



## Research

# Activity rhythms and use of nest boxes of juvenile mink in seminatural group housing



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## ABSTRACT

The aim of this study was to investigate the activity patterns of American mink (*Neovison vison*). Twenty mink from a commercial mink farm were housed in a free-range enclosure (290 m<sup>2</sup>) at the age of 13 weeks. In the enclosure, the mink were offered 20 nest boxes (animal-to-nest-box ratio: 1:1), food *ad libitum*, and 3 kinds of water basins. The activity rhythms and the use of the nest boxes were assessed by an automatic registration device that recorded the amount of time spent inside or outside the nest box or in the entrance tunnel for each individual mink over a period of 18 weeks between July and December. In addition to analyzing the mink's daily and seasonal activity patterns, we sought to detect any social preferences or preferences for individual nest boxes. Results showed that the mink had crepuscular activity patterns with 2 activity peaks during dusk and dawn and that the former shifted when the daylight period shortened. Throughout the experiment, the activity time spent outside the nest boxes declined with increasing age and decreasing ambient temperature. In addition, the mink showed a preference for nest boxes that faced the feeding lots and not the water basins. During sleep and rest periods, the mink spent high amounts of time using the nest boxes in company. Furthermore, the mink structured their own habitat by using certain nest boxes for sleeping and others as latrine boxes. Small differences between male and female mink existed in their activity (i.e., time spent inside or outside nest boxes) but not in their preference for certain nest boxes or other individuals. Based on our results, any environmental enrichment item should be presented all day long, so each mink has the opportunity to use them individually during their main activity times mostly at dusk and dawn, and their daily handling should be adjusted to this rhythm. A mink-to-nest-box ratio of 1:1 does not seem necessary as juvenile mink often slept in groups of 2 or more animals in 1 nest box. Furthermore, the animals should be given the opportunity to distinguish between a sleeping and a latrine area.

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## Introduction

In the wild, and in seminatural housing conditions, American mink (*Neovison vison*) usually demonstrate most of their activity during dusk and dawn. Exceptions can be observed during breeding season, especially for females (Gerell, 1969; Sabaš, 2014). A number

of studies showed that farmed mink develop a new rhythm with maximum activity levels during night (Gerell, 1969; Zielinski, 1986; Hansen and Jeppesen, 2003). In addition, farmed mink adapt their daily rhythm to the circumstances they experience, such as feeding times or the presence of prey, climatic conditions, risk of predators, light programs, and human presence (Gerell, 1969; Zielinski, 1986, 1988; Niemimaa, 1995; Garin et al., 2002; Zuberogoitia et al., 2006; Harrington and MacDonald, 2008; García et al., 2009; Wellman and Haynes, 2009; Zschille et al., 2010; Melero et al., 2011; Brandl, 2014; Dallaire and Mason, 2016). The mean activity level of farmed mink depends on the ambient temperatures, length of nights, and differs between the sexes (Gerell, 1969; Zschille et al.,

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2010; Brandl, 2014). The females' behavior in pregnancy has to be interpreted separately because their daily rhythm changes totally during this time (Gerell, 1969; Zschille et al., 2010). Some adult mink, however, show no significant difference in behavior between summer and winter (García et al., 2009; Melero et al., 2011). Wellman and Haynes (2009) found that wild mink's main activity strongly depends on the mink's prey. They compared the activity of wild mink in the highlands with that of those in the wetlands of the State of New York and observed that the mink living in the wetlands were more active during daytime because the aquatic prey appeared during the day, depending on light conditions. Hansen and Damgaard (2009) analyzed 62 female mink in single-housing standard cages, half of them enriched, half of them nonenriched. For both groups, the highest activity levels could be observed around feeding time. Hansen et al. (1994) observed 66 female mink by videotaping them for 24 hours during September and October. They demonstrated the influence that cage equipment and ad libitum feeding had on social behavior, food intake, and the daily rhythm of farmed mink. Among other things, they found that feeding times at noon caused a rest interruption because the primary activity period of mink was between 4 a.m. and 10 a.m.

Locomotion is one of the most important forms of regular activity, for example, during breeding season or during the search for food. Wild male mink in the northeast of Spain demonstrated more and longer locomotion than did the females, and juveniles were more active than adults (Melero et al., 2011). During their time of retreat and rest, farmed mink make use of the nest boxes, which is why the time they spend outside the nest boxes can be seen as activity time (Brandl, 2014). The mink in the experiment by Hansen et al. (1994) referred to rest in company and spent more than 70% of the day passively. Melero et al. (2008) could not resolve whether mink prefer sleeping alone or with nest mates, it was clear that they like to change their nest boxes and—given the opportunity—use more than 1 box (Nimon and Broom, 1999). Females, especially, demonstrated greater use of the entrance tunnels to nest boxes (i.e., resting in the tunnel while observing the enclosure), which can be interpreted as protective and frightened behavior (Meagher et al., 2013; Brandl, 2014).

