



2005 Report on the Wolf Population Status in Croatia



State Institute for Nature Protection

LIFE Project on Conservation and Management of Wolves in Croatia

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1. Distribution of Wolves in Croatia

1.1. Area of Distribution

The wolf population of Croatia is a portion of a larger Dinaric population inhabiting Slovenia, Croatia and Bosnia and Herzegovina and spreading further to the south of the Dinarides. In Croatia the wolf is constantly present along the Dinarides, from the Slovene border to Montenegro. This area encompasses Gorski kotar, Lika and Dalmatia, covering 17,468 km² or 32.4 per cent of the total mainland area of Croatia. Along the edges of this area, both on the south and north side, the wolf may be found occasionally. This area encompasses 9,543 km² i.e. 17.7 per cent of the mainland Croatia. In the area of Istria (except Čićarije and Učka) and the continental, lowland Croatia encompassing 26,843 km² or 49.8 per cent of the territory no wolf has been recorded (Kusak 2002) (Fig. 1).



Fig. 1: Distribution of wolf in Croatia

From the administrative aspect the area occupied by the wolf spans the territories of seven counties of Croatia – Primorsko-goranska, Karlovačka, Ličko-senjska, Zadarska, Šibensko-kninska, Splitsko-dalmatinska and Dubrovačko-neretvanska.

1.2. Human Population, Livestock Breeding and Presence of Game in the Wolf's Area of Distribution

According to the 2001 census, the mainland part of seven counties inhabited by the wolf has 1,222,897 inhabitants or 27.5 per cent of the total population of Croatia, of which 511,162 (42 per cent) live in seven major towns – Split, Rijeka, Zadar, Karlovac, Šibenik, Dubrovnik and Gospić. The entire coastal zone is characterized by a considerable number of inhabitants, but the inland is in general sparsely populated.

The mainland portion of the County Ličko-senjska covers the largest area, but has the smallest number of inhabitants. With the population density of only 9.6 inhabitants per square kilometre, which is one eighth of the average population density in entire Croatia (78.4 inhabitants/km²), this is by far the most underpopulated among Croatia's counties. The highest density of population in the wolf's area of distribution has been recorded in the County Splitsko-dalmatinska (118.6 inhabitants/km²). However, although the majority lives in the mainland part, the population is not distributed evenly. About 70 per cent of the population live in 45 towns situated on the coast or next to the coast. A higher density of population may only be found in the mainland part of the County Primorsko-goranska (104.7 inhabitants/km²), while all other counties show a considerably lower number of inhabitants (Table 1, Fig. 2 and 3).

Table 1: Number of inhabitants in the wolf's area of distribution

| County | Mainland area (km ²) | No. of inhabitants in mainland area | Population density (no./km ²) |
|------------------------|----------------------------------|-------------------------------------|---|
| Karlovačka | 3,626 | 141,787 | 39.1 |
| Primorsko-goranska | 2,543 | 266,305 | 104.7 |
| Ličko-senjska | 5,258 | 50,342 | 9.6 |
| Zadarska | 3,046 | 142,815 | 46.9 |
| Šibensko-kninska | 2,848 | 107,968 | 37.9 |
| Splitsko-dalmatinska | 3,614 | 427,817 | 118.4 |
| Dubrovačko-neretvanska | 1,321 | 103,863 | 78.6 |

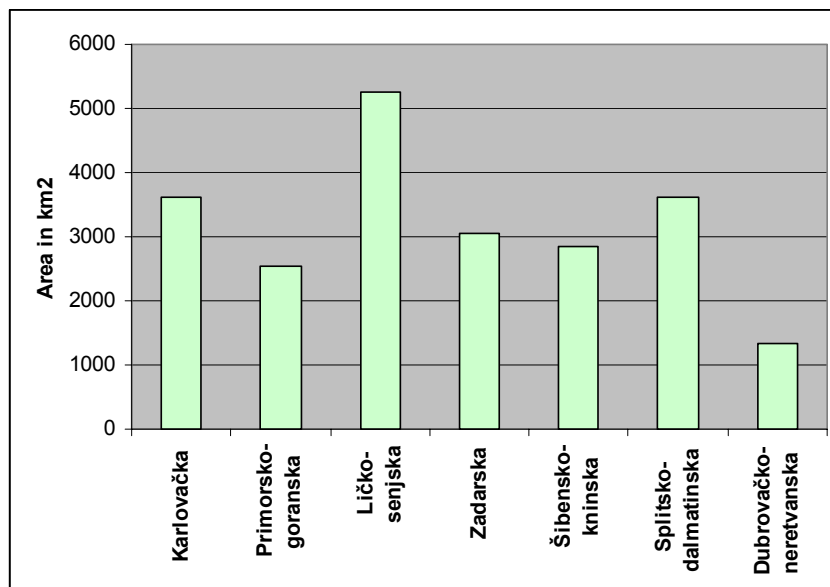


Fig. 2: Area of the mainland portion of counties in the range occupied by the wolf

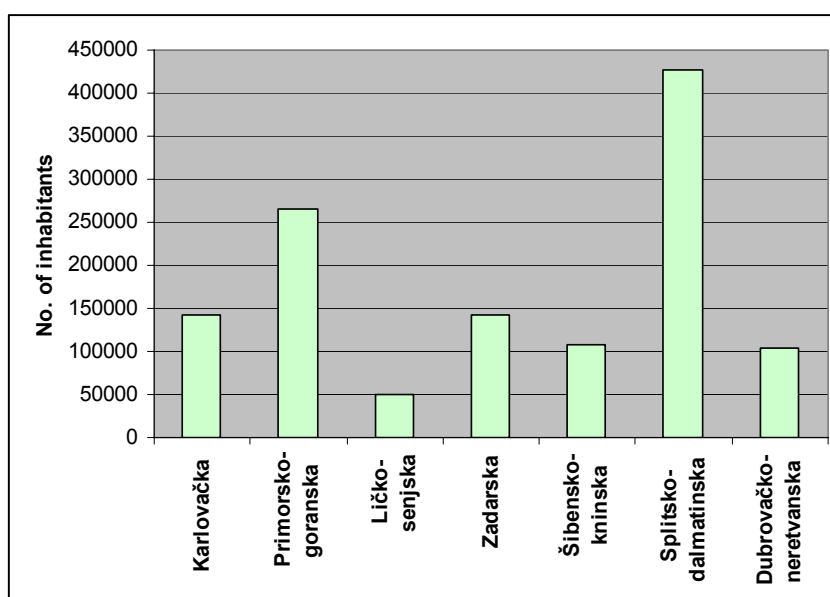


Fig. 3: Number of inhabitants in the mainland portion of counties in the range occupied by the wolf

In Dalmatia a great number of inhabitants breed livestock, primarily sheep and goats, which is evident from the 2004 data furnished by the Croatian Livestock Breeding Centre, showing precisely the counties Zadarska, Šibensko-kninska and Splitsko-dalmatinska to have the highest number of registered sheep and goats. In the mainland part of those three counties permanently or occasionally inhabited by the wolf a total of 180,613 or 34.2 per cent of all sheep in Croatia and 28,233 or 50.2 percent of all goats in Croatia has been recorded. A considerable number of sheep is also bred in the mainland part of the County Ličko-senjska (50,542), but due to the

size of the area the density is only 9.6 animals per square kilometre (equal to the population density!). The largest density of sheep has been recorded in the mainland part of the County Šibensko-kninska – 25.3 animals per square kilometre, and that of goats in the mainland of the County Zadarska – 4.5 animals per square kilometre. In the counties Primorsko-goranska, Karlovačka and Dubrovačko-neretvanska sheep and goats are bred to a far lesser extent (Tables 2 and 3, Fig. 4 and 5).

The majority of the livestock in the wolf's area of distribution is bred extensively and pastured mostly by aged shepherds (the shepherds' average age calculated by analysing damage reports is 57.6). In a small number of cases shepherds who suffered damage caused by a wolf protected their flocks by sheepdogs too.

