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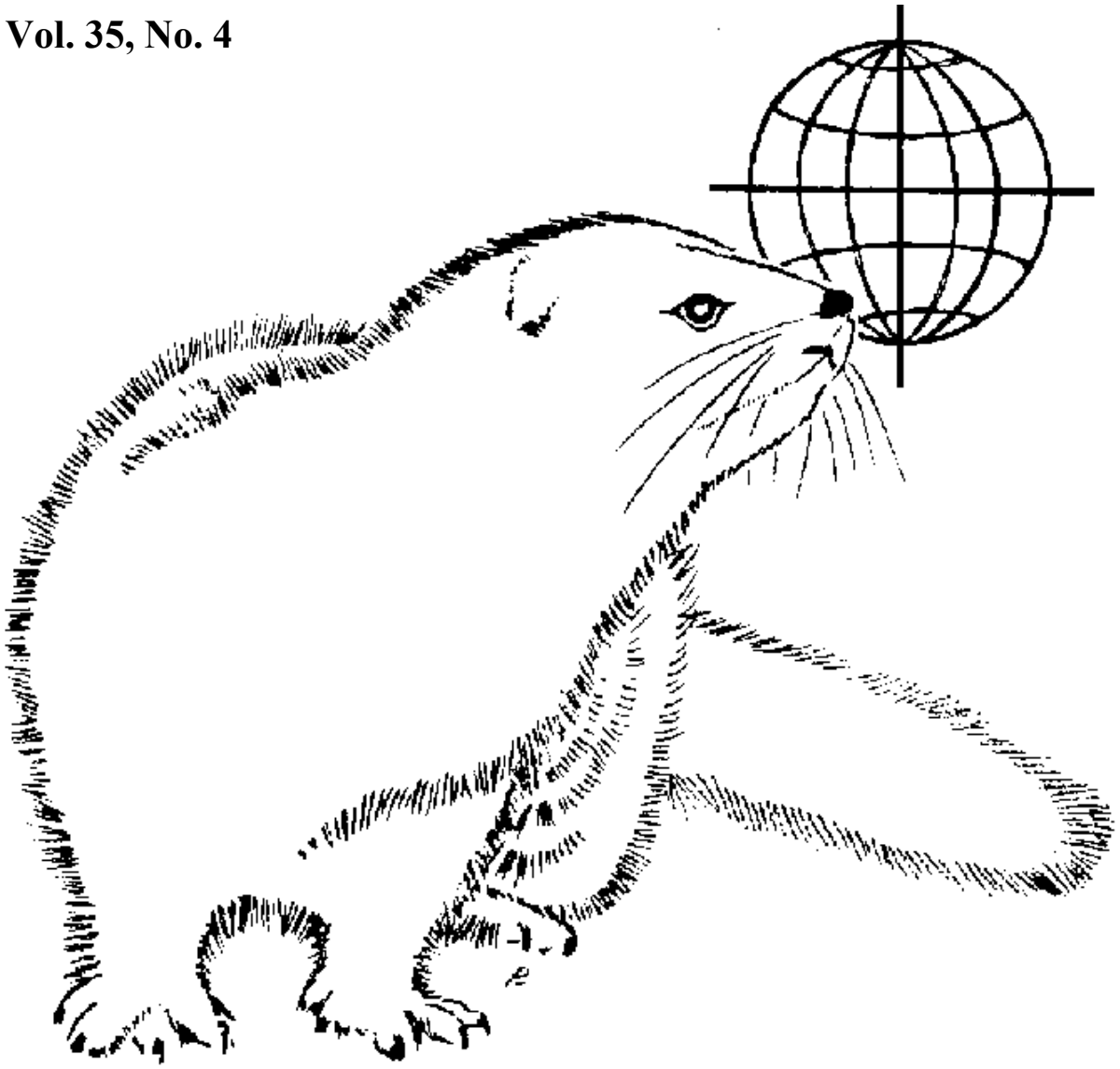

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INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION

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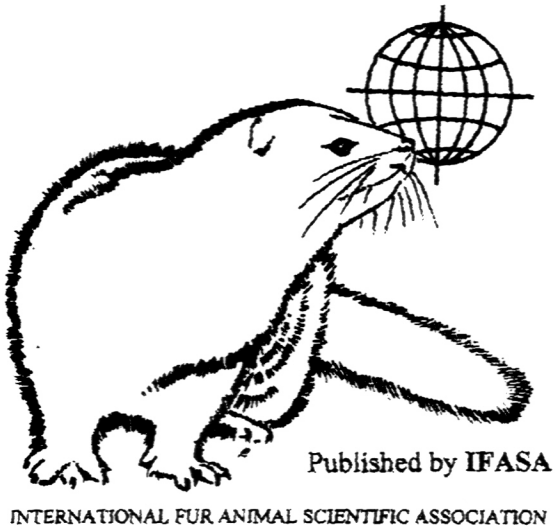

Notes from the Editor

The fur animal scientific community has lost a valued and respected colleague. This issue of Scientifur brings an obituary for Dr. Bruce Hunter recently Coordinator of the Canada Mink Breeders Research Program.

Plasmacytosis or Aleutian Disease is a serious problem in mink production. The disease is caused by Aleutian mink disease virus. The infection results in production of high amounts of antiviral antibodies and formation of immune complexes may lead to death of the mink. It is debated whether infection with Aleutian mink disease virus also may cause hair depigmentation resulting in white hair in the pelt known as sprinklers. This issue contains a publication focusing on this matter. Other diseases in fur animals are described in the presented abstracts.

The Nordic NJF Autumn Meeting within Fur Animal Research was held in Knivsta, Sweden from 1st to 3rd November 2011. Results of research within ethology and welfare, nutrition and management, and breeding, genetics and reproduction in fur animals were presented at this NJF Seminar No. 450. Abstracts from the meeting are published.

Vivi Hunnicke Nielsen
Editor Scientifur

Obituary

Dr. D. Bruce Hunter
1950-2011

The scientific community, veterinary science and the world are poorer for the untimely passing on October 19, 2011 of our respected friend and valuable colleague, Dr. Bruce Hunter. Bruce was born in Alberta, and received his veterinary and graduate degrees from the University of Saskatchewan. He went on to be one of the world's best known and most accomplished fur animal pathologists. He was an active member of IFASA since its inception and served on the IFASA Board since 2008. He and I were scientific organizers of the 1988 IFASA Congress in Toronto, and co-editors of the proceedings. He contributed to organization of every congress since. He made a major contribution to the industry with publication of his book, Mink, Biology, Health and Disease in 1996. His multiple publications on mink disease are classics of completeness, from the view that they define a disease problem, explore the mechanism and develop a treatment. He was a stalwart supporter of the Canadian and North American mink industry. At the time of his death he was Coordinator of the Canada Mink Breeders Research Program and served as veterinary consultant to ranchers across the continent. Although he said that it was his work with fur animals that he loved the best, he had a wide influence in many other areas. He built a clinic for treatment of injured wild birds at the University of Guelph. He played key role in establishing a national consortium on Eco-Health, including graduate courses on ecosystem approaches addressing animal health. He conceived, developed and directed a poultry project in Ghana for Veterinarians Without Borders. After his passing, it was learned that the proposal that he wrote this fall to support that initiative was awarded 1M$ in Canadian Government support. Bruce is said by his wife, Daina, to have been "clinically addicted to work". But his refuge and his sanctuary was his farm, Land's End, in southern Ontario.

There he raised, in addition to three daughters; horses, mules, cattle, sheep and herd dogs. The farm was a retreat for his growing extended family, which included three grandchildren. Bruce was easygoing, likeable, modest and circumspect. He had multiple interests and never touted his accomplishments. I only learned after his passing that he had played the cello in a symphony orchestra and a string quartet. The church where Bruce's memorial was held was far too small to contain the crowd who wished to pay him final respect. A website for tributes and stories contained more than one hundred entries, reflecting the enormous international influence that Bruce had as a professor, a mentor, a scientist and a colleague. According to his family, Bruce often said, "Life is not fair". It seems so unfair that the world should lose him so young, with so much more to contribute. We are grateful for all that he gave us.

