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SCIENTIFIC OPINION

Welfare of American mink, red and Arctic foxes, raccoon dog and chinchilla kept for fur production

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The declarations of interest of all scientific experts active in EFSA's work are available at https://open.efsa.europa.eu/experts

Abstract

This Scientific Opinion (SO) addresses a mandate from the EC regarding welfare of the following animals when farmed for their fur: (i) American mink (*Neogale vison* or *Neovison vison*), (ii) Red fox (*Vulpes vulpes*, also known as 'silver fox'), (iii) Arctic fox (*Vulpes lagopus*, also known as 'blue fox'), (iv) Raccoon dog (*Nyctereutes procyonoides*, also known as 'Finnraccoon') and (v) Chinchilla (*Chinchilla lanigera*). The request was to identify the most relevant welfare consequences (WCs) for each species and to determine whether these could be prevented or substantially mitigated in the current husbandry systems. 'Current system' refers strictly to the cage systems and cage dimensions as described in the EFSA Technical report produced under this mandate, as there was no or very limited information available on animals kept in alternative farming systems. Using information obtained from a review of literature, consultations with stakeholders and consideration by EFSA experts, the SO addresses for each species these WCs along with their underlying hazards and potential preventive or mitigating measures. In all species, Restriction of movement, Inability to perform exploratory or foraging behaviour, and Sensorial under- and overstimulation were selected as the most relevant WCs, sharing common hazards linked to current cage size and barrenness. Species-specific WCs include: soft tissue lesions and integument damage (mink), and handling stress (mink and foxes); locomotory disorders (Arctic fox); group stress (red fox), locomotory disorders and isolation stress (raccoon dog); and inability to perform comfort behaviour, resting problems and predation stress (chinchilla). In the majority of cases, it is concluded that neither prevention nor substantial mitigation of the identified WCs is possible in the current system. The SO also includes conclusions on limited or substantial mitigation measures in the current system and, when not possible, on substantial mitigating measures which would require a change to a different system.

KEYWORDS

American mink, animal welfare, cage, chinchilla, fox, fur production, raccoon dog

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SUMMARY

Background and Terms of Reference

EFSA was requested by the European Commission to provide an independent view on protection of the following animals kept for fur production in the EU: American mink, red and Arctic foxes, raccoon dogs and chinchillas. Two separate publications were requested: one with an update of the literature on the biology of these species as well as a review of the most common husbandry systems and rearing practices to keep these species (EFSA, 2025), and another with an assessment of welfare focussing on the most relevant welfare consequences (WCs) for each species. The present Scientific Opinion (SO) corresponds to the latter.

EFSA was requested to review the available scientific publications and other sources to provide a sound scientific basis for the Commission to consider the necessary follow-up to the European Citizens' Initiative “Fur free Europe” and whether specific legislation on farming of fur animals would be needed or whether the farming of fur animals (or some species of fur animals) should be phased out. The specific mandate requested: (i) To identify the most relevant welfare consequences (WCs) and corresponding hazards in relation to common husbandry systems and practices for fur production; and (ii) For the most relevant WCs (maximum 5), to assess whether the WCs identified under point (i) can be prevented or substantially mitigated under current farming conditions or other field-tested farming systems.

Interpretation of Terms of Reference

The species considered in this SO are: (i) American mink (*Neogale vison* or *Neovison vison*, previously classified as *Mustela vison*), (ii) Red fox (*Vulpes vulpes*, also known as ‘silver fox’), (iii) Arctic fox (*Vulpes lagopus*, previously classified as *Alopex lagopus* and also known as ‘blue fox’), (iv) Raccoon dog (*Nyctereutes procyonoides*, also known as ‘Finnraccoon’) and (v) Chinchilla (*Chinchilla lanigera*).

Of the species listed above, the mandate excludes: animals kept specifically for research, as companion animals or for hobby purposes, gaming, hunting or in zoos; animals living in the wild; production phases of transport and killing; and disease outbreaks, zoonoses and One-Health considerations.

The term ‘current system’ refers to the cage system and cage dimensions described in the technical report (EFSA, 2025), which is based on information from the call for evidence and literature on husbandry systems and farm practices for animals kept for fur. An ‘enclosure’ is defined as any other type of husbandry system for keeping fur animals not currently in use in the commercial practice.

At an EFSA stakeholder meeting on 22nd January 2024, stakeholders called for the interpretation of animals' welfare needs, particularly in relation to their behavioural requirements and for consideration of their level of domestication. These aspects are clarified in Section 1.2 of this SO. In brief, in the context of this SO, a behavioural need is defined as the presence of one/more negative welfare outcomes if a certain behaviour cannot be performed to satisfy the respective underlying motivation. The degree of domestication of the species was not considered in the assessment since there is evidence indicating it does not impact their fundamental needs.

Stakeholders also raised aspect related to the evaluation of abnormal behaviours (including stereotypic behaviour) as indicators of poor welfare. These behaviours are useful animal-based measures (ABMs) for assessing the welfare of fur animals when interpreted in context and used alongside other indicators. While their presence signals compromised welfare, their absence does not necessarily imply good welfare. Species-specific considerations on abnormal behaviours are detailed in the relevant welfare assessment sections.

A last aspect raised concerned the provision of open water to mink. This topic is treated under mink welfare assessment to allow description of WCs associated with lack of open water (Section 3.3.4), hazards related to the absence of open water (Section 3.3.4.2) and preventive and mitigating measures (Section 3.4.5).

Data and Methodology

To fulfil the mandate, a broad literature search was performed. Information from stakeholders on the question of the mandate were received via four calls for evidence and in technical meetings. The welfare assessment was carried out considering information retrieved from the literature search, contributions from stakeholders and EFSA expert opinion. For each species, relevant scenarios for consideration were based on the production stages (animal categories) and related husbandry systems and farm practices, as derived from the information in the Technical Report produced under this mandate (EFSA, 2025). For each scenario, the most relevant WCs were then identified by an Expert Knowledge Elicitation (EKE), using the list of 33 WCs defined in the EFSA Guidance (EFSA AHAW Panel, 2022) as the starting point. The 5 WCs per species (6 in chinchilla) that were given the highest score for relevance across scenarios (based on estimation of their severity, duration and frequency of occurrence) were selected for further assessment. In many cases, other WCs had overlapping or interacting hazards; these were identified as ‘linked WCs’ and discussed in the context of the most relevant ones. Other WCs than those selected as most relevant for each species here may also exist and may impact the welfare of the animals when kept for fur production but are not dealt with in this opinion.

For each of the WCs selected as most relevant, the hazards, as well as preventive and mitigating measures, were identified. Preventive measures are intended as measures that can be put in place to prevent a WC from occurring by preventing

the hazards. Mitigating measures are intended as any measure that can mitigate (i.e. reduce) the WC if the hazard is still present. The definition of substantial mitigation was not provided in the mandate and was therefore interpreted by EFSA experts to refer to circumstances where a mitigating measure or, most often, a combination of mitigating measures, acts together to markedly reduce the risk of experiencing or reducing the severity of adverse effects associated with a specific WC, within the relevant animal population. This was agreed by expert consensus based on the available evidence. When a mitigating measure was not considered 'substantial' it is reported in the conclusion as of 'limited extent'. The conclusions to the specific questions in the mandate for each of the species considered are summarised below.

In all species, Restriction of movement, Inability to perform exploratory or foraging behaviour, and Sensorial under- and overstimulation were selected as the most relevant WCs, sharing common hazards linked to current cage size and barrenness. Since Sensorial understimulation shares the same hazards, preventive and mitigating measures as Restriction of movement and Inability to perform exploratory behaviour, it is not repeated in the list below.

Welfare assessment of mink

Welfare assessment of American mink is reported in Section 3. The most relevant WCs are restriction of movement, inability to perform exploratory or foraging behaviour, sensorial under- and/or over-stimulation, soft tissue lesions and integument damage, and handling stress.

Restriction of movement is linked with the WCs Inability to perform play behaviour and Resting problems, because of shared hazards, including: (i) insufficient floor area, cage height and structural complexity of the cage to allow motivated types of active behaviours including locomotion and play; (ii) inadequate floor material; (iii) nestbox with too small floor area and/or size of openings, insufficient number of nests; (iv) lack of open water. Due to limited floor area, cage height and lack of structural complexity (including resources to perform highly motivated behaviours, such as presence of open water), the WC Restriction of movement cannot be prevented or substantially mitigated in the current system.

Inability to perform exploratory or foraging behaviour is linked with the WCs Inability to perform play behaviour, inability to chew and prolonged hunger because of shared hazards, including: (i) lack of physical complexity of the cage; (ii) limited cage size (both horizontal and vertical space); (iii) lack of enrichment and inadequate feed texture and delivery, not providing stimuli for appetitive and consummatory foraging behaviour; (iv) feed restriction (increasing foraging motivation and/or prolonged hunger); (v) lack of open water. This WC cannot be prevented or substantially mitigated in the current system due to the hazards listed above. However, changes to the texture of feed, a system of delivery that favours natural feeding postures, and the provision of choice between additional chewable resources that stimulate consummatory elements of foraging behaviour will correct the hazard shared with the WC Inability to chew. Changes in feeding management, avoiding genetic selection strategies that promote extremes of body condition or too large litters (which impacts on dam energetic requirements) will correct the hazard shared with linked WC Prolonged hunger.

Sensorial overstimulation is linked with the WCs Handling stress, soft tissue lesions and integument damage, and Group stress because of shared hazards for mink kept in group housing.

Soft tissue lesion and integument damage is linked with the WC Group stress because of shared hazards if more than one mink is kept per cage or enclosure. Hazards for soft tissue lesions and integument damage are either related to (i) intraspecific aggression or (ii) floor material, and vary depending on the scenario, however, all scenarios are affected. The WC cannot be prevented in the current system, but substantial mitigation can be possible in the case of juveniles kept in pairs of one male and one female (instead of same sex pairs or group housing) until Sept–Oct (natural dispersion time) and then individually, and, if sufficient resources are provided to avoid competition, during pair housing.

Handling stress is linked with the WCs Inability to avoid unwanted sexual behaviour because of shared hazards associated with the transfer to the mating cages. Hazards for the WC are: (i) handling and restraint during production procedures; (ii) fearful mink temperament; (iii) lack of habituation to humans. As handling is necessary for certain essential production activities, this WC cannot be prevented. Further research is required to evaluate whether substantial mitigation of this WC could be achieved in the current system by minimising the number of handling occasions, using appropriate equipment when for handling occurs, proper training of handlers to have appropriate competence, as well as by reducing the stress associated with human contact potentially through genetic selection for animals with less fearful and aggressive responses to human interactions.

Welfare assessment of foxes

Welfare assessment of foxes is reported in Section 4. For red foxes and Arctic foxes, the most relevant WCs in both species are Restriction of movement, Inability to perform exploratory or foraging behaviour, Sensorial under- or overstimulation and Handling stress.

The WC Restriction of movement is linked with the WCs Inability to perform play behaviour and Inability to perform exploratory or foraging behaviour because of shared hazards, including: (i) insufficient floor area to allow motivated types of active behaviours including such as locomotion and play; (ii) insufficient cage height and structures to facilitate movement in three dimensions; (iii) inadequate floor material. The dimensions of the cages in the current system severely restrict the size, amount and type of resources that can be provided, thereby severely restricting both the qualitative and quantitative expression of active behaviours and sustained locomotion. Therefore, this WC cannot be prevented or substantially mitigated in the current system.

The WC Inability to perform exploratory or foraging behaviour is linked with the WC Inability to chew because of shared hazards. Hazards for the WC are: (i) lack of physical complexity of the cage; (ii) limited cage size (both horizontal and vertical space); (iii) lack of enrichment providing stimuli for appetitive and consummatory foraging behaviour; (iv) flooring substrate not suitable for digging and vole jumps.

The dimensions of the cages in the current system severely restrict the size, amount and type of resources that can be provided, thereby severely restricting the possibility to perform exploratory and foraging behaviours. Therefore, this WC cannot be prevented or substantially mitigated in the current system. Changing the texture of feed and providing resources suitable for chewing necessitates a change of feed delivery method. This would correct the hazard shared with the linked WC Inability to chew in the current system.

The WC Sensorial overstimulation is linked with the WCs Resting problems and Group stress because of shared hazards, including: (i) lack of nest box or den-like structure for resting and to function as a retreat; (ii) lack of an elevated place for surveillance and resting; (iii) disturbance by neighbouring animals and group housing. Due to dimension of the cage that does not allow to correct all the hazards listed, this WC cannot be prevented or substantially mitigated in the current system.

The WC Handling stress is linked with the WCs Inability to avoid unwanted sexual behaviour and Resting problems because of shared hazards, including: (i) handling and restraint during production procedures; (ii) fearful temperament; (iii) lack of habituation to humans. Due to the necessity for handling and restraint during essential production procedures, the WC cannot be prevented in the current system. Further research is required to evaluate whether substantial mitigation of this WC could be achieved in the current system by combining selective breeding with measures to address the other hazards.

The WC Locomotory disorders (including lameness) was identified as most relevant in **Arctic foxes** but can also occur in red foxes, with similar hazards including: (i) genetic predisposition as a side-effect of genetic selection for production traits; (ii) inappropriate feeding management (mainly excess of energy resulting in obesity); (iii) inadequate floor material. Providing appropriate veterinary care to affected animals would mitigate the impact, although not address the causes. Whether this WC can be prevented in the current system is unknown, and further research is essential to provide quantitative information about the consequences of implementing genetic selection against undesired traits (e.g. bent feet) and associated traits causing fast growth and obesity, careful management of body condition and a nutritionally balanced diet, in the current system.

The WC Group stress was identified as most relevant in **red foxes**, with the main hazards: (i) disturbance by neighbouring animals; (ii) group housing, especially after the onset of dispersal motivation in autumn. The WC cannot be prevented in the current system due to high animal density on the farm and within group cages. It is unknown whether substantial mitigation in adult animals is possible through measures such as providing opportunities for visual isolation from nearby individuals and managing the relative social status of neighbouring vixens. Due to the limited space in the cage, this WC cannot be substantially mitigated in juveniles kept in the current system.

Welfare assessment of raccoon dog

Welfare assessment of raccoon dog is reported in Section 5. For raccoon dog, evidence for specific behavioural needs and motivations underlying the behaviour and welfare of this species is extremely limited. The most relevant WCs in raccoon dogs are Restriction of movement, Inability to perform exploratory or foraging behaviour, sensorial under- and/or -overstimulation, isolation stress and locomotory disorders including lameness.

Restriction of movement is linked with the WC Inability to perform play behaviour because of shared hazards, including: (i) insufficient floor area to allow motivated types of active behaviours including such as locomotion and play; (ii) insufficient cage height and structures to facilitate movement in three dimensions; (iii) floor material (wire mesh) potentially limiting proper walking and other movement; (iv) lack of possibility to maintain space between animals and faeces; (v) lack of opportunity to establish latrines. Due to limited floor area, cage height and lack of structural complexity, the WC Restriction of movement cannot be prevented or substantially mitigated in the current system.

Inability to perform foraging or exploratory behaviour is linked with the WCs Inability to chew and Gastroenteric disorders because of shared hazards. Hazards for the WC are: (i) limited cage size and lack of physical complexity (including lack of resources providing stimuli for exploratory, appetitive and consummatory foraging behaviour); (ii) insufficient feed texture and delivery method for consummatory behaviours including chewing; (iii) feed being inappropriate and not fulfilling the dietary requirements. The dimensions of the cages in the current system severely restrict the size, amount and type of resources that can be provided, thereby severely restricting the possibility to perform exploratory and foraging behaviours. Because of that, the WC cannot be prevented or substantially mitigated in the current system. Changing the texture of feed and providing resources suitable for chewing in the current system will require a change in the feeding method moving away from trays placed outside cages forcing the animal to eat through wire mesh. This will correct the hazard linked to the WC Inability to chew. Providing feed that meets the nutritional requirements of raccoon dogs will correct the hazard linked to the WC Gastroenteric disorders in the current system.

The WC Sensorial overstimulation is linked with the WCs Handling stress and Resting problems because of shared hazards, including: (i) lack of nest box for resting and to function as retreat; (ii) close presence of own faeces and faeces from neighbouring animals; (iii) handling. The WC cannot be prevented due to the hazards listed above but can be substantially mitigated by providing an all-year retreat area (e.g. nest box), regular removal of manure and minimising the number of handling occasions (including artificial insemination), and by the use of appropriate gentle methods and equipment as well as training of handlers to have appropriate competence.

The WC Isolation stress applies to adult breeders which are kept in single housing. Mitigation of the WC requires that animals are not single housed, but due to the lack of space in breeder cages of the current system, the WC cannot be prevented or substantially mitigated.

The WC Locomotory disorders (including lameness) is related to bent feet and other disorders that may impact locomotion which exist in farmed raccoon dogs. Further prevalence studies are needed to determine the extent, severity and causality of the problem. Hazards for the WC are: (i) genetic predisposition as a side-effect of genetic selection for production traits; (ii) inappropriate feeding management, not fulfilling the dietary requirements of raccoon dogs and potentially leading to obesity; (iii) inadequate floor material. Whether this WC can be prevented or substantially mitigated in the current system is unknown, but mitigating measures proposed for foxes can likely be applied to raccoon dogs. Providing appropriate veterinary care to affected animals would mitigate the impact but not the cause.

Welfare assessment of chinchilla

Welfare assessment of chinchilla is reported in Section 6. For chinchilla, evidence for specific behavioural needs and motivations underlying the behaviour and welfare of this species is extremely limited. The most relevant WCs are restriction of movement, predation stress, inability to perform exploratory or foraging behaviour, sensorial under- and/or -overstimulation, inability to perform comfort behaviour and resting problems.

The WC Restriction of movement is linked with the WC Inability to perform play behaviour because of shared hazards, including: (i) insufficient floor area to allow motivated types of active behaviours including such as locomotion and play; (ii) insufficient height and structures of the cage; (iii) inadequate floor material (hindering locomotion due to foot and limb injury). Due to the limited cage floor area and height, restriction of movement cannot be prevented or substantially mitigated in the current system.

Predation stress and the linked WC Handling stress, the main hazards are: (i) lack of shelter for hiding; (ii) barren cage environment; (iii) production procedures involving handling or close human contact. Since production procedures involving handling are inherent to the current system, predation stress cannot be prevented or substantially mitigated.

Inability to perform foraging or exploratory behaviour is linked with the WCs Inability to chew and Gastro-enteric disorders because of shared hazards: (i) the combination of cage dimensions and lack of complexity providing stimuli for exploratory as well as appetitive and consummatory foraging behaviour; (ii) lack of feed texture for consummatory behaviour; (iii) inappropriate feed. Due to the combination of cage dimensions and lack of physical complexity, the WC cannot be prevented or substantially mitigated in the current system. The consummatory aspects of exploratory and foraging behaviour, as well as the common hazards of the linked WC Inability to chew and Gastro-enteric disorders, can be corrected by modifying the feed texture, providing enrichment materials suitable for gnawing and by providing feed of good nutritional and hygienic quality.

The WC Sensorial understimulation is linked with the WCs Isolation stress and Inability to perform play behaviour due to shared hazards: (i) lack of physical complexity of the cage and enrichment; (ii) use of single housing systems. Due to the lack of physical complexity of the cage, as well as space restrictions, the WC cannot be prevented or substantially mitigated in the current system. The hazards of single housing, which is shared with the linked WC Isolation stress, can be corrected by housing pairs or groups of dams with kits and juveniles (as it is currently a common practice), but in the case of adults, the same hazard cannot be corrected in the current system because the space in the cage is insufficient to keep pair or group housed adults.

The WC Sensorial overstimulation mainly results from: (i) lack of shelter; (ii) presence of aversive and unpredictable noises; (iii) inability to escape from undesired social contact with cage mates. The WC cannot be prevented in the current system due to the inability to prevent all external disturbance but can be substantially mitigated by providing structural complexity in the cage that allows shelter for hiding and escape from undesired social contact in group cages, and by minimising sudden and aversive noises, and other disturbing sensory input.

