

DISTRIBUTION OF THE LYNX IN THE FRENCH ALPS

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ABSTRACT - The European lynx disappeared from the French Alps around the beginning of the 20th century. The recovery in France is due to the re-introduction in Switzerland between 1971 and 1976. From 1974 to 1994, there were 70 records. The first records were recorded in Chablais. More regular records were around the Aravis mountains. Over 20 years, a southward expansion of about 200 km has been observed but no continuous distribution area has been shown by the survey. Observations remained scattered, probably because of low observation effort in many areas. Different possibilities for connections with the Jura populations seemed to exist in the French Alps. Bauges, Chartrouse and even Salève could have been reached by individuals originating from the Jura or from the northern Alps. If the presence of the lynx south of Grenoble in the Vercors and in the Hautes Alpes département is confirmed, expansion of the population over the whole south-east of France would be possible.

Key-words: *Lynx lynx*, status, distribution, monitoring, France, Alps

INTRODUCTION

The European lynx (*Lynx lynx*) disappeared from the Alps around the beginning of the 20th century (Lavauden 1930, Schauenberg 1969, Mingozi et al. 1988). Its recovery in France is due to the reintroduction in Switzerland from 1971 to 1976 in the Alps and in the Jura (Breitenmoser 1983, Breitenmoser and Baettig 1992, Breitenmoser et al. 1998). The first proof of presence of the lynx in France was registered in the Jura forests in October 1974. In the Alps, the presence of the lynx was suspected as early as 1975 (Kempf 1979), but the first confirmed records occurred much later, in January and February 1982 in the Haute Savoie département. Some doubtful records that cannot be related to the Swiss reintroductions were collected in the Haute Savoie département during the 1960s (Ariagno 1976, Estbeve 1982) and in the Queyras in the mid 1970s (Mingozi et al. 1988). The survival of an unnoticed indigenous alpine population up to this period is improbable, and these records will not be taken into account in this report.

From 1979 to 1989, no standardised national method was used to collect data on the presence of the species. Some data were collected by C. Kempf from different people up to 1984, then by the Office national de la chasse from 1985 onwards. Some other data were published (Erome 1982, F.R.A.P.N.A undated). A preliminary synthesis of data collected between 1974 and 1986 on the presence of the species in the Vosges and Jura Mountains was published by Herrenschmidt and Léger (1987) but the few data collected in the Alps remained unused.

From 1989 onwards, an original methodology of data collection was set up by the Office national de la chasse at the request of the Ministry of Environment. A network of observers was created (i) to evaluate the damage caused by lynx to domestic animals, and (ii) to survey the distribution trend of the lynx. These lynx-specialised groups were set up in 1989 in the Jura Mountains. In 1990 they were set up in the Alps départements where the presence of the species had already been proven (Savoie, Haute Savoie, Isère). To the south, in the dé-

partements of Drôme and Hautes Alpes, the personnel of the Office national de la chasse was on the alert to detect the coming of lynx as soon as possible. At the beginning of 1994, after the first signs of presence had been detected, lynx-specialised groups were also created in these *départements*. This report contains an analysis of data collected between 1974 and 1994.

ORIGIN OF THE LYNX IN THE FRENCH ALPS

The presence of lynx in the French Alps was due to the Swiss reintroduction. No information supports the hypothesis of clandestine reintroductions in France. A reintroduction project was launched at the end of the 1970s in the Vercors (Noblet 1979) but did not become effective. Reintroductions were made in Switzerland in different parts of the Alps and the Jura. Some lynx dispersal was observed in the Swiss Alps as well as in the Swiss Jura (Breitenmoser 1983, Breitenmoser and Baettig 1992). The Jura population spread over the whole French Jura forest (Vandel et al., in prep.). In the French Alps, some overlapping areas and exchange possibilities may exist between the populations of Alpine and Jura origin. The areas which might be concerned by the expansion of either population and the hypothetical colonisation routes will be presented in the chapter *Development of the population*.

LEGAL STATUS

Under the *Protection de la nature* law, destruction, mutilation, capture, transport, trade and utilisation of European lynx specimens are forbidden. Offenders are liable to a fine of 60,000 French Francs (FF.) and six months imprisonment. The Ministry of Environment, after taking advice from the *Conseil national de la protection de la nature*, may authorise the capture or destruc-

tion of some individuals to prevent important damage to livestock, to protect public safety or to ensure the conservation of the species in the wild. The national laws applied are:

Law n° 76-629 of July 10, 1976 (article 3, art. 4, and art. 32); decree n° 77-1295 of November 25, 1977; decree of April 17, 1981 adopting the list of protected mammals; and the decree of July 22, 1993 which modifies the former decree.

International regulations on the subject are (i) the Washington Convention (CITES; ratified in 1978 by France): The lynx is listed in Appendix II. Offenders may be subject to punishment under customs legislation or the law for protection of nature. (ii) the Bern convention (Convention on the Conservation of European Wildlife and Natural Habitats; ratified by France in 1990): The lynx is listed in Appendix III. (iii) the Directive 92/43 of the Council of Europe of 21 May, 1992: The lynx is listed in Appendix II (species for which special conservation areas are to be designated ("Natura 2000" network) and in Appendix IV (strictly protected species).

