

Note

Diurnal activity and observations of the hunting and ranging behaviour of the American mink (*Mustela vison*)

Activité diurne et observations du comportement de chasse et habitat du vison d’Amérique (*Mustela vison*)

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The American mink has been introduced into several countries out of its original range for fur purposes (Bevanger and Henriksen 1995). In many areas where this carnivore has become feral, it has had a great impact on native wildlife (Heggenes and Borgstrom 1988, Burness and Morris 1993, Halliwell and Macdonald 1996). Despite huge worldwide research efforts carried out on American mink ecology, data on the predation techniques and general behaviour of this species in the wild are scanty (Dunstone 1993).

We conducted a radio-tracking study on an American mink population on the Butron River system, Biscay, Northern Spain. This is a small catchment of 40 km in length and an area of 174 km². We focused the study on 20 km of the central part of the catchment, where the largest stretch of the main river is 10 m wide and 1.5 m deep under normal weather conditions, although most stretches are between 3 and 6 m wide and between 30 and 50 cm deep. Riparian vegetation is patchy; it usually forms a line on both sides of streams, mostly restricted to the riverbank. Alder trees (*Alnus glutinosa*) and willow (*Salix alba*) are the main species, and are sometimes associated with a dense undergrowth dominated by brambles (*Rubus* spp.). Brambles, other bushes and rank grass also appear in some areas with no tree cover, and in some areas the riverbank vegetation has been completely removed and replaced with meadows.

We live-trapped 11 American mink and fitted 10 (five males and five females) of them with radio tags (Biotrack

Ltd., Wareham, UK). Radio-collars weighed approximately 15 g, representing <3% of the lightest adult female caught in our study area (520 g). We located animals twice every week, mainly during daylight, but also during the first hours of night (between 10:00 and 20:00 h). Radiotracking was conducted between 16 November 2004 and 7 April 2005. We recorded activity through variations in radio signal strength (White and Garrot 1990). Inactive fixes were taken within 1–4 m of the animal using the homing technique (Kenward 2001) with an accuracy of 2 m². In the case of an active mink, we approached the animal cautiously, located it using the homing technique or triangulation at close distance, and then waited and watched. Every location was recorded on georeferenced, high-resolution aerial photographs, with an accuracy of 3 m², and implemented in a geographic information system (GIS). Measures of distances between locations were obtained from the GIS following the shortest distance along the stream.

We located the American mink 201 times (n=76 active locations during the daytime and n=9 active locations at night). We directly observed animals on 19 occasions, totalling 79 min of direct observations. In general, we found two types of hunting behaviour. The most common (n=12, 63.2% of the direct observations, and n=61, 80.3% of the active locations) was a detailed search-stalking behaviour in bramble thickets or rank undergrowth areas. The mink moved slowly and carefully within vegetation thickets, making little or no noise at all. Occasionally they seemed to stop, as deduced from radio signal stability, probably stalking prey. The American mink moved carefully within bramble thickets in either a straight line or zigzagging, with the nose held close to the ground. Sometimes they stopped and raised their heads. We did not witness any capture, although we observed a mink stopping to eat and producing sounds while chewing. Four observations corresponded to mink moving fast along riverbanks. In three of these cases, the mink moved in a zigzag pattern up and down the riverbank. They stopped occasionally, with raised heads, to descry and scent out, especially after strange sounds or movements. This type of movement was more common in open areas, i.e., with no undergrowth. In general, mink moved at approximately 4.5 km/h, but punctuated movement with faster speeds close to 20 km/h. Such fast movements appeared to be related to poor quality habitat (perhaps scarce in prey or regarded as unsafe by the mink), with mink moving fast across the area, but scenting out and describing occasionally (may-

be to feed opportunistically or to seek out social information from scats). Research on other mustelids has shown that individuals use their home ranges in different ways, exploiting some areas intensively, while others are crossed quickly and possibly act as mere passages between better-quality habitat areas in which they rest and hunt (Weber 1989, Dunstone 1993, Brainerd et al. 1995, Schröpfer et al. 1997, Yamaguchi et al. 2003). Our observations suggest that mink, having linear home ranges along streams, exhibit this behaviour as well. Indeed, activity locations associated with hunting behaviour were closer to known resting sites than points randomly distributed along the home range (Mann-Whitney U-test, $z=-2.849$, $p=0.004$, $n=176$), while observations of mink moving fast and in the open were significantly farther from resting sites than detailed search-stalking behaviour locations (Mann-Whitney U-test, $z=-3.230$, $p=0.001$, $n=69$). This agrees with the references cited above in showing that the mink, like other mustelids, use some areas of their home range intensively, while moving fast in stretches between two favourable areas, especially when crossing open sites with overhead vegetation, possibly as a consequence of predation risk perception (Zabala et al. 2003).

