

## SITUATION AND DISTRIBUTION OF THE LYNX (*LYNX LYNX* L.) IN SLOVENIA FROM 1995-1999

CVETKO STANISA\*, IZTOK KOREN<sup>o</sup> AND MIHA ADAMIC\*<sup>o</sup>

\* *ZGS, OE Kocevje, Rozna ul. 39, 1330, Slovenia*

<sup>o</sup> *ZGS, GL Razor - Prodi, Tumov drevored 17, 5220 Tolmin, Slovenia*

\*<sup>o</sup> *Biotehniska fakulteta, Oddelek za gozdarstvo, Vecnapot 83, 1000 Ljubljana, Slovenia*

**ABSTRACT** - In this paper we analyse signs of lynx presence and their distribution to evaluate the status of lynx in Slovenia. From 1995-1999, a total of 499 signs of lynx presence were reported that allowed us to distinguish between 4 different regions: (1) The southern part of the country comprising the area south-east of the Ljubljana-Trst highway (Kocevska, Notranjska) where lynx were re-introduced and the lynx number is still the highest. (2) The western part of the country with the Julian Alps, where lynx have started to immigrate in the mid 1980s. (3) The Karavanke and Kamniško-Savinjske Alps in the north of the country, as well as some other isolated areas where only a very low number of lynx signs of presence were collected. (4) The fourth region comprises the north-east of Slovenia where lynx is still absent. Based on the available data, we estimated the number of lynx in southern Slovenia between 30 to 40 individuals, while in the west of the Jesenice-Ljubljana-Trst highway we estimated that around 10 individuals are present. The area of lynx occurrence has not increased during the past five years, on the contrary, the fact that the annual hunting quota has not been reached since 1992 - even though the quotas were set considerably lower than previously - indicates that the number of lynx has decreased. The Slovenian lynx population was always considered the most vital Alpine occurrence, as it has shown rapid expansion into neighbouring Croatia, Italy and Austria. However, during the past years a slight regression in lynx numbers was observed, in contrast to the brown bear and wolf.

*Key words:* *Lynx lynx*, monitoring, distribution, Slovenia

### INTRODUCTION

In this paper, we analyse lynx signs of presence and their distribution in Slovenia for the period from 1995-1999. At the turn of the 19<sup>th</sup>/20<sup>th</sup> century, the lynx was exterminated in most of Europe, as well as on the territory of present-day Slovenia. The species had survived only in the Carpathian Mountains and in some lesser developed parts of eastern and northern Europe. Kos (1928) mentioned that the last lynx was captured in Slovenia in 1908. The change in people's attitude towards Europe's largest cat led to the re-introduction of lynx from 1970 to 1980 into some European countries. In 1973, 6 lynx were also re-introduced to Slovenia, after which they quickly spread over southern Slovenia and into neighbouring Croatia (Cop and Frkovic, 1998). Re-

search on the success of re-introduction and the expansion of the range of the newly established population was carried out by the Institute of Forestry and Wood in Ljubljana. Today, the re-introduction of lynx in Slovenia is seen as one of the most successful in Europe. The chronological course of the re-introduction is described in the re-introduction project's expert report (Cop, 1994).

In 1978, five years after the re-introduction, the ministries in charge issued the first permission for the hunting of 5 lynx. Each animal shot underwent an obligatory examination at the Veterinary Faculty in Ljubljana. Until the end of 1999, 132 lynx have been legally killed, run over, or found dead. If we include Croatia this number adds up to nearly 300. From 1994-1995, a radiotelemetry pro-

Table 1 - Number of data for each quality category for the southern and western sub-populations, divided by the Ljubljana-Trst highway (see methods for the categorisation of the data).

Quality of data	South	West	total
Q1	6	1	7
Q2	230	77	307
Q3	61	124	185
TOTAL	291	202	499

ject was carried out to assess the home range size and social organisation in southern Slovenia. This project also opened up new areas of inquiry, particularly that of feeding habits (Huber *et al.*, 1995). In this report we included only the data from wild ungulates found by radio-telemetry, as these data were included into the official statistics of the monitoring in this area. The first review of the Slovenian-Croatian lynx population in the frame of the SCALP project was carried out by Cop and Frkovic (1998) up to mid 1995. This second status report now investigates the further development of this population in the Slovenian range for the 1995-99 period.

