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The Eurasian lynx in Continental Europe

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Cover Photo: Camera trap picture of two Eurasian lynx kittens in north-eastern Switzerland. 11 December 2014 (Photo KORA).

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The development of the Harz lynx population

Between 2000 and 2006, 24 zoo born lynx *Lynx lynx* have been released into the Harz Mountains HM in central Germany. In the monitoring year 2010/11, 25 cells of the EU reference grid were occupied by lynx belonging to the Harz Lynx Population HLP. In the same season, the first reproduction outside the HM was proven. Until the monitoring year 2018/19, the number of cells of the EU monitoring grid occupied by the HLP has increased to 84. This represents an average annual increase of 7.4 grid cells. Although the mountain range is surrounded by major roads and landscapes with low forest cover, reproducing females have established territories in five different areas outside the HM. Telemetry, genetic and photo data show that single male dispersers can be found in distances of up to 309 km from the source population in the HM, whereas reproducing females have not been proven further than 100 km away from the population centre and a female without cubs has been reported in a maximum distance of 143 km.

In the 1970s, the first suggestions were formulated to reintroduce lynx into the HM in central Germany (see Stahl 1972). After that, the discussion lasted almost three decades before in 1999 the political decision was taken to start such a project. The Ministries for Agriculture and Conservation of Lower Saxony accompanied by the Hunting Association of Lower Saxony became executors of the project. The practical work was carried out by the Harz National Park. In early summer 2000, the first lynx individuals were transferred to the HM, set into an enclosure in the central part of the national park and released after a few weeks of acclimation. All 24 (15 females, 9 males) animals released until 2006 were captive bred individuals from German and Swedish enclosures.

The use of zoo born lynx, the scientific support of the project and the suitability of the HM as a project area have been intensively discussed before and during the first years of the program (Wotschikowsky et al. 2001, Schadt et al. 2002a/b, Barth 2002, Kramer-Schadt et al. 2005, Wotschikowsky 2007). In the following, we will give an overview over the development and range increase of the population almost twenty years after its establishment.

Methods

Study area

The Harz Mountains in central Germany (51°43'27.8''N 10°43'56.7''E) is a low mountain range covering an area of 2,200 km² with elevations ranging up to 1,141 m. The mountains touch the three German federal states of Lower Saxony LS, Saxony Anhalt SA and Thuringia TH. 250 km² of the area are under the protection of the Harz National Park.

About 75 % of the mountain range are forested. The forest is largely dominated by European spruce *Picea abies* of anthropogenic origin but also holds natural spruce stands in elevations higher than 800 m. Due to an immense human impact on the vegetation

(mining, charcoal burning in historic times) beech forest *Fagus sylvatica*, once dominant in the area, nowadays appears mainly at the edges of the mountain range. The relief is shaped by several largely undisturbed rivers, many of them originating in the moors in the higher elevations of the HM.

At high elevations, the ungulate population is dominated by red deer *Cervus elaphus*. Wild boar *Sus scrofa* frequently occurs in the forests. Roe deer *Capreolus capreolus* is rare at higher elevations with high snow cover during the winter season, but is more dominant at lower altitudes. A few isolated populations of introduced mouflon *Ovis amon* occur mainly in the eastern and north-western parts of the HM. Outside the HM, red deer are absent and roe deer and wild boar are the dominant ungulate species.

The landscape surrounding the HM is dominated by agriculture and the edges of the Harz forest represent a sudden change in habitat quality. In the western and southern foreland of the mountain range, the forest cover reaches a maximum of about 25 % whereas north and east of the area, forest is scarce due to fertile soils allowing profitable agricultural production.

