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THE RE-INTRODUCTION OF THE LYNX IN SLOVENIA AND ITS PRESENT STATUS IN SLOVENIA AND CROATIA[1]

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ABSTRACT - The lynx disappeared from Slovenia and Croatia at the beginning of the 20th century. In 1973, six lynx from the Slovakian Carpathian Mountains were translocated to Kocevje in southern Slovenia. In this densely forested region where prey animals are plentiful, a core population developed immediately and spread over Slovenia and Croatia. In 1984 the first lynx reached the Julian Alps and crossed over to Italy. The population increased so fast that already in 1978, hunting of lynx was legalised. From 1978 to the present, a total of 229 individuals were hunted, another 48 deaths from other reasons are also known. The intense harvest hindered further expansion of the population, especially the re-colonisation of the Alps. In recent years the hunting season and the hunting quota were reduced, and in Slovenia, hunting is now restricted to the core area of the population.

Key-words:Lynx lynx, re-introduction, status, distribution, mortality, Slovenia, Croatia

INTRODUCTION

At the beginning of the 19th century the Eurasian lynx (*Lynx lynx*) was still roaming over the whole Balkan peninsula. After Turkish rule ceased, the human population increased, and along with it logging and overhunting. Predators were persecuted as pests. In Slovenia a bounty of 20 to 25 Gulden was paid from 1821-1909 for every lynx killed. The species disappeared from Slovenia in 1908, from Croatia in 1903, and from Bosnia-Herzegovina in 1911, respectively (Miric 1978, Cop 1977). Today the autochthonous lynx population of the Balkans is restricted to the south of former Yugoslavia (Montenegro and Macedonia) and to Albania (Breitenmoser and Breitenmoser-Würsten 1990). In 1973 the lynx was re-introduced to Kocevje in southern Slovenia. This region is densely forested, as in 1941 more than 200 villages were destroyed. Only 10% were later rebuilt. About 300 km^2 of agricultural land returned to forest in the meantime (Cop 1977). All autochthonous ungulate species exist there, together with brown bear (*Ursus arctos*), wolf (*Canis lupus*), golden jackal (*Canis aureus*) and wild cat (*Felis silvestris*). Population densities of ungulates are higher than 100 years ago and this was a positive precondition for the return of the lynx. In two large enclosures, mouflon (*Ovis musimon*) were kept for sport hunting, which forms an important part of tourism in southern Slovenia (Cop 1977).

MONITORING AND DATA AVAILABLE

The description of the development and the present status of the lynx population in Slovenia and Croatia is mainly based on analysis of the hunting bag. Before the beginning of legal hunting of lynx in 1978, ob-

[1] Data compiled and text written by Urs Breitenmoser and Christine Breitenmoser-Würsten

servations were randomly communicated by hunters, foresters, or naturalists. Since 1978, there have been precise data for every lynx legally shot in Slovenia (Appendix I). Additionally, information about lynx found dead or killed in traffic accidents, and direct observations was collected. For Croatia, data were available until 1991. Later, only the northernmost part (Istria peninsula and Gorski Kotar) was still monitored. From further south no recent data were available because of the war. Likewise, there is at present no information on the status of the lynx in Bosnia-Herzegovina, where two lynx moving in from Croatia were killed as early as 1984 and 1986, respectively (Cop 1989).

Legal situation

The autochthonous lynx population in the south of former Yugoslavia was put under legal protection as early as 1946 (Bojovic 1978). In Slovenia, lynx were re-introduced in 1973 and hunting became legal again in 1978 (see Appendix I). The annual hunting quota is determined by the Ministry of Forestry and Agriculture in Ljubljana; females with kittens are protected. The number of lynx that could be hunted was reduced to eight for the last three seasons, and will be only five for the winter of 1995/96. The hunting season was also shortened (Cop 1995). At first, it lasted from 1.11.-28.2, then it was as long as 1.9.-28.2., but since the season of 1993/94 it has been shortened to 1.11.-15.2., and will be from 1.11.-31.1. for the next season. In order to protect dispersing animals, hunting was restricted to the core area of the population (Kocevje, Postojna, Krim and Slavnik) in 1992. All animals found dead (traffic accidents, diseases, etc.) count for the hunting quota. Under the hunting law, hunters have to send the lynx carcasses to Ljubljana for diverse analyses (rabies, stomach content, etc.). In Croatia, the hunting season is from 15.11.-1.3. without any spatial restrictions. For the season of 1995/96, 14 animals are open for hunting. Livestock killed in Slovenia was examined by J. Cop and veterinarian A. Bidovec until 1994. Today foresters and local policemen examine the carcasses. If an animals was killed by a lynx, compensation is paid by the ministry of agriculture and forestry. In Croatia predator kills are inspected by A. Frkovic. At present, no compensation is paid.

