Faglig Årsberetning

2000

Pelsdyrerhvervets Forsøgs- og Rådgivningsvirksomhed

Annual Report

2000

Danish Fur Breeders Research Center

Editor: ***Peter Sandbøl***
Lay out: ***Peter Sandbøl***
Cover photo: ***Bente Krogh Hansen©***
Printed by: ***DP/DPA***

ISSN 1395-198X

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Reports on: Ethology and Animal Welfare

The swimming behaviour of farm mink at different ambient temperatures

C.P.B. Hansen, L.L. Jeppesen

Previous research with farm mink (*Mustela vison)* has shown a significant positive correlation between ambient temperature and swimming activity. Because a link with the general increase in activity during the warmer summer month could not be ruled out, we set up an experiment to investigate specifically whether ambient temperature influences the swimming activity. In separate cages with access to bath water, three times four female mink were placed in a temperature controlled room. After a week of familiarisation the animals were subjected to two periods of four days for each of four temperatures (8, 16, 24 and 32 degrees). The animals were recorded on video during day three after which water losses from the baths and water drunk were measured. From the video tapes the animals position and behaviour were both scanned every ten minutes and recorded in the intervals through one-zero sampling.
The level of activity was independent of the temperature and the time of feeding and peaked at night between 19:00 and 07:00 (Fig. 1).

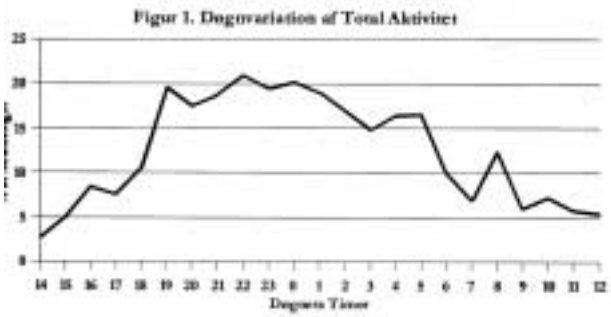

Fig. 1. Circadian variation in total activity of mink
x-axis: Hours. y-axis: % of observations

Although ten of the mink used the bath for swimming, more than 70% of swims were conducted by one individual alone. Four of the animals did express stereotyped behaviour but neither this nor swimming was correlated with the ambient temperature. The most significant influence of the temperature was the position of the animals. At higher temperatures the animal were lying significantly more on the shelve above the water and less in the nest box than at lower temperatures. This was probably due to the occurrence at this temperature of a temperature gradient of 1.7 degrees with the higher end in the nest box. The water consumption of the animals doubled between eight and thirty-two degrees. When allowed, 85% of the animals´ water intake was from the bath instead of from the standard water tube. A significant correlation between swimming activity and water losses from the baths was also found.
The results presented here do not support the theory that the mink's swimming activity is correlated with ambient temperature. Instead, it seems more appropriate to assume that the previously encountered correlation has been due to seasonal variation in the level of general activity.

Annual Report 2000, 7-11. 3 tables, 1 fig., 9 refs. Danish Fur Breeders Research Center, Holstebro, Denmark

Effect of external strain on lactating mink

L. Overgaard

Research may demand conditions that are less suitable for the animals. 58 lactating mink were subject to high external strain caused by passing of the feeding machine 5 or 10 times per day and only being fed once or twice (unpredicted feeding). 54 lactating females (control group) were subject to low external strain and were fed all at one time once or twice daily (predicted feeding). Until one week before expected parturition all the mink had equal conditions.

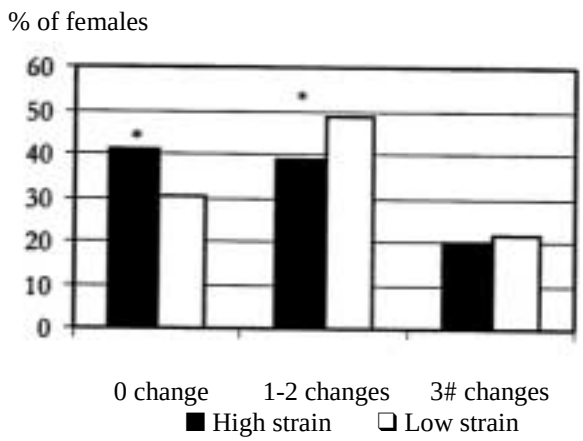

Fig. 1. % of females changing 0, 1-2 and 3 or more times between the cage and nest box. Mean of 10 min. observations 2 times weekly in 6 weeks.
* = p<0.05

The two groups gave birth to an equal number of kits, but the females subjected to high external strain weaned fewer kits due to larger kit mortality; partly because of more greasy kits. The females´ activity was evaluated according to how often they changed between being in the nest box or in the cage during 10 minute observation periods over six weeks (Fig. 1).