Table 2: Number of sheep in the wolfs area of distribution

| County | Mainland area (km ²) | No. of sheep in mainland area | Sheep density (no./km ²) |
|------------------------|----------------------------------|-------------------------------|--------------------------------------|
| Karlovačka | 3,626 | 14,410 | 4.0 |
| Primorsko-goranska | 2,543 | 5,964 | 2.3 |
| Ličko-senjska | 5,258 | 50,542 | 9.6 |
| Zadarska | 3,046 | 74,926 | 24.6 |
| Šibensko-kninska | 2,848 | 72,022 | 25.3 |
| Splitsko-dalmatinska | 3,614 | 33,665 | 9.3 |
| Dubrovačko-neretvanska | 1,321 | 3,374 | 2.6 |

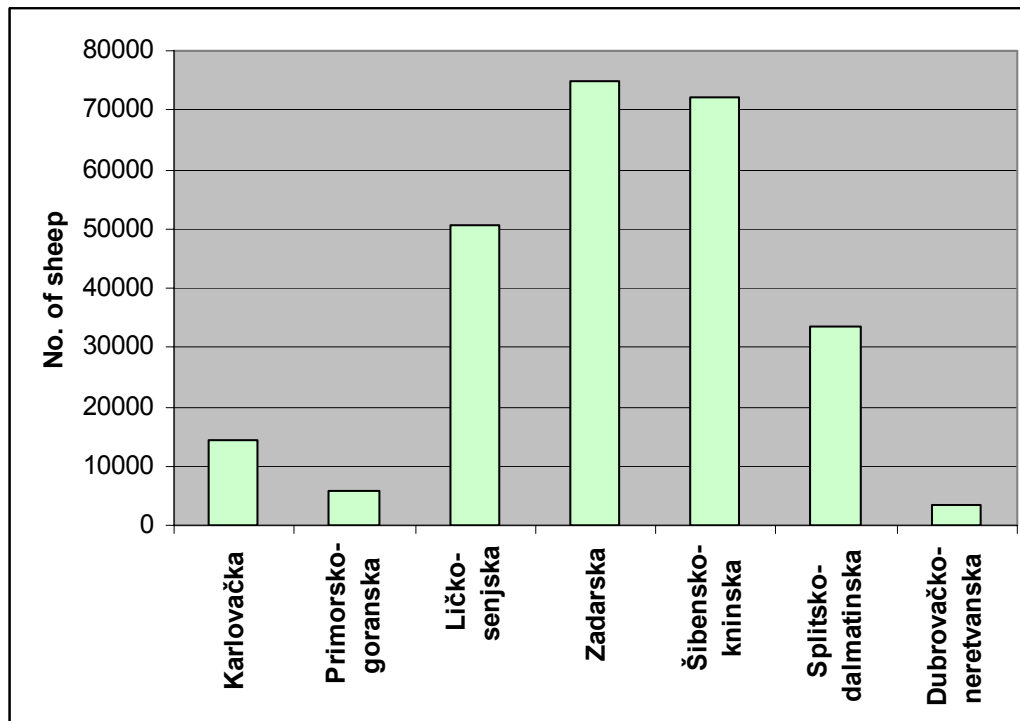
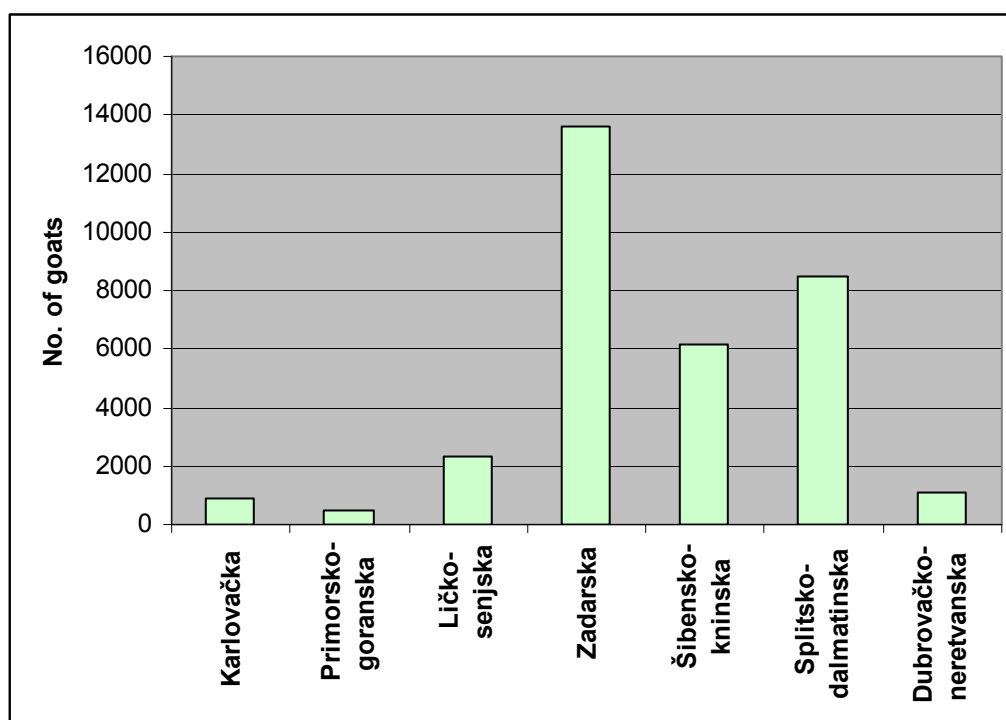


Fig. 4: Number of sheep in the mainland portion of counties in the wolf's area of distribution

Table 3: Number of goats in wolf's area of distribution

| County | Mainland area (km ²) | No. of goats in mainland area | Goat density (no./km ²) |
|------------------------|----------------------------------|-------------------------------|-------------------------------------|
| Karlovačka | 3,626 | 905 | 0.2 |
| Primorsko-goranska | 2,543 | 466 | 0.2 |
| Ličko-senjska | 5,258 | 2,322 | 0.4 |
| Zadarska | 3,046 | 13,587 | 4.5 |
| Šibensko-kninska | 2,848 | 6,182 | 2.2 |
| Splitsko-dalmatinska | 3,614 | 8,464 | 2.3 |
| Dubrovačko-neretvanska | 1,321 | 1,101 | 0.8 |

**Fig. 5:** Number of goats in the mainland portion of counties in the wolf's area of distribution

The data on game were collected by means of forms that the State Institute for Nature Protection supplied to hunters clubs and leaseholders of hunting grounds situated in the range occupied by the wolf. 205 of all hunting grounds that received the forms returned them completed, i.e. about 60 per cent. Despite the fact that some hunting grounds failed to complete the forms and that the data received are not scientifically founded and should therefore be taken with some reservation, certain conclusions may nevertheless be drawn:

1. The highest density of game, which is the wolf's natural prey, may be found in the County Primorsko-goranska – 284.1 animals per 100 km². It is followed by the County Karlovačka with 194.2 and the County Ličko-senjska with 121.4 animals per 100 km². Dalmatian counties show considerably lower game densities – from 25 to 50 animals per 100 km² (Table 4).

2. The highest diversity of game species has been recorded in the area of the counties Primorsko-goranska and Ličko-senjska – 5 species of even-toed ungulates (roe deer, deer, wild boar, chamois and mouflon) (Table 5).
3. Roe deer is by far the most numerous game species found in the counties Primorsko-goranska, Ličko-senjska and Karlovačka. On the other hand, the number of roe deer in Dalmatian counties is negligible, but they are inhabited by a considerable number of wild boars and so is the Biokovo Mountain by the chamois (Tablica 5).