The WC Inability to perform comfort behaviour results from the lack of, or insufficient access to, sand bathing substrate in the current system. It can be prevented in the current system by the provision of permanent access to a bath with clean and appropriate sand (e.g. quartz-free sand). To achieve substantial mitigation in the current system, daily access is needed although further research is needed to provide quantitative information about the necessary period of access.

The WC Resting problems in the current system results from: (i) lack of a suitable resting area; (ii) improper lighting conditions; (iii) disturbances linked to production procedures. Due to the necessary production procedures during the working day, the WC cannot be prevented, but it can be substantially mitigated in the current system by the provision of an enclosed resting area (e.g. shelter, box or tube), elevated platforms, a diurnal lighting pattern allowing the animals to maintain their natural circadian rhythms, and by minimising noises and human presence.

Substantial mitigating measures

The majority of the welfare consequences (WCs) listed cannot be prevented or substantially mitigated within the current husbandry systems (as defined in Section 1.2). For informational purposes, instances where the current system offers limited mitigation for a specific WC are reported. Additionally, for all species, this SO lists measures that could provide substantial mitigation but would require changing from the current system to a different type of enclosure. For animals kept for fur production, there was little or no information available on alternative farming systems, highlighting the need for further research on the quantitative aspects of enclosures required to substantially mitigate the identified WCs. Across all species, substantial mitigation would require enclosures that provide sufficient three-dimensional space to incorporate structures and resources that enhance environmental complexity, to allow the quantitative and qualitative expression of fundamental behaviours (e.g. sustained locomotory activity, exploration, foraging and vigilance).

These aspects are discussed in further detail in the species-specific welfare assessment Sections and summarised in the conclusions in Section 7, where factors to be considered are mentioned, such as floor area, enclosure heigh, elevated structure, enriching resources, floor materials and presence of a retreat area. For WCs not directly related to the housing system, such as locomotory disorder or handling stress, measures for substantial mitigation are also listed (multifaceted approaches involving e.g. breeding strategies and changes in feed or handling management).

1 | INTRODUCTION

EFSA was requested by the European Commission to provide an independent view on the welfare of animals (American mink, red and Arctic foxes, raccoon dogs and chinchillas) that are reared for fur in the EU. This scientific opinion was requested to be provided in two separate publications; one with the description of current husbandry systems and practices to keep these species (Art. 31, EFSA, 2025), and another with the welfare assessment, this is, an evaluation of the impact of such systems and practices on the welfare of the species mentioned above (Art. 29). This document corresponds to the latter (Art. 29).

1.1 | Background and Terms of Reference as provided by the requestor

1.1.1 | Background

On 14 June 2023, the successful European Citizens' Initiative (ECI) "Fur free Europe" was submitted to the Commission inviting it to prohibit by law, throughout the Union, the:

- keeping and killing of animals for the sole or main purpose of fur production;
- placement of farmed animal fur, and products containing such fur, on the EU market.

The main arguments to ban fur farming and the farmed fur products invoked by the organizers of the ECI relates to the practice itself which they consider to be:

- unethical – the complex behavioural needs of wild animal species, such as foxes and mink, cannot be met in fur farms;
- unsafe – fur animals pose risks to animal and human health, e.g. new variants of the SARS-CoV-2 virus were found to have been transmitted to humans from animals;
- unsustainable - significant environmental impact (dressing (cleaned, softened, stretched, etc.) and dyeing of fur involves the use of toxic chemicals) and it poses a serious threat to native biodiversity.

There is currently no specific EU animal welfare legislation covering animals kept for fur production, but animals kept for fur production are covered by Directive 98/58/EC.

In accordance with the Farm to Fork Strategy, published on 20 May 2020, the Commission is working on the revision of the EU animal welfare legislation.

In 2001, the Scientific Committee on Animal Health and Animal Welfare of the European Commission (SCAHAW), published a report on "The welfare of animals kept for fur production".

There are no previous EFSA opinions on the welfare of animals kept for fur production.

Against this background, the Commission would like to request the EFSA to review the available scientific publications and other sources to provide a sound scientific basis for the Commission to consider the necessary follow-up to the ECI "Fur free Europe" and whether specific legislation on fur animals would be needed or whether the farming of fur animals (or some species of fur animals) should be phased out.

This request is about the protection of animals kept for fur production (mink, foxes, raccoon dogs and chinchillas). The assessment of welfare during killing is not in the scope of this request.

1.1.2 | Terms of Reference

The Commission therefore considers opportune to request EFSA to give an independent view on the protection of animals kept for fur production:

- Mink,
- Foxes,
- Raccoon dogs,
- Chinchillas.

The Commission requests EFSA to deliver a technical report in accordance with Article 31 of Regulation (EC) No 178/2002 on the elements below for these species:

- TOR 1 a) An update of the literature review of the report "The welfare of animals kept for fur production" (SCAHAW, 2001), on the relevant topics of Sections 4 and 5 (Section 4 on general aspects of carnivore biology – foxes, mink and raccoon dogs, and Section 5 – general aspects of rodent biology - chinchillas).
- TOR 1 b) A review of the most common husbandry system(s) (including field-tested systems) and rearing practices for keeping animals for fur production for the species named above.

The Commission requests EFSA to deliver a scientific opinion in accordance with Article 29 of Regulation (EC) No 178/2002 for mink, foxes, raccoon dogs and chinchillas:

- TOR 2 a) Identify the most relevant welfare consequences and corresponding hazards in relation to common husbandry systems and practices for fur production;
- TOR 2 b) For the most relevant welfare consequences (maximum 5), assess whether the welfare consequences identified above can be prevented or substantially mitigated under current farming conditions or other field-tested farming systems. The welfare assessment will be focused on the welfare consequences considered highly relevant in a certain animal category.

Response to the ToR1a and ToR1b of the mandate of fur production, is addressed in the Technical report on biology, husbandry systems and farm practices on American mink, red and Artic foxes, raccoon dog and chinchilla kept for fur production (EFSA, 2025).[1]

1.2 | Interpretation of the Terms of Reference

This is the first mandate in EFSA requesting the assessment of the welfare of animals kept for fur production. For this reason, this Scientific Opinion (SO) uses as a starting point a report from 2001 published by the Scientific Committee on Animal Health and Animal Welfare from the European Commission (SCAHAW, 2001), which describes the general biology and ecology of these animals as well as the husbandry systems used to rear animals kept for fur at the time of the report.

The mandate requested to revise the information contained in the SCAHAW report (2001). The updated information is described in the technical report (Art. 31 of Regulation (EC) No 178/2002[2]) and intended as a background for the assessment of welfare of animals kept for fur, as object of this SO, in accordance with Article 29 of Regulation (EC) No 178/2002.

The species being considered in this scientific opinion are: (i) American mink (*Neogale vison* or *Neovison vison*, previously classified as *Mustela vison*); (ii) Red fox (*Vulpes vulpes*, also known as 'silver fox'), (iii) Arctic fox (*Vulpes lagopus*, previously classified as *Alopex lagopus* and also known as 'blue fox'), and hybrids of these two species; (iv) Raccoon dog (*Nyctereutes procyonoides*, also known as 'finnraccoon'); and (v) Chinchilla (*Chinchilla lanigera*).

For all the species, it was decided to use the common name. In foxes, the common name is 'red fox' in taxonomy, but in the fur industry and sometimes in the literature, individuals of this species are referred to as 'silver fox', as this is the predominant colour morph selected for fur production. However, since many other colour morphs exist within the same species, it was decided to use the common name to make it clear that the species was considered independently from the colour morph. The same applies to the Arctic fox, which is often referred to as 'blue fox' in the fur industry, although other colour morphs also occur.

Due to the very limited literature on hybrid foxes, these animals are not specifically mentioned in the text below; however, the welfare assessment also encompasses them.

Any mink, foxes, raccoon dogs and chinchillas kept specifically for research, as companion animals or for hobby purposes, gaming, hunting or in zoos are not in the scope of the mandate and therefore will not be assessed. Assessments of wild animals are not within the scope of this mandate. Assessments of environmental impact of wild, farmed or escaped/feral mink, foxes, raccoon dogs and chinchillas are out of the scope of this mandate.

Production phases such as transport and killing are out of the scope of this mandate, as are disease outbreaks, zoonoses and One-Health considerations.

Description of biology of the animals, production cycle, husbandry systems and farm practices are included in EFSA (2025). Animal category as intended in this SO is explained in Table 1.

TABLE 1 Summary of all categories of animals involved in fur production as referred to in the Scientific Opinion and in this Technical report (EFSA, 2025), with indication of the production purposes.

Animal category	Definition
Male breeders	Adult or subadult males kept for breeding (natural mating and/or artificial insemination depending on species).
Adult female breeders outside the breeding period	Mature female before first pregnancy, female after weaning her kits/cubs and before a new pregnancy.
Pregnant females	Gravid female. Also includes mated females, which did not get pregnant
Lactating females	Female breeder between parturition and the weaning of the kits/cubs.
Suckling kits/cubs	Kits/cubs from birth to weaning.
Juveniles	Weaned kits/cubs after separation from the mother until pelting* or selection as future breeders

*Pelting is referred to the process of killing animals kept for fur with the purpose of collecting pelts. It is currently done on-farm and under the Council Regulation (EC) No 1099/2009 of 24 September 2009 on the protection of animals at the time of killing. The term 'harvesting' is sometimes used in the field or in the found source to describe the same practice.

[1]The EFSA Technical Report on biology, husbandry systems and farm practices for mink, foxes, raccoon dog and chinchilla kept for fur production is based on information collected from literature, and through four public calls for evidence and a technical hearing. The information presented therein is reported as received, as explained in the Methodology section of the Report (EFSA, 2025).

[2]OJ L 31, 1.2.2002, p. 24.

Welfare assessment may consist of two components, i.e. the risk assessment, with identification of the negative welfare consequences (adverse effects) that occur to an animal in response to a hazard, and the benefit assessment, with identification of positive welfare consequences. In the current SO, EFSA addressed the EC mandate by focusing on certain adverse effects only. In the context of this SO, the adverse effects are called 'welfare consequences' (WCs) (EFSA AHAW Panel, 2022).

The term 'current system' refers to the cage system and cage dimensions described in the technical report (EFSA, 2025), which is based on information from the call for evidence and literature on husbandry systems and farm practices for animals kept for fur. An 'enclosure' is defined as any other type of husbandry system for keeping fur animals not currently in use in the field.

In cages or enclosures for the species covered in this SO, elevated structures may constitute platforms (free-standing raised level structures that can be permanently installed) or shelves (raised surfaces of e.g. wood or wire mesh firmly attached to the side walls). Both these types serve as a place of retreat, for resting or as vantage point in the context of exploratory behaviour. For the purpose of this opinion, the term 'platform' is used to cover both types.

In the text, the term 'resources' refers to any physical addition or modification to the environment that the animal might interact with, or which affects sensory input. The term 'enrichment' is used when a resource is documented to have a positive effect on animal welfare as discussed by Cait et al. (2024) and Newberry (1995), in addition to the standard of the current system.

In reply to ToR2b of the mandate, firstly measures to prevent or substantially mitigate the highly relevant WCs were identified, and the methodology is described in Section 2.5. Subsequently, the question of ToR2b was translated as 'can the welfare consequence be prevented or substantially mitigated in the current system?' to formulate the conclusion. The possible answer to this question in the conclusion can be 'yes', 'no' or 'unknown'. 'Unknown' was concluded when no evidence was found in reply to the question for a particular WC.

1.2.1 | Follow-up on aspects raised at the stakeholder meeting

On the 22nd of January 2024, EFSA carried out a stakeholder meeting in Brussels, with the aim to engage in a technical discussion on the challenges and opportunities around this mandate, focusing on the available data and data sources that can be used to inform EFSA's scientific advice on the welfare of animals kept for fur production. One of the aspects raised by several stakeholders was how to consider the needs of these animals in the view of a debate around their level of domestication. The EFSA experts agreed to include in Sections below (1.2.1.1 and 1.2.1.2) an explanation on how these aspects have been considered for the risk assessment, in line with EFSA policy of openness and transparency. Another aspect raised involves evaluating the expression of stereotypies as an ABM for poor animal welfare. General concepts for assessing stereotypic measures are addressed in Section 1.2.1.3, with species-specific considerations discussed in Section 3.2.1 for mink, 4.2.1 for foxes, 5.2.1 in raccoon dogs and 6.2.1 for chinchillas.

A third aspect raised concerned the provision of open water[3] to mink. This is treated under mink welfare assessment to allow description of WCs associated with lack of open water (Section 3.3.4.1 and 3.3.4.2), hazards related to the absence of open water (Section 3.3.4.3) and preventive and mitigating measures (Section 3.4.5).

1.2.1.1 | *Consideration of needs and wants in the context of this Scientific Opinion*

Dawkins (2008) articulated a conceptualisation of animal welfare by posing the question *'is the animal healthy and does it have what it wants?'*, and subsequently proposed that measurement of an animal's willingness to work for a desired outcome can be used to assess the strength of its needs or wants (Dawkins, 2008). Together with the increasing literature on the consideration of positive welfare when carrying out welfare assessment (Mellor & Beausoleil, 2015; Rowe & Mullan, 2022), this necessitates consideration of the definition of behavioural needs and behavioural wants/preferences in risk assessment methodology.

EFSA AHAW Panel (2023) stated that *'A behavioural need is related to behaviours, which are part of the natural repertoire and are primarily motivated by internal causal factors (*Weeks & Nicol, 2006*). Animals will attempt to perform these behaviours even in the absence of an optimum environment or the necessary resource (e.g. sham dust bathing of laying hens on wire mesh'* (Louton et al., 2016). However, earlier reviews (Jensen & Toates, 1993) highlighted the complexities of providing a definition of animal needs based on assumptions regarding causal motivation, stressing that the designation of certain behaviours as 'needs' is dependent on a thorough understanding of the causative factors affecting that behaviour and is largely context specific. There are probably needs associated with the performance of all species-specific behaviours, and those are a complex of obtaining a goal and performing the motor patterns (e.g. showing elements of a certain behavioural pattern, for instance, nest building). Whether one wants to describe behaviour as a need therefore depends on the knowledge of the environmental context, since a behaviour may be called a need in a particular situation. Jensen and Toates (1993) provided a more pragmatic definition of a need as a *'state, which if not attained causes suffering to an animal as indexed by disturbed behaviour, an increased risk of pathology and/or a hormonal profile consistent with stress'*. This definition aligns with

[3]**Open water** is defined in this SO, (consistent with also EFSA AHAW Panel, 2023) as a water resource of any size and depth which has a freely accessible surface (i.e. not a drinker). It may have different features, can be for example a small dish, a larger basin or a deep pool. Water can be static or flowing. Considering the variety found in literature, details summarising the main features are provided during the discussion of each of the studies reported.

the current methodological guidance of EFSA AHAW Panel (2022) who approaches welfare risk assessment by evaluating the occurrence of defined WCs which lead to negative affective states if not mitigated.

Given the introduction above, in the context of this SO, a **behavioural 'need'** is defined as the presence of one/more negative welfare outcomes if a certain behaviour cannot be performed to satisfy the respective underlying motivation.

In contrast, a **behavioural 'want'** is the ability to make choices and satisfy preferences that allows animals to exercise 'agency' (Mellor & Beausoleil, 2015), and contributes to positive welfare,[4] but the absence of such preferences does not necessarily result in measurable negative WCs or negative affective states. A behavioural preference ('want') indicates the relative outcome (ABM) when an animal has been provided a choice.

Therefore, in this SO, we consider primarily risks associated with behavioural needs and wants as outlined in the current guidance document (EFSA AHAW Panel, 2022), although the same guidance also acknowledge that *'future assessments might also include positive welfare indicators and not only negative WCs and negative affective states, considering that animals should be provided with opportunities for positive experiences with a given assumption that one should not inflict pain or suffering on an animal'*.

1.2.1.2 | *Consideration on domestication in American mink, foxes, raccoon dog and chinchilla within the context of this Scientific Opinion*

This text aims to clarify how the concept of domestication was considered in the assessment of American mink, foxes, raccoon dogs and chinchillas within the scope of this mandate. It does not intend to provide a comprehensive review of the domestication process in animals bred for fur production. Instead, it seeks to establish a foundational understanding of how domestication has been considered into the assessment. Practical examples are included to support the explanation but are not meant to serve as an exhaustive review of the available literature on the subject.

Prevailing definitions of domestication usually focus on the altered selection pressures in captivity as compared to the natural situation. For example, Price (2002) suggested that domestication is the process whereby captive animals adapt to man and the environment he provides. In this definition, Price (2002) included both the genetic changes occurring over generations and the effects caused by experiences during an animal's lifetime. Ontogenetic effects are shared with all animals in captivity and should therefore not be included in a formal definition, so a more recent definition states that *'Domestication is the process whereby populations of animals change genetically and phenotypically in response to the selection pressure associated with a life under human supervision'* (Jensen & Wright, 2022). Hence, domestication is a process that takes several generations of genetic changes and there is no definite boundary for the transition from wild to domesticated.

The domestication process is driven by three different evolutionary forces (Jensen & Wright, 2022). Firstly, there is a relaxation of specific natural selection pressures such as predation and starvation, common to most species kept in captivity. Secondly, there is an intensified selection imposed by humans for certain preferred traits, for example, growth, appearance or reproduction, and thirdly, there is passive selection for traits that are genetically or functionally correlated to those actively selected for, such as significant modification of the intestinal anatomy in broilers as a consequence of selection for high growth rates (Jackson & Diamond, 1996).

Having defined domestication and how it affects animals, 'wild' animals can be defined as populations that live and reproduce without significant interference from humans, i.e. under typical natural selection pressures. Furthermore, 'feral' (or 'feralised') can be defined as populations that have a history of domestication, but that have for several generations returned to a life where they are no longer supervised or controlled by humans (Jensen & Wright, 2022). Feral animals are thus not dependent on humans to survive. Lastly, it should be noted that 'tame' refers to a behavioural response, not a genetic process. A tame animal has a reduced fear of humans that can be affected by genetic factors but is essentially a result of ontogenetic processes. Consequently, regardless of whether individuals belong to wild, domestic or feral populations, tameness can vary widely depending on life-time experiences (Albert et al., 2009). Hence, it is important to differentiate between selection for increased tameness on one hand and domestication on the other – tameability is only one aspect of the much wider concept of domestication.

The oldest domesticated animal is the dog, descendant of grey wolves that came to live under human auspice at least 15,000 years ago (Wang et al., 2016). After this first event of successful domestication, it took another 5–6000 years until the major outbreak of domestication coinciding with the spread of agriculture around 8–10,000 years ago. This involved the majority of today's farm animals, such as goats, sheep, pigs, cattle and chickens (Clutton-Brock, 2012). Species that are commonly kept for fur production and the subject of this mandate – American mink, red foxes, Arctic foxes, raccoon dogs and chinchilla – were brought into captivity within the last 150–200 years. This recent transition may raise questions regarding their progress in relation to domestication, based on the definitions given above.

An important aspect of the domestication process is the development of the so-called domestication syndrome (or domesticated phenotype) (Price, 2002; Wilkins et al., 2014). This concept describes a collection of traits that appear to evolve in most, if not all, domesticated mammals (and to some extent also birds) despite distant relatedness (Jensen & Wright, 2022).

[4]**'Positive animal welfare is defined as the animal flourishing through the experience of predominantly positive mental states and the development of competence and resilience**. Positive animal welfare goes beyond ensuring good health and the prevention and alleviation of suffering. Positive mental states result from rewarding experiences, including having choices and opportunities to actively pursue goals and achieve desired outcomes, according to species-specific capabilities. Genetic, developmental and experiential factors (e.g. pre-natal, early life, environmental) contribute to individual differences in the ability to achieve positive animal welfare. Positive animal welfare can be assessed using animal-based indicators. Positive animal welfare can be evaluated over different timescales, thereby contributing to the lifetime picture' (Rault et al., 2025).