Swimming, although not uncommon, was second to running in fast movement. It took place occasionally either to cross the stream or to move along it, mainly when the bank steepness increased and did not allow the mink to continue walking. In fact, we only watched mink swimming six times, often following the behaviour pointed out earlier. Mink only swam large distances in two cases. This species preys on fish and other aquatic prey (Birks and Dunstone 1985, Lodé 1993, Maran et al. 1998), and we registered several observations by local people who watched mink fishing. However, most of the time, people observed mink walking. Thus, diving (as a hunting technique) may be an occasional behaviour related to high availability of a particular prey. On the other hand, diving was not uncommon for mink, especially females, after being released from traps. Mink dived and then came ashore under rank bramble thickets, suggesting that diving into deep water is a way of escaping.

Domestic dogs are abundant in the study area, and we located mink close to dogs on many occasions (including mink resting less than 20 m from dog kennels). Most times, dogs were unaware of the presence of mink. Nevertheless, we saw dogs scenting mink into dense brambles on three occasions, where mink moved easily and escaped from the dogs. On one of these occasions, a dog had detected one of our radio-tagged female mink below a pile of thickets and was harassing her. The female managed to escape by rushing away, and simultaneously expelled the contents of her anal scent glands. This left a foul, dense odour that caused the dog to sniff and attack the spot where the mink was for a long time, while the mink moved far away (as deduced by the radio signal). Although these events took place close to rivers, mink did not escape by diving or swimming. Other observations included grooming beneath brambles in daylight, which took place at a sunny spot during a cold winter day.

The American mink is commonly regarded as a nocturnal species (Gerell 1969, Yamaguchi et al. 2003). How-

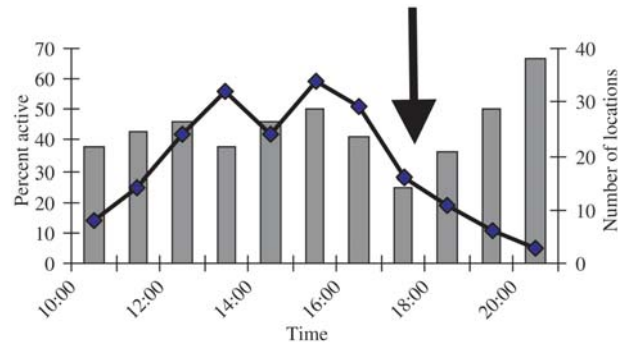


Figure 1 Degree of mink activity at different times. The line indicates the number of radio locations, while bars represent the percentage of locations of active mink. The arrow shows approximate sunset time.

ever, according to Dunstone (1993) and Niemimaa (1995), this species may develop a great deal of diurnal activity. The average percentage of daytime activity was 43.54% (37% for males and 44% for females), and there were no statistical differences in the frequency of activity at different hours of the day ($\chi^2_{10}=5.92$, $p=0.82$). The graph in Figure 1 suggests that mink may increase activity after dusk. It is possible that no significant differences were found because of the small sample size during the last 2 h. Moreover, there were no significant differences in the activity and inactivity patterns of males (Mann-Whitney test, $U=44.5$, $p=0.289$) or females ($U=50.5$, $p=0.509$). Likewise, there were no differences in the activity/inactivity patterns among individuals for both sexes (Kruskal-Wallis test, $H=3.023$, $p=0.388$). Only mustelids such as the weasel (*Mustela nivalis*) and stoat (*Mustela erminea*), which have high energy demands, develop both diurnal and nocturnal activity (Erlinge 1980). No other carnivores present in the study area, except domestic cats and dogs, show daylight activity (Lodé 1995, Zuberogoitia et al. 2001, Garin et al. 2002, Zabala et al. 2002). This may allow American mink to exploit resources with high availability during the day (Lodé 1995, Niemimaa 1995) (i.e., lizards, snakes, frogs, birds, fishes and even small rodents). It may also allow mink to rest in sheltered places during the coldest hours of night. This might be important for mink, since their short fur and high surface/volume ratio make them more vulnerable to cold than similar-sized mammals (Harlow 1994). However, diurnal activity increases risks, because the number of potential predators is higher (dogs, cats, common buzzards *Buteo buteo*, goshawks *Accipiter gentilis*, booted eagles *Hieraaetus pennatus*; Zuberogoitia and Torres 1997, Zuberogoitia et al. 2001) and increases the likelihood of being killed by humans. The American mink may reduce such risks by exploiting sheltered areas covered by dense vegetation (Zabala and Zuberogoitia 2003, Zabala et al. 2003) and rushing along open areas, displaying the ranging and hunting behaviours described above.

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