Origin, development, and present status of the population

In January 1973 three male and three female lynx, caught in the wild in Slovakia, were translocated to Kocevje. They were originally designated for a re-introduction project in the German Harz Mountains, but the project was postponed (Cop 1980). The six lynx were finally set free on the 2 March, after 46 days of quarantine in Kocevje (Fig.1a). During the first year after the release, the lynx all stayed close to the quarantine place. In the early years, there was only one known mortality; an adult male lynx trapped on 6 February 1974 near Mala gora, 20 km from Kocevje (Fig. 1a; Cop 1977). On the other hand a considerable number of observations of young lynx indicated that there was good reproduction (Table 1).

Three observations of kittens in the summer of 1973 showed that mating had taken place right after the release of the lynx. In the third year the lynx started to disperse. By October 1975 they had reached Risnjak National Park in Croatia, 35 km to the southwest. To the north-west animals moved even further. There was a direct observation of a lynx near the village of Kamnik on Rakitna (46 km).

1978-83 (Fig. 1a)**.** From 1978-1981, lynx were mainly hunted in Slovenia close to the release site. One lynx was illegally killed in Croatia in 1978, in the Zumberak area, 35

Table 1. Observation of young lynx in the core area (430 km^2) during the first years after the re-introduction in March 1973.

Year	Number of females	Number of kittens	Total
1973	3	2,1,1	4
1974	1	1	1
1975	2	2,2	4
1976	5	2,2,3,1,1	9
1977	3	2,2,1	5
1978	5	2,2,1,1,1	8

km east of the release site. But during this time, observations were already recorded from Gabrska gora in the north-west (90 km) and Postojna in the west (60 km) (Fig. 2). All observations during this five-year period in Slovenia were made within the Dinaric Alps (which is a secondary mountain chain south of the Alps). The expansion of the population to the south into Croatia went quickly. In 1983, an animal was shot near Otocac, 100 km away from the release site in Slovenia. Most animals, however, were shot in the Gorski Kotar and near the coast north of Novi Vinodolski (Fig. 2).

Table 2. Known losses of lynx in Slovenia, Croatia and Bosnia-Herzegovina 1974-1995. The sex ratio of the dead animals was 56 males to 62 females (6 unknown) in Slovenia and 54 males to 79 females (20 unknown) in Croatia.

Hunting season	Slovenia	Croatia	Bosnia-Herzegovina	Total
1974	1	-	-	1
1978/79	5	1	-	6
1979/80	3	2	-	5
1980/81	2	5	-	7
1981/82	4	9	-	13
1982/83	5	10	-	15
1983/84	4	12	-	16
1984/85	9	11	2	22
1985/86	10	9	-	19
1986/87	7	18	1	26
1987/88	11	11	2	24
1988/89	15	6	1	22
1989/90	8	11	?	19
1990/91	13	8	?	21
1991/92	9	6	?	15
1992/93	7	9	?	16
1993/94	4	16	?	20
1994/95	7	9	?	16
Total	124	153	6	283

