



# Social behaviour of endangered European mink (*Mustela lutreola*) litters in captivity



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## ABSTRACT

In litter-bearing mammals, the environment and social interactions during early life often have a substantial effect on future behaviour of the animal. Most information though derives from lab rodents, pets or farm animals while comparable data are scarce for non-domesticated species, and endangered carnivores in particular. In this study, we focused on social behaviour of juvenile European mink, with the practical aim to provide information for enhancing the ex-situ breeding programme of this critically endangered species. As the first step, we compiled a detailed ethogram of social behaviour observed among the European mink cubs. For the 13 captive born litters available, we then systematically recorded the relative duration of different types of behaviour during a two months period. The behaviour of the captive cubs was found to be diverse, containing all elements characteristic of congeneric mustelids, with no indication of litters deviating from the typical pattern. In all broods, a considerable and approximately equal share of time was allocated to social play, a suggested indicator of positive welfare. Aggressive behaviour of the mother towards her offspring was minimal when the cubs were young and, increased only with the litter dispersal period approaching. Bites between the cubs during play fighting did not increase with the age of the juveniles. We found no evidence that captive environment adversely affects the behaviour of the juveniles during the first months of their life.

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## 1. Introduction

Sufficient knowledge about the behaviour of a species is often a precondition for a successful captive breeding programme (Snyder et al., 2010). In particular, the development of behaviour throughout the early ontogeny has frequently been found to have long-lasting effects on the reproductive performance of adult individuals (Diez-Leon et al., 2013; Uriarte et al., 2009), thus being of key importance in this context. For litter-bearing mammals in particular, it has been shown that the environment during the individual's early development influences the formation of its personality type (Melo et al., 2009; Rödel and Meyer, 2011). Social interactions of the juvenile with the mother are of primary relevance as well as those between the littermates (Crews et al., 2009; D'Eath, 2004; Trillmich and Hudson, 2011; Whitworth, 1984).

Abnormal behaviour is common in captive mammals, the problems being often similar across species. These include stereotypic behaviour (Mason, 1991), atypical mating behaviour (Dalerum et al., 2006; Hawkins and Battaglia, 2009; Peng et al., 2009; Wolf et al., 2000) or sibling aggression (Naidenko and Antonevich, 2009; Wahaj and Holekamp, 2006). The reasons why those types of behaviour develop may be due to different keeping or handling conditions. To fully understand the development of abnormal behaviour in captivity, we may need a comparative approach involving different species (Clubb and Mason, 2007). So far the number of studies on the ontogenetic development of behavioural traits is not particularly high in mammals. Those studies rely on a limited number of species, represented primarily by lab rodents, pets and farm animals (Brink et al., 2004; Fels et al., 2012; Rödel and Meyer, 2011). The number of studies on endangered species is even more modest (Sutherland, 1998).

For our focal species, the critically endangered (IUCN, 2015) European mink (*Mustela lutreola*), the ontogeny of social behaviour has not previously been studied. As the species is on the verge of

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**Table 1**  
Parameters of the *M. lutreola* litters born in Tallinn Zoo 2012–2013, used in the present study.

Litter id	Birth date	Number of cubs	Sex ratio ( $\sigma^{\circ}:\varrho$ )	First observation <sup>a</sup>	Separation of mother <sup>a</sup>	Last observation <sup>a</sup>	Litter separation <sup>a</sup>
1706	18.05.12	3	3:0	49	73	93	93
1689	22.05.12	5	2:3	46	72	89	92
1701	24.05.12	2	2:0	44	72	90	92
1700	27.05.12	4	0:4	42	73	89	91
1936	29.05.12	3	0:3	48	72	91	92
1694	29.05.12	3	1:2	45	72	90	91
1474	1.06.12	3	0:3	45	73	92	93
1960	3.06.12	4	1:3	46	72	91	93
1935	4.06.12	2	2:0	46	72	90	92
2470	12.05.13	7	4:3	51	71	94	95
1933	23.05.13	4	2:2	49	74	92	97
2108	29.05.13	4	2:2	48	75	91	92
1931	2.06.13	3	1:2	50	73	90	92
Sum		45	Mean $\pm$ SD	46.9 $\pm$ 2.6	72.6 $\pm$ 1.0	90.9 $\pm$ 1.5	92.3 $\pm$ 1.7

<sup>a</sup> Age of cubs in days.

extinction, mere documentation of the behaviour (for comparative purposes etc.) is of undeniable value *per se*: in the worst case, in some time, there may be no opportunity for doing so. Moreover the applied significance of studying the behaviour of European mink in captivity is to the needs the species may have in terms of its breeding environment.