The German Order on the Protection of Animals and the Keeping of Production Animals (2006) regulates by law the housing conditions of farmed mink based on the biology of wild mink. Each mink needs to have access to a nest box and a water basin, and group housing is prescribed.

The objective of this study was to determine the activity patterns of farmed juvenile mink housed in a free-range enclosure. Specifically, we examined daily and seasonal rhythms in activity, social preferences, and the use of the nest boxes. The results of this study could help to improve the regulations for the housing of farmed mink and promote the animals' welfare during rearing.

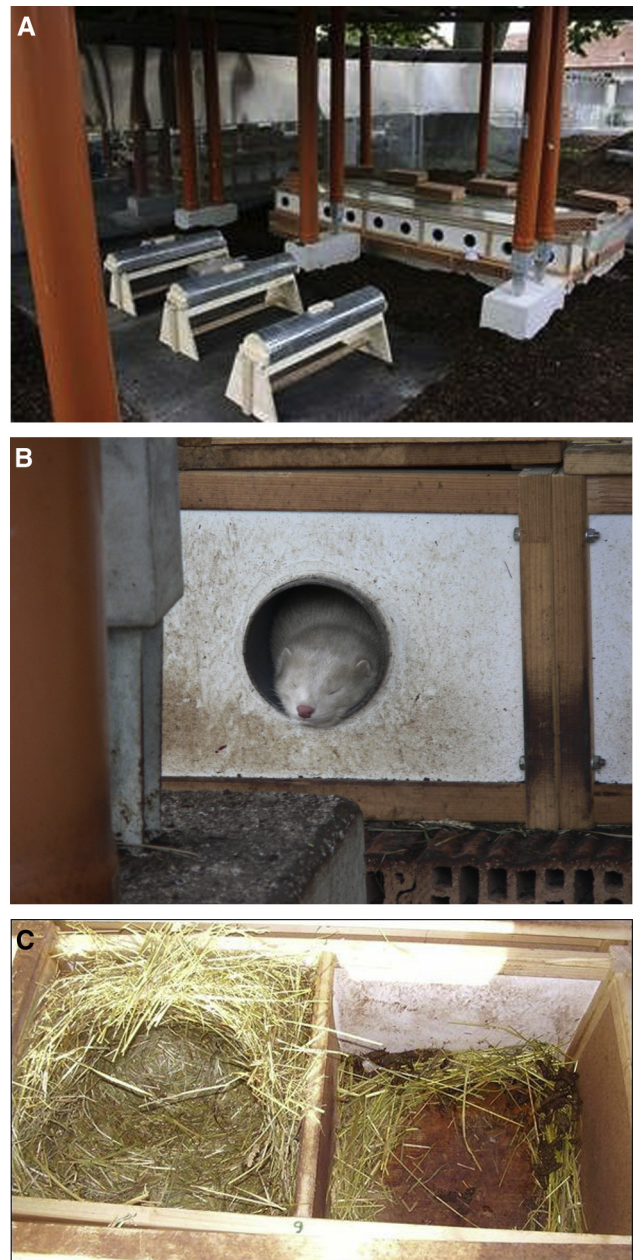
## Animals, materials, and methods

### Subjects and experimental design

The study was carried out at a research center of the LMU Munich, Germany, from the end of July to the beginning of December. Twenty American mink (*N vison*) were housed in a free-range enclosure with a size of approximately 290 m<sup>2</sup> (Figure 1A). For a general overview of the enclosure, see Schwarzer et al. (2016). The animals were bought from a commercial mink farm after weaning at 9 weeks of age and kept in a quarantine facility for 3 weeks, in aviaries (2 × 2 m) without water basins. At the age of 13 weeks, they were moved to the free-range enclosure. The group had a sex ratio consisting of 6 demibuff females, 5 silverblue females, 5 demibuff males, and 4 pearl males. This type of free-range

social housing in large groups is typical neither for wild mink after weaning nor for mink living on commercial farms. Nevertheless, it was chosen to be able to observe the behavior of a large number of individual animals at the same time in seminatural surroundings as a starting point for further studies.

To identify the individual animals for health inspections and their use of the nest boxes (see next paragraph and *Activity monitoring and data management*), all mink were microchipped subcutaneously between the shoulder blades with a 23-mm glass transponder (Half Duplex Data Transmission Radio Frequency Identification System; Texas Instruments, Thief River Falls, MN) using general anesthesia (animal experimentation permit: see *Ethical statement*). Each mink was recognized by an individual transponder number (Hagn, 2009).



**Figure 1.** (A) Nest box settings in the free-range enclosure. The 3 feeding lots are located to the left, facing 10 of the 20 nest boxes (to the right). (B) A mink in an entrance tunnel. (C) A nest box used for sleeping (left) and one used as a latrine (right).

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