## METHODS

For Slovenia, we considered not only the Alpine occurrence as in the other status reports of this volume, but the whole country, because the lynx occurrence in southern Slovenia is very important for the expansion of lynx into the Alps. However, to improve the data interpretation and comparison with the other status reports we defined (1) the lynx occurrence west of the Jesenice-Ljubljana-Trst highway as western sub-population and (2) the lynx occurrence south-east of Ljubljana-Trst highway as southern sub-population (Fig. 1). At the last meeting of the SCALP group (*Status and Conservation of the Alpine Lynx Population*), a common method was agreed on for the interpretation of the collected signs of lynx presence that will allow a comparison of data from different countries. All signs of presence are divided into three categories based on their reliability and verifiability. The first category (quality 1) represents all undisputed

facts indicating lynx presence, i.e. animals found dead or captured. The second group (quality 2) classifies all the data concerning the presence of lynx that have been verified by lynx experts. These data include damage to livestock, tracks, scats, casualties to game caused by lynx, as well as other signs of presence that have been verified. The third group (quality 3) classifies all other collected data that have not been verified by lynx experts. In Slovenia, only data on animals shot or found dead were collected consistently for the entire country. The hunting organisations (Lovska Zveza Slovenije) reported for all other signs (tracks, scats, etc.) of lynx presence by locality. Therefore, these data had to be adapted to the SCALP recommendations by assigning co-ordinates. Since this was not possible for all the data, a fourth category of data was represented with a map that shows the region where the data were found with a polygon. However, this fourth category generally included only a small number (10-15% of all collected data) of different signs of lynx presence that have not been verified by lynx experts (quality 3).

To evaluate the trend of lynx population in Slovenia, different data sources had to be used: (1) Since the re-introduction in 1973, all lynx mortalities were collected from all over Slovenia. (2) Since 1976, the official statistics contain data on any wild ungulates killed by large carnivores which are found by chance (definition from hunting law 1976) per hunting district. (3) Since 1986 for the GL Medved Kocevje (Wildlife Reserve "Medved" Kocevje) and since 1991 for the GL Jelen Sneznik (Wildlife Reserve "Jelen"

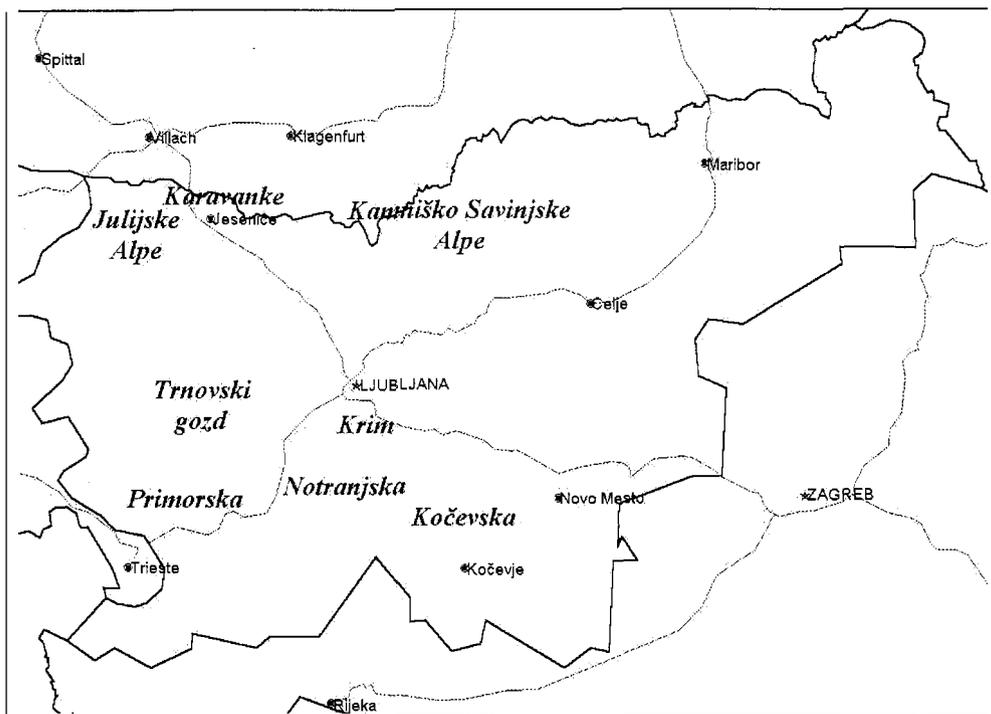


Figure 1 - A map of Slovenia with several important locations mentioned in the report.

