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VI: Behaviour & Welfare

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VI – 1 RP

Why should environmental enrichment be used to improve welfare on mink farms?

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Abstract

The aim of this review paper is to present a general scientific and political argument for the greater enrichment of mink cages. I first give an overview of the animal welfare issues common to many husbandry systems, before assessing how mink farming compares with other sectors. I highlight two ways in which mink farming (like many other forms of farming) could be improved in welfare terms: in its use of restrictive feeding, and the barren, unenriched nature of many animals’ cages (common in some countries, though now rare in others). I will also review in more detail what we know – both scientifically and practically – about specific possible enrichments for farmed mink. Even simple enrichments like wire cylinders, year-round straw, and lengths of rope may have marked effect on mink behaviour and welfare, and, especially in a climate where fur-farming seems to be scrutinised more closely and harshly than many other animal sectors, finding functional, cost-effective ways of enriching environments and reducing abnormal repetitive behaviours are to be encouraged.

Introduction

In this paper I first give a brief overview of the animal welfare issues common to many husbandry systems, before assessing how mink farming compares. I highlight two ways in which mink farming (like many other forms of farming) could be improved in welfare terms: in its use of restrictive feeding, and the barren, unenriched nature of many animals’ cages. I review literature on other species to explain why this last is important in terms of both stress reduction and proper forebrain development, and then review the extent to which we see abnormal repetitive behaviour like stereotypic pacing on mink farms. In my plenary talk itself, and also a subsequent companion paper (Mason in prep.), I will additionally review in more detail what we know – both scientifically and practically – about specific possible enrichments for farmed mink. The aim of this present review is to present a more general scientific and political argument for the greater enrichment of minks’ cages.

Welfare issues in captive animals: on a spectrum from ‘good’ to ‘bad’, where does fur farming sit?

Animal welfare relates to an animal’s affective (colloquially, ‘emotional’) state: what it feels. Good welfare thus means experiencing positive emotional states and negligible suffering, while poor welfare entails experiencing severe or prolonged states of suffering (e.g., Dawkins 1980, 1990; Mason & Mendl, 1993). Worldwide, more than 22 billion individuals are currently kept by humans for food, for research, for companionship, and in zoos (cf. the few million farmed mink). For these animals, being housed very differently from how they would live if free or wild, is nearly ubiquitous. Although the aims and methods of these various husbandry systems differ, common welfare themes therefore recur. Veterinary expertise, scientific research and common sense all show, for example, that hygiene, vaccination regimes, nutrition, handling regimes, stress and genotype
have major effects on physical health – with animals that are in pain, nauseous, or otherwise in discomfort from disease or injury obviously having poor welfare. Being unable to maintain homeostasis, due to insufficient access to food, water or a suitable thermal environment, causes both psychological stress and welfare problems from impaired physiological functioning. Housing conditions which restrict movement and/or present little opportunity for naturalistic behaviours, are typically non-preferred by animals, induce stress, and cause the development of abnormal repetitive activities like stereotypic pacing and fur- or feather-plucking (all behaviours which I discuss in more detail below). Housing animals in groups, be they mothers with their offspring, or unrelated similar-age conspecifics, may help solve this problem, but often brings with it others: particularly competition for food, and aggression that subordinate animals cannot escape from. Finally, handling, transport and slaughter are often stressful processes for animals.

These welfare issues occur and recur in many systems from the familiar to the exotic: laboratory mouse breeding units, poultry farms, pig farms, even timber camps using working elephants – and a myriad others. These recurring welfare concerns have therefore prompted the ‘Five Freedoms’ (Brambell, 1965) to become generally accepted tenets for ensuring good welfare, across a host of diverse systems; these are: (1) freedom from injury and disease; (2) freedom from hunger, thirst and malnutrition; (3) freedom from fear; (4) freedom from thermal or physical distress; and (5) freedom to express most ‘normal’ behaviors. These recurring welfare concerns also allow the exchange of ideas, opinions, techniques, data and welfare evaluations between scientists working on similar problems, even when the species and system they are studying varies.

Such exchanges would suggest that in many ways, a well-run mink farm compares extremely favourably with many other animal industries -- particularly with those in food animal agriculture (cf. Spruijt, 1999; also SCAHAW 2001 and Pedersen et al., 2002; Hansen 2007), but arguably also with many research animal facilities, and even some (the most environmentally restrictive) forms of pet- and zoo animal housing. For example, infant mink are left with their mothers until they have transitioned to solid food (unlike piglets and calves, for instance); left physically intact (not castrated, branded, tail-clipped, tooth-clipped or given any other type of painful mutilation, unlike e.g. piglets, calves, lambs, laying hens, and many research rodents); and often housed with siblings beyond that. Overall kit mortality to weaning age has been estimated at between 20 and 35% (reviewed SCAHAW 2001); fairly similar to that seen in piglets without farrowing crates (reviewed Mellor & Stafford 2004), and lower than rates seen in some bear and ‘big cat’ species in zoos (Clubb & Mason, 2003, 2007). Levels of fear are typically low. Mink cages give animals space to move, separate resting/nesting areas, and separation from their faeces (unlike typical poultry, pig and some dairy systems). Stereotypic behavior on mink farms is less prevalent than in say, tethered dry sows, isolated laboratory macaques, or even zoo-housed giraffes (surveyed in Mason & Latham, 2004; Mason et al., 2007), and when mink are well-fed, it is also less time-consuming than that performed by many carnivore species in zoos (Clubb & Mason, 2003, 2007). Adult mink mortality rates are on average 2-5% per year (reviewed SCAHAW 2001); this contrasts with, say the 16-17% first and second litter sows that are culled for lameness (e.g. Gill, 2007; to give just one example; data from intensive dairy cattle or aviary laying hens would provide poorer contrasts still). Finally, mink are hardly ever transported (unlike the vast majority of food animals); and euthanasia is on-farm, and typically an extremely swift process.
So on a spectrum from ‘good’ to ‘bad’, where does fur farming (as best practiced) sit? ‘Firmly in the middle’ would be my judgment. Thus many millions or even billions or food animals would benefit if their housing and husbandry involved more of the attributes of a well-run mink farm, while millions or even billions of many other animals, from caged parrots to racing horses, arguably have welfare that is fairly similar. These comparisons are not here to induce complacency, but instead to illustrate that welfare issues are widespread across many systems, with mink farms far from standing out as ‘worst offenders’: indeed in certain ways, as highlighted above, mink farms are really rather good. There are, however, two notable ways in which mink farming fails to be better than other practices: in the restrictive feeding of breeding females, and in the barren, unenriched nature of most cages. I will focus primarily on the latter topic in the rest of this paper.