To assess the females nesting ability a 'kit-retrieval-test' was carried out. The two behavioural observation methods showed that females subjected to high external strain were less active and used more time to catch the kit back into the nest box than females subjected to low external strain (Fig. 2). It was concluded, that high external strain affected lactating mink, so that they took less care of their kits, resulting in high kit mortality.

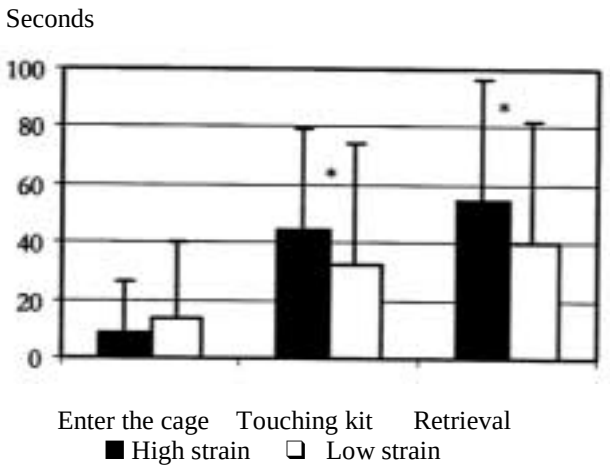

Fig. 2. The time passed before the female enters the cage, touches the kit or gets the kit back to the nest. * = p<0.05

Annual Report 2000, 13-16. 2 tables, 2 figs., 4 refs. Danish Fur Breeders Research Center, Holstebro, Denmark.

Activity of mink selected for high or low feed efficiency II.

L. Overgaard, K. Sørensen

The aim of this study was to investigate whether feed efficiency was a heritable property in mink. Included in this study it was tested if the selection would affect the activity level of the mink. The study was made with two lines of mink selected for high or low feed efficiency. The activity level of the mink was examined in 1999 at 145 males in July and 127 pairs in October, and again in 2000 at 171 males in July and 141 pairs in October (Fig. 2 and 3).

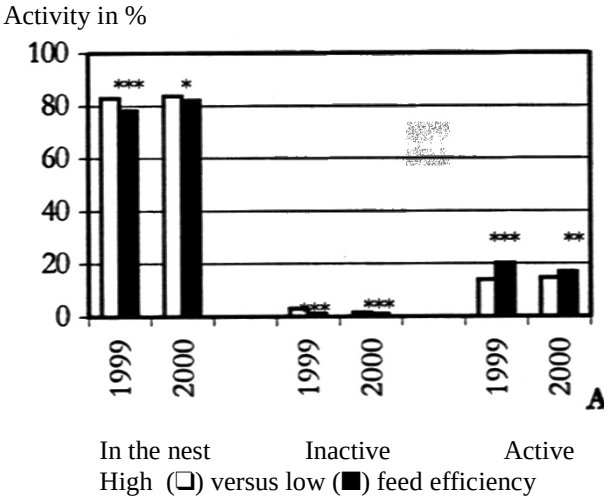

Fig. 2. Activity of male kits selected for high and low feed efficiency. Observation week 42 in October 1999 and 2000. * = p<0.05; ** = p<0.01; *** = p<0.001.