Sneznik) all signs of lynx presence were collected in a system of quadrants. The size of the squares was 1x1 km. To show the trend, we established an equalised value by averaging three consecutive years. The total size of both regions is 73.000 ha. (4) Since 1996, a monitoring system was organised for an area of 220.000 ha in the north-west of Slovenia by collecting and assigning co-ordinates to all signs of lynx presence. (5) For Kočevska, Notranjska and Primorska, the areas where lynx are permanently present, the collection of all signs of lynx presence has only been established by the Forestry Association in 1998. This monitoring system relies on a large number of district foresters. All signs of lynx presence were collected by the existing network of forestry departments, each covering an average area of 3000 ha. This data has a precision of less than 1 km<sup>2</sup>. The estimation of the number of lynx present in all Slovenia was based on these monitoring systems.

#### LEGAL STATUS

In Slovenia, lynx are protected year-round and are on the list of rare and endangered animal species. However, the ministries in charge can issue a permission for a quota of lynx to be hunted based on the estimated lynx population. The hunting is spatially divided by region and is also limited in time to the hunting season that lasts from October/November to 28<sup>th</sup> February. The quota is issued for each year separately. On the basis of the available data, the ministries in charge did not issue the above-mentioned permission in the years 1997, 1999, and 2000.

#### RESULTS

For the period 1995-1999, we were able to assign a total of 499 lynx signs of presence to the three SCALP quality categories (Table 1). A little less than two-thirds of the data (62%) comply with the second level of data quality, 37% comply with the third level of data qual-

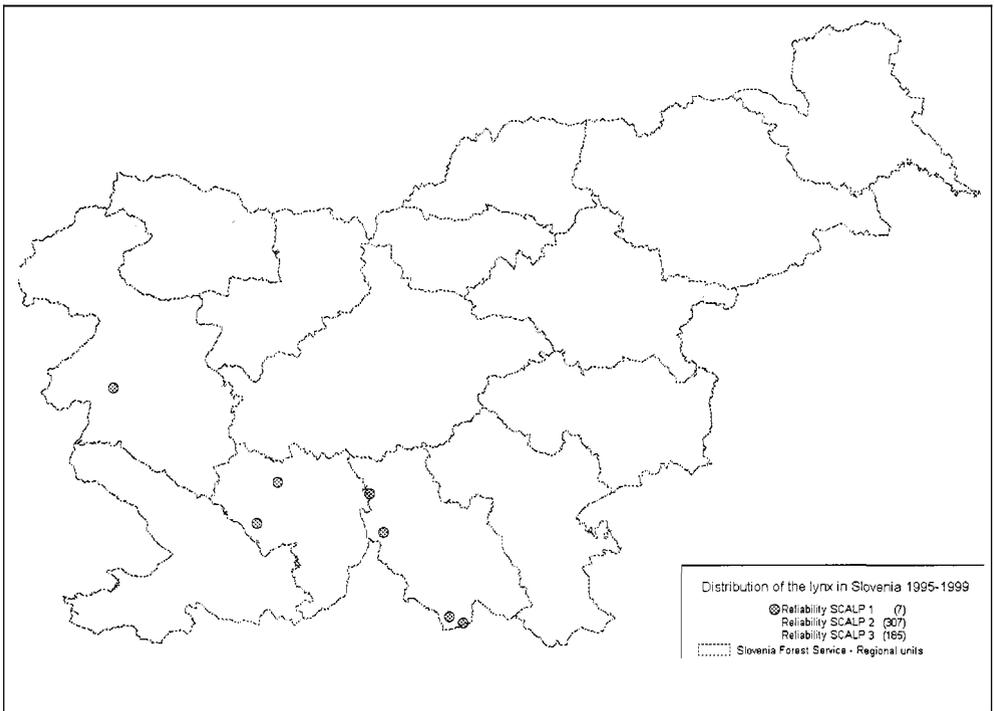


Figure 2 - Distribution of known lynx mortality in Slovenia from 1995-1999 (quality level 1 data). Co-ordinates were not available for 6 known dead lynx.