Bruce Murphy
A colleague and a friend

Aleutian mink disease virus infection may cause hair depigmentation

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Key words: Aleutian mink disease virus, Hair depigmentation, Histopathology, Mink, Polymerase chain reaction

Abstract
Some black mink develop white hair fibers throughout their bodies, causing significant reduction in the market value of the pelt. It is believed that this phenomenon is the result of infection with the Aleutian mink disease virus (AMDV). The objective of this study was to verify AMDV infection in mink with white hair fibers using viral detection by PCR. Seventeen melatonin-implanted black mink with white hair fibers from two ranches were pelted in late October. Animals were approximately six months old when pelted. All animals had moderate to severe histo-pathological lesions suggestive of Aleutian disease in their kidneys, heart, liver and/or brain, and the virus was detected by PCR in their spleens. The findings suggested that AMDV infection was possibly the cause of hair depigmentation.

Introduction

Aleutian mink disease virus (AMDV) infection causes the production of high amounts of antiviral antibodies, hypergammaglobulinemia and the formation of immune complexes which cause death in some mink (reviewed in Bloom et al., 1994). It is widely believed that the presence of white guard hair fibers throughout the pelt, known as sprinklers, is caused by AMDV infection, but there is no published information supporting this hypothesis. Hair depigmentation starts to appear from the end of August when winter fur begins to develop. Only some mink on AMDV-infected ranches exhibit this defect. White hair fibers are tougher than normal hair fibers and significantly reduce pelt softness and market value. The objective of this study was to test the presence of the AMDV in mink with sprinklers, and to investigate the histopathological effects of AMDV infection in such animals.

Materials and Methods

Eight male and eight female black mink from one ranch and one female from another ranch which had white hair fibers were used in this study. Animals were born on commercial ranches in Nova Scotia, where the entire herds were pelted by October or November. Facilities were disinfected and ranches were repopulated with breeder mink from one AMDV-free ranch in the following February. Breeder mink were thus free of AMDV at the time of arrival at the new location. All adults and kits on these ranches were implanted with melatonin around July 10, which is used to accelerate fur development. Animals were pelted at the local commercial pelting plant in late October when they were approximately six months old. Animals were not tested for AMDV infection prior to pelting. The carcasses were shipped in labeled individual plastic bags to the Veterinary Services, Nova Scotia Department of Agriculture in Truro. Carcasses were subjected to post-mortem examination and samples of lungs, liver, kidneys, brain and heart were stored in formalin for histology. An additional spleen sample was collected from each mink and stored at -80°C for DNA extraction and viral detection.

Sections from each organ were fixed in 10% neutral buffered formalin, processed according to the standard procedures, and embedded in paraffin. Tissue sections (5µM thick) were stained with hematoxylin and eosin and examined under light microscope for lesions suggestive of Aleutian disease (AD). Histopathological lesions were subjectively scored by an experienced pathologist on a scale of 0 (no lesion) to 4 (very severe lesions from advanced AD). Scoring was based on the accumulation of plasma cells in the tissues with

some associated lesions which were not expected in uninfected animals (Johnson et al. 1975).

DNA was extracted from the spleen samples using the salt-extraction method (Aljanabi and Martinez, 1997) with minor modifications and addition of an RNAse treatment step (2µL of a 10µg/µL RNAse and incubation at 37°C for 30 min).

Sequences of the AMDV from Genbank (http://www.ncbi.nlm.nih.gov/) and strains that are circulating in Nova Scotia (Farid, unpublished data) were used to design two pairs of primers by the Oligo Primer Analysis Software, Version 6 (Molecular Biology Insight, Cascade, CO, USA) for the amplification of the viral genome by the polymerase chain reaction (PCR).

The primer pairs were 40-F: 5'-TTT GCT GCT GGT AAC GGT and 40-R: 5'-GTC CCA TGT CTT TTA TAG TTG C, corresponding to nucleotides 902-919 and 1421-1397, respectively, of the NS1 gene of the ADV-G, Genbank accession number NC_001662, and 60-F: 5'-GGG TGT ATG GAT GAG TCC TAA A and 60-R: 5'-CCC CAA GCA ACG TGT ACT, corresponding to nucleotides 2771-2792 and 3302-3285, respectively, of the VP2 gene of the ADV-G.

PCR amplifications were performed in 15µL total volumes containing (final concentration) 0.1% Tween 20, 1X PCR buffer, 0.2mM each dNTPs, 400 nM each primer, 0.8 unit of *Taq* polymerase (Invitrogen) and 2.5mM $MgCl_2$. Different volumes of DNA were used (1.7X, X, X/10, X/20, where X is 1.5µL of the stock DNA) in 15µL final PCR reaction mixture, along with a positive and a negative control in each test. Samples were first tested with the primer set 60F-60R. In cases where no amplification was observed, the four DNA volumes were used with the 40F-40R primer set. The thermal cycler was programmed for 95°C initial denaturation for 5 min, followed by 30 cycles of 94°C for 30s, annealing temperature at 54.4°C for both primer sets, and extension at 72°C for 60s, followed by a 10 min final extension at 72°C.

Statistical analysis: The distributions of lesion scores among the four organs and between the two sexes were compared by the Chi-square test (SAS, 2008).

Results

AMDV was detected in the spleen samples of all 17 mink by PCR. Post mortem examination showed no gross abnormalities characteristic of AD on any of the organs of the carcasses examined. Lungs of all animals showed microscopic lesions that are not normally caused by AMDV infection, namely mild to moderate lymphoplasmatic infiltrates around airways and blood vessels, and occasionally a few regions with macrophages in alveoli. Because of the uncertainties about the cause of these lesions, information on the lungs was excluded from the evaluation. Microscopic examination of the other four organs showed that 82%, 12% and 6% of the animals had lesions suggestive of AD in four, three and one organs, respectively. The mean lesion score of the four organs was higher than 1 (minor), 2 (moderate), or 3 (severe) in 94%, 65% and 35% of the animals. The widespread and severe histological AD lesions suggested that all the mink were not healthy.

The distributions and means of lesion scores were comparable among the four organs, with the exception of liver which had significantly lower lesion scores compared with kidneys ($?^2$=19.6, P=0.012, Table 1). Very severe lesions (score 4) were not detected in the liver, while such lesions had high frequencies in the kidney and heart, indicating that the latter two organs were most severely affected by the AMDV infection. There was no difference between the two sexes for the distribution of lesion scores for any of the organs ($?^2$=2.6, P>0.45). The mean intensity of the lesions over all organs was 2.25 in the males and 2.26 in the females, indicating that both sexes were equally vulnerable to the development of lesions by the AMDV.

Table 1. Distribution of mink with various intensities of the AD lesions in different organs (%) and mean lesion scores

Organ	Lesion score					Mean lesion score
	0	1	2	3	4	
Brain	0.0	25.0	43.8	18.8	12.5	2.2
Liver	0.0	23.5	41.2	35.3	0.0	2.1
Kidney	11.8	11.8	23.5	17.6	35.3	2.5
Heart	11.8	35.3	11.8	5.9	35.3	2.2

Discussion

AMDV infection is known to reduce reproductive performance in mink (Padgett et al., 1967; Hansen and Lund, 1988) and this study showed that the disease may also cause reduction in pelt value because of sprinklers (Fig. 1). Histopathological signs of AD, which were observed in the four organs with rather severe intensities, may suggest that the infection could potentially have negative effects on animal growth as well. It is not clear whether the presence of sprinklers is an indication of more severe AD lesions. Absence of visible signs of AD on any of the organs at necropsy may be due to the short time elapsed between the onset of infection and pelting. It may take 5 or 6 months before kits from infected dams to show visible signs of AD (Padgett et al., 1967). The virus on these ranches may also be mildly pathogenic, not causing visible disease symptoms in the mink by six months of age.

