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RE-INTRODUCTION AND PRESENT STATUS OF THE LYNX (*LYNX LYNX*) IN SWITZERLAND

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ABSTRACT - A lynx recovery programme started in Switzerland in 1970. From 1970-76, at least 14 lynx were translocated from the Carpathian Mountains into the Swiss Alps. Another re-introduction took place in the Jura Mountains, but no corridors exist as a connection between these two populations in Switzerland. The development of the populations was not monitored at first. In 1980 systematic research was initiated, which gradually evolved into the *Swiss Lynx Project*. Not all releases were successful, but the re-introduction in the northern and western Alps founded a population that covered an area of some 4000 km^2 in 1981. In the western Swiss Alps, lynx moved into Italian and French territory. Towards the eastern Swiss Alps, the expansion was slower and ceased about ten years ago. During the last five years, there even has been a reduction of the area occupied. Today, the population covers an area of about 10000 km^2 in the Swiss Alps, of which 50% is suitable lynx habitat. Based on size and overlap of average home ranges of radio-tagged lynx, the population was estimated to include some 50 adult residents. At present, the growth rate of the population appears to be too low to allow a further expansion in range. It is uncertain whether recruitment is sufficient to compensate for the high losses among resident adults induced by traffic accidents and illegal killing

Key-words: *Lynx lynx*, re-introduction, status, monitoring, depredation, mortality, Switzerland, Alps

INTRODUCTION

The lynx population of Switzerland was exterminated during the 18th and 19th centuries. This was a period when Switzerland faced ecological disaster: Many of the forests were destroyed or in an alarming state, the wild ungulate species were eradicated (*Cervus elaphus*, *Capreolus capreolus*, *Capra ibex*, and *Sus scrofa*) or heavily reduced (*Rupicapra rupicapra*). Along with the lynx, predators such as the wolf (*Canis lupus*), the brown bear (*Ursus arctos*), and even the scavenging bearded vulture (*Gypaetus barbatus*) disappeared. Since the end of the 19th century, forests have regenerated, and during the first half of the 20th century, the ungulate populations recovered quickly. This improvement inspired the idea of also bringing back large predators. In the late 1950s, reports of the expansion of the Carpathian lynx population towards the west (Hell 1961) and rumours about lynx migrating through the Alps (Schmidt 1960) directed wider attention to this large feline. In 1962, lynx and brown bear were given legal protection in Switzerland. As a result, plans of re-introducing the lynx were seriously discussed, and studies on the decline of the species in Switzerland created further support (Schauenberg 1969, Eiberle 1972). A resolution of the Swiss federal government approved the return of this large cat in 1967, and Switzerland was the first country to officially re-introduce the lynx into the Alps in the early 1970s. This re-introduction was started as a contribution to the First European Nature Conservation Year in 1970 (Lienert 1980).

The lynx population in the Swiss Alps is, apart from the Slovenian one, the most established of the re-founded populations, and is often cited as a rare example of a successful re-introduction of a large predator

(Yalden 1993). In recent years, however, the expansion of the population has halted, and a decrease in the number of observations in the former centre of the population indicates that the population may not be as viable as generally assumed. In fact, there are two lynx populations in Switzerland, one in the Alps and one in the Jura Mountains in north-western Switzerland. In this report, we will focus on the Alpine population. The data presented and the maps shown will, however, include both populations, because they may have merged in France (Stahl and Vandel 1998). Furthermore, some of our more general conclusions are based on observations from the Jura population, as in recent years field work has only been carried out in the Jura Mountains.

Monitoring and data available

The releases of lynx in Switzerland were not coordinated, and there was no research or monitoring programme accompanying the re-introduction. None of the lynx set free in Switzerland were radio-tagged. On the contrary, the releases were kept secret and some official actions were even denied in public for some time. Consequently, there was no systematic collection of observations in the earliest phase of re-colonization, with the exception of the examination of presumed lynx kills (Klingler and Breitenmoser 1983). A scientific programme started only in 1980, when problems of predation on livestock arose. Since then, an on-going research and monitoring programme has evolved into what we now call the *Swiss Lynx Project.*

The first study reconstructed the expansion of the lynx population in the northern Swiss Alps, using 535 observations from the years 1971-81 that were gathered from annual reports of state game wardens as well as from questionnaires (Breitenmoser 1983). Haller (1992) completed the review for the central Swiss Alps. A similar study was carried out for the Jura Mountains (350 lynx observations from 1972-87; Breitenmoser and Baettig 1992). Capt (1995) resumed this survey in 1992 by distributing lynx-observation forms to potential observers (mainly game wardens) in all lynx areas of Switzerland. Fifty-three direct or indirect observations (kills, tracks) were reported for the year 1992 alone. As this method did not allow discrimination between 'no report' and 'no observation', simplified annual questionnaires have been sent out to all state game wardens and hunters' associations since 1993, in order to obtain a systematic monitoring of the Swiss lynx populations (Capt 1995).