Specific measures are taken to reconcile sheep-farming and lynx conservation. A procedure for the evaluation of lynx damage to domestic animals and for the payment of compensation to Farmers was set up by the Ministry of Environment in the Jura Mts in 1989 and in the Alps in 1990. Lynx damage appraisal: Damage assessment by an expert is required if the farmer wants to receive compensation. The expert is a sworn official (generally a warden from the Office national de la chasse) who has followed special courses on the biology of the lynx (see *Monitoring*). Lynx damage compensation : For every domestic animal acknowledged to have been killed or wounded by a lynx, compensation is paid to the farmer by the *Fonds Français pour la nature et l'environnement* (French Fund for Nature and Environment). Agricultural organisations are consulted to set the scale of

compensation. When the expert has any doubts about the responsibility of the lynx in an attack, less compensation is paid. If the farmer disagrees with the expert, the report is examined by a committee of representatives of the administration and farmers. For sheep, compensation varies between 500 FF and 3500 FF per animal, depending on age, sex and quality of the animal. For each attack, a contractual compensation depending on herd size is also paid for disturbance (maximum of 1500 FF). Veterinary care for the injured animals is repaid. Compensation paid to farmers in France has reached a maximum annual amount of 600,000 FF.

Measures to protect herds: Several experimental measures are proposed to farmers (watchdogs, fitting sheep with thick leather collars). These measures may be partly funded by the *Fonds Français pour la nature et l'environnement*. However, in sheepfolds surrounded by forest, the only effective method is to keep the sheep in a pen at night. Permits to remove lynx which attack sheep may be delivered by the Ministry of Environment in strictly controlled situations in order to stop attacks in high-damage areas. Removal of lynx is performed by trapping or shooting by the wardens of the Office national de la chasse and is only permitted when the lynx enters a herd to eat a previously-killed prey or when it is in the process of attacking domestic prey. No permit has been requested or delivered in the Alps. In the Jura, seven lynx were removed in high-damage areas between 1989 and 1991, and none between 1991 and 1994.

MONITORING

Seven signs of presence were taken into account: tracks, wild prey remains, domestic prey remains, sightings, dead lynx, scats, and hair. Two periods were distinguished:

(a) Before establishment of the survey methods

(1974-1989). Origin of data: The data collected were (i) the records compiled by Kempf until 1984; (ii) data entered in the Office national de la chasse database collected between 1985 and 1989; and (iii) data from the literature. Assessment of reliability of the data: The reliability of the data collected before 1989 was difficult to assess. All data were carefully examined by ourselves and the same criteria applied for the period 1990-1994 were used to evaluate their reliability (see below). According to these criteria, some data were rejected, others previously believed to be confirmed became questionable. They failed if they were in the category of doubtful cases.

(b) After establishment of the survey methods (1990-1994). Origin of data: Since 1990, data gathered by the lynx-specialised boards have been centralised by the Office national de la chasse. The local administration is responsible for the lynx-specialised boards. In each *département*, they bring together about 30 regional coordinators (Office national de la chasse agent, foresters, hunters, naturalists). Regional coordinators participate in a two-day course given by the predator specialists of the Office national de la chasse. They are then in charge of (i) the evaluation for every attack on domestic animals reported by farmers in which a lynx is suspected (ii) the collection and verification of data on presence of the species. They do not have to search for field signs by themselves but rather to gather and verify all possible sightings made by other people (foresters, hunters, hikers). Data reliability assessment: Each category of field sign is described on an appropriate form. Objective identification criteria are defined for each category of field sign. Criteria are listed on each form and should be examined and completed by the regional coordinator before he reaches a conclusion about the reliability of the data. Hair and scats are a special case. They are not identified by the regional coordinators but are sent to the Of-

fice national de la chasse. Morphological analysis (medulla, cortex, scale pattern) is carried out by the usual methods. Scats are attributed to lynx only if lynx hairs are found in the scats.

Three levels of reliability are acknowledged: (1) Confirmed data: data are confirmed only if a proof is produced (a photograph for sightings, a photograph or a plaster cast for tracks, a diagram of the spaces between the bite holes and a precise description of the consumption characteristics for a wild or domestic prey. corpses for dead lynx). (2) Probable data: reliability of data is probable when information is entirely consistent but without material proof. (3) Doubtful data: data fall into this category when information is incomplete or unverifiable. Many sightings fall into this category (many people could describe a lynx even if they had not seen one). For attacks on domestic animals, the case is somewhat different. Data is classified as doubtful if the regional coordinator has doubts about the identification of the predator but cannot prove that a lynx is not involved. For compensation, a doubtful lynx attack should benefit the farmer. When studying distribution, isolated doubtful data are of little interest. but their repeated occurrence in the same areas may attract attention to the possible presence of the species.

Since the establishment of the boards of lynx specialists, criteria of reliability have not changed. All data transmitted by the re-

gional coordinators were nevertheless examined before they were included in the database in order to adjust for a possible overestimation of their reliability.

