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Short communication

Status of the Eurasian lynx (*Lynx lynx*) in the Black Forest region, South Western Germany

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During the 18th and 19th centuries habitat destruction, reduced prey base and direct persecution led to the extinction of wolf (*Canis lupus*), brown bear (*Ursus arctos*), and lynx (*Lynx lynx*) in many parts of western Europe (Fengewisch 1968; Kratochvil 1968; Zimen 1978; Festetics 1980; Jacubiek 1993). Today, international treaties as well as national law demand the restoration and conservation of these species. Recently, attention towards the return of large carnivores is increasing also in Germany as wolves sporadically remigrate into eastern parts of the country, and, with partially unknown origin as well as due to releasing, lynx occur in several areas (Wölfl et al. 2001; Wölfl and Kaczenski 2001; Barth 2002; Huckschlag unpubl.).

In the Black Forest low mountain range lynx was present until the 18th century (Gossmann-Köllner and Eisfeld 1990). During the 15th and 16th century the lynx was hunted intensively, and population density assumedly was relatively low at that time. Due to decreasing human population and reduced hunting pressure in the period of the 30-year-war, abundance of lynx and wolf as well as their natural prey base increased significantly. In the second half of the 17th century persecution of wolf and lynx was intensified since these species were treated as pests (Wagner 1876). Based on hunting records from this period, abundance of lynx is estimated at 1.5 individuals per 100 km^2 (Gossmann-Köllner and Eisfeld 1990). Improved firearms are assumed to had a considerable impact on hunting in these times. Hence, in the 18th century direct persecution as well as reduction of the natural prey caused the extermination of lynx in the Black Forest region. Two records of lynxes killed, one in 1740 (Jensen 1901) and another one in 1770 (Wagner 1876; v. Gagern 1963), are, respectively, depicted by different authors supposed to be the "last lynx" shot in the Black Forest.

Discussions about reintroduction of lynx into the Black Forest already emerged in 1971 (Hockenjos pers. comm.). Irrespective of the fact that no official releases have been carried out to date, lynx sporadically was reported in the region during about the last 20 years (Gossmann-Köllner and Eisfeld 1990; Thor and Pegel 1992 unpubl.). Remarkably, 1988 a specimen has been killed on a motorway in the Rhine valley, and a sub-adult lynx obviously originating from an enclosure was shot in the Black Forest region in 1991 (Eisfeld pers. comm.).

In the past, signs of presence and sightings have not been recorded and verified systematically. As a result rumours of both illegal

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releases and illegal killings turned the debates into emotional quarrels in which ecologically based arguments were marginalized by the particular interests of the different stakeholders. The objective of the present monitoring project therefore was to provide data on lynx occurrence in Baden-Württemberg that are required for reasonable discussions on future management assessments.

The Black Forest is located in the very southwest of Germany in the Land of Baden-Württemberg and covers about 6000 km^2. The topography is typical low mountain range. Altitude extends to almost 1500 m. In the higher zones snow cover lasts from November till March (Selter et al. 1996). Below about 600 m a.s.l. natural woodland plant communities are mixed forests dominated by beech (*Fagus silvatica*). Above about 600 m a.s.l. forests mainly consist of beech and silver fir (*Abies alba*), and on the leeward side of the main divide beech, silver fir and Norway spruce (*Picea abies*) are dominating (Müller et al. 1974).

As potential prey roe deer (*Capreolus capreolus*) as well as red fox (*Vulpes vulpes*) and brown hare (*Lepus europeus*) are abundant in the whole area. Due to regulations on management, red deer (*Cervus elaphus*) is restricted to an area of 1070 km^2 in the north of the Black Forest and to a small region in the southern part (175 km^2). Chamois (*Rupicapra rupicapra*) has been introduced to the Black Forest between 1935 and 1939 (Strittmatter unpubl.). To date, the main population exists in the southern Black Forest consisting of about 700–900 individuals in total (Vinnai pers.comm.).

In the Black Forest area about 49, 000 sheep are present in the potential range of the lynx (Landesamt für Statistik Baden-Württemberg).

We conducted monitoring from winter 1995/96 to 2003, collecting randomly registered hints on direct observations, tracks, scats, and kills from throughout the study area. In order to derive contemporary information about lynx presence we called for direct transmission of information. About 50 offices of the forest administration, the administrative structure of the hunting association, and two tourist information centres, respectively, located in the north and in the south of the study area, served as information network. Additionally, public awareness has been increased by information events throughout the region and by reports in regional newspapers, radio and TV. During the study period, status reports maintained the awareness of foresters and hunters.

For categorizing signs of lynx presence, most of the European alpine countries implemented criteria stated in the ''Memorandum of the Status and Conservation of the Alpine Lynx Population (SCALP)'' (Molinari-Jobin et al. 2001). Due to this convention, hard facts, as specimen, which were found dead, photographs of lynx, or lynx actually caught are classified as quality level 1 (Q1); indirect signs like kills, tracks and scats, identified by experts, refer to quality level 2 (Q2). Vocalization, direct observation and non-verified cases of indirect indications are assigned to quality level 3 (Q3).

