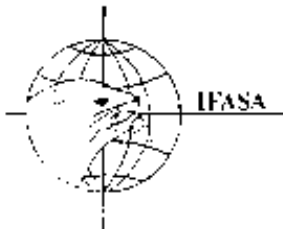
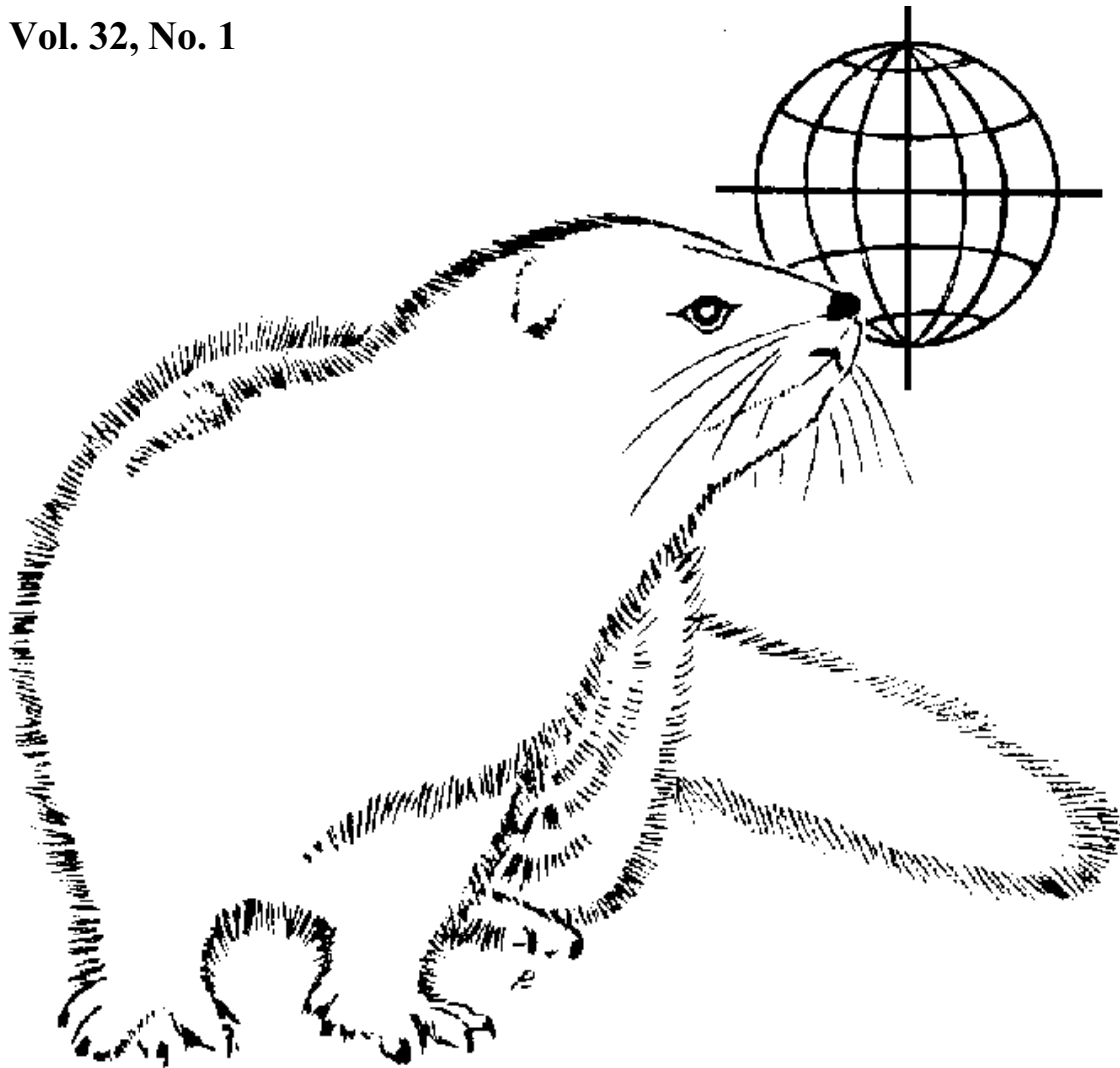