Table 4: Number of game in wolf's area of distribution

| County | Mainland area (km ²) | Area of hunting grounds considered (km ²) | Share in total area (%) | No. of game 2004/2005 | Game density per 100km ² |
|------------------------|----------------------------------|---|-------------------------|-----------------------|-------------------------------------|
| Dubrovačko-neretvanska | 1,321 | 350.14 | 26.51 | 173 | 49.4 |
| Splitsko-dalmatinska | 3,614 | 2,258.22 | 62.49 | 963 | 42.6 |
| Šibensko-kninska | 2,848 | 856.56 | 30.08 | 225 | 26.3 |
| Zadarska | 3,046 | 1,903.12 | 62.48 | 825 | 43.4 |
| Ličko-senjska | 5,258 | 3,901.50 | 74.20 | 4,737 | 121.4 |
| Primorsko-goranska | 2,543 | 1,606.90 | 63.19 | 4,565 | 284.1 |
| Karlovačka | 3,626 | 2,656.54 | 73.26 | 5,160 | 194.2 |

Table 5: Number of head of game by species and by county in the hunting season 2004/2005

| County | Area considered (%) | Roe deer | Red deer | Mouflon | Chamois | Wild boar | TOTAL |
|------------------------|---------------------|--------------|--------------|------------|--------------|--------------|---------------|
| Dubrovačko-neretvanska | 26.51 | 0 | 0 | 36 | 35 | 102 | 173 |
| Splitsko-dalmatinska | 62.49 | 26 | 0 | 53 | 531 | 353 | 963 |
| Šibensko-kninska | 30.08 | 19 | 0 | 30 | 40 | 136 | 225 |
| Zadarska | 62.48 | 127 | 18 | 0 | 118 | 562 | 825 |
| Ličko-senjska | 74.20 | 1,934 | 321 | 440 | 229 | 1,813 | 4,737 |
| Primorsko-goranska | 63.19 | 2,351 | 1,165 | 95 | 158 | 796 | 4,565 |
| Karlovačka | 73.26 | 3,761 | 121 | 0 | 0 | 1,278 | 5,160 |
| TOTAL | 60.81 | 8,218 | 1,625 | 654 | 1,111 | 5,040 | 16,648 |

2. Impact on Livestock and Game

2.1. Impact on Livestock

Since 1995, when the wolf was declared legally protected in Croatia, compensations for damage have been paid to livestock breeders with verified wolf attacks on their livestock. For the purpose of proving that the damage was caused by the wolf, sixteen experts authorized for investigation have been appointed. Following the invitation of a person who suffered damage, a court appointed expert comes to the spot, searches the ground and examines the animals attacked. On the basis of the findings he makes a judgement on the damage causer. All observations are written down in a prescribed report form, which will subsequently be used as a basis for effecting the payment of compensation. All data contained in the report are entered into the database maintained by the State Institute for Nature Protection within the LIFE Project on Conservation and Management of Wolves in Croatia, analysed and displayed by the GIS.

Since the rate of entering the data into the database lies slightly below the speed at which the reports are received and the cases resolved, the last year fully recorded and analyzed is 2003. For that reason the data presented in the present report mostly refer to the 2003 status. The most recent information furnished by the Ministry of Culture relating to claims for damages received in 2005 are much more scanty, but, since fresh, they were also processed and included in the report.

In 2003 1,313 claims for compensation of damage caused by predators were submitted. In 1,219 cases or 92.8 per cent it was concluded that the damage had been surely or possibly caused by a wolf and the owners received the compensation. By far the largest number of damages occurred in the counties Šibensko-kninska (595) and Splitsko-dalmatinska (367) where about 80 per cent of all damages caused by wolves were recorded. With 110 damages reported the County Zadarska is in the third place. The municipalities with the largest number of damages reported were Unešić, Kistanje, Šibenik, Drniš and Ervenik in the County Šibensko-kninska, Prgomet and Klis in the County Splitsko-dalmatinska and Benkovac and Obrovac in the County Zadarska (Tables 6 and 7, Fig. 6), where 2.3 head of livestock were killed per attack on average.

Table 6: Distribution of reported damages caused to livestock shown by presumed type of predator and by counties in 2003

| County | Wolf | Lynx | Bear | Golden jackal | Dog | Unknown | TOTAL |
|------------------------|--------------|----------|----------|---------------|----------|-----------|--------------|
| Dubrovačko-neretvanska | 64 | 0 | 0 | 0 | 0 | 1 | 65 |
| Splitsko-dalmatinska | 367 | 0 | 0 | 0 | 2 | 29 | 398 |
| Šibensko-kninska | 595 | 0 | 0 | 5 | 0 | 51 | 651 |
| Zadarska | 110 | 0 | 0 | 0 | 0 | 1 | 111 |
| Ličko-senjska | 64 | 4 | 0 | 0 | 0 | 1 | 69 |
| Primorsko-goranska | 11 | 0 | 0 | 0 | 0 | 0 | 11 |
| Karlovačka | 8 | 0 | 0 | 0 | 0 | 0 | 8 |
| TOTAL | 1,219 | 4 | 0 | 5 | 2 | 83 | 1,313 |

Table 7: Municipalities with the largest number of damages recorded in 2003

| Municipalities | No. of damage events | No. of livestock affected |
|----------------|----------------------|---------------------------|
| Unešić | 292 | 556 |
| Prgomet | 103 | 217 |
| Kistanje | 67 | 133 |
| Šibenik | 56 | 112 |
| Drniš | 48 | 118 |
| Benkovac | 43 | 118 |
| Ervenik | 40 | 87 |
| Obrovac | 37 | 112 |
| Klis | 36 | 98 |
| Ružić | 33 | 65 |

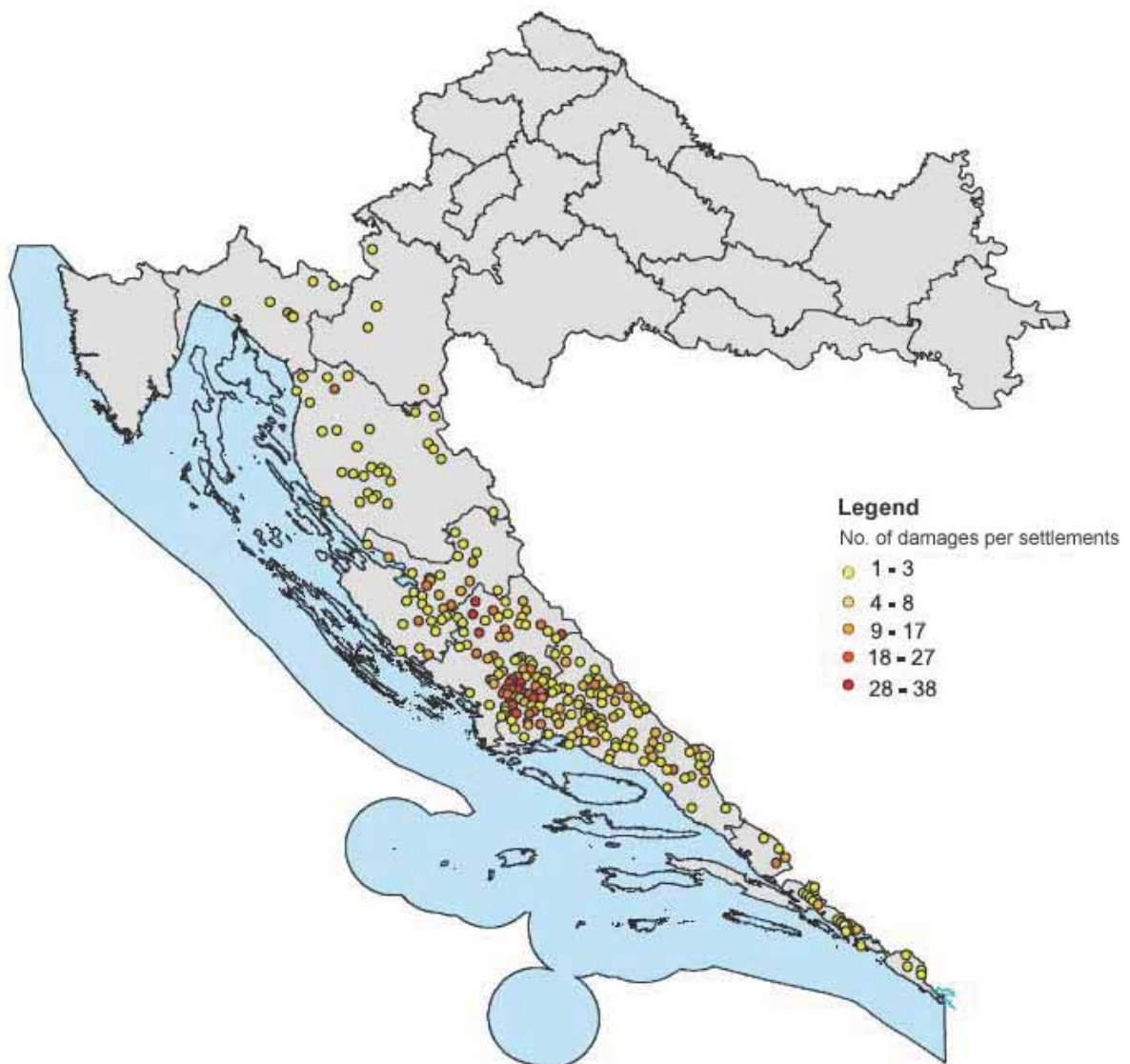


Fig. 6: Locations of damages caused by wolves in 2003

In 1,219 damages caused by wolves and recorded in 2003 2,700 head of livestock fell victims to the wolf (injured or killed) - most of all sheep (70 per cent of all animals affected) and goats (25 per cent of all animals) and far less dogs, cattle, donkeys and horses. From the aspect of the space, the extent of damage with regard to the livestock fallen victim to the wolf turned out to be the greatest in the area of the County Šibensko-kninska, where 1,184 animals (44 per cent) were affected. It is followed by the counties Splitsko-dalmatinska with 801 (30 per cent) and Zadarska with 341 (12.6 per cent) animals (Table 8).

