



**Opinion of the Panel on Animal Health and Welfare of the Norwegian
Scientific Committee for Food Safety**

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**Risk assessment concerning the welfare of animals kept for fur
production**

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Acknowledgements

VKM has asked the Norwegian University of Life Sciences to prepare a background report concerning the welfare of animals kept for fur production. VKM has used this report as a basis to answer the request from the Norwegian Food Safety Authority.

The authors of this background report; Scientist, cand.scient. Anne Kathrine Akre, Professor Morten Bakken, Professor Bjarne O. Braastad and Scientist, dr.scient Anne Lene Hovland are acknowledged for their valuable contribution with the report that was prepared as a basis for this opinion.

The Norwegian Scientific Committee for Food Safety has also appointed an *ad hoc* group consisting of both a VKM member and external experts to answer the request concerning the risk of stress and suffering of fur animals associated with the use of various methods to kill these animals at pelting. VKM has used this report as a basis to answer the request from the Norwegian Food Safety Authority.

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The members of the *ad hoc* group are acknowledged for their valuable contribution with the report that was prepared as a basis for this opinion.

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SUMMARY

The Norwegian white paper to the Parliament (St.meld. No 12 2002-2003) points out that there should be an ongoing process to update the Norwegian Regulation of 20 September 1998 No 901 concerning the farming of fur animals. Further, it is emphasized that the welfare of animals kept for fur production needs to be significantly improved in the future. According to this white paper (Ch. 9.6.10), the fur industry should achieve significant breeding improvements during the next ten years with regard to the animal's mental health. Otherwise, the phasing out of fur animal farming will be considered.

Based on the animal welfare problems outlined in the Norwegian Action Plan on Animal Welfare, the Norwegian Food Safety Authority requested the Norwegian Scientific Committee for Food Safety, Panel on Animal Health and Welfare, to assess the risks related to the welfare of animals kept for fur production.

A scientific report concerning the welfare of animals kept for fur production was made for the Norwegian Scientific Committee for Food Safety (Vitenskapskomiteen for mattrygghet, VKM) by experts from the Norwegian University of Life Sciences.

The Norwegian Scientific Committee for Food Safety has also appointed an *ad hoc* group consisting of both a VKM member and external experts to answer the request concerning the risk of stress and suffering of fur animals associated with the use of various methods to kill these animals at pelting.

The reports were prepared as a basis for this opinion.

With respect to the welfare of foxes, the Panel on Animal Health and Welfare concludes that the welfare of foxes kept in a standard production environment in adherence to the present regulations is adequate and does not cause risk of suffering to a noticeable degree in an average individual, when compared to other farmed species. However, the following modifications of the present housing and management routines would improve the welfare of foxes further: Selection for confidence in humans, regular changes of enrichment objects, stress reduction during pregnancy, provision of suitable cover in the wire-mesh cage prior to weaning, cub housing in groups after weaning, ad libitum provision of water of adequate quality or temperature, and construction of a more complex housing environment that reduces competition for resources between the animals. Further research studies regarding composition of groups, weaning age, animal density and the effect of housing on vixens' future maternal motivation are needed before conclusions can be drawn on these aspects.

With respect to the welfare of mink, Panel on Animal Health and Welfare concludes that the risk of suffering in mink kept in a standard production environment is relatively low. However, the following modifications of the present housing and management routines would improve the welfare of mink further: The use of enrichment objects (e.g. permanent tubes or platforms), selection for confidence to humans, and limitation of restrictive feeding. Research studies regarding group housing need to continue in order to reduce aggression. Additionally, studies regarding the value, health effects and development of enrichment devices which improve the environmental enrichment potential, and alternatives to restrictive feeding, should be continued.

With respect to the welfare of ferrets and chinchillas, Panel on Animal Health and Welfare concludes that a thorough assessment of their welfare is difficult due to the lack of scientific studies, so more research is needed if these species should be kept on farms in the future. In general, the regulations for mink can also be used for ferrets until new knowledge becomes available.

The floor space requirements of farmed species are discussed. Additional space may allow completed play behaviour in both foxes and mink, indicating improved welfare. Additional space also enables installations of different environmental enrichments, thus reducing the risk of suffering. Flexible cage systems provide a more complex environment which can stimulate both physiological and psychological needs.

Human factors that put welfare at risk, and thus should be minimized, include the farmer's/stockperson's lack of knowledge of the animals' needs, the failure to apply such knowledge, the use of restraint devices, immobilization and handling which the animal can conceive as negative. Stress and fear from handling may be reduced by suitable measures, e.g. by regularly handing out titbits, developing a positive relationship between man and animals, and breeding for more confident animals.

Evaluation of killing methods for mustelids

* **Carbon dioxide** (CO₂) is an anaesthetic gas which can produce unconsciousness at different concentrations. Because the gas is an irritant to the eyes and nose (is pungent) and causes a feeling of breathlessness and thus is aversive, a higher concentration (close to 100%) is recommended because the induction period then is relatively short (20-30 seconds).

* **Carbon monoxide** (CO) is highly toxic, but does not seem to be noticed by the animal. If delivered from a pure source (cylinder), CO may be the best method of choice from an animal welfare point of view. However, it should be noted that CO represents a danger to the operator. If exhaust gas is the source of CO, as is customary in Norway, the welfare advantage is less obvious. The concentration of CO is lower and the atmosphere will probably contain some exhaust irritants as well as less O₂ and more CO₂.