Furthermore, domesticated animals tend to have a faster early development including earlier sexual maturity, prolonged retention of juvenile behaviour and reduced relative brain mass (Jensen & Wright, 2022; Price, 2002). This has been suggested to be a result of traits that evolve because they are genetically correlated to the increased tameability that is a central prerequisite for successful domestication (Agnvall et al., 2018; Jensen, 2014). With respect to the reduction in brain mass, it should be remembered that different parts of the brain appear to respond independently to selection, so some brain regions are unaffected by domestication or even larger in domesticates than in their ancestors (Balcarcel et al., 2021; Henriksen et al., 2016). Some studies reported that this change in brain size might be reversible when farmed animals (e.g. American mink) are feralised (Pohle et al., 2023), which may indicate that environmental stimuli play a role.

Correlated selection responses creating syndromes like described above can emerge from a number of different genetic mechanisms (Jensen & Wright, 2022), such as 'genetic linkage', pleiotropic mechanism or epistatic effects (Wilkins et al., 2014).

Whilst morphological and physiological traits are distinctly affected by domestication, behavioural traits are considerably more conservative and resilient to drastic changes (Jensen & Andersson, 2005). Systematic comparisons between domesticated farm animals and their ancestors (i.e. living ancestral species) reveal that behavioural changes typically occur through modified release thresholds, and not by alterations of fundamental, species-specific behaviour. For example, domesticated pigs and chickens are less active and investigative, more tolerant to social strangers and less vigilant than wild counterparts (i.e. wild genotypes), but still have a strong motivation for species-specific behaviour, such as perching and dust-bathing in chickens, and nest-building in pigs (Jensen & Andersson, 2005). This concept was corroborated in a study where Red Junglefowl, ancestor of the domesticated fowl, was selected for reduced fear of humans (Agnvall et al., 2018). Despite being calmer, more socially tolerant and less explorative, their basic motivation for, e.g. perching and dust bathing, remained unaffected.

Furthermore, the cognitive capacities of domesticated animals have changed marginally relative to their ancestors (Ferreira et al., 2023). In a study of farmed Arctic foxes kept in semi-natural enclosures over two breeding seasons, the foxes were shown to perform the full range of typical Arctic fox parental behaviour, including similar den emergence of the young and comprehensive biparental care (Malm et al., 1995).

Some experimental trials have been conducted in red foxes and mink in an attempt to recreate and understand the domestication process. In the most comprehensive experiment, the Russian geneticist Belyaev selected farmed red foxes of the silver colour-type for reduced fear of humans over generations and recorded a broad range of phenotypical changes (Trut et al., 2009). As a result of this selection, many of the less fearful/less aggressive foxes developed several of the traits typical of the domesticated phenotype as correlated responses: loss of pigmentation, chondrodystrophy, earlier ontogenetic maturation and increased tameability. In this case, increased tameability was connected with development of a domesticated phenotype, but reduced fear of humans and reduced stress responsivity towards humans cannot, although important in relation to welfare, be considered as the only aspect involved in domestication.

When it comes to selection for tameness (based on whether animals approach or avoid humans), experimental trials have been conducted on American mink (Malmkvist & Hansen, 2002). Based on these data, it was concluded that after 10 generations of divergent selection (and up to 14 generations in (Malmkvist, 2019), offspring from a confident breeding line of mink were less fearful and more explorative than those from a fearful breeding line when exposed to voluntary or forced human contact. It also showed that mink from these breeding lines generalised their fear and exploratory responses across various social and non-social situations. This was demonstrated through tests involving a novel object, an unknown mink, novel food in their home cage and being placed in a novel environment. A study investigating the effects of selection for tameness in farmed mink documented correlated selection responses in breeding lines raised within research facilities replicating the farming environment. Among the findings were earlier onset of mating in animals selected for explorative behaviour (Malmkvist et al., 1997), changed HPA-axis activity (Malmkvist, 2019) linked to the brain serotonergic system (Malmkvist et al., 2003), a changed sense maturation indicated by an earlier onset of eye-opening, motor ability and play in offspring from explorative than in fearful or unselected production mink (Lassen, 2007). In another population of farm mink, selected for production related traits, the heritability of behaviour (curiosity and fearfulness) was estimated to 0.19 (±0.03) for both sexes of farm mink (calculated on basis of behavioural tests of 26,371 one year old Brown farm mink over four successive years), without any effect on production traits such as reproductive output or pelt quality (Thirstrup et al., 2019). However, besides the selection studies in mink (supplementing the Russian fox studies), studies in other species kept for fur production (Artic fox, chinchilla, raccoon dog) are scarce or absent, and do not include recordings of correlated selection responses related to other phenotypes. Thus, the domestication syndrome is only partly covered in animals farmed for fur production, and for most species not at all.

These experiments demonstrated that reduction in fearfulness can be accelerated through human-driven selection, but also emphasise that domestication is a wider concept than tameness and reaction towards humans only. Several correlated factors (e.g. stress response, oestrus, behaviour in young) may change. However, it is worth noting that the majority of results described here are at the experimental level and might not correspond to the current animal genotypes in animals kept for fur, i.e. to what extent selection for temperament is implemented. Farmers may not select for less fearful and more confident mink in practice, although recommended in some countries. For mink, some data on temperament (avoidance in a simple test) exist from data collected in approximately 2000 farms between 2017 and 19 (Henriksen et al., 2022), but the current status in Europe is unknown. In fact, there is a lack of knowledge on this aspect for all farm animal species.

Another important aspect from the studies referred above is that the fundamental species-specific behaviour of the foxes and mink remained mostly unaffected. The threshold for experiencing fear and stress might change. Fewer or no studies on domestication (including the outcome of the selection for less fearful and more confident animals) were found in other animals farmed for fur than mink and red foxes. One study showed that Arctic foxes (based on data from one a colour variation) can be selected for increased confidence in relatively few generations (Kenttämies et al., 2002; Rekilä, 1999).

In a study on genotypes of farmed American mink, red foxes and raccoon dogs, it was reported that they differ from those of their wild counterparts (Supporting information SF1). While this result is expected, because it is a known consequence of populations that have been separated for years, it does not provide sufficient insight into the implications of the genetic differences on animal welfare, as the impact depends on where these genetic variations are located. As explained above, domestication is not defined by changes in phenotype and genotype per se but is a fundamental change to the biology of the species achieved by many generations of selection (including the relaxation of natural selection). It can be hypothesised that domestication affects the reactivity of animals kept for fur to certain stimuli, meaning that the threshold for the severity and occurrence of the WCs associated might differ between domesticated animals and their wild counterparts. However, given that fundamental behaviours remain largely unchanged by domestication, it is likely that also animals kept for fur will continue to experience the same WCs in relation to the inability to express fundamental behaviours, regardless of their level of domestication.

Based on the above, animals kept for fur, that have been under human selection for a relatively limited time compared to most other farm animals, are in the early phases of a domestication process. Mink are able to feralise and form thriving populations in the wild, where they generally revert to a lifestyle and niche similar to that of their wild counterparts, and also revert to some of the pre-domestication traits such as braincase size and volume (Pohle et al., 2023). Newly escaped farm mink have some ability to hunt, however, have a higher mortality risk than wild-born mink. A reduction in body size has been observed for populations of farm mink after generations in the wild (cited in Rørbæk et al., 2023). Even species with a long history of thousands of years of domestication will revert to a similar lifestyle and behaviour as their wild ancestors in cases where they escape captivity, survive and become feralised. Examples are pigs (Pavlov & Hone, 1982); chickens (Johnsson et al., 2016) and horses (Hampson et al., 2010).

From an animal welfare perspective, the question of whether animals kept for fur are domesticated is somewhat irrelevant. There is no transition borderline between non- and fully domesticated, and what matters from a welfare perspective is whether the animals can fulfil their behavioural and other needs and wants (see Section 1.2.1.1) which are largely unaffected by domestication. Therefore, from a welfare perspective, there is evidence that domesticated animals need to fulfil behavioural needs regardless of the degree of domestication and this fully applies also to animals kept for fur production.

1.2.1.3 | *Introduction to abnormal behaviours as ABMs of animal welfare*

Abnormal behaviour refers to any behavioural pattern that deviates significantly from species-typical behaviour and/or a behaviour resulting from pathology. Abnormal behaviours in animals kept for fur can be classified into several categories, including stereotypic behaviours, redirected behaviours and self-inflicted damage. Redirected behaviours occur when an animal is unable to perform a specific behaviour and instead directs the behaviour towards an inappropriate target. For instance, in farmed mink, the lack of suitable nesting materials may lead to excessive fur chewing or manipulation of cage elements. This type of behaviour can indicate a deficiency in environmental complexity. Self-inflicted damage includes fur chewing, sometimes called tail chewing, which has not been documented to result in lesions of the skin and the underlying tissues, but probably can. The existence of skin lesions which can be self-inflicted and caused by, for example, excessive grooming or self-biting are also reported (WelFur, 2020), however data on prevalence and severity are lacking in all species. These behaviours are often linked to prolonged stress, frustration or pathological conditions such as neurological disorders.

Another relevant group of abnormal behaviours regarding the assessment of animal welfare are stereotypic behaviours (SB). They are defined as repetitive, invariant movements without apparent function (Mason, 1991; Ödberg, 1989) caused by motivational frustration and/or brain dysfunction (as reviewed by Mason & Rushen, 2006). SBs are not displayed in the wild (Mason & Rushen, 2006; Mason & Würbel, 2016). Carnivore species display different forms of SBs, with pacing – which involves high activity and consequently high energy mobilisation – being one of the most common (Clubb & Mason, 2007). Over time, animals may perform SB in longer bouts and/or increased frequency and SBs may then be triggered by a variety of different cues and become more difficult to interrupt. This phenomenon is either due to altered neurophysiology (repeated movements are performed without much cognitive brain activity, i.e. 'automatically' (Mason & Latham, 2004), or due to neurological dysfunction induced by impoverished, welfare-reducing early life conditions, so that SBs might persist as a 'scar' even after the SB-inducing conditions have been removed (Malmkvist et al., 2011; Mason et al., 2001, 2007; Mason & Rushen, 2006; Meagher et al., 2012; Svendsen et al., 2007).

The aetiology of SB has implications on the use of SB as an ABM and welfare indicator: The onset of SB is typically caused by motivational frustration (e.g. attempts to escape). At this stage, SB is a good ABM for the current welfare status. However, long established SB, especially in adult animals, may rather be an indicator of early and/or cumulative negative experiences (CCAC, 2021) than track the current welfare state. Hence, context data such as age, timing and previously experienced hazards need to be taken into account when using SB as an ABM for animal welfare. SB is a more valid indicator of welfare for comparing husbandry systems than for assessing the welfare of different individuals within the same housing system (Mason & Latham, 2004). Additionally, individual levels of SB might reflect individually different personalities (i.e. response styles to stressors; Svendsen et al. (2007). Therefore, Díez-León et al. (2016) suggested using SB in combination with other indicators, e.g. FCM (Rauch et al., 2013; Svendsen et al., 2007), lying awake (Meagher & Mason, 2012), cognitive performance (Malmkvist et al., 2024). The correlation between elevated FCM and SB might reflect arousal: a combined effect of adrenocortical activity/reactivity and activity with increased SB (Meagher et al., 2012). This highlights that absence of SB may not be used as the only ABM for absence of negative WCs or for positive welfare conditions, as the animals may express impaired welfare in a different way (i.e. lack of responsivity or boredom like behaviour as reported in Meagher & Mason, 2012) or be individually less susceptible to stressors (for example due to different personality traits, as suggested by Ijichi et al. (2013) or Díez-León et al. (2016) for mink housed within the same environmental conditions). Therefore, the presence of a certain hazard might not cause the increase of SB but still affect other ABMs that better indicate a certain WC, and therefore relationship between SB and hazards needs to be investigated.

Even though SB has been shown to be reduced by genetic selection in a population of mink (Hansen et al., 2008), it should be confirmed if the effect of a certain hazard on animal welfare is affected and if other welfare related consequences of this selection exist (Díez-León et al., 2016; Díez-León & Mason, 2019; Malmkvist, 2012; Malmkvist et al., 2024; Malmkvist & Hansen, 2001). Therefore, across animal species, the underlying causes for the development of SB (i.e., motivational frustration caused by insufficient housing conditions, enrichment and space allowance) should be addressed to improve animal welfare instead of reducing SB by genetic selection (Mason et al., 2007).

In summary, abnormal behaviours are considered a valuable ABM for animal welfare assessment of animals kept for fur under the following conditions: abnormal behaviours should not be used as the only ABM, but in combination with other ABMs and in context with the age and life history of the animals. The presence of abnormal behaviours indicates that animal welfare has been compromised at some point during the life of the animal. The absence of abnormal behaviours is not a valid ABM for good animal welfare.

Abnormal behaviours in the different species are reported in the related sections of mink (Section 3.2.1), foxes (Section 4.2.1), raccoon dogs (Section 5.2.1) and chinchilla (Section 6.2.1).

2 | DATA AND METHODOLOGIES

This SO follows the protocol detailed in the methodological guidance that was developed by the EFSA AHAW Panel to deal with all the mandates in the context of the Farm to Fork strategy revision (EFSA AHAW Panel, 2022).

According to the protocol, EFSA translated the assessment question listed in the mandate (ToR2a, ToR2b) into more specific sub-questions according to the APRIO (Agent- pathway- risk- intervention-outcome) protocol that was developed in agreement with EFSA AHAW Panel (2022). The protocol of the assessment questions and translation into sub-questions is mapped in Appendix A. Three main approaches were used to answer the sub-questions: (i) literature search, (ii) consultation with MSs and Stakeholder umbrella organisation representatives, followed by (iii) expert opinion through WG discussion. These methodologies were used to address the mandate extensively.

2.1 | Literature search

A broad literature search was performed in Scopus to identify peer-reviewed articles providing information that can be relevant for the welfare of animals kept for fur production.

Records from the search were documented and screened for relevance, which involved checking article titles, keywords and abstracts. Details of the literature search strategy and number of records that supported the process are provided in Appendix B.1 – Literature search carried out for the assessment of welfare consequences of mink.

Additional articles deemed relevant to the subject of matter were also added to the post-screening collection. Details of the number of records contributed in this manner are stated in Appendix B.1 – Literature search carried out for the assessment of welfare consequences of mink.

The SO focuses on husbandry and management practices for keeping animals for fur in EU. Therefore, the literature search focused on studies performed in the EU. However often the overall production system and management practices found was comparable to non-European conditions (e.g. cage-based systems, adult animals kept singly). There might, though, be differences in, e.g. cage size. Literature from studies performed outside the EU was therefore included when considered relevant/applicable (e.g. North American studies often applied similar methodologies or pursued similar topics of study as European studies, and thus these contributions to the mink welfare literature were included to provide a comprehensive review of available information) even though there may be differences between European and non-EU production conditions and management practices. In cases where studies were performed outside EU, differences in the conditions of the animals (e.g. different cage size) are emphasised. Information from the papers obtained through the described literature search was used to answer the questions from the mandate.

2.2 | Consultation of stakeholders

In line with EFSA commitment to openness and transparency, and in response to the growing public attention around animal welfare, EFSA engaged with the interested parties throughout the risk assessment. The engagement with stakeholders was carried out regularly throughout the mandate.

2.2.1 | Stakeholder first meeting

The participatory process on the welfare of animals kept for fur kicked off with the Stakeholder meeting held in Brussels on the 22nd of January 2024, to set the scene for an open and regular dialogue between EFSA and its stakeholders from the early stages of the risk assessment process. It fostered a technical dialogue concerning the current evidence and information sources that could contribute to EFSA's scientific advice on the welfare of animals kept for fur production.

2.2.2 | EFSA network meeting

As a preparatory work, in March 2024 during the annual meeting, EFSA and its Network subgroups dealing with animal welfare topics (AHAW Network – Animal Welfare topic and scientific National Contact Points Network for Council Regulation (EC) 1099/2009) presented the mandate and collected legislative background and field experience by the participants. The outcome of the discussion is reported in the minutes of the event.[5]

2.2.3 | Call for evidence

To complement literature data, information on the biology of the species, most common husbandry systems and farm practices used for mink, foxes, raccoon dogs and chinchillas, and welfare protocols was requested by EFSA via four calls for evidence[6,7,8,9] carried out from the 1st of March 2024 to the 19th of April 2024.

EFSA launched four public calls for all potentially relevant available evidence (published, unpublished or newly generated evidence) from interested parties to ensure a comprehensive assessment of the welfare of American mink, foxes, raccoon dogs and chinchillas. The purpose of these calls for evidence was to offer interested parties (e.g. fur farming operators, national authorities, research institutions, academia) and/or other stakeholders the opportunity to submit documented information (published or unpublished) relevant to the welfare of mink, foxes, raccoon dogs and chinchillas kept for fur production.

The specific objectives of the calls were:

Specific objective 1: to collect information related to specific aspects of the biology, farm practices, breeding and reproduction of animals kept for fur production.

Specific objective 2: to collect information on the current housing conditions of animals kept for fur production during all stages of the production cycle.

Specific objective 3: to seek information on using welfare assessment protocols in animals kept for fur production. In particular to:

- retrieve information on any protocol used for assessing the welfare of the animals on farm;
- obtain data available (especially raw or unaggregated) and recorded within the application of a specific protocol.

For specific objectives 1 and 2, stakeholders were asked to respond to a questionnaire, whereas for specific objective 3, a technical description of the welfare assessment protocol, along with raw data in Excel or CSV format and any other relevant information, were requested.

Information was provided via Portalino tool.

2.2.4 | Technical hearing meeting

Stakeholders who have provided relevant data/information were invited to an ad-hoc technical hearing of the EFSA scientific working group on 17 December 2024 when clarification or additional information have been identified on specific aspects. Additional information was provided before and after the meeting via Portalino tool upon request on specific aspects.

2.2.5 | Field visits

In addition to the above-mentioned activities, to gather further information from the field, two fact-finding missions were carried out in Poland and Denmark by EFSA. The first mission in Poland was organised by EC in September 2024, and

[5]https://www.efsa.europa.eu/sites/default/files/2024-04/23rd%20AHAW%20Network%20minutes_for%20publication%20%281%29.pdf.
[6]https://www.efsa.europa.eu/en/call/call-evidence-scientific-opinion-welfare-animals-kept-fur-production-mink.
[7]https://www.efsa.europa.eu/en/call/call-evidence-scientific-opinion-welfare-animals-kept-fur-production-foxes.
[8]https://www.efsa.europa.eu/en/call/call-evidence-scientific-opinion-welfare-animals-kept-fur-production-raccoon-dogs.
[9]https://www.efsa.europa.eu/en/call/call-evidence-scientific-opinion-welfare-animals-kept-fur-production-chinchilla.

included visits to Ministries, Competent Authorities and fur farms. The second visit was organised by the Danish Ministry of Food Agriculture and Fisheries in October 2024 and included visit to Competent Authorities and fur farms. EFSA also participated online in a meeting on the welfare of fur animals, organised within an EC mission in Finland.

2.2.6 | Use of the information provided by stakeholders

Information obtained by means of the engagement activities was then revised by EFSA's experts and those included in the present SO have been cited in the text and published under Supporting information 1. Information submitted claiming confidentiality has been considered in the welfare assessment when relevant, but will not be published, according to Transparency Regulation (EU) (2019/1381).[10]

This Scientific Opinion includes information submitted by stakeholders in response to four public calls for data launched by EFSA,[11,12,13,14] and technical hearing meeting (see sections 2.2.3 and 2.2.4). The data were provided through an open consultation and reflect a variety of reported practices concerning the welfare of American mink, red and Arctic foxes, raccoon dog and chinchilla. The information was considered as received when informative for the assessment and was not verified or validated by EFSA.

2.3 | Experts' opinion through group discussion

To address ToR-2a, a semi-quantitative expert elicitation and group discussion was carried out in each species on the basis of EFSA experts' knowledge and the information retrieved from the available literature and the consultation of stakeholders (see Sections 2.2.1 and 2.2.2).

ToR-2b was carried out via literature search, contribute of stakeholders and expert knowledge via group discussion (see Sections 2.1–2.3).