The comparison of data collected in 2000, 2001, 2002 and 2003 shows the upward trend in the number of livestock that fell victim to the wolf – in 2001 this number increased by 4.5 per cent as compared to 2000, in 2002 by 14.5 per cent as compared to 2001 and in 2003 by 31.3 per cent from a year earlier. The data

mentioned might lead to a premature conclusion that the number of wolves is increasing. However, the increased number of reports on livestock fallen victim to the wolf results mainly from the fact that an ever-larger number of livestock breeders are aware of their right to have the damage caused by a protected animal compensated. This is evident from the very reports in which the persons who suffered damage often stress that they have had no information about the right to receive compensation so far. Nevertheless, the damage caused to livestock testifies to the presence of wolves and the population stability.

Table 8: Number of each individual breed of livestock attacked by the wolf, shown by counties

| 2003 | | | | | | | |
|------------------------|-------------|----------|------------|-----------|--------------|-----------|--------------|
| County/Predator | Beef cattle | Horse | Goat | Donkey | Sheep | Dog | TOTAL |
| Dubrovačko-neretvanska | 28 | 3 | 31 | 5 | 70 | 0 | 137 |
| Splitsko-dalmatinska | 15 | 0 | 337 | 6 | 391 | 52 | 801 |
| Šibensko-kninska | 6 | 0 | 138 | 15 | 1,012 | 13 | 1,184 |
| Zadarska | 2 | 2 | 150 | 1 | 185 | 1 | 341 |
| Ličko-senjska | 0 | 1 | 8 | 0 | 182 | 0 | 191 |
| Primorsko-goranska | 0 | 0 | 2 | 0 | 30 | 1 | 33 |
| Karlovačka | 0 | 0 | 4 | 0 | 9 | 0 | 13 |
| TOTAL | 51 | 6 | 670 | 27 | 1,879 | 67 | 2,700 |

The actual impact of wolves on economic activities of a region is best reflected in the share of livestock fallen victim to wolves, primarily sheep and goats as the most frequent victims of wolves' attacks, in the total number of local livestock. The data on the total number of livestock in 2003, resulting from the analysis of applications for government incentives, were furnished by the Croatian Livestock Breeding Centre (HSSC). In carrying out our analysis these data underwent a slight modification – only the total number of livestock in the mainland portion of counties or rather in the wolf's area of distribution was taken into consideration (the livestock kept on islands was excluded from the analysis).

The analysis showed that in the County Šibensko-kninska, where in 2003 the largest number of livestock fell victim to the wolf, the share of the sheep attacked in the total number of sheep amounted to 1.5 per cent and that of goats 2.4 per cent. In the County Splitsko-dalmatinska, where the largest number of attacks on goats was recorded, the share of goats fallen victim to wolves in the total number of goats amounted to 4.1 per cent. The share of sheep affected was lower and totalled 1.75 per cent. Wolves' attacks recorded in the County Zadarska, with the largest number of livestock kept in Dalmatia in 2003, were few and the share of animals fallen victims in the total number of livestock registered was only 0.26 per cent for sheep and 1.1 per cent for goats (Table 9).

Table 9: Share of sheep and goats fallen victims to wolves in the total number of sheep and goats by counties

| 2003 | | | | |
|-------------------------|------------------------------------|---|------------------------------------|--|
| Type | Sheep | | Goats | |
| No. of cattle County | Total no. registered by HSSC | Share of sheep fallen victim to wolves (%) | Total no. registered by HSSC | Share of goats fallen victim to wolves (%) |
| Dubrovačko-neretvanska | 3,054 | 2.3 | 1,020 | 3.04 |
| Splitsko-dalmatinska | 22,353 | 1.75 | 8,221 | 4.1 |
| Šibensko-kninska | 66,552 | 1.5 | 5,768 | 2.4 |
| Zadarska | 72,135 | 0.26 | 13,493 | 1.1 |
| Ličko-senjska | 45,442 | 0.4 | 2,398 | 0.33 |
| Primorsko-goranska | 7,641 | 0.4 | 419 | 0.5 |
| Karlovačka | 14,065 | 0.06 | 864 | 0.5 |
| TOTAL | 231,242 | 0.8 | 32,183 | 2.1 |

In the period from 1 January to 1 September 2005 the Ministry of Culture received 934 claims for damages found to have been caused by the wolf. This number does not reflect the actual number of damage events that occurred in 2005, because numerous applications received after 1 January 2005 refer to damages suffered in 2004. It should also be noted that a number of data on the very damage events were not available, which makes it impossible to analyse the period and present data on the livestock affected. However, the data received give a general insight into the status of damage caused over the last year.

Just like in 2003, the majority of damages were recorded in the County Šibensko-kninska (51 per cent), followed by the counties Splitsko-dalmatinska (30 per cent) and Zadarska (10.5 per cent). The largest number of damage events was reported in the municipality of Unešić in the County Šibensko-kninska, where 190 attacks on livestock happened, making 20 per cent of all damages! Other municipalities that recorded a substantial number of damage events are Kistanje, Drniš and Knin also in the County Šibensko-kninska, Obrovac in the County Zadarska and Sinj in the County Splitsko-dalmatinska. Although the year 2005 has not finished yet, the data received by 1 September point to a decline in the number of damages reported in the area of the County Ličko-senjska (Tables 10 and 11, Fig. 7).

Table 10: Number of claims for damages found to have been caused by the wolf and received from 1 January to 1 September 2005, showed by counties

| County | No. of damages in 2005 |
|------------------------|-------------------------------|
| Dubrovačko-neretvanska | 53 |
| Splitsko-dalmatinska | 282 |
| Šibensko-kninska | 480 |
| Zadarska | 98 |
| Ličko-senjska | 14 |
| Primorsko-goranska | 6 |
| Karlovačka | 1 |

Table 11: Municipalities with the largest number of damages caused by wolves in 2005 (based on claims for damages received in the period from 1 January to 1 September 2005)

| Municipalities | No. of damages in 2005 |
|-----------------------|-------------------------------|
| Unešić | 190 |
| Kistanje | 133 |
| Obrovac | 51 |
| Drniš | 45 |
| Knin | 38 |
| Sinj | 34 |
| Šibenik | 29 |
| Benkovac | 26 |
| Lećevica | 24 |
| Dugopolje | 23 |
| Ervenik | 23 |
| Promina | 23 |