* **Inert gases** (argon, nitrogen), which work by displacing O₂, are probably not acceptable in mink, which are relatively resistant to hypoxia.

All gas methods require no handling beyond taking the animal out of its cage and carrying it to the gas chamber.

* **Mechanically-operated instruments** which penetrate the brain (*i.e.*, captive bolt) induce immediate unconsciousness. A perfect hit requires that the animal is well restrained. To ensure death, another method should be used in addition (*e.g.*, neck dislocation, bleeding, gas).

* **Blow to the head**, *e.g.*, by a wooden club, may be used for killing single animals, but is unsuitable for a larger number of animals due to the risk for bad hits or insufficient force. Blow to the head may cause reversible unconsciousness only and should always be followed by another method, ensuring death.

* **Electric stunning/killing** is acceptable provided that sufficient amperage through the brain is ensured. The *ad hoc* group has not found documentation as regards the amperage needed to produce immediate unconsciousness in mustelids. Low volt equipment should not be used. The apparatus formerly used in Norway did not kill the mink, even though it had a nose to

foot application of electrodes, and had to be followed by immediate breaking of the neck. The method requires handling of animals, but this handling will hardly compromise their welfare.

* **Cervical dislocation** (cracking the neck) is only acceptable if applied on deeply unconscious animals.

* **Injection of an overdose of drug** with anaesthetic properties is an acceptable method if modern veterinary principles are applied (*i.e.*, choice of drug, administration route, and premedication to reduce handling stress and discomfort).

Evaluation of killing methods for fox

* **Electrocution** with cardiac arrest (with one electrode inserted in the rectum and the other applied to the mouth) is the common method used for killing foxes in Norway and Finland today. However, electrocution is banned in some countries and some states in the USA. The application of electrodes (mouth and rectum) is not very aesthetic, but secures good electrical contact and low resistance in the system. Scientific studies of the apparatus "Fox Final™" (claimed to be similar to the Norwegian device Euthanatos 3™) has shown that an epileptoid EEG pattern which is considered a proof of unconsciousness, is present after 1 second, and that application of electric current for 3-4 seconds induces cardiac fibrillation/arrest and irreversible unconsciousness. However, there may be a need for broader margins (claim on minimum amperage and application time) than those given by the Finnish legislation. The Panel finds the method acceptable *per se*, but recommends actions to reduce handling stress prior to electrocution.

* **Carbon dioxide or carbon monoxide** gases has as far as the *ad hoc* group is aware of, not been described in scientific literature for killing of farmed foxes. Based on general knowledge, the Panel expects that CO gas from a gas cylinder may be acceptable from an animal welfare point of view. There may be practical problems to construct a chamber for on farm use which is suitable for such large animals, and operator safety is a concern when using CO.

* **Mechanically-operated instruments** which penetrate the brain (*i.e.*, captive bolt) induce immediate unconsciousness. To ensure death, another method should be used in addition. A perfect hit requires that the animal is well restrained, which may be stressful for the fox. Provided that the handling may be performed without inflicting high stress levels, the Panel finds penetrating captive bolt to be acceptable (requires subsequent exsanguination or other method to ensure death).

* **Injection of an overdose of drug** with anaesthetic properties is an acceptable method if modern veterinary principles are applied (*i.e.*, choice of drug and administration route, and premedication to reduce handling stress and discomfort).

The Panel does not recommend other methods but suggests that premedication is considered in combination with electrocution or CO-gas.

Evaluation of chloroform as killing method for chinchilla

The *ad hoc* group has not been able to find literature describing behaviour or evaluating the use of chloroform to kill chinchillas. Chloroform has been in widespread as an anaesthetic in humans as well as animals, but was abandoned because it is unsafe (narrow margin between anaesthetic and lethal dose). Chloroform is also carcinogenic and hepatotoxic. Presently it has

only a historical relevance. On the other hand, the *ad hoc* group has found no information to indicate that it would represent a welfare concern when used for killing of smaller animals.

Premedication

Premedication given in feed or titbits prior to stunning and killing appears as a promising means to reduce handling stress and discomfort connected with stunning and killing in several species, including fox and mink. This practice should be considered in combination with electrocution as well as gas killing methods. Since the *ad hoc* group has not found any research results published in this field, and some substances may furthermore have negative side effects (*e.g.*, nausea), the Panel is of the opinion that the usefulness and practical application of premedication should be further researched and developed.

KEY WORDS

Animal welfare, blue foxes, silver foxes, mink, chinchillas, ferrets, housing, management, enrichment

BACKGROUND

The Norwegian white paper to the Parliament (St.meld. No 12 2002-2003) points out that there should be an ongoing process to update the Norwegian Regulation of 20 September 1998 No 901 concerning the farming of fur animals. Further, it is emphasized that the welfare of animals kept for fur production needs to be significantly improved in the future. According to this white paper (Ch. 9.6.10), the fur industry should achieve significant breeding improvements during the next ten years with regard to the animal's mental health. Otherwise, the phasing out of fur animal farming will be considered.