Lynx monitoring

The Harz National Park is responsible for the lynx monitoring in the two federal states of Lower Saxony (LS) and Saxony Anhalt (ST). The neighbouring states (Hesse, North Rhine-Westphalia, Thuringia) have implemented their own monitoring infrastructures. Within the whole population range, lynx monitoring follows the national guidelines (Kaczensky et al. 2009, Reinhardt et al. 2015) which are based on the SCALP criteria and distinguish into C1, C2 and C3 records (Molinari-Jobin et al. 2003). The results have to be reported at an annual meeting of lynx experts responsible for the monitoring in the federal states. The national agency for nature conservation (BfN) collects the data and produces an annual distribution map based on the EU monitoring grid. Each grid cell covers an area of 100 km² (10 x 10 km). A grid cell is regarded as occupied by lynx if there was at least one C1 record or at least two C2 records within that cell. Telemetry data of evidently dispersing lynx do not count towards presence within a grid cell. A lynx is considered resident in an area if it has been confirmed with C1 or C2 records covering a period of at least six month (Reinhardt et al. 2015). In 2009, lynx monitoring was standardized nationwide. Including the monitoring year 2009/10, all grid cells occupied by resident lynx of the HLP were located within the HM. Only in the following years did individuals establish permanently outside the low mountain range. Therefore, in order to describe the range development of the Harz Lynx Population (HLP), all grid cells from the monitoring years 2010/11 and 2018/19 in the federal states of Lower Saxony, Saxony Anhalt, Thuringia, Hesse and North Rhine-Westphalia were considered (BfN 2011, BfN 2019). In 2018/19, two grid cells in western North Rhine-Westphalia occupied by a zoo escapee were discounted.

Chance observations

Chance observations of lynx such as sightings, tracks, prey remains etc. reported by hunters, foresters and the general public represent the basis of the monitoring and have been collected since the first lynx were released in the summer of 2000. Lynx pictures taken as chance observations occasionally offer the opportunity to identify individuals by their coat pattern (Weingarth et al. 2012) and to recognize dispersers.

Camera trap monitoring

In 2001, the opportunistic use of camera traps has been implemented. At that time, the devices have mainly been placed at prey remains in order to gain C1 lynx evidence. Between 2014 and 2017, a systematic camera trap monitoring has been conducted with 60 sites and two opposing cameras at each site. Data on lynx abundance and density have been collected this way in three different study areas in the HM (Anders & Middelhoff