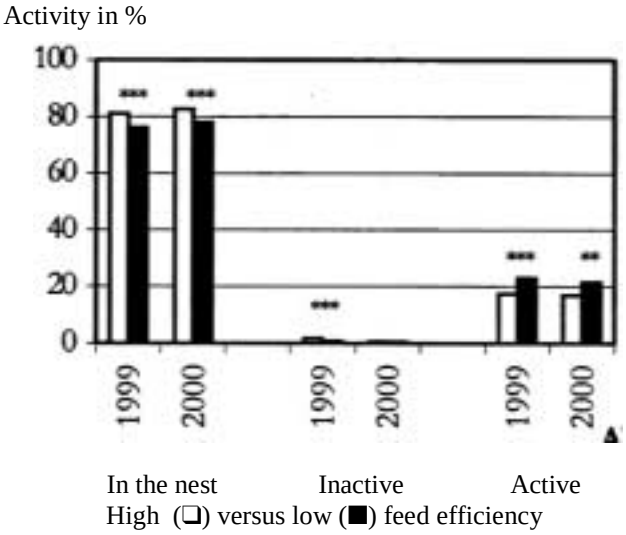

Fig. 3. Activity of female kits selected for high and low feed efficiency. Observation week 42, October 1999 and 2000. ** = p<0.01; *** = p<0.001.

In July 2000 and October both years mink selected for high feed efficiency were less active than mink selected for low feed efficiency. In July 1999 there were no differences in activity between the selection lines. It was concluded that selection on feed efficiency in mink influences their activity level.

Annual Report 2000, 17-20. 1 table, 3 figs., 6 refs. Danish Fur Breeders Research Center, Holstebro, Denmark.

Alternative management routines and housing systems of farmed foxes: How do they affect reproduction?

V. Pedersen

In order to examine consequences of different housing systems on the behaviour, welfare and performance of farmed foxes, a Danish study on alternative housing was conducted in the years 1993-1996 (Jeppesen, 1994, Pedersen, 1994, 1997; Pedersen and Skovgaard, 1995, 1996, Pedersen et al., 1996). Among other results, this study left the impression that one of the alternative systems caused an impaired reproductive success reflected in a higher proportion of vixens loosing their cubs around birth in some years. Since the alternative system in question in previous studies (Jeppesen and Pedersen, 1992, Pedersen and Jeppesen, 1993) had shown to reduce fearfulness and increase welfare of adult silver fox vixens it seemed important to examine the causes of a higher cub mortality in this system. Eventually, it was revealed that this system differed from the traditional system in some uncontrolled ways. Firstly, the vixens were kept permanently in the same cage (and nest box) year-round and the time span of birth dates between neighbours could be up to 6 weeks. In the traditional system, when mating was completed, vixens were moved to other but similar cages according to date of parturition, starting from the bottom of the shed. This accomplished that neighbouring vixens gave birth at largely the same dates in this system. Secondly, the individual vixen was kept in closer contact with neighbouring vixens during the breeding season in the alternative system due to the location of the nest boxes on the roof of the cages. In the traditional system, the nest box was placed in one of the two rooms of the fox cage in such a way that it blocked for the vixens' access to that room and thus blocked for the access to close contact with neighbouring vixens.

The objective of the present study, conducted for a 3-year period, was to examine how the above-mentioned different housing and management routines affected reproductive success in farmed silver fox vixens. One hundred primiparous vixens were randomly assigned to a 2x2 factorial design, where the housing system was either the traditional ($1.2m^2$, standard nest box in the cage, T) or an alternative cage environment ($2.2m^2$, top mounted nest box and two platforms, A) and the management routine was either the traditional (alternate neighbours, successive birth dates, T) or an alternative (permanent neighbours, random birth dates between neighbours, A). Numerous parameters linked to reproduction were registered during the course of the study. The main findings were that a stable environment seemed to benefit reproductive success in the silver foxes, most strongly expressed in the traditional housing system (Fig. 3). The alternative housing system showed a potential for an improved reproductive success, but differed significantly only from the traditional cage environment with the traditional management routine on a few occasions.

y-axis = number of cubs

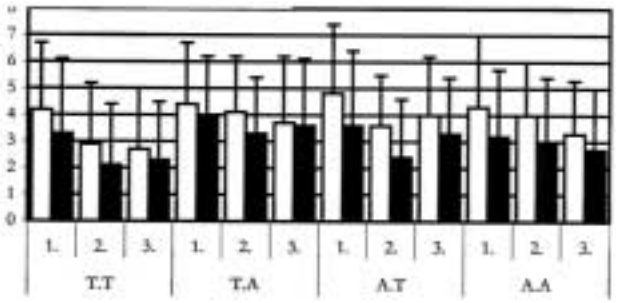

Fig. 3. Mean number of cubs (+ SD) born (❑) and weaned (■) in the 3 years and in the 4 experimental groups: T.T = traditional housing and management with new neighbours according to whelping date. T.A = traditional housing, constantly same neighbours. A.T = alternative housing, traditional management with new neighbours according to whelping date. A.A = alternative housing, constantly same neighbours.