Norway produces fur from silver fox (*Vulpes vulpes*), blue fox (*Alopex lagopus*), mink (*Mustela vison*). At present there are about 500 Norwegian farms, which in 2007 traded 103,155 silver fox furs, 157,364 blue fox furs (total of 260,519 fox furs) and 463,000 mink furs. Finland, China and Norway produce the majority of fox furs. China (34.7 %), Denmark (24.3 %) and Netherlands (7.5 %) produce the majority of mink pelts, while Norway produced 1.2 % (2006). China and Russia are important export markets for Norwegian fur and the market value for Norwegian furs in 2004 was NOK 277 million.

The Animal Welfare Concept

In this assessment the risk of suffering is interpreted in terms of the animal welfare concept. Animal welfare incorporates the animal's quality of life. Various definitions have been proposed to define welfare and several are still used. In this assessment animal welfare is defined as *the individual's subjective experience of its mental and physical condition as regards its attempt to cope with its environment*. In this definition, mental state incorporates emotional and cognitive states; physical state includes physical and physiological states which affect the mental state; and environment encompasses the animal's social, physical and other biological environment. The welfare level is characterized by the balance between positive and negative experiences. Health, behaviour and physiologically related indicators are important.

Suffering can be described as a negative emotional state which derives from adverse physical, physiological and psychological circumstances, depending on the cognitive capacity of the species and of the individual being, and its life's experience. It could include mental states such as fear, not being able to move freely, and anxiety, and other states such as prolonged hunger and thirst.

Pain, discomfort or stress of short duration or repeated at a relatively low frequency, usually does not have a permanent effect on animal welfare, unless it includes serious tissue damage. One of the criteria that puts an animal on the negative scale of welfare, which requires action to change the environment, is that the suffering occurs at a certain prevalence or frequency.

Domestication can be seen as a process by which captive animals adapt to humans and the environment they provide. The concept may be defined in various ways and includes different approaches, but here it is defined as *that process by which a population of animals becomes adapted to man and to the captive environment by genetic changes occurring over generations and environmentally induced developmental events reoccurring during each generation*.

Red foxes and silver foxes (*Vulpes vulpes*)

Silver foxes are colour variants of red foxes (*V. vulpes*) and can produce one litter (4-6 cubs) a year. The first successful attempt to breed foxes in captivity was in Canada in 1894. The first farm in Europe appeared in Norway in 1914 based on animals imported from Canada. At first animals were selected for body and litter size; later on farmers also included fur quality in the breeding goal. This selection led to animals being less stress sensitive and fearful as a result of breeding efforts. In the 1920s, the farm foxes were housed in wire pens on the ground. But in the 1930s, due to low reproduction, parasites, hygienic problems and a desire to keep more animals in a given space, the farmers constructed wire mesh cages. Improved reproductive ability and reduced aggressiveness and fearfulness towards conspecifics and humans can easily be achieved if based on available scientific evidence.

Arctic foxes and blue foxes (*Alopex lagopus*)

Blue foxes are colour variants of the arctic fox (*A. lagopus*) and produce one litter per year (normally 8-12 cubs, with a maximal reported litter size of 22 cubs). They were first kept in captivity on small islands off the Alaskan coast, where they bred freely in 1885. In the late 1920s some of these were exported to Norway and Sweden, where they were kept in wire cages. From 1925, Alaskan blue foxes (relatively large and highly fertile) were crossed with wild-caught variants from Greenland and other North-Atlantic islands (light-coloured and less fertile). The selection of blue foxes has led to increased body weight and litter size (from 1-3 to 7-8 cubs after 10-15 years of selective breeding in Norway).

Mink (*Mustela vison*)

Mink have been kept in captivity for approximately 90 years and can produce one litter (5-6 kits) a year. The feral mink are brown, but several colour mutations are described and about ten of these are proven to be economically viable. About 80 % of farmed mink are darkish brown or black.

Ferrets (*Mustela putorius furo*)

Ferrets are thought to be domesticated polecats (*M. putorius*, *M. eversmanni*). To fight its rabbit plague in the 1880s, New Zealand imported thousands of ferrets and some polecats. The introduced species wiped out the rabbits, but also several other native species. Ferrets became a pest themselves and had to be hunted. The hunters sold the pelts and this induced fur farming. In the 1970s, fitch (cross between polecats and ferrets) farming was introduced in Finland and Scotland and spread across Europe. Ferrets are found in a range of colours, and they show great tameness and are capable of attachment to humans. The ferrets can produce two litters per year.

Chinchillas (*Chinchilla spp.*)

Scientific work related to domestication level and its relation to animal welfare is not available. Breeding began after the near extinction of wild chinchillas. In 1923, 17 long-tailed chinchillas (*C. laniger*) were trapped, eleven of which may be the ancestors of all farmed chinchillas in the U.S.A. Breeders have failed to produce more fertile animals with pelts equal to the quality of wild Chinchilla pelts, which may be due to the inevitable inbreeding the

chinchillas have experienced. The Chinchilla Fur Breeders Association was founded in 1960 in Europe, and breeding is mainly done on *C. laniger*.

Selection for tameness

It has been shown that fox and mink are easily selected for tameness in the course of a few generations. This indicates that the length of the domestication history of a population is not a good welfare indicator. Welfare should be addressed in relation to how well individuals are adapted to life in captivity with the environment provided and the quality of human contact provided.

Based on the animal welfare problems outlined in the Norwegian Action Plan on Animal Welfare, the Norwegian Food Safety Authority requests VKM to prepare a risk assessment concerning the welfare of animals kept for fur production.