The restrictive feeding of breeding females
One of the most important welfare issues on mink farms is the restrictive feeding of breeding female mink, to ‘condition’ them over the winter. I will deal with this just briefly here. A major welfare issue for female broiler breeders and breeding sows (e.g. de Jong et al., 2003; Bergeron et al., 2006), in Europe at least it has long been recognized as, similarly, a major welfare concern for female mink. On mink farms, feed restriction greatly elevates stereotypic behaviour, increases animals’ chances of dying over the winter, and also increases risks of ‘greasy kits’ once the litter is born (reviewed SCAHAW 2001). The best-researched solution to this problem is to use more graduated, gentle over-winter slimming (reviewed SCAHAW 2001); while new possible solutions include increasing the bulk of feed without increasing its energy content (e.g. reviewed SCAHAW 2001; also e.g. Damgaard & Hansen, 2004), and using a combination of weighing and feeding technology to help the precise feed levels needed by each individual animal be supplied and adjusted more appropriately (e.g. Sønderup & Bækgaard, 2005; Møller et al., 2007). Other potential solutions for the future might include finding ways to select breeding stock earlier in the fall (so that they can avoid being excessively ‘fattened up’ during this time; e.g. Møller et al., 2007), and perhaps selecting for animals whose fall growth involves less fat deposition. Reducing stereotypic behaviour (e.g. via enrichment) should also be beneficial – since it is the positive feedback between hunger and hyper-activity (with food deprivation triggering stereotypic activity, but stereotypic activity in turn using up energy reserves) that seems particularly likely to put some females on a ‘knife-edge’ over the winter. Last but least, where there is still a culture of ‘if females aren’t dying, they’re not being slimmed hard enough’, I seriously urge that this is dropped: it is unlikely that this belief is supported with actual evidence, and, more importantly, its ethical/welfare implications are impossible to defend. Overall, it is a moot point as to whether feed restriction for female mink is a more or less serious welfare issue than is the feed restriction of females in the pork and meat chicken industries. It is probably safest to conclude that it is serious issue in all three, and perhaps one that may best be reduced via more correspondence in the future between researchers trying to address this issue in all three sectors.

Lack of enrichment: why is this a problem in principle?
A second major welfare issue for farmed mink is the barren and unstimulating nature of their cages. Barren and unstimulating cages cause concern to the general public, but there is also now much scientific data as to their deleterious effects. An overview of these is given below.

First, barren, unstimulating environments may prevent natural activities that are essential for good welfare within the cage – if these are
prevented, animals display evidence of chronic stress (e.g. endocrine and immunological changes; e.g. Dawkins, 1990). Examples of such ‘behavioural needs’ are social contact for primates and many other group-living species (e.g. rats, horses); nest-building for peri-patruent sows; climbing structures that allow vertical flight for some zoo animals (e.g. clouded leopards; some primates); and appropriate nests or shelters for laboratory rodents and also farmed mink. Second, barren, unstimulating environments prevent activities that are definitely rewarding when performed (e.g. Dawkins, 1990; Mason et al., 2001), even if the absence of these activities does not seem to cause chronic stress. Examples of such behaviours might include dust-bathing for hens, playing, copulation and maternal care in many species, and, some have argued (though see Mason in prep.), swimming in mink. Third, barren environments reduce welfare in an additional way: by making animals less resilient to stressful events that happen to them once they are removed from the cage. This reduced ability to cope has been best studied in laboratory rodents. Elevated anxiety if exposed to frightening situations outside the cage (as manifest in physiological responses, approach/escape behaviours, and even wound-healing rates) is seen when gregarious animals (e.g. rats; female mice; some hamster species) are isolation-housed. Similar effects are typically also seen when simple laboratory cages fail to be enriched with shelters and others forms of physical complexity (e.g. reviewed by: Olsson & Dahlborn, 2002; Smith & Corrow, 2005). Fourth, barren, unstimulating conditions compromise the development and functioning of the mammalian forebrain, as evidenced in physical indices such as reduced dendritic branching, as well as in cognitive indices like impaired learning (reviewed by e.g. Van Praag et al., 2000; Nithianantharajah & Hannan, 2006). This may perhaps not in itself be a welfare issue, but it does seem very likely to exacerbate a well-known sign of poor welfare: stereotypic behaviour (e.g. Mason, 2006; Tanimura et al., 2008). Stereotypic behaviour is the fifth and final reason to advocate environmental enrichment. ‘Stereotypies’ or ‘stereotypic behaviours’ have long been interchangeably defined as repetitive, unvarying and apparently functionless behaviour patterns. Behaviour meeting these criteria is statistically associated with environments or husbandry practices that cause other signs of poor welfare (see meta-analysis by Mason & Latham, 2004), and statistically reduced in frequency by environmental enrichment (see meta-analysis by Swaisgood & Shepherdson, 2005).

Precisely how ‘unvarying’ or how ‘functionless’ an activity has to be for inclusion has led to debates as to what to label such behaviours as over-grooming, which involve quite variable motor patterns, or wheel-running which involves an enrichment. I have therefore suggested that the broad term ‘stereotypic behaviour’ be used instead to cover all ‘repetitive behaviour induced by frustration, repeated attempts to cope and/or C.N.S. (brain) dysfunction’ (Mason, 2006), with the term ‘Abnormal Repetitive Behaviour’ being used when we do not have data on biological causation. Many stereotypic behaviours specifically involve altered functioning of the forebrain’s basal ganglia which cause behavioural symptoms such as ‘perseveration’ – the functionless repetition of evoked responses (e.g. reviewed Mason, 2006; see also e.g. Tanimura et al., 2008).

Overall, it is currently unknown in general (let alone for mink per se) how the five effects of impoverished environments that I have listed here inter-relate. For example, is impaired brain function necessary for the emergence of stereotypic behaviour? Is the meeting of specific behavioural needs needed to reduce stereotypic behaviour, or to induce the ‘out-of-cage’ stress-protective effects of environmental enrichment? We do not know. One thing is certain, however:
there is a strong welfare case – as well as, pragmatically, a public relations case – for enriching barren cages.

Abnormal Repetitive Behaviour (ARB) in farmed mink

To start with the least well understood, and the least common form of ARB: occasionally large portions of the front part of the back and/or neck will be clipped of top hair, sometimes leaving only the head and back of the neck untouched. Pelt-clipping may be directed to the self or a cage-mate. In one study no pelt-chewing was observed in well-provisioned kits, only those experimentally fed at low intensities, and it also seems to be absent from wild pelts (reviewed SCAHAW 2001); although little is really known of the cause or welfare significance of this particular behaviour.

Another, more common form of mink ARB is tail-sucking or -chewing, which is typically self-directed and results in a clipped or bald tail-tip. Unlike locomotor stereotypic behaviour (see below), and possibly pelt-chewing (see above), tail-biting/-sucking does not seem to be reliably affected by feeding levels, but it does decrease with certain enrichments (Hansen et al., 2007) and increase if swimming enrichment is provided but then withdrawn (reviewed SCAHAW 2001; Vinke et al., 2008). It also seems to be absent from wild pelts (reviewed SCAHAW 2001). It is therefore probably best described as a true stereotypic behaviour, although much more work is needed as to biological causation. Its prevalence differs greatly across farms, e.g. as few as 10% of kits or more than 50% (Møller 2000 cited by SCAHAW 2001), may have bitten or sucked tails by pelting time. Other assessments of tail-biting in adults show that as with kits, its prevalence varies greatly between farms (e.g. between 19% and 66%) and even between years (e.g. from 10% to 22% at the Research Center for Mink of the Dutch Research Institute for Animal Husbandry; de Jonge et al., 1986 cited by SCAHAW 2001).

Farmed mink commonly perform locomotor stereotypic behaviour, which typically involves pacing along the cage wall, vertical rearing in a cage corner, repetitive circling or nodding of the head/front half of the body, and/or repeatedly entering and leaving nest-box. Pacing (often called ‘pendling’ in Danish studies) seems to be the most common (reviewed SCAHAW 2001). This behaviour is, again, absent in the wild, as well as exacerbated by feed restriction, and also reduced by delaying weaning and some forms of environmental enrichment. Some instances also suggest underlying perseverative changes, or involve self-harm (for example, kits may transiently continue to stereotype for some seconds after the arrival of food, and adults may – albeit rarely – perform forms that involve repeatedly crashing down from the cage-top onto their backs; Mason, 1994; reviewed SCAHAW 2001). It is for these reasons that I class these as true stereotypic behaviours, although precise biological bases are as yet unknown. Note that a subsidiary but important reason for aiming to reduce this behaviour in mink is that highly stereotypic lines are more vulnerable to over-winter mortality (SCAHAW 2001).