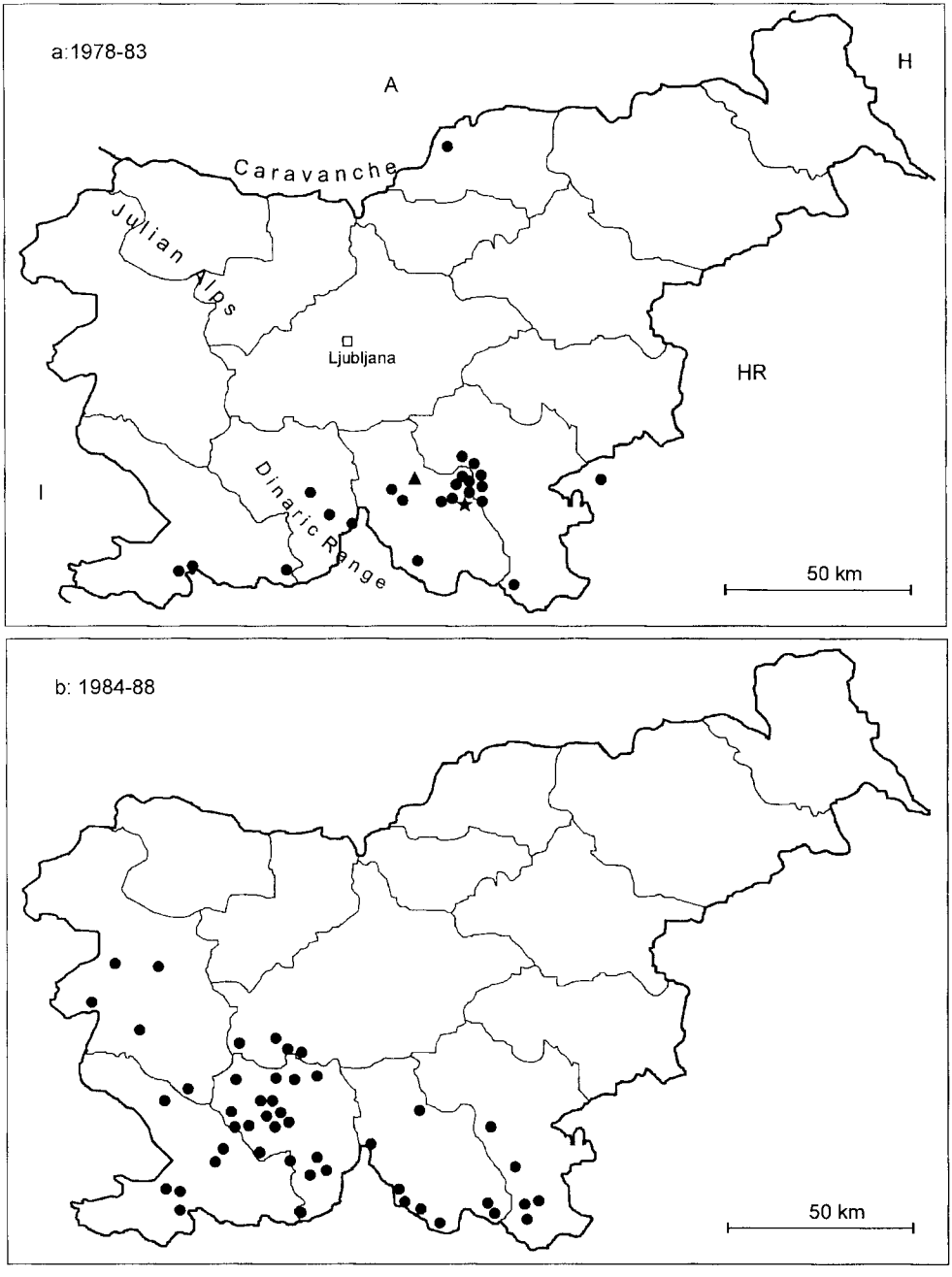

Figure 1: Distribution of dead lynx in Slovenia. (a) 1978-83, (b) 1984-88, (c) 1989-93 and 1994-95. The star in (a) indicates the release site in Kocevje. In (c) dots mark dead lynx for 1989-93 and triangles for 1994-95. The shaded area indicates the region open for hunting.

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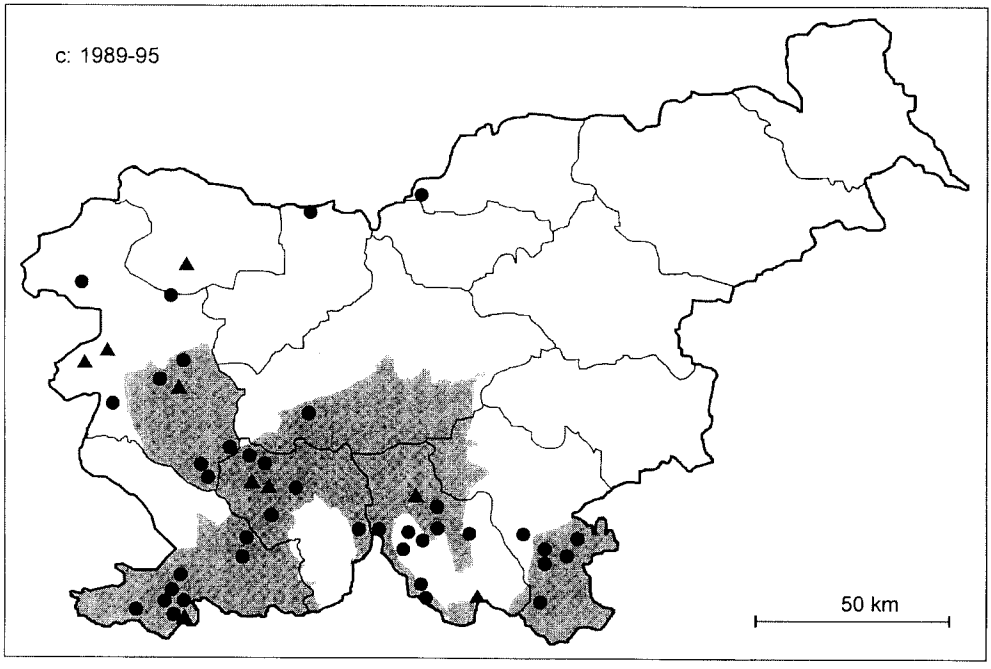