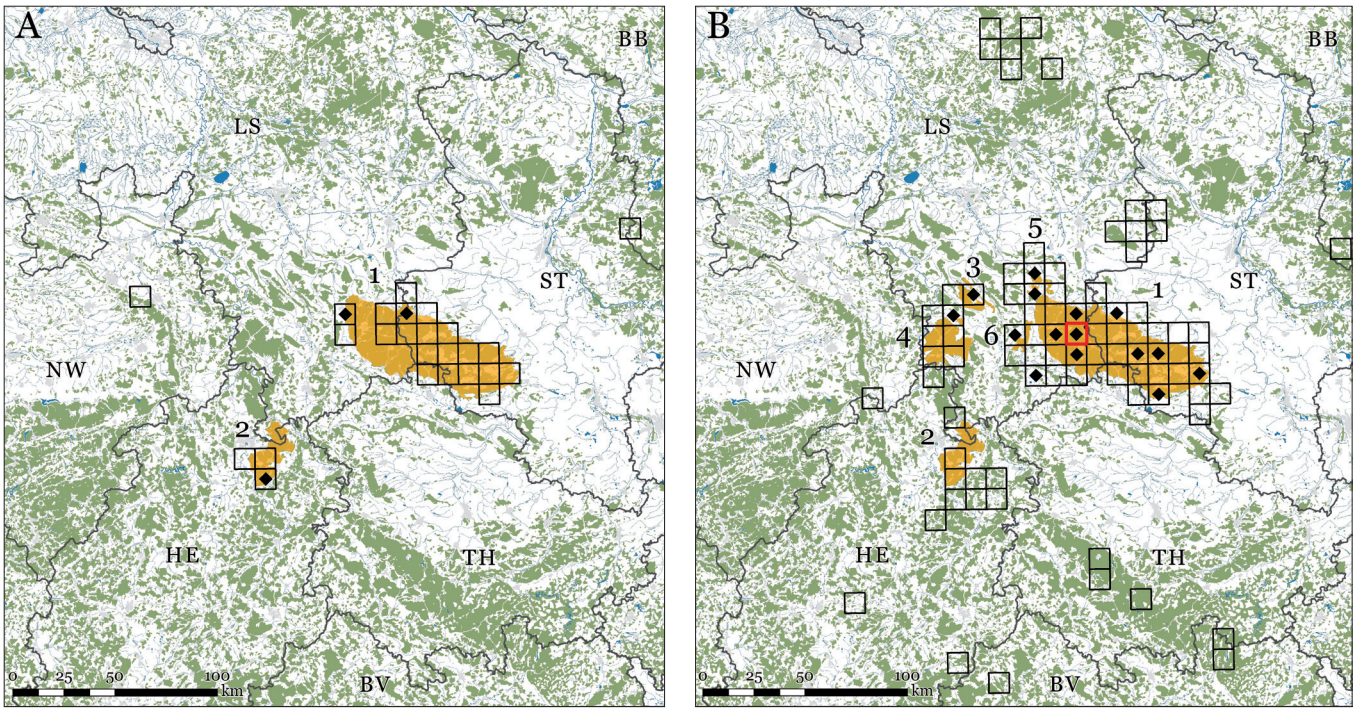

Fig. 1. Distribution area of the Harz Lynx Population in the monitoring years 2010/11 (BfN 2011) (A) and 2018/19 (BfN 2019) (B). Each cell of the EU reference grid covers 100 km². Grid cells with black dots hold reproduction evidence. Between 2016 and 2019, there has been no evidence of reproduction in HE. B: The orange marked areas with numbers define the six reproduction areas: 1 Harz, 2 Kaufunger Forest, 3 Hils and surrounding forests, 4 Solling, 5 Hainberg, 6 Westerhoefer Forest. The red grid cell marks the population centre.

