (167.5) individuals distributed in 48 packs**. Of these, 22 packs (46%) are border packs shared with Slovenia or Bosnia and Herzegovina. Within the borders of Croatia, there are 26 packs inhabiting the territory of nine counties, while some packs cover the territory of two or even three counties.

2. The abundance of wolf individuals in 2014 was reduced even further in comparison to 2013, and significantly in comparison to 2012, making this **the fourth consecutive year with an estimate of less than 200 individuals**, which is the target minimum pursuant to the Wolf Management Plan in Croatia for the period 2010–2015, after the estimates were over 200 for a five-year period. Even the upper calculated limit of 199 wolf individuals is below this target. Since 2005, when the first annual Report on the state of the wolf population in Croatia was drafted, the Croatian part of the population has recorded the highest drop in the population size in 2014. **The abundance for 2014 is the lowest since 2005, since the same methodology was implemented and the abundance assessed**.

3. There is evidence that two wolf individuals, WCRO248 and WCRO251, were killed illegally. **Despite the fact that legal culling was approved every year, with the exception of the season 2013/14, illegal culling continues to be present**. Also, as in previous years, there have been a number of reports on illegal killing of wolves (illegal shooting, poisoning, traps). However, this information could not be confirmed. Due to a lack of evidence, it was impossible to discover the perpetrator even in cases when the wolf carcass was located, while some data were submitted with a substantial time lag. With illegal culling, the reports are always made with a

significant time lag, usually without evidence, and when physical evidence is found, the time lag makes it impossible to conduct a proper investigation.

4. After the third season of research (2012/2013), researchers gathered together on the project LIFE+ SloWolf included the data from 2009 and data collected from the Croatian researchers (J. Kusak and Đ. Huber) into their database, and drafted a map of the distribution of wolves in Slovenia along the border with Croatia. **It was assessed that there is an average of 46 wolf individuals inhabiting the territory of Slovenia, and including the border area with Croatia, an average of 54 wolf individuals, and for the part of Gorski Kotar along the Slovenian border, an average of 8 wolf individuals**. These are the first real assessments of the size of the Slovenian wolf population made based on the systematic research and monitoring in the period 2010–2013, which indicated that their previous assessments, ranging from 70 to 100 individuals, were overestimated.

5. **Modelling the possible effects of interventions in the form of culling quotas suggested that the risk of eroding the stability of the wolf population would be unacceptable, given all the collected and shown parameters, i.e. it would have a negative impact on the conservation of the wolf population in Croatia.**

6. For Bosnia and Herzegovina, there are no official data, considering that there continues to be no systematic monitoring of the wolf population in that country.

7. The trend in the border area with Slovenia (in Gorski Kotar) is also a reason for concern. It is necessary to take measures to halt this trend. **It is essential to begin active cooperation with Slovenia as soon as possible in the joint management of the population**.

8. **In the season 2014/15, no legal culling of the wolf may be approved. Exceptionally, only the need for urgent interventions into the population may be considered, exclusively in cases that meet the prescribed conditions.**

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Appendix 1. Form for entering data on the observation of signs of wolf presence

Name of area/hunting ground:_____ Area/hunting ground number:_____

OBSERVATION NUMBER	DATE AND TIME OF OBSERVATION	LOCALITY (DRAW ON MAP, ENTER NAME OF LOCALITY AND CODE IN TABLE, IF POSSIBLE ADD COORDINATES)			SIGN (excrement, paw print, howling, photo trap image, sighting, dead prey, etc.)	ASSESSED MINIMUM NUMBER OF ANIMALS (based on signs found)	REMARKS (concerning the observation)**	OBSERVED BY (FULL NAME IN BLOCK LETTERS AND SIGNATURE)
		Name of locality and code **(if no coordinates)***	X coordinate	Y coordinate				
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

***Locality code (A,B,C,D,…) should be entered onto the topographic map of the area (if no coordinates are available), and in the case of multiple observations at the same location, use the same locality code.**

****** List any accompanying documentation being submitted (photograph, photo-trap image, etc.).**

Send filled out forms and accompany documentation by post to: State Institute for Nature Protection, Trg Mažuranića 5, 10000 Zagreb. Send images on CD by post or send to e-mail: velikezvijeri@dzzp.hr