1984-88 (Fig. 1b). The expansion towards the south-east was very dynamic until 1985/86. The front of the population now reached Bosnia-Herzegovina (Table 2). In 1984, a lynx was killed in the Una valley in Lika (close to the town of Bihac, Bosnia-Herzegovina), 185 km from the release site. In 1986 a lynx intruded into a stable and was killed 210 km to the south in Kamenica near Zavidovic. To the north-west the population did not expand as fast (Fig. 1b). Nevertheless, the first lynx from the Slovenian population reached the Alps. In 1986 a lynx was shot in Kanalski Lom, near Most na Soci (120 km), close to the border with Italy. This was the first proof of lynx in the Julian Alps. It is probable that lynx crossed into Italy in the same year (Perco 1989). In May 1987, lynx were observed in the Trenta valley in the area of Triglav National Park. In 1988 another lynx was shot close to the border with Italy, in the village Grgar.

1989-93, 1994-95 (Fig. 1c). In 1989 and 1990, two lynx were shot at the border with Austria. Their origin, however, is uncertain. They could have come either from the re-introduced population in Styria, Austria (see Huber and Kaczensky 1998), or from the Slovenian nucleus. But up to then, there had been no evidence that lynx had crossed the valley of the Save. In the meantime, lynx also arrived on Istra, Croatia (Fig. 3). An animal was shot near Borec, at the Adriatic coast in 1993. We can assume that the lynx had immigrated from Slavnik (Slovenia). In this period there was no further important expansion to the south-east in Croatia. For the season 1992/93, hunting became restricted to the core area in Slovenia, and consequently, the records of lynx shot since (Fig. 1c) no longer represent the expansion of the population as they did in previous years.

In Slovenia, the area occupied by lynx has steadily increased since the re-introduction in 1973 (Fig. 1). Today, lynx roam over 3700 km^2. For Croatia we have to add about 3000 km^2, so that the total area occupied by lynx is about 6700 km^2 (Fig. 3). In the north of Slovenia, observations indicate that a small and isolated population nucleus per-

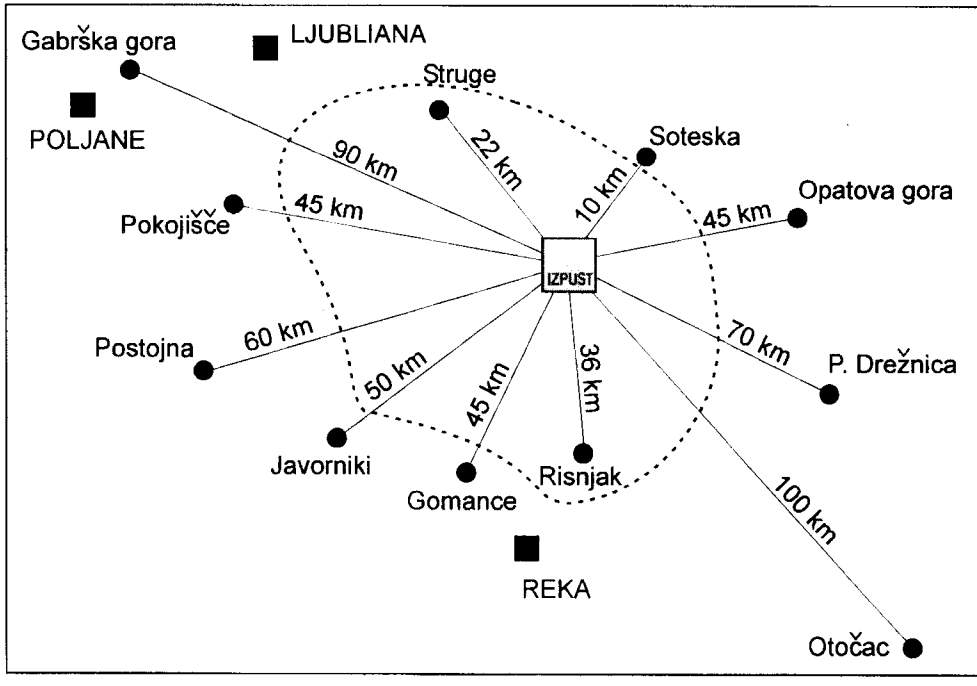

Figure 2: Dispersal distances of lynx from the release site in Kocevje 1973-1981.

sists along the border with Austria (Fig. 3). In the south, the situation in Bosnia-Herzegovina is not known; according to rumour the lynx - as other large game species - may have suffered from the war. Hunters' associations estimate the Slovenian-Croatian population at 300 individuals, but we estimate only 140 animals for both countries, corresponding to a density of two lynx per 100 km^2.