The degree to which adults stereotype in this way varies greatly. Some animals perform none, others perform them for over four-five hours a day. Thus during the seven hours before feeding, mink in some populations spend on average 49% of their time in the behaviour, while pre-feeding levels have been reported of between 4% and 32% on five different Dutch farms (reviewed SCAHAW 2001), and 13% - 35% on five different Danish farms (e.g. Møller & Hansen SW 2001). In one survey, focusing on non-feed-restricted animals only, the mean level was under 10% of the day (Clubb & Mason 2003, 2007). Females show
consistently higher levels than males (reviewed SCAHAW 2001). The prevalence of adult females with the behaviour also varies, averaging 98.3% on one site studied 61.6% on another, but under 10% on yet another. A range of 31–85% has also been reported for farms within the Netherlands (reviewed SCAHAW 2001).

Overall, ARBs including stereotypic behaviours thus have been common on mink farms, and are common still in more traditionally run establishments (though for exceptions and recent changes in Europe see e.g. Vinke et al., 2002; Jeppesen 2004).

Discussion and Conclusions
Poor welfare is often presented by campaigning groups as a reason to single out fur farming. The HSUS, for example, states on its website that ‘suffering is a common ingredient in all methods of procuring fur, from fur factory farming to trapping’1. In condemning some of the worst practices seen worldwide (not least the skinning of animals that are injured but not dead), the HSUS and similar organizations are absolutely right: in countries where fur farming is completely unregulated, practices may occur which are simply indefensible. But another extreme by far are those farmers who work under regulation (in some countries meeting very specific legal husbandry requirements), and/or with a personal ethic that the animals in their care should not suffer. How do welfare standards on such farms objectively compare with the ways that food animals, research animals, pets and zoo animals are treated in those same countries? They are similar to many, and considerably better than some. There are therefore lessons that other sectors could learn from the mink industry.

However, by the same token there are lessons that even the most responsible elements of the fur industry need to learn from other sectors. Alleviating the hunger caused by food restricting breeding females is one. Enriching cages (and modifying other aspects of husbandry) to reduce stereotypic behaviour, along with other benefits, is another. Some enrichment of cages is becoming standard practice in, for example, some Scandinavian countries, but in others (e.g. the US and Canada) it is far from the norm. Even simple enrichments like wire cylinders, year-round straw, and lengths of rope may have marked effect on mink behaviour and welfare (Jeppesen, 2004; Hansen et al., 2007; Mason, in prep.), and, especially in a climate where fur farming seems scrutinised more closely and harshly than many other animal sectors, finding functional, cost-effective ways of enriching environments and reducing ARB are to be encouraged.

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Maternal behavior of chinchilla females changes during the first month after birth

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Abstract
The behavioral activity of Chinchilla (Chinchilla lanigera) females and offspring was estimated during first month after birth. Five activity types were described: the females' own activity; the females' social activity; the females' maternal activity; own activity of offspring; social activity of offspring. It was observed that the number of maternal activity patterns decreased during estimated period. The number of individual activity patterns decreased during first two weeks then increased, whereas the number of social activity patterns increased during first two weeks after birth then decreased.

Introduction
Knowledge about the behaviour of chinchillas is important in order to increase the welfare of the animals according good codes of practice and law regulations. Any observed abnormal behavior patterns could be treated as precautionary signals informing about breeding problems on the farm, such as health, living conditions and feeding. There are several studies describing various aspects of animal behavior (Manning & Dawkins, 1998; Kaleta, 2003; Sadowski, 2003), but only a few are specific to chinchillas (Dzierzanowska-Goryn et al., 2005; Indulska, 2003). The aim of this study was to describe the maternal behavior pattern in chinchilla females during the first month after birth. This is the nursing period and determines the weaning results.

Chinchillas are animals with night-time activity and they are mostly resting and relaxing during the light period of the natural day (Barabasz, 2001; Dzierzanowska-Goryn et al., 2005). Maternity is a special period, when females have to be active all the time, even against their natural rhythm. After birth, the offspring needs the mother's attention and she is caring for and nursing her young nearly constantly. When the kits are older, they are more and more independent. By observing tendencies in the animals' activity (individual and social), we can describe the behavioral patterns of the females and her offspring after birth.

Materials and Methods
The studies were carried out on 9 females with litters with a total of 24 animals. Nest boxes are not used on chinchilla farms and the females give birth directly on the floor of the pen. The cages were made from wire mesh and it was possible to observe the animals' activity without disturbing them. The animals were observed during a 2-hour period, between 10:00 am – 12:00 pm every day from birth to 30 days post partum and all behavioral activity was recorded.

The following activities were observed:
- Individual activity: moving, eating, coprophagy, grooming, resting, sleeping, biting hard objects, playing with pellets, urination, defecation.
- Social activity: vocalization, resting together, cleaning each other, stealing pellets, following, escaping, imitating.

The number of occurrence was recorded for each kind of activity and totaled per hour.
**Figure 1. Chinchillas individual activity**

![Graph showing individual activity over days after birth for females and offspring.]

**Figure 2. Chinchillas social activity**

![Graph showing social activity over days after birth for females and offspring.]

Legend:
- Females activity
- Offspring activity
- Females - trend line
- Offspring - trend line
The results are presented as number of observed occurrences per hour and are averaged as estimated tendencies.

Results and Discussion
The results concerning the chinchillas’ individual activity (females and offspring) are presented in Figure 1. The tendency line of the mothers and offspring individual activity during first month after birth looks like letter "U" with the lowest point at days 14-16 (Figure 1). The tendency line of social activity for mothers and offspring during first month after birth looks like letter "A" with the highest point at days 18-19 (females) and days 12-16 (offsprings, Figure 2). The females' maternal activity tendency line is the highest right after birth, then decreases up to day 31 (Figure 3).

In summary it can be seen, that the first week after birth is especially important. High activity of the females (nursing, protecting, care, cleaning young) and young chinchillas (learning all behavioral patterns as eating, escaping, grooming, playing) was observed during the first week. The end of the second week (days 14-15) was a turning point in the young chinchilla' activity. After this time their individual activity started to predominate over social interaction when they have to begin to take care of themselves. At the end of the 3rd week (days 18-20) the females' behavior changed also and more individual and even agonistic patterns (escaping) were observed in comparison to maternal and social behaviors.

Conclusions
In conclusion, five behavioural activity types were described: the females' own activity; the females' social activity; the females' maternal activity; the own activity of the offspring; and the social activity of offspring. It was observed that the number of maternal activity patterns decreased during the observation period. On the other hand, the number of individual activity patterns decreased during the first two weeks then increased, whereas the number of social
activity patterns increased during the first two weeks after birth and decreased thereafter.