2.4 | Selection of most relevant WCs (ToR-2a)

The mandate requested the identification of the most relevant WCs for each of the identified husbandry systems and farm practices per animal category (here called 'scenarios'). The starting point of this process was the list of 33 WCs previously identified by EFSA (EFSA AHAW Panel, 2022), see Appendix C Table C.1 – List and description of 33 welfare consequences used for all animal species. These WCs were screened for relevance to the topic of this SO by EFSA experts. Only one WC was removed (motion stress) since it referred to animal transport, which is out of the scope of this mandate, then making a total of 32 WCs for this SO. WCs were interpreted to include species-specific aspects for the animals kept for fur production (see in Section 3.3 in mink, 4.3 in foxes, 5.3 in raccoon dogs and 6.3 in chinchilla). The description of each WC reported in the list refers to either one or more negative affective states (e.g. pain, fear, fatigue, boredom). These affective states derive from the occurrence of the WC and can potentially lead to animal suffering (see EFSA AHAW Panel, 2022). The EKE exercise to select the highly relevant WCs was carried out separately for each husbandry system (including common farm practices) per animal category (i.e. scenarios).

The process consisted of:

1. In the available digital tool, each EFSA-expert scored each of the 32 WCs in each of the scenarios listed in Table 3 in mink, Table 10 in foxes, Table 14 in raccoon dogs and Table 15 in chinchilla. For each scenario, EFSA experts were asked to classify, based on an estimate of their magnitude, the 32 WCs into four categories of relevance: 0 = not applicable, 1 = less relevant, 2 = moderately relevant, 3 = highly relevant.

The magnitude was defined as the combination of severity, duration and frequency of occurrence (EFSA AHAW Panel, 2022).

- 'Severity' referred to extent of the negative effect of hazards associated to the scenario on the animals in relation to a certain WC,
- 'Duration' referred to the proportion of time an animal experiences a certain WC within a scenario,
- 'Frequency of occurrence' was defined as the prevalence of animals experiencing the WC in that scenario.

[10] Regulation (EU) 2019/1381 of the European Parliament and of the Council of 20 June 2019 on the transparency and sustainability of the EU risk assessment in the food chain and amending Regulations (EC) No 178/2002, (EC) No 1829/2003, (EC) No 1831/2003, (EC) No 2065/2003, (EC) No 1935/2004, (EC) No 1331/2008, (EC) No 1107/2009, (EU) 2015/2283 and Directive 2001/18/EC (Text with EEA relevance.) https://op.europa.eu/en/web/eu-law-in-force/bibliographic-details/-/elif-publication/b6394e44-d05f-11e9-b4bf-01aa75ed71a1.

[11] https://www.efsa.europa.eu/en/call/call-evidence-scientific-opinion-welfare-animals-kept-fur-production-mink.

[12] https://www.efsa.europa.eu/en/call/call-evidence-scientific-opinion-welfare-animals-kept-fur-production-foxes.

[13] https://www.efsa.europa.eu/en/call/call-evidence-scientific-opinion-welfare-animals-kept-fur-production-raccoon-dogs.

[14] https://www.efsa.europa.eu/en/call/call-evidence-scientific-opinion-welfare-animals-kept-fur-production-chinchilla.

Owing to the lack of published data on these three parameters, no attempt was made to quantify the magnitude and the experts expressed their opinion on the magnitude of the WCs qualitatively (using the four categories of relevance, described in point 1).

The experts were asked to their individual judgements that were then collated.

2. Group discussion was used to:

   a. Agree on the list of scenarios and discuss any aspect that emerged as needing to be specified.
   b. Agree and remove WCs of 'less relevance' (agreed score minor than 1). These were not kept through further steps. In case discrepant opinions emerged, consensus was sought through group discussion.
   c. Among the remaining WCs, the moderately-highly relevant ones were identified (score ≥2). The experts went individually through the list of WCs and identified the ones belonging to the category 'highly relevant'. These were kept through the further steps. In case discrepant opinions emerged, consensus was sought through group discussion.

   The outcome of the exercise for all species, scenarios and WCs is reported in Appendix D.

3. ToR2b of the mandate requested to focus the assessment on maximum 5 WCs per species ('most relevant WCs'). For this selection, the EFSA experts agreed on identifying a maximum of five WCs according to the following methodology:

   a. Calculation of the median score given to a certain WC across scenarios.
   b. A given WC was selected if the average score was ≥ 2 (corresponding to at least moderately relevant) and, in addition, the WC was given a score of ≥ 2 for at least two scenarios that did not involve the same animal category. E.g. in the case of 2 or more scenarios involving juvenile animals, at least one additional scenario (e.g. adult breeders or females with kits) had to achieve ≥ 2 in the scores in order to meet the selection criteria.
   c. Some WCs may have overlapping or interacting hazards and/or resultant affective states and ABMs, such as 'Prolonged hunger' and 'Inability to perform exploratory or foraging behaviour'. For both these WCs, feed restriction, for example during slimming, is a hazard. In such cases, group discussion was used to allow integration of aspects of both WCs into the next steps, if considered relevant. For the purpose of this SO, such WCs are called 'linked', and will be discussed in the context of the most relevant ones.
   d. Similarly, if any important aspect was considered not covered by the selected WCs, it was added following unanimous expert consensus (e.g. 'handling stress' in mink and 'resting problems' in chinchilla).

Outcome of the selection of the most relevant WCs and linked ones is reported in Sections 3.1 in mink, 4.1 in foxes, 5.1 in raccoon dogs and 6.1 in chinchilla (Appendix D – Selection of most relevant welfare consequences) Appendix A.

2.5 | Identification of preventive and substantially mitigating measures (ToR-2b and conclusions)

After identifying the most relevant WCs, the mandate requested an assessment of whether measures could be implemented to prevent or mitigate these. This part of the mandate was addressed through group discussions among experts, considering information retrieved from the literature search (see Section 2.1), contributions from stakeholder involvement (see Section 2.2) and EFSA expert opinion.

In the mandate, ToR2b requested, for the most relevant WCs (maximum five), to assess whether they can be prevented or substantially mitigated under current farming conditions or in other field-tested farming systems. These are also reported in the conclusions.

Preventive measures are intended as measures that can be put in place to prevent a WC from occurring by preventing the hazards.

Mitigating measures are intended as any measure that can mitigate (i.e. reduce) the WC if the hazard is still present.

The definition of 'substantial mitigation' was not provided in the mandate and was therefore interpreted by EFSA experts in the following way: In the context of this SO, substantial mitigation occurs when a single mitigating measure or a combination of mitigating measures can reduce the impact of the WC to a certain extent on a specific animal population. Substantial mitigation refers to circumstances where a mitigating measure or, most often, a combination of mitigating measures acts together to markedly reduce the risk of experiencing, or reducing the severity of, adverse effects associated with a specific WC, within the relevant animal population. The assessment of whether a measure or a combination of measures will lead to substantial mitigation of the WC is based on group discussion and expert consensus after a qualitative assessment of evidence discussing available ABMs (e.g. behavioural, physiological or health measures) that are biologically relevant.

When a mitigating measure was not considered 'substantial' it is reported in the conclusion as of 'limited extent'.

2.6 | Uncertainty analysis

The uncertainty in the assessment performed for this SO was investigated in a qualitative manner, in accordance with the methodology outlined in the EFSA guidance on uncertainty analysis in scientific assessments (EFSA Scientific Committee, 2018a, 2018b).

The EFSA experts agreed to address the uncertainty related to the methodology employed to identify WCs, ABMs and related hazards by describing the underlying sources of uncertainty.

Regarding the overall impact of the identified uncertainties on the conclusions of the SO, it was decided to conduct an assessment only for a selected subset of key conclusions that directly address the explicit questions outlined in the mandate (i.e. prevention and mitigation of the most relevant WCs in the current system), for which evidence to support the assessment was found.

Based on this, the following conclusions were included in the uncertainty analysis:

1. conclusions related to the prevention of the most relevant WC in the current system;
2. conclusions related to the substantial mitigation of the most relevant WCs in the current system.

It is to be noted that, as explained in Section 1.2, the outcome of the assessment of some WCs in the current system was inconclusive due to lack of evidence. In these cases, it was unknown whether the welfare consequences could be prevented or mitigated, and an uncertainty analysis was not conducted, as a high level of uncertainty is already implied by the term 'unknown'. It is also to be noted that some conclusions indicate that same preventive and mitigating measures apply to those suggested for another WC, and in these cases certainty ranges are not indicated as they are also intended to be the same.

The analysis was conducted separately for each of the five species covered by the mandate. The selected conclusions were first reformulated into specific questions considering whether the WCs derived from the exposure of animals to a well-defined scenario described in the conclusion could be prevented or substantially mitigated under the current systems. For each species, the questions were asked considering the whole EU animal population.

Experts were then asked to express their certainty for each question according to three predefined agreed certainty ranges (Table 2) derived from the approximate probability scale in the guidance on uncertainty (EFSA Scientific Committee, 2018a, 2018b).

TABLE 2 Three ranges used to express agreed (consensus) certainty around conclusions.

	Certainty range		
Quantitative assessment	**50%–100%**	**66%–100%**	**90%–100%**
Qualitative translation	From more likely than not to almost certain (summarised as 'more likely than not')	From likely to almost certain (summarised as 'likely')	From very likely to almost certain (summarised as 'very likely')

Experts were initially asked to individually select the certainty range that best reflected their degree of confidence for each conclusion considered. Then, a group discussion provided an opportunity for experts to present the rationale behind their assessments. Consensus was then sought to identify the range that best reflected overall certainty; if consensus could not be reached, the broader range encompassing all individual judgements was selected. The uncertainty in the assessment performed for this SO was investigated in a qualitative manner, in accordance with the methodology outlined in the EFSA guidance on uncertainty analysis in scientific assessments (EFSA Scientific Committee, 2018a, 2018b).

3 | WELFARE ASSESSMENT OF AMERICAN MINK

3.1 | Most relevant WCs for American mink

3.1.1 | Scenarios used for the selection of the most relevant WCs in mink

The scenarios selected to answer ToR2a and ToR2b for mink are shown in Table 3. The three scenarios #3.1, #3.2 and #3.3 cover the same age category of animals (juvenile animals that are weaned and up to age of pelting or selection as future breeders) kept under three different housing arrangements: single, pair or group or combinations of both. For the remaining scenarios, each age category is represented by a single distinct scenario.

TABLE 3 List of the identified scenarios in mink welfare assessment.

Scenario No.	Name	Farm practices included
#1	Adult and future breeders during the breeding season kept in individual cage units with permanent presence of a nest box.	• Mating trials • Slimming and flushing* • Handling
#2	Dam and kits in family cage units with permanent presence of a nest box.	• Cross-fostering • Weaning (to also consider the dam) • Handling (including separation, vaccination)
#3.1	Juveniles from weaning to pelting or selection as future breeders kept in (typically male–female) pairs kept in cage units with permanent presence of a nest box (on some occasions, one juvenile male can be kept with his dam).	• Handling (including fur grading, vaccination and separation)
#3.2	Juveniles from weaning to pelting or selection as future breeders kept in a group (> two animals) kept in cage units with permanent presence of a nest box.	• Handling (including fur grading, vaccination and separation)
#3.3	Juveniles from weaning to September–October kept in pairs or a group in cage units with permanent presence of a nest box (on some occasions one juvenile male can be kept with his dam), and then until pelting or selection as future breeders in individual cage units with permanent presence of a nest box.	• Handling (including fur grading, vaccination and separation)
#4	Mink outside the breeding season kept in individual cage units with permanent presence of a nest box. This includes: – Males and unmated/barren[15] females, after mating and before the next reproductive season. – Females after weaning and before the next reproductive season. – Juveniles from after weaning to pelting.	• Handling (including fur grading in juveniles, vaccination and separation)

*Before the mating season, female mink are often subjected to a period of diet restriction (also called 'slimming' or 'conditioning'; EFSA, 2025 chapter 3.2.2) followed by ad libitum feeding called flushing. The main reasoning for flushing is, from the productive point of view, to increase ovulation, conception and embryo implantation rates (Tauson, 1988).

3.1.2 | Outcome of the selection of WCs in mink

As an outcome of the selection process described in Section 2.4, the four WCs selected based on the criteria were: (1) Inability to perform exploratory or foraging behaviour, (2) Restriction of movement, (3) Sensorial under- and overstimulation, and (4) Soft tissue lesions and integument damage. The WC 'Handling stress' was judged highly relevant in one scenario only but, based on group discussion, the EFSA-experts unanimously agreed that this WC might not be among the top four based on the methodology described above. Handling stress, however, is important for animal welfare in relation to fear of humans. For this reason, this WC was exceptionally included as the fifth one (Table 4).

TABLE 4 Outcome of the process of selection of the five most relevant WCs, including the linked ones (see Section 2.4).

Most relevant WC	Scenarios*	WCs linked to the most relevant WCs listed in the first column
Restriction of movement	All	• Inability to perform play behaviour. • Resting problems
Inability to perform exploratory or foraging behaviour	All	• Prolonged hunger • Inability to chew[†] • Inability to perform play behaviour
Sensorial under-stimulation[a]	All	None
Sensorial overstimulation[a]	All	• Group stress
Soft tissue lesions and integument damage	Scenario #2 Scenario #3.2 Scenario #3.3	• Group stress
Handling stress[¥]	Scenario #1	• Separation stress • Inability to avoid unwanted sexual behaviour

[a]This WC is originally called 'Sensorial under- and/or overstimulation' in the EFSA guidance (EFSA AHAW Panel, 2022) but is here subdivided to enhance clarity of the content.

*The WC may also be present in other scenarios but was not selected as one of the five most relevant WCs.

[†]The original WC is 'inability to chew and ruminate' but rumination was removed as this is not applicable to mink.

[¥]This WC was added after reaching unanimous consensus during group discussion. Whilst occurring in all scenarios, it was scored as ≥ 2 only for scenario 1, where handling is more frequent.

[15]The term 'barren female' means female that did not get pregnant or could not produce offspring.

3.2 | Animal-based measures (ABMs) related to the most relevant WCs

Table 5 summarises the ABMs used for the assessment of the most relevant WCs (including the linked WCs) in farmed mink. ABMs were retrieved during literature review and by consultation of stakeholders (Sections 2.1 and 2.2). The list should not be considered as an exhaustive list of ABMs.

Additionally, further details on abnormal behaviours are reported below (see Section 3.2.1), since the need to address them emerged following discussions with stakeholders (see Section 1.2).

TABLE 5 Summary of ABMs of farmed mink welfare referenced in Section 3. The list includes ABMs that have been recorded in studies testing the effects of housing modifications on the behaviour and welfare of farmed mink, as well as ABMs that might not have been tested in this context but can indicate the presence of welfare consequences.

ABM	Definition	Interpretation of the measure	Welfare consequence(s)[a]
Agonistic behaviours	Social interactions including (but not limited to): – Aggression – Biting (Pedersen et al., 2004)	The presence of the WC is deduced from the increase of agonistic behaviour following the presence of one/more hazards.	• Restriction of movement • Group stress
Behaviours performed in/around water	Range of behaviours such as: – Walking along the edge of open water – Observation of water – Head dipping – Swimming – bathing – Diving – Walking on frozen water – Social play – Drinking (Schwarzer et al., 2016)	The presence of the WCs is deduced from a reduction or impossibility to perform one or more of these behaviours following the presence of one/more hazards.	• Restriction of movement • Inability to perform exploratory or foraging behaviour • Sensorial understimulation
Bite marks	Bite marks number and position observed postmortem as tooth punctures and melanocyte-related black spots on the leather side of the pelt (Figure 5), indicating that the animals have been bitten by another mink. (Hansen et al., 2014)	The presence of the WC is deduced from the presence of the condition in the animals following the presence of one/more hazards.	• Restriction of movement • Soft tissue lesions and integument damage • Sensory overstimulation • Group stress
Comfort behaviours	Set of behaviours with focus to maintain the integrity of the integument, e.g. rubbing behaviour performed in absence or presence of open water. (Díez-León et al., 2013; Sabass, 2014)	The presence of the WC is deduced from the impossibility or reduction of possibility to perform the behaviour following the presence of one/more hazards.	• Restriction of movement
Concentration of cortisol in plasma, faeces or urine cortisol	Intended as a change in cortisol concentration, considered an indirect measure of stress (Malmkvist et al., 2011; Mason et al., 2001)	The presence of the WC is deduced from the increase of cortisol concentration following the presence of one/more hazards.	• All, but see[#]
Exploratory and foraging behaviours	Range of behaviours finalised to satisfy motivation for exploration (manipulating or exploring objects), locomotor play (running, leaping or chasing) or social play (engaging in mock fighting or chasing with other mink) (Nowak, 2014; Sabass, 2014)	The presence of the WC is deduced from the reduction of expression of exploratory and foraging behaviours following the presence of one/more hazards.	• Restriction of movement • Inability to perform exploratory or foraging behaviour
Fearful behaviour	The mink shows behaviours indicating fear response such as: • fearful or avoidance behaviour (e.g. escapes to the back of the cage, hyperactivity, excessive inactivity, hiding in the nest box), • vocalisation (e.g. screams, hisses) or • defecation when approached by a human or another stimulus perceived as fearful. Dams vocalise after separation from their offspring (Meagher et al., 2013; Zielinski, Slaska, & Rozempolska-Rucinska, 2019; Zielinski, Slaska, Rozempolska-Rucinska, & Zon, 2019)	The presence of the WC is deduced from the presence of the ABM in animals following the presence of one/more hazards.	• Handling stress • Separation stress

TABLE 5 (Continued)

ABM	Definition	Interpretation of the measure	Welfare consequence(s)[a]
Foot pad condition	Changes in foot pad condition, such as hyperkeratosis, hair loss and crusting. (Jespersen et al., 2016)	The presence of the WC is deduced from an increase in pathological foot pad conditions, potentially impairing walking and limiting movement following the presence of one/more hazards.	• Soft tissue lesions and integument damage • Restriction of movement
Fur chewing/fur damage	Damage to the fur on the body or the tail as a consequence of fur chewing or pulling. Sometimes called fur biting or fur pulling (Hansen et al., 2007; Malmkvist et al., 2013)	The presence of the WC is deduced from an increasing amount of fur-chewing behaviour or increased areas and severity of the fur damage, following the presence of one/more hazards.	• Restriction of movement • Inability to perform exploratory or foraging behaviour • Sensorial under- stimulation
Locomotory behaviours (non-abnormal)	Range of active locomotory behaviours such as: – Turning – Walking – Running – Intense acceleration – Vertical movements including jumping – Surveillance and patrolling (Kuby, 1982; Nowak, 2014; Sabass, 2014)	The presence of the WCs is deduced from a reduction or impossibility to perform one or more of these behaviours following the presence of one/more hazards.	• Restriction of movement
Lying posture	Capacity for the mink to lay down in a preferred (curled-up or other positions) (Nowak, 2014)	The presence of the WCs is deduced from a reduction or impossibility to perform one or more of these behaviours following the presence of one/more hazards.	• Resting problems
Play behaviours	Play can be seen as: – Object play – Social play – Locomotory play (Lassen, 2007; Malmkvist & Hansen, 2002)	The presence of the WCs is deduced from a reduction or impossibility to perform one or more of these behaviours following the presence of one/more hazards.	• Restriction of movement • Inability to perform exploratory or foraging behaviour • Sensorial under-stimulation
Skin lesions	Lesions of the skin or underlying tissue as seen by visual inspection. (Malmkvist, 2020; WelFur, 2015a)	The presence of the WC is deduced from an increase in number, severity and frequency of skin lesions following the presence of one/more hazards.	• Soft tissue lesions and integument damage • Sensory overstimulation • Handling stress • Group stress
Stationary behaviours (non-abnormal)	Range of behaviours such as: – Surveillance – Standing on hindlegs – Lying (Nowak, 2014; Sabass, 2014)	The presence of the WCs is deduced from a reduction or impossibility to perform one or more of these behaviours following the presence of one/more hazards.	• Restriction of movement • Resting problems
Stereotypic behaviours (SB)	Repetitive behaviours as described in Section 3.2.1	The presence of the WC is deduced from an increase in SB in terms of duration, number of repetitions and/or difficulty to interrupt, following the presence of one/more hazards at some point in the life of the animals	• Restriction of movement • Inability to perform exploratory or foraging behaviour • Sensorial understimulation

[a]It includes also linked WCs.