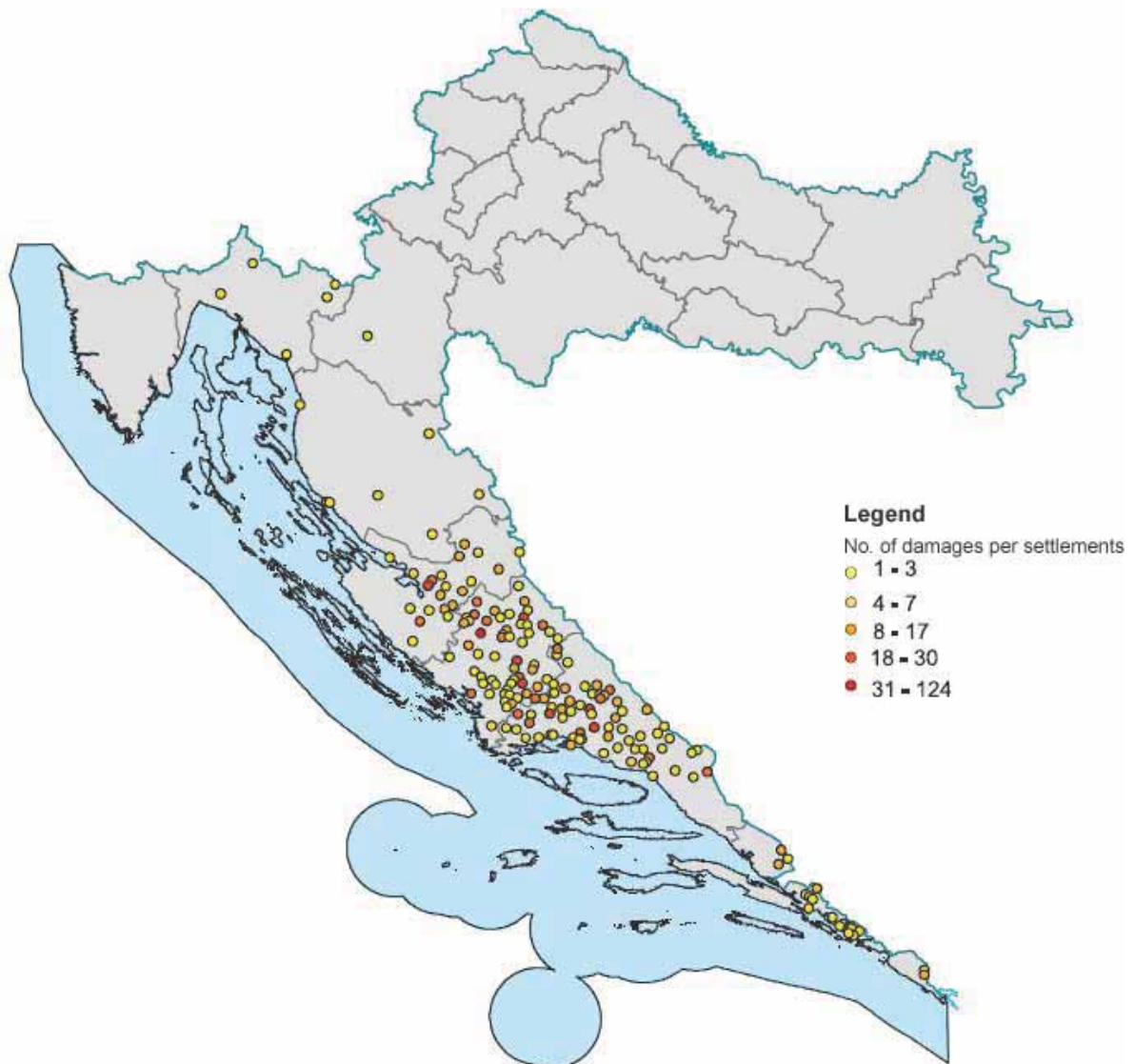


Fig. 7: Locations of damages caused by wolves in 2005 (based on claims for damages received in the period from 1 January to 1 September 2005)

2.2. Impact on Game

One of the questions included in forms that were submitted to hunting grounds situated in the wolf's area of distribution related also to the number of head of game that fall victim to the wolf yearly. The calculation based on the forms received showed that the share of game attacked by wolves in the total number of game present in individual counties in the hunting season 2004/2005 ranged from as little as 0.89 percent in the County Šibensko-kninska to the almost unbelievable 17.76 per cent in the County Splitsko-dalmatinska. The data relating to all other counties are uniform, or rather ranging from 2 to 5 per cent of animals affected. The average value relating to the entire wolf's area of distribution is 3.98 per cent. Major discrepancies between the results obtained for individual counties are a consequence of the subjective character of the data received; they are not scientifically founded, but rather reflect the estimated field status only (Table 12).

Table 12: Number of game killed and share in the total number of game, showed by the causes of death and by counties for the hunting season 2004/2005

| County | Total no. of game | Game shot | No. of game killed by the wolf | No. of game killed by the lynx | Share of game shot in the total no. of game (%) | Share of game killed by the wolf in the total no. of game (%) | Share of game killed by the lynx in the total no. of game (%) |
|--------------|-------------------|--------------|--------------------------------|--------------------------------|---|---|---|
| D-n | 173 | 49 | 9 | 0 | 28.32 | 5.20 | 0.00 |
| S-d | 963 | 44 | 171 | 0 | 4.57 | 17.76 | 0.00 |
| Š-k | 225 | 19 | 2 | 0 | 8.44 | 0.89 | 0.00 |
| Zad | 825 | 135 | 31 | 1 | 16.36 | 3.76 | 0.12 |
| L-s | 4,737 | 622 | 197 | 49 | 13.13 | 4.16 | 1.03 |
| P-g | 4,565 | 666 | 153 | 60 | 14.59 | 3.35 | 1.31 |
| K | 5,160 | 800 | 99 | 16 | 15.50 | 1.92 | 0.31 |
| TOTAL | 16,648 | 2,335 | 662 | 126 | 14.03 | 3.98 | 0.76 |

3. Wolf Population Status

3.1. Wolf Population Size Estimate

The size of the wolf population in Croatia has been estimated on the basis of statements given by local experts – experts authorized by the Ministry of Culture for the assessment of damage caused by protected animal species. Thirteen experts from six counties were given geographical maps of wider areas where they conduct investigations to mark possible wolf packs locations. The experts also indicated the anticipated number of individuals in each pack and the general wolf population trend in the respective area (downward, no change or upward). A contribution to estimate was also given by Tomislav Šporer, the local master of the hunt from Gorski kotar; Josip Tomaić, the supervisor of the Velebit Nature Park and Dragan Šarić, the regional co-ordinator of the LIFE Project on Conservation and Management of Wolves in Croatia for Gorski kotar and Lika. The radio telemetry data used for the area of the western part of Gorski kotar were provided by Dr. Josip Kusak of the School of Veterinary Medicine of the University of Zagreb. A contribution to the estimate for a smaller part of Lika was given by Dr. Goran Gužvica, a research associate of the LIFE Project.

From the data collected it follows that the wolf population in Croatia ranges from a minimum of 155 to a maximum of 225 individuals, or rather 190 individuals on average, belonging to some forty packs. The largest number of individuals, i.e. 65 on average, was assessed to inhabit the area of the County Splitsko-dalmatinska and the smallest number – 10 on average – that of the County Dubrovačko-neretvanska. Ms. Anita Petković, an expert covering the area of the County Dubrovačko-neretvanska, also pointed to the drastic reduction, or rather practically the disappearance of damages caused to livestock over the last few months, assuming that wolves had disappeared from the area. Since those were wolves from the adjacent Bosnia and Herzegovina, who, driven by unfavourable living conditions, used to come down to these areas and harass the livestock several times a year, it is likely that they were shot in the area of Herzegovina where they are not legally protected.

The number of wolves in the County Ličko-senjska, which is the largest county in the wolf's area of distribution, was estimated at not more than thirty. This is most probably due to a comparatively small number of damages caused to livestock that the experts used to estimate the wolf population size, and to the fact that this large area has not been sufficiently scientifically examined. It seems therefore reasonable to assume that the actual size of the wolf population in Like exceeds the one estimated. The western part of Gorski kotar is scientifically best explored. The majority of damages caused to livestock, or rather proved cases of the presence of wolves in an area, were reported in Dalmatia where, for lack of the game, livestock represents the major source of wolf's diet.

As to the population trend, the prevailing opinion of local experts is mostly that the wolf population size is stable. As a result of a rise in the number of damages caused

to livestock as compared to the previous year, Ivica Šupe, a court appointed expert of the County Šibensko-kninska, believes that in his respective area the wolf population size has substantially increased. On the other hand, as already mentioned, the expert of the County Dubrovačko-neretvanska finds the population size to have steeply and drastically dropped (Table 13, Fig. 8).