The causes of hair depigmentation in the mink infected with the AMDV are yet to be elucidated. It can be hypothesized that it is caused by a disruption in the melanin production in hair follicles due to the death or malfunctioning of melanocytes or the disruption of melanin pathway (Brenner and Hearing, 2008). AMDV infection causes elevated levels of the Th1 and Th2 cytokines (Bloom et al.,1994; Jensen et al., 2003), which may result in the death of melanocytes, similar to the depigmentation in patches of skin in humans with vitiligo disorder (Brenner and Hearing, 2008).

It seems that the presence and the extent of hair depigmentation are influenced by the mink genotype, the stage of infection and the stage of fur growth, because only some of the infected animals on a ranch develop sprinklers. Supportive evidence for the genetic control of hair depigmentation in mink is the fact that the NALP1 gene that regulates inflammation and cell death through activation of interleukin-1ß is expressed at high levels in patients with vitiligo. Understanding the genetic control of hair depigmentation is important for ranchers who decide to keep infected mink rather than eradicating the virus.

Animals used in this study were all implanted with melatonin, which is not expected to have any effect on AD symptoms or production of sprinklers. Melatonin implants significantly reduce mortalities associated with AMDV infection as a result of its antioxidant effect and its ability to modulate immune response to infection (Ellis, 1996).

Figure 1. Pelts from black mink (left) and those with white hair fibers (right).

Conclusion

Although the number of animals was small, it can be concluded that AMDV infection possibly results in the production of sprinklers in some mink. Presence of sprinklers can assist ranchers in noticing that their herd is possibly infected with the AMDV. Since only some infected mink produce sprinklers, the presence or absence of white hair fibers should not replace proven methods of screening mink for AMDV infection.

Acknowledgements

Financial support for this project was provided by mink industry organizations, Atlantic Innovation Fund of ACOA, Agriculture and Agri-Food Canada through the CARD Councils of Ontario, British Columbia and Nova Scotia (Agri-Futures Nova Scotia), and the Technology Development Program of the Nova Scotia Department of Agriculture.

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Genetics of behavior in the silver fox

A.V Kukekova, S.V. Temnykh, J.L. Johnson, L.N. Trut, G.M. Acland

The silver fox provides a rich resource for investigating the genetics of behavior, with strains developed by intensely selective breeding that display markedly different behavioral phenotypes. Until recently, however, the tools for conducting molecular genetic investigations in this species were very limited. In this review, the history of development of this resource and the tools to exploit it are described. Although the focus is on the genetics of domestication in the silver fox, there is a broader context. In particular, one expectation of the silver fox research is that it will be synergistic with studies in other species, including humans, to yield a more comprehensive understanding of the molecular mechanisms and evolution of a wider range of social cognitive behaviors.

Mamm. Genome., 2011: Nov 23. [Epub ahead of print]

Emergence of a New Swine H3N2 and Pandemic (H1N1) 2009 Influenza A Virus Reassortant in Two Canadian Animal Populations, Mink and Swine

D. Tremblay, V. Allard, J.F. Doyon, C. Bellehumeur, J.G. Spearman, J. Harel, C.A. Gagnon

A swine H3N2 (swH3N2) and pandemic (H1N1) 2009 (pH1N1) influenza A virus reassortant (swH3N2/pH1N1) was detected in Canadian swine at the end of 2010. Simultaneously, a similar virus was also detected in Canadian mink based on partial viral genome sequencing. The origin of the new swH3N2/pH1N1 viral genes was related to the North American swH3N2 triple-reassortant cluster IV (for hemagglutinin [HA] and neuraminidase [NA] genes) and to pH1N1 for all the other genes (M, NP, NS, PB1, PB2, and PA). Data indicate that the swH3N2/pH1N1 virus can be found in several pigs that are housed at different locations.

J. Clin. Microbiol., 2011: 49(12), 4386-4390

An overview of animal prion diseases

M. Imran, S. Mahmood

Prion diseases are transmissible neurodegenerative conditions affecting human and a wide range of animal species. The pathogenesis of prion diseases is associated with the accumulation of aggregates of misfolded conformers of host-encoded cellular prion protein (PrPC). Animal prion diseases include scrapie of sheep and goats, bovine spongiform encephalopathy (BSE) or mad cow disease, transmissible mink encephalopathy, feline spongiform encephalopathy, exotic ungulate spongiform encephalopathy, chronic wasting disease of cervids, and spongiform encephalopathy of primates. Although some cases of sporadic atypical scrapie and BSE have also been reported, animal prion diseases have basically occurred via the acquisition of infection from contaminated feed or via the exposure to contaminated environment. Scrapie and chronic wasting disease are naturally sustaining epidemics. The transmission of BSE to human has caused more than 200 cases of variant Cruetzfeldt-Jacob disease and has raised serious public health concerns. The present review discusses the epidemiology, clinical neuropathology, transmissibility and genetics of animal prion diseases.

Virol. J., 2011: 8, 493

Novel amdovirus in gray foxes

L. Li, P.A. Pesavento, L. Woods, D.L. Clifford, J. Luff, C. Wang, E. Delwart

We used viral metagenomics to identify a novel parvovirus in tissues of a gray fox *(Urocyon cinereoargenteus)*. Nearly full genome characterization and phylogenetic analyses showed this parvovirus (provisionally named gray fox amdovirus) to be distantly related to Aleutian mink disease virus, representing the second viral species in the Amdovirus genus.

Emerg. Infect. Dis., 2011: 17(10), 1876-1878

Preliminary Evaluation of Raboral V-RG(R) Oral Rabies Vaccine in Arctic Foxes *(Vulpes lagopus)*

E. Follmann, D. Ritter, R. Swor, M. Dunbar, K. Hueffer

We tested the Raboral V-RG® recombinant oral rabies vaccine for its response in Arctic foxes (*Vulpes lagopus*), the reservoir of rabies virus in the circumpolar North. The vaccine, which is currently the only licensed oral rabies vaccine in the United States, induced a strong antibody response and protected foxes against a challenge of 500,000 mouse intracerebral lethal dose 50% of an Arctic rabies virus variant. However, one unvaccinated control fox survived challenge with rabies virus, either indicating a high resistance of Arctic foxes to rabies infection or a previous exposure that induced immunity. This preliminary study suggested that Raboral V-RG vaccine may be efficacious in Arctic foxes.

J. Wildl. Dis., 2011: 47(4), 1032-1035

Nordic Association of Agricultural Scientists

NJF-Seminar no. 450

Fur Animal Meeting

Autumn Meeting

Knivsta, Sweden

1-3 November 2011

Nordic Association of Agricultural Scientists

NJF Subsection for Fur Animals

Testing the WelFur assessment protocol for mink on-farm in three seasons of production

S.H. Møller, S.W. Hansen

Welfare Quality® seems to develop into a standard for farm animal welfare assessment and European Fur Breeders' Association initiated the "WelFur" project in 2009 in order to develop a welfare assessment protocol for mink and fox farms after the WQ standards. The assessment is based on four principles and 12 underlying criteria, to be measured at the farm. Based on validity, reliability, and feasibility, 22 measures have been selected for use in the three seasons of mink production: 1. Breeders during winter, 2. Dams with kits during spring, and 3. Juveniles during growth in the autumn, in order to cover the life cycle of the mink. The final welfare assessment is categorised as: "Excellent", "Above average", "Acceptable" or "Not classified" according to the welfare score for each of the four principles. The protocols for the three seasons are being tested in several countries and the Danish results shows that the WelFur protocol is feasible for a one-day visit and sensible enough to discriminate between farms in the same category. A stratified sample of 120 cages seems to be sufficient. It is concluded that it is possible to assess the welfare in mink using the principles developed in Welfare Quality® using a stratified sample facilitating implementation.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 8 pp. Authors' abstract

WelFur – Foxes: State of affairs in autumn 2011

L. Ahola, H. Huuki, A.L. Hovland, T. Koistinen, J. Mononen

The WelFur project, with the main aim to develop on-farm welfare assessment protocols for farmed foxes (blue fox *Vulpes lagopus*, silver fox *Vulpes vulpes*), and mink (*Neovison vison*), was launched by the European Fur Breeders' Association (EFBA) in 2009. In this presentation, we describe the developmental work behind the assessment protocol for foxes, and the state of affairs in autumn 2011.