References
VI-3 RP

Production and welfare of Finn Raccoon (Nyctereutes procyonoides) in enriched-cage housing

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Abstract
Traditionally Finn Raccoons are housed in male-female pairs during the growing-furring season. Biologically, Finn Raccoon is rather social compared to other farmed fur animals and therefore might benefit from housing in larger group. Group housing in two-tiered enriched-cages would be feasible and cost efficient in traditional fur-animal sheds. During the period from July to November, 100 enriched-cage housed and 100 standard-cage housed juvenile Finn Raccoons were studied to find out the effects of different housing systems on production and welfare. The cubs housed in the enriched-cages were heavier than those in the traditional-cages in the middle and at the end of the experiment. As well the organ masses were higher in the group of enriched-cage housed Finn Raccoons. The cortisol:creatinine-ratio did not differ between groups. We conclude that enriched-cage housing had no negative effects on production or welfare of Finn Raccoon in the present study. It is, however, important to analyse the data of fur quality evaluation and pelt prices before final recommendations can be made.

Introduction
The Raccoon dog Nyctereutes procyonoides originated from East-Asia and spread to the North-Eastern areas of the former Soviet Union in the 1930-1950s (Lavrov, 1971, in Kauhala, 1992). It was adopted from the wild to Finnish fur farms in the 1970s (Korhonen, 1988) and named Finn Raccoon. Already in the beginning of the farming trials it was noticed that Finn Raccoons were easy to handle, feed and breed in farm conditions. The Finn Raccoon has been farmed similarly to its relatives from the Vulpes and Alopex families, even though there are not many scientific studies related especially to welfare issues, such as barren cage environment, foot problems and diseases (European Commission 2001). Until now, ethological studies have been concentrated on the general activity (Korhonen 1988) with a single group-housing experiment (Ahola et al., 2007) in which group-housed animals were shown to stereotype less than traditionally raised animals. The Finn Raccoon is traditionally housed in male-female sibling-pairs, but as a social species it could benefit from group housing. This would also allow for species-specific need fulfilment due to the larger variation of social environment. The enriched-cage housing with cages in two tiers would offer a more diversified environment with the possibility for separation from the cage mates in case of aggressive behaviour.

Enriched-cage housing has also received interest from farmers because of its potential profitability. The enriched-cage consists of two similar size standard cages which are placed on top of each other and connected by an opening. This way it is possible to house a larger number of animals without enlarging the housing buildings, while the area requirements of animal protection laws are fulfilled. At the same time the animals are getting more social contact, their living area is increased and the cage-environment enriched. Enriched-cage housing has earlier been investigated in mink with positive results (Hänninen et al., 2008; Vinke et
The aim of the present study was to investigate the influence of enriched-cage housing on health, growth, production and stress level of the Finn Raccoon.

Materials and Methods

The present study was carried out on a commercial farm, of Kauppilan Turkis Oy in Lohtaja, Finland. The animals were fed *ad libitum* with fresh fur animal feed manufactured by a local feed kitchen. Straw was available for the animals during the whole experiment to satisfy the dietary fibre needs. Water was also available *ad libitum*. The health of the Finn Raccoons was checked daily. Altogether 200 juvenile Finn Raccoons were used in the experiment during the growing-furring season 2007. The experimental animals were divided into the two groups, which each consisted of 100 animals. The enriched cage group consisted of four animals per cage and the standard cage group consisted of two animals per cage. The enriched cage was made of two similar size standard cages placed on top of each other and were connected by an opening. There were platforms in both cages and the platform in the lower cage allowed the animals to climb into the upper cage. During the first week the animals housed in the enriched cages were prevented entry to the upper cage in order to get them used to defecating in the lower cage.

The animals were weighed at the beginning (July), middle (October) and at the end of the experiment (November). The final weighing was carried out in association with pelting. Urine was collected for a 24-h period in October from animals living in 10 cages per experimental group by urine-collecting pads placed under the cages. Cortisol:creatinine-ratio in the urine was measured to determine the stress level of the animals. The animals were killed by electro-execution at the end of the study. Fifty animals per group were dissected to measure the mass of heart, spleen, and adrenals, and the scars on the flesh side of the pelts were counted. The fur quality and prices of pelts will be evaluated by professional fur graders at the Finnish Fur Sales Ltd (Helsinki, Finland) during the autumn 2008.

Table 1. Growth indices and stress parameters in the Finn Raccoons between the experimental groups (mean±SD).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group</th>
<th>Standard cage</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass in July (g)</td>
<td>4043±1030 n=95</td>
<td>4022±892 n=98</td>
<td>NS</td>
</tr>
<tr>
<td>Body mass in October (g)</td>
<td>13481±1609 n=95</td>
<td>12238±1312 n=98</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Body mass in November (g)</td>
<td>15636±2133 n=95</td>
<td>13515±1583 n=98</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Heart mass (g)</td>
<td>46.3±5.2 n=50</td>
<td>42.7±4.5 n=50</td>
<td>NS</td>
</tr>
<tr>
<td>Adrenal mass (mg)</td>
<td>289.0±42.0 n=50</td>
<td>259.7±48.1 n=50</td>
<td>NS</td>
</tr>
<tr>
<td>Spleen mass (g)</td>
<td>21.3±6.5 n=50</td>
<td>18.2±4.6 n=50</td>
<td>NS</td>
</tr>
<tr>
<td>Cortisol:creatinine-ratio</td>
<td>2.01±0.19 n=50</td>
<td>1.66±0.17 n=50</td>
<td>NS</td>
</tr>
<tr>
<td>Scars in pelts (number)</td>
<td>1 n=50</td>
<td>0 n=50</td>
<td>-</td>
</tr>
</tbody>
</table>
The growth-data was statistically analysed using the Proc Mixed (SAS for Windows release 9.1) with a model: 

\[ y_{ijk} = \mu + \tau_i + \rho_{j(i)} + \varepsilon_{ijk}, \]

where \( \mu \) is the overall mean, \( \tau_i \) the effect of the treatment \( i \), \( \rho_{j(i)} \) the effect of the cage \( j \) in the treatment \( i \) and the \( \varepsilon_{ijk} \) is the error for animal \( k \) of the treatment \( i \) in the cage \( j \). Organ masses were analysed by Proc Mixed model using body mass as covariate. The cortisol:creatinine -ratio was analysed using the Proc Mixed model without the effect of the cage \( j \). The level of statistical significance was set at \( p<0.05 \).

**Results**

The animals in the enriched cages were significantly heavier than the animals in the standard cages in October and in November (Table 1.).

As well the heart, adrenal and spleen masses were higher in the animals housed in the enriched cages than in the animals housed in the standard cages, however after using the body mass as covariate the differences disappeared. In the beginning of the study in July there were no differences in the body masses between the groups. There were no significant differences in the cortisol:creatinine-ratio between the animals housed in the standard cages and the enriched cages. Only one scar from the flesh side of the pelt was found in an enriched-cage housed Finn Raccoon.

**Discussion**

In the wild, the Finn Raccoon might be the most social among the farmed fur-bearing animals (Siivonen, 1972; Sandell, 1989; Ward & Wurster-Hill, 1990; Kauhala, 1998), even though it is considered relatively solitary by some researchers (see Ikeda, 1986; Ward & Wurster-Hill, 1990). Group housing of Finn Raccoons seems to be quite promising (see e.g. Korhonen et al., 1986a, 1991a, Hänninen et al., 2002b). Our results showed no real signs of aggressions related to the large group-size in the enriched cages. Finn Raccoons formulate a social hierarchy in a group (Korhonen et al., 1991a), which may explain the low amount of aggressive behaviour observed (Korhonen & Harri, 1987b; Korhonen, 1988c).