Data were analysed with the Geographic Information System 'ARC INFO'. Data were pooled by periods of 12 consecutive months. Each period starts in May at the onset of dispersion of the subadult lynx and ends the following year in April. The detection of dispersal movements outside the previous distribution area is then maximised and may allow a better detection of year to year expansion. For convenience, periods are numbered by the first year (for example '1974' is the period from May 1974 to April 1975).

The convex polygon method was not appropriate for estimating areas occupied by lynx in the Alps because of the presence of large inhabited areas (urbanised areas in the valleys), and areas of high alpine mountains. To estimate the minimum size of the distribution area, each item of data was centred in an circle of 8 km radius (= 200 km²), which is the possible size of a lynx home range. These circles were truncated if they crossed important natural barriers (large rivers, railways without viaducts). For each period, all the 8-km-radius areas were overlaid to estimate the extent of lynx distribution.

Figures were drawn for five-year periods. For each five-year period, the confirmed distribution of the first year was drawn first. Confirmed distribution areas for the follow-

Table 1. Number and reliability of records collected of the presence of the lynx in the French Alps.

| Reliability | Period | | | |
|-------------|-----------|-----------|-----------|-----------|
| | 1974-1978 | 1979-1983 | 1984-1988 | 1989-1994 |
| Confirmed | 1 | 3 | 2 | 11 |
| Probable | 0 | 1 | 1 | 13 |
| Doubtful | 4 | 7 | 1 | 26 |
| Total | 5 | 11 | 4 | 50 |

ing years were then added to complement them year by year. Probable data not already included in the confirmed distribution areas were added in the same way. Finally, doubtful data were added if they were not already included in the confirmed and probable distribution areas. Between 1974 and 1994, 70 data were collected on the presence of the lynx in the Alps: 64 field signs (wild prey, tracks, sightings, dead lynx, scats and hairs) and 6 attacks on domestic animals. These data were classified as confirmed in 17 cases, probable in 15 and doubtful in 38 (Table 1, Appendix I).

DEVELOPMENT OF THE POPULATION

Distribution trends are shown in Fig. 1. Areas did not vary much during the first three periods (Table 2). An increase in the distribution area was only detected during the last five-year period (1989-1994). Between 1974 and 1994, a southward expansion of about 200 km was recorded (Fig. 1). Nevertheless no continuous distribution area could be shown and areas where the lynx occurred remained separated by wide areas without any information.

In the description of the area of presence here below, numbers in brackets refer to the number of the data listed in Appendix I:

1974-1978: Presence of the lynx in the French Alps was proven in 1976 in the Chaîne de Belledonne (4) where a dead lynx was found (Noblet 1977). This lynx was one

of the two males released in the Val Savaranche in the Grand Paradiso National Park in Italy (Boitani 1979). The Italian reintroduction programme was definitively stopped after the release of these two individuals and this observation remained isolated. Nevertheless, it emphasized the possibility of a lynx crossing between the Italian and French sides of the Alps.

If one excepts these records, four doubtful data were recognised for that period, all of them in the Haute Savoie *département*, three in the Chablais (2, 3, 5) and one to the south-east of Geneva (1). According to Kempf (1979), tracks were observed in the Glières plateau, east of Annecy as early as 1975, but we do not know the origin of these data.

1979-1983: as in the former period, all data (n=11) were recorded in the Haute Savoie *département*. Two doubtful data were recorded at the eastern border of Chablais (7, 13). The presence of lynx in that area was supported by other signs recorded nearby, one probable in Voiron (8) and two confirmed in Faucigny (14,16). In the same way, doubtful data recorded to the south in Glières (6, 9, 10, 11) were confirmed later, a lynx being killed by a train in the area (15). Lastly, an area of presence, south of Annecy lake in Semnoz (12) remained doubtful.

1984-1988: Data were scarce (n=4). In Chablais, there was only one doubtful record (19). On the other hand, the presence

Table 2. Areas occupied by lynx in the French Alps (km²)

| Reliability | Period | | | |
|-------------|-----------|-----------|-----------|-----------|
| | 1974-1978 | 1979-1983 | 1984-1988 | 1989-1993 |
| Confirmed | 200 | 570 | 400 | 1170 |
| Probable | | | 200 | 1500 |
| Doubtful | 590 | 600 | 200 | 1000 |
| Total | 700 | 1170 | 800 | 3670 |