The first fox protocol, i.e. the set of fox welfare measures, was developed in 2009-2010. The development was mainly based on a review of the scientific literature on farmed foxes' behavior and welfare. This preliminary protocol was tested on Finnish commercial farms (18 farms) in autumn 2010 to study the feasibility, reliability and validity of the included measures. Based on the experiences gathered during these farm visits and during the discussions among the fox experts and WelFur project group, this preliminary protocol was revised during spring 2011. In this revision, some of the measures originally included in the preliminary protocol were removed from the protocol, some new measures were included, and the measure descriptions of all included measures were rechecked. The revised fox protocol, with 26 measures, was tested in summer 2011 on fox farms in both Norway (8 farms) and Finland (6 farms). The main aims of these farm visits were: 1) to assess the appropriate number of animals to be assessed on each farm in order to get a reliable picture of the welfare of animals on farm level, 2) to study inter-observer reliability of the measures included in the revised protocol, and 3) to find out feasibility of the measures in different kinds of fox farming systems. The results from these farm visits as well as the state of affairs in autumn 2011 will be discussed in the presentation.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 1 p. Authors' abstract

WelFur: Stereotypic Behaviour in Silver foxes and Blue foxes in Norway and Finland during the Whelping Season

H. Huuki, A.L. Hovland, T. Koistinen, J. Mononen, L. Ahola

The WelFur project, initiated in 2009, aims to develop on-farm welfare assessment protocols for farmed foxes (Silver fox *Vulpes vulpes* & Blue fox *Vulpes lagopus*), and mink (*Neovision vison*). At the moment, the protocol for foxes comprises 26 measures, including one for assessing the occurrence of stereotypic behaviour (SB). The main aim of the present study was to evaluate the feasibility of this SB measure in silver and blue foxes housed in different farming conditions.

Furthermore, we assessed the occurrence of SB on both Norwegian and Finnish fox farms during the whelping season.

The measure for assessing the occurrence of SB was tested on fur farms in Norway (N=6), and Finland (N=4) in June-July 2011. Four assessors assessed altogether 862 foxes (out of which 5% were blue foxes and 95% silver foxes) in Norway and 831 foxes (77% blue foxes and 23% silver foxes) in Finland. Out of all observed silver foxes and blue foxes, 73% and 57% were active during the observations, respectively. The percentage of foxes expressing SB differed between the farms (Mean: 1.9%, min-max: 0-4.1%: $p<0.05$), but the percentage of foxes behaving stereotypically out of active foxes (SB/A foxes) did not differ between the farms (Mean: 2.8%, min-max: 0-4.9%; Kruskal-Wallis: $p>0.05$). The percentage of foxes showing SB (Norway: 2.1%, Finland: 1.8%) and the percentage of SB/A foxes (Norway: 2.9%, Finland: 2.9%) did not differ between the countries (?^{2} and Mann-Whitney both: $p>0.05$). The percentage of foxes showing SB was higher in silver foxes than in blue foxes (2.8% vs. 0.7%; χ^2: $p<0.05$), but there was no difference between the silver and blue foxes in the percentage of SB/A (3.8% vs. 1.3%; KW: $p>0.05$). There was no difference in the percentage of males (M), vixens without cubs (VNC), vixens with cubs (VC) and foxes of uncertain sex (US) showing SB during the observations (0%, 2.5%, 1.9% and 1.5%, respectively; ?^{2}: $p>0.05$). Nor was there a difference in the percentage of SB/A foxes between the different fox types (M: 0%, VNC: 4.0%, VC: 2.7%, US: 2.4%; KW: $p>0.05$).

According to this study, the occurrence of stereotypic behaviour on farms was low (see e.g. Mason & Latham, 2004). It seems that this stereotypic behaviour assessment method, developed for WelFur protocol, could be used for measuring the occurrence of stereotypic behaviour, as well as categorizing farms according to the prevalence of stereotypic behaviour. It is necessary, however, to have further studies to assess validity of this. method.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 5 pp. Authors' abstract

Competition capacity, social preference and behaviour in farmed silver fox vixens (*Vulpes vulpes*)

A.L. Hovland, A.K. Akre

In general, social rank is known to affect the outcome of disputes over preferred, limited or future resources. Thus, we should expect individuals' social preference to be affected by their own and other individuals' competition capacity. Here, we investigated silver fox vixens' social preference and behavioral response towards unfamiliar vixens of different competition capacities (CC) in a choice test arena. CC was measured by the vixens' ability to compete for and defend a limited food resource. The duration of the choice test was 3h. The results showed that low CC vixens spent significantly less time with high CC vixens (44 ± 10 min), compared to the time spent in front of low CC vixens (101 ± 15 min, $P < 0.05$). Also, the low CC vixens' time spent in front of high CC vixens (44 ± 10 min) was significantly lower compared to the amount of time spent by the high CC vixens (70 ± 11 min, $P = 0.03$), indicating that low CC vixens avoided contact with high CC vixens to a larger extent. High CC vixens tended to display more aggressive postures in front of other high CC vixens than towards low CC vixens ($P = 0.09$). Time spent performing behaviors like exploration, resting and sitting in front of a stimulus animal were also affected by the foxes' CC. The vixens were also retreating significantly more from the high CC vixens (2 ± 0.8 times) than from the low CC vixens (0.4 ± 0.4 times, $P = 0.03$), possibly reflecting that high CC vixens were more offensive than the low CC vixens. The results from this study demonstrate that own competition capacity influences young silver fox vixen's preference for other vixens of different competition capacities. Potentially, these findings could have implications for the composition of social groups in farmed foxes. To what extent such varying preferences reflect differences in the strength of social motivation would be interesting to examine in a future study.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 1 pp. Authors' abstract

Euthanasia in farmed mink *(Mustela vison)*: a questionnaire study

H.T. Korhonen, J. Sepponen, P. Eskeli

A questionnaire was formulated to collect data on euthanasia procedures and routines in farmed mink (*Mustela vison*). The principle aim was to clarify the extent and functionality of the main killing methods, i.e. filtered exhaust and cylinder CO, and cylinder CO_2. The questionnaire was sent to 397 mink farms in Finland and to 143 in the Netherlands. The final response rates were 34.3% for Finland and 24.5% for the Netherlands. On the basis of the present study, farmers consider that all three euthanasia methods, namely cylinder CO, cylinder CO_2 and filtered exhaust CO are effective and useful ways of killing mink in farming practice. In the Netherlands, cylinder CO is the only gas employed for killing mink. In Finland, on the other hand, cylinder CO is totally unknown and the most common euthanasia method is filtered exhaust CO. Also cylinder CO_2 is used in Finland. Exposure of farmers on CO and CO_2 seems to be slight during killing procedure.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 5 pp. Authors' abstract

Effect of different dietary fat: carbohydrate ratio on fur characteristics in mink and silver foxes