ity, and 1% of the data comply with the first level of quality. It is necessary to emphasise that these were not all the data on lynx signs that were collected from the period from 1995-1999, as the majority of the data on losses of wildlife due to lynx are missing, as well as almost all the locations of the damages to domestic animals. These data were classified in a fourth category.

The number and distribution of the data that have been assigned co-ordinates, together with the remaining information of quality 4 data, adequately defined the regions where lynx were present from 1995-1999 (Figs. 2-5). During this pentad, the lynx were continuously present in southern Slovenia in the Kocevska and Notranjska, both of which directly border Gorski Kotar in Croatia. A large number of lynx signs have also been reported in western Slovenia, from Trnovski Gozd (Trnovo Forest) to the Julian Alps and the Krim region (south of Ljubljana). There are a small num-

ber of lynx signs reported each year from the remaining regions, such as Primorska, the Karavanke and Kamniško-Savinjske Alps, which lead us to suppose that there were only single individuals that regularly inhabit this region. The lynx is not present in the whole eastern and north-eastern regions of Slovenia. It is also interesting that since 1994 there have been very few lynx signs in the Kocevski Rog region where the lynx was first re-introduced.

The evaluation of the current status of the lynx population was based on (1) data from the monitoring of large carnivores in GL Medved Kocevje (Fig. 6) and GL Jelen Sneznik (Fig. 7), (2) data on monitoring from north-west Slovenia, (3) data of lynx killed or found dead (Table 2), and (4) data on the payment for damages by lynx in Slovenia (Table 3). In GL Medved Kocevje, 20 to 80 different signs of the presence of lynx have been recorded each year over an area of 43,000ha. From the graph

Table 2 - Approved quota, actual number killed, and verified number of lynx found dead for the period from 1990-1999.

year	Quota issued	Killed	Found dead	total
1990/91	7	9	4	13
1991/92	8	8	1	9
1992/93	8	7	0	7
1993/94	8	1	2	3
1994/95	8	5	2	7
TOTAL FOR 1990-1994	31	30	9	39
1995/96	5	4	1	5
1996/97	5	3	1	4
1997/98	0	0	2	2
1998/99	5	0	1	1
1999/00	0	0	1	1
TOTAL FOR 1995-1999	15	7	6	13

in Figure 6 it is clear that the number of lynx signs from 1990 to 1996 decreased, but slightly increased during the past few years. In GL Jelen Sneznik, 20 to 40 different signs of lynx presence have been recorded each year over an area of 30,000 ha. From the graph in Figure 7 it is clear that the number of lynx signs fluctuated from 1991 to 1999, although a fitted curve shows a continuous slightly positive growth. The lynx was permanently present in both regions. A spatial analysis of the data showed a slight shift in the central range of the lynx towards the west compared to previous years (Stanisa, 1996). Based on the available data, we estimated the number of lynx in Slovenia to be between 40 to 50 individuals. South-east of the highway, the population consisted of 30-40 individuals, while in the west of the Jesenice-Ljubljana-Trst highway (see definition in Methods) we estimated that around 10 individuals were present.

In the period from 1990-1994, the ministry issued 5 quotas approving the hunting of a total of 31 lynx (Table 2). Consequently, 30 lynx were legally shot. Additionally, 9 lynx were found dead or run over. In the period from 1995-1999, the ministry issued 3 quotas (in 1995, 1996 and 1998) approving the hunting of a total of 15 lynx. But only 7 lynx were

legally killed and 6 were found dead or run over. The ministry did not issue any quota approving the killing of lynx during the 2000/2001 hunting season. Since 1992 the lynx quota has never been reached. Since 1997 no lynx has been legally shot in Slovenia, although 3 were found run over (2 near the Ljubljana-Trst highway and 1 in Kočevje) and another lynx was found dead (in Kočevje).