Three more sources of information on the presence of lynx are available: (1) records of livestock killed by lynx (Appendix I), (2) reports on lynx killed or found dead (Appendix II), and (3) lynx trapped alive for the purpose of equipping them with radio-collars. All domestic animals clearly killed by lynx are compensated for. Up to 1988, this reimbursement was paid by the *Swiss League for the Protection of Nature* (SBN), and subsequently by the federal and the cantonal governments. As a loss will only be compensated for if approved by a qualified state game warden, these records are mostly an objective proof of lynx presence, though both errors and even deception have occurred. To instruct game wardens how to recognize lynx kills, special courses were organized, and a brochure (Breitenmoser and Denzler 1989) and an educational video (Breitenmoser et al. 1989) were produced. Data of lynx predation on livestock have been compiled by Breitenmoser (1988), Blankenhorn et al. (1990), and Capt et al. (1993). The best evidence of lynx presence is a lynx found dead. The *Swiss Lynx Project* maintains a data base of all known carcasses of lynx from the two Swiss populations. Until autumn 1995, this file contained 103 records.

A total of 37 lynx were caught and fitted with radio-collars for the research projects carried out in the northern Alps from 1983-88 (Haller and Breitenmoser 1986, Breitenmoser and Haller 1993), in the central Alps from 1986-89 (Haller 1992) and in the Jura Mts from 1988 to the present (Breitenmoser et al. 1993). These field studies are the main source of information on the land tenure system and the population dynamics of the lynx in Switzerland.

Origin of the populations

The information available on the re-introduction in Switzerland has been reviewed by Breitenmoser (1983) and Haller (1992) for the Alps, by Breitenmoser and Baettig (1992) for the Jura Mountains, and summarized by Breitenmoser and Breitenmoser-Würsten (1990). At least 14 lynx were released in five different places in the Swiss Alps, 8-10 lynx in the Jura Mts, and 3 lynx in the Swiss Plains (Table 1, Fig. 1). There is some uncertainty about the exact numbers and origin of the lynx set free in Switzerland, because all releases were made clandestinely and private actions took place apart from the officially authorized operations. There was some legal uncertainty about the translocation of wildlife in those years. The lynx for the official, and probably for most of the unauthorized, translocations came from the autochthonous population of the Slovakian Carpathian Mountains. The animals were provided by the Ostrava Zoo, who got them from hunters who captured the lynx in the wild. There is, however, no proof that all the lynx released in Switzerland were really wild-born animals, because the source of some of the unofficially released animals is not known. All lynx for the official translocations were transferred to Switzerland through the Basel Zoo, where they spent one month in quarantine. The animals were then brought to the site of release and were set free immediately. None of the animals released was fitted with a radio-collar, and

Table 1. Releases of lynx in Switzerland. Cantons: BE: Berne; GR: Grisons; LU: Lucerne; NE: Neuchâtel; OW: Obwald; VD: Vaud; VS: Valais. # Lynx M/F: Number of lynx (males / females) released. Fig. 1: sites of releases as shown in Figure 1. Notes in *italic* indicate unconfirmed releases.

Year	Site	Canton	Region	Fig.1	# Lynx M/F	Origin	Type of re-introduction
1971	Grosses Melchtal	OW	Alps	1	1/1	Ostrava	official
1972	Kleinschlierental	OW	Alps	2	1/1	Ostrava	official
1972	*Moutier*	*BE*	*Jura*	*6*	*1/1*	*?*	*unofficial*
1972	Pilatus	LU	Alps	2	1/1	Ostrava	unofficial
1972	Engadin	GR	Alps	3	1/1	Ostrava	unofficial
1973	Pilatus	LU	Alps	2	1/1	Ostrava	unofficial
1974	Creux-du-Van	NE	Jura	6	1/1	Ostrava	official
1974	*Vallée de Joux*	*VD*	*Jura*	*8*	*2/2*	*?*	*unofficial*
1975	Creux-du-Van	NE	Jura	6	1/1	Ostrava	official
1975	*Corbeyrier*	*VD*	*Alps*	*4*	*?*	*?*	*unoffical*
1976	Grand Muveran	VD	Alps	4	2/0	Ostrava	official
1976	*Val d'Anniviers*	*VS*	*Alps*	*5*	*?*	*?*	*unofficial*
1980	Engadin	GR	Alps	3	1/1	Ostrava	unofficial
1989	Jorat	VD	Plateau	9	*3*	?	unofficial