SCIENTIFUR

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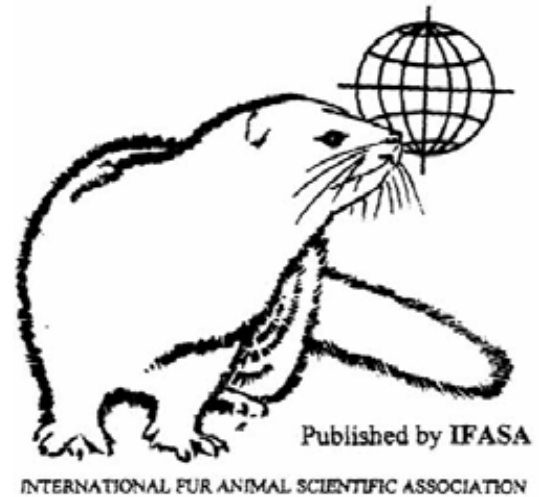
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Notes from the Group of Editors

This issue of *Scientificur*, Volume 32, No 1, contains the abstracts included in the Annual Report 2007 of the Danish Fur Breeders' Research Center.

As always, we invite our readers to submit proceedings from congresses and seminars with

relation to fur animal production. We also invite you to submit short communications, abstracts and letters on fur animal production, and in particular we ask you to send us articles for reviewing.

On behalf of the
Group of Editors

Birthe Damgaard

Genetic parameters in Finnish blue fox population: Pelt character and live animal grading traits

J. Peura, I. Strandén, E.A. Mäntysaari

Finnish blue fox farmers breed for increased litter size and pelt size, and improved fur quality. Some farmers select pelt size and fur quality indirectly using live animal evaluations (grading traits). In order to be able to define breeding goals properly, heritabilities and genetic correlations were estimated for size traits and fur quality traits. There were four pelt character traits (pelt size, pelt colour darkness, pelt colour clarity and pelt quality) measured on dried skins, and six grading traits (animal size, grading colour darkness, grading colour clarity, underfur density, guard hair coverage and grading quality). The data included 54,680 animals born during the years 1987-2002, originating from seven farms. The heritabilities were high for pelt colour darkness and grading colour darkness, moderate for pelt size and low for other traits. In general, heritability of a pelt character trait was higher than its corresponding grading trait. Genetic correlations within the pelt character traits were low (~0.11) and within the grading traits mainly moderate or high (~0.44). There was high genetic correlation between pelt darkness and grading darkness, pelt quality and grading density, pelt size and animal size; between pelt quality and grading quality and between pelt colour darkness and grading guard hair coverage. This suggests that selection of pelt character traits via grading traits in most cases is relatively effective.

Acta Agriculturae Scandinavica, Section A – Animal Sciences, 2005: 55, 137-144.

Transformation of digestive enzymes in different genotypes of farm-bred American mink (*Mustela vison schreber, 1777*) under domestication

E.B. Svetchkina, N.N. Tyutyunnik

A comparative research of trypsin and amylase activity in the blood of wild (captured in nature) and different colour types of farming American mink was

carried out. High trypsin activity of wild as well as farmed mink reflects genetic determination of predators digestive tract to high content of animal forage protein. At the same time more higher level of amylase activity was revealed in the blood of farmed mink as the consequences of their selection for diet transformation in artificial conditions.