In the current study, the animals in the enriched cage group were heavier in the middle (October) and at the end of the study (November) than in the standard cage group. This might be a result of higher social competition and increased appetite. Effect of group housing on production parameters and welfare of Finn Raccoon has been studied earlier in cages placed side by side. Hänninen et al.,(2002) reported that there were no differences in growth between the group-housed and traditional sibling-housed animals. Also Korhonen and Harri (1988) did not find any effects of group housing on growth of the Finn Raccoon. On the other hand, fur quality has been shown to be slightly worse in earlier group housing experiments (see Hänninen et al., 2002; Ahola et al., 2004). However, mechanical scuffing was assumed to be the reason when animals were entering from one cage to another through a small opening. The adrenal glands were heavier in the group-housed Finn Raccoons, and this was related to the stress induced by group housing (Hänninen et al., 2002). However, in the same experiment the pair-housed Finn Raccoons exhibited more stereotypic behaviour (Ahola et al., 2007). Opposite to previous findings, in the current study there were no differences between the groups in the mass of adrenals or the urinary cortisol:creatinine –ratio, which are measures of the general level of stress.

**Conclusions**

It would be tempting to conclude that according to the better growth results, the enriched-cage housing is a better system for the Finn Raccoon that the traditional style housing. However, even if there was no sign of negative effects on any of the studied parameters it is important to include the results of the fur quality evaluation and pelt prices before final conclusions can be drawn.
References
Social preferences in relation to familiarity and age in silver fox females

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Introduction
Foxes should possess the ability to recognise and distinguish conspecifics individually due to their flexible social structure. Determining foxes’ social preference and how this influences their social behaviour towards different conspecifics at different ages may give us a better understanding on how to prevent foxes from exposure to possible social stressors when housed in groups.

Materials and Methods
The effect of familiarity on social preferences in young silver fox females and their motives for seeking social contact were studied in 14 silver fox female at the age of 9½ and 24½ weeks in a preference test where they could choose between a sister, an unfamiliar female or an empty cage. The position and behaviour of the females were recorded using instantaneous sampling every tenth minute for twenty-six hours.

Results and Discussion
There was a clear preference for seeking contact with a conspecific at 9½ weeks (p<0.01). The foxes did not differentiate between the familiar or unfamiliar stimulus (p>0.05), however there was a tendency to play more in front of the unfamiliar stimulus (p=0.067). No preference was seen for either of the stimuli provided to the foxes when 24½ weeks old, (p>0.05), but they were more aggressive towards the unfamiliar fox (p<0.01).

Conclusions
The motives for seeking contact as cubs were non-aggressive and possibly related to play motivation, whereas the aggressive behaviour displayed by juveniles towards the unfamiliar females indicates an increased competitive motivation.
**Intensive handling of mink (Neovison vison) dams during lactation reduces litter performance and weaning weight**

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**Introduction**

Gestational stress has been found to reduce maternal behaviour such as arched back nursing in rat dams (Smith et al., 2004). The behaviour of stressed rat dams is directed more often to digging, eating, drinking and resting rather than to their pups (Patin et al., 2002). Patin and colleagues (2002) suggest that this is the reason why the pups from stressed rat dams have a higher mortality and lower growth rate compared to controls. Reduced maternal care can also have detrimental effects on the adult offspring, causing them to be more fearful and also exhibit less maternal care (Francis et al., 2002). The objective of this study was to determine if the intensiveness of handling and blood sampling of mink dams during the lactation period affects the weight of the kits.

**Materials and Methods**

This study is part of a larger study that used four-hundred (400) breeder female mink with an even distribution of age (multi or primiparous) and colour (dark or pastel) over a two-year period to investigate the effects of resting bunks on body condition, the activation of the hypothalamic pituitary adrenal (HPA) axis, heat stress and oxidative stress and consequently glycemic control and reproductive performance of female mink. To determine the effect of the intensiveness of handling on the weight of mink kits, 304 mink females that whelped were blocked by the intensiveness of the blood sampling they received during the lactation period. These included: 128 Not Sampled (females that did not have a blood sample taken), 128 Sampled (females that had a drop of blood taken from one clipped hind limb toe nail for the measurement of blood glucose), and 48 Intensively Sampled (females that had multiple hind limb toe nails clipped to obtain five capillary tubes of blood and their rectal temperature measured). The MIXED procedure of repeated measures was performed using a model with blocks: Age (Multiparous or Primiparous), Colour (Dark or Pastel) and Blood Sampling Group (Non Sampled, Sampled and Intensively Sampled) as fixed effects with full interactions. Year was used as a random block and Litter Size a covariate. Statistical significance was set at \( P < 0.05 \).

**Results and Discussion**

Using litter size and the number of male and female kits as covariates, there was a significant effect of the intensiveness of handling and blood sampling on the litter weight over the lactation period \( (P = 0.0007) \). The weaning weights of the litters from the Intensively Sampled females were significantly lower \((1714.97 \pm 52.67)\) compared to the weaning weights of the litters from the mink dams who were blood sampled for glucose only (Sampled) \((1887.09 \pm 36.09)\) and the mink dams who were not blood sampled (Not Sampled) \((2097.46 \pm 39.96)\) during lactation.

The lower litter weights at weaning in the Sampled and Intensively Sampled groups compared to the Not Sampled group may be
attributed to the stress level of the dams. Similar outcomes have been observed in the silver fox (*Vulpes vulpes*), where female cubs from stressed vixens had a lower litter weaning weight and were less active compared to cubs from non-stressed vixens (1660 ±42g and 1491±40g) (Bakken, 1998). The lower weaning litter weight may also be the result of reduced maternal care (Champagne & Meaney, 2006). A reduction in maternal care is mediated by changes in oxytocin receptor levels (Pedersen & Boccia, 2002). As a result of the stress from environmental adversity, rat dams reduce their level of maternal care as compared to control dams (Champagne & Meaney, 2006). Similarly, Bosch and colleagues (2007) found that prenatally stressed rat dams nursed their pups significantly less than control dams.

Using litter weight as an indicator, it was determined that the intensiveness of handling and blood sampling during the lactation period is stressful to the mink dams. The mink dams that were not blood sampled during the lactation period had significantly higher litter weights at weaning compared to the females that had a blood glucose sample taken and the females that were handled more intensively with multiple blood samples taken at a time. Moreover, the females that only had a blood glucose sample taken had significantly higher litter weights at weaning compared to the females that were sampled for blood more intensively and also measured for rectal temperature. The results indicate that during the lactation period, blood sampling and prolonged handling of mink dams should be avoided in order to reduce the negative effects stress may have on maternal care.

**References**


Seasonal body weight, body condition score, blood glucose and stress level of female mink (Neovison vison) with or without access to resting bunks

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Introduction
There are no previous studies outlining the effects of resting bunks on the body weight, blood glucose concentration, stress level and reproductive performance of female mink. Resting bunks may allow for the possibility of a less sedentary lifestyle. This could improve the body condition of the mink and also aid in glycemic control (Hynes et al., 2004). The bunks may also provide an occasional escape from the demands of lactation thereby reducing the excess mobilization of body reserves and uncontrolled gluconeogenesis associated with nursing sickness (Clausen et al., 1992). This may also reduce the level of oxidative stress, such as seen in humans with type 2 diabetes (Pitozzi et al., 2003). The alternative resting place and increased cage surface area provided by the bunks may also reduce stress from heat and crowding that occurs due to the close confinement of the dam and her growing kits in the nest box. The ability of the dam to escape from her kits may make the weaning process more gradual as in nature; this may be less stressful to both the dam and her kits (Dunstone, 1993). This research examined the effects of resting bunks on body condition, the activation of the hypothalamic pituitary adrenal (HPA) axis, heat stress and oxidative stress and consequently glycemic control and reproductive performance of female mink.