Table 13: Number of wolves and wolf packs and a general population trend in various counties assessed on the basis of local experts' statements (population trend: <<->> downward; <<+>> upward; <<=>> unchanged; <<?>> unknown)

| County | Min. no. of packs | Max. no. of packs | Min. no. of individuals | Max. no. of individuals | Average no. of individuals | Trend |
|------------------------|-------------------|-------------------|-------------------------|-------------------------|----------------------------|-------|
| Karlovačka | 1 | 1 | 3 | 5 | 4 | ? |
| Primorsko-goranska | 7 | 8 | 35 | 40 | 37.5 | = |
| Ličko-senjska | 7 | 8 | 22 | 38 | 30 | = |
| Zadarska | 4 | 4 | 15 | 16 | 15.5 | = |
| Šibensko-kninska | 5 | 6 | 26 | 34 | 30 | + |
| Splitsko-dalmatinska | 12 | 14 | 52 | 76 | 64 | = |
| Dubrovačko-neretvanska | 4 | 4 | 8 | 12 | 10 | - |
| TOTAL | 40 | 45 | 161 | 221 | 191 | |

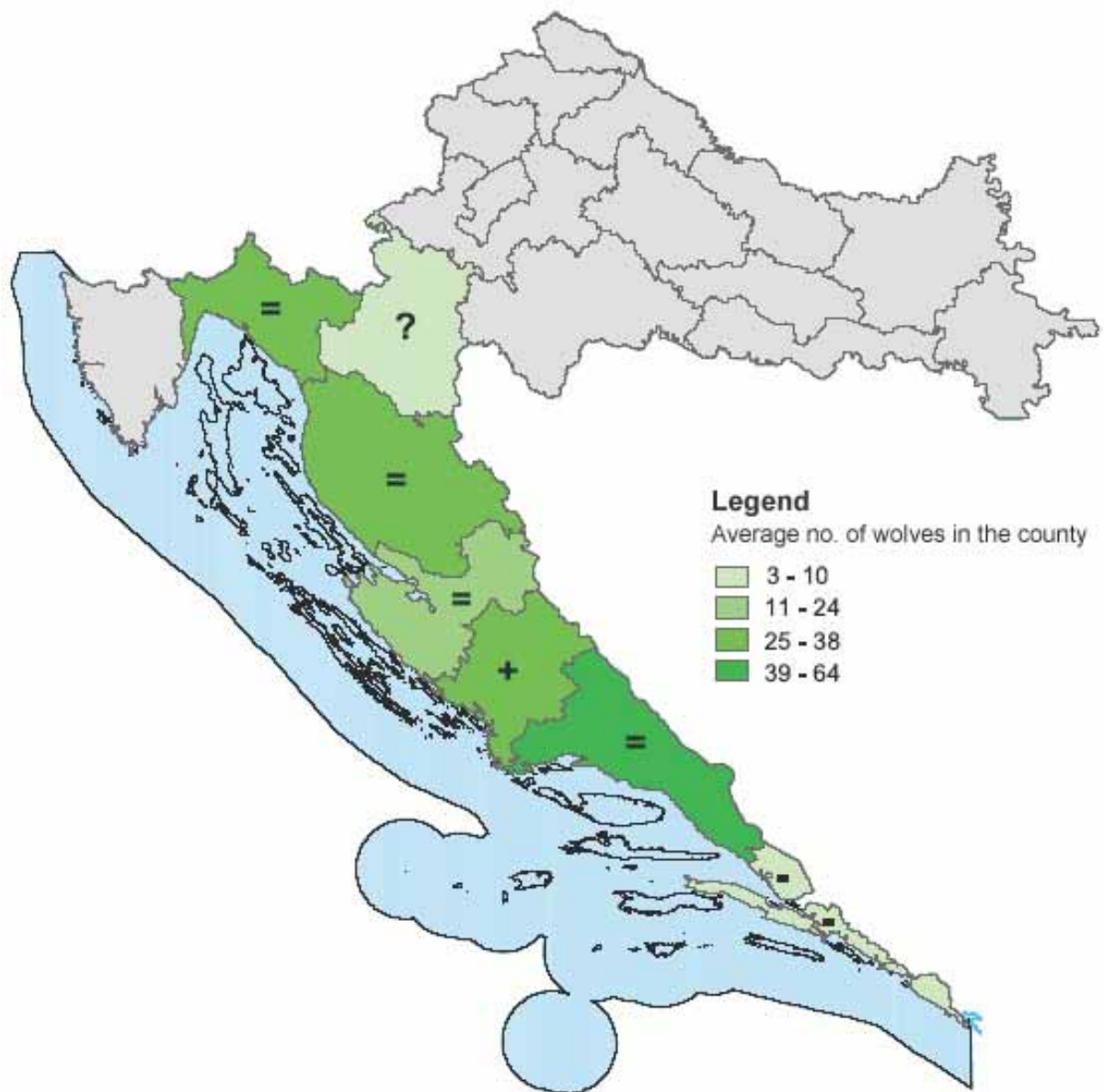


Fig. 8: The wolf population trend by various counties in the wolves' area of distribution (<<->> downward; <<+>> upward; <<=>> unchanged; <<?>> unknown)

After having analysed all input data and presumed the most likely solutions under uncertain estimates, the locations of wolf packs in Croatia were re-enacted. The number of packs present was estimated at 44, with the majority, i.e. 14 of them, located in the County Splitsko-dalmatinska. This county is followed by the County Ličko-senjska with the wolf packs estimated at 8, the counties Primorsko-goranska and Šibensko-kninska with 7 packs each and finally by the counties Zadarska and Dubrovačko-neretvanska with 4 packs each. These results were then compared with the estimated number of wolf packs in Dalmatia based on the analysis of the attacks on livestock in terms of space and time (Desnica 2005) and found to deviate only slightly. By estimating the number of packs on the basis of attacks on livestock, the packs were calculated at 13 in the County Splitsko-dalmatinska, 7 in the County Šibensko-kninska and 4 in the County Zadarska. One pack more in the County Splitsko-dalmatinska named "Svilaja" and identified by means of local experts'

statements is explained by the low population density, the shortage of livestock and the coverage of the area by mines. One pack less in the County Šibensko-kninska is explained by a high concentration of damages in a relatively small area (wider area of the Unešić municipality), which made it impossible to assess accurately the number of packs (Šupe –2, Desnica – 3). Under the conditions of a high concentration of livestock in a smaller area, wolves from various packs may prey on livestock relatively close to each other (Kusak 2002).

The average number of individuals per pack in the entire area of Croatia is estimated at 4.3. The largest estimated average number of individuals per pack, i.e. 5, was recorded in the area of the counties Primorsko-goranska and Šibensko-kninska. The packs present in the County Splitsko-dalmatinska consist of 4.7, in the County Zadarska of 3.8 and in the County Ličko-senjska of 3.5 individuals on average (Table 14, Fig. 9).

Table 14: Estimated wolf packs in Croatia including the respective number of individuals and experts that made the estimates (for easy reference and orientation in the space the pack names are fictitious, except the Snježnik, Risnjak and Platak packs identified by Dr. Josip Kusak)

