



First breeding record of a 1-year-old female Eurasian lynx

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Abstract

According to the literature, Eurasian lynx start to breed at the age of two. The proportion of 2-year-old lynx females that give birth is generally lower than that of older females, and this proportion varies significantly between lynx populations, which might be an effect of prey availability resulting in different growth rates. In this paper, we describe the first case of a 1-year-old breeding female Eurasian lynx ever recorded in the wild. Although such a case was documented in other lynx species, it has never been found in Eurasian lynx. This case was documented in the Bohemian-Bavarian-Austrian lynx population, which is systematically monitored by camera traps. A young female (Svit), born in 2016 to a female called Jiskra, was repeatedly camera trapped during the 2017 lynx year (1 May 2017–30 April 2018) with its male kitten Stello. Altogether, 31 events with the Svit family group were recorded. The social consequences of this early reproduction are that Svit did not leave her mother's territory, which would be usual for a subadult young female, but stayed in the area where she was born and which was still inhabited by her mother.

Keywords Eurasian lynx · Reproduction · 1-year-old female · Bohemian-Bavarian-Austrian lynx population · Bohemian Forest ecosystem

The age of first reproduction varies in mammal species (Harvey and Zammuto 1985), with body mass, phylogeny, and various ecological factors possibly being responsible for this variation (Wootton 1987). In Eurasian lynx (*Lynx lynx*), previous studies have indicated a clear effect of body mass on age of maturity (Nilsen et al. 2010). Ecological factors were also found to affect first reproduction age in Eurasian lynx. In Scandinavia, the proportion of 1.5-year-old females that ovulated was generally lower in the northernmost areas

(Nilsen et al. 2010), thus indicating a slower life cycle in more extreme northern environments. Also, the proportion of young females (i.e. 2 years old) that actually gave birth and produced a litter varied markedly between study populations; it was highest in the southernmost population, lowest in the northernmost, with other populations showing intermediate values (Nilsen et al. 2012). This geographical variation in the breeding proportion may be caused by differences in feeding conditions and growth rates between areas (Nilsen et al. 2012), a theory supported by the findings that body size and body mass of lynx in southern Sweden were related to roe deer availability during the first year of life (Yom-Tov et al. 2010).

First breeding at 1 year of age has so far been documented in three lynx species: *L. rufus* (Fritts and Sealander 1978), *L. canadensis* (Quinn and Thompson 1987) and recently also in *L. pardinus* (Garrote et al. 2017), but never in *L. lynx*. Here, we present the first breeding record of a 1-year-old female Eurasian lynx.

The lynx distribution area stretches across the border triangle of the Czech Republic (Bohemia), Bavaria, and Austria; therefore, this population is called the Bohemian-Bavarian-Austrian (BBA) lynx population. It is delimited by the Danube River in the South, Krušné hory/Erzgebirge and

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Fig. 1 Map of Bohemian-Bavarian-Austrian lynx population. The region of Novohradské hory/Freiwald, where the yearling female Svit was documented, is circled in red



Thuringian Forest in the North, Waldviertel and Bohemian-Moravian Highlands in the East and Fränkische Alb in the West. International lynx monitoring efforts started several years ago. However, in 2017, partners from the three countries joined in the first common lynx monitoring and conservation project, called 3Lynx. Within the scope of this project, a common lynx monitoring system was launched and the data gained from this monitoring shared, analysed and interpreted together. The camera-trapping method is used as a major lynx monitoring method in all three countries, complemented by snow tracking and genetic analyses. To space the camera traps

evenly across the region, we use $10 \text{ km} \times 10 \text{ km}$ grids (ETRS LAEA 5210 10 km grid) and install two to eight camera traps per grid cell, depending on the area and habitat type. Altogether, 131 grid cells have been covered by camera trapping in the 3Lynx Project. All data are classified based on SCALP criteria (Molinari-Jobin et al. 2012), further refined for large carnivore monitoring in Germany (Reinhardt et al. 2015). The data are recorded in 60-min events, which means that several pictures and/or videos taken within this time period by camera trap(s) at the same trapping site are counted as one event. Thus, the data are not multiplied, even when more