Materials and Methods
Four-hundred (400) breeder female mink with an even distribution of age (multi or primiparous) and colour (dark or pastel) were used for this study over a two-year period. Each year, half (100) of the cages were fitted with flexible plastic resting bunks, supplied for this research by UNIQ Farm Systems ApS (Hovervej, Denmark). Monthly measurements of body weight, body condition score (BCS) and blood glucose concentration were taken. The litter size, and kit weight and sex were determined on days 1, 21 and 42 post partum (PP). For the statistical analysis females were categorized as Barren, High Weight Loss (HWL, lost more than 20% of their body weight over the lactation period) and Regular Weight Loss (RWL, lost less than 20% of their body weight over the lactation period). For the determination of their stress level, 48 female mink (24 Bunk) were categorized as Handled and used to determine the rectal temperature, total number of protein bands using isoelectric focusing of serum samples, fecal cortisol metabolite concentration and comet assay score of leukocytes in whole blood samples at a base line measurement before bunks, day 1 PP and day 42 PP.

Results and Discussion
The bunks did not have a significant effect on the body weight, BCS, blood glucose concentration or the physiological stress response as measured by the rectal temperature, total number of protein bands, fecal cortisol metabolite concentration and comet assay score. There was a significant interaction effect of treatment and day \((P=0.046)\), with a higher mortality rate in the HWL Control group (10.1%) on day 21 PP compared to that of the HWL Bunk group (5.8%). The Handled Bunk group had a marginally lower \((P= 0.085)\) kit
mortality rate over the entire lactation period (27.2%) compared to the Handled Control group (37.8%). However, females in the RWL Bunk group had higher kit mortality on day 1 PP (19.72%) compared to the RWL Control group (10.96%) \( (P = 0.006) \). Using litter size and the number of male and female kits as covariates, the Handled Bunk dams had higher litter weights at weaning \( (1461.36\pm113.66g \text{ vs. } 1843.40\pm115.84g) \) \( (P = 0.034) \) compared to the Handled Control dams, and 29% of the dams in the Handled Bunk group were also able to wean litters of 7 or more kits compared to only 16.7% of females in the Handled Control Group \( (P = 0.035) \).

The ability of the dam to raise her kits reflects the health of the dam. The lower kit mortality rate in the HWL and Handled Bunk groups may suggest that during the lactation period the bunks could have provided an escape from the demands of lactation allowing the dam to better care for herself and consequently her kits. This may also be reflected by the fact that more Handled Bunk females were able to wean litters of 7 or more kits. In the RWL Bunk group, climbing on and off of the bunks and possibly falling from the bunks during late gestation could have caused trauma to the fetuses, as seen in humans \( (\text{Grossman, 2004}) \), leading to a higher kit mortality on day 1PP. The lower litter weight at weaning in the Handled Control group may be attributed to the elevated stress level of these dams. In foxes and rats, stress and environmental adversity can lead to reduced maternal care and lower litter weight at weaning \( (\text{Bakken, 1998; Champagne & Meaney, 2006}) \). Due to the potential for increased neonatal mortality it is suggested that if resting bunks are going to be used, they should not be placed in the female’s cages until 2-3 weeks after whelping.

References


Group housing of juvenile mink: effects on pelt length, general impression and price

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Introduction
Group housing could be a potential way of enriching the housing environment of juvenile farmed mink. A larger cage system, required for a group of mink, makes it possible for all animals in the group to utilize a larger space, and also provides room for a more complex environment. Social contacts within the groups could also act as enrichment. Furthermore, by housing mink in groups of four in climbing cages, i.e. a standard cage with nest box and an extra cage built on top of it, twice as many mink can be housed in a certain floor area as compared to traditional pair housing. Consequently, savings in building expenses of mink barns are obvious. However, the welfare of group housed mink might be compromised (Hänninen et al., 2008, Pedersen et al., 2004), e.g. because of fighting and social stress, and the productivity of the mink could be worse due to poorer growth, or lower pelt quality and price. Therefore, research on group housing of mink is needed.

Material and Methods
We carried out four experiments to study the effects of group housing on pelt length, general impression and price in juvenile mink. In experiments 1 and 2, group housing (GH) in row cage systems where several standard mink cages were connected to each other was compared to traditional pair housing (PH) of mink in standard mink cages. In experiments 3 and 4, group housing of mink in climbing cages was compared to the traditional pair housing. The total N was 136, 156, 1356 and 444 mink in experiments 1-4, respectively. The analyses of pelt length and the ratio pelt price/average price in an auction (hereafter price ratio) were performed with linear mixed model. The price ratio was used instead of pelt price in order to correct for price differences between different auctions, colour types and sexes. General impression data were analysed either with Wilcoxon matched pairs test (row cage experiments) or Mann-Whitney U -test (climbing cage experiments) depending on the set-up in each experiment.

Results
There were no differences in pelt length between the GH mink (males 76±1 cm, 78±1 cm, 77±0 cm and 78±1 cm, females 63±1 cm, 64±1 cm, 64±0 cm and 63±1 cm, x±SE, in Exp. 1, 2, 3 and 4 respectively) and PH mink (males 75±1 cm, 80±1 cm, 77±0 cm and 78±0 cm, females 61±1 cm, 64±1 cm, 63±0 cm and 62±1 cm) (for all comparisons: p>0.05). General impression was worse in the GH than PH mink in experiments 1 (6.2±0.4 vs. 7.7±0.3, p<0.01) and 2 (5.6±0.5 vs. 7.2±0.3, p<0.05), i.e. the row cage experiments. This difference was not seen in experiments 3 (6.4±0.1 vs. 6.6±0.1, p>0.05) and 4 (6.0±0.1 vs. 5.7±0.2, p>0.05) where the GH mink were housed in climbing cages. The price ratio did not differ between the GH and PH mink in experiments 1 (0.83±0.02 vs. 0.83±0.02, p>0.05) and 3 (0.93±0.12 vs. 0.93±0.15, p>0.05), whereas the GH mink had lower price ratio than the PH mink in experiments 2 (0.88±0.05 vs. 1.03±0.05).
Discussion
Group housing seems to have no effect on pelt length. In row cage experiments, the general impression of the pelt was worse and the price ratio, to some extent, lower in the GH mink than in the PH mink. In climbing cage experiments, on the other hand, no difference in the general impression was observed, and the difference in the price ratio was not as remarkable as in the row cage experiments. In climbing cage systems these putative negative effects on pelt prices can possibly be compensated for by the savings in building expenses and possible timesavings in the daily farm labour. In conclusion, the results show that group housing especially in climbing cages is a feasible way of housing mink.

References

Running in a running wheel substitutes for stereotypies in mink (*Neovison vison*) but does it improve their welfare?

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Introduction
Many investigations have shown that restricted feeding increase the activity of mink and especially the performance of stereotypic behaviour (Damgaard et al., 2004). The presence of stereotypies is often assumed to indicate reduced welfare, but it is possible that a high level of appetitive fed searching behaviour in a limited area will enhance the development of patterns of movement that seem stereotypical. If this assumption is correct, we would expect that giving mink access to a running wheel would prevent the development of stereotypic behaviour, but would it also improve their welfare?