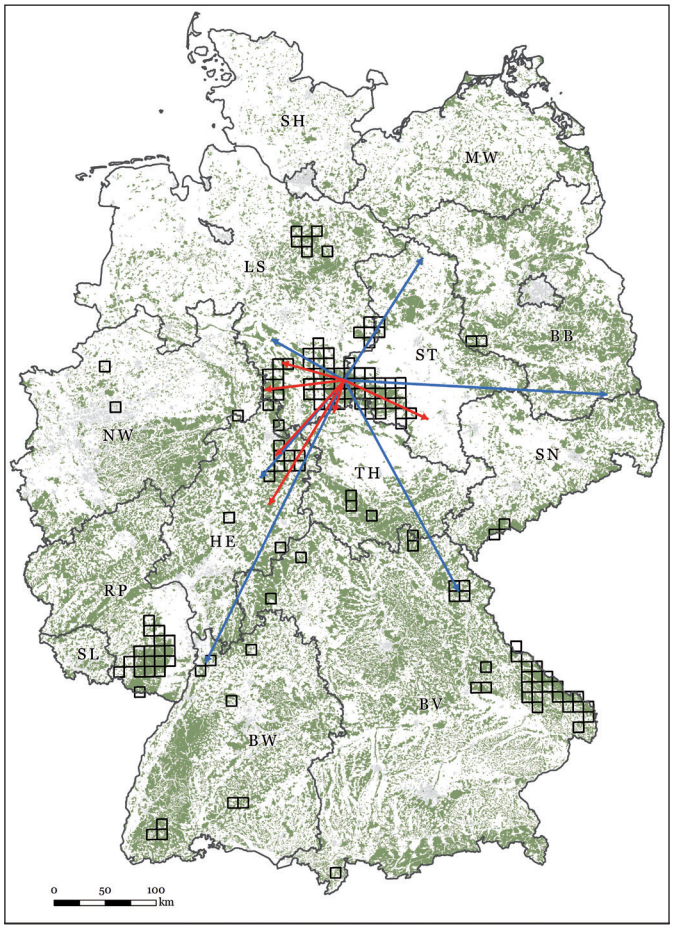

Fig. 2. Maximum distances of male and female lynx from the population centre in the Harz Mountains. Green: Forest cover in Germany. Grey lines are borders of the federal states: Schleswig-Holstein (SH), Mecklenburg-Western Pomerania (MW), Lower Saxony (LS), Saxony Anhalt (ST), Brandenburg (BB), North Rhine-Westphalia (NW), Hesse (HE), Thuringia (TH), Saxony (SN), Rhineland Palatinate (RP), Saarland (SL), Baden-Wuerttemberg (BW), Bavaria (BV). Grey grid cells show lynx distribution in the monitoring year 2018/19 (BfN 2019). Beside the Harz Population, lynx have been reintroduced into RP since 2016. BV holds parts of the Bavarian-Bohemian-Austrian Lynx Population. Red lines show maximum distances of female detections from the population centre in the Harz Mountains. Blue lines show the maximum distances of male detections from the population centre. Six male detections and six female detections with the highest distances have been chosen for graphic representation.

2016, Middelhoff & Anders 2018). Each of the overlapping study sites covers an area of at least 741 km². The data has been analysed with the module CAPTURE in the Computer program MARK (White & Burnham 1999). Moreover, since 2015, camera trap projects with the use of 10 to 22 devices have been alternating between all areas with verified lynx reproduction outside the HM in order to identify, both, resident lynx and juveniles before their dispersal. Like lynx photographs from chance observations, camera trap pictures can be used to identify dispersers between different study areas (see Singh et al. 2013).

Telemetry

Between 2008 and 2019, 23 lynx (15 m, 8 f) were fitted with GPS/GSM collars. The animals had been previously trapped in box traps and immobilized from a blowpipe or in two cases, immobilized with a tranquilizer gun, without prior trapping. The collars were either produced by VECTRONIC AEROSPACE, Germany or LOTEK, Canada. Another two individuals (1 m, 1 f) have been equipped with VHF collars by WAGENER, Germany. Telemetry data have originally been collected in order to gain information on home range sizes and nutrition, and more recently, on dispersal routes from the HM (see Anders et al. 2012). Here, these data are used to show dispersal directions and distances from the source population.

Genetic monitoring

A genetic monitoring has first been implemented in the HLP in 2009 when the Senckenberg laboratory for conservation genetics was designated as the German reference laboratory for wolf and lynx genetics. Until autumn 2019, a total of 179 lynx individuals from the HLP have been identified from blood, saliva, hair and scat samples, among them 10 founder individuals. Individuals from the HLP can be distinguished from those of other populations and due to founder effects even from zoo lynx (Mueller et al. 2020). Accordingly, genetic analyses are used here to verify the Harz origin of lynx, to define start and end points of lynx dispersals and moreover, to gain C1 lynx evidence.

Distances of lynx individuals from the population centre

As the maternal home ranges are known only for a small number of dispersers from the HLP, we used the erstwhile location of the release enclosure in the Harz National Park as an equal starting point to measure dispersal distances. We measured the maximum distances dispersers from the HM, dispersers with unclear starting points and resident lynx outside the HM have gained from this population centre (PC). Moreover, we took single C1 chance observations into consideration when females where photographed with cubs or clearly visible genitalia. We measured the distances between the locations of observation and the PC.