Damage to livestock. In two hunting enclosures, each of an area of 10 km^2, lynx exterminated colonies of mouflon. The

Table 3. Reasons for mortality in the lynx population of Slovenia and Croatia 1974-1995.

	Slovenia			Croatia	Total
	Adult	Juvenile	Total	Total	
Hunting	76	27	103	126	229
Trapping	2	1	3	4	7
Poisoning	1	1	2		2
Traffic	3	4	7	9	16
unknown	2	7	9	12	21
Total	84	40	124	153[a]	277

[a] 106 adults, 38 subad/juv. and 9 unknown

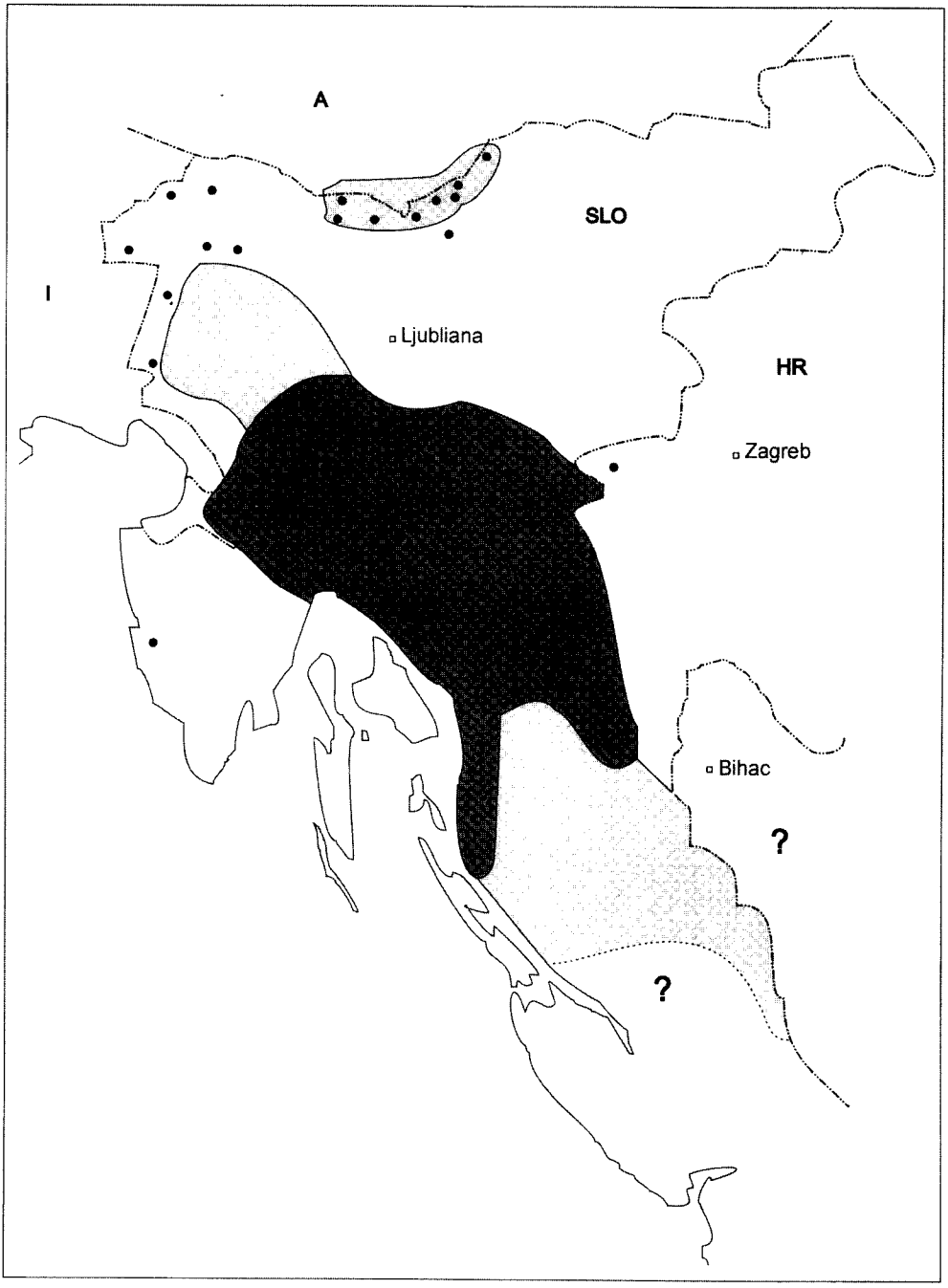

Figure 3: Present distribution of lynx in Slovenia and Croatia. The core area of the population is dark shaded, peripheral areas light shaded. The situation in southern Croatia and Bosnia-Herzegovina is unknown. Dots indicate single observations or dead lynx outside the species' range.