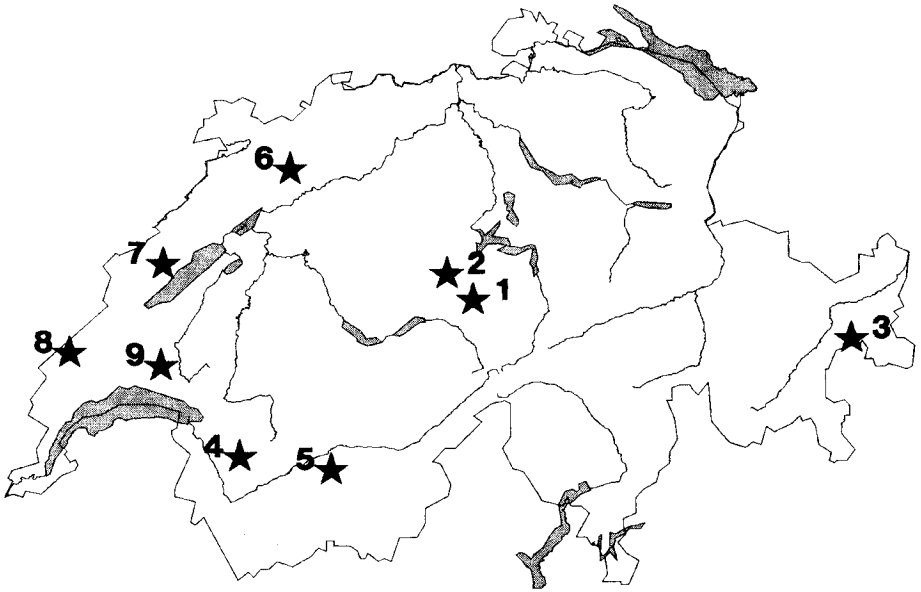


Figure 1. Sites of lynx releases in the Alps (1-5), the Jura Mountains (6-8) and on the plateau (9) of Switzerland. 1: Grosses Melchtal; 2: Kleinschlierental / Pilatus; 3: Engadine (Swiss National Park / Italian border); 4: Grand Muveran / Corbeyrier; 5: Val d'Aniviers; 6: Moutier; 7: Creux-du-Van; 8: Vallée de Joux ; 9: Jorat. Further details see Table 1.

presumably only the first ones were tagged. Thus, the fate of the founder individuals remained unknown.

Legal status

Lynx was given legal protection by the Swiss federal law in 1962. This was the juridical prerequisite for the return of the large feline. With the revision of the *Federal Law on the Hunting and Protection of Free Living Mammals and Birds* (JSG) and the corresponding decree (JSV) in 1988, the protection was even strengthened. The species is now protected year-round (JSG Art. 7^1), and a lynx causing damage to livestock can only be shot or captured if both cantonal and federal authorities give permission (JSG Art. 7^2, JSV Art. 10^4). On the other hand, the confederation has to pay 30-50% of all damages caused by lynx (JSG Art. 13^4, JSV Art. 1^4). The remaining compensation has to be covered by the cantons. There was some uncertainty about the juridical requirements for translocations in the early 1970s, when the unauthorized releases took place. This has been clarified with the revision of the law, as today, all translocations of protected species need to be sanctioned by the fede-ral authorities (JSG Art. 9^1). Switzerland has signed and enforced both, the Washington convention (CITES, in 1975) and the Bern Convention (in 1982), which provide an international protection for lynx.

Development and present status of the populations

The first releases in the Alps were those in the canton of Obwald from 1971-73 (Table 1, Fig. 1). Of the 2 lynx released in the *Grosses Melchtal* and the 6 lynx released in the *Pilatus* region, an initial population de-

veloped and spread over the northwestern part of the Swiss Alps. Because of the topographical characteristics of this region, the lynx advanced faster towards the west than to the east. By 1981 - ten years after the first releases - the population covered an area of some 4000 km^2 (Breitenmoser 1983). By then, the lynx released in the canton of Vaud (Fig. 1) had already merged with the population of the northern Alps. Lynx also migrated into the canton of Valais (central Alps). Early observations in the cantons of Vaud and Valais, however, indicate that there were already lynx present - from unofficial releases - before the first animals from the northern part of the Alps migrated there (Haller 1992). Two trials in the Swiss National Park from 1972 and 1980 did not found a new population. There was never any evidence of reproduction, and in spite of Schloeth's (1978) optimistic statement that the lynx was re-integrated in the Lower Engadine, all lynx set free in this area disappeared with fates unknown. Nevertheless, it cannot be ruled out that the presence of lynx in the Valtellina Valley (Italy) may have their origin in the releases of 1980 at the Swiss-Italian border (see also Ragni et al. 1998).