Regarding to the situation in the Black Forest Region – lynx occurrence was unproven, and forestry administration as well as hunting associations could not provide staff with appropriate field experience – we tightened the criteria of Q2 and Q3 for a better explanatory power:

All direct observations respected in this study have been evaluated by personal interviews with the observers. In consideration of the heterogeneous background and a probable bias due to initial knowledge of the observers, open ended questions were asked according to a check list (Atteslander et al. 2000).

Indirect signs of presence were examined according to approved procedures (Molinari et al. 2000). Kills were identified by injuries characteristic for lynx attacks and additional indications in the surrounding of the location where the kills have been found. As we did not judge single footmarks, tracking over a certain distance was substantial for the identification of tracks of lynx. Scats were identified due to deposition in the field, undigested remains, and characteristic smell. Verification by experts directly in the field or laboratory was a prerequisite for the confirmation of kills, tracks, and scats. As a result of intensifying the SCALP criteria, in

our study the Q3 category exclusively consists of direct observations whereas tracks, kills or scats are allocated to Q2 or have been excluded as not being confirmed.

During the study period, out of 154 potential signs of presence we recorded 42 observations in category Q3 and nine hints on kills, tracks or scats rated as Q2. A lynx photographed in the year 2000 represents the only case of the Q1 category (Tab. 1)

In 1996 we assumed six cases of direct observation as being consistent. These sightings were registered in the middle and in the northern part of the study area. In 1997 none out of five announced sightings could be actually judged as reliable. Spatial distribution of lynx evidence from 1998 to the end of 2003 is shown in figure 1. Snow tracking a lynx in 1998 in the northern part of the study area provided first and up to now single Q2 evidence in the northern Black Forest whereas remaining indications from this area are restricted to category Q3.

From the middle part of the study area information on lynx is very scarce. However, in November 2003, a single sheep has been killed by a lynx in this region.

We derived the majority of indications from the southern Black Forest. Apart from reliable observations, which occurred regularly over years, a few tracks, scats, and kills gave sporadic evidence on lynx. In summer 1999 a lynx scat has been found, and while tracking a lynx on two different occasions in winter 1999/2000, we found a killed chamois and a fresh scat, respectively. In addition a lynx was photographed by chance in 2000. Several sightings are denoted from the very southeast of the Black Forest in close proximity to the Swiss border since 2000. In 2001 tracks indicated two cases of lynx presence. No indirect signs of presence could be confirmed in 2002. Nevertheless, 2002 and 2003 reliable observations have been reported rarely but regularly.

In summary, signs of presence are distributed over almost the whole Black Forest mountain range; main evidence was, however, derived from the southern part of the study area. Frequency of indications increased slightly from the beginning of the study in winter 1995/1996, culminating in 2000/2001, but numbers of proven signs of presence remained constantly low (Tab. 1). Increasing numbers of signs of presence may result from reporting subsequent sightings of the same specimen within a certain area or due to the public awareness growing after the observation of a lynx was announced. To judge the status of the species, therefore, it may be more appropriate to concentrate on the area visited by lynx rather than interpreting numbers of signs of presence. Accumulating data from 1998 to 2000 and 2001 to 2003, respectively, demonstrates that the extension of the area visited by lynx

Table 1. Numbers of signs of lynx presence 1995 – 2003

Year	Quality level 2		Quality level 3	
	Confirmed	Not confirmed	Reliable	Not reliable
1995	0	0	2	2
1996	0	4	6	4
1997	0	11	0	5
1998	1	3	6	1
1999	5	8	4	2
2000[a]	0	9	8	10
2001	2	13	5	6
2002	0	16	6	2
2003	1	7	5	0
Total	9	71	42	31

[a]A photography of a lynx in 2000 means the only one incidence of quality level 1 during the study period.