In the whole of Slovenia for the period from 1995-1999 a total of 71 cases of damage to livestock by lynx have been recorded (Table 3). Damages amounting to 11,154,000 SIT (around 51.400€) were paid from 1995-1999. It was surprising that in the region of the Kočevsko, where the lynx have been re-introduced, only around 300,000 SIT (around 1.400€) were paid for damages by lynx for 1995-1999. Over this 5-year period, damages caused by lynx in Slovenia represented a relatively small percentage of the costs paid for damages caused by wolves and bears.

#### DISCUSSION AND CONCLUSION

In Slovenia, the only data that was consistently collected since the re-introduction in 1973 were the lynx mortalities. The monitoring system established in the Kočevska, Notranjska and Tolmin, where all signs of lynx

Table 3 - Number of damage cases on livestock and compensation paid for 1995-1999.

Year	N. of cases	SIT	€
1995	25	1.250.000	5.750
1996	2	93.000	400
1997	8	310.000	1.450
1998	21	7.770.000	35.800
1999	15	1.731.000	8.000
TOTAL FOR 1995-1999	71	11.154.000	51.4003

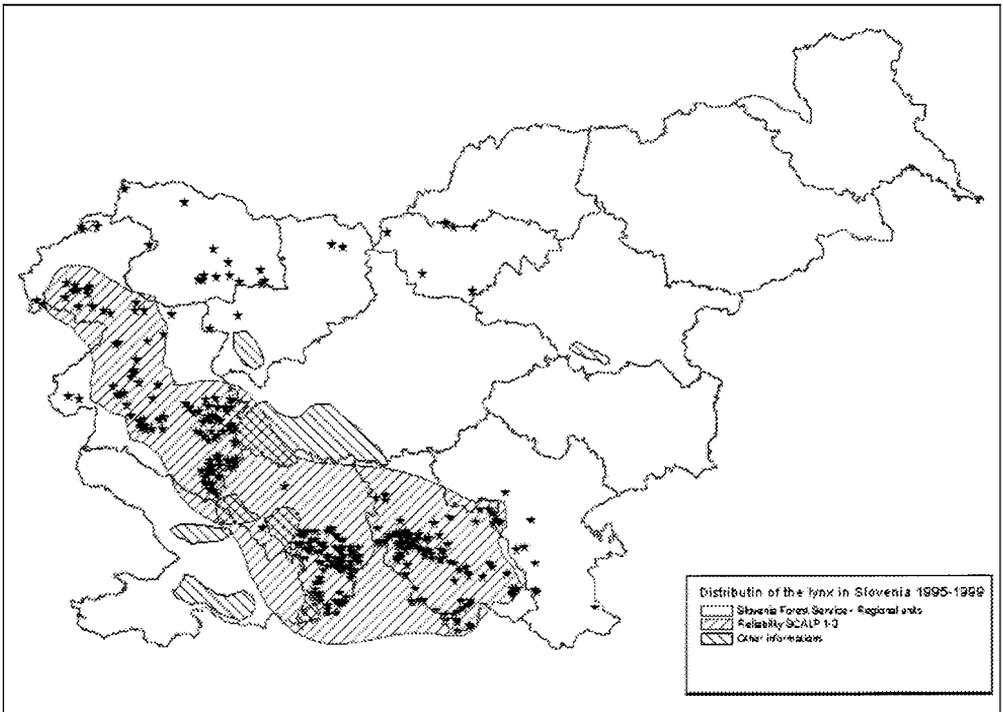


Figure 3 - Distribution of the lynx signs of presence in Slovenia from 1995-1999 (quality level 2 data).

presence are collected and reported by co-ordinates, proved to be very efficient. However, to improve the monitoring in areas where lynx do not occur permanently, the district foresters, who are in charge of data validation, should be trained regularly in distinguishing signs of presence of all large carnivores. Besides, this monitoring system should be expanded to the north and north-east of the country, where lynx have been absent up to now, and all data should be geo-referenced in

order to be able to compare data from Slovenia with other countries. The existing monitoring systems for collecting the signs of lynx presence needs to be updated, particularly with regard to interaction with the geographical information system and computer support, since the majority of the systems for collecting the data were established before the geographical information system was set up. The number and distribution of the signs of lynx presence in Slovenia allowed us to dis-