[#]In mink, as in other species, the use of urinary cortisol as a non-invasive indicator of stress presents some limitations. While both faecal and urinary cortisol measures reflect HPA axis activation, mink primarily excrete glucocorticoids via faeces, with faeces:urine ratio of ~5:1 (Malmkvist et al., 2011). As a result, urinary cortisol may underrepresent total glucocorticoid output, potentially reducing its sensitivity as a stress biomarker. Moreover, urine concentrations are influenced by hydration status, necessitating normalisation typically using creatinine to correct for dilution effects (Mason et al., 2001). This adds an extra analytical step and potential source of variability. Overall, in recent years, the construct validity limitations of in the use of cortisol (urinary, faecal, saliva or plasma) as ABM for aspects of animal welfare across animal species are being discussed (as reviewed by Cobb et al., 2025; Tiemann et al., 2023). Animal welfare interpretation using the cortisol results alone face significant challenges due to the substantial influence of variables such as individual differences, sex, circadian rhythms, hormonal status and activity levels (Tiemann et al., 2023). Results should therefore be interpreted carefully considering the sample size and all the variables, and in combination with other ABMs (e.g. behavioural, clinical) for studies using this metric in this SO.

3.2.1 | Abnormal behaviour of farmed mink

As described in Section 1.2.1.3, abnormal behaviours (e.g. fur chewing and stereotypic behaviour (SB)) are acknowledged to be a welfare concern for mink kept for fur production (Mason, 1991).

Fur chewing (also called fur biting or fur pulling) in mink is a well-documented abnormal behaviour that is considered a sign of compromised welfare (Malmkvist & Hansen, 2001) and is not part of the normal behavioural repertoire of mink.

This behaviour typically manifests as the mink chewing its own fur, often resulting in visible bald patches, especially on the tail and lower back. In the case of the tail, literature reports it as tail chewing or biting. As the pulling of the fur is not documented to result in lesions of the skin and the underlying tissues, in this SO this will be further referred to as 'fur chewing' only. Fur damage has been documented in mink kits from around 8 weeks of age. Because of the multifactorial aetiology, there are different hazards that can contribute to the occurrence and severity of this behaviour. For example, fur damage on the tail increased when mink were separated or when females lost their kits at weaning (Hansen et al., 1998). Early separation of mink kits to individual housing (social deprivation) has been found to increase signs of fur chewing (Hansen et al., 1998). As an alternative to group housing, environmental enrichment (Hansen et al., 2007) and selection against fur chewing (Malmkvist & Hansen, 2001) have been shown to reduce signs of fur chewing significantly in mink housed in pairs, but not in larger groups.

In order to use SB as an ABM, other factors need to be taken into consideration. As is the case for most welfare indicators, SB should not be used as a single ABM but in conjunction with other ABMs and context data such as age, environment and presence of other hazards to be correctly interpreted in relation to animal welfare (see Section 1.2.1.3). Mink and other carnivores mainly show locomotory SB (Table 6), including so-called pacing, i.e. running back and forth in the cage or enclosure, although other forms of SBs (e.g. oral licking and up-down-movements) have also been observed by Malmkvist et al. (2024), Polanco et al. (2017), Hansen and Jeppesen (2001a), Hansen et al. (2007). Certain forms (e.g. scrabbling, route-tracing) appear to be better indicators of present welfare than past welfare status (Díez-León et al., 2016; Polanco et al., 2017).

In addition, the form and timing of observation in relation to diurnal activity and feeding time are important in the use of SBs across farms, as the behaviour will appear less prevalent post-feeding and during resting periods. Further, as mentioned above (Section 1.2.1.3) fixed SBs develop over time, with the onset in mink typically being triggered at weaning (Mason, 1993) and the form of SB not fully fixed until 7 months of age so it may be less useable as an ABM in very young animals, e.g. not for kits during the lactation period or just after weaning (Scenario 2).

TABLE 6 Description of stereotypies in mink (Polanco et al., 2017).

Stereotypy	Description
Pacing	Moving back and forth along the cage side
Nestbox pacing	Pacing back and forth between the nestbox and the cage
Tail chasing	Mink chases its own tail
Head twirling	Circular head movements while all four legs remain stationary
Mixed twirling	Circular head and/or upper body movements while both hindlegs remain stationary
Whole body bobbing	Vertical upper body movements while both hindlegs remain stationary
Head bobbing	Vertical head movements while all four legs remain stationary
Mixed bobbing	Mix of whole body and head bobbing
Head weaving	Horizontal head movement while all four legs remain stationary
Scrabbling	Repeatedly scratching on the cage walls with front paws

3.3 | Description of WCs, hazards, preventive and mitigating measures

This Section describes the highly relevant WCs identified according to the methods described Section 2.4. Although not specifically requested in the mandate, for these WCs ABMs that have been recorded in studies testing the effects of housing modifications on the behaviour and welfare of farmed mink, as well as ABMs that might not have been tested in this context but can indicate the presence of WCs, have been identified and interpreted in Section 3.2.

3.3.1 | Restriction of movement

3.3.1.1 | *Description of restriction of movement and linked WCs*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as pain, fear, discomfort and/or frustration due to the fact that it is unable to move freely or is unable to walk comfortably (e.g. due to overcrowding, unsuitable floors, gates, barriers)'.*

Interpretation for mink. When kept for fur production, the size of the standard cages for mink (70, 80 or 90 cm × 30 or 31 cm (l × w) cm (EFSA, 2025) limits their ability to move freely and may limit their possibility to perform motivated behaviours. In addition, EFSA experts agreed that Restriction of movement is linked to two other WCs: Inability to perform play behaviour and resting problems, as defined by EFSA AHAW Panel (2022).

Restriction of movement relates not only to the quantity of movement (cumulative time spent in active behaviours) but also to the type of movement, in relation to the species-specific behaviours and motivations of an animal. The type and quantity of movements which are possible are not only related to the space availability but also to the environmental complexity that will allow expression of these species-specific behaviours in relation to needs and motivations of the animals (Clubb & Mason, 2007).

This WC applies to all scenarios listed in the SO (Table 4) and the whole period they are kept on farm.

The requirement for static activities such as standing, turning and resting will be dictated by the body size of the mink. As reviewed by EFSA (2025) the body length of mink (excluding tail) has been reported to be up to 65 cm for adult males and 61 cm for adult females (in feral Spanish population, see Melero et al., 2012) and to be on average 49 ± 2.3 cm (std) and 41 ± 1.8 cm for males and females, respectively (in a Danish farm population of 956 animals, measured at pelting and born the same year, see Villumsen et al., 2019). The stride length is approximately 35–60 cm (Bang & Dahlström, 2000). The standard cage sizes allow for standing and turning as the mustelid body is flexible enough to turn around, even if the width of the cage is smaller than the body length (Figure 1).

FIGURE 1 Examples of use of space and ability to turn in mink kept in standard cage (Upper figure: ©Toke Munch Schou, Aarhus University, Denmark; Lower figure: ©Jens Malkmvist, Aarhus University, Denmark).

The length of the standard cages restricts the forward movement of mink (Hansen et al., 2007). The animals will run back and forth, which may develop into stereotypic pacing (Hansen et al., 2007). Other types of locomotory behaviours, including intense acceleration or moving straight more than 90 cm, irrespective of the gait, which has been observed in experimental enclosures not used in fur farms (i.e. 2 × 2 m floor area, 2 m high including vertical enrichment per mink or shared with two to three other mink, Nowak, 2014) cannot be performed in current cage systems. Similarly, vertical movement – such as climbing or jumping – is restricted to 45 cm in a standard cage size (up to 90 cm in some systems, EFSA, 2025). Mink have been observed to vertically move up to 2 m in studies in non-commercial enclosures (Nowak, 2014).

Mink in the wild live in territories that may extend to 1 km^2 (as reviewed in EFSA, 2025), partly regulated by season and prey availability. In a standard cage, mink typically have access to 0.21–0.28 m^2 per animal, plus the additional space provided by the nest box and (if available) platforms or shelves. Restriction of movement was selected among the most relevant WCs in all scenarios, considering that the current cage system does not allow or limit several species-specific and highly motivated behaviours.

The confinement relates somewhat to the size of the animals, as very large males (up to 65 cm) may have difficulty in entering and lying in other than a curled-up position in the nest box. During the first part of the lactation period (Scenario 2), non-weaned kits are less affected, since they are born altricial with low mobility and motivation to move around (Brandt et al., 2013; Lassen, 2007; Nowak, 2014). Likewise, in nature, this age group would be relatively confined to the den at least during the first 4 weeks of life (EFSA, 2025). Overcrowding in large litters in one cage is evident towards the end of the lactation period (Figure 2), providing further restriction of the restricted space for locomotory activity (e.g. running and social play), which also may negatively affect thermoregulation (risk of heat stress) (Díez-León & Mason, 2019). Kits in large litters experience more severe lack of space for walking and/or running, for locomotory playing, as well as for keeping distance from other mink, than kits in small litters. As a consequence, overcrowding increases the risk of heat stress and negative social interactions. Additionally, when kits are older than approximately 6 weeks, space restriction limits the possibility for the dam to temporarily withdraw from the young if wishing to avoid them. Approx. from week 4 until the end of the lactation period, dams may not be willing to nurse the kits at all times as part of a natural weaning process. In the current housing system, restriction of movement is also present for juveniles post-weaning when they are kept in social housing (EFSA, 2025).

FIGURE 2 Example of overcrowding (dam and kits) at the end of the lactation period (©Jens Malmkvist, Aarhus University, Denmark).

Other factors such as inappropriate flooring/wall material, locomotory disorders or lack of appropriate stimuli and/or resources that limit the performance of motivated behaviours might add to the severity of the WC, although there is a lack of studies focussing on the consequences of wire mesh (vs. solid floor or e.g. soil) as cage flooring.

Space allowance per mink integrates the space the animals can use for stationary and active behaviours. As reviewed in EFSA (2025), the behaviour of mink in the wild includes patrolling and defence of the territory. Patrolling behaviour has been observed in studies using large, enriched aviaries (Nowak, 2014). Although the relevance of these behaviours may be of less functional importance in captivity, it cannot be excluded that WCs exist. There is some evidence that SB in carnivores is related to their ranging behaviour (though it may be confounded with foraging and exploration for resources in the environment (Clubb & Mason, 2007).

Juvenile and adult mink appear motivated for exploration, foraging and searching/hunting for food (as reviewed in EFSA, 2025; Nowak, 2014; and Sabass, 2014 as well as searching for breeding partners; Scenario 1, during the season of heat only). Some of these behaviours may be performed if suitable resources are provided, however, others are difficult to express fully, or cannot be met at all, in the current system due to restriction of space and lack of relevant stimuli. This restriction increases the risk of developing abnormal behaviours, such as SB and fur-chewing (Malmkvist et al., 2013).

Restriction of movement is not only related to the space available per animal but is also dependent on the floor area and height of the cage. Restriction of movement is also related to two other elements of standard cage design, such as the dimension of the nest box, and the presence, number and dimensions of platforms and shelves. Further, the absence of enriching resources such as open water, outdoor access or other objects limits complexity and, therefore, the ability to perform certain types of activity; these aspects are detailed in Sections 3.3.2 and 3.3.4. Similarly, also floor and wall materials can limit the possibility to perform certain types of active behaviour (e.g. climbing, reaching higher position, sustained running), if no other features are present. Lastly, restriction of movement may increase the magnitude of linked WCs as well, such as inability to perform play behaviour and resting problems, which are explained below.

Linked WC: Inability to perform play behaviour

Inability to perform play behaviour is defined as negative affective states of frustration resulting from the thwarting of the motivation to engage in social, locomotor or object play (EFSA AHAW Panel, 2022). Animals actively seek opportunities to play, and the performance of play behaviour is rewarding (Wood-Gush & Vestergaard, 1991). Play is widespread among vertebrates (and has even been described in some invertebrates), particularly in young animals (Held & Špinka, 2011). It is difficult to provide an unanimous definition of play that allows an observer to categorise it with certainty, but there is consensus around five criteria that are typical for play (Burghardt, 2005): (1) the behaviour apparently lacks immediate function in the occurring context; (2) it is self-rewarding; (3) it is different in structure or temporal organisation from functional expression of the corresponding behaviour; (4) it is performed repeatedly in a flexible, non-stereotypic fashion; (5) it occurs mainly when the animal is in good health and free from stress. Although the functional significance of play is not fully understood, it is often assumed to be important for the development of different behaviours and physical as well as cognitive skills (Zeiträg & Jensen, 2024). For these reasons, it is clear that play relates closely to animal welfare (Held & Špinka, 2011). Not only can the performance of play behaviour be a sign of positive welfare (as seen from the five criteria mentioned above) (Ahloy-Dallaire et al., 2018), but it may also have long-term positive effects on cognition and stress resilience (van Poucke et al., 2024).

For mink, play can be seen as object play (manipulating or exploring objects), locomotor play (running, leaping or chasing in a seemingly purposeless but joyous manner) or social play (engaging in mock fighting or chasing with other mink) and all types of play require space and resources. Elements of play behaviour are seen in young mink in the current system, however not the full scope of play behaviour as observed in housing systems built to study animal behaviour (Erlebach, 1989; Kuby, 1982). Mink of confident breeding lines seem to play more (Lassen, 2007; Malmkvist & Hansen, 2002). In an on-farm study in standard cages under high-density conditions, post-weaning play increased from occurring in 10%–15% of litters on day 42 to occurring in 40%–50% of litters at day 48, and then reached a steady level (Møller et al., 2020). It is worth noting that, when kits are with the dam or when juveniles are group housed, it may be hard, by observation, to differentiate between aggressive behaviours and rough-tumble-play.

The ontogeny of play behaviour in large outdoor enclosures featuring natural vegetation and open water is described in Kuby (1982). In short, play behaviour was observed from shortly after the opening of the eyes of the kits, and continued to develop during lactation and beyond. From the 60th to 70th day of life onwards, play behaviour also takes place in the open water (Erlebach, 1989; Kuby, 1982).

The presence of resources might enhance the possibility for mink to perform play behaviour, however, the introduction of these is contingent on the space available (Hansen et al., 2007; Nowak, 2014; Sabass, 2014). Increasing space without adding resources has been poorly studied in relation to play behaviour. Additionally, the study of Hansen et al. (2007) noticed that juvenile mink in enriched cages (pull-ropes, table-tennis balls, and wire mesh and plastic tubes) had fewer signs of tail-chewing, fewer SB and a reduced level of FCM, which confirms a positive impact of increased environmental complexity on the welfare of mink.

Vinke et al. (2005) compared play behaviour in young (7–11 weeks old) mink housed with access to a small water basin and standard Dutch resources (a loose cylinder and platform). The study showed that the animals played significantly (approximately 29%) more in the cage provided with open water, even if the play behaviour was observed in other areas of the cage, than mink housed in the same environment but without access to the open water including extra floor area (40 cm tunnel) and an entry platform. The authors suggested that being able to explore open water may directly or indirectly influence the development of play behaviour in mink. Restriction of movement due to overcrowding in Scenario 2 (especially in large litters), is expected to be related to this WC (see Figure).

Linked WC: Resting problems

The WC Resting problems is defined as negative affective states such as discomfort, fatigue and/or frustration that the animal can experience due to the inability to lie or rest comfortably (EFSA AHAW Panel, 2022). As typical of many carnivores, mink in the wild spend a large part of their time budget (approximately 16 h per day) inside their dens (EFSA, 2025). On farm, mink may rest on the wire cage floor and platforms (when available); however, this does not substitute the use of the nest box to rest or perform active behaviours. Mink show high motivation to access a nest box and exhibit negative consequences when the access is hindered (Hansen et al., 1992). Access to a nest box can, therefore, be considered a behavioural need in mink (Hansen et al., 1992), and the WC Resting problems is relevant in all animal categories, and more severe in mink kept in groups and for large-sized males. Main hazards related to this WC include nest availability in terms of nest box space (i.e. floor area) and nest box accessibility (i.e. size of openings).

See above in this section for description of mink's body size. The tail length seems less relevant in relation to space needed for resting. Typical nest box sizes range are from 30 × 20 × 18 to 31 × 24 × 24 cm (EFSA, 2025), indicating that the nest boxes are not big enough to enable a stretched out lying of the mink for resting and sleeping position, if preferred by the mink. Mink are often observed using a curled-up resting position (Figure 1) also in nature, however other postures (e.g. stretched out) occur as well, e.g. on a platform or shelf, and may be of value (Brandl, 2014; Nowak, 2014).

3.3.1.2 | *Hazards leading to restriction of movement and linked WCs*

- **Insufficient floor area to allow motivated types of active behaviours including locomotion and play, and insufficient cage height and structural complexity of the cage**

Meta-analyses of carnivore behaviours in zoo settings have posited that carnivores with very large annual home ranges (larger than for mink) may be more predisposed to perform SBs) in captivity and have poorer reproduction than carnivores with smaller annual home ranges (Clubb & Mason, 2003, 2007). In particular, the ratio of daily travel distance to annual travel distance (DD:AD) better predicts carnivore SB in captivity than annual home range (Bandeli et al., 2023). These authors posit that a lower DD:AD ratio, meaning the animal travels only fractions of their total home range each day, reflects itinerant lifestyles (semi-nomadic lifestyles in which animals relocate frequently within their extensive home ranges, exploring novel environments and creating multiple dens or resting places annually), and that itinerant lifestyles predispose animals to increased negative WCs in captivity. This would position American mink, with their relatively small home ranges compared to other carnivores (EFSA, 2025), and large DD:AD ratios (Bandeli et al., 2023), as a species that would adapt relatively better to captivity than carnivores with larger home ranges and smaller DD:AD ratios, at least with regards to displaying SB and the WCs associated to performing these behaviours. However, it is evident that mink in cages in the current system of 30 × 45 × 90 cm displayed more SB than mink in larger, more complex experimental cages (three interlinked cages of this size) (Hansen & Jeppesen, 2001a; Jeppesen et al., 2000) or large, highly enriched experimental aviaries (Erlebach, 1993). Similarly, adult females housed in three interconnected stacked cages performed less abnormal behaviour (including SB) compared to those in a standard single cage (Lidfors et al., 2012).

No SBs were observed in large, highly enriched experimental outdoor aviaries featuring open water (Erlebach, 1993; Hagn, 2009), and mink in experimental settings which included open water as part of a more complex cage system displayed fewer SB and showed other signs of improved welfare (Díez-León et al., 2013). Dams with kits provided with a platform to get away from them also show improvements in welfare (studied in smaller than EU standard cages (Buob et al., 2013; Dawson et al., 2013).

Cage size in most studies is, however, confounded with complexity of the environment. One study manipulating cage size and resources independently (Hansen et al., 2007) found no effect of doubling of cage sizes, whereas provision of resources alone reduced abnormal behaviour (SB and fur-chewing, see Section 3.3.2). Thus, most studies only found significant improvements from adjusting cage size if the control treatment involved cage sizes that are considerably smaller (e.g. floor areas of 0.07 m^2) than those used in the current system (0.27 m^2) (EFSA, 2025).

Pedersen et al. (2004) showed that modifying available cage space for group-housed mink by connecting three cages horizontally (i.e. 'row system', floor area 90 × 90 cm) vs. stacking two cages vertically (i.e. 'stacked system', floor area 30 × 90 cm) had no effect on SB or behaviours such as social play, but mink showed more surveillance behaviour (i.e. being alert and vigilant of surroundings) and agonistic behaviour in the stacked system compared to the row system. Access to a horizontal additional empty cage compartment also had no effect on SB, signs of fur-chewing or levels of FCM (whereas provision of other enrichment or resources did) in Hansen et al. (2007). Cage size did not significantly affect physiological ABMs (cortisol concentrations or the number of eosinophil leucocytes) in mink kits housed in male–female pairs across three cage sizes (1.05 m^2, 0.27 m^2 and 0.10 m^2) (Hansen & Damgaard, 1991), thus results on cage size effect alone are inconclusive (Aulerich et al., 1991; Mink Code of Practice Scientists' Committee, 2012). It is important to mention that the use of an enclosure larger than three times the standard European cages (see (EFSA, 2025) without the addition of resources has not been studied.