Commissioned by VKM, the Norwegian University of Life Sciences was asked to prepare a scientific background report concerning the welfare of animals kept for fur production.

VKM has also appointed an *ad hoc* group consisting of both a VKM member and external experts to answer the request concerning the risk of stress and suffering of fur animals associated with the use of various methods to kill these animals at pelting.

The scientific report “Risk assessment concerning the welfare of animals kept for fur production - a report to the Norwegian Scientific Committee for Food Safety” from the Norwegian University of Life Sciences and the report from the *ad hoc* group “Report from the *ad hoc* group concerning stress and suffering in the killing of fur producing animals” can be found at www.vkm.no.

TERMS OF REFERENCE

Based on the animal welfare problems outlined in the Norwegian Action Plan on Animal Welfare, the Norwegian Food Safety Authority requests the Norwegian Scientific Committee for Food Safety, Panel on Animal Health and Welfare to:

- 1) Assess the risk of suffering in silver fox, blue fox, and mink kept for fur production according to the Norwegian Regulation September 20th 1998 No 901 concerning the farming of fur animals (Forskrift 20. september 1998 no. 901 om hold av pelsdyr), with special emphasis on the physiological and behavioural needs of the different species, and their special health problems

The keeping of animals in wire-mesh cages

- i. Possibility for locomotion / exercise (need of space and need of activity)
 - ii. The suitability of the wire-mesh cage, the floor in particular, regarding suitable temperature and climate, place to hide, place to rest and the well-being of the different animal species and age groups
 - iii. Possibilities to develop and conduct natural behaviour, including exploration and appropriate stimulation through play and activity, species specific behaviour and social relations
 - iv. Access to water (as environmental enrichment and drinking water)
- 2) Assess the risk of suffering in terms of stress and fear of humans in mink, silver fox, and blue fox, specially related to:
 - i. Tending and care routines in current fur animal farming
 - a. Inspection and care required only once per day
 - b. How care and inspection is carried out
 - ii. Routines for capturing and handling, including the use of restraint devices such as:
 - a. Snout-clip and halter
 - b. Neck-tong
 - c. Restraint for heat/rut evaluation and artificial insemination
 - d. Duration of the restraint
- 3) Suggest suitable measures in order to reduce the risk of suffering from stress and fear towards humans in the above mentioned species when kept for fur production
- 4) Assess the risk of suffering in animals kept for fur production regarding;
 - a. Breeding for tameness
 - b. Breeding in order to create large animals
 - c. Breeding from mutants and hybrids
 - d. Restrictive feeding
 - e. Infanticidal behaviour in foxes
 - f. Weaning of pups and separation from the mother

- 5) Suggest alternatives to the current systems for keeping silver fox, blue fox and mink for fur production to meet the animal welfare problems outlined in the Norwegian Action Plan on Animal Welfare
- 6) Evaluate the need for further investigations on alternatives to the current systems for keeping animals for fur production in Norway
- 7) Assess the general risk of suffering in ferrets and chinchillas kept as fur animals in Norway

In the Norwegian fur animal industry ferrets and chinchillas play a minor role. If the keeping of these animal species for fur production involves a risk of suffering, a ban to keep both species for fur production may be evaluated.

- 8) Assess the risk of stress and suffering regarding:
 - a. The killing of mink and ferrets by exposure to carbon dioxide, carbon monoxide, mechanically-operated instruments which penetrate the brain, injection of an overdose of drug with anaesthetic properties, cracking the neck after stunning by blow to the head or electricity, electrocution with cardiac arrest, or other methods
 - b. The killing of foxes by electrocution with cardiac arrest (with one electrode inserted in the rectum and the other applied to the mouth), carbon dioxide, carbon monoxide, mechanically-operated instruments which penetrate the brain, injection of an overdose of drug with anaesthetic properties, or other methods
 - c. Assess the risk of suffering in chinchillas killed by exposure to chloroform

ASSESSMENT

The Scientific Committee, Panel on Animal Health and Animal Welfare, has made their assessments based on the two background reports. The report from the Norwegian University of Life Sciences (UMB) is covering question 1-7 in the terms of reference and the report from the *ad hoc* group is mainly covering question 8.

(1) Concerning the risk of suffering of fox and mink when housed according to the current farming conditions with the present specifications for regulations for wire mesh cages, the VKM Panel 8 agrees with the suggestions made in the UMB report.

(2) Concerning the risk of suffering in terms of fear of humans and handling routines during various situations when handling is considered necessary, such as inspection, oestrus control, moving of animals to a different cage and at killing prior to pelting, VKM Panel 8 agrees with the suggestions made in the UMB report.

(3) The panel also considered methods to improve animal welfare as suggested by the measures proposed by the report from UMB. An overall reduced level of fearfulness may result in improved welfare for both foxes and mink. A way to reduce fearfulness is breeding for tameness, and breeding for increased tameness is possible within a short time frame of a few generations. The use of titbit handouts and regular human contact which should be carried out as frequently as once daily, but at times when the interruption is less significant to the animals, or when it induces positive expectations e.g. at feeding time, are promising measures to increase the welfare of these animals.

(4) There is no known scientific documentation of side effects when selecting for increased body size in blue foxes, but in minks smaller litter sizes have been observed. However, the increased body size may affect bones and joints due to rapid growth as in dogs. Breeding in order to produce larger pelts (larger animals) is not considered negative per se but may have side effects that may have positive (less fearful animals, larger litter size) or negative impact (larger body size, altered endocrinology, e.g. two-seasonal animals) on animal welfare, since it may influence health and animal behaviour. Husbandry of such animals should take these factors into considerations particularly with respect to space requirements and feeding regimens. Breeding for increased size should be closely monitored for negative side effects.