Appendix 2. List of associates

Hunting societies

1. Gacka, Otočac, IX/106
2. Gradina, Udbina, IX/121
3. Lane, Perušić, Golo trlo, IX/12
4. Svilaja, Vrlika, D.L. XVII/3 Dinara – Crvene grede, Z.L. XVII/120 Vrlika
5. Klisa, Perušić, DL Risovac IX/12
6. ZOL Perušić IX/109
7. Ravna Gora Sinac 14/14 Ličko Lešće, IX/15 Godača
8. Ozeblin, Donji Lapac IX/123
9. Poljičko hunting society Mosor, Priko Omiš, Podmosorje XVII/142
10. IX/10 Ramino korito
11. Dalmacija lov, DOL XVII/ 9 Mosor

Standing experts and members of the intervention team for wolf and lynx of the Ministry of Environmental and Nature Protection, scientific associates, staff in protected areas

1. **Slavko Medved**
Member of the intervention team of the Ministry of Environmental and Nature Protection, Croatian Forests
Forest Directorate, Delnica District Office, Vrbovsko
telephone: 051 875 202, mobile: 098 440 790
2. **Igor Hak**
Standing expert and member of the intervention team of the Ministry of Environmental and Nature Protection, Gračac
telephone: 023 773 071, mobile: 098 446 665
3. **Josip Tomaić**
Member of the intervention team of the Ministry of Environmental and Nature Protection, Public Institute of Velebit Nature Park, Krasno
telephone: 053 851 600, mobile: 098 9070 495
4. **Damir Bosiljevac**
Standing expert and member of the intervention team of the Ministry of Environmental and Nature Protection, Omiš
telephone: 021 863 239, mobile: 091 5133 263
5. **Zoran Bračulj**
Standing expert and member of the intervention team of the Ministry of Environmental and Nature Protection, Split
telephone: 021 374 260, mobile: 091 6060 663

6. **Marko Ljubičić**
Standing expert and member of the intervention team of the Ministry of Environmental and Nature Protection, Knin
telephone: 022 661 402, mobile: 091 4668 901
7. **Dragan Milković**
Standing expert and member of the intervention team of the Ministry of Environmental and Nature Protection, Gospić
telephone: 053 679 026, mobile: 098 439187
8. **Boris Šabić**
Standing expert and member of the intervention team of the Ministry of Environmental and Nature Protection, Makarska
telephone: 021 612 008, mobile: 098 445 665
9. **Ivica Šupe**
Standing expert and member of the intervention team of the Ministry of Environmental and Nature Protection, Šibenik
telephone: 022 214126, mobile: 091 5052 267
10. **Željko Dasović**
Standing expert of the Ministry of Environmental and Nature Protection, Brinje
telephone: 053700688, mobile: 098 414 355
11. **Berislav Šimunić**
Standing expert of the Ministry of Environmental and Nature Protection, Senj
telephone: 053881418, mobile: 0981882 833
12. **Ana Grgas**
Standing expert of the Ministry of Environmental and Nature Protection, Benkovac
telephone: 023 681997, mobile: 098 9362 726
13. **Stipe Kokić**
Standing expert and member of the intervention team of the Ministry of Environmental and Nature Protection, Sinj
telephone: 021 824901, mobile: 098 423 159
14. **Anita Petković**
Standing expert of the Ministry of Environmental and Nature Protection, Dubrovnik
telephone: 020331139, mobile: 098 9271 007
15. **Dražen Matičić**
Standing expert of the Ministry of Environmental and Nature Protection, Karlovac
telephone: 047 613438, mobile: 098 439 413
16. **Ivan Pavličić**
Standing expert of the Ministry of Environmental and Nature Protection, Drežnik Grad
telephone: 047784009, mobile: 098 446 813
17. **Goran Bručić**
Standing expert of the Ministry of Environmental and Nature Protection, Sunja
telephone: - , mobile: 098 445 353
18. **Goran Gužvica**
Scientific associate and member of the intervention team of the Ministry of Environmental and Nature Protection, OIKON – Institute for Applied Ecology, Zagreb