Recent studies additionally using behavioural welfare indicators, including preference and comparing smaller floor areas used in North America to the minimum floor area used in Europe, confirmed that increase in cage size alone does not substantially improve welfare (Díez-León et al., in press). Moreover, in an experimental setting, single-housed mink did not appear to value an empty cage compartment as much as cage compartments containing resources like water baths, novel items or hay boxes (Cooper & Mason, 2000). During the lactation period (Scenario 2 in the present SO), cage space and nest box size can be a hazard particularly for restriction of movement from approximately 6 weeks of kits age (Rørvang & Hansen, 2013), especially with litter size of at least seven kits (Malmkvist et al., 2016b).

Restriction of particular types of movement may also be a consequence of the hazard of space restriction affecting mink welfare. Clubb and Mason (2007) suggested that since stereotypically pacing mink on fur farms may accomplish daily travel distances up to 4 times longer than they would in the wild, this may represent motivations to perform particular types of locomotion, such as sustained running. However, other factors such as olfactory, visual and auditory cues and the willingness to exert control over their environment need to be taken into consideration as factors motivating locomotory activity and species-specific movements (Clubb & Mason, 2007).

In addition to restriction of horizontal movement, vertical movement can be restricted in standard cages when the cage height does not allow the animals to stand bipedally on their hind legs fully stretched. In a study comparing different cage heights (45 cm and above), all the largest individuals were able to reach the feed delivered on top of the cage at 45 cm. At the highest cage height of the study (53 cm), only 60% of the mink were able to reach the feed while standing, with 40% having to climb to reach it (Figure 3). Thus, standing and climbing are in the behavioural repertoire of mink, and used for reaching access to resources, both on farm and in nature. It is currently unknown whether the expression of the behaviour is a need (see Section 1.2.1.1) or is driven by other motivations such as access to resources, platforms or exploration, as the motivation of mink to perform certain vertical locomotory activity has not been studied.

One study showed that mink can climb if motivated to reach a certain resource (e.g. feed or more space) (Díez-León et al., 2017). In addition, having access to elevated platforms is known to improve mink welfare (studied in cages that were lower than EU standard) (Buob et al., 2013; Dawson et al., 2013), but it is unknown whether the lack of vertical movement opportunity is related to an increase in the performance of SB or other ABMs beyond the lactating period for dams. During the late lactation period, kits may act as a stressor from which the dam should have the possibility to escape when having access to an elevated shelf or platform in the cage (Dawson et al., 2013; Dobson & Rouvinen-Watt, 2008; Hansen, 1990). Dams used these elevated structures increasingly with growing kit age up to approximately 6 weeks (end of observation period in (Dawson et al., 2013), followed by decreased use at 8 weeks postpartum. This is probably due to the improved climbing capability of older kits, diminishing the value of the elevated structure as a safe place for the dam (Hansen, 1990). Likewise, use of platforms was greatest in mink dams with bigger litters (Buob et al., 2013). Even though climbing behaviour has been observed in other scenarios (e.g. juveniles, single-housed adults, see Brandl, 2014; Díez-León et al., 2016, 2017; Hagn, 2009; Nowak, 2014; Sabass, 2014), it is unstudied whether climbing itself is of value for mink.

FIGURE 3 Mink climbing (left, juvenile) and standing (right, adult female) to gain access to food on top of their cages (©María Díez-León).

In relation to cage height, it should be mentioned that the prevalence of tail tip injuries was seen to increase after the transition in some European countries (e.g. Norway) from single-level to multi-tiered cages (Heimberg et al., 2018). These injuries have been suggested to occur when mink descend at high speed from the top level of their cage to the bottom level of their cage, hitting their tail on various parts of the cage wiring on the way down (Heimberg et al., 2018). The causal relationship has not been documented though. These tail tip lesions are found to be reduced by the installation of an additional hammock in the pathway between the top and bottom levels of the cage. If multi-tiered housing is used, research is required to investigate causes for tail tip lesions and to optimise cage design to prevent injury (Heimberg et al., 2018).

In the current system, the performance of vertical locomotory activity is partially possible on the wire mesh cage walls depending on the height of the cage, the availability of a platform and the presence of other enrichment or resources which stimulate vertical movement. In the current system, structures other than platform and wire mesh sidewalls allowing vertical movement are lacking.

In the current system, cage height is also related to the feeding practice, as feed is delivered on the top of the cage (EFSA, 2025). Therefore, in case the height of the enclosure is increased, the feeding method needs to be adjusted accordingly. Mink have been reported to prefer to eat in a 'quadrupedal position' (i.e. not standing on their hind legs) (Díez-León et al., 2017).

Thus, in summary, the floor area in the current system restricts movement, in some scenarios more than others, particularly the sustained (i.e. continuous) movement beyond the boundaries of the cage, including the ability to move away from conspecifics (e.g. kits). In the current system, the performance of vertical locomotory activity is partially possible, but resources allowing vertical movement other than a platform and wire-mesh sidewalls are lacking. Motivational studies on vertical locomotory behaviours are lacking.

Inadequate floor area in relation to play behaviours

Only two studies on play behaviour of farmed mink have recorded play in relation to floor area availability. In a study on 300 litters (6–11 kits per litter), Møller et al. (2020) observed the proportion of litters that displayed play behaviour. No significant differences were found between litters housed with more available floor area (0.27 m^2; for three to six kits per cage) at weaning when they were 6–10 weeks old compared to those housed at higher density that remained with the dam (0.27 m^2 for three to five kits + their dam per cage). However, when interpreting the results of this study, confounding effects such as the novelty of being moved to another cage (in theory increasing play) or earlier age at weaning (in theory suppressing play), and the presence of the dam cannot be ruled out. In addition, it needs to be noted that the total cage floor area remained the same in this study across experimental groups.

In a case study reported in a Masters' thesis by Erlebach (1993) less play behaviour (was observed in three sibling juvenile mink (observed between 4 and 8 months old) in sheltered 0.36 m^2 cages (cm 91 L × 40 w × 41 h, wire mesh floor with external nest box and water bowl inside the cage) as compared to the same number or mink housed in a enriched outdoor enclosure (floor area of approximately 33 m^2 on solid floor with sand, earth and stones, natural vegetation and climbing opportunities, two nest boxes, open water approx. 4 m^2).

In **summary**, although the effect of floor area alone on play behaviour is not clear, it is likely that increased floor space has a beneficial effect on play and locomotor play in particular. Additionally, more space contributes to avoiding overcrowding of young mink and enables the addition of enriching resources.

- **Inadequate floor material**

The effect of flooring material on the ability of mink to move freely has not been adequately studied, and there are no studies comparing mink preferences for different types of floor materials. See Section 3.3.5 for results on soft tissue lesions potentially linked to the wire mesh of the current cage system.

According to the EFSA experts, the use of wire mesh flooring in mink cages can be considered a hazard, especially if the wire mesh size is not adequate for the size of the animal. In mink cages, mesh wire is reported to be equal to or smaller than 8.8 cm^2 with wire thicknesses of at least 1.8 mm^2 (EFSA, 2025). The size and shape of (adult) mink tracks are like that from polecats (*Mustela putorius*; Bang & Dahlström, 2000). The forefoot tracks on relatively solid floor are 3–3.5 cm long and 2.5–4 cm wide, the hind foot tracks are slightly longer. However, some variation exists, and especially younger animals are smaller.

Kits, in particular, benefit from smaller wire mesh, since otherwise they are at risk of being restricted in their ability to move. In large litters, suckling kits can use the area outside the nest to rest in case of lack of space in the nest box and thus may not have access to a comfortable resting area. Additionally, by choice (e.g. during hot temperatures) mink dams may choose to nurse and rest on the wire floor rather than in the more closed nest box (Figure 1).

Observations from experimental settings where mink have been housed on solid ground (made of soil) suggest that alternative flooring options than mesh floor may allow the expression of certain behaviours such as rubbing behaviour (Brandl, 2014; Nowak, 2014; Sabass, 2014). Also, the type of platform inside standard cages can facilitate the expression of rubbing behaviour, depending on the material they are made.

Mink are motivated to use running wheels made of wire mesh, also for a long bouts of time and maintain interest over time (Hansen & Jensen, 2006a, 2006b; Malmkvist et al., 2021), however no other materials have been systematically tested, evidencing a gap of knowledge in this field. Additionally, wire mesh flooring beneath the feeding place may limit feeding opportunities, as it is difficult to successfully display the natural 'caching' behaviour of mink (taking small bites, transporting it to a horizontal place to eat) in the current system. Thus, wire flooring may restrict foraging behaviour, as compared to a portion of solid floor for feeding and straw provision (see Section 3.3.2).

In **summary**, although wire mesh flooring is commonly used in the current cage system and its impact on mink behaviour and welfare is largely unstudied, certain behaviours might be restricted by wire mesh flooring. Further studies on the effect of flooring material on the ability of mink to move freely are needed to fully understand this hazard.

- **Nestbox with too small floor area and/or size of opening, insufficient number of nests**

Mink demonstrate a high motivation to access nest boxes and experience negative consequences when access is restricted (Hansen et al., 1992). In the current system for farmed mink each cage is permanently equipped with a nest box. However, the number of animals per cage (Henriksen et al., 2021) and the nest box dimensions vary across commercially available types of nest boxes (see EFSA, 2025 for further details).

Since nest boxes are used for multiple purposes, including resting and feeding, restricted access along with wet and dirty floor conditions is associated with welfare concerns for mink in all scenarios of this SO. Hazards arise when the nest box floor area is too small, the size of the entrance is too small or the number of available nest boxes is insufficient. Mink without access to a nest box display more SB (Hansen et al., 1994). Research on nest box sizes suggests that boxes may be too small in relation to both the size of the dam and the increasing size of kits as they grow until weaning (Rørvang & Hansen, 2013). This indicates that movement restrictions can occur, both in the nest box itself and in the cage area, particularly for litters housed in standard cages towards the end of the lactation period (Figure 2).

One study, involving 30 dams per group, found that provision of a smaller than standard nest box (24 × 30 × 22 cm) led to less time spent inside, poorer udder health and lower frequency of body position allowing suckling (observed between weeks 3 and 8 after birth) compared to animals with a larger nest box (41 × 30 × 22 cm). This suggests that space restriction during lactation may negatively impact maternal behaviour. Additionally, dams spent less time with their kits in small nest boxes as compared to larger ones (Rørvang & Hansen, 2013).

For cage units housing multiple animals, particularly larger individuals approaching weaning, nest boxes can become a limited resource and limit behaviours such as resting postures and comfort. Also, other WCs than Restriction of movement, such as Heat stress or Cold stress, might be affected by this. Experimental studies on juvenile mink in a highly enriched outdoor enclosure with access to multiple nest boxes showed that the animals preferred to sleep together, engaging in allohuddling (Hagn, 2009). Furthermore, juveniles did not exhibit a preference for a specific nest box, but instead used all available options interchangeably (Hagn, 2009).

Another hazard is nest box entrance size, which can make it difficult for larger individuals (particularly adult males or juveniles before pelting) to enter. Further, limited access is particularly relevant in group housing, where overcrowding can restrict free access to preferred resting sites. Even solitary large males may struggle if the entrance or interior space of the nest box is insufficient. Given the motivation of mink to use the nest box for multiple purposes and the negative welfare implications if this is restricted, findings from studies on nest deprivation are considered applicable to this situation.

3.3.2 | Inability to perform exploratory or foraging behaviour

3.3.2.1 | *Description of inability to perform exploratory or foraging behaviour and linked WCs*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as frustration and/or boredom resulting from the thwarting of the motivation to investigate the environment or to seek for food (i.e. extrinsically and intrinsically motivated exploration)'.*

Interpretation for mink. This WC is especially linked to sensory understimulation due to the inability to perform highly motivated behaviours such as searching, exploring and hunting in terrestrial and aquatic environments. The motivation to perform foraging behaviour refers not only to the consummatory phase of foraging but also to its appetitive phase.

Exploration is closely linked to the search for food and other resources, such as mating possibilities or shelter. In practice, foraging and exploratory behaviours can often not be fully separated. This WC is among the most relevant for all scenarios of this SO as all mink are subject to the main hazards for this WC almost throughout all their life from weaning to pelting/mating.

Foraging behaviour comprises an appetitive phase of searching for suitable prey, activity required to catch and kill/manipulate the prey and a consummatory phase involving the ingestion (eating) of the food (Estévez & Newberry, 2017). In the natural habitat, foraging and exploratory behaviour of mink include a range of different behavioural patterns performed in terrestrial and/or aquatic environments (as reviewed in EFSA, 2025). Locomotory behaviour during exploration on land includes for example running, climbing and jumping on and over surfaces, inspection of holes in the ground and standing on hind legs. In addition, mink may perform foraging and exploratory behaviour around or in open water, such as head dipping and diving (See Section 3.3.4).

In the current system for mink kept for fur, the appetitive phase of foraging behaviour cannot fully be performed. When performing terrestrial hunting, mink sneak up on their prey and rely on a quick jump (Wiepkema & de Jonge, 1997). Hearing is rudimentary before weaning, but adult mink can localise high-frequency (> 70 kHz) calls of rodents, suggested to be adaptive for terrestrial hunting and locating rodents as well as playing a role in maternal care (Brandt et al., 2013). Nowak (2014) reported mink dams, housed individually with their litters in enriched aviaries (2 × 2 m floor area with open water 1 m^2, 30 cm deep, one nest box, one box with sawdust, two climbing branches, one high platform), to carry out more than one third (36%–47%) of all behaviours observed outside the nest box (an average of 14.7% of a 24 h day) on exploratory and foraging.

In general, the current standard cages do not allow the type and amount of exploratory and foraging behaviours observed in the wild or in, for example, aviaries, due to the lack of complexity of the environment, the lack of stimuli favouring the motivation to explore or forage, and the lack of adequate space to perform the behaviours.

Linked WC: Inability to perform play behaviour

Not providing mink with an environment with suitable stimuli and resources is linked to this WC. As described above (Section 3.3.1.2), increased play was found in a study involving three juvenile mink, when kept in an enriched enclosure vs. in standard cages (Erlebach, 1989).

Linked WC: Inability to chew

The consummatory component of foraging behaviour in mink is related to inability to chew, defined in mink as the animal experiencing negative affective states such as frustration resulting from thwarting of the motivation to chew and to perform the complete consummatory behaviour (EFSA AHAW Panel, 2022). As described above, farmed mink have limited possibilities to chew on whole feed items (e.g. tissue, muscle, bone), as they are typically fed a paste-like feed, which they ingest, typically from the underside of the top of their cage (EFSA, 2025), often delivered by a stockperson-driven machine. The importance of the ability to perform consummatory parts of foraging was demonstrated in farm mink, showing that provision of chunky vs. standard, finer-grounded, feed reduced SB and signs of fur chewing in a study following up to 200 farmed mink for 7 months from weaning and until mating (Malmkvist et al., 2013). Further, when given the choice, mink prefer to eat with four legs on the ground and place food on the floor (see Section 3.3.1.2) instead of standing on hindlegs to reach top of the cage (Díez-León et al., 2017), as is the case during conventional farm feeding. This WC is relevant for all mink in all scenarios, but less so for unweaned animals and not for the youngest suckling kits during their first weeks of life.

Linked WC: Prolonged hunger

A WC that can increase the severity of Inability to perform exploratory or foraging behaviour is **Prolonged hunger**, which is especially relevant in adult females but also in males in preparation of the breeding season, where animals are often slimmed (EFSA, 2025). The increase of hunger during the slimming period (i.e. prolonged hunger) will most likely increase the motivation of the mink to forage and search for food. Moreover, feed restriction might also be more intense in case of fat or obese animals at the end of the juvenile period. As described in EFSA (2025), after weaning mink are fed ad libitum until pelting or selection as new breeders.

3.3.2.2 | *Hazards leading to inability to perform exploratory or foraging behaviour and linked WCs*

- **Lack of physical complexity of the cage**

Mink cages are typically made entirely of wire mesh with an attached wooden nest box, usually containing nesting material like straw, and this environment remains the same throughout the life of the animals (EFSA, 2025). Periodic replacement of straw induces activity and provision of resources has become common. On European farms, this typically includes a raised shelf/platform and a loose wire mesh tube on the cage floor (for descriptions of typical resources, see EFSA, 2025).

Studies have demonstrated that mink will work harder for access to a novel object (e.g. when a weighted door is placed between them and the novel object) than for access to a known object or wire cylinders that are comparably less novel (Cooper & Mason, 2000), suggesting that mink value the opportunity to explore novel objects. See Section 3.3.4 explaining operant conditioning studies in further details. Clark et al. (2023) showed that mink interacted significantly more with resources when numerous different items were available (two mobile items, a shelf, and a hanging rope or chain), some of which were novel, compared to only having one permanent mobile resource and a shelf. However, the topic of shifting vs. permanent access to cage resources still needs further investigation.

It is also important to note that resources can have welfare benefits that are not necessarily proportionally correlated with frequency of use. The exchange of selected resources in the cage to maintain novelty was suggested to increase exploration of all items in the cage, even permanently present ones (Clark et al., 2023). In a study including a non-enriched control group and providing mink with biting objects during group housing (four mink per cage, Scenario 3), straw briquettes (7 × 15 cm) or plastic tubes (4 × 15 cm) reduced signs of fur-chewing as compared to the non-enriched control group. The positive welfare effect between permanent access or a shift between these biting objects did not reach significance (Hansen, 2012), but the biting objects reduced signs of fur-chewing in 41% of mink affected in the control group (having permanent access to biting objects) versus 16% in the group which has shift between objects. No effect of biting objects was found on aggression or bite marks (see definition of this ABM in Table 5) according to the scoring system used in (Alemu et al., 2014).

In the presence of limited, simple resources such as balls, mink have been shown to habituate to the items within 30 days of introduction (Jeppesen & Falkenberg, 1990). More promising types of resources shown to positively affect the welfare of mink are biting ropes (Hansen et al., 2007), reducing SB and signs of fur chewing, and for which mink show prolonged interest from after weaning and into adulthood (next year's mating season). Adult mink with access to a biting rope in the cage showed less prevalence of tail-chewing (19%) than those without such access (42%) (Malmkvist et al., 2013). In juveniles, access to biting ropes reduced the occurrence and intensity of signs of fur chewing (observed mainly on the tail) scored in December in both males and females (approximately halved in occurrence to 16% with this enrichment), with no clear effect on SB with permanent access.

The experimental studies of Clark et al. (2023) and Hansen et al. (2007) indicated that mink spent more time with resources that they can physically manipulate, alter or eat, like sisal rope and pig ears, which are highly chewable and destructible (e.g. compared to a golf ball). Some of the used items may have been characterised by additional traits such as texture, smells or tastes that satisfy appetitive or food-related motivations, e.g. the pig ears (Clark et al., 2023). However, added cage elements like pig ears or biting ropes hanging from the ceiling/connecting cages (Díez-León et al., 2013, 2016) differ from those of standard resources used on European farms today (e.g. wire mesh tunnels, fixed platforms, straw). With the exception of straw, the main types of resources used are not manipulable to the same extent (Malmkvist et al., 2013).

Exploratory behaviour can be considered to reflect positive affective states in animals and often in animal populations, high levels of exploration are associated with reduced fear of novelty and lower physiological responses indicative of stress (as supported by research in other species; summarised by (Bak & Malmkvist, 2020) as well as in mink (Malmkvist & Hansen, 2002). Interestingly, mink used biting ropes most during periods of feed restriction, reflecting increased motivation to perform appetitive foraging behaviours like chasing and attacking, but also potentially consummatory behaviours like biting and tearing apart prey, since ropes had to be replaced frequently throughout the study (Malmkvist et al., 2013).

Both SB and signs of fur chewing have been found to increase during periods of restricted feeding (Hansen et al., 2007; Malmkvist et al., 2013). Because of their different aetiologies (Malmkvist et al., 2024; Polanco et al., 2017), each form of abnormal behaviour should be specifically targeted through different enrichment methods (Malmkvist et al., 2013, 2024; Svendsen et al., 2013). For example, adding more complex texture to the daily diet of mink has been shown to reduce signs of fur chewing by increasing consummatory chewing opportunities (see Section 3.2.1).