Fig. 2 Photo of lynx female Svit (right) and her kitten Stello (left)



camera traps are installed at the same site or a series of photos are taken by the same camera. One event can include more lynx individuals, for example a mother with kittens. Then, each individual is recorded extra, but within one event. The data are analysed in “lynx years” that is periods starting on 1 May and ending on 30 April of the following year. As kittens are born in May/June and become independent in April of the following year, in this way reproductive units (lynx female with kittens) are only assessed once in each “lynx year”. This ensures accurate population size assessment.

Lynx female Svit was born in spring 2016 to female Jiskra, who is the resident female lynx in the transboundary Czech-Austrian area called Novohradské hory/Freiwald. This area is far away from the large protected areas of Šumava National Park or Bavarian Forest National Park, where the centre of the BBA population is (see Fig. 1). On 31 August 2017, Svit was recorded for the first time with a kitten, a male called Stello. Altogether, 31 events of the family occurrence were recorded. In 16 events, Svit and Stello were recorded together, in 8 events Svit was recorded alone, and in 7 events Stello was recorded alone; but there was always a strong spatial and temporal proximity between mother and son, with Svit being followed by her kitten on a regular basis (Fig. 2).

Stello was never recorded together with Jiskra or any other adult lynx female. During July–August 2017, when lynx kittens are still highly dependent from their mothers, Svit’s and Jiskra’s families mostly occupied camera trapping sites approx. 10 km far from each other, a distance which would be hardly covered by a small kitten on his own. Moreover, Jiskra’s family group is very well documented. Between 29 and 30 July 2017, Jiskra and her 4 kittens were recorded sleeping, resting, grooming and playing in front of camera trap in a rocky hideout. During these 2 days, 64 photos and 28 videos were recorded showing clearly the mother Jiskra and her 4 kittens repeatedly from both sides, covering their activity from morning till evening. Stello was absent in all these records. In July, the lynx kittens are very small and usually still breastfed (depending on their exact age) so it seems impossible that kitten Stello would not be in close proximity to his mother during whole 2 days or that it would be entirely missed by camera trap. For all these reasons, we believe Stello is not a 5th kitten of Jiskra or an offspring of any other lynx than Svit.

The last record of kitten Stello comes from 27 August 2018, so he successfully survived until more than 1 year of age.

In addition, our data suggest that Svit’s sister Boure, also born in spring 2016, probably also gave birth to two kittens in spring 2017. Since only a few records of this second family were obtained, we cannot say this with certainty. However, the only other explanation is that Boure was repeatedly associated with unfamiliar kittens, who were not her own nor her mother’s or sister’s, and that seems to be highly unlikely, especially given the fact that no other female was recorded in the area.

Due to very early reproduction, Svit did not leave her mother’s territory, which would be the usual behaviour for a subadult Eurasian lynx, who are known to disperse at the age of 8–11 months, shortly after separation from their mothers (Schmidt 1998; Zimmermann et al. 2005; Samelius et al. 2012). Svit’s territory largely overlapped with her mother Jiskra’s territory and both females tolerated each other. Since Jiskra also bred in lynx year 2017 and had four kittens, this resulted in an unusually high density of reproducing females in the area. This finding is similar to the case of a 1-year-old female Iberian lynx, who also remained in her mother’s territory (Garrote et al. 2017).

Svit’s case represents the first record of a 1-year-old female Eurasian lynx breeding in the wild. We can only speculate as to the reasons for this very unusual event. Very favourable ecological conditions, such as a high density of prey in the area, could positively influence animal body mass, growth rate and fitness in general, thus leading to early maturity of animals. Another explanation could be that early reproduction is a possible adaptation to high turnover and short lifespan of animals inhabiting unprotected areas with very strong human impact, an effect which has been found in other mammals (Gamelon et al. 2011).

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