Breeding from mutants and hybrids may be important to the fur breeders to respond to market demands. However, the mutants must be robust to inbreeding so as not to cause negative effects on animal welfare such as increased pup mortality, decreased disease resistance or abnormal behaviour. Production of mutants that have reduced welfare due to any of these factors should be avoided.

Hybrids between the silver fox and the blue fox have been produced since the 1970'ies when artificial insemination with frozen semen made it possible to produce hybrid pups (named Bluefrost), since the two fox species are not naturally attracted to each other and have a slightly different breeding season. The hybrids have been claimed to show more aggressive behaviour, but the allowance of cage enrichments may reduce this problem. The demand for bluefrost hybrids has decreased markedly.

Restrictive feeding should be avoided whenever possible in both mink and foxes due to the negative impacts on health and wellbeing as pointed out by the UMB group. Other methods should be used to reduce the weight of the animals, such as increased exercise, altered feeding routines and caloric intake without decreasing time spent for food consumption. Infanticidal behaviour is virtually absent in blue foxes, but may be a problem among silver foxes. Breeding for good mothering ability, socially motivated grouping of the animals and genetic

as well as learned reduced fearfulness is a way to alleviate this problem, but research so far has not provided a good explanation to why this behaviour is elicited in some animals.

No specific demands in relation to weaning age of cubs are given in the Regulations. Weaning normally take place when the cubs are 6-8 weeks, depending on the farm traditions. Possible welfare issues in relation to weaning age in foxes have not been widely investigated, but experience from other canids suggest 6-8 weeks, which then is the longest allowed time of mother offspring interaction allowed in any domestic animal production system. However, if 8 weeks is used as in dogs, the dam should be allowed the possibility to escape from her cubs whenever she wants from 5 weeks post partum, so as to wean naturally and avoid bite wounds.

(5) and (6) In the development of alternative housing systems for foxes and mink, one problem of current interest are the dimensions and placement of resources that minimize competition between the individuals. Resources like alternative water and nutrient sources, ensuring that all animals in a social group (in flexible housing systems) have access to enough water and food or the opportunity to withdraw from other individuals, are important to consider in the housing systems. Competition and aggression can be reduced with alternative and flexible systems throughout the year which allow animals to select location and form socially motivated groups.

The Panel agrees with the UMB report that further research is needed to develop cage and husbandry systems for mink and foxes that are acceptable with respect to fur quality and at the same time improves animal welfare.

(7) There are only few studies regarding the welfare of chinchillas and ferrets. Ferrets are related to mink (family *Mustelidae*) and ferrets are mostly kept in mink cages and are handled as mink. A low level of intraspecific aggression, however, enables the farmers to keep ferrets in groups. Ferrets show less fear towards humans and are therefore popular as pets. This characteristic should make them more responsive to positive welfare measures, such as cage enrichments and rewards. Apart from the particular sensitivity to heat, which should be taken into account in housing systems, ferrets have similar needs as minks and can be kept in socially motivated groups. Hence, the Panel cannot find any particular reasons to discourage the farming of ferrets should the demand for these furs make it economically feasible to do so.

With regard to chinchillas, little information is available on methods assessing welfare and possible environmental factors that impact the welfare of farmed chinchillas, as pointed out by the UMB report and the VKM report on killing methods. Due to the scarcity of farming of these animals few people, including veterinarians, have deep knowledge on the needs of these animals in captivity. Therefore, if chinchilla farming should be a part of Norwegian fur production in the future demands should be put on experience and knowledge among the farmers and caretakers, and more research should be carried out on both husbandry systems and killing methods.

The Panel agrees with the general conclusion of the UMB report in that there is still much research to be done in relation to the welfare of farmed fur animals, and conclusions must be drawn quite cautiously. When comparing overall welfare issues of foxes and mink with those of some of the other animal production systems i.e. pigs and laying hens, mink and foxes in some aspects may experience better welfare, in others, maybe poorer welfare. Several care and environmental routines required by the present Regulation of 1998 on Farming of Fur Animals are adequate and do not cause risk of suffering to a noticeable degree. However, the

lists also include a number of specific items that do cause risk of suffering, and which should be given further consideration in the regulations if those risks are to be diminished.

(8) Killing of animals always poses a risk that the animal may suffer for shorter or longer time. Killing methods should aim at minimizing this risk and also be operator safe and rapid to use in an industrial setting. Presently, acceptable methods for killing of foxes and minks do exist as pointed out by the report from the VKM *ad hoc* group. Among these, the use of CO or CO₂ gases for both minks and foxes or in the case of foxes only, the use of electrical stunning and killing using appropriate time and amperage, seem to be the most efficient procedures which pose the least risk of suffering. However, the VKM panel shares the *ad hoc* group's concern over handling stress and supports the recommendation for more research on the use of premedication prior to stunning and killing.