This experiment investigated whether access to a running wheel affects the development of stereotypies during restricted feeding and whether selection for high or low levels of stereotypy affects the use of the running wheel. Furthermore, the daily rhythm of stereotypies and wheel running activity were tested, and plasma cortisol concentrations were compared in stereotyping and non-stereotyping mink.

Materials and Methods
64 female mink selected for high or low levels of stereotypy were used. Half of the females were kept in standard cages each with access to a running wheel, whereas the other half had no access. The number of turns of the running wheel, behaviour, feed consumption, body weight and the concentration of plasma cortisol were measured during the winter slimming period, when the mink are given restricted feed.

Results and Discussion
The mink with access to a running wheel did not perform stereotypic behaviour, but stereotypic behaviour was observed in 24 out of 28 females without access to a running wheel during restricted feeding. Thus, the opportunity to use a running wheel reduces the risk of mink developing stereotypic behaviour in the cage. The mink selected for a high level of stereotypies had more turns in the running wheel than the mink selected for low levels of stereotypy ($X^2=21.84; P<0.0001$) and the females selected for a low level of stereotypy used the nest box more than the mink selected for a high level of stereotypy ($X^2=17.54; P<0.0001$). The results indicate that selection for or against stereotypy may be a more general selection for or against a high level of activity, and that mink with a high level of activity when housed in the normal standard cages have an increased risk of stereotypic behaviour. The number of turns in the running wheel peaked at the end of the slimming period and was at its lowest when the mink were fed *ad libitum* in the beginning of March. The body weight correlated negatively with the frequency of observed stereotypies ($r = -0.51; P < 0.01$) and the number of turns in the running wheel ($r = -0.66; P < 0.01$).

The results confirm that a high feeding motivation increases the stereotypic activity as well as wheel running activity and that both types of activity appear to be highly plastic and responsive. Mink with access to a running wheel used the running wheel just as much as mink without...
access to a running wheel performed stereotypies (Mink selected for high stereotypy: $X_1=1.13; P<0.288$), and the daily rhythms of the two types of activity were identical with a peak around feeding time ($F_{1,51,8}=0.00; P = 0.96$). No other behavioural differences between stereotyping and non-stereotyping mink were found and neither was there any difference in plasma cortisol concentration.

**Conclusions**

In conclusion, running in a running wheel substitutes for stereotypies in mink, but there were neither behavioural nor physiological indicators that the non-stereotyping individuals running in the running wheel had a better welfare than the stereotyping individuals without access to running wheels. Increased activity in the form of stereotypies or increased wheel running activity caused by reduced feeding may be a useful tool for feed management and assessment of welfare at farm level.

**References**

Genotype affects maternal retrieval and ultrasonic vocalisations of mink kits

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**Introduction**
We know very little about the nature and function of mink kits’ vocalisations. Therefore, the aim of the present study was to describe the kits’ vocalisation when placed away from their warm mother, the protective nest, and their littermates. We investigated the influence of the vocalisations on maternal behaviour in terms of the dam’s kit retrieval.

**Materials and Methods**
We used 58 one-year-old female mink (*Mustela vison*) of two genetic lines (colour type ‘Palomino’ \(n=23\) and ‘Black’ \(n=35\)). All recordings were made during a standardised kit-retrieval test performed 5 days after birth, with equipment sensitive to sounds up to 100 kHz.

**Results and Discussion**
Our recordings demonstrated for the first time that mink kits produce complex ultrasonic vocalisation of up to 50 kHz. The call consists of long trains of multi-harmonic pulses with a relative long pulse duration (average 264-874 ms) and a high repetitions rate (0.6-2.3 pulses/s). Genetic line affected both kit vocalisations and maternal retrieval since Palomino kits had a higher variation in their pulse duration than Black kits \((p=0.023)\) and Palomino dams had an impaired kit-retrieval compared to Black dams \((p=0.008)\).

**Conclusion**
In conclusion, mink kits do produce ultrasonic vocalisation when away from their mothers and nests. Genotype influenced both the nature of kit vocalisation and maternal behaviour during a standardised kit-retrieval test.

**References**
The effect of environmental enrichment on farm mink in Sweden

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Introduction
The welfare of farmed mink has been heavily debated in Sweden over the last two decades. Reasons for reactions against mink farming include the perception of fur as a luxury product, and distaste for keeping wild animals in cages, exacerbated by the stereotyped behaviour exhibited by some caged mink. Over the years there have been several incidences of releases of mink from their cages and arson against two mink feed kitchens.

Swedish authorities in response to these problems have prepared extensive reports, the most recent of which investigated how to acceptably keep mink from both an animal welfare and an animal health point of view (SOU 2003:86). Sweden has also considered European findings on the same problem (European Commission, 2001).

In Sweden, the Animal Welfare Act §4 states “Animals shall be accommodated and handled in an environment that is appropriate for animals and in such a way as to promote their health and permit natural behaviour” (SFS 1988:534, SFS 2003:1077), and it also sets minimum standards for cage sizes and heights. An addendum to this act, proposed by the Ministry of Agriculture (Ds 2005:32), but voted down in Parliament in December 2006, stated “Mink raised for fur production shall be accommodated in a way so that their need for movement, climbing, expressing their hunting behaviour and using time for other activities, and of being alone at periods are fulfilled. In addition mink shall have access to water to swim in.”

The Swedish report (SOU 2003:86), which concluded that research to improve Swedish housing and management of mink, in order to reduce stereotyped behaviour and improve mink welfare is necessary, further outlined a four year PhD project which has been financed by SPR (the Research Fund within the Swedish Mink Farmers Association). This project was to investigate the frequency of stereotyped behaviour in the Swedish mink and the effects of environmental enrichment on the behaviour, health and fur quality of the mink.

Since 2004 two of the five larger investigations which have been conducted will be presented in this abstract, while two other studies will be presented in the abstract by Lindberg (2008).

Materials and Methods
Experiment 1: The aim of this study was to investigate which enrichments were most used by farmed mink when given several to choose from and the effect of the available enrichments on stereotyped behaviour and tail biting. The study was conducted on a private farm in Sweden during March and April 2004. A total of 20 10 month old silver-blue female mink were kept individually seven days in a row first either in a large enriched cage and then in a traditional cage (control) or vice versa in a cross-over design. The larger cage was 195 cm long and 80 cm deep, with wire mesh floor over one half and wooden floor on the other, two nest boxes, and six water nipples. The enrichments were a water bath, cylinders (one plastic and one wire mesh), shelves (one wood and one wire mesh), ropes, balls, branches and straw. The traditional cage was 30 cm long and 80 cm deep with wire mesh floor, one nest box and one water nipple. Both cage types were 40 cm high.
Experiment 2: The second study evaluated different enrichments in a standard cage system and the behavioural effects of these in female mink during the winter (December to April 2005). On two private farms (F1; F2) 150 eight month old black-cross females were housed individually in standard cages (80 or 90 x 30 cm, 40 cm high). The females were randomly allocated to one of the following treatments: wire net shelf, plastic cylinder, plastic ball, all three combined or no enrichments (control). Behaviours were recorded with one-zero sampling nine times during 10s each per month and individually on 75 females before and after feeding.