The spatial development of the Alpine population can be derived from the distribution (Fig. 2a-d) and the development of cases of depredation and of lynx killed or found dead (Appendix I). Up to 1979 (Fig. 2a), the observations were somewhat concentrated in the region south-west of the *Vierwaldstättersee* (Lake Lucerne) and east of Lake Thun. In the following five years (1980-84; Fig. 2b), there was an expansion to the east and to the west. In the east, the river *Reuss* was crossed, and observations were regularly reported from the cantons of Uri and occasionally Glarus. In the west, lynx crossed the river *Aare* and reached the *Simmental* (Bernese Oberland). At least one individual crossed the *Grimsel* pass (2165 meters) from the canton of Berne towards the canton of Valais (Breitenmoser 1983). During this time, the lynx released in the western part of the Swiss Alps merged with the population spreading from central Switzerland. The area occupied no longer increased from 1985-89 (Fig. 2c), though the observations rose (mainly due the number of sheep killed in the canton of Valais). During the last five years (1990-94; Fig. 2d), a reduction in range to the east and also a decrease in depredations, whereas reported lynx mortalities have remained almost the same (Fig. 2). In recent years, no more observations were reported from areas in the cantons of Uri or Glarus (eastern Central Switzerland), which had continuously produced observations in the 1980s. In the 1992/93 inquiry (S. Capt, unpubl.), the presence of lynx east of the river *Reuss* was reported only from three isolated game districts. In the south-west of the population in the Swiss Alps, lynx probably migrated to the French and Italian Alps, but there is no indication that populations are established in these parts of the Alps (see also Ragni et al. 1998 and Stahl and Vandel 1998).

The expansion of lynx in the Swiss Jura Mountains until 1987 was described by Breitenmoser and Baettig (1992). Since then, the population has not spread any further. It is more likely that the area occupied has even decreased in the north-east of this mountain range. The fate of the lynx released in the lowlands (site 9 in Fig. 1) is not known. Signs of lynx presence in this region ceased after a few observations in winter 1989/90.

Haller (1992) estimated the lynx population of the Swiss Alps at 35-40 adult individuals. This figure was based on personal experience in the northern and central Alps as well as on reported observations. Estimating the number of individuals in a large carnivore population in forested habitat is particularly difficult because the low population density impedes the application of standard methods such as night counts, track transects, or catch-and-release procedures. An approximation can be calculated if (1) the land tenure system of the species is characteristic, (2) data on individual home-range size