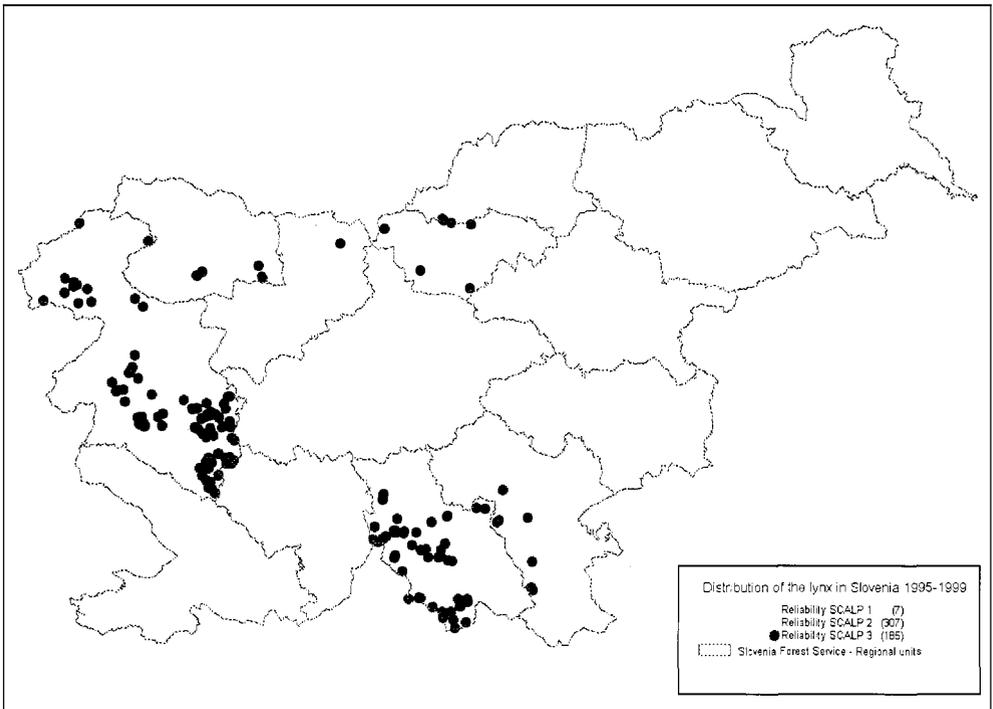


Figure 4 - Distribution of the lynx signs of presence in Slovenia from 1995-1999 (quality level 3 data).

tinguish between 4 different regions (Fig. 5): (1) The southern part of the country comprising the area south-east of the freeway Ljubljana-Trst (Kocevska, Notranjska) where lynx were re-introduced and the lynx number is still the highest. (2) The western part of the country with the Julian Alps, where lynx have started to immigrate in the mid 1980s (Cop and Frkovic, 1998). (3) The Karavanke and Kamniško-Savinjske Alps in the north of the country, as well as some other isolated areas where only a very low number of lynx signs of presence were collected. (4) The fourth region comprises the north-east of Slovenia where lynx is still absent.

The area of lynx occurrence has not increased during the past five years, on the contrary, the fact that the hunting quota has not been filled since 1992 even though the quotas were set considerably lower than previously and efforts were constant may indicate that the number of lynx has decreased. Besides, west of the freeway Ljubljana-Trst only 1 lynx mor-

tality was reported for the 1995-1999 period, whereas 4 lynx mortalities were reported for 1994 only (Cop and Frkovic, 1998). The only area where the monitoring data allowed to assess the population trend was in GL Medved Kocevje and GL Jelen Sneznik. In Kocevje, the lynx number fluctuated reaching the lowest number in 1995, whereas in Sneznik the number increased very slightly during the past 10 years.