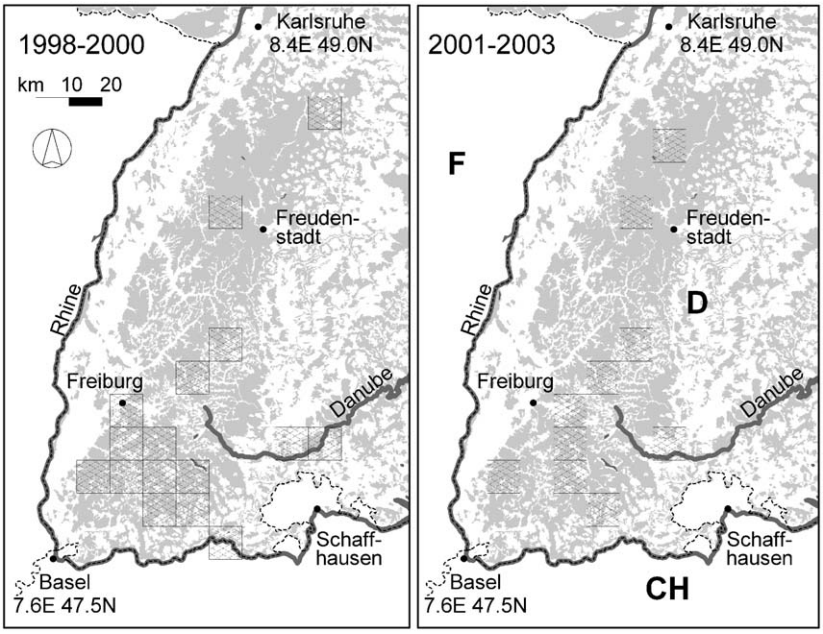

Fig. 1. Distribution of signs of presence of lynx in the Black Forest region 1998 – 2003. Each square indicates at least one incidence of lynx presence. Squares are 10 × 10 km in size. Dark shading indicates forest cover. Dashed line shows country borders. CH = Switzerland, D = Germany, F = France.

in the Black Forest did not increase over time (Fig. 1).

Eight years of monitoring reliable observations and verified tracks, kills and scats revealed at least temporary presence of lynx in the Black Forest. The origin of these animals is still unknown, and rare incidences do not allow conclusions about the actual number of lynx living in the region. These findings correspond with the situation in the Palatine Forest, Germany, where few Q2 and Q3 signs are assumed to indicate the occurrence of a small number of specimens (Huckschlag 2004 unpubl.).

Comparing the different classification categories in our study reveals a considerable mismatch between direct observations and indirect signs of presence. Whereas we confirmed about 60% of the direct observations as consistent, the amount of indirect signs of presence that actually could be verified as originating from lynx was only about 10% (Tab. 1).

Sighting a lynx is an impressive event whereas tracks, scats or even kills probably do not attract the attention of most people. However, direct observations of lynx are essentially not revisable and are influenced by the observer's subjective perception whereas indirect signs like tracks, kills or scats can be verified in the field or in the laboratory. The exceedingly high amount of indirect hints that actually could not be confirmed after verification emphasizes the need for a thorough examination of these signs of presence. This is particularly important within a region of sporadic lynx occurrence, where the main objective is to evaluate the occurrence of a few individuals rather than documenting trends within a population.

Irrespective of a broad information network it is quite clear that we obtained only a certain amount of the indications that are potentially available, and since we ruled the verification very strictly, our data represent a minimum estimation of signs of lynx presence

in the Black Forest Region. Within cultural landscapes mortality of subadult lynx due to traffic accidents is remarkable (Schmidt-Posthaus et al. 2002), and depredation on sheep is described a common phenomenon in the range of the lynx (Kaczenski 1999). Since no killed lynx has been recorded during the 8 years monitoring period, and there was almost no evidence of depredation on livestock caused by lynx, we assume that our data correspond to the actual situation of the lynx in the Black Forest as several, non-resident specimens. As there is also no evidence for reproduction up to now, the Black Forest occurrence obviously cannot be regarded as a lynx population.

The origin of the lynx specimens occurring spontaneously in the Black Forest area is unknown. Speculations about the potentials of founding a population due to lynx dispersing from Switzerland into the Black Forest revived in 2003 as a radio-collard lynx crossed the river Rhine, a main motorway and large non-forested zones till it was live-trapped at the Swiss–German border next to the Black Forest. The fact that the animal surpassed landscape features that, to our recent understanding, are supposed to be considerable barriers, seems to support the hypothesis of lynx dispersing into the Black Forest. A closer view on the case casts considerable doubt on assumptions of a possible restoration of the lynx due to immigration. This particular adult male specimen, previously caught in the Swiss Jura Mountains, had been released in the north-eastern part of Switzerland (Ryser pers. comm.). The specific case of a translocated animal allows conclusions neither on the dispersal behaviour characteristic for the lynx nor on mechanisms that operate the expansion of a population. All occurrences of lynx currently present in different regions of western Europe actually originate from releases (Festetics 1979; Wotschikowsky 1985; Herrenschmidt 1988 unpubl.; Haller 1992; Breitenmoser and Haller 1993; Cop and Frkovic 1998; Wölfl et al. 2001; Barth 2002; Huckschlag 2004 unpubl.). Expansion of western European lynx populations is considered extremely limited even in areas, e.g. the North-Western Swiss Alps, where lynx is known to be abundant (Zimmermann 2004). In conclusion, after a period of about 20 years of frequently proclaimed indications in the area, there is no evidence at all indicating an increasing lynx occurrence, and due to our current knowledge, migration into the Black Forest region will not suffice to establish a stable population in the near future. Verifying the origin and analysing the behaviour of the few individuals occurring in the Black Forest region seems to be an intriguing question. Provided that a genetic differentiation between populations of Eurasian lynx is possible, systematic sampling of genetic material is required. Reliable information on the behavioural aspects is exclusively achievable by means of radio telemetry investigation. However, as such measures are laborious and costly, any kind of investment should be reflected very intensively against a background of a few sporadically occurring specimens in the area. Our data provides an insight into the current situation of the lynx in the Black Forest region. Now a clear definition of goals and objectives is a basic for any kind of future measures concerning the lynx in the Land of Baden-Württemberg.

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