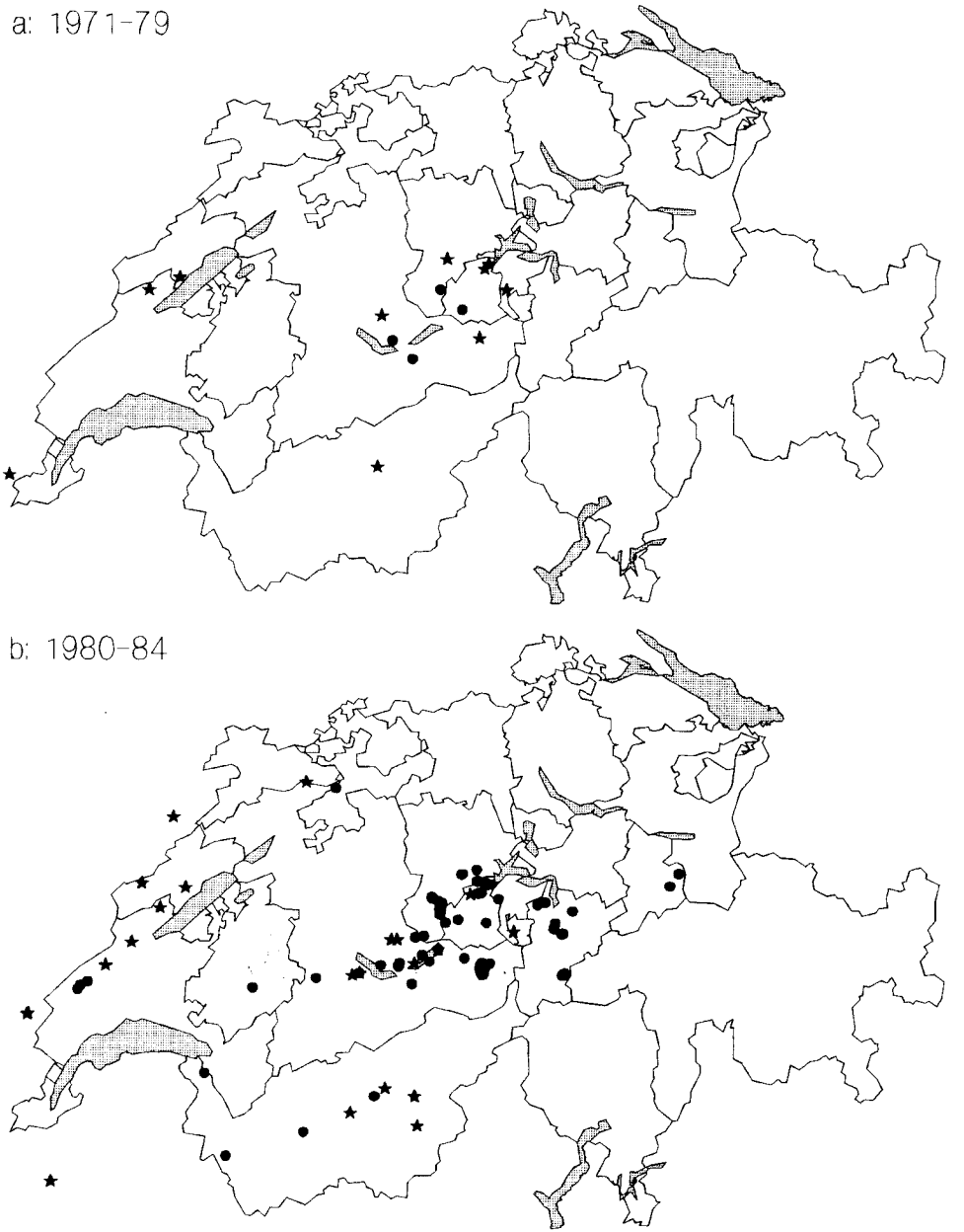
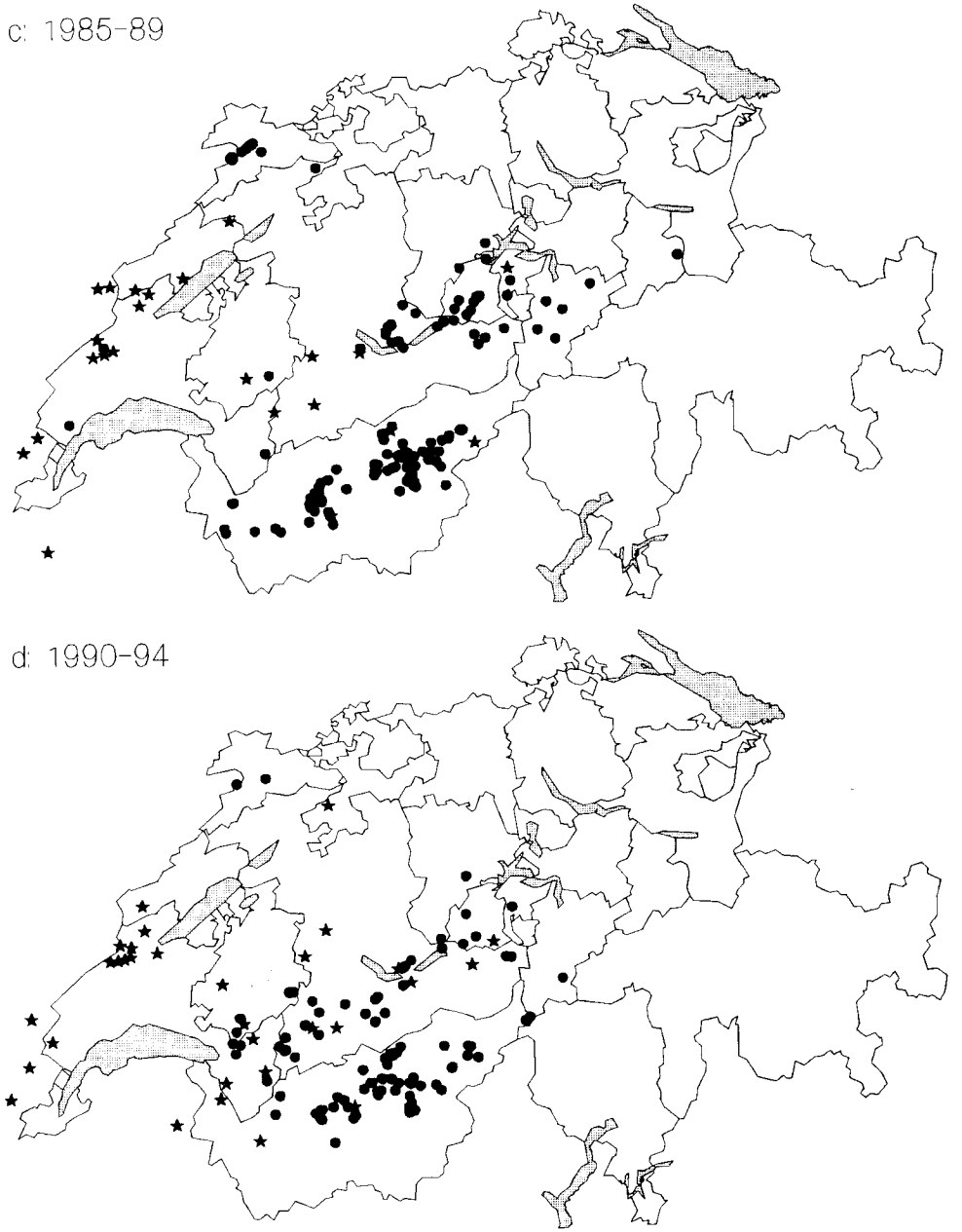