Ø. Ahlstrøm

The aim of the study was to examine the effect of changing the dietary fat carbohydrate ratio on ME basis from 55:15 to 45:25 during the growing period on fur quality characteristics in black mink and silver foxes. Four groups of 100 mink kits and 40 silver fox cubs were in included: Group 1, received the 55:15 diet from the start in July until pelting in December, Group 2, received the 55:15 until beginning of September and the 45:25 diet thereafter, Group 3, received the 55:15 diet until beginning of October and the 45:25 diet thereafter. The Group 4 diet was produced from 55:15 diet by adding 3.4% piglet feed which reduced the F:C ratio to about 50:20. This diet was given through the whole experimental period. Energy intakes recorded on a group basis were similar among the groups, but Group 1 revealed slightly higher energy intake for both mink and foxes. Average body weights at pelting did not differ significantly. In mink, skin and fur characteristic skin were for similar for most traits, but males in Group 1 obtained lower score in underfur density and overall fur quality score than the other groups ($P<0.05$). These effects were not observed in mink females. In silver foxes, all four diets produced similar fur characteristics. The study showed that the a decrease in dietary F:C ratio from 55:15 to 45:25 in September or October had little impact of fur characteristics in mink or foxes. But the significant negative effect on underfur density in mink males in Group 1 given the high fat-low carbohydrate diet confirm the general knowledge from practice that dietary carbohydrates are important for underfur development.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 6 pp. Authors' abstract

The effect of fat content of blue fox feed on skin quality during growing-furring period

N. Koskinen, J. Sepponen, T. Mikkola

The ME deviation recommendation in Finland for blue foxes during production period is 25:50:25. According to the analysis of FFBA laboratory in September 2010 the deviation of ME in fox feed was 23:60:18. Analyze result was the average of all the Finnish feed kitchens. At highest fat percentage of ME was 62.1 % and lowest 53.7 %. In practice the part of the fat in fox feed during production period is obviously higher than the recommendations. Some health problems have been observed such as diarrhea and leg weakness. Also questions about the feeding intensity with high energy diet have been raised. So to say if it is possible to produce high quality and size blue fox skins with restricted feeding. It is needed to renew the feed recommendations and solve out if the high fat and energy content of the feed affects welfare and health problems on the blue foxes. Benefits of the higher carbohydrates on the animal health were also in focus. Furthermore, economical point of view is important while calculating the cost of raw materials, feed consumption, feed efficiency, fur quality and the auction price of the raw skin.

The study was conducted in the research station Luova Ltd during 1st of September until 30th of

November 2010. Each treatment group included 25 full-sib pares, total of 200 blue foxes. Animals were divided to four treatment groups: 1) HU: High fat (min. 60 % fat of ME), unrestricted feeding, 2) HR: High fat (min. 60 % fat of ME) 20-30 %, restricted feeding, 3) NU: Normal fat (appr. 50 % fat of ME), unrestricted feeding and 4) NR: Normal fat (appr. 50 % fat of ME) 20-30 %, restricted feeding. Both feeds were formulated and manufactured from the same feed ingredients at the same time according to the recommendations. Only the fat and carbohydrate content differed in the feed. Feed consumption was recorded and animals were weighed three times during the experiment. The health status and the front leg score of the animals were followed. At pelting the fat content of the internal fat was evaluated, the weight of the livers was measures, the bone samples for the ash and structure analyses were taken. Animals were graded before skinning. The raw skins were graded in Finnish Fur Sales before auction and also in the commercial skin grading.

Some health problems -mainly minor diarrhea and urine infections were observed. The front leg weakness was low at the beginning of the trial and got worse during the trial. The animal material used in the trial was from commercial farm so it might be that genetically the animals had leg weakness. The final average live weight and feed consumption was highest in groups HU and NU. Unrestricted feeding affected negatively on growth, body condition and skin quality. According to the fat content of the feed there were minor differences on skin quality.

With unrestricted feeding the average live weights were similar in HU and NU groups. Also the average live weights were similar in groups HR and NR. The best guard hair quality and overall quality were observed when animals were fed according to the energy recommendations in groups HR and NR. Feeding intensity affected to almost all measured trades. The fat and energy content of the feed didn´t affect on the weight, size, colour, mass or overall quality of raw skins. Quard hair quality was the best in groups NU and NR compared to the groups HU and HR.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 1 p. Authors' abstract

Genetic parameters of pelt character, feed efficiency and size traits in the blue fox (*Alopex lagopus)*

R. Kempe, N. Koskinen, I. Strandén

Pelt character traits are important economic traits in the blue fox breeding in Finland. They are evaluated by professional pelt graders and by automatic grading machines (length and colour) in the auction house. However, at this moment the exact measurements of pelt size (in cm) or colour (in pixels) are not saved into database for further use and a lot of important information is lost. The present study is the first to address the heritability estimates for continuous pelt character traits: pelt size (pSI_{cm}), pelt colour clarity (pCL_{pix}) and pelt colour darkness (pDA_{pix}). Better feed efficiency (FE), in turn, is an interesting new and important breeding goal for fur animals since feeds represent a major share of the production costs. The main purpose of this study was to estimate the heritabilities for the new pelt character traits and the genetic correlations between pelt character traits, FE and size traits.

The heritability estimates obtained for pSI_{cm}, pCL_{pix} and pDA_{pix} were 0.50, 0.23 and 0.54, respectively. pSI_{cm} had a high positive genetic correlation with live animal grading size (gSI), final body weight (BW_{Fin}), body length and daily gain (DG) and moderate correlation with body condition score (BCS). Selection for pelt size indirectly via live animal size traits is quite effective due to high genetic correlations between the traits. Genetic correlations between size and pelt quality traits were mainly low or moderate and standard errors of the correlations were high. However, the low negative genetic correlation between BCS and pCL_{pix} gives weak support for the conclusion that fatness may to some extent relate to the undesirable reddish colour clarity and to a lighter pDA.

pSI_{cm} and DG had a favorable genetic correlation with FE, but a fairly high unfavorable genetic correlation with DMI. Therefore, selection for big and fast-growing animals will simultaneously increase DMI and, thus, feeding costs. The genetic correlations between FE and pelt quality traits were mainly very low. The selection for better FE does not have any major influence on pelt quality traits except for pCL as there was a low antagonistic genetic correlation between these traits. The

antagonistic connections between FE, size, DMI and pCL should be taken into account in the blue fox breeding programme.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 8 pp. Authors' abstract

QTL-mapping in mink *(Neovison vison)* shows evidence for QTL for guard hair thickness, guard hair length and skin length

J. Thirstrup, R.S. Labouriau, B. Guldbrandtsen, R. M. Anistoroaei, K. Christensen, M. Fredholm, V.H. Nielsen

Fur quality in mink is a complex trait, composed of e.g. guard hair length, guard hair thickness and density of wool. A genome wide QTL analysis was performed to detect QTL for these traits in mink. An F2-design analysis was performed on fourteen chromosomes on mink (*Neovison vison*) using 100 microsatellites as markers with a distance of approximately 20 cM. The two lines used for the F_2-design were Nordic wildmink and American short nap mink. In total 1083 animals (21 wildtype, 25 short nap, 103 F1 and 934 F2) were genotyped for the 100 markers and recorded for the three fur quality traits. For the QTL-analyses a regression analysis implemented in the QTL Express software was used.