colonies were founded in 1964 and 1972, respectively, for tourist hunting. By 1982, there were no mouflons left. When legal hunting started in 1978/79, the first three lynx were actually shot within these enclosures. Up to 1982, a total of 11 lynx were killed in the vicinity. This represents a fairly high concentration of lynx in an area of about 100 km^2. Obviously, the lynx were attracted to the mouflon enclosures. Up to 1995 there was no important problem with lynx killing livestock. But in the summer of 1995 lynx were blamed for the killing of 40 sheep and eight goats near Nova Gorica, close to the border with Italy. Lynx have only recently moved into areas in the Alps where sheep farming is more important, and where sheep spend the summer unguarded on mountain pastures.

Discussion

The initial dynamics of the re-introduced lynx population in Slovenia were outstanding, compared with other translocations (see e.g. Huber and Kaczensky 1998; Breitenmoser et al. 1998). The released lynx met excellent conditions in the Kocevje area: extended forests with plenty of prey animals, but a rather sparse human population. An important aspect was the high reproduction in the early stage (Table 1). However, the initial dynamics were reduced by the heavy losses from legal hunting (Table 3). Lynx reached the Alps and some animals spread into Italy in 1986/87 (Perco 1989), but the remaining emigration was not sufficient for a reunion with the population in Austria. Animals killed at the front of the population were mostly adult males (Cop 1992; Appendix I). To date, females have not followed, so there are no observations of reproduction at the expansion front. In order to help the weak Austrian population (Huber and Kaczensky 1998) and to support the re-colonisation of the Italian Alps (Molinari 1998; Ragni et al. 1998), it is important to maintain the hunting ban in the Slovenian Alps. Furthermore, the hunting restrictions in the core area must also be continued. Local overharvesting in a hunting area at the north-western edge of the core area (Fig. 1c; Fig. 3) was probably responsible for the weak expansion towards the Alps.

Though harvesting a lynx population can weaken it and therefore has to be done very carefully, *Kugel-Telemetrie* ('bullet telemetry') provides valuable information on the distribution of lynx. As this form of record is no longer available outside the core area of the population in Slovenia, a distinct monitoring system is urgently needed. This is also true for the southern part of the lynx population. From Bosnia-Herzegovina and from parts of Croatia, no information has been available in recent years, and the status of the population cannot be confidently judged (Fig. 3). The lynx population re-established in Slovenia and Croatia is still small and isolated. Although it developed very well in the first years and is still a healthy population, it could suffer in the long term suffer from its (genetic) isolation.

Povzetek

Naselitev risov v Sloveni, ji in današnji status tedivjadi v Sloveniji in Hrvaški. Ris je v Sloveniji in Hrvaški izumrl ob koncu 19. stoletja. Leta 1973 je bilo v Karpatih Slovaške odlovljeno šest risov; kateri so bili prepeljani v Slovenijo in iz pušeni v gozdove Koševske. Izjemno ugodni naravni pogoji (visoka gozdnatost, zadostna prehrana, mir) so omogošili hitro povešanje števila risov, vsakoletni priratek je teil konstanten, kar je omogošilo odseljevanje in postopno naselitev novih lovišč v Sloveniji in tudi obmošij gozdov preko reke Kolpe v Republiki Hrvaški. Iz osrednjega (centralnega) obmošja, kjer živita autotat. populaciji tudi medveda in volka, so se risi odseljevali proti Julijskim Alpam, kjer so bili prvi opašeni leta 1984 tudi preko meje v Italiji.

Ugoden razvoj nove populacije risov je dovoljeval minimalni odstrel te divjadi; katerega je Ministestvo za gozdarstvo prviš dovolilo leta 1978, sprva le v centralnem območju, ne periferiji. Od tega leta dalje je do danes bilo uplenjeno skupaj 225 risov, nadalnjih 48 je bilo najdeno mrtvih, ki so na en ali drug našin poginili. Vsakoletni odstrel deloma zavira hitreješo prostorsko širjenje populacije, predvsem v pogorje Alp. Od leta 1992 je bil odstrel risov dovoljen le v centralnem območju skrajšana je bila lovna doba in znižala se je dovoljena količina odstrela.