Results and Discussion

Experiment 1: There were significant differences in the percentages of recordings spent interacting with the different types of enrichments (p<0.001). Of their active time the mink used water bath 10.4%, shelves 4.8%, cylinders 3.2%, ropes 2.1%, balls 1.2%, straw 0.3% and branches 0.3%. Interactions with the enrichments were highest on day 1, which can be due to a novelty effect. Stereotyped behaviour was performed more frequently in the traditional cages (10%) than in the large enriched cage (1.4%, p<0.05). The type of stereotypies performed in the traditional cages were “circular” (43%), “pendling” (34%), “vertical” (15%), “acrobatic” (6%), “nest box” (1%) and “horizontal” (1%), whereas in the large enriched cages “circular” (89%), “pendling” (9%) and “vertical” (2%) stereotypies were performed. Tail biting was observed in two females when kept in the traditional cage.

Experiment 2: There was a significant effect of treatment on interactions with enrichments on both farms (p<0.001), where the highest percentage of recordings were found in cages with a shelf, followed by combined, plastic cylinder and ball. The mink interacted with enrichments 4.2% in F1 and 3.9% in F2. There was no significant effect of treatment on either farm on the percentage of recorded stereotyped behaviour (n.s.). The mink performed stereotyped behaviours 11.6% in F1 and 10.2% in F2. There was a significant effect of treatment on activity (p<0.05) in F2, but not in F1 (n.s.). In F2 mink with a shelf were less active than in the other treatments. Active behaviours were performed 28.8% in F1 and 20.9% in F2. There was a significant positive correlation between activity and stereotyped behaviour (F1; p<0.001, r=0.29, F2; p<0.001, r=0.64).

Conclusions

In conclusion stereotyped behaviour in female mink during the winter can be disrupted by giving them a highly enriched cage (see also Lindberg, 2004), whereas giving females that already have developed stereotyped behaviours enrichment in their standard cage does not appear to reduce stereotyped behaviour.

References

VI-11 P
Effects of climbing cage and feeding strategy on behaviour and production in farmed mink

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Introduction
The development of stereotypies in farmed mink is influenced by the environment and by management routines such as the feeding strategy (Malmkvist & Hansen, 2001). Climbing cages could offer a better welfare for farmed mink because they provide a more complex environment when housing juvenile mink in groups, during the growing season and for singly housed adult mink during the breeding season. However, aggression may be a problem in group housing of juvenile mink. Hunger seems to be an important part of the development of stereotypies. Dietary fibres can reduce the feeling of hunger (Sparti et al., 2000), so by mixing dietary fibres, such as sugar beet pulp, into the feed stereotypies may be decreased.

Our studies aimed to investigate the influence of climbing cages, group housing and feeding strategy, on behaviour and production in farmed mink.

Materials and Methods
The studies were carried out at a private farm in the southwest of Sweden. In study 1 a total of 330 mink kits were housed, from July until November, one female and one male in standard cages, one female and one male, two female and one male or two female and two males in climbing cages. In study 2 a total of 360 females were singly housed in standard cages or in climbing cages from November until March. Direct observations were carried out and all pelts from the group housed mink were visually investigated for scars in November. From July until November all animals were fed ad libitum five days each month. From November until March all animals were fed with either restricted feeding, restricted feeding + 2% sugar beet pulp (dried) and 10% water or “ad libitum” (25% more energy then restricted).

Results and Discussion
The amount of stereotypies performed was low in all treatments, less than 1% of observed time, in juvenile mink. Neither the cage type (n.s) nor the group housing had any significant effect on the development of stereotypies. The cage type had no effect on stereotypies on breeding females either (n.s). The amount of performed stereotypies in breeding females average between 2,5% and 4,8% of the observed time. The energy intake however affected the frequency of stereotypies in both juvenile mink and in adult mink. Stereotypies in juvenile mink were less frequently performed during the 5 days each month they were fed ad libitum (p<0.01). In breeding females, the frequency of stereotypies decreased when mink were fed “ad libitum” during 2 month compared to fed restricted or restricted + sugar beet pulp (p<0.01). Around flushing, all animals were fed feed with the same energy, the frequency of stereotypies were still lower in the animals.
which had been fed “ad libitum” before flushing (p<0,01). No differences in pelt scars between group sizes were found (n.s.).

Conclusions
In conclusion, feeding strategy had an effect on stereotypies in both juvenile mink and in breeding females. An increase in cage size and complexity of the cage environment did not affect stereotypies, in juvenile mink or in breeding females. The amount of pelt scars did not increase in group sizes of 3 or 4 juvenile mink in our study, however, a potential increase in aggression should be considered when housing mink in groups.

References
Does inactivity in the nestbox predict poor reproductive performance in mink?

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Introduction
Within a population of identically-housed animals, such as mink on a farm, individuals differ greatly in their behaviour. They range from spending most of the day performing stereotypic behaviour to becoming extremely inactive (Broom & Johnson, 1993). This may be linked to varying levels of stress; presumably somewhere within the range is a well-adapted phenotype associated with lower levels of stress. Stress is a concern not only for welfare but also for productivity, because it commonly impairs reproduction, both through physiological effects and through suppression of proceptive and receptive behaviours (Wingfield & Sapolsky, 2003).

While stereotypic behaviour has been well studied in this species, little attention has been paid to inactivity. This behaviour pattern could be normal (Hartley & King, 2003), reflecting positive welfare states such as calmness. However, it could also reflect negative welfare states such as ‘apathy’ (Broom & Johnson, 1993) or chronic fear (c.f. felids hiding: Carlstead et al., 1993). We hypothesize that individuals showing the most extreme levels of inactivity are experiencing stress, and consequently predict that their reproductive output will be comparatively low.

Materials and Methods
We conducted a preliminary study with 350 female mink on a commercial farm. Of these, 110 were primiparous, while the others ranged in age up to 4 years. Their colour types were Black, Demi (wild-type) and Pastel. Behavioural data were collected through scanning observations conducted pre-feeding over four days before mating began. Mink withdrawn inside the nestbox were considered inactive unless obvious movements were visible (e.g. grooming). We used litter size at birth and infant mortality as our measures of reproductive success. We also scored quality of nest-building, which was considered an aspect of maternal care. The relationships between these measures and inactivity were analysed using general linear models or logistic regressions where appropriate.

Results
Although most females were stereotypic, some spent up to 90% of the day inactive. The majority of inactive time was spent in the nestbox. Results were similar whether the measure used was total inactivity, inactivity in the nestbox, or all time in nestbox. Inactivity in the nestbox predicted small litter sizes at birth ($F_{1,331}=6.89, P=0.009$), and poorer nest quality before parturition, although the latter was only a trend ($F_{1,26}=3.49, P=0.074$). There was also a trend for a positive correlation with risk of some kit mortality between birth and weaning when all time in nestbox, rather than inactive time only, was used ($P=0.087$); a binary logistic regression was used for this analysis since mortality data were non-normal. Stereotypic behaviour was significantly inversely correlated with inactivity, but was a less consistent predictor of reproductive performance.

Discussion
The link between inactivity and poor reproduction may be due to excess body fat in these individuals; high body weight is associated with small litters, high kit mortality...
and increased risk of barrenness in this species (Jeppesen et al., 2004). Alternatively, the observed relationship may be mediated by fear, which could elicit hiding in the nestbox and has been linked to decreased reproductive success (Korhonen et al., 2002). We are replicating this study to investigate these possibilities, as well as determining whether inactivity in different postures has different reproductive correlates. If specific forms of inactivity can be used to identify mink that are stressed, selective breeding to reduce these behaviours could increase productivity and likely improve welfare at the same time.

References
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