In the present study we focused on social interactions between the siblings and the mother. For this purpose, we first compiled a detailed description of the social behaviour of the cubs of European mink during the litter period, and formalized such knowledge as an ethogram. We observed the dynamics of different types of behaviour in the course of the development of the cubs, and evaluated the consistency of these patterns among individual litters. A practical value of the among-brood comparison was to identify any outliers which may indicate problems in the juvenile development, with a possible reflection to the future behaviour of those animals.

## 2. Material and methods

### 2.1. Captive population and its management

Our study was performed in the Species Conservation Research Lab at Tallinn Zoological Gardens, Estonia, which houses the world's largest captive population of European mink ( $N=100\text{--}120$  animals). The management of the captive population has been overall successful: mortality has been low as unexpected deaths are scarce, and breeding has been regular. However, there are problems with some of the males which behave aggressively or are passive during the breeding attempts and therefore fail to sire any young. On ongoing conservation actions and unsolved issues with the captive population, see Kiik et al. (2013) and Maran et al. (2009) on survival of captive-born animals in restoration programmes.

At Tallinn Zoo, European mink are housed individually in  $2\text{m} \times 2\text{m} \times 4\text{m}$  enclosures located in two rows separated by a service corridor. Each enclosure has a nest box ( $34\text{cm} \times 25\text{cm} \times 27\text{cm}$ ), a water pool ( $64\text{cm} \times 35\text{cm} \times 30\text{cm}$ ) and various other items to serve the purpose of environmental enrichment such as branches and tubes. The enclosures are separated from each other by double welded, wire mesh walls. The lower parts of the wall are covered by plywood to reduce visual contact between the animals. The enclosures are cleaned and the animals are fed once a day, except the females with litters, which are fed twice a day.

After mating (see Kiik et al., 2013; for a detailed description of a mating trial) females remain in their individual enclosures. Three weeks after the expected parturition date (gestation length  $\sim 42$  days (Youngman, 1990)) all the successfully mated females are

checked for having delivered a litter. The cubs are weighed and microchipped for later identification at about three weeks of age.

### 2.2. Litter observation

This study involved all 13 *M. lutreola* litters born (by 13 different dams) born and kept at Tallinn Zoo in a two-year period (2012 and 2013; Table 1). The litters were housed in enclosures as described above.

Behavioural observations on the mink litters started when the cubs were seven weeks of age. By this time, the cubs were old and active enough for us to observe their social behaviour outside of the nest box. On each litter, the observation was performed on every fifth day and 10 times in total, and each time the litter was filmed for 30 min on that day. The mother was separated from the litter when the young were approximately 10 weeks old, i.e. after the sixth observation event. By that age, mothers started to behave aggressively towards the offspring to a degree that they could even injure the cubs. The last observation was made when the cubs were about 13 weeks old. The litters were separated thereafter and each individual was housed in a separate enclosure.

Observations started in the morning after feeding time (about 10 o'clock). Such timing was motivated by our intention to record social behaviour other than that related to the competition for food. Observations were terminated when 30 min of active time (defined as at least two of the cubs being outside, actively moving around the enclosure) had been filmed for each litter. Litter behaviour was recorded with a hand camera (Panasonic NV-GS320) and the videos were analysed subsequently using the "JWatcher" program (<http://www.jwatcher.ucla.edu/>). In "JWatcher", each type of behaviour is coded as a letter on the keyboard. Viewing the recorded videos, the researcher presses keys according to the type of behaviour conducted by the cubs.

The durations of different types of behaviour were recorded using continuous sampling (Martin and Bateson, 2007). The litter as a whole was treated as an observation unit: the sampling was focused on the occurrence of a certain type of behaviour within the litter, regardless of which particular cub was conducting the behaviour, or how many animals were directly involved. Such an approach was chosen because it was not possible to follow one single, focal animal – we were unable to distinguish individuals. This is because we could not identify any method of marking the cubs which would last sufficiently long, and be recognizable in video recordings. All the marking methods considered would have caused too much stress, and would have probably affected the behaviour, or even the health of the young. Since we lack individual-based information, the variables recorded and used in the analyses reflect the time during which a certain type of behaviour lasted

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