The only potential habitat barrier that separates the western from the southern lynx occurrence is the Ljubljana-Trst highway. But since brown bears regularly cross this highway (Kaczensky, 2000), we assume that lynx do the same. North and west of this highway there exists no major habitat barrier that hinders the dispersal of lynx from Slovenia into Italy and Austria. The dispersal of lynx into these two countries, and therefore the natural re-colonisation of the Alps, depends very much on the management decisions in the border areas. The data available is not sufficient

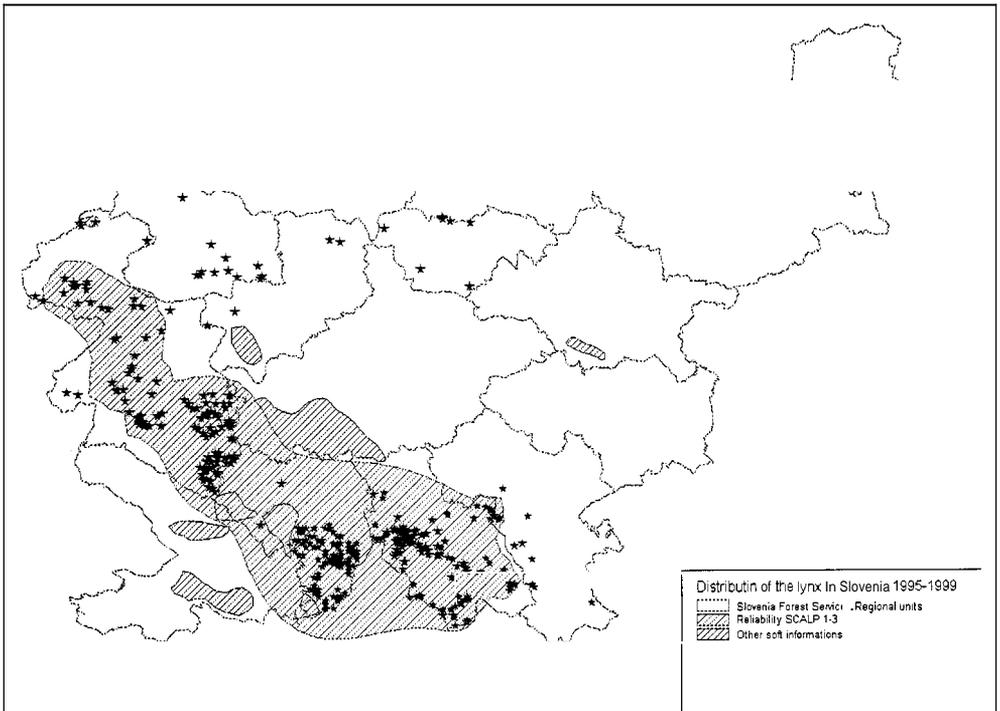


Figure 5 - Distribution of the lynx in Slovenia 1995-1999 (data for quality levels 1-3 and other data).

to evaluate the magnitude of lynx dispersal into the Alps. Only a radio-telemetry study would reveal further insight in the dispersal capacity of lynx from southern Slovenia into the Alps.

Comparing the data collected from 1995-99 with the data of the previous pentad, it is possible to conclude that the main body of the lynx population of Slovenia has shifted somewhat to the west. Possible reasons for this are lower numbers of roe deer, increased wolf numbers in Kocevsko in the past few years, illnesses and genetic difficulties due to the founder effect in the population, and illegal killings. The close link between the lynx in Slovenia and conditions in the neighbouring Republic of Croatia shows just how imperative it is that, in the future, there be balanced co-operation between the two countries for the effective safety and management of the lynx in this part of Europe.

At the 1<sup>st</sup> SCALP Symposium in 1995, the Slovenian lynx population was considered the

most vital Alpine occurrence, as it has shown quick expansion into neighbouring Croatia, Italy and Austria (Cop and Frkovic, 1998). Up to now, southern Slovenia has always acted as a source population. However, during the past years a slight regression in lynx numbers was observed, in contrast to the brown bear and wolf.

#### ACKNOWLEDGEMENTS

We thank the following organisation for a good collaboration: the monitoring data was kindly provided by the Association of the Forests of Slovenia, GL Medved Kocevje, GL Jelen Sneznik, and from the Ministry for Agriculture, Forestry, and Food. The manuscript benefited from reviews by U. Breitenmoser, A. Molinari-Jobin and J. Linnell.