Results

Range increase

Until the monitoring year 2009/10, all grid cells occupied by lynx within the range of the HLP, were located inside the HM. In the following season 2010/11, five out of a total of 25 occupied grid cells were located outside the HM (Fig. 1). In the season of 2018/19, 84 occupied grid cells appeared on the distribution map (Fig 1). 48 (57 %) of them do not touch the HM. Most of the latter are located west and south of the HM. 19 grid cells appear north and east of the HM (see BfN 2011 and 2019). Between 2010/11 and 2018/19, the number of grid cells occupied by lynx increased by 59 cells (236%) representing an average increase of 7.4 cells per year.

Lynx abundance and density in the HM

The results of the systematic camera trap monitoring in different study areas inside the HM analysed with non-spatial capture-recapture models ranged between 2,1 and 2,9 independent lynx/100 km². From this, a mean density of 2.5 independent individuals can be derived and an abundance of 55 independent individuals (Anders & Middelhoff 2016, Middelhoff & Anders 2018) which form the source population from which dispersers emerge to settle the foreland of the HM or to migrate over long distances.

Reproduction areas

Inside the HM, the first evidence of lynx reproduction has been detected in 2002. In each of the following years, lynx offspring were recorded. In the monitoring year 2010/11, camera trap pictures showed lynx cubs in northern Hesse (Kaufunger Forest) around 100 km from the population centre in the HM (Denk 2011 and 2012; see Fig. 1). Since then, reproduction has taken place in four more areas outside the HM in distances of 30 to 70 km from the population centre (Hils and surrounding forests: 2013ff, Solling: 2016 ff, Hainberg, 2018ff and Westerhoefer Forest 2018 ff). However, after 2015, the reproduction area in the Kaufunger Forest collapsed. At least two females died of sarcoptic mange (Port et al. 2020, Wölfl et al. 2021).

Distances from the population centre

Between 2010 and 2019 a total of 11 (9 m, 2 f) lynx, that started their dispersal inside the HM and later left the area, have been detected either by telemetry data, adjacent photo trap pictures or genetic evidence. Ten additional males started their dispersal at an unknown location but have been GPS-collared or repeatedly photographed outside the HM. Moreover, three resident females have been repeatedly sampled and photographed outside the HM. The areas where they were once born are unknown, though. All of these animals (n = 24) are either genetically proven members of the HLP themselves or offspring of genetically proven females. In order to find out the maximum distance to the PC reached by female lynx, we considered single C1 photo evidences from Northern Hesse. The pictured lynx females were neither genetically sampled nor photographically identified.

The first of the two GPS collared females that left the HM (Fig. 2) had already given birth to a litter of three when it started to disperse in September 2012 accompanied by at least one of the juveniles. The animal left the HM in an eastern direction (max. distance to PC: 92 km) but returned to the area before the collar stopped to work. In 2014, the second collared subadult female left the HM. It had been caught as an orphan and raised in an enclosure of the Harz National Park. The female established a territory south of the edges of the HM in semi open habitat (max. distance from PC: 34 km) and gave birth to a litter in May 2015 (Anders et al. 2016 a). The female was found dead in December of the same year. The three resident females have been reproducing in different circumjacent reproduction areas (max. distances from PC: 63, 78 and 87 km; see Fig. 2). Unknown females with cubs have been photographed in a maximum distance of 100 km from the PC (Kaufunger Forest, Denk 2013). A single C1 evidence of a female without cubs occurred south of the Kaufunger Forest and 143 km from the PC (Denk 2016).

In contrast to that, single male dispersers from the HM have been verified by telemetry, genetic or photo data in distances up to 258 km from the centre of the population. A GPS collared individual trapped around 90 km northwest of the HM, has later reached the maximum distance of 309 km from the PC (Fig. 2).