Вестник ВОГУС, 2007, Том 11, 99-108

Lipoprotein lipase in the kidney: activity varies widely among animal species

T. Ruge, L. Neuger, V. Sukonina, G. Wu, S. Barath, J. Gupta, B. Frankel, B. Christophersen, K. Nordstoga, T. Olivecrona, G. Olivecrona

Much evidence points to a relationship among kidney disease, lipoprotein metabolism, and the enzyme lipoprotein lipase (LPL), but there is little information on LPL in the kidney. The range of LPL activity in the kidney in five species differed by 500-fold. The highest activity was in mink, followed by mice, Chinese hamsters, and rats, whereas the activity was low in guinea pigs. In contrast, the ranges for LPL activities in heart and adipose tissue were less than six- and fourfold, respectively. The activity in the kidney (in mice) decreased by 50% on food deprivation for 6 h without corresponding changes in mRNA or mass. This decrease in LPL activity did not occur when transcription was blocked with actinomycin D. Immunostaining for kidney LPL in mice and mink indicated that the enzyme is produced in tubular epithelial cells. To explore the previously suggested possibility that the negatively charged glomerular filter picks up LPL from the blood, bovine LPL was injected into rats and mice. This resulted in decoration of the glomerular capillary network with LPL. This study shows that in some species LPL is produced in the kidney and is subject to nutritional regulation by a posttranscriptional mechanism. In addition, LPL can be picked up from blood in the glomerulus.

Am J Physiol Renal Physiol, 2004: 287, 1131-1139.

Effects of synthetic amino acids on morphological and biochemical blood parameters, and on health status of arctic foxes

M.O. Lorek, A. Hartman, A. Gugolek, P. Matusevičius

The effect of synthetic amino acids supplementation on morphological and biochemical blood parameters, and the general health status of Arctic foxes was investigated. The experiment comprised 120 Arctic foxes from weaning to slaughter, which were divided into 2 groups – control (I) and experimental (II). The control foxes were fed normal diet given to all animals in the farm. The foxes in experimental group were fed diet supplemented with synthetic amino acids: methionine, lysine and threonine, in the amount of 2 g of each amino acid per 100 g of total protein content in diet. Before slaughter blood samples from five randomly selected females in each group were collected for morphological and biochemical analysis. After slaughter five carcasses of males of each group were selected randomly for postmortem examinations.

The results of this experiment demonstrated no significant effect of synthetic amino acid supplementation on the morphological and biochemical parameters in blood and had no effect on the internal organs and alimentary tract segments examined.

Veterinarija ir zootechnika, 2005: 30 54-59.

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Reports on: Behaviour

Cross fostering of lines of mink selected for or against stereotypic behaviour

A.M.J. Haagensen, L.L. Jeppesen

Mink were selected for or against stereotypic behaviour for 5 generations and afterwards subjected to cross fostering in order to examine,

whether the result of the selection could be due to maternal influences during the lactation period. The two selection lines comprised 150 low stereotyping females and 150 high stereotyping females. After delivery, cubs were interchanged between half of the females from each of the lines. This resulted in 4 experimental groups: low stereotyping females with own cubs, low stereotyping females with cubs from the high stereotyping line, high stereotyping females with own cubs, and high stereotyping females with

cubs from the low stereotyping line. Females and cubs were observed in the lactation period, and the cubs were observed later on as juveniles in their first autumn and as adults in their second autumn. The behaviour of the females and of the cubs was influenced by the interchange. The females with interchanged litters were less in the nest and performed more stereotypic behaviour. The interchanged cubs were more active in the lactation period and also when they were observed as juveniles. As adults they were more stereotyping, however, this was only in the high stereotyping line. The behavioural differences between the lines, which were established during the selection, were maintained in all four groups to an extent clearly showing that the result of the selection cannot be due to maternal transfer of information in the lactation period.