Figure 2. Distribution of the lynx in Switzerland per five-year periods shown from the cases of predation on livestock (dots) and lynx killed or found dead (stars). (a) 1971-79: 9 domestic animals, 11 dead lynx; (b) 1980-84: 177 domestic animals, 23 dead lynx; following page: (c) 1985-89: 333 domestic animals, 27 dead lynx; (d) 1990-94: 185 domestic animals, 37 dead lynx (including 5 dead lynx from January - June 1995). The figures show the data reported both from the Swiss Alps and from the Jura Mts. The two lynx populations are separated by the Swiss Lowlands, which extend from Lake Konstanz to Lake Geneva. This densely settled and cultivated area has not been crossed by lynx so far.



are available, and (3) the total area occupied is known. Lynx in the Swiss Alps occupied individual home ranges from 39-425 km^2 for females and 135-450 km^2 for males (Haller and Breitenmoser 1986, Haller 1992, Breitenmoser and Haller 1993). The home ranges in the Jura Mts were 71-243 km^2 and 237-281 km^2, respectively (Brei-

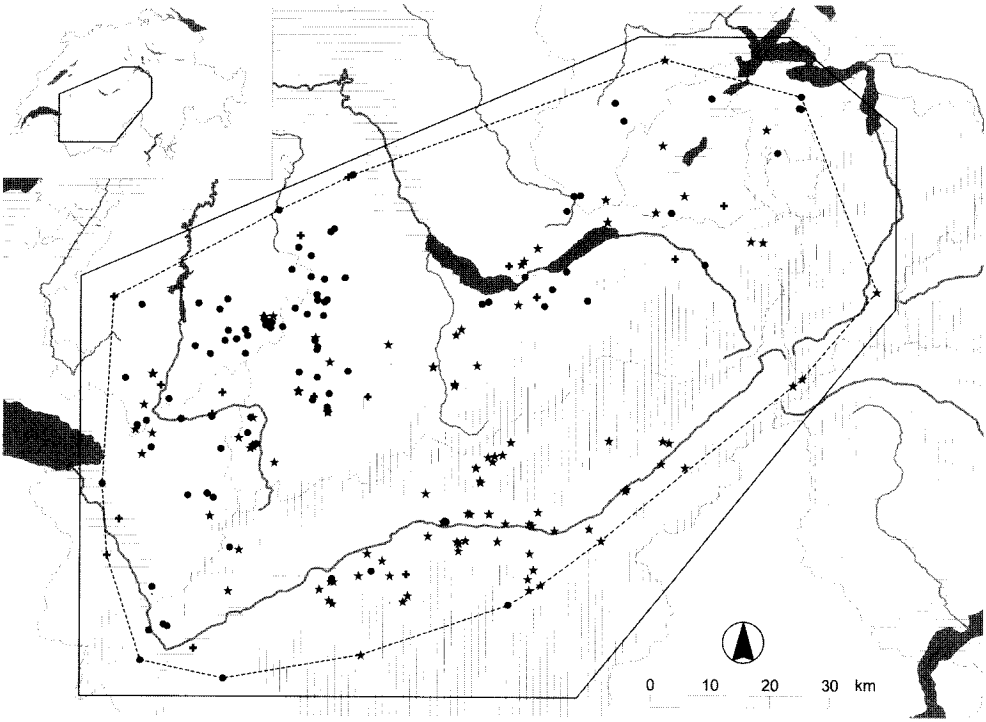


Figure 3. Distribution of lynx records in the Swiss Alps during the 1990-94 period. Stars indicate dead lynx (n = 36), circles livestock killed by lynx (n = 185), and squares all other confirmed observations (n = 94). The broken line represents the convex polygon of the outermost observations, the solid line polygon (10,448 km^2) includes the approximate area which is at present occupied by lynx. Solid lines mark the borders of cantons and of Switzerland, respectively. Major lakes are shown in black. The horizontal shading represents terrain below 600 m, vertical shading terrain above 2000 m (the broken vertical pattern south of the polygon is a region of mainly high-alpine elevations from where digitised altitude data were not available).

tenmoser et al. 1993). The ranges of neighbouring females did not overlap (Kaczensky 1991), and those of males only marginally (<10%; Dötterer 1992). We can deduce from these studies that the average density in the Alpine lynx population in Switzerland is no higher than one resident individual per 100 km^2 of suitable habitat. For the 1990-94 period, a polygon drawn around the signs of lynx presence (94 observations, 185 kills of domestic animals, and 36 lynx found dead) covered an area of 10,448 km^2 (Fig. 3). This sector includes 3243 km^2 of ground above 2000 meters and 691 km^2 below 600 meters, where lynx roam only exceptionally. Of the remaining area, 1841 km^2 are agricultural land, settlements or water bodies; thus we estimate the area at some 5000 km^2 of suitable habitat (mainly woodland, meadows, pastures, and unproductive areas). This would correspond to 50 resident lynx for the total area occupied in the Swiss Alps. In addition to these resident adult lynx, the population consists of subadult dispersers and of kittens accompanying their mothers. Observations in the Jura Mts during winter revealed that juveniles added to the overall density of the population by about 0.5 lynx per 100 km^2 (Breitenmoser et al. 1993). The estimate of 50 resident lynx is still quite