CONCLUSION

Animal welfare is defined here as *the individual's subjective experience of its mental and physical condition as regards its attempt to cope with its environment*. Indicators for validating welfare are mortality, morbidity, body condition, reproduction, behaviour and physiology (stress), although a single indicator can sometimes show that welfare is at risk. Conclusions about welfare should always be based on all available evidence and not only rely on a single or few experiments. There is still much research to be done in relation to the welfare of fur animals, and conclusions must be drawn quite cautiously. When comparing overall welfare issues of foxes and mink with those of pigs and laying hens, two reports concluded that there is better welfare in foxes and mink. As specified in the bullet lists below, several care and environmental routines required by the present Regulation of 1998 on Farming of Fur Animals are adequate and do not cause risk of suffering to a noticeable degree. However, the lists also include a number of specific items that do cause risk of suffering, and which should be given further consideration in the regulations if those risks are to be diminished.

All fur animals have been submitted to some degree of domestication, but they have different domestication histories. It is easy to select foxes and mink for tameness during a few generations, and this indicates that the duration of the domestication history within a population is not a good welfare indicator. The effective degree of domestication is a function of genetic tameness and individual experience of human caretakers during behavioural development and adult life. By combining these two processes in a positive direction, the risk of fearfulness towards humans will decrease.

Care routines, capturing and handling

- It is important that the caretaker has adequate knowledge of the animals that he/she cares for, e.g. of the suitability of the environment provided, and of general health and behaviour changes which indicate reduced welfare. Lack of knowledge or not implementing measures in line with such knowledge will put the welfare at risk.
- The regulation does not specify how and how often positive human-animal contact should be carried out in order to increase the animals' confidence in humans. Infrequent positive contact may put welfare at risk.
- Restraint devices are used to limit injuries to stockpersons and the animals, and to minimize handling time. Mink are handled with gloves or in traps, adult foxes often with neck-tongs. Use of restraint devices, immobilization and handling which the animal can conceive as negative may put welfare at risk, and should thus be minimized. The traditional type of neck-tongs may cause damage to the animals' teeth and increase stress.
- Stress and fear from handling may be reduced by suitable measures, e.g. regular titbit handouts, development of positive relationships between humans and animals during the animal's life and breeding for more confident animals.
- Display of live animals from fur farms at commercial exhibitions should be avoided as it may potentially put welfare at risk, although this is not specifically documented by research.

Enrichment

- Presence of certain objects in the cages may satisfy a motivated behaviour in foxes and mink to explore or interact with the environment, and thus reduce the risk of suffering. However, the use varies within and between individuals.
- Objects should be exchanged at regular intervals to ensure good welfare.
- More studies on the value, health effects and development of enrichment devices in cages for foxes and mink are needed to find enrichments that are more able to resist tearing, chewing and biting, while still maintaining the animal's interest and requiring less maintenance from the caretaker.
- Studies show that swimming water for mink is not an exclusively preferred enrichment. Other alternative enrichments may be equally attractive and meet the mink's needs. Including a general requirement of swimming water in the regulation may increase the risk of pneumonia and other health problems during winter conditions.

Wire mesh cage

- In standard cages, both foxes and mink are able to perform the most basic behaviours related to movement, e.g. stretching, turning and walking.
- Full-grown foxes and mink do not reject the wire mesh floor when given a choice.
- Access to solid floor material may improve welfare in some aspects, but reduce it in others.
- Additional space provided to young animals, both foxes and mink, would probably to a greater extent allow completed play behaviour, a parameter which indicates improved welfare. Additional space may enable installations of different environmental enrichments and therefore reduce the risk of suffering.

Hiding and resting

- For foxes, access to a nest box may give the animals opportunity to hide and rest in seclusion and reduce the risk of suffering. There are individual and species differences, and such boxes may be more important for the more fearful or subordinate foxes. However, hiding inside the nest box could provide the foxes with less human contact. A more open structure would offer the most benefit.
- For mink, a permanent enrichment with tubes or platforms would increase welfare.

Group housing

- Group housing of animals can only increase welfare if the individual perceives this as being superior to solitary housing. Non-motivated group housing may induce social stress and aggression between animals and therefore put welfare at risk.
- Focus should be on the composition of groups, since different animals have different motivations for seeking contact with conspecifics, and on the construction of a more complex housing environment that lowers the level of competition for resources between the animals.
- Social contact in farmed foxes appears to have several welfare benefits when adjusted for the animal's sex, age and season (prior to the onset of the period for natural dispersion and sexual maturation). Cubs should not be housed individually after weaning as it would impact their welfare negatively.

- As increased aggression may be a problem in group-housed mink and foxes, further welfare studies on this are needed before more detailed statements can be made on how welfare risks can be reduced by this measure.

Drinking water

- If the water supply is frequently restricted in terms of quantity or quality, this could affect the general health and welfare situation in mink and foxes.
- Frost-free irrigators may reduce the risk of inadequate water supply in areas that frequently experience below-freezing temperatures during winter.

Breeding

- Breeding can improve the welfare situation under farm conditions, but should not cause physical distress or affect normal behaviour.
- The body size development seen in fur animals today, particularly in blue foxes, increases the chance of suffering.

Restrictive feeding

- Restrictive feeding of foxes and mink is very likely to cause frustration and reduce welfare. If measures are needed to reduce the weight of the animals, alternatives should be sought that do not reduce the amount of time spent eating (e.g. composition of the diet).