| ID | Pack name | Min. no. of ind. | Max. no. of ind. | Average no. of ind. | Local experts | County |
|----|--------------------|------------------|------------------|---------------------|-------------------|----------------------|
| 0 | Snježnik | 2 | 6 | 4 | Frković, Kusak | Primorsko-goranska |
| 1 | Risnjak | 2 | 6 | 4 | Frković, Kusak | Primorsko-goranska |
| 2 | Platak | 2 | 6 | 4 | Frković, Kusak | Primorsko-goranska |
| 3 | Vrbovsko | 5 | 6 | 5.5 | Frković, Šporer | Primorsko-goranska |
| 4 | Stari Laz | 5 | 9 | 7 | Frković, Šporer | Primorsko-goranska |
| 5 | Fužine-Mrkopalj | 5 | 6 | 5.5 | Frković, Šporer | Primorsko-goranska |
| 6 | Bjelolasica | 5 | 6 | 5.5 | Frković, Šporer | Primorsko-goranska |
| 7 | Krivi Put – Brinje | 3 | 5 | 4 | Dasović, Šimunić | Ličko-senjska |
| 8 | Krasno | 3 | 5 | 4 | Dasović, Šimunić | Ličko-senjska |
| 9 | Ramljani | 3 | 5 | 4 | Dasović | Ličko-senjska |
| 10 | Cesarica | 2 | 4 | 3 | Milković Šarić | Ličko-senjska |
| 11 | Smiljan | 2 | 4 | 3 | Milković Šarić | Ličko-senjska |
| 12 | Medak | 2 | 4 | 3 | Milković Šarić | Ličko-senjska |
| 13 | Štirovača | 2 | 3 | 2.5 | Šimunić, Tomaić | Ličko-senjska |
| 43 | Donji Lapac | 3 | 6 | 4.5 | Gužvica | Ličko-senjska |
| 14 | Plaški – Slunj | 3 | 5 | 4 | Dasović | Karlovačka |
| 15 | Deringaj | 4 | 5 | 4.5 | Hak | Zadarska |
| 16 | Golubić | 3 | 3 | 3 | Grgas | Zadarska |
| 17 | Kaštel Žegarski | 5 | 5 | 5 | Grgas | Zadarska |
| 18 | Rodaljice | 3 | 3 | 3 | Grgas | Zadarska |
| 19 | Ervenik | 4 | 5 | 4.5 | Hak, Ljubičić | Šibensko-kninska |
| 20 | Polača | 4 | 5 | 4.5 | Ljubičić | Šibensko-kninska |
| 21 | Kistanje | 4 | 5 | 4.5 | Ljubičić, Šupe | Šibensko-kninska |
| 22 | Drniš – Ružić | 7 | 7 | 7 | Šupe | Šibensko-kninska |
| 23 | Unešić | 3 | 6 | 4.5 | Šupe | Šibensko-kninska |
| 24 | Radonić | 4 | 6 | 5 | Šupe | Šibensko-kninska |
| 25 | Lečevica | 6 | 6 | 6 | Bračulj | Splitsko-dalmatinska |
| 26 | Prgomet | 4 | 4 | 4 | Bračulj | Splitsko-dalmatinska |
| 27 | Svilaja | 4 | 6 | 5 | Bosiljevac, Kokić | Splitsko-dalmatinska |
| 28 | Debelo brdo | 3 | 3 | 3 | Kokić | Splitsko-dalmatinska |
| 29 | Visoka Plišivica | 4 | 6 | 5 | Kokić | Splitsko-dalmatinska |
| 30 | Modre Grede | 2 | 5 | 3.5 | Kokić | Splitsko-dalmatinska |

| | | | | | | |
|----|---------------------|---|---|-----|------------|------------------------|
| 31 | Kamešnica – Rude | 4 | 6 | 5 | Kokić | Splitsko-dalmatinska |
| 32 | Klis | 4 | 6 | 5 | Bosiljevac | Splitsko-dalmatinska |
| 33 | Mosor | 3 | 4 | 3.5 | Bosiljevac | Splitsko-dalmatinska |
| 34 | Cista | 4 | 6 | 5 | Bosiljevac | Splitsko-dalmatinska |
| 35 | Imotski | 4 | 6 | 5 | Bosiljevac | Splitsko-dalmatinska |
| 36 | Brela | 5 | 7 | 6 | Šabić | Splitsko-dalmatinska |
| 37 | Tučepi | 7 | 7 | 7 | Šabić | Splitsko-dalmatinska |
| 38 | Vrgorac | 3 | 4 | 3.5 | Šabić | Splitsko-dalmatinska |
| 39 | Metković | 2 | 3 | 2.5 | Petković | Dubrovačko-neretvanska |
| 40 | Dubrovačko primorje | 2 | 3 | 2.5 | Petković | Dubrovačko-neretvanska |
| 41 | Dubrovnik | 2 | 3 | 2.5 | Petković | Dubrovačko-neretvanska |
| 42 | Konavle | 2 | 3 | 2.5 | Petković | Dubrovačko-neretvanska |

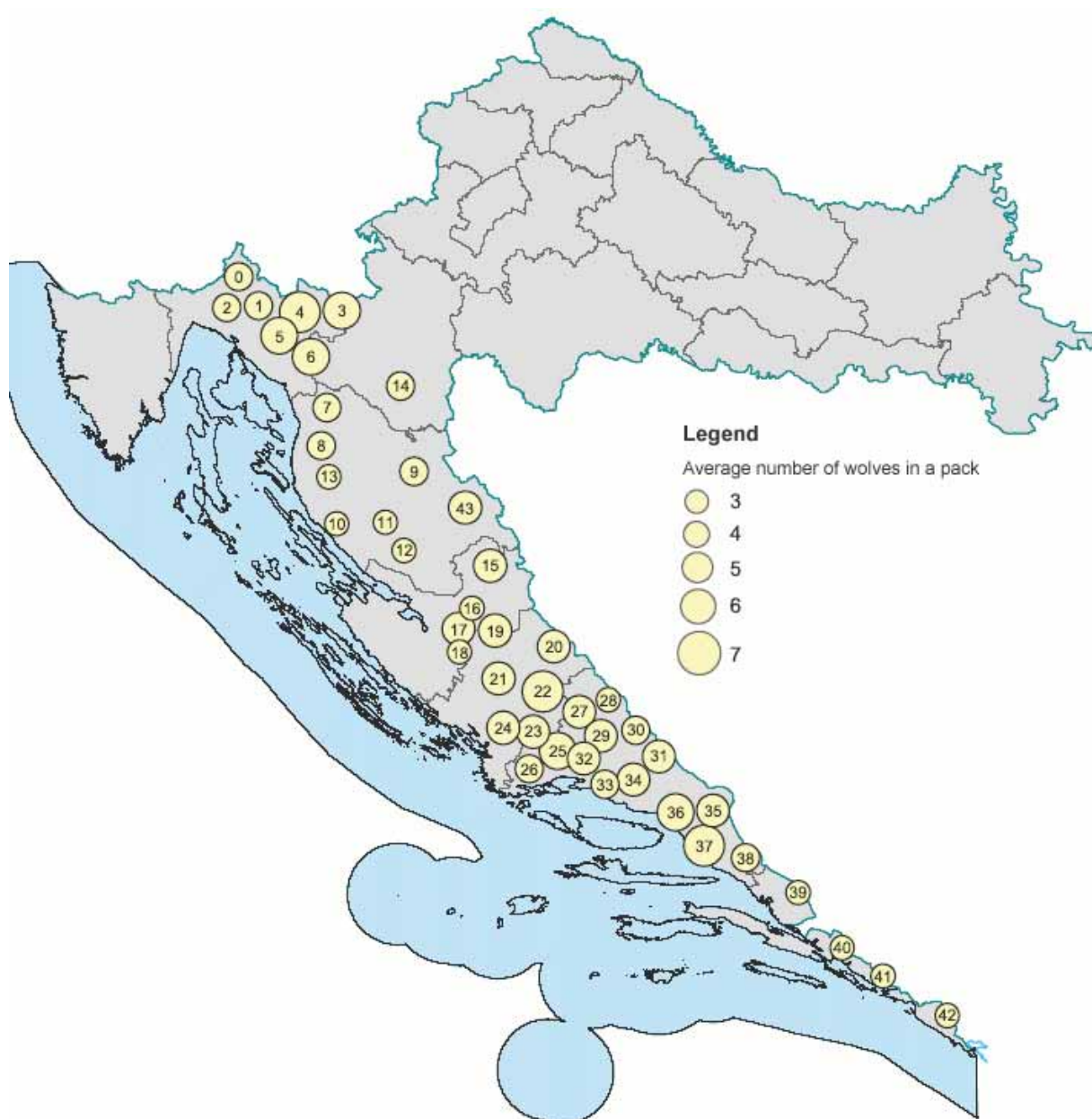


Fig. 9: Wolf pack locations in Croatia identified according to local experts' statements. The packs are numbered (from 0 to 43) and relevant data are contained in Table 14 (the size of the symbol does not indicate the actual size of the pack's

range, but only the different number of individuals in a pack: a larger circle → a larger number of individuals). A small number of wolves and packs in Lika is a result of the deficient knowledge of their status, rather than a small number of wolves.