#### POVZETEK

Tekst obravnava znake prisotnosti risa in njegovo razširjenost v Sloveniji. V letih 1995-1999 je bilo zbranih in analiziranih skupaj

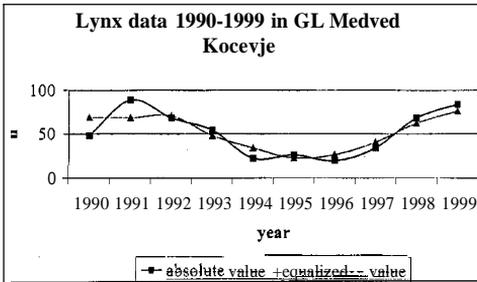


Figure 6 - Lynx data 1990-1999 in GL Medved Kocevje.

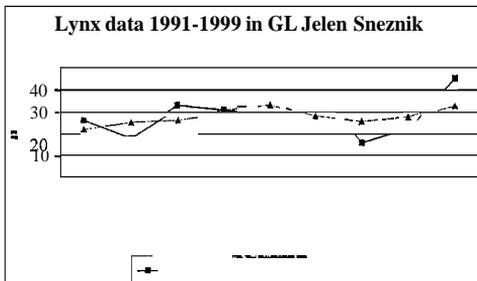


Figure 7 - Lynx data 1991-1999 in GL Jelen Sneznik.

499 znakov risove prisotnosti na osnovi katerih je mogoče ločiti 4 različna območja: (1) Južni del države, ki obsega območje jugovzhodno od avtoceste Ljubljana-Trst (Kočevska, Notranjska), kjer je ris bil ponovno naseljen in kjer je ris stalno prisoten. (2) Zahodni del države z Julijskimi Alpami, kamor se je ris pričel seliti po letu 1980. (3) Karavanke in Kamniško-Savinjske Alpe na severu države, kakor tudi ostala bolj ali manj izolirana območja z zelo majhnim številom evidentiranih znakov prisotnosti risa. (4) Severovzhodni del Slovenije, kjer ris ni prisoten. Na osnovi zbranih podatkov ocenjujemo, da v južnem delu Slovenije živi 30-40

osebkov, zahodno od avtoceste Jesenice-Ljubljana-Trst pa še dodatnih 10 osebkov (skupaj za Slovenijo 40-50 osebkov). Velikost območja, v katerem se ris pojavlja, se v zadnjih petih letih ni zmanjšala. Nasprotno pa vsakoletno Stevilo za odstrel dovoljenega števila risov ni bilo dosejeno že od leta 1992 – čeprav je to Stevilo v primerjavi s preteklimi leti občutno manjše – kar nakazuje, da se je število risov v zadnjih petih letih zmanjšalo. Populacija risov v Sloveniji se je vedno smatrala za najvitalnejšo v alpskem prostoru, kar je nakazovala tudi zelo nagla Siritev risov na Hrvaško ter proti Italiji in Avstriji. Kljub temu pa je v zadnjih nekaj letih opaziti rahlo nazadovanje populacije risov, v nasprotju z rjavim medvedom in volkom.

## REFERENCES

- Cop, J., 1994. The monitoring of lynx re-introduction in Slovenia 1973-1993. Research project, IGLG Ljubljana: 1-256.
- Cop, J. and Frkovic, A., 1998. The re-introduction of the lynx in Slovenia and its present status in Slovenia and Croatia. *Hystrix*, 10: 65-76.
- Huber, T., Kaczynsky, P. and Stanisa, C., 1995. Telemetrieprojekt Kočevska Slovenien. Abschlussbericht des Projektes: 1-24.
- Kaczynsky, P., 2000. Co-existence of brown bear and men in Slovenia. PhD. Thesis, University of Munich, Munich: 1-216.
- Kos, F., 1928. Lynx on the ethnographic area of Slovenia. Newsletter of the museum society for Slovenia 1.x., vol 1-4: 57-72.
- Stanisa, C., 1996. Comparison of methods for establishing the presence of large carnivores. Diploma thesis, Biotechnical Faculty, Forestry Dept., Ljubljana: 1-89.