Cub-mortality was relatively high in the alternative cage environment though no significant differences were found between this and the traditional environment. However, reasons for cub mortality in the alternative environment should be examined thoroughly, especially since it has been proven to increase welfare of the vixens in previous studies. Through modifications of the nest box design and the access to the nest box the welfare of cubs might be improved as well, thus reducing cub mortality.

Annual Report 2000, 21-28. 3 tables, 4 figs., 12 refs. Danish Fur Breeders Research Center, Holstebro, Denmark.

Reports on: Genetics and Breeding

Selection for kit growth - considering welfare of the dam. Results of the fourth year of selection

B.K. Hansen, P. Berg, J. Malmkvist, S.W. Hansen, U.L. Rasmussen

The present report is the fourth provisional report of a selection project started in 1996. The aim of the project is to evaluate the genetic variation in early kit growth and its relation to body weight later in the growth period and the demands on the dam. The three selection lines were established in 1996. In line 51 the selection criteria is litter size. The selection for growth of kits is in line 52 based on kit´s own capacity and in line 53 on the maternal ability to induce growth in kits, in both lines kit growth is adjusted for litter size. In all lines the breeding values are estimated by an Animal Model. The material includes registrations from 7865 kits. There is a positive response in the selected trait in all lines (Fig. 1).

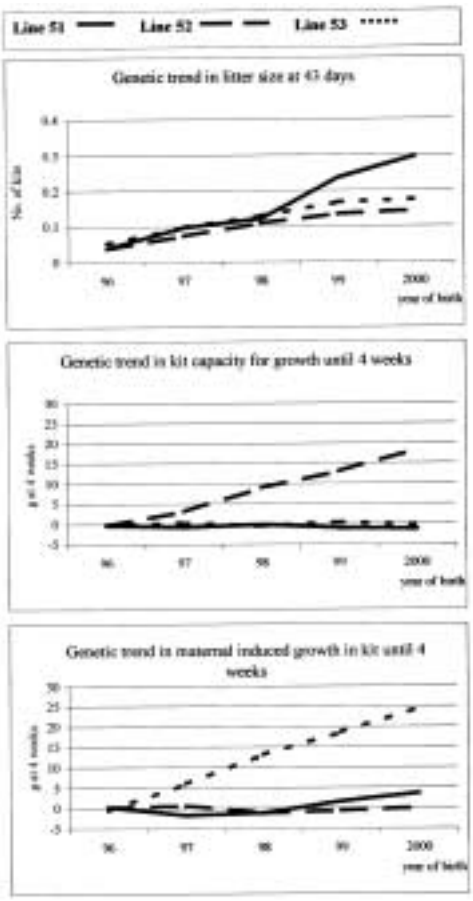

Fig. 1. Genetic trend using all animals and information available from all years.

The response in litter size is 0.3 kit at 43 days in line 51. The response in male kit growth is about 18 grams at 4 weeks in line 52 and about 24 grams of body weight at 4 weeks in line 53. Preliminary results from the present selection experiment confirm that there are two ways to affect the early growth of kits by selection: to select for the kits own growth capacity or to select for maternal ability to induce growth on kits. In line 53 the phenotypic effect on kit body weight at 4 weeks is highest. Registrations from the behaviour tests are collected, but not analysed.

Annual Report 2000, 29-32. 1 table, 1 fig. 7 refs. Danish Fur Breeders Research Center. Holstebro, Denmark.

Is feed efficiency a hereditary trait?

K. Sørensen, P. Berg, U.L. Rasmussen, B.K. Hansen

Feed is the largest expense in the production of mink; this was the main reason for a selection experiment on feed efficiency using mink of brown colour type. Feed efficiency was measured on male kits in July over a 4-week period as weight gain divided by dry matter feed intake. The selection started in 1989 with lines selected for high (HFE) and low (LFE) feed efficiency, in 1992 the LFE line was stopped. In 1993 the HFE line became basis for new selection lines which has currently been selected for seven generations for either high (HFE-HW) or low (LFE-HW) feed efficiency combined with high body weight in November. The data contained records from eleven generations (years) with 4508 animals of which 1868 were males with records for feed efficiency. Genetic parameters and genetic trends for feed efficiency, weight gain, feed intake and weight in November have been estimated using bivariate Animal Models by an Average Information REML algorithm. Heritability for feed efficiency was 0,29 and 0,61 for weight in November. Comparisons of selection lines show that statistically significant differences for mean breeding values of feed efficiency were found in all years. Differences in feed efficiency in recent years were mainly due to differences in weight gain because there were only small differences in feed intake.