Meanwhile, more complex cage enrichment relative to standard cage resources is shown to reduce route-tracing and locomotor SB (Campbell et al., 2013; Dallaire et al., 2012; Díez-León et al., 2013, 2016; Hansen et al., 2007; Hansen & Jeppesen, 2001a; Jeppesen et al., 2000; Meagher et al., 2012, 2013; Malmkvist et al., 2013). Also signs of fur-chewing (Hansen et al., 2007; Malmkvist et al., 2013; Meagher et al., 2014), and indicators of physiological stress, such as increased FCM levels (Díez-León et al., 2013, 2016; Malmkvist et al., 2013; Meagher et al., 2013, 2014) have been shown to differ when complex enrichment is used. This is also the case for boredom indicators (Meagher & Mason, 2012) and fear (Meagher et al., 2014).

Despite the available research, strongly suggesting that complex enrichment influences the welfare of mink, further research is needed to fully understand the benefits of environmental enrichment for mink, for example to clarify whether enrichment has uniform effects across individuals. Kits have probably the ability to sense tactile and also olfactory stimuli from birth (Lassen, 2007). After this age, the provision of early-life enrichment appears to be more effective than enrichment initiated during adulthood (Ahola et al., 2011; Axelsson et al., 2009; Campbell et al., 2013). However, enrichment provision limited only to early development (e.g. from 4 to 15 weeks of age) has not been shown to produce substantial long-term welfare benefits (Clark et al., 2025), suggesting that enrichment should be continuously provided throughout life of mink.

Effects of space on play behaviour in mink was discussed in Section 3.3.1.2. Play behaviour is not only affected by space, but also by the level of resources provided. Barren cages or cages with minimal resources have been shown to be insufficient to promote the development of play behaviour or to stimulate the full range of play behaviour in farmed mink. For example, mink kits group-housed in standard cages with no resources were observed to mostly perform solo locomotory play and low levels of social play (Brink & Jeppesen, 2005). The authors concluded that playing alone seems important and may contribute to locomotory skill development, though they were surprised by the low levels of social play observed since social play has been suggested to be important for developing social skills in mammals (Brink & Jeppesen, 2005).

Mink kits reared and housed in cages with complex enrichment (two floor cage: lower floor: 170 cm l × 60 cm w × 45 cm h, two nest boxes with straw, platform, plastic cylinder, water bowl 25 cm diameter; upper floor: 72 cm l × 63 cm w × 45 cm h, platform, running wheel, commercial hiding and sleeping bag for ferrets, organic chewing material hung on chains, commercial floss rope for dogs and tree branches for climbing and chewing) showed more social, solitary and exploratory object play (Vinke et al., 2004), as well as increased social behaviours like social grooming and social platform use (Vinke et al., 2004), than kits housed with less complex enrichment. The authors concluded that enrichment can increase variation in the behavioural repertoire, specifically regarding exploratory play behaviours and social behaviours (Vinke et al., 2004).

Meagher et al. (2014) reported 3–5 month old juveniles in North American farms to spend 2.4% of their time using resource items such as balls (golf balls, perforated plastic balls, cat toy with bells), chewing objects of animal origin (pig ears, cow ears, hide strips, cow hooves, marrow bone), other chewing objects (pieces of fire or garden hose, plastic plumbing fixtures, wood, nylon rope, sisal twine) and tunnels (plastic or wire). Mink provided with the resources showed increased play, were less aggressive in temperament tests, quieter when handled, and males were less fearful and less likely to fur-chew compared with control mink. No difference was found in terms of SB.

Modifying group housing alone does not appear to significantly influence social behaviours (beside increasing aggression as demonstrated across studies), as Pedersen et al. (2004), along with older studies (SCAHAW, 2001), found no difference in social play or allogrooming when juvenile mink were housed in traditional male–female sibling pairs vs. experimental sibling groups. Social housing even in larger cages is expected to result in more aggression in production like systems and aviaries (less studied), however, aggression is reduced somewhat by the addition of several feeding places (Pedersen et al., 2004). Further, threats (agonistic behaviour not leading to overt aggression) may occur. The difficulties of relying on behavioural observations of aggression are the main driver of developing and using other indicators such as bite marks observed post-mortem as tooth punctures and melanocyte-related black spots on the leather side of the pelt (see Figure 5).

- **Limited cage size (both horizontal and vertical space) to perform exploratory and foraging behaviours**

The limited cage size is a hazard for the WC Inability to perform exploratory or foraging behaviour for similar reasons as described for play behaviour. The restricted size severely limits the ability to provide multiple and complex enrichment such as running wheels and open water (see Sections 3.3.1 and 3.3.4). Studies comparing mink housed in multiple enriched vs. less enriched enclosures found increasing enrichment use (Vinke et al., 2004). The experimental comparison of standard cages similar in size to those currently in use in Europe (but barren) with much larger and complex enclosures revealed changes in types of resting behaviour (e.g. more behaviours indicative of boredom-like states in mink (Meagher & Mason, 2012, but cf. Polanco et al., 2021).

- **Lack of enrichment and inadequate feed structure and delivery, not providing stimuli for appetitive and consummatory foraging behaviour**

There are no studies that have specifically addressed whether the inability to perform the appetitive phase of foraging behaviour (e.g. inability to hunt live prey) compromises the welfare of mink, although studies providing mink with different types of resources find that food-based resources and those with high manipulable properties (including interconnecting items to induce movement), are highly preferred (i.e. most used by the mink and more likely to show welfare benefits (Clark et al., 2023, 2025; Díez-León et al., 2013, 2016).

The main hazard is the physical structure of the feed and type of delivery, which does not allow to perform natural chewing behaviour or feeding postures, see Section 3.4.2. As mentioned, mink feed on farms is typically a soft paste (EFSA, 2025) and is therefore not as mechanically challenging to consume as the whole-carcass varied diet they are predisposed to eat in the wild (EFSA, 2025). This is proposed to result in compromised consummatory foraging behaviour and the linked WC Inability to chew, potentially causing frustration resulting from for example thwarted behavioural motivations, though some of these effects have not been studied in detail.

In a survey of mink health across farms, involving approximately 40 animals from each of six Danish farms, examined at pelting, Møller (2003) reported low grades of tartar on the molar teeth in 92.7% of male and 82.9% of female mink (244 animals in total, gender distribution unknown) aged approximately 6 months at the time of pelting on six mink farms in Denmark. Tartar is hardened plaque made up of bacteria, food particles and saliva, that has been associated with various oral health problems in dogs and cats, and where nutritional and feed structure are mentioned as risk factors (as reviewed by Wallis and Holcombe (2020). The clinical significance of the findings reported by Møller (2003), particularly for older individuals in the breeding population, is unknown.

Provision of typical meat-based paste (i.e. farm feed), as compared to the provision of a more texturally complex daily diet has been shown to increase signs of fur chewing and SB in wintertime, likely through the lack of functional chewing opportunities in the current system (Malmkvist et al., 2013). The inability of mink to perform natural foraging behaviours, in combination with feed restriction during wintertime, is one of the most important hazards causing abnormal behaviour on farms. Only anecdotal evidence exists on farmed mink feeding on carcasses (e.g. readily eating day old chicks fed in complex enclosures (Erlebach, 1989; Kuby, 1982), but also reluctance to feed from carcasses in farmed mink or observations of opportunistic hunting events in farmed mink witnessed by experts). Therefore, further research is needed to ascertain whether carcass-feeding impacts the welfare of farmed mink.

Inadequate feed delivery presents another hazard for the consummatory phase of foraging behaviour. As mentioned above, Díez-León et al. (2017) reported a preference of mink to eat in a more natural body position compared to eating standing on hindlegs, as on fur farms (EFSA, 2025). In addition, inadequate floor type is considered a hazard for the consummatory phase of foraging behaviour, as feed might fall through if not of adequate and/or increase the risk of caching in the nestbox.

- **Feed restriction (increasing foraging motivation and/or prolonged hunger)**

Farmed mink are often fed diets designed for high energy availability from fat (Hynes & Rouvinen-Watt, 2007) in amounts that may exceed energy requirements (Dick et al., 2014), since larger animals result in large pelts, which might be a desirable trait for farmers (Thirstrup et al., 2017; Villumsen & Lund, 2018). Access to more feed than the animals can consume is not considered a problem, but the resultant obesity may represent a welfare concern, as both over- and under-weight mink are known to develop insulin resistance (Fink & Børsting, 2002; Rouvinen-Watt, 2003) and liver issues such as fatty liver syndrome (Dick et al., 2014). The latter has been found to arise particularly when animals are offered large amounts of energy-rich feed followed by rapid slimming (accomplished by fasting) in the production year (Dick et al., 2014). Female breeders are known to show glyceria, i.e. excretion of glucose in the urine, in the perinatal period (Bis-Wencel et al., 2018) or at all stages in the reproductive cycle (Hynes et al., 2004) due to obesity. Mink with 'heavy' body condition scores are particularly susceptible to this condition (Bis-Wencel et al., 2018). Increased concentrations of glucose in the urine are a risk factor for dehydration and energy loss in lactating females (Hynes et al., 2004). History of obesity (leading to insulin resistance) is also a predisposing factor for nursing sickness, a metabolic disorder with high mortality in lactating mink females (Rouvinen-Watt, 2003). Thus, the authors suggested that females should be maintained in moderate body condition through appropriate feeding/management to avoid morbidity or mortality from the disease. For reproduction, several studies both on research farm (Malmkvist, Sørensen et al., 2016b) and across commercial farms (Bækgård et al., 2007) reported improved reproduction and lower kit mortality in mink dams of intermediate BCS compared to thin and fat mink dams.

Although the heritability of litter size is relatively low (as in most multi-bearing mammals, around 10% (Thirstrup et al., 2017), mink have been selected for litter size, resulting in larger litters than in the wild mink population (see EFSA, 2025) for average wild and captive litter sizes). Thus, farmed mink dams often have fewer teats than the number of offspring in their litter (e.g. only 8–10 teats, Malmkvist et al., 2016b). This is, however, less of a problem in a species like mink (compared to, e.g. pigs) as the milk letdown and nursing is not synchronised and kits therefore can share teats. However, large litters exert a metabolic burden on the resources of the dam, leading to problems in sustaining a large litter through the entire lactation period from birth to 7–8 weeks. Since dams are more burdened by the energy demands of lactation with a larger litter, it is suggested that kits be fostered out to dams with smaller litters to create more even litter sizes

(Rouvinen-Watt, 2003). It is also suggested that early weaning may prevent nursing sickness (Rouvinen-Watt, 2003), but as discussed in Section 3.3.6.1, early weaning compromises the long-term welfare of kits and can be temporarily stressful for dams.

Annual slimming of females prior to breeding is known to be practiced at some European farms. According to reports for 2017–2019 in (Henriksen et al., 2022), feed restriction, begins in winter followed by approximately a week of ad libitum feeding leading up to mating in late winter/early spring. This period impacts mink welfare negatively due to prolonged hunger being a negative affective state combined with the inability to perform foraging behaviour motivated by the hunger state.

The feeding motivation and metabolic rate of mink increase in decreased ambient temperatures (MacLennan & Bailey, 1969). Consequences of restricted feeding and subsequent weight loss are increased performance of SB (Axelsson et al., 2009; Hansen et al., 2007; Hansen & Damgaard, 2009), running activity (Hansen et al., 2007), increased signs of fur chewing (Hansen et al., 2007; Malmkvist et al., 2013) and increased concentration of plasma cortisol (Hansen & Damgaard, 2009) in mink females. Slimming may also to some extent be practiced in males (EFSA, 2025), but potential consequences of this practice in males constitute a gap in knowledge, as most studies have focussed on the females (typically outnumbering males by 5:1 after pelting until delivery).

For both sexes, high-stereotyping mink often have lower body weights than low-stereotyping mink despite all other management aspects remaining the same (Malmkvist et al., 2011; Svendsen et al., 2007), likely due to greater expenditure of energy and higher levels of circulating cortisol (playing a role in the mobilisation of energy (Mormède et al., 2007). Stereotypic mink are known to lose the most weight over winter (de Jonge & Wassink, 2000a, 2000b, as cited in SCAHAW (2001).

3.3.3 | Sensorial under- and/or overstimulation

As explained in Table 4, this WC is originally called 'Sensorial under- and/or overstimulation' in the EFSA guidance (EFSA AHAW Panel, 2022) but is here subdivided into two separate sections (sensorial understimulation and sensorial overstimulation) to enhance clarity of the content.

3.3.3.1 | *Description of sensorial understimulation*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as fear, discomfort due to visual, auditory or olfactory understimulation by the physical environment'.*

Interpretation for mink. For mink, this WC was chosen due to both types of sensorial stimulations, however with different hazards. When kept for fur production, both the size of the cages and their barrenness imply sensorial understimulation. However, sensorial overstimulation may also be present. Especially mink kept in social housing (pairs or groups) (relevant for Scenarios 2 and 3) may experience this WC, if they cannot retreat from sensorial input from their conspecifics.

As mink in the wild spend a large proportion of their awake time in locomotion associated with territory defence and hunting, they are adapted to daily periods of a high degree of stimulus processing and activity (EFSA, 2025) divided by longer periods of low activity and rest. The WC Sensorial understimulation applies to all scenarios in this SO (with the exception of kits during the early lactation period, as they have no auditory and visual ability). The comparison of standard cages similar in size (but barren) to those currently in use in Europe revealed changes in types of resting behaviour (e.g. more behaviours indicative of boredom-like states in mink, Meagher & Mason, 2012, but cf. Polanco et al., 2021).

Limited or absent resources and unchanging cage environments lead to chronic understimulation (sometimes interpreted as boredom – defined by Meagher et al. (2013) as '*an unpleasant emotion including suboptimal arousal levels and a thwarted motivation to experience almost anything different or more arousing than the behaviours and sensations currently possible*') in farmed mink (Meagher et al., 2013, 2017; Meagher & Mason, 2012; Polanco et al., 2021). There is evidence in the literature that abnormal behaviours like fur chewing are linked to understimulation (Hansen et al., 1998), resulting in over-expression of other behaviours like self-grooming. For example, Svendsen et al. (2013) found that mink showing signs of fur chewing had higher FCM while also being more explorative/less fearful towards novel objects, and Svendsen et al. (2013) found that signs of fur chewing could be reduced by environmental enrichment, however this finding is not consistent across studies. Malmkvist et al. (2013) hypothesised that the effectiveness of biting ropes and coarsely ground feed in mitigating fur chewing may be attributed to the enhanced stimulation these items provide, as evidenced by mink showing a preference for newly introduced ropes over those provided the previous day, and by the daily variation in the composition of their ground feed as described in Section 3.3.2 to allow a more 'natural or species specific' consummatory behaviour than providing feed on the top of the cage which is common practice in the current system (EFSA, 2025).

Maybe comparably, adult mink provided with complex enrichment (multiple play/climbing objects, access to open water etc.) had decreased levels of waking inactivity compared to non-enriched mink in standard cages (Meagher et al., 2013). This form of inactivity is proposed to reflect understimulation or states comparable to boredom, since it occurs at higher levels in mink kept in non-enriched cages and can decrease when mink are moved to enriched housing (Meagher et al., 2013). Research before Canada's 2013 mandatory enrichment mandate showed that mink in barren housing were more likely to explore novel and even aversive stimuli, indicating chronic understimulation (Meagher et al., 2017; Meagher & Mason, 2012). Post-mandate studies found this tendency persisted, though less strongly, in mink with minimal resources compared to those with complex enrichment (Polanco et al., 2021). Notably, signs of understimulation decreased within just 2–12 days of exposure to complex enrichment, suggesting rapid improvements are possible.

Whether physical outdoor access with or without open water, or whether access to outdoor stimuli alone without physical interaction (i.e. shifting seasons, visual, auditory and olfactory experiencing surroundings) have a similar or different effect on the WC Sensorial understimulation for mink is unknown. In the current system, it might make a difference from a welfare perspective, whether a mink is situated in the outer or the inner row of a mink shed, as for example, in North American commercial farms, light levels are markedly lower for mink in the middle of a row (Ahloy-Dallaire, 2015).

In addition, EFSA experts agreed that hazards for Sensorial understimulation overlap to some extent with WCs Restriction of movement as (Section 3.3.1), and Inability to perform exploratory or foraging behaviour (Section 3.3.2).

3.3.3.2 | *Hazards leading to sensorial understimulation*

Hazards for the WC Sensorial understimulation overlap with the WC Restriction of movement and WC Inability to perform exploratory or foraging behaviour (see Sections 3.3.1.2 and 3.3.2.2).

3.3.3.3 | *Description of sensorial overstimulation and linked WCs*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as fear, discomfort due to visual, auditory or olfactory overstimulation by the physical environment'.*

Sensorial overstimulation applies mainly to group housed juveniles and to dams with kits in the late lactation period, especially with large litters. In standard cages, the amount and variability of sensory stimulation is limited due to space limitations and a narrow range of different resources (EFSA, 2025). However, at the same time there is a high degree of visual, acoustic and olfactory stimuli from other mink in the same or neighbouring cages. This high animal density is very different to the living conditions of mink in the wild (EFSA, 2025). However, adaptation to a certain degree of social tolerance may have developed during the domestication process (see Section 1.2.1.2; EFSA, 2025). Hence, although there is a risk for under- as well as overstimulation, the impact of understimulation is considered more severe in EFSA experts' opinion.

In addition, EFSA experts agreed that Sensorial overstimulation is linked to another WC, **Group stress** as defined by EFSA AHAW Panel (2022). Hazards for sensorial overstimulation overlap to some extent with WCs restriction of movement, soft tissue lesion and integument damage (Section 3.3.5) and handling stress (Section 3.3.6).

3.3.3.4 | *Hazards leading to sensorial overstimulation and linked WCs*

- **Disturbance of the diurnal rhythm of activity and rest, including human disturbance**

In the wild, mink are crepuscular, with peaks of activity in the morning and evening (EFSA, 2025). This has also been observed in juvenile mink in outdoor enclosures (Schwarzer et al., 2016). The same study also observed increased activity during feeding times in the morning and afternoon, indicating human influence on the circadian rhythm of the animals. Hansen et al. (1994) reported the primary activity period of female farmed mink fed ad libitum to be from 04:00 to 10:00 a.m. Even though the study did not recognise food anticipatory activity, feeding at noon interrupted the resting period. When fed restrictively, mink adjusted their daily activity rhythm to the expected feeding time and anticipatory activity was observed (Hansen & Møller, 2008). There is evidence that SB increases before feeding time (Axelsson et al., 2009; Hansen et al., 2007; Mason, 1993; Vinke et al., 2002).

- **Handling**

See Section 3.3.6 on Handling stress.

- **Small cage size resulting in over-crowding when dams are kept with their litter**

Depending on litter size and timing, when kits become bigger in proximity of weaning sensorial overstimulation and group stress can occur in the current system due to limited space available. Delayed separation of the dam from her kits beyond nutritional weaning (e.g. at maximum 10 weeks of age) can increase the stress level of dams and promote fearful temperament traits in offspring (reviewed by SCAHAW, 2001), which may be due to prolonged forced proximity and inability to get away from their kits as they would in the wild. Thus, it is likely that weaning, i.e. separation of the dam and kits, at some point before 10 weeks post-partum would be needed in current system to preserve dam welfare in breeding conditions (as proposed by Brink & Jeppesen, 2005).

In support of this, dams in the presence of kits perform increasing amounts of SB from week 4 to 8 post-partum, which can be interpreted as increasing frustration when the kits get older (however, the authors alternatively consider that SB may increase across this period since kits need less care, allowing the dam more time to perform SB (Brink & Jeppesen, 2005). Similarly, on a North American farm, dams housed with their kits until postnatal week 6 used more the provided 'get-away bunks' (elevated wire mesh half-cylinders attached to the cage ceiling) as kits aged, showing increased motivation to temporarily move away from their kits (Dawson et al., 2013). This behaviour was also shown in dams housed in climbing cages, who used the elevated portions of the cage, out of the kits' reach, more as kits aged (Lidfors et al., 2012). Dams with elevated bunks have also been observed resting more and stereotyping less (Dawson et al., 2013) or tending to stereotype less (Buob et al., 2013) than dams without them. Bunk use was also found to be related to litter size, as it was greater in dams with larger litters (Buob et al., 2013).