generous, as the polygon shown in Fig. 3 contains areas such as the *Emmental-Napfgebiet* (about 700 km^2) with no observations reported. Furthermore, a single observation in Fig. 3 indicates the presence of the lynx in the valley of the *Reuss* (canton of Uri) during the last decade. The game wardens of this region have no longer reported any lynx observations in recent years. On the other hand, some isolated and unconfirmed observations east of the settled area (Fig. 2, Capt 1995) suggest that at least one lynx dispersed further east. We conclude that our density estimation is similar to Haller's (1992) estimate, and that there has been no recent expansion of the lynx population in the Swiss Alps.

Discussion: Verdict on the present situation

After a swift expansion towards the west in the first decade, the lynx population in the Swiss Alps has stagnated over the last ten years, although there is still suitable habitat in the east and in the south (cantons of Grisons and Ticino). The reduced density of observations in recent years mainly in the east of the occupied area indicates that the population has even retreated. Population growth was obviously not high enough to encourage further expansion. Solitary territorial animals such as the lynx may not behave very exploratively. Even during the early years after the re-introduction, the expansion to the west was probably not as first assumed by Breitenmoser (1983), because the extent of the clandestine releases in the western part of the Swiss Alps had been underestimated. Lynx remain in contact with their conspecifics for the acquisition of high quality territories and subsequent reproduction. Consequently, the capacity for expansion of a lynx population is rather low, as new territories are only added at the edge of a settled area if the population produces surplus individuals. In the Jura Mts, where we have observed a similar tendency, low survival of young lynx did not allow the replacement of losses among adult lynx (Breitenmoser et al. 1993). The same may apply for the Alpine population. However, the number of observations reported varies from region to region and from year to year. While for most areas the number of records decreased, it increased in the region southwest of the lake Thun during the last three years (Fig. 2d). Therefore, it is difficult to establish a general trend for the entire lynx population in Switzerland.

The stagnation of the population could be related to (1) reduced survival of young lynx and/or (2) increased mortality among resident adults. Both possibilities have to be taken into consideration. The mean age of adult lynx caught during our field study was 4.8 years (2-15 years, n=22). This rather low mean age for a long-living species indicates that the turnover - and therefore the mortality - among the resident lynx is high. The losses given in Appendix II are minimum estimates. Undoubtedly, the number of unknown cases of lynx illegally killed is quite large. For example in the Jura Mts, only one out of four radio-tagged lynx that were shot would have been found without a transmitter. We assume that illegal killing is still the most important single cause of mortality. Haller (1992) concluded that illegal shooting of lynx was a serious threat to the lynx population in the canton of Valais. Although the controversy about the lynx re-introduction has levelled off in recent years, and most hunter's association today formally accept the lynx as a part of our autochthonous fauna, some hunters and sheep breeders still regard the lynx as a pest and - although the species is protected by law in Switzerland - frankly state that they would shoot any lynx given the opportunity. One reason (or rather excuse) for the opposition of hunters to the lynx is the fact that the releases were carried out clandestinely, and some even without the required permission. Though the re-introduction was lengthily discussed and a

lasting controversy about the return of this predator arose, there was no follow-up programme after the animals had been set free. Those who initially released lynx believed that they were best protected when left alone and no information on the project was disclosed. Although this strategy appeared successful in first place, it may have amplified and maintained the controversy. As no authentic information was available, there was much room for rumours and the confirmation of archaic prejudices, which are now very hard to overcome.

On the other hand, we have observed low kitten survival in the Jura Mts (Breitenmoser et al. 1993) and speculated that this may be an effect of genetic problems (Breitenmoser et al. 1994). There is no evidence for this hypothesis so far, but we have to bear in mind that for the re-introductions, no precautions were taken to prevent genetic problems. The number of individuals released was low, and - as they presumably all originated from the same source - the degree of relatedness was probably high. Again, the lack of information about the translocations and the unknown history of the released individuals do not allow further conclusions at this stage. To secure the future of the lynx populations in Switzerland we must establish genetic monitoring and compare our populations with other re-introduced or autchthonous populations. At the same time, law enforcement and education must be improved in order to stop the illegal killing of lynx.