Infanticidal behaviour in foxes

- Stress during pregnancy will impair welfare in mothers and also affect their maternal behaviour, thus contributing to reduced ability of cubs to cope with their environment.
- Such stress can probably be avoided by careful distribution of pregnant vixens among the sheds; giving subordinate vixens a larger distance to neighbouring animals. However, studies that investigate the effect of animal density and housing on the vixen's future maternal motivation should be completed before conclusions can be drawn.

Weaning of offspring

- Despite signs that late weaning is better for welfare, some caution is needed before drawing conclusions. The effects of weaning age and weaning methods on welfare need further investigation.
- Late-weaning in mink can cause outbreaks of aggression, which may be a particular problem in larger litters, as these tend to have more aggression.

Alternatives to current systems

- Flexible cage systems with closable doors between individual cages could result in better welfare for farmed foxes and mink because such systems provide a more complex environment which can stimulate both physiological and psychological needs.

Welfare of ferrets and chinchillas

- The welfare of ferrets and chinchillas has received very little attention. Possible welfare problems are broadly similar to those of foxes and mink.
- Ferrets and mink shall be housed in the same way, according to the Norwegian Regulations, even though ferrets are more social. The risk of fear of humans is probably lower in ferrets and easier to handle if it occurs. Chinchillas are not included in the Norwegian Regulation.
- No conclusions on welfare status can be drawn from keeping chinchillas or ferrets under present regulations. Research is needed regarding housing and whether the required systems fulfil the animals' biological needs, including the opportunity for social and exploratory behaviour.

Conclusions concerning the risk of stress and suffering of fur animals associated with the use of various methods to kill these animals at pelting.

Drugs

Carcasses of fur animals are no longer used as an ingredient in feed for other fur animals. This allows the use of drugs for killing these animals.

Injection

Killing by lethal injections of drug with anaesthetic properties is a humane and thus acceptable method for all fur animal species if modern veterinary principles are applied (*i.e.*, appropriate choice of drug and administration route, and premedication to reduce handling stress). Some, but not all relevant drugs are expensive. The method requires presence of a veterinarian, which will be an additional cost. Previously unhandled animals may be stressed by the necessary handling, but handling may be kept at a minimum and does not exceed that necessary for other killing methods. The animal can be left in its home cage to calm down after premedication. Intraperitoneal administration is not advisable to use in blue foxes, which usually have large fat deposits in the abdomen which can interfere with the absorption.

Inhalation

Killing by inhalation in a chamber has the advantage that many animals may be killed per time unit and that only simple handling is necessary.

Inhalation of an anaesthetic agent is generally an acceptable method for all fur animals, provided that the agent is not causing irritation or excitation, and preferably performed after premedication. If the gas is unpleasant in any way, the induction period must be short.

The *ad hoc* group has not been able to find literature describing welfare relevant information or evaluating the use of chloroform vapour to kill chinchillas. Chloroform has been in widespread use for anaesthesia in humans as well as animals, but was abandoned because in addition to having a narrow margin between anaesthetic and lethal dose it poses a human health risk, and now it has only historical relevance. On the other hand we have found no

information to indicate that it would represent a welfare concern. However, chloroform is carcinogenic and hepatotoxic and according to the AVMA, it should not be used at all (AVMA 2007).

CO₂ gas is widely used for stunning/killing animals, but is nevertheless a disputed method. The gas is pungent and many species including mink find higher concentrations aversive. EFSA advises against the use of CO₂ for stunning of laboratory animals, ferrets and foxes included (EFSA 2004b). Advantages are that CO₂ is readily available, easy to use and relatively safe for the operator. The *ad hoc* group did not observe obvious flight responses in mink during the induction, but distinct anal gland smell indicates that the mink were stressed.

CO gas is considered to be the ideal killing agent (Blackmore 1993) as it is not detected by the animal. CO₂ and O₂ may be kept at normal levels in the gas atmosphere. CO gas has an extremely high affinity to haemoglobin. It forms an irreversible bond to haemoglobin, and is therefore lethal. The main problem is that CO gas represents a considerable danger to the operator, and the gas chamber should only be placed outdoors. In Norway, exhaust fumes is commonly used as the CO source. Even though the exhaust is conducted through water or rockwool mats, the gas may still contain some irritants and also levels of CO₂ and O₂ in the chambers may be affected. Lambooy (1985) found more behavioural reactions in mink killed by exhaust fumes compared to CO from a pure source. This may be the reason that the *ad hoc* group did not observe obvious differences in mink behaviour when exposed to CO₂ or exhaust fumes.

Inert gases (argon, nitrogen) are shown to have advantages compared to CO₂ at least in some species. There is a lack of knowledge in this area, but due to the semi-aquatic biology of mink replacement of O₂ may not be a preferred method for this species.

HCN (cyanide) is not mentioned among methods for killing fur animals by EFSA or AVMA. HCN is very poisonous and represents a danger to operators. However, it has been used for killing spent hens on farm and is judged to have some welfare advantages (Mejdell and Lund, 2006).

Based on available literature and the demonstration the *ad hoc* group finds that CO₂ does raise welfare concerns but might be acceptable in mink. CO gas is considered a better choice, but personnel safety is of major concern. CO gas should come from a pure source rather than exhaust. Premedication prior to killing with CO₂ or CO from exhaust fumes should make these methods fully acceptable.