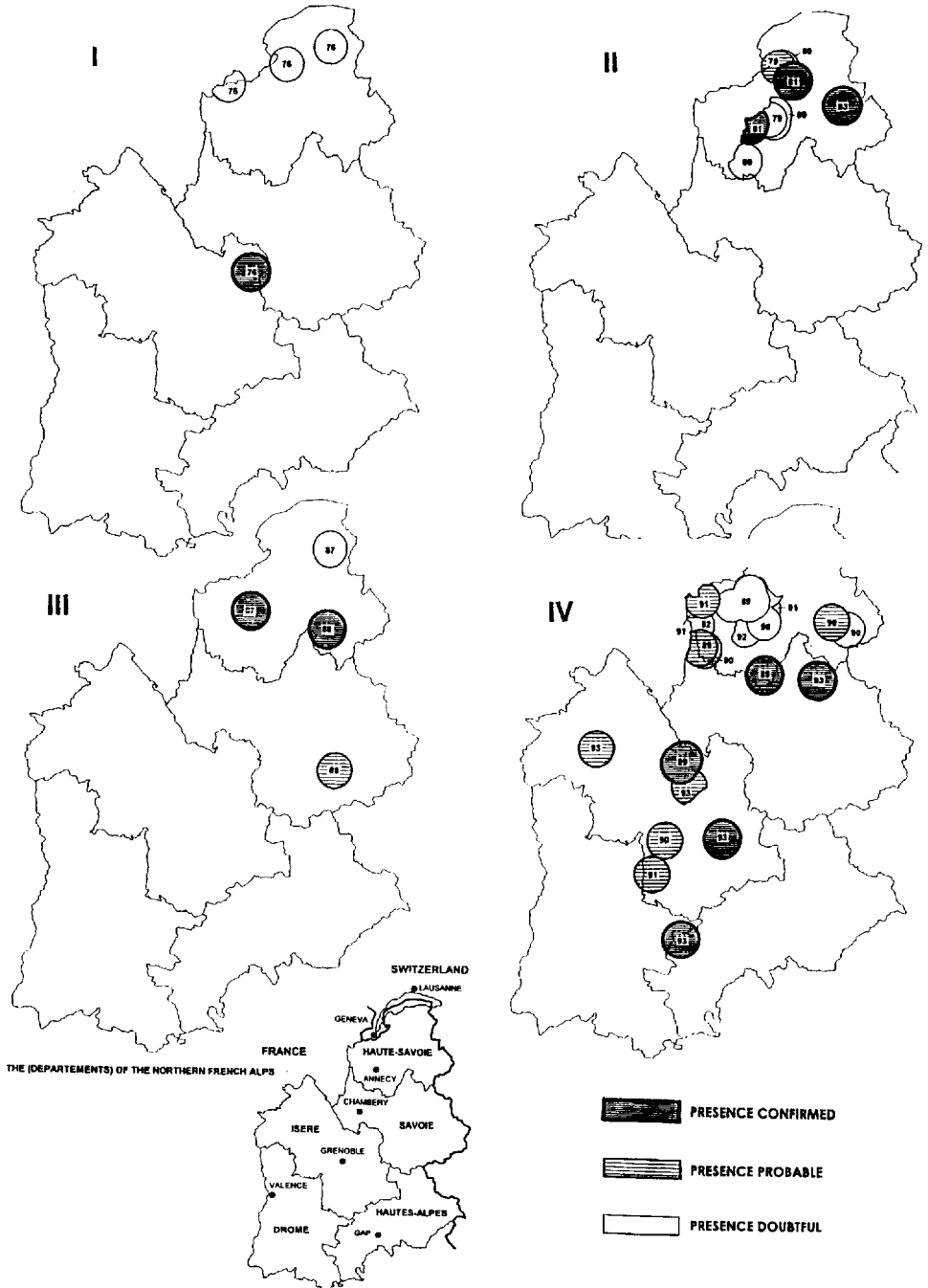


Figure 1. Distribution trend of the lynx in the French Alps (I=1974-1978; II= 1979-1983; III= 1984-1988; IV= 1989-1994). Note that the confirmed presence of period I refers to the male found dead from the Gran Paradiso National Park release.

of lynx at the border of Glières was once again confirmed, a lynx being killed on the motorway between Bonneville and Annecy (18). Two other new areas of presence were recognised: a subadult lynx was killed on a road in the Chamonix valley near St-Gervais (20) and a probable record was reported far away to the south in Vanoise (17).

1989-1994: Data were more numerous ($n=50$). If one excepts Chablais, data were recorded in all the areas already mentioned: Different doubtful records inside a triangle between Annecy, Geneva and Bonneville which includes the Glières plateau (21-25, 30, 35, 39, 45, 46, 49, 50, 52, 60, 61, 64) and one probable area of presence was recorded in the Chamonix valley (38, 42). Different new areas of presence were observed in the continuation of the Jura Mts: probable data were recorded all along the left side of the Rhône river from the Défilé de l'Ecluse in the immediate vicinity of the Jura, up to the north of Bourget lake (26, 36, 37, 47, 55, 56, 57). Two new confirmed areas of presence were observed around Albertville, one in the Bauges (27) and the other one in the Beaufortin areas (59, 68, 70). To the south, the presence of lynx was confirmed in Chartreuse (28, 29, 31-34, 40, 41, 44, 53, 54, 70), where a lynx was trapped in a foot snare. in Tallefer (58, 62, 63, 67) and in Haut Buech near the border of the *départements* of Drôme and Hautes Alpes (66). Finally, presence of lynx was probable at the eastern border of Vercors (43, 48, 51) and its presence was suspected in a plains forest south-east of Vienne (65). If one rules out the possibility of clandestine re-introductions in France, different hypothetical recolonization routes may be established by mapping the records to explain the north-to-south expansion. Some recolonization routes involve the Alpine population, but other realistic alternatives involve an expansion of the Jura population. These hypothetical routes are drawn in Figure 2.