Annual Report 2007, 7-12, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Bite marks as a welfare indicator in mink

S.W. Hansen, L.L. Jeppesen

The objective of this study was to examine whether there is a relation between bite marks to the neck, body and tail and the extent of the aggression the animal has been exposed to. Further, it has been the aim to investigate whether mink generally use the nest box less when housed in groups than when they are alone in the "climbing cage", and whether particularly mink with bite marks are more fearful than mink without bite marks. Finally, the aim has been to investigate if there is a relation between bite marks and a number of blood parameters elucidating health status and stress level. The study was performed with 96 mink placed in groups of 4 in 24 "climbing cages". The study showed that bite marks on the leather side of body and tail can be related to aggression and fearful temperament, but bite marks have no lasting effect on the activity level of mink, placement in the cage or on blood parameters. Bite marks to the neck cannot be related to aggression. Whether the bite marks occur as a result of aggression, play or beginning sexual activity, it is damaging to the animal and therefore undesirable when considered from a welfare point of view, but also from a financial point of view as the fur will be damaged. Registration of bite marks in connection

with pelting makes it possible for the farmer to objectively evaluate the social environment among the mink and thus provides him with a tool to evaluate the effect of housing routines. Group housing reduced the mink's use of the nest box. Limited space and a consequent temperature rise in the nest box may result in less use of the nest box.

Annual Report 2007, 13-24, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Restricted feeding postpones the diurnal activity pattern of mink but does not increase the level of activity

S.H. Møller, L.L. Jeppesen

We have tested if long term mildly restricted feeding leads to increased diurnal activity in terms of appetitive behavior and stereotypy before feeding, and whether this activity is induced by expectation of feed at a specific time of the day. Activity and stereotypy of mink kits were observed directly each hour as well as feed leftovers during four autumn days and nights. Activity and stereotypy were also observed during postponed feeding. No general differences were observed related to feeding intensity, but the restricted fed mink were less active at sunrise and more active prior to feeding time. The body weight was negatively correlated to activity. Few stereotypies were observed but mink without feed for more than 8 hours performed most stereotypies. The main activity periods were around sunrise, feeding, and sunset. The activity increased when the restricted mink expected the next feeding, but they reduced activity when they had no feed left. It was concluded that long term restricted feeding does not increase the total activity level in mink. The expectation of feeding at a specific time induces feeding behavior in hungry mink while satiated mink do not react before they hear the feeding machine. Therefore it is important to feed at the same time of the day in restricted feeding periods.

Annual Report 2007, 25-30, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Reports on: Breeding and reproduction

Stereotypic behaviour in mink is hereditary

B.K. Hansen, L.L. Jeppesen, P. Berg

The existence of genetic variance in stereotyped behaviour and its possible relation to production traits is tested. A total of 1598 adult females from two lines selected for High versus Low frequency of stereotyped behaviour were observed for whether in cage or in nest box, and in cage for stereotyped, active and inactive behaviour. Additionally the production traits kit body weight, relative adult body weight both weights were measured in October, litter size at birth and 2-3 weeks after birth and percent alive kits in the litter at birth and at 2-3 weeks after birth were registered. The study continued from 2001 to 2005. Behaviour traits are inherited with low to moderate heritability. Genetic and phenotypic correlations are estimated.

Annual Report 2007, 31-38, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Genotype-environment interaction in mink

V.H. Nielsen, S.H. Møller, B.K. Hansen, P. Berg

Lines selected for high November weight under ad libitum (AL) and restricted (RF) feeding and for high feed conversion rate under ad libitum feeding (FE) were tested for November weight and feed consumption under both feeding conditions after three generations of selection. The genetic correlation between November weight under ad libitum and restrictive feeding was estimated to 0.92. This indicate that November weight under the two feeding conditions are genetically not exactly the same trait. An interaction was also observed between line and test feed for feed consumption. The smallest number of kits was observed in the AL-line.