Discussion

After the monitoring year 2010/11 and thus more than ten years after the first reintroduction, the density of lynx and the population pressure in the HM have reached a level that made dispersals into the foreland more and more likely. It is at least conceivable that the lynx density within the HM today is in the range of the carrying capacity. The density of independent lynx in the HM, estimated on the basis of non-spatial capture-recapture models, can only be compared to a limited extent with the results described in the literature and determined with different methods. However, these vary from 0.3 lynx per 100 km² in Norway (Sunde et al. 2000) to 4.2 independent lynx in Turkey (Avgan et al. 2014). Similar methodology as in the Harz Mountains is used to determine lynx densities in Switzerland. According to Zimmermann et al. 2020, results obtained with non-spatial capture-recapture models ranged from 1.44 individuals/100 km² in western central Switzerland to 3.48 individuals/100 km² in the southern Jura. For north-eastern Switzerland and the northern Jura, values of 2.53 and 2.55 individuals/100 km², respectively, were similar to those reported for the Harz Mountains.

The Eurasian Lynx is a species described as highly bound to forest habitat (Haller & Breitenmoser 1986, Breitenmoser & Breitenmoser-Würsten 2008, Rozylowicz et al. 2010). Therefore as expected, the range increase of the population leads west- and southwestwards into areas with a reasonably high forest cover. Whereas the range increase to the east and the north is comparatively low due to a low percentage of forest in these areas. Schmidt (1998) found that during their dispersal, radio collared subadults in eastern Poland apparently followed the distribution of forest habitat.

Nevertheless, animals that leave the HM in either direction have to cross major roads and more or less open agricultural landscape before they reach the shelter of the next forest patches. Anders et al. (2016 b) assumed that beside the forest cover, the permeability of roads around the HM influences the direction in which individuals travel. Roads as migration barriers hamper the speed in which the population spreads. Huck et al. (2010) regard major roads (international roads, express roads, highways etc.) as factors hindering large carnivore dispersal.

In recent years, it has been more likely to identify male than female dispersers in the Harz foreland, whereas Zimmermann et al. (2005) found no sex bias in the proportion of dispersers in the Swiss populations in the Jura Mts and the Alps. Schmidt (1998) reports that the distances travelled during dispersal are farther for males than females. Dispersing males from the HM carry the potential to travel over long distances and therefore might easier accept less suitable habitat. They have in some cases even come close to the ranges of the Palatinate and the Bavarian/Bohemian/Austrian lynx populations and in one case a reproduction between a Harz male and a translocated Bavarian female has occurred (Wölfl et al. 2021). However, the rather moderate dispersal distances of females seem to dictate the velocity of the HLP range increase.

References

Anders O. & Middelhoff T. L. 2016. Der Einsatz von Fotofallen beim Monitoring des Luchsbestandes (*Lynx lynx*) im Harz – Abundanz und Dichte im Herbst und Winter 2015/2016. Beiträge zur Jagd- und Wildforschung 41, 319–331.

Anders O., Kaphegyi T., Dees M. & Kubik F. 2012. Untersuchungen zum Dispersionsverhalten eines männlichen Luchses (*Lynx lynx*) im Dreiländereck zwischen Thüringen, Niedersachsen

und Hessen. Säugetierkundliche Informationen 45, 455–462.

Anders O., Middelhoff T. L., Boddenberg J., Müller U. & Eberl C. 2016a. Sendermarkierte Luchsin (*Lynx lynx*) gebiert fünf Jungtiere. Ein Wurf mit außergewöhnlicher Jungtieranzahl in Nordthüringen. Säugetierkundliche Informationen 50, 205–212.

Anders O., Middelhoff T. L., Dobrescu B. & Kajanus M. 2016b. Wie kommt der Luchs (*Lynx lynx*) aus dem Harz heraus? Untersuchungen zur Durchlässigkeit von Bundesstraßen- und Autobahnunterführungen. Säugetierkundliche Informationen 50, 225–236.

Avgan B., Zimmermann F., Güntert M, Arıkan F. & Breitenmoser U. 2014. The First Density Estimation of an Isolated Eurasian Lynx Population in Southwest Asia. Wildlife Biology 20, 217–221.