Our results show evidence of QTL on 8 out of 14 autosomale mink chromosomes for guard hair length, guard hair thickness and density of wool. There was evidence for QTL for guard hair thickness on chromosome 1, 2, 3, 6, 7 and 8; evidence for QTL for quard hair length on chromosome 1, 2, 3, 4, 6, 7, 8 and 11; and evidence for wool on chromosome 7. The position and inheritance of QTL for guard hair length and guard hair thickness were similar on chromosome 2, 6 and 7. This indicates that the two traits to some degree may be controlled by the same genes.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 8 pp. Authors' abstract

Life cycle assessment of mink and fox pelts produced in Finland

F. Silvenius, N. Koskinen, S. Kurppa, T. Rekilä

Life cycle assessment of mink and fox pelts produced in Finland was funded by Finnish Fur Breeders Association and Finnish Fur Sales and was made by MTT Agrifood Research Finland in 2010-2011. The studied impact categories were greenhouse gas emissions, acidification and eutrophication and ecotoxicity was studied qualitatively. The functional unit in our study was a single piece of modified and sewn mink or fox skin. The life cycle standards ISO 14040 and ISO 14044 were followed.

The aim of the study was to find out the main ecological impacts of Finnish fur farming. One key option was to include the consequences which fur farming has in utilising side-products of meat and seafood production. As the Baltic Sea is very sensitive to eutrophication, one special consequence was to point out the significant amounts of captured nutrients in feed fish fishing of Baltic Sea. One aim was also to find the most important possible improvements, which reduce the environmental impacts caused by fur farming.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 4 pp. Authors' abstract

Body condition in mink *(Neovison vison)* is inherited

B.K. Hansen, K. Rouvinen-Watt, S.H. Møller

The genetic variation of body condition in mink during the growth period was studied. Body condition was defined as different relationships between body weight and body length. The data is derived from a selection project with four lines. Two lines were selected for high weight gain in the early growth period; one of them due to kits' own capacity for growth and the other for maternally induced kit growth. In addition, there was a control line and a consumption line. Altogether data from 4106 mink kits of the black colour type was included. The DMU package (Madsen and Jensen 2008) was used to estimate the (co) variance components, using an AI-REML algorithm (Jensen *et al.* 1997). Genetic variation of different relationships between body weight and body length was

estimated in mink kits in the suckling period and in juvenile mink from separation until pelting. Correlations between different body condition measures for kits and for juvenile mink were estimated. The variance components were analyzed using a univariate model including random additive direct, and additive maternal genetic effects and random specific environment. The preliminary analyses show that genetic variation of body condition exists with a heritability of 0.2 in the suckling period increasing to 0.3 in the final growth period. Ranking of animals based on body condition in September is compared with their body condition in November.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 1 p. Authors' abstract

Feeding intensity and body condition of young blue fox vixens, effect on the breeding result

N. Koskininen, J. Sepponen, A.-H. Tauson

As a strictly seasonal animal the blue fox exhibits seasonal fluctuations in feed intake and accretion of body fat, feed intak and bogy fat retention being very high during autumn and early winter while fed unrestrictedly. In practice blue foxes are fed *ad libitum* during the growing – furring period both those aimed for pelting and the future breeding stock. Selective breeding has focused on producing heavy animals and meanwhile reproductive performance has declined among yearling vixens. Too little is known about the weight gain, body condition, and feeding recommendations of young blue fox vixens and the impact of body condition on the breeding result.

The aim of this study was to examine the effect of rearing intensity and body condition on reproductive performance and cub survival of juvenile blue fox vixens. Furthermore, the intention is to monitor plasma concentrations of some important regulating hormones and metabolites and relate their concentrations to the animal's metabolic status and the breeding result. The young blue fox vixens' body condition class was recorded during early growth, at the time of artificial insemination and until whelping.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 2 pp. Authors' abstract

Selection on numbers of active (mammary) nipples is effective
High number of nipples is beneficial and heritable

J. de Rond, F.C. Kleyn van Willigen

Edelveen and the Animal Health Service have looked into the effect of the number of developed and active (mammary) nipples in relation to kit growth and female condition. Till 4 weeks of age, kits growth is only depending on the milk production of the mother. When the kits start eating, they look for moister through the water in the feed, saliva of the mother and milk (Brink, 2004). It takes 2 weeks between the first feed intake and drinking water at the drinking system at the end of the pen (Möller, 1991; Brink, 2004). There is a big variation in number of active mammary nipples (de Rond, 2010). The objective of this project is to look into the effect of the number of active mammary nipples on kits growth and female condition from 3 to 7 weeks of age.

At the third week of lactation 2011, all females at Edelveen were checked at the number of active mammary nipples. At the same time the number of kits was counted. Based on this information, next litters were selected in this project: number of active mammary nipples (6, 7, 8, and 9), litter size at 3 weeks (5 or 6 kits, 7 or 8 kits and 9 or 10 kits) and day of birth (28th of April, 3rd, and 9th of May). For each number of active mammary nipple, (±)15 litters per litter size were selected. In total 175 litters, kits and mother were weighted at 3, 5, and 7 weeks of age.

The weight of the mother at 3 weeks showed no difference between the groups and was in average over 1.3 kg. Also the average weight of the kits showed no differences at the start (135 g/kit).

The kits growth of the litters of the 9th of May had a better weight at 5 and 7 weeks in nearly all groups. Due to the small and constant differences based on whelping date, only the correlation between litter size and number of active mammary nipples was calculated. Based on number of active mammary nipples, there was no difference in kit growth between 3 and 5 weeks, but from 5 till 7 weeks kits with a mother with 9 active mammary nipples grew 5% more than kits with a mother with 6 or 7 nipples. Per litter size there is a benefit for kits when the mother has 8 or 9 active mammary nipples. With 9

or 10 kits and a mother with 9 nipples, kits weight at 7 weeks is 7% higher than kits with a mother with 6 or 7 nipples. Also in litter size 7 or 8 kits those litters show a slightly better weight. The kits from litters with 5 or 6 kits and a mother with 8 nipples had a 6% better weight at 7 weeks compared when the mother had 6 or 7 nipples active.

The weight loss of the mother between 3 and 7 weeks showed a big variation. Some females gain weight, others loose over 300 gram in this 4 week period. The weight loss of the mother had a reverse correlation between active mammary nipples and litter size compared to the kits growth. Mothers with 8 or 9 active nipples loose about 40-50% less weight in litter size 9 or 10 kits compared to mothers with 6 or 7 nipples. In average the weight loss was less in the biggest litter with 9 or 10 kits (100 gram) compared to the other litter sizes (140 gram). The females with 8 or 9 nipples, in general loose 30% less weight in all litter size classes compared to 6 or 7 active mammary nipples. The females with the biggest weight loss in June have kits with the lowest weight at 7 weeks of age.

Kit losses in this period showed no correlation with number of active mammary nipples.

The impact of the number of active mammary nipples goes further than the first weeks of the lactation period. Females with many active mammary nipples (8 or 9) have kits with a better growth and higher weight at 7 weeks of age. Those females also keep a better condition because of a lower loss of weight.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 7 pp. Authors' abstract

Causes of death in mink kits from birth to the end of July

T. Clausen

To get an overview of the cause and number of dead kits in the nursing period, post mortem data was collected for several years at the research station Kopenhagen Farm. From birth to the 1st of August 6.3 percent of the kits die. From birth to day 28 only a few kits die, but in the end of May there is an increase. The courses of death in June are mainly diarrhoea, cachexia, and bites. Kits eaten after death is seen from 28 to 60 days of age. Biting is seen from day 41 to day 68. It is especially in the big litters we see biting, and it is the small kits that are intimidated and therefore most often female kits. About 80 percent of kits with bites are female kits. To prevent bites dividing the litters at 6 weeks of age could be advisable. Problems with biting are largest from day 42 to day 49, and whether the female is with the litter or they are weaned is off less importance. Weaning of kits already at day 42 did not reduce the number of litters with bites, on the contrary the weight of the kits was lower when they were weaned early. Increasing feeding intensity (from day 28 to day 56) reduced the number of litters with kits dying from biting. Also water supply to the kits through the feed is important, by adding different ingredients to bind the water in the feed there is an indication that the group of kits with the highest intake of water per 100 kcal had the lowest number of dead kits due to biting. About 0.5 percent of the females kill some of their kits in the period from day 28 to 54, again mainly in the big litters. Problems with bladder and kidney infections are seen from the middle of June, i.e. from about 44 days of age.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 10 pp. Authors' abstract

Kit performance and behaviour between 30 and 50 days of age when easy access to drinking water

Drinking water in/near nest box for better welfare female and kits

J. de Rond, F.C. Kleyn van Willigen

In 2008 and 2009, Research Farm Edelveen and the Animal Health Service have looked into the effect of available drinking water in the nest box. Two years of individual measurement per pen showed that mink kits used a lot of water in the nest box (de Rond, njf, 2009). Ahlstrom described the importance of drinking water for little kits in April 2010 (njf workshop energy supply).