Annual Report 2007, 39-42, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Map of the mink chromosomes

K. Christensen, R. Anistoroaei, A. Farid, B. Benkel

By typing 252 gene markers (mikrosatellites) in 5 families with 92 progeny, 146 of the markers have been mapped to 13 of the 15 chromosome pairs in the mink. Chromosome one, for example, has the largest linkage group, which contains 25 markers. By use of sequences from a BAC library produced in Canada there are now 171 mikrosatellites, which due to homology can be placed on the human chromosome map. Fifty-one of them are informative mikrosatellites. By means of that, many of the gaps in the mink map have been filled. In situ hybridization of 15 BAC clones has given a physical anchorage of the genetic map, so the map is turned correct on the chromosomes. The Regal White gene has been mapped to chromosome 7, and it codes for the enzyme tyrosinase (Tyr).

Annual Report 2007, 43-48, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Mink selected to produce on a low protein content in the feed. Status for growing period 2006 and final conclusion

T.N. Clausen, P. Sandbøl, C. Hejlesen

A selection experiment was initiated in 2002 to investigate the possibility of breeding mink with a good fur quality when the content of protein in the feed was low (SEL), without negative consequences for reproduction and pelt length compared to a control group (KON). At pelting 2005 four new groups were made from these, two groups continuing on selection feed (SS14) or control feed (KK11), and two groups changing between control and selection feed (KS13 and SK12). To the growing furring period 2006 each of these groups were split in two fed either KON or SEL feed (total 8 groups). The selection experiment stopped at pelting 2006, thereafter genetic parameters will be estimated.

Feeding low protein and selecting of the best kits, resulted in a parallel increase in pelt weight and skin length in the control and selection groups. Against that a low protein feed had a negative effect on kit growth in the nursing period.

Annual Report 2007, 49-54, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Reports on: Nutrition and feeding

Protein to mink in the gestation period. Continued investigations

T.N. Clausen, P. Sandbøl

To continue the investigations on the need of protein and amino acids in the gestation period (April 4 to April 26), and the possible importance of the gestation feed for milk production and early kit growth, we used 6 groups each consisting of 135 brown mink females. The females were fed with feed from the local Feedkitchen until April 6, thereafter the protein content was changed in 5 groups from 24 percent of metabolisable energy from protein (MEp) to 40 % (24, 28, 32, 36 and 40 respectively). After April 26 these females had 30 MEp. Day 28 in the nursing period, the protein content was raised to 45 MEp to satisfy the kits need for protein. The control group was fed 52 MEp in the whole investigation period. Only females giving birth between April 26 and May 5 was included in investigation.

The results showed that in the gestation period April 6 to April 26, the females need 40 MEp or more, with this amino acid profile and energy concentration, to get the highest number of live borne kits and the best kit body weight day 49. 32 MEp or less increased the number of dead kits at birth. The number of barren females was highest (not significant) in groups feed the lowest amount of protein.

Annual Report 2007, 55-60, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Feed with different energy distribution to mink kits from July to mid September

T.N. Clausen, P. Sandbøl, C. Hejlesen

The purpose of this investigation was to evaluate the effect of energy distribution on kit growth in July. To the investigation we used 14 groups of each 112 brown male- and female kits. The kits were feed investigation feed from July 3 to September 15. The amount of metabolisable energy (ME) from protein varied from 26 – 32 percent, the amount of ME from fat varied from 44 – 59 percent and carbohydrate varied from 15 – 27 percent of ME. To achieve the best growth in July the amount of energy from protein should be at least 32 percent, the amount of energy from fat should be from 50 to 59 percent and carbohydrate should not exceed 18 percent of ME in that period. Within these levels we also saw the longest skins and the best fur quality.

Annual Report 2007, 61-68, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Analysis of minerals in ingredients for mink feed

M. Schulin-Zeuthen, B. Munkøe, P. Sandbøl

The Table of Feed Ingredients for mink feed is the basis for the database in the software program Agrosoft, which is used for economical optimisation by the feed kitchens.

In connection with VMP III (Environmental Water Protection Plan III) a range of feed ingredients rich in phosphorus have been analysed and presented in the Annual Report 2006 (Hejlesen 2007).

The present analysis program was initiated to supplement this earlier investigation for a continued update of the The Table of Feed Ingredients.