3.2. Wolf Mortality in 2005

At present the major threats to wolves are illegal kills, construction of roads that fragment the habitats and intersect migratory routes and the shortage of natural prey. According to the data available, in the period from 1 January to 5 September 2005 a total of 12 wolves were reported killed. 5 of them died due to highway collision, 4 were shot and the cause of death for 3 of them is uncertain or cannot be determined. The police reported the wolf no. WCRO60 to have been hit by a vehicle, but poisoning is also suspected. The death cause for the wolf found beside the forest road close to Donji Lapac and reported by Jovo Krnjajić, the master of the hunt of the Ozeblin Hunters Club employed in the forestry office of Donji Lapac, could not be determined due to the state of the carcass and its subsequent removal. As to the wolf no. WCRO64 he is believed to have been killed by sheepdogs (Table 15, Fig. 10).

Since these data cover only the period until 5 September 2005 and given the trend so far, more mortalities can be expected to be reported by the end of the year. The analysis of known wolf mortality causes over the last few years shows, namely, the increase in mortalities due to highway collision (18 individuals or 50 per cent of all mortalities in the period from 1 January to 5 September 2005).

In the years before wolves were declared legally protected, it was possible to assess the distribution of wolves and the population size by hunting statistics. After having protected the wolf and imposed high fines for killings, the mortality data have become scant, because a great number of illegally killed individuals are not reported. After the adoption of the "Plan for the Management of Wolves in Croatia" by which, among other things, specific interventions in the wolf population are planned, more and more information on illegally killed wolves started coming in with the assistance of hunters, which will make the information markedly more accurate and improve our knowledge of the population size and mortality causes. This does not mean, however, that all cases of illegal kills or human-caused wolf mortalities are being reported. So, for example, unofficial information was received about the alleged hunt for wolves organized in the area of Švica in Lika this winter in which 6 wolves were shot. Moreover, in the area of the Kistanje municipality several cases of dog poisoning were reported late in winter, for which the dog owners claim to have been caused by poisonous baits used to solve the problem of "mischief-doers". It is not to be excluded that targeted wild animals, including the wolf, also fell victim on that occasion.

Table 15: List and basic features of wolves found killed in the period from 01.01. to 05.09.2005

| No. | Date | Place | Area | Marking | Sex | Age (yrs.) | Weight (kg) | Cause of death |
|-----|------------|-------------------------|---------------|---------|-----|------------|-------------|------------------------------------|
| 1. | 02.01.2005 | Novo Selo Bosiljevsko | Kordun | WCRO59 | F | 6.0 | 37 | Kill |
| 2. | 17.02.2005 | Vrbnik Polje – Kaldrema | Dalmatia | WCRO60 | F | 0.8 | 24 | Unknown (vehicle and/or poisoning) |
| 3. | 17.02.2005 | Čitluk – Poljane | Dalmatia | WCRO61 | F | 11.0 | 29 | Kill |
| 4. | 18.04.2005 | Koprivno | Dalmatia | WCRO62 | F | 2.0 | 26 | Vehicle |
| 5. | 05.05.2005 | Grab, Trilj | Dalmatia | | M | 2.0 | | Vehicle (wolf burnt) |
| 6. | 01.06.2005 | Oraovac, Donji Lapac | southern Lika | | | | | Unknown |
| 7. | 14.06.2005 | Lovreč | Dalmatia | WCRO63 | F | | | Vehicle |
| 8. | 20.07.2005 | Voštane Gornje | Dalmatia | WCRO64 | F | 2.0 | | Unknown (shepherd dogs?) |
| 9. | 03.08.2005 | Vinjani kod Imotskog | Herzegovina | WCRO65 | F | 2.5 | | Kill |
| 10. | 21.08.2005 | Ondić | southern Lika | WCRO66 | F | 2.5 | 30 | Vehicle |
| 11. | 01.09.2005 | Mazin, Donji Lapac | southern Lika | WCRO67 | M | 3.5 | 37 | Kill |
| 12. | 05.09.2005 | Mojanka, Sinj | Dalmatia | WCRO68 | | | | Vehicle |



Fig. 10: Locations where killed wolves were found in the period from 1 January to 5 September 2005

4. Wolf Population Status in Neighbouring Countries

4.1. Bosnia and Herzegovina

Data relating to the wolf population status in Bosnia and Herzegovina were furnished by Milanka Jovanović from the Ministry of Agriculture, Forestry and Water Management of Republika Srpska, by Bajram Pešković of the Federal Ministry of Agriculture, Water Management and Forestry and by Vlado Soldo, the former official of the public enterprise of "Šume Herceg-Bosne". All of them co-operate mutually and with hunting associations throughout the territory of Bosnia and Herzegovina, which were one of the main data sources.

The wolf population size throughout the entire Bosnia and Herzegovina is estimated at 480-490 individuals. Since a large portion of the country is covered by forests and thicket, mountain pastures and vast areas overgrown by *Pinus mugo*, and the number of inhabitants in underdeveloped and rural areas has dropped considerably, the living conditions for the wolf are evaluated as highly favourable. The wolf population is assessed as vital and on a constant rise.

Pursuant to hunting legislation of individual entities of Bosnia and Herzegovina the wolf falls into the category of unprotected species, with the annual kill of about 140 individuals. In 2004 and 2005 196 wolves were recorded killed – 90 in Republika Srpska and 105 in the Federation of Bosnia and Herzegovina. In municipalities bordering Croatia, in the area from Trebinje to Bihać, the killing of 64 individuals was recorded (16 in the Tomislavgrad municipality, 15 in the Trebinje municipality, 9 in the Posušje municipality, etc.).

In rural areas of Bosnia and Herzegovina damages caused to livestock by wolves are frequent and livestock breeders often suffer financial loss. These damages are mostly caused to goats, sheep and hunting dogs. Due to the wolf's status of an unprotected species, there is no ground available for the state to pay compensation for damages to livestock breeders affected.

4.2. Slovenia

Data relating to the wolf population status in Slovenia were furnished by Anton Marinčič, head of the "Jelen" breeding-hunting ground within the Forestry Institute of Slovenia. The Forestry Institute of Slovenia, in co-operation with hunting organizations, is in charge of assessing the size, trends and the general status of the wolf population in Slovenia. The data indicated are also used by the Ministry of Environment and Spatial Planning, the Environmental Agency of the Republic of Slovenia, which is responsible for issuance of permits to eliminate protected wild animals from the wild.

The wolf population size in Slovenia is estimated at 60-100 individuals that, judging by locations where damages to livestock occurred, inhabit the central and southern Slovenia – the mainland, the coastal-karst and the region of Kočevje and Bela krajina. Some recent observations point to the spread of population in the direction of Bela Krajina and Novo Mesto. The Forestry Institute finds the population stable, i.e. still on the rise as compared to previous years. On the other hand, the sightings of

wolf packs in the range of the "Jelen" breeding-hunting ground in the region of Kočevje and Bela krajina in the period between 1991 and 2002 showed the average count of 1.8 to 3.5 wolves per pack, which leads to the conclusion that the wolf population in this part of Slovenia is not on the rise, but quite the opposite. In Slovenia the wolf enjoys the status of a protected animal species and on these grounds livestock breeders that suffer damages to livestock receive compensations. The total number of claims for damages and compensations paid by years show clearly a considerable rise in damages caused over the last five years, with a markedly great number of attacks on livestock in 2002.

Although the wolf is legally protected in Slovenia, interventions in the wolf population are permitted in the context of a regular control action and emergency kill. The permits for regular kills are issued on a yearly basis and for emergency kills only in cases of serious conflict situations. Even then these permits are expressly limited in terms of time and space. However, only four permits for a regular control action were issued in the last eleven years, under which 15 wolves were eliminated from the wild. In the same period 11 individuals were killed in emergency and illegal actions and further 7 fell victims of other causes (vehicles, disease, poisoning). Over the last 11 years a total of 33 wolves were killed, but the actual number is presumably a bit higher, because there are reports on some illegal kills lacking concrete evidence. For the year 2005 the Forestry Institute proposed 9 wolves to be killed by a regular control action – 3 in each of the coastal and mainland region and the region of Kočevje and Bela krajina. However, the Nature Protection Institute of Slovenia found that little was known of the wolf population dynamics and size. Consequently, from the aspect of population stability the killing would not be appropriate, because it would very likely have a negative impact on the desired status of the population of this species in Slovenia. On the above-mentioned grounds the Ministry of Environment decided not to permit any intervention in the wolf population in 2005, leaving open the possibility to issue a special permit for killing in case of an immediate threat to humans and their property.

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