From the Swiss Alpine population, individuals probably reached Chablais in 1974-

1978. Some other individuals might also have reached the Chamonix Valley from Martigny. From these areas, they could have spread into the Aravis. There were records on spurs of the Aravis chain in 1979-1983. More to the south, two major communication routes may be drawn: (1) On the left side of the Iskre river between Albertville and Grenoble lies a stretch of continuously forested areas. Data recorded in Beaufortin in 1989-1994, in Vanoise in 1984-1988 between the Maurienne and Tarentaise valleys may support the hypothesis of a colonisation process by this route. Nevertheless, a gap exists between these areas and the mountains situated to the south of Grenoble; no data were collected in the Chaîne de Belledonne. (2) Another route could be drawn along the right bank of the Iskre river, linking Aravis to Bauges and then to Chartreuse and Vercors. Presence of the lynx was observed in all these areas in 1989-1993, although different obstacles exist. To reach Vercors the lynx must have crossed the valley between Bauges and Chartreuse first and then the Iskre valley between Chartreuse and Vercors. In this valley, well urbanised areas, motorways and rivers represent many barriers.

The Jura population spread since 1974: as early as 1988, the presence of the lynx was confirmed in all the southern parts of the Jura forests (Fig. 3). From the Jura forests, lynx might have reached the Alps by different corridors. From Bugey, south of the Jura, lynx might have reached Chartreuse by natural forested expanses. More forests exist to the east, on each side of the Défilé de l'Ecluse or between the Grand Colombier and the Gros Foug mountains. Probable or confirmed records occurred in 1989-1994 in these areas. From these areas, lynx might also have reached Bauges or Chartreuse.

Finally, there is the possibility of communication between the Alpine and Jura population through the Usse valley south-east of Geneva. Through this valley, there could be a link between the Vuache mountain to the