Annual Report 2007, 69-71. Danish Fur Breeders' Research Center, Holstebro, Denmark.

Reports on: Physiology and analytical techniques

Susceptibility of post weaning diarrhoea in mink kits – establishment of a challenge model

B.M. Damgaard, M.S. Hedemann

The aim of the project was to establish a challenge model for susceptibility of post weaning diarrhoea in mink kits, and further to characterise the development of the intestine. The project was performed during the first 7 days after weaning. The mink kits were orally challenged with coli bacteria (*Escherichia coli* O68) 1 and 2 days after weaning. The faeces consistency was registered daily as an indicator of diarrhoea. The development of the intestine was characterised at weaning and at the end of the experiment. The frequency of mink kits with diarrhoea was higher in challenged kits than in control kits. The body weight, the growth and the feed intake were not influenced by the challenge with bacteria. The depth of the intestine crypts was lower in challenged kits than in control kits indicating that the growth of the intestine was reduced.

Annual report 2007, 73-76. Danish Fur Breeders' Research Center, Holstebro, Denmark.

Evaluation of staining methods for quantification of placental scars in farm mink (*Mustela vison*)

A.S. Hammer, T. Hammer-Jensen, C.M. Sørensen, T.N. Clausen

Three staining methods for detection of placental scars are compared, to identify a suitable method for improved quantification of placental scars in farm mink (*Mustela vison*). The number of placental scars detected using method A (Turnbull) were significantly larger than the number of scars detectable prior to staining ($p < 0.001$). Generally all methods allowed for a more specific detection of placental scars, but we did not find significantly more scars using the remaining two staining methods (B + C) compared with evaluation prior to staining. Placental scars could be detected in uteri obtained from first year females 6-7 months post partum, but it was not possible to detect placental scars in uteri obtained from females ≥ 12 months post partum. This result confirms that quantification

of placental scars provide an estimate of female fecundity in the recent breeding season. It is remarkable that 39 % of females which were considered barren ($n=100$), had placental scars, which indicates that females had been pregnant, but experienced late termination of pregnancy or neonatal death of the kits.

The results indicate that staining of placental scars may be a useful tool in improving the quantification of placental scars in farm mink until pelting time, which increase the usability of the method for application in research and diagnostic investigations.

Annual report 2007, 77-80. Danish Fur Breeders' Research Center, Holstebro, Denmark.

Reports on: Health

Mastitis in farm mink (*Mustela vison*)

A.S. Hammer, T. Hammer-Jensen, C.M. Sørensen

This report concerns preliminary results of investigations of mastitis in Danish farm mink during the period 2005-2007. The material included 71 mink females with lost or significantly reduced litters 0-2 days post partum and 38 mink females collected from 7 farms experiencing problems with mastitis. Results of pathological and microbiological investigations indicate that a large proportion (31 %) of neonatal losses were associated with bacterial infections in the mammary glands of the female mink. Several types of bacteria, mainly *Escherichia coli* and *Staphylococcus intermedius* were identified as causes of mastitis in mink. Histopathological analyses showed that *E. coli* most often causes peracute-acute, necrotizing mastitis, while staphylococcal mastitis typically results in milder and chronic infections and often abscessation of affected glands. Mortality due to mastitis were low (<5 %) on the farms included in this study, but our investigations indicate that mastitis is an important and likely underdiagnosed cause of neonatal death in mink kits.

Annual report 2007, 81-86, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Urine investigations on farms 2006

T.N. Clausen, V. Weiss, M.U. Hansen, M. Lassén, B. Muldbjerg

In the growth period 2006 we investigated feed and urine samples at Danish mink farms, in an attempt to find a correlation between feed composition (feed Base Excess) and urine pH. The purpose was to find a method to prevent urinary diseases. To the investigation we took feed and urine samples from tree farms receiving feed from Holstebro Feed kitchen.