19. Josip Kusak
Scientific associate and member of the intervention team of the Ministry of Environmental and Nature Protection, Faculty of Veterinary Medicine, University of Zagreb, Zagreb
mobile: 091 2212 133
20. Đuro Huber
Scientific associate and member of the intervention team of the Ministry of Environmental and Nature Protection, Faculty of Veterinary Medicine, University of Zagreb, Zagreb
mobile: 098 256 506
21. Slaven Reljić
Scientific associate and member of the intervention team of the Ministry of Agriculture, Faculty of Veterinary Medicine, University of Zagreb, Zagreb
mobile: 091 5846 114
22. Vedran Slijepčević
Scientific associate and member of the intervention team of the Ministry of Environmental and Nature Protection, Karlovac College, Karlovac
telephone: 047 843 523, mobile: 098 9272 073
23. Tomaž Skrbinšek
Scientific associate, Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia
24. Hubert Potočnik
Scientific associate, Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia
25. Marko Modrić
Member of the intervention team of the Ministry of Environmental and Nature Protection, Priroda Public Institute for managing protected natural areas in Primorje-Gorski Kotar County
26. S. Kalabić, Lj. Meničanin, F. Šklempe
Public Institute for managing protected natural areas in Sisak-Moslavina County
27. S. Mekinić
Public Institute for managing protected natural areas in Split-Dalmatia County
28. A. Novosel, N. Magdić, I. Čorak, I. Matovina, Ž. Rendulić, D. Vuković, T. Mrkonja
Plitvice Lakes National Park
29. I. Ađžić, N. Andačić, F. Špalj, D. Bušljeta, G. Lukač, I. Milovac, P. Knežević, I, Ramić
Paklenica National Park
30. S. Lupret Obradović, I. Krušić Tomaić, T. Devčić, Lj. Tonković, I. Krmpotić
Northern Velebit National Park
31. J. Tomaić, T. Rukavina, M. Vukelić
Velebit Nature Park
32. Risnjak National Park
33. Biokovo Nature Park

Appendix 3. Implementation of intervention culling of individuals of strictly protected taxa - wolf (*Canis lupus*)

In accordance with the Wolf Management Plan in Croatia for the period 2010–2015, in order to consider and execute intervention culling of individuals of a strictly protected taxa, the wolf (*Canis lupus*), the following conditions must be met: that the stability of the wolf population is not jeopardised, i.e. that the population is maintained in a favourable conservation status, and that the intervention is executed on a selective basis.

Urgent interventions may be conducted in individual situations, and outside the legally approved and planned culling exclusively in cases of the appearance of rabies, unusual (deviant) behaviour, attacks against humans and similar situations.

In order to allow for consideration and approval of an urgent intervention, the following criteria must be met:

- an individual wolf or group of wolves repeatedly come to the same location in the proximity of human settlements
- in so doing they show a reduced fear of people
- repeatedly case the same type of damage
- when additional protection and wolf detraction methods have not been successful.

Interventional culling may be executed without written authorisation only in the case of an actual attack against humans or the appearance of a rabid individual.

The members of the Intervention team for wolf and lynx are entrusted with the procedures in urgent intervention, as follows:

1. The member of the Intervention team keeps precise records on the date and time for events described under the conditions (point 1).
2. The member of the Intervention team recommends additional protection and wolf detraction methods and confirms that these measures have been applied.
3. If the additional measures fail to give results, the member of the Intervention team collects and confirms data on the occurrence of undesirable behaviour of wolves, and recommends a solution to the competent authority.
4. If the proposed solution envisages the lethal removal of a wolf individual(s), the intervention shall be considered at the session of the Committee for monitoring the large carnivore populations, which may be performed via electronic mail, and the competent Ministry is advised of the recommendation regarding the intervention.
5. Upon receiving the approval of the competent Ministry (decision, or in urgent cases verbal decision), the member of the Intervention team organises the implementation of the

intervention measures, and ensures that the target individual(s) is removed from the population.

6. In the case of the appearance of a rapid wolf or actual attack against humans, the decision is made instantly, or following telephone consultation if such conditions permit.