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Zusammenfassung

Der Luchs wurde in der Schweiz im 18. und 19. Jahrhundert ausgerottet. Nachdem die Art 1962 gesetzlichen Schutz erhielt, begann 1970 ein Wiederansiedlungsprogramm (Tab.1). Bis 1976 wurden mindestens 14 Luchse aus den slowakischen Karpathen in den Schweizer Alpen freigelassen (Abb.1). Eine zweite Wiederansiedlung erfolgte im Jura; zwischen den beiden Populationen besteht jedoch in der Schweiz keine Verbindung. Die Wiederansiedlungen wurden am Anfang nicht überwacht. Erst als 1980 die ersten Schäden an Haustieren (Appendix I) auftraten, begann ein noch andauerndes Forschungsprojekt. Die Übergriffe auf Haustiere erreichten 1988 mit 86 Tieren ihr Maximum. Seither sind sie zurückgegangen und haben sich bei 30-40 Tieren pro Jahr stabilisiert. Die Wiederansiedlungen in den Alpen waren unkoordiniert und nicht überall erfolgreich. Nur die Freilassungen in den Nord- und Westalpen führten zur Populationsgründung. 1981 besiedelten die Luchse in den Schweizer Alpen rund 4000 km^2. Im Westen haben die Luchse heute Frankreich und Italien erreicht. Gegen Osten schritt die Ausbreitung langsamer voran und kam vor 10 Jahren zum Stillstand. Während den letzten 5 Jahren beobachteten wir sogar eine Reduktion der besiedelten Fläche im Osten des Verbreitungsgebiets (Abb.2). Die Luchspopulation besiedelt heute in den Schweizer Alpen eine Fläche von rund 10'000 km^2 (Abb. 3), wovon 50% geeignetes Luchshabitat ist. Nach der mittleren Wohngebietsgrösse und der Überlappung der Territorien benachbarter Luchse - ermittelt aufgrund radiotelemetrischer Überwachungen - schätzen wir die Zahl der residenten Luchse im besiedelten Gebiet auf ungefähr 50 Tiere. Der für eine weiter Expansion des Siedlungsgebiets notwendige Populationsdruck scheint gegenwärtig zu fehlen. Die Zahl der überlebenden Jungtiere vermag kaum die Verluste unter den adulten

Tieren durch Verkehrsunfälle und illegale Abschüsse (Appendix II) zu kompensieren.

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Appendix I: Predation on livestock by lynx in Switzerland and compensation paid. In the Alps, 14 cases were species other than sheep or goats; in the Jura Mts, 7 cases were not sheep. Other species were: 15 fallow deer (*Dama dama*), 1 red deer (*Cervus elaphus*), 1 moufflon (*Ovis ammon*) (all from enclosures), and 4 cattle (calves of the small-size "Aberdeen" breed born on pastures, unconfirmed lynx kills). Total compensation (Amount) is given in Swiss Francs.

Year	Alps			Jura Mts		Cases compensated	
	Sheep	Goats	Total	Sheep	Total	Number	Amount
1973	1	0	1	0	0	1	300
1975	1	0	1	0	0	1	150
1979	7	0	7	0	0	7	690
1980	10	1	11	0	0	11	2,470
1981	43	0	50	2	3	53	13,022
1982	44	8	53	3	3	56	17,598
1983	34	0	34	0	0	34	7,310
1984	23	0	23	0	0	23	8,890
1985	54	1	55	0	4	59	12,330
1986	57	4	61	11	11	72	20,852
1987	42	0	42	27	29	73	16,291
1988	77	4	81	5	5	82	26,486
1989	51	12	64	8	8	72	31,000
1990	34	3	40	2	2	42	13,413
1991	19	5	24	0	0	24	9,220
1992	30	2	32	0	0	32	15,400
1993	18	3	23	2	2	25	14,930
1994	39	4	43	0	0	43	16,970
	584	47	645	60	67	712	227,322

Appendix II: Causes of lynx mortality from the two re-introduced populations in Switzerland. Spatial and temporal distribution see Fig. 2. The categories include: Traffic: road (23) and railway (5) accidents; unknown: carcasses where an anamnesis was not done or no longer possible; natural: disease (4), drowning (3), or accidents (2); illegally shot: lynx shot during the hunting season or found dead with injuries caused by firearms; captured: young orphaned lynx caught in the wild and put into captivity; other human: other direct or indirect mortality caused by humans. The age categories are: ad: adult (>2 years); sub: subadult 1-2 years); juv: juvenile (<1year); ?: unknown age. Of the 103 total casualties, 41 were males, 35 females, and 25 were lynx of unknown sex.

Category	Alps				Jura Mts				Total
	ad	sub	juv	total	ad	sub	juv	total	
Traffic	6	3	5	14	4	6	4	14	28
Unknown	6	2	5	15	4	0	5	11	26
Natural	1	1	1	3	2	3	1	6	9
Illegally shot	7	2	5	17	7	0	1	10	27
Captured	0	0	5	5	0	0	1	1	6
Other human	1	0	2	3	0	1	3	4	7
Total	21	8	23	57	17	10	15	46	103