Annual Report 2000, 33-38. 4 figs., 6 refs. Danish Fur Breeders Research Center, Holstebro, Denmark.

Reports on: Nutrition and Nutritional Physiology

Astaxanthin (Novasta™) for mink females in the reproduction period 2000

T.N. Clausen, C. Hejlesen, P. Sandbøl

We investigated the possible effect on reproduction in mink of adding algae meal (Novasta™) with a high content of astaxanthin to the feed in the winter and reproduction period. Two groups of wild type mink females with approximately 350 females per group were used. To the feed in the study group 0,25 g of Novasta per animal per day was added from February 14 to weaning of the kits at 6 weeks. There were no differences in number of kits and kit weight at weaning between control and investigation group. Analyses of astaxanthin in the feed and plasma showed much lower values than expected. No clear explanation as to the cause of this discrepancy has been found.

Annual Report 2000, 39-42. 4 tables, 5 refs. Danish Fur Breeders Research Center, Holstebro, Denmark.

Energy Distribution in Mink Feed in the Winter and Reproduction Periods

C. Hejlesen, T.N. Clausen

It has been shown, that feed protein content in the winter and reproduction periods can be lowered from 55% of the metabolizable energy (ME) to 45% with a carbohydrate content of 10 to 15% of the ME without negative effects. A protein content of 45 % of the ME and a carbohydrate content of 20% has indicated reduced number of live born kits. Furthermore 30% of the ME from protein (a typical growth period diet) in the period from December to late February has elevated the frequency of greasy kits.
The aim of this investigation was to elucidate possible effects on reproductive performance of lowering the protein content in the winter and reproduction periods from 55% of the ME to 45%, and varying the carbohydrate content between 10 and 25% of the ME. In addition to this, feeding a typical growth period diet from December to late February was investigated
It is concluded that without negative effects on reproductive performance the protein content in the winter and reproduction periods can be reduced from 55 to 45% of the ME with 40% and 15% of the ME from fat and carbohydrate respectively.
Feeding 30% of the ME from protein from December to late February elevated the number of live born kits, but it also elevated the kit loss from birth to weaning. It did not have any significant effect on the frequency of greasy kits.

Annual Report 2000, 43-50. 16 tables, 7 refs. Danish Fur Breeders Research Center, Holstebro, Denmark.

Ad libitum or restrictive feeding of scanblack mink females in the gestation period

T.N. Clausen, C. Hejlesen

We investigated the importance of feed intensity in April for mink females milk production, based on kit weights at day 28 and at weaning. Two groups of standard mink females were fed *ad libitum* (AD LIB) versus 20 % less than *ad libitum* (RESTR) in the gestation period (March 25 to April 24; Fig. 1).

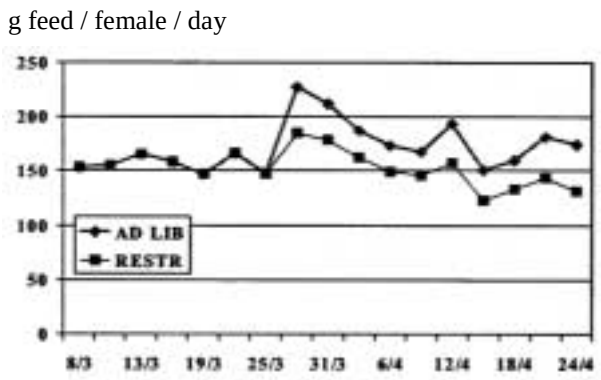

Fig. 1. The amount feed per female in AD LIB and RESTR groups during gestation period.

There were no significant differences in the number of kits at birth and at weaning, but significantly more kits died from birth to day 28 in the RESTR group.

The kit weight in the AD LIB group was higher at day 28 (significant) and at weaning (not significant) than in the RESTR group (Table 3).

The females in AD LIB had higher weight at birth, but lower weight at day 28 and weaning than the RESTR group, due to more kits and heavier kits (Fig. 3).