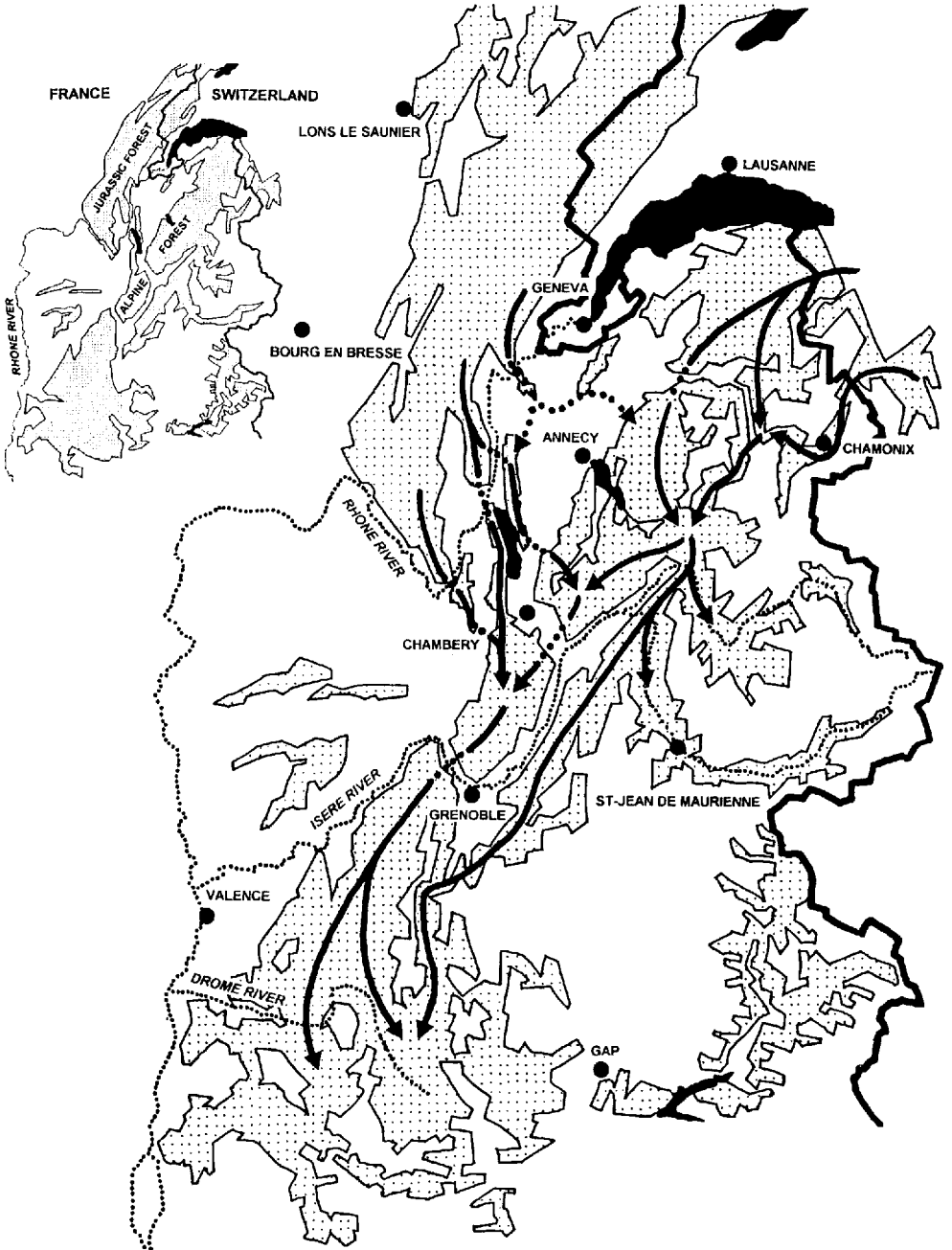


Figure 2. Hypothetical recolonization routes of lynx in the French Alps.

east and the Salève and Glières plateau to the west. Repeated doubtful records west of the A41 motorway as well as the lynx found dead on that road support the hypothesis of possible exchanges between the Jura and Alpine populations in these areas.

DISCUSSION

The mapping of data collected between 1974 and 1994 showed a southward extension of the areas of presence of the lynx. Presence of the lynx was first detected in Chablais in 1974-1978. This area is some 200 km distant from the confirmed data collected more to the south in Haut Buech in 1993. Despite this apparent north-south expansion, data did not reveal a continuous and permanent distribution range of the lynx in the French Alps. Observations remained scattered and well separated by wide areas without any record. The sole exceptions are the mountains around Aravis where the presence of lynx has been proven or more or less regularly suspected since 1979.

Despite the patchy distribution of data, we hesitate to draw any firm conclusion about the distribution of the lynx in the French Alps. Before 1990, there was no nationally standardised method of data collection and information on the lynx. From 1974 to 1990, we believe that, in most areas, efforts devoted to the detection of the presence of lynx were very meagre or absent. Our experience in teaching advisers of the lynx-specialised board showed that many people did not recognise signs of lynx presence if their attention was not drawn to its characteristics. In three of the four areas where lynx were found dead (Chamonix valley, Bauges) or had been live-trapped (Chartreuse) between 1987 and 1989, the presence of lynx had not been detected earlier. In Chartreuse, all the subsequent data were recorded in only one locality and the presence of lynx remained undetected in the surrounding areas. In the fourth area

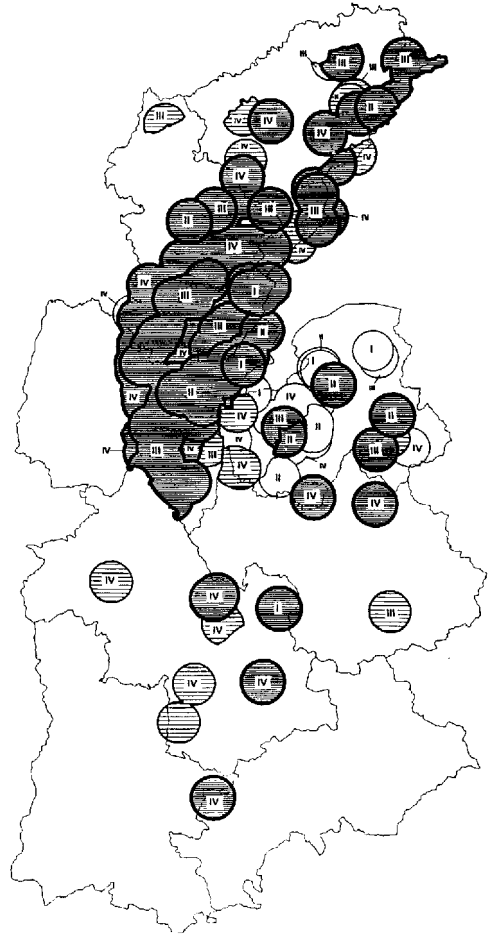


Figure 3. Distribution of the lynx in the Jura and Alps (I=1974-1978; II= 1970-1083; III= 1984-1988; IV= 1989-1994).

(Glières border), a lynx was found dead on a road in 1988. The only former record collected in that area was of another lynx found dead on the same road six years before. No field signs or sightings were recorded between these two events. From 1990 onwards, lynx-specialised boards were set up. A few more data have been collected but the same problem of a low level of observation and unequal distribution of observers has persisted.

The lynx-specialised boards were primarily set up to provide for the expertise and compensation of lynx damage on sheep in case of a sudden increase during the lynx recolonization process. The number of attacks remained low in the Alps and not all the regional coordinators remained alert. The attention of the public was not directed to the lynx by the media and very few people (hunters, foresters, naturalists) were aware of the existence of lynx-specialised boards. Therefore for the whole 1974-1990 period, we believe that the absence of data on the presence of lynx in the French Alps is not always equivalent to the absence of the lynx itself.