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Appendix I: Known lynx mortality in Slovenia since 1973.

Date	Place	Hunting Ground	Sex	Age	Cause of mortality
07.02.74	Mala gora	ZGD Medved	M	ad	trapping
15.01.79	Beli Kamen	ZGD Medved	M	ju	hunting
15.01.79	Beli Kamen	ZGD Medved	F	ju	hunting
15.01.79	Beli Kamen	ZGD Medved	F	ju	hunting
00.02.79	Soteska Dvor	ZGD Medved	M	ad	traffic
31.01.79	Klec	LD Ribnica	M	ad	hunting
23.11.79	Gabrovka	LD Ribnica	F	ju	hunting
23.11.79	Grabovka	LD Ribnica	M	ju	hunting
05.12.79	Kor.Selovec	LD Prezihovo	M	ad	hunting
21.03.80	Ob.Smuka	ZGD Medved	F	ad	hunting
22.03.80	Ob.Smuka	ZGD Medved	F	ad	hunting
28.10.81	Dragarji	Kocevska Reka	F	ad	hunting
02.08.81	Stari Log	ZGD Medved	F	ju	traffic
29.11.81	Telebacnik	LD Babno polje	F	ju	hunting
02.01.82	Stumfna	ZGD Medved	F	ad	hunting
03.10.82	Slavnik	LD Kozina	M	ad	hunting
07.11.82	Grascica	LD Predgrad	F	ad	hunting
29.11.82	Kozlek	LD Kozlek	F	ad	hunting
16.12.82	Kozarsce	ZGD Jelen	F	sa	found dead
27.02.83	Rog	ZGD Medved	M	ad	hunting
06.09.83	Plesivica	LD Zadnik-Obr.	M	sa	hunting
30.10.83	Goricice	LD Gor.Jezero	F	sa	hunting
14.01.84	Podgozd	LD Plesivica	M	ad	hunting
09.02.84	Ovsarsko	LD Vrhe-Vrace	M	sa	hunting
16.05.84	Podturn-Zaga	ZGD Medved	?	?	traffic
24.09.84	Kanal, Lom	LD Most na Soci	M	ad	hunting
03.10.84	Plavina	LD Osilnica	M	ad	hunting
29.11.84	Zavrce	LD Kozlek	M	ad	hunting
01.12.84	Barka-Lesa	ZGD Jelen	M	ad	hunting
08.12.84	Sneznik	ZGD Jelen	F	sa	hunting
22.12.84	Bleska planina	LD Osilnica	F	ad	hunting
24.12.84	Struznica	Ld Banja Luka	F	sa	hunting
25.12.84	Javornik	Ld Gornje jez.	M	sa	hunting
17.10.85	Ivanje Selo	LD Rakek	F	ad	hunting
02.11.85	Koprivnik	LD Predgrad	F	sa	hunting
03.11.85	Hrib Cukl	LD Kojnik-Podgorje	F	ad	hunting
23.11.85	Masun	ZGD Jelen	M	ad	hunting
29.11.85	Savske Grize	LD Prestranek	F	ju	hunting
09.12.85	Debeli vrh	LD Loka	M	sa	hunting
14.12.85	Vardjanske z.	LD Javornik	F	ju	hunting
15.12.85	Slavnik	Ld Kojnik	F	ju	hunting
17.12.85	Cevacec	LD Dragatus	F	ad	hunting

continue

Appendix 1 (continued)