In June 2010 and June 2011 Edelveen carried out a project to implement a practical drinking system close to the kits and looked at the impact on growth, kit losses and behaviour. Growth was measured from many litters (kits and female) at the start and the end of the month (110 litters in 2010, 150 litters

in 2011). Behaviour was scored 4 times a day: 4 hours prior and after feeding and 2 hours prior and after feeding. Each time, next items were scored: drinking in/near the nest box, drinking at the regular water system at the end of the pen, saliva licking from kits at the dam's lips and restless behaviour between kits. All scored behaviour was correlated to the age of the kits and presented as the actions between the age of 30 and 50 days.

In 2010 a line of mink cages with young female mink (type wild) was adapted with a drinking water system inside the nest box with the same drinking nipple as the one at the end of the pen. In total 111 litters of mink received water in the nest box and those were compared with 111 litters without. In 2011 this project was adapted with 3 new groups: a drinking system at the entrance of the nest box at the side of the pen (close to the nest box); 3 time feeding a day (in the control group 1 time feeding per day); and keeping the extra bottom in the pen to the age of 7 weeks. The groups in 2011 consisted of 50 young females each.

The results were consistent between both years. In 2011, the groups 3 times feeding per day and the extra bottom to 7 weeks of age had similar results as the control group. The group with the drinking system at the entrance of the nest box showed similar results with water in the nest box.

The growth of the kits was slightly better when water was in or close to the nest box (+4-5% 2010/2011). The females lost more weight in the control group (165g vs. 110g (2010), 125g vs. 95g (2011)). Kit losses were lower when water was in/close to the nest box in both years compared to the control group (2010:0.5% vs. 1.2%, 2011: 1.2% vs. 2.8%). In 2010 5% of the females in the control group suffered on nursing sickness, none in the testing group.

Kits started drinking 4 to 5 days earlier when water was in the nest box (age 32 vs. 36) and 2 to 3 days when water was close to the entrance. At the age of 40 days, kits with water in or close to the nest box were spotted 5 times more often drinking compared to the control kits. At the age of 45 days the kits with water in or close to the nest box were still spotted drinking 2 to 3 times more often than the controls. Saliva licking started at 31/32 days of age in all groups, but the frequency was much lower when water is available in or close to the nest box (5% vs. 25% (2010), 8% vs. 20% (2011)). Saliva licking stopped 5 days earlier in the testing group in 2010, but not in 2011. When the kits were spotted saliva licking in the control group, the kits in the test groups were spotted drinking inside or close to the nest box. Restless behaviour among kits started at 31-32 days of age and it was maximum spotted at the age of 40 days. In the test groups it was spotted 2-3 times lower than the control (3% vs. 9% (2010), 4% vs. 14% (2011)). The restless behaviour between kits stopped earlier in the testing groups, but only after the age of 50 days.

Especially the 2 weeks period between 33 and 47 day of age of the kits is very important regarding the welfare of mink. The kits start eating feed and need to drink water. Before drinking at the drinking nipple they find the moisture in feed, milk and through saliva licking at the dam (Moller, 1991). Water inside or close to the nest box makes the kits drink earlier, drink more often, less need to find moisture at mother's lips and less restless behaviour. The dams loose less weight and no losses of dams in the critical period for nursing sickness. The average weight gain of kits is better and less kits losses between 30 and 50 days of age. Drinking water inside or close to the nest box supports the welfare of mink and farmer.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 9 pp. Authors' abstract

Effect of active mammary nipples on kit growth and female condition in second part of the lactation period

J. de Rond, F.C. Kleyn van Willigen

Edelveen and the Animal Health Service have looked into the effect of the number of developed and active (mammary) nipples in relation to kit growth and female condition. Till 4 weeks of age, kits growth is only depending on the milk production of the mother. When the kits start eating, they look for moister through the water in the feed, saliva of the mother and milk (Brink, 2004). It takes 2 weeks between the first feed intake and drinking water at the drinking system at the end of the pen (Möller, 1991; Brink, 2004). There is a big variation in number of active mammary nipples (de Rond, 2010). The objective of this project is to look into the effect of the number of active mammary nipples

on kits growth and female condition from 3 to 7 weeks of age.

At the third week of lactation 2011, all females at Edelveen were checked at the number of active mammary nipples. At the same time the number of kits was counted. Based on this information, next litters were selected in this project: number of active mammary nipples (6, 7, 8, and 9), litter size at 3 weeks (5 or 6 kits, 7 or 8 kits and 9 or 10 kits) and day of birth (28th of April, 3rd and 9th of May). For each number of active mammary nipple, (±)15 litters per litter size were selected. In total 175 litters, kits and mother were weighted at 3, 5 and 7 weeks of age.

The weight of the mother at 3 weeks showed no difference between the groups and was in average over 1.3 kg. Also the average weight of the kits showed no differences at the start (135 g/kit).

The kits growth of the litters of the 9th of May had a better weight at 5 and 7 weeks in nearly all groups. Due to the small and constant differences based on whelping date, only the correlation between litter size and number of active mammary nipples was calculated. Based on number of active mammary nipples, there was no difference in kit growth between 3 and 5 weeks, but from 5 till 7 weeks kits with a mother with 9 active mammary nipples grew 5% more than kits with a mother with 6 or 7 nipples. Per litter size there is a benefit for kits when the mother has 8 or 9 active mammary nipples. With 9 or 10 kits and a mother with 9 nipples, kits weight at 7 weeks is 7% higher than kits with a mother with 6 or 7 nipples. Also in litter size 7 or 8 kits those litters show a slightly better weight. The kits from litters with 5 or 6 kits and a mother with 8 nipples had a 6% better weight at 7 weeks compared when the mother had 6 or 7 nipples active.

The weight loss of the mother between 3 and 7 weeks showed a big variation. Some females gain weight, others loose over 300 gram in this 4 week period. The weight loss of the mother had a reverse correlation between active mammary nipples and litter size compared to the kits growth. Mothers with 8 or 9 active nipples loose about 40-50% less weight in litter size 9 or 10 kits compared to mothers with 6 or 7 nipples. In average the weight loss was less in the biggest litter with 9 or 10 kits (100 gram) compared to the other litter sizes (140 gram). The females with 8 or 9 nipples, in general loose 30% less weight in all litter size classes compared to 6 or 7 active mammary nipples. The females with the biggest weight loss in June have kits with the lowest weight at 7 weeks of age. Kit losses in this period showed no correlation with number of active mammary nipples.