Any sound implementation of conservation measures must be based on a precise knowledge of the distribution of the species. The first objective of a lynx project in the French Alps should be to implement a survey of its distribution and status. In the Jura forest where lynx-specialised boards were first set up, a sudden and dramatic increase in the number of attacks on sheep (Vandel et al. 1992) had drawn attention to the lynx. Despite a subsequent drop in the number of attacks, many field signs of presence other than attacks on sheep continue to be gathered every year showing that lynx-specialised boards are effective in collecting information on lynx presence. The Jura survey showed that a three-year period is sufficient to obtain a precise knowledge of lynx distribution (Vandel et al. in prep.). When the lynx-specialised boards and the public have been well informed, a three year survey should also be conducted in the French Alps.

Cartographic inventories and conservation of the regular exchange possibilities between the wide Alpine forested areas are important for the longterm conservation of lynx populations. Despite the low number of data collected, their mapping suggests that different exchange possibilities exist between populations of Jura and Alpine origin. Bauges, Chartreuse and even the

Salève could have been reached by individuals originating in the Jura or in the northern Alps. Chartreuse is a possible point of junction between the northern and southern Alps, surrounded to the south and to the east by major communication routes and industrialised areas. From a conservation point of view, a detailed study of the dispersal of subadults born in this area would be of prime interest to assess the reality and extent of exchanges between this semiisolated area and the Jura, and other parts of the Alps.

In the northern Alps, habitats are fragmented by high relief and urbanised valleys. The development of a large lynx population may therefore be difficult. To the south of Grenoble, very wide continuous forested habitats exist and spread of a lynx population could occur without important natural barriers. The six *départements* of southeastern France could be colonised from the Pre-Alpes to the Italian boundary. Recolonization from the Maurienne valley to Italy and Briançonnais has not yet been shown but there were probable and confirmed records in the Vercors and Hautes Alpes in 1993. The presence of lynx in these areas suggests that lynx have been able to pass one of the major physiographic bottlenecks between the North and South Alps, i.e. Chartreuse or the Chaîne de Belledonne. Data collected in the *départements* of Drôme and Hautes Alpes, south of this bottleneck, are nevertheless still scarce. The presence of lynx needs to be carefully surveyed in these areas because it is the first step towards a possible spread over the whole south-cast of France.

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RESUME

Le lynx d'Europe a disparu des Alpes françaises entre la fin du 19^{ème} et le début du 20^{ème} siècle. Sa réapparition en France est due aux réintroductions faites en Suisse entre 1971 et 1976. De 1974 à 1994, 70 données de présence ont été recensées dans les Alpes françaises. Les premières données ont été recueillies dans le Chablais. Les données les plus régulières ont ensuite été obtenues autour de la chaîne des Aravis. En 20 ans, une progression des observations d'environ 200 km vers le sud a été observée mais aucune aire de répartition continue n'est apparue. La dispersion des observations est probablement due à une faible pression d'observation dans de nombreux massifs. La cartographie des observations suggère qu'il pourrait exister dans les Alpes françaises différentes possibilités de jonction avec les populations originaires du Jura. La Chartreuse, les Bauges et même le Salève ont pu être atteints par des individus issus des populations alpines ou jurassiennes. Si la présence du lynx au sud de Grenoble dans le Vercors et les Hautes Alpes se confirmait, une expansion du lynx dans tout le sud-est de la France serait possible.

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Appendix I. List of records collected. Numbers are referred to in the text. (Type of sign: O = Sighting; L = dead lynx; S = Scat; T = Track; P = Wild prey; D = Domestic prey; H = Hair. Reliability: C = Confirmed, P = Probable, D = Doubtful).