Date	Place	Hunting Ground	Sex	Age	Cause of mortality
02.01.86	Palcje	LD Pivka	F	ad	hunting
03.09.86	pod Nanosom	LD Bukovje	M	ad	hunting
02.11.86	Kosana	LD Gradisce	F	ju	hunting
23.11.86	Bilpa	Koc.Reka	M	ad	hunting
28.12.86	Ravnik	LD Begunje	M	sa	hunting
10.01.87	Rakov Skocjan	LD Scerknica	F	ad	hunting
20.02.87	Rakov Skocjan	LD Scerknica	F	sa	hunting
24.02.87	Rakov Skocjan	LD Scerknica	M	ad	hunting
13.09.87	Martaloz	LD Loski potok	M	sa	hunting
14.10.87	Jurjeva dolina	Jelen-Snerznik	M	sa	hunting
06.11.87	Ljublj.vrh	LZS	F	ju	hunting
08.11.87	Hrusica	LD Logatec	M	sa	hunting
17.11.87	Stene Kozice	LD Predgrad	F	ad	hunting
12.12.87	Zavrh	LD Zilce	F	ju	found dead
18.12.87		LD Kosana-Gr.	F	ad	hunting
13.02.87	Mala gora	LD Struge	F	sa	hunting
24.05.88	Prdivnik	LD Jelenk-Sp.Idr.	M	sa	hunting
11.06.88	Plasina	LD Bukovca	F	sa	hunting
25.07.88	Slavnik	LD Kozina	M	sa	hunting
04.10.88	Lj.Vrh	LZS	F	sa	hunting
04.10.88	Lj.Vrh	LZS	M	ju	hunting
30.10.88	Vlacno	LD Pivka	F	?	traffic
02.11.88	Matenja	LD Prestrank	M	ju	hunting
02.11.88	Prestrank	LD Prestrank	F	ju	hunting
02.11.88	Zagon	LD Crna Jama	F	ju	traffic
06.11.88	Mirna gora	LD Crnomelj	M	sa	hunting
13.11.88	Poljane-Podsgr.	LD Brkini	M	ad	hunting
14.11.88	pod Golaki	LD Trnovski g.	F	ju	found dead
20.11.88	Javorniki	LD Cerknica	M	ad	hunting
31.10.88		LD Dragatus	F	ju	hunting
18.12.88	Podlaska g.	LD Grgar	M	ad	hunting
15.01.89	Slavnik-Spicnik	LD Videz-Kozina	F	ju	hunting
15.01.89	Koprivna	LD Koprivna	M	ad	hunting
27.02.89	Glazura	GL Medved	M	ad	hunting
08.10.89	Gorica	LD Dragatus	M	sa	hunting
24.10.89	Kosuta	ZGD Kozorog	M	ad	hunting
13.11.89	Planina	LD Crnomelj	M	ad	hunting
19.11.89	Sustar	LD Podbrdo	M	ad	hunting
20.12.89	Vel.gora	LD Ribnica	F	ju	hunting
17.01.90	Karlovica	LD Cerknica	F	ju	found dead
18.02.90	Mala gora	LD Struge	M	sa	hunting
00.07.90	Nanos	LD Nanos	M	ad	found dead
15.09.90	Loski potok	Ld Loski potok	F	ad	hunting

continue

Appendix I (continued)

Date	Place	Hunting Ground	Sex	Age	Cause of mortality
12.10.90	Grintovec	LD Osilnica	F	ju	trapping
21.10.90	Plan.gora	LD Planina	M	ad	hunting
04.11.90	Lipe/Vipava	LD Nanos	M	ad	hunting
11.11.90	Mala Vrata	LD Slavnik-M.	F	ad	hunting
02.12.90	Crnjava	LD Bukovje	F	ju	hunting
09.12.90	Kot	LD Smuk-Semic	F	sa	hunting
15.12.90	Krokar-KR	LD Osilnica	M	ad	hunting
22.12.90	Predgrad	LD Loka	M	ad	hunting
24.01.91	Crzez	LD Bukovje	F	?	trapping
17.02.91	Krn	LD Dreznica	M	sa	poison
03.06.91	Burjovec	LD Krekovse	F	sa	hunting
10.11.91	Srebotnik	LD Materija	M	ad	hunting
12.11.91	Bosinjakovo	LD Suhor	M	ju	hunting
15.11.91	Mrzili Doli	LD Predgrad	M	ad	hunting
15.12.91	Nadrt-Hursica	LD Col	F	ju	hunting
21.12.91	Smrecje	LD Trnovski gozd	F	ju	hunting
25.12.91	Vugar	LD Dolenja vas	F	ad	hunting
28.01.92	Vanganel	LD Marezige	M	ju	hunting
02.11.92	Osojnica	LD Pivka	F	ad	hunting
11.11.92	Polana	LD Iga vas	F	ad	hunting
02.12.92	Obora Smuka	GL Medved	F	sa	hunting
27.12.92	Vrh Krima	LD Tomiselj	F	ju	hunting
31.01.93		LD Krekovse	M	ad	hunting
19.02.93	Kukovo Sturge	LD Kocevje	M	ad	hunting
28.02.93	Za Susjakom	LD Pivka	M	ad	hunting
07.11.93	Kostel	LD Banja Loka	F	ju	hunting
15.09.93	Koper-Divaca	LD Obrov Zabnik	?	ju	traffic
14.10.93	Idrija	LD Krekovse	?	ju	found dead
00.07.94	Ratitovec	LD Zelezniki	?	?	found dead
16.10.94	Idrija	LD Dole	F	ad	hunting
03.11.94	Notr	LD Crna Jama	M	ju	hunting
03.11.94	Notr	LD Crna Jama	F	ju	hunting
28.11.94	Kocevje	LD Ribnica	F	ad	hunting
11.12.94	Gorica	LD Grgar	M	ju	hunting