The impact of the number of active mammary nipples goes further than the first weeks of the lactation period. Females with many active mammary nipples (8 or 9) have kits with a better growth and higher weight at 7 weeks of age. Those females also keep a better condition because of a lower loss of weight.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 6 pp. Authors' abstract

The incidence of wounds and injuries in mink production systems

S.H. Møller

The prevalence of wounds and injuries in mink production has been in focus again in 2011. As part of our advice to the authorities we have examined available data on the prevalence under different conditions. The mortality of mink during the growth period in well managed farms and pair wise housing be around 1.1% of the weaned kits and 0.1% have bite wounds. Data on group housed kits are scarce and have been found only on few of the many potential combinations of number and sex. With two males and two females housed together a mortality of 4.4% was found and 2.1% had wounds. Inspection of mink in the cages revealed less than 1 percent with injuries and less than 1 in thousand with serious injuries demanding treatment or euthanasia. Almost half the serious cases were wounds. Examination of the dead bodies at pelting time revealed almost only wounds in the tail region. The majority of these were minor lesions at the tip of the tail that was healed and could only be recognized by palpation. Unhealed wounds were found in 1.0 % of pair-wise and 3.8 % of group housed juveniles (including those in treatment). Untreated serious wounds were not found. It is concluded that very few serious injuries can be expected at inspection of mink in the cages during the autumn, and those that develop seems to be found in the daily surveillance of the animals. A thorough examination of the dead bodies at pelting

will reveal less serious and healed wounds and injuries.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 1p. Authors' abstract

Preliminary results from testing a fast method for differentiation between *P. Aeruginosa* and *E. Coli* hermorrhagic pneumonia in mink

C.M. Salomonsen

Hemorrhagic pneumonia is a recurring problem in mink farming. The disease has a seasonal pattern and is primary diagnosed in period from September to December. The disease is caused by infection with either *Pseudomonas aeruginosa* or haemolytic *Escherichia coli.* The spread and mortality on the farm varies. Diagnosis of either *P. aeruginosa* or *E. coli* pneumonia relies on culture of the bacteria, since the macroscopic and microscopic appearance of the diseased animals are indistinguishable.

A commercial kit developed for differentiation of *E. coli* or *P. aeruginosa* sepsis in humans based on fluorescence in situ hybridization is available (AdvanDx Inc, Woburn MA). This kit was tested on smears and frozen tissue sections from lungs of mink dying with hemorrhagic pneumonia. The kit performed well on smears of bacterial cultures but was not possible to localize bacteria in the smears. E. coli showed fluorescence on thin slices of frozen mink lungs in one experiment indicating that by this procedure it might be possible to develop a protocol for fast differentiation between the two pathogens.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 6 pp. Authors' abstract

The follow up of black spots in subcutis of mink skins in the Netherlands

F.C. Kleyn van Willigen, J. de Rond, L. Boekhorst

Black spots in the subcutis of the pelt can be found in the inguinal region, the back, the abdomen, the neck or spread over the whole body. The subcutis is the "meat side" of the pelt. The black spots have been indicated by the fur farmers as bite marks in the past. Examination of the leather side of the skins learns that the distribution of the black spots did not concur with the places where bite marks usually develop. The density of the spots was variable, from high to low, as well as the distribution of the density of the spots.

When started with pelting in the first week of November and finishing pelting the last animals of the same group in December in 2008 and 2009 there was a decrease of occurrence of the black spots, and the density of the black spots was remarkably decreased. The results in 2010 are almost the same as the results in 2008 and 2009. The males generally had fewer black spots than the females, but when pelted in December almost all the females and males were free of black spots. The results of the females and males, with 50% Danish blood, were in pairs better than in groups. Minks treated from the second week of September with 100 mg vitamin C (ascorbic acid) per 1 kg food shows less black spots in the Dutch breed and in the 50% Danish breed.

In the period that the breeder males were killed in the end of March, they started changing their winter coat for the summer coat. Black spots were not found, but some males developed the typical blue pelt colour characteristic for the changement of winter coat to summer coat.

Macroscopical examination of the skin samples with black spots did not reveal scars indicative of bite wound trauma. If the hairs in a black spot were pulled out, the black spot disappeared, indicating that the black spots consisted of the hair and/or hair follicle itself. In the areas with black spots hairs were seen protruding from the subcutaneous side of the pelts after passage through the scraping machine.

Histological examination of the black spots similarly does not reveal indications of damage caused by biting, as haemorrhage, inflammation or fibrosis. The researchers are convinced that black spots are the results of local retarded maturation of the skin.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 8 pp. Authors' abstract

New findings in the pathogenesis of paralysis-paresis of mink

R. Fernández-Antonio, L. Espino López, A. Barreiro Lois, J.D. Bareiro Vázquez, M. Vila Pastor, G.A. Ramírez, M.M. Yllera, M. Lombardero

Posterior paresis/paralysis in mink is assumed to be caused by bacterial diskospondylitis that probably occur secondary to bacteremia of unknown origin. In this report we present two minks with posterior paralysis, one with a radiographic diagnosis of vertebral physitis **(nº1)** and other even a more intriguing case with no radiographic changes but with a histological diagnosis of vertebral infection **(nº2)**. We conclude that affection of vertebral physic presented herein may be a possible explanation of how spinal infection starts for this condition in minks.

NJF-Seminar no. 450, Knivsta, Sweden. November 2011, 1p. Authors' abstract

Stereotypic behaviour – a useful indicator for unfulfilled feeding motivation in mink

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Mink chosen for breeding are slimmed during the winter and flushed just before mating. However, the slimming procedure may increase the development of abnormal behaviour such as stereotypy. Stereotypic behaviour in mink is primarily observed prior to the normal feeding time during the winter period and therefore we hypothesized that the occurrence of stereotypy in winter is mainly a reflection of the feeding motivation of the mink.

In order to investigate this we compared the level of feed allowance and stereotypies in 784 female mink during the winter period. The stereotypic behaviour was registered by scanning observations on Tuesdays and Thursdays in weeks 2, 4, 5, 8, and 13 in 2009. On Tuesdays, stereotypies were registered once an hour from sunrise to sunset. On Thursdays the feeding time was postponed from 11.00h to 13.00h and stereotypies were registered once an hour from 9.00h to 12.00h. It took approximately 45 minutes to complete the observations. Furthermore, we tested whether a larger allowance of low energy feed in week 4-6 could reduce the feeling of hunger and thereby decrease the performance of stereotypies.

Stereotypies were almost exclusively observed 1-2 hours before feeding time (11.00h). During postponed feeding the occurrence of stereotypies were seen 1-2 hours before expected feeding time and remained at an elevated level for 1-2 hours after expected feeding time. The occurrence of stereotypies during daytime observations was affected by loose of bodyweight ($F_{1,750}$=46.18; P=0.0001) and the greater the weight loss the more stereotypy was observed. Stereotypy was almost absent in week 2 (0.06%) but significantly increased over time, to 4.3%, 4.4%, and 15.9% in week 4, 6, and 8 and decreased again to 3.3% in week 13 after flushing. The type of feed (standard vs. low energy feed) in week 4-6 decreased the occurrence of stereotypy in week 4 (P=0.0294) and 6 (P=0.0895) but did not have lasting effects in week 8 and 13. The occurrence of stereotypy during postponed feeding reflected the level of stereotypy during the daytime observations. Based on the correlation between stereotypy and feed restriction, the hypothesis that stereotypy in winter is mainly a reflection of feeding motivation in mink was accepted.

The timing of stereotyped behaviour in relation to the feeding time, and the relationship between the level of stereotypy and the degree of feed restriction, makes stereotypic behaviour a useful indicator of unfulfilled feeding motivation during the winter – clearly important for welfare – in farmed mink.

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Genetics of eye infection in the blue fox (*Alopex lagopus)*

T. Köykkä, R. Kempe, N. Koskinen, I. Strandén

The frequency of eye infections has increased in the farmed blue fox during the past decade. Eye infection might incur economic losses to producers through reduced selection intensity. Ethical aspects should also be considered, since eye infection may reduce the animal's wellbeing.

It is still unclear what factors cause eye infections in the Finnish blue fox, but there appears to be a genetic background. The abnormalities in the eyelid

structure may cause eye infections and increased grading size has been suspected as one predisposing factor.

The main purpose of this study was to estimate the genetic parameters for eye infection, and also to determine the potential for efficient selection against it. Genetic correlations between eye infection and production traits were also examined.

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