Electricity

Stunning/killing by electricity seems to be an effective, fast and simple method. The animal is rendered irreversibly unconscious if sufficient current passes both through the brain and heart and the application time is sufficiently long. In Norway, electricity is currently used in foxes only. It was formerly used in mink, but the method required neck dislocation even after nose-to-hindleg application to ensure death. Breaking the neck manually is physically demanding, especially in large scale killing. From an animal welfare point of view, with the same reservations as given below, the Panel finds the method acceptable.

Research shows that the foxes are stunned (as judged by epileptiform EEG and lack of reflexes) by 110 V, 0.4 A and 1 sec (mouth to rectum application of electrodes), but the application time must be prolonged to 3-4 seconds to kill the fox (Lambooy 1983). Results from Korhonen *et al.* (2006) support this; they found epileptiform EEG in all 15 foxes immediately following stunning for 2.34 to 5.21 seconds with current of 0.32 to 0.69 A. However, the experiments were performed on a very small number of animals, and the concern addressed by AVMA is valid: there is no guarantee that every animal is rendered unconscious at the time the other effects (tonic muscle cramps, cardiac fibrillation) occur. The voltage measured by Lambooy (1983) in the “Fox Final” apparatus was lower (110 V) than that stated by the manufacturer (220 V) and also low compared to that used for stunning of slaughter animals. The very good electrical contact achieved by the electrode positions compensates probably for the low voltage. On the other hand, there may be individual differences (causing variation in amperage crossing the brain) that should be accounted for. When slaughter animals are stunned by a head to body method, it may be performed in one operation (head to chest, brisket, back or leg) or in two sequences (first head only application, then head to body). Stunning in two sequences will reduce the risk that unconsciousness occurs after the cardiac arrest. However, Temple Grandin does not recommend the one method over the other (www.grandin.com). In Norway, two-sequence stunning is recently being used for pigs. Here the two head electrodes are applied for 4 seconds (*i.e.*, normal time for head-only stunning) and then the third is applied to the body (Elisiv Tolo, personal communication). This will make sure that unconsciousness occurs before cardiac arrest.

Based on research results and personal observation, the Panel considers electrocution to be an acceptable method for foxes. However, larger safety margins should be considered, for example higher amperage and longer application time might be required.

The Panel finds the handling of foxes prior to electrocution to be a concern. Today, fur farmers are urged to handle their foxes without use of the necktongs. At the demonstration, even the frequently handled blue foxes at UMB research farm avoided the tongs and resisted being dragged out of the cage. To be suspended by the tail and neck is most likely an unpleasant experience, even if it lasts for a short time. Other methods to restrain the foxes should be considered. An alternative may be to give the foxes some premedication.

Mechanical methods

Blow to the head with a wooden club or a similar tool may be used for small sized animals, *e.g.*, cubs. It is not a method of choice for killing a large number of animals, because of the danger of operator fatigue resulting in poor performance.

Percussive stunning with a penetrating captive bolt is considered a reliable method in many species. However, it will damage the head pelt and may contaminate the fur. A non-penetrating bolt will thus be more practical. Both methods are acceptable from an animal welfare point of view, but death must be assured with an additional method. There is a need to restrain the animal so that the instrument can be positioned to make an exact hit to the brain.

Other comments

Premedication should be considered given prior to the killing by the methods described. Premedication can be given as an injection or *per os*, *i.e.*, mixed in the food or in a titbit. The use of premedication would reduce handling stress and also the possible discomfort caused by the killing method.

The assessment of killing methods is summarized in table 1.

Table 1. Assessment of killing methods. Premedication with analgesic and anxiolytic drugs should be considered prior to application of any killing method, to reduce fear and discomfort.

Method	Animal welfare considerations	Handling stress	Required operator skills	Human risk	Risk of failure/errors	Suitability
<i>Gases</i>		All methods involving gas require handling, removing the animal from the box, transporting it to the killing site and lifting it into the gas box				Gas killing is currently not used in foxes, but may be an alternative if suitable on-farm methods can be developed
CO ₂	Aversive. Pungent, induces a feeling of breathlessness. Triggers stress reactions		Low	Low	Low Gas meter should be available for continuous measuring gas concentration	High concentrations (close to 100%) should be used to get short induction period EFSA advices against use in lab animals including foxes and ferrets
CO	Not aversive if pure gas source is used. Exhaust fumes contain irritants and provoke reactions		Low	Very high	Low	Better than CO ₂ from an animal welfare point of view, but requires safety measures due to operator hazard
Inert gases (Ar/N ₂)	Not aversive. Doubtful for use in mink; due to semi-aquatic biology it reacts negatively to hypoxia		Low	Low	Low Meters should be available to measure O ₂ -concentration	Probably not suitable for mink but could be an alternative for other species. Currently not used
Chloroform	Probably no big negative effects, but no recent studies available		Low	High; carcinogenic and hepatotoxic	Low	Has been used for chinchillas. Better gas anaesthetics are available today AVMA advices against its use, human health risks

Cyanide (HCN)	Efficient and quick, but other welfare effects unknown		Moderate	Very high	Low	Currently not recommended for killing of animals; little knowledge available, currently not used
<i>Electricity</i>	Efficient method if enough electric current (amperage) passes through the brain. More research is needed to establish recommended levels of current to ensure immediate stunning of all individuals	High, esp. in foxes	Moderate	Moderate	Low (but welfare consequences if stunning fails are great)	Suitable if correctly applied; efficient and simple method. Handling raises welfare concerns. AVMA advises against its use. Prohibited in some countries

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