Barth W. E. 2002. Luchs-Wiederauswilderungsprojekt im Nationalpark Harz: Ein erster Erfahrungsbericht. Naturschutz und Landschaftsplanung. Zeitschrift für angewandte Oekologie 34, 157–159.

BfN (Bundesamt für Naturschutz) (Hrsg.) 2011. Luchsverbreitung in Deutschland im Monitoringjahr 2010/2011 (1.5.2010–30.4.2011). Zusammengestellt vom Bundesamt für Naturschutz (BfN) nach den Monitoringdaten der Bundesländer. Bonn, Germany.

BfN (Bundesamt für Naturschutz) (Hrsg.) 2019. Luchsverbreitung in Deutschland im Monitoringjahr 2018/2019 (01.05.2018–30.04.2019). Zusammengestellt vom Bundesamt für Naturschutz (BfN) nach den Monitoringdaten der Bundesländer. Bonn, Germany.

Breitenmoser U., Breitenmoser-Würsten C. 2008. Der Luchs. Ein Großraubtier in der Kulturlandschaft. Salm Verlag, Wohlen – Bern, 537 pp.

Denk M. 2011. Arbeitskreis Hessenluchs, Luchshinweise in Hessen – Bericht 2011. Monitoringberichte im Auftrag des Hessischen Ministeriums für Umwelt, Energie, Landwirtschaft und Verbraucherschutz.

Denk M. 2012. Arbeitskreis Hessenluchs, Luchshinweise in Hessen – Bericht 2012. Monitoringberichte im Auftrag des Hessischen Ministeriums für Umwelt, Energie, Landwirtschaft und Verbraucherschutz.

Denk M. 2013. Arbeitskreis Hessenluchs, Luchshinweise in Hessen – Erfassungsjahr 2012/13. Monitoringberichte im Auftrag des Hessischen Ministeriums für Umwelt, Energie, Landwirtschaft und Verbraucherschutz.

Denk M. 2016. Arbeitskreis Hessenluchs, Luchshinweise in Hessen – Erfassungsjahr 2015/16 – mit Ergebnissen des Fotofallenmonitorings der Universität Göttingen. Monitoringberichte im Auftrag des Hessischen Ministeriums für Umwelt, Energie, Landwirtschaft und Verbraucherschutz.

Haller H. & Breitenmoser U. 1986. Zur Raumorganisation der in den Schweizer Alpen wiederangesiedelten Populationen des Luchses (*Lynx lynx*). Zeitschrift für Saugetierkunde 51, 289–311.

Huck M., Jędrzejewski W., Borowik T. & Miłoszcielma M. 2010. Habitat suitability, corridors and dispersal barriers for large carnivores in Poland. Acta Theriologica 55, 177–192.

Kaczensky P., Kluth G., Knauer F., Rauer G., Reinhardt I. & Wotschikowsky U. 2009. Monitoring von Grossraubtieren in Deutschland. BfN – Skripten 251. Bundesamt für Naturschutz, Bonn - Bad Godesberg, Germany. 86 pp.

Kramer-Schadt S., Revilla E. & Wiegand T. 2005. Lynx reintroductions in fragmented landscapes of Germany: Projects with future or misunderstood wildlife conservation? Biological Conservation 125, 169–182.

Middelhoff T. L. & Anders O. 2018. Abundanz und Dichte des Luchses im östlichen Harz, Fotofallenmonitoring 2017, Projektbericht, Nationalpark Harz.

Molinari-Jobin A., Molinari P., Breitenmoser-Würsten C., Wölfl M., Stanisa C., Fasel M., ... & Breitenmoser U. 2003. The Pan-Alpine Conservation Strategy for the Lynx, Nature and environment 130, Council of Europe, 25 pp.

Mueller S. A., Reiners T. E., Middelhoff T. L., Anders O., Kasperkiewicz A. & Nowak C. 2020. The rise of a large carnivore population in Central Europe: genetic evaluation of lynx reintroduction in the Harz Mountains. Conservation Genetics 21, 577–587.