The results showed low urine pH at the farms compared to earlier years. This was due to addition of large amounts of acidified raw materials in the feed in the early growth period. Due to low urine pH there were only few urine samples with crystals. The bacteriological investigations showed contamination of the samples. Analysing feed mineral content and calculating feed BE can not be used to predict urine pH when different raw materials and acids are used.

Annual Report 2007, 87-94, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Sodium-hydrogen-sulphate and ammonium chloride to mink in the growing period

T.N. Clausen, P. Sandbøl, C. Hejlesen

The purpose of this investigation was to look at the effect of 0.5 % Na-hydrogen-sulphate and 0.2 % ammonium chloride on urine pH, kit growth and fur quality. To the investigation we used 3 groups of black siblings consisting of each 47 male kits. The investigation was from July 7 to pelting, one group had control feed (KON), one group had control feed with the addition of 0.5 % Na-hydrogen-sulphate (NABI) and the last group had control feed with the addition of 0.2 % ammonium chloride (AMM).

0.5 % NABI and 0.2 % AMM to mink kits in the growing - furring period had no negative effect on kit growth, pelt length and skin quality. Urine pH was measured monthly, 0.5 % NABI reduced feed pH and reduced urine pH most of the period. 0.2 % AMM had only a marked effect on urine pH at one measurement.

Annual Report 2007, 95-98, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Investigations of causes of death among mink kits from June to October

M.U. Hansen, V. Weiss, T.N. Clausen, B. Muldbjerg, M. Lassén

The Danish Fur Breeders suffer from losses every year due to urinary tract diseases in July and August. In the growing-furring season 2006 a survey was performed by the National Centre | Fur Animal together with Holstebro Veterinary Hospital and The Danish Fur Breeders Research Centre to enlighten the occurrence of urinary tract diseases in mink in the area around Holstebro. This area had a high occurrence of urinary tract diseases in 2005. As can be read from the results the occurrence of urinary tract diseases was low in 2006. The project gave although an extensive knowledge into the causes of death among mink kits from June to October.

Annual Report 2007, 99-108, Danish Fur Breeders' Research Center, Holstebro, Denmark.

Reports on: Management

Correlation between early kit mortality and body condition of female mink and activity in the period from February to birth

H. Bækgaard, M.U. Hansen, P.F. Larsen, M. Sønderup

1st year brown/Glow females give birth to 9 kits per litter on average. At weaning around 1st of July in Denmark 2007, we had 5,64 kits per female. With a barren percent of 10 %, this means that we loose 2.5 kits per female from birth to 1st of July. The majority of the lost kits, dies within the first 3 days post partum and is often referred to as "Early kit mortality". Previous studies have shown that the body condition of the female plays an important role for the number of both live and dead born kits. In this study, 6 farms with a total of 3878 1 year Brown/Glow females were included. The body condition was evaluated once in each of the

following periods; primo February, ultimo February; (before flushing), ultimo March and ultimo April. The body condition was evaluated on a 5 scale (5: Very fat, 4: Fat, 3: Medium, 2: Thin, 1: Very thin). As a measure for activity, the females were observed and scored 1 to 4. (1) In the nest box (2) Outside nest box (3) Run in cage (4) Stereotypi. Activity measurements were conducted ultimo April together with the body condition score. To get the best measure for activity the observations were conducted just before feeding. This study shows that female body condition has an influence on the number of both dead and living kits. Based on these observations we conclude that the body condition of the female is an important factor in relation to the phenomenon "Early kit mortality". Moreover, from this study we see that females with a positive development in body condition from ultimo February to ultimo April, on average, get more live kits per litter. Thus, it appears that a score 2 in ultimo February, score 3 ultimo March and a score 4 in ultimo April is the combination that on average gives most living kits per litter.

Finally we found no correlation between female activity and the number of either dead or living kits. Neither could we find any correlation between activity and body condition. We therefore conclude that the activity of the female is less important than the body condition in relation to early kit mortality.

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