| Num- ber | Period | Date | Year in figures | Type of data | Reliability | Locality (<i>département</i>) |
|-------------|--------|------------|--------------------|-----------------|-------------|---------------------------------|
| 1 | I | **.**.1975 | 1975 | O | D | Viry (74) |
| 2 | | **.**.1976 | 1976 | O | D | Boège (74) |
| 3 | | **05.1976 | 1976 | S | D | Riot (74) |
| 4 | | 12.05.1976 | 1976 | L | C | La Ferrière d'Allevard (38) |
| 5 | | **06.1976 | 1976 | S | D | Biot (74) |
| 6 | II | **.**.1979 | 1979 | O | D | Thorens Glière (74) |
| 7 | | 19.07.1979 | 1979 | O | D | St Cergues (74) |
| 8 | | 15.04.1980 | 1979 | T | P | Les Voirons (74) |
| 9 | | **.**.1980 | 1980 | O | D | Thorens Glière (74) |
| 10 | | **.**.1980 | 1980 | T | D | Thorens Glière (74) |
| 11 | | **05.1980 | 19x0 | O | D | Thorens Glière (74) |
| 12 | | **12.1980 | 1980 | O | D | St Jorioz (74) |
| 17 | | **03.1981 | 1980 | T | D | Boège (74) |
| 14 | | 20.01.1982 | 1981 | T+H | C | Ville en Sallaz (74) |
| 15 | | 25.02.1982 | 1981 | L | C | Charvonnex(74) |
| 16 | | 02.07.1983 | 1983 | T | C | Samoëns (74) |
| 17 | III | 21.07.1986 | 1986 | T | P | Pralognan la Vanoise (73) |
| 18 | | 15.01.1988 | 1987 | L | C | Charvonnex (74) |
| 19 | | 03.03.1988 | 1987 | | D | St Jean d'Aulps (74) |
| 20 | | 11.09.1988 | 1988 | L | C | Combloux (74) |
| 21 | IV | **.**.1989 | 1989 | O | D | Arbusipny (74) |
| 22 | | **.**.1989 | 1989 | O | D | Evires (74) |
| 23 | | **10.1989 | 1989 | O | D | Evires (74) |
| 24 | | **10.1989 | 1989 | O | D | Evires (74) |
| 25 | | **10.1989 | 1989 | O | D | Evires (74) |
| 26 | | 10.10.1989 | 1989 | O | P | Moye (74) |
| 27 | | 20.01.1990 | 1989 | L | C | Faverges (74) |
| 28 | | 22.01.1990 | 1989 | L | C | St Laurent du Pont (38) |
| 29 | | 15.02.1990 | 1989 | T | C | St Laurent du Pont (38) |
| 30 | | **03.1990 | 1989 | O | D | Evires (74) |
| 31 | | 15.03.1990 | 1989 | W | C | St Laurent du Pont (38) |
| 32 | | 29.03.1990 | 1989 | T+O | C | St Laurent du Pont (38) |
| 33 | | 10.04.1990 | 1089 | W | C | St Laurent du Pont (38) |
| 74 | | 10.04.1990 | 1989 | W | D | St Laurent du Pont (38) |
| 75 | | **07.1990 | 1990 | O | D | Evires (74) |
| 36 | | 15.08.1990 | 1990 | O | D | Rumilly (74) |
| 37 | | 07.09.1990 | 1990 | O | P | Rumilly (74) |
| 38 | | 15.09.1990 | 1990 | L | P | Passy (74) |
| 39 | | **10.1990 | 1990 | O | D | Evires (74) |

Appendix I. (continued)

| Num- her | Period | Date | Year in figures | Type of data | Reliability | Locality (<i>département</i>) |
|-------------|--------|-------------------|--------------------|-----------------|-------------|---------------------------------|
| 40 | | 11.10.1990 | 1990 | W | D | St Laurent du Pont (38) |
| 31 | | 06.11.1990 | 1990 | <i>O</i> | C | St Laurent du Pont (38) |
| 42 | | 19.12.1990 | 1990 | W+T | D | Les Houches (74) |
| 43 | | 23.12.1990 | 1990 | W | P | St Paul de Varces (38) |
| 44 | | 24.12.1990 | 1990 | T | P | St Laurent du Pont (38) |
| 35 | | ** 03.1991 | 1990 | O | U | Thorens Glière (74) |
| 46 | | ** 03.1991 | 1990 | O | D | Arenthon (74) |
| 47 | | ** 05.1991 | 1991 | <i>O</i> | P | Clarafond (74) |
| 38 | | 25.05.1991 | 1991 | T | P | St Paul de Varces (38) |
| 49 | | ** 06.1991 | 1991 | <i>O</i> | D | Chêne en Semine (74) |
| 50 | | 11.08.1991 | 1991 | W | D | Thorens Glière (73) |
| 51 | | 06.10.1991 | 1991 | D | P | Gresse en Vercors (38) |
| 52 | | 03.01.1992 | 1991 | <i>O</i> | D | Thorens Glière (74) |
| 53 | | 05.01.1992 | 1991 | W | D | St Laurent du Pont (38) |
| 54 | | 27.01.1992 | 1991 | T | P | St Laurent du Pont (38) |
| 55 | | 06.08.1992 | 1992 | T | D | Droisy (74) |
| 56 | | 10.08.1992 | 1992 | O | D | Droisy (74) |
| 57 | | 11.08.1992 | 1992 | O | D | Massingy (74) |
| 58 | | 16.11.1992 | 1992 | D | D | Ornon (38) |
| 59 | | 22.11.1992 | 1992 | T | P | Beaufort/Doron (73) |
| 60 | | 10.12.1992 | 1992 | O | D | Annecy le Vieux (74) |
| 61 | | 13.03.1993 | 1992 | O | D | La Chapelle Rambaud (74) |
| 62 | | 08.05.1993 | 1993 | D | C | Ornon (38) |
| 63 | | 10.06.1993 | 1993 | D | C | Ornon (38) |
| 64 | | 21.06.1993 | 1993 | O | D | La Chapelle Rambaud (74) |
| 65 | | 16.07.1993 | 1993 | T | P | Commelle (38) |
| 66 | | 25.07.1993 | 1993 | D | C | St Julien en Beauchêne (05) |
| 67 | | 17.11.1993 | 1993 | U | U | Ornon (38) |
| 68 | | 18.03.1994 | 1993 | O | P | Beaufort/Doron (73) |
| 69 | | 11.04.1994 | 1993 | H+W | P | Le Sappey en Chartreuse (38) |
| 70 | | 22.04.1994 | 1993 | T+H+W | C | Beaufort/Doron (73) |