Port M., Henkelmann A., Schröder F.,Waltert M., Middelhoff T. L., Anders O. & Jokisch S. 2020. Rise and fall of a Eurasian lynx (Lynx lynx) stepping-stone population in central Germany. Mamm Res 66, 45–55.

Reinhardt I., Kaczensky P., Knauer F., Kluth G., Wölfl S., Huckschlag D. & Wotschikowsky U. 2015. Monitoring von Wolf, Luchs und Bär in Deutschland. BfN-Skripten 413. Bundesamt für Naturschutz, Bonn - Bad Godesberg, Germany. 96 pp.

Rozylowicz L., Chiriac S., Sandu R. M. & Manoulache S. 2010. The habitat selection of a female lynx (*Lynx lynx*) in the northwestern part of the Vrancea Mountains, Romania. North-Western Journal of Zoology 6, 122–127.

Schadt S., Revilla E., Wiegand T., Knauer F., Kaczensky P., Breitenmoser U., ... & Trepl L. 2002a. Assessing the Suitability of Central European Landscapes for the Reintroduction of Eurasian Lynx Source. Journal of Applied Ecology 39, 189–203.

Schadt S., Knauer, F., Kaczensky P., Revilla E., Wiegand T. & Trepl L. 2002b. Rule-Based Assessment of Suitable Habitat and Patch Connectivity for the Eurasian Lynx. Ecological Applications 12, 1469–1483.

Schmidt K. 1998. Maternal behaviour and juvenile dispersal in the Eurasian lynx. Acta Theriologica 43, 391–408.

Singh R., Qureshi Q., Sankar K., Krausman P.R. & Goyal S. 2013. Use of camera traps to determine dispersal of tigers in a semi-arid landscape, western India. Journal of Arid Environments 98, 105–108.

Stahl, D. 1972. Möglichkeiten und Aussichten einer Wiedereinbürgerung des Luchses (*Lynx lynx* L.) im westlichen Harz. Zeitschrift für Jagdwissenschaft 18, 57–66.

Sunde, P., Kvam T., Moa P., Negård, A., Overskaug, K. (2000) Space use by Eurasian lynxes *Lynx lynx* in central Norway. Acta Theriologica 45, 507–524.

Weingarth K., Heibl C., Knauer F., Zimmermann F., Bufka L. & Heurich M. 2012. First estimation of Eurasian lynx (*Lynx lynx*) abundance and density using digital cameras and capture-recapture techniques in a German national park. Animal Biodiversity and Conservation 35, 197–207.

White G. C. & Burnham K. P. 1999. Program MARK: Survival estimation from populations of marked animals. Bird Study 46, 120–138.

Wölfl S., Anders O. Middelhoff T. L., Hohmann U., Back M., Idelberger S., ... & Steinberg C. 2021. Zeitschrift für Naturschutz und Landschaftspflege 96, 2–10.

Wotschikowsky U., Kaczensky P. & Knauer F. 2001. Wiederansiedlung des Luchses im Harz – Eine kritische Stellungnahme aus wildbiologischer Sicht. Naturschutz und Landschaftsplanung 33, 259–261.

Wotschikowsky U. 2007. Haben Luchse Flügel? Ein Plädoyer für aktive Wiederansiedlung. Naturschutz und Landschaftsplanung 39, 317–319.

Zimmermann F., Breitenmoser-Würsten C. & Breitenmoser U. 2005. Natal dispersal of Eurasian lynx (*Lynx lynx*) in Switzerland. Journal of Zoology 267, 381–395.

Zimmermann, F., Manz, R., Räber, J. & Kunz, F. 2020. Fang-Wiederfang-Schätzung der Abundanz und Dichte des Luchses im Oberwallis IVe im Winter 2019/20 KORA Bericht 95, 23 pp.

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