There is also evidence for less suckling of kits nearing 8 weeks of age, due to a reduced number of active nipples and lower nipple surface temperatures compared with earlier weeks (Malmkvist, Sørensen et al., 2016a). Since body condition and weight of dams did not differ between the 7 week and 8 week weaning groups and there was no evidence of nipple inflammation or irritation, it is unlikely that removal of the kits at 8 weeks of age has stressful or exhaustive or stress/exhaustive effect on dams.

Litter size had greater impact on maternal welfare than weaning age in the above study: dams with litters of seven kits or more vocalised less following separation than those with smaller litters, and larger litters were associated with greater declines in dam body weight and condition, as well as increased SB (Malmkvist, Sørensen, et al., 2016b). SB has been shown to increase during periods of hunger in dams (Hansen & Møller, 2008; Svendsen et al., 2013; Vinke et al., 2002), which may be the source of increased SB in dams with higher metabolic demands due to lactation. In females, higher SB is also found with reduced body weight (Damgaard et al., 2004; Hansen & Møller, 2008; Jeppesen et al., 2004; Svendsen et al., 2007) and higher concentrations of plasma cortisol (Malmkvist et al., 2011; Svendsen et al., 2007).

It has been suggested that feed competition between dam and kits may increase with litter size and kit age (Malmkvist, Sørensen et al., 2016b). This is consistent with findings that dams housed with their litters until 8–11 weeks postpartum exhibited higher level of SB than in those separated earlier 7 weeks, and this difference increased with litter size. Indeed, aggression is observed to increase when whole families are left together in standard cages until 11 weeks postnatally (Mason, 1994). Similarly, Pedersen and Jeppesen (2001) reported that when dams were kept with their litters in 'family housing' beyond nutritional weaning (up until late autumn), dams had higher plasma concentration of cortisol, more fur defects, scars and bitten teats than females traditionally separated from their kits at weaning. Under experimental settings, family-housed dams weighed more than single-housed dams and stereotyped less (Pedersen & Jeppesen, 2001), which is interesting considering that greater housing densities are thought to increase competition for feed. A similar family housing paradigm found that family-housed mink showed lower levels of ABMs indicative of physiological stress (i.e. by measures of adrenal weight and adrenal cortex response to ACTH) than mink housed in male–female sibling pairs (Hänninen, Mononen, et al., 2008).

Dams with get-away bunks, as described above, were less likely to have clinical signs of mastitis than dams without get-away bunks (Dawson et al., 2013), suggesting that less opportunity to escape kits results in more health issues arising from nursing. Noteworthy, this result is variable since Buob et al. (2013) provided the same get-away bunks to dams and did not find decreases in clinical signs associated with mastitis.

- **Close proximity of conspecifics in adjacent cages**

In mink kept individually, brief visual contact between neighbouring single-housed mink has been shown to decrease aggression in animals who were later placed together, while females visually isolated from other mink had delayed gonadal and follicular development and/or did not come into oestrus, and visually isolated males exhibited increased exploration/motivation for stimulation (SCAHAW, 2001). Meanwhile, Polanco et al. (2018) found that adult male mink typically avoided proximity to neighbouring mink, and that males directed stereotypic scrabbling towards neighbours who were close to the shared cage partition. Moreover, scrabbling SB was significantly increased in mink with all-male neighbours and could be effectively reduced by removing these neighbours (Polanco et al., 2018).

- **Same-sex pair housing and group housing of juveniles**

See Section 3.3.5 on WC Soft tissue lesions and integument damage.

3.3.4 | Welfare consequences in relation to absence of open water

The reasoning for including a separate Section concerning open water in mink and its welfare implications is explained in Section 1.2.

3.3.4.1 | *Description of the welfare consequences in relation to absence of open water*

As described in in EFSA (2025), mink are biologically adapted to a life in terrestrial and aquatic habitats (sometimes called 'semi-aquatic lifestyle') and interact behaviourally with sources of open water[16] (e.g. swim or explore, Table 7) if this resource is provided. The debate on whether access to open water represents a behavioural need (and, therefore, significantly affects welfare

[16]**Open water** is defined in this opinion (consistent with also EFSA AHAW Panel, 2023) as a water resource of any size and depth which has a freely accessible surface (i.e. not a drinker). It may have different features, for example a small dish, a larger basin or a deep pool. Water can be static or flowing. Considering the variety found in the literature, details summarising the main features are provided during the discussion of each of the studies reported.

of farmed mink) has been ongoing for the last two decades following a seminal paper (Mason et al., 2001) where mink were found to be willing to pay high costs to get access to this resource and experienced physiological signs of frustration when access was denied (see below for details in this and the research that followed). For mink kept for fur production, lack of open water may be relevant for four out of the five selected highly relevant WCs: **Restriction of movement**, **Inability to perform exploratory or foraging behaviour**, **Inability to perform play behaviour** and **Sensorial understimulation**.

This section describes the current knowledge on the welfare of mink with or without access to open water. In addition, this section describes the current knowledge on lack of access to open water as a potential hazard for the four WCs in mink.

Interpretation for mink. The current system provides mink with drinking water through drinking nipples or drinking cups, with automatic or manual systems (EFSA, 2025) but there is no presence of other sources of water (i.e. open water). Potential WCs as a result of being kept without access to open water apply to all scenarios of this SO except for kits before a certain age. Mink kits have been safely provided with access to open water from 35 days of age (Díez-León & Mason, 2016). Swimming behaviour in mink kits was first documented on day 49 (Sabass, 2014) and at 60 days of age (Kuby, 1982). Most studies on open water access have been performed in juveniles after weaning (Scenario 3, Schwarzer et al., 2016), however there are experimental studies on mink dams and kits (Scenario 2) with access to open water from birth (Nowak, 2014; Sabass, 2014) and also in adult mink (Scenario 4, Brandl, 2014).

WC: Restriction of movement

The absence of open water, and the type and accessibility of open water, can influence the WC Restriction of movement due to the type and quantity of behaviours that can be expressed in or near the water. It is currently unclear whether these behaviours are specific needs or rather means of assessing resources or exploring the open water source. Depending on its area, open water can allow behaviours such as swimming, diving and head dipping. A range of explorative behaviours around the water edge has also been described in farmed mink (Schwarzer et al., 2016).

Reported use of open water in studies of mink kept in large, enriched aviaries

Studying the behaviour of 40 mink (not individually identified) with access to a pond, a creek and a pool, Schwarzer et al. (2016) observed animals in and near the water for approximately 7 min per hour (corresponding to 12% of time), and more than 3 min per hour (corresponding to 5.5%) exclusively in the water during the main active time of the day. The size of the three water resources studied was 20.5 m^2 (rectangular 'pool', depth approximately 30 cm), 4.9 m^2 (a round 'pond', depth approximately 80 cm) and a 10.0 m long, 40 cm wide and 3.4 cm deep 'running creek' with a surface area of 4.0 m^2.

TABLE 7 Examples of behaviours of mink performed in or near different types of open water.

Behaviours	Illustration	Specification of the open water source features
Mink observing water surface while walking along the edges	 ©Ludwig-Maximilians-University Munich, Germany  ©Ludwig-Maximilians-University Munich, Germany	Round water basin, surface area 4.9 m^2, 80 cm deep

TABLE 7 (Continued)

Behaviours	Illustration	Specification of the open water source features
	 ©Ludwig-Maximilians-University Munich, Germany	Rectangular water basin, surface area 1 m^2, 30 cm deep
Head Dipping	 ©Ludwig-Maximilians-University Munich, Germany	Pool approx. 15 cm deep in a 10 m × 40 cm running 'creek'
Swimming		Natural basin, dimensions not available.
Mink entering in the water to dive	 ©Ludwig-Maximilians-University Munich, Germany	Rectangular water basin, surface area 20.5 m^2, 30 cm deep Rectangular water basin, surface area 20.5 m^2, 30 cm deep

(Continues)

TABLE 7 (Continued)

Behaviours	Illustration	Specification of the open water source features
Walking on and digging in ice	 ©Ludwig-Maximilians-University Munich, Germany  ©Ludwig-Maximilians-University Munich, Germany	
Social play	 ©Ludwig-Maximilians-University Munich, Germany	Round water basin, surface area 4.9 m^2, 80 cm deep
Drinking from open water surface	 ©Ludwig-Maximilians-University Munich, Germany	

In her thesis, Sabass (2014) conducted 24 h continuous video observation of mink dams (n = 5 and 8 in two consecutive years) with their litter (from birth until 56 days post-partum) and group housed juvenile mink (n = 80 and 48 in two consecutive years, group sizes between 3 and 6 animals) from July to November in enriched aviaries (2 × 2 m floor area, 2 × 0.5 m open water, box with sawdust, elevated platforms, climbing branches, nest box) There was a large inter-individual variation in swimming activity between the dams. Swimming activity of the juveniles was seen on average for 123 s/ 24 h (= 0.14%)

for females and 49 s/24 h (= 0.06%) for males. Females swam more than males. Further, in males, swimming behaviour negatively correlated with age. Large individual variation was also observed in juveniles. The mean duration per swimming bout was 23 s (± 1) for females and 23 s (± 3) for males. The open water was used for both social and solitary play behaviour. Four out of thirteen dams observed showed SB, whereas 1/128 juveniles exhibited SB during the single observation day.

Reported use of open water in studies of mink kept in modified and enriched cages

In two studies, Hansen and Jeppesen (2001a, 2001b) kept adult mink in cages constructed of either three combined mink cages (total cage area 0.81 m^2) or three combined fox cages (total cage area 2.34 m^2). In each of these environments, the floor of the middle cage was changed into a 15 cm deep open water basin. The animals lived in these cages all their life. The first study (Hansen & Jeppesen, 2001a) included 80 adult mink. During 2 weeks in August, the authors scanned the behaviour of the animals during the activity peak in the morning hours and in the late afternoon, with scans at 10 min intervals, giving a total of 141 observations per animal, 69 in the morning and 72 in the afternoon. Feeding took place 30 min after termination of the morning observations. Overall, at least one animal was observed in the water seven times. While performing the rounds of observations, animals not being observed at that moment were both seen and heard entering the water. This is likely expected, as short-lasting and infrequent behaviours can be underestimated by the use of scan sampling observation techniques (Lehner, 1992).

In the second study, the authors selected 11 females from the first study, six of which were classified as heavy users of water. These had been noted to enter the water every day during the previous experiment. The other five had never been observed swimming. Of the 11 animals, six were in the large cages and five in the small ones. The behaviour of the animals was observed continuously for 24 h in August. As expected, the 11 animals showed large individual variation in their use of the open water. For example, the number of swims varied from 0 to 177 in the 24 h period.

In a study investigating the use of open water across seasons, an increased use of the open water during winter (when it was frozen) was found, attributed by the author to the novelty of the element and the possibility to maintain extra space available in the enclosure (Mohaibes et al., 2003). And, as mentioned above, regarding mechanisms underlying effects of environmental enrichment, it has been hypothesised that resources may benefit animals through the option of using them, regardless of how often they are actually used (Bakken et al., 1994; Decker et al., 2023). Thus, even when not used to a large extent, adding resources (such as open water, as in the experiments described above) to the environment of animals may still have value.

Linked WC: Inability to perform play behaviour

As mentioned above, mink have been observed to perform play behaviour in the presence of open water, more than during access to platforms only (Vinke et al., 2005). Lack of enrichment, including access to open water, can contribute to the WC Inability to perform play behaviour. The size of the water basin can influence social play of juvenile mink. Irrespective of sex, in the case study by Sabass (2014), in a 2 × 0.5 m × 30 cm open water (within a 2 × 2 m aviary), following continuous 24-h observations, two minks were observed to swim together in 7% (± 2.4) of the swims, and no observations of more than two juveniles swimming together occurred. In the study with large and complex open water resources, and involving many more animals per group, Schwarzer et al. (2016), observed that open water was used by groups of 10 or more juvenile mink at the same time.

WCs: Inability to perform exploratory or foraging behaviour and Sensorial understimulation

Access to open water can induce exploratory behaviour. Therefore, the absence of open water and the type and accessibility of open water can influence the WCs Inability to perform exploratory or foraging behaviour and Sensorial understimulation. When access to open water was provided to mink, their uses or interactions with the water often involved head-dipping and other exploratory behaviours in or near the water (Schwarzer et al., 2016). Hansen and Jeppesen (2001a) suggested that inspection of the water from above (peering into the water), accompanied by head-dipping or submergence of the upper abdomen, resembles wild foraging behaviour that mink perform when searching for food ('prey detection behaviour'). Similarly, as illustrated in Table 7, mink may increase their interaction with water resources once the water is frozen and may be interpreted as a novel stimulus in their environment. In such a situation, the ice may offer different information-gathering opportunities and promote exploratory behaviour.

In addition to terrestrial behavioural elements, in her thesis Nowak (2014) observed the following water-related behaviours: swimming, diving, head dipping and walking along the water edges while observing the water (see Table 7). The mink dams in the study used approximately 5% of their time spent outside the nest box at the water (e.g. head dipping, patrolling along water), equivalent to an average of 10.6 min of the 211 min spent outside the nest box per day. In another thesis, Sabass (2014) studied the behaviour of 24 juvenile mink (50% males and 50% females) from eight litters kept in groups of three animals of the same sex post-weaning in similar aviaries as those in Nowak (2014) (2 × 2 m floor area, open water 1 m^2 and 30 cm deep, three nest box, one saw dust box, climbing and elevated resting facilities). From the 13th to the 30th week of life, mink spent on average 75% of a 24 h period inside their nest boxes. Of the remaining 25% of the time outside the nest box, they spent on average 2.5% (9 min) in or at the edge of the water basin (Sabass, 2014). The time spent in water amounted to a few minutes daily.

Open water can be provided to mink enclosures without directly impacting their health (Brown, 2013; Nowak, 2014; Sabass, 2014; Schwarzer et al., 2016). Open water presents a dynamic, ever-changing enrichment allowing for the expression of a range of different motivated behaviours. Parameters such as the proximity of the nest boxes in relation to open water, and whether or not the animals are fed in the water might have an influence on their preferences and the overall welfare relevance of open water as a resource, yet these questions remain unstudied.

Studies exploring the need of mink to access open water

Operant conditioning and motivational studies

In the attempt to understand the need of mink for open water, motivational studies tested the amount of work that the animals will perform to access open water, in comparison to other resources. This type of study aims at quantifying motivation in an experimental set-up, not focussing on mitigation of WCs.

In a series of publications, Mason and co-workers (Cooper & Mason, 2000, 2001; Mason et al., 2001) studied the motivation of mink to access resources (Cooper & Mason, 2000, 2001) such as feed, nest box, platform, straw/hay, toys, open water and additional empty space. Before the operant conditioning test, the mink had no experience with open water, but each mink received 2 days of exposure to the test apparatus with unrestricted access to all eight compartments prior to testing over 5 successive days. The size of the open water resource varied slightly but was large enough to allow mink to swim (size approximately 150 × 50 × 15–20 cm; L × W × D). In short, animals were conditioned to perform a specific action (pushing a weighted door) to access the resource. To measure motivation, researchers systematically increased the effort or cost required for the animal to obtain the resource (the weight required to open the door), with motivation to 'pay' the higher cost equating the value of the resource.

The study mentioned in both Cooper & Mason (2000, 2001), the authors used 6 mink (3 males and 3 females) of approximately 6 months of age. For testing, the mink were housed individually in standard cages but with access to a number of additional resources in a so-called closed economy test arena. In the context of operant conditioning studies in animal welfare, a 'closed economy' refers to an experimental setup where an animal's access to resources is limited to the rewards earned through task performance. In other words, resources are not freely available outside of the test conditions.

The test arena included the home cage and seven additional cages, each connected by a wire corridor. The resources for which the mink could work for access were (i) an empty cage, (ii) a box of hay, (iii) open water (1.5 m × 0.5 m size, 15–20 cm deep), (iv) a platform, (v) a cylinder, (vi) novel objects, (vii) the home cage (with feed and drinking water ad libitum) and (viii) small manipulable toy items. In the study, entry and exit to each compartment was restricted by a one-way door, which weighed 50 g without weights. During testing, the placing of the resources was varied between the individual mink. All entry doors (except the home pen) were given a weight ranging from 0 to 1000 g (in a random order). The results suggest that mink may reschedule their time with different resources when the cost increases, but novel objects, a nest box with hay, and open water appeared more attractive for mink than a platform and cylinder and more space (i.e. an empty cage).

Although such methodology appears intuitive, methodological pitfalls requires attention (as discussed by for example in (Cooper & Mason, 2001; Hansen & Jensen, 2006a, 2006b). For example, as found in the study, and later concluded by Cooper and Mason et al. (2001), animals may compensate for the increased cost of access with longer visit duration. Furthermore, observation of the behaviour of animals during testing has shown that resource interaction can be more intense once the animals have overcome higher costs. As a consequence, measures based on time with the resource need to be interpreted in terms of these methodological aspects and may thus not be a true reflection of the value of different resources.

An alternative approach is the study of the maximum price paid by the animals (as proposed by Mason et al. (2001) and Cooper and Mason (2001). Mason et al. (2001) present results from a somewhat similar experimental set-up, discussed further also in Cooper and Mason (2001). Their study involved 16 adult mink and doors weighing up to 3000 g. In addition, feed was removed from the home cage and placed in its own resource compartment. The authors described that since feed was not provided elsewhere in the test arena and is expected to be an important resource, they believed the price paid to enter the feed compartment would act as a yardstick with which to compare the maximum price paid for other resources. The animals had unlimited access to the resources in terms of time, when the door had been opened.

In accordance with the expectations, the weight mink were willing to push to access feed and open water did not differ. The paper did not include methodological details but reported that the mink worked least hard for the manipulable items and tunnels (mean maximum price of 1281 ± 515 g and 1312 ± 403 g, respectively). Mink worked hardest for the open water (2000 ± 605 g) and the feed (2062 ± 602 g). The price paid for the remaining resources was intermediate. This indicates that animals placed a higher value on feed and open water than on other resources (Cooper & Mason, 2001; Mason et al., 2001). Further, the authors concluded that mink found the open water more valuable than all the other resources, as it 'attracted the greatest total expenditure and had the highest reservation price, greatest consumer surplus measures of utility and the most inelastic demand' (Mason et al., 2001).

Their conclusion was also informed by the finding that urinary cortisol increased only following deprivation of open water (i.e. blocking access), but the same did not happen with other resources, apart from feed (Mason et al., 2001). Deprivation of feed or access to open water significantly increased urinary cortisol levels in mink by approximately 50% and 34%, respectively, with no significant difference between these two physiological responses, interpreted as indicators of physiological stress. Blocking access to other resources (e.g. platforms, toy items) did not elevate urinary cortisol. The urinary cortisol increases correlated with heightened physical activity, especially when access to the open water was denied ($R = 0.70$, $p = 0.005$). However, significant increases in activity were only observed during food deprivation. See Table 5 on the recent knowledge about the possibilities to interpret indicators of HPA-axis activity or reactivity in terms of animal welfare.

The studies by Cooper and Mason (2000, 2001) and Mason et al. (2001) observed that as the cost (e.g. weight pushed) to access certain resources increased, mink spent more time using the resource once accessed but made fewer attempts to reach it. This behavioural adjustment suggests that mink strategically re-scheduled their activities to maintain access to valuable resources. These findings were anticipated and interpreted as follows: resources perceived as low in value, which were associated with lower costs, were not defended and thus exhibited high demand elasticity.[17] In contrast, high-value resources (e.g. open water and hay boxes) were defended and characterised by low elasticity, indicating their essential role in the welfare of the animals.

In another study, Hansen and Jensen (2006a), standardised the reward that animals work for in terms of access and time. The authors tested the motivation for adult female mink to reach a running wheel or open water (area: 0.27 m^2, depth 28 cm) placed in a box, that would be hoisted up to the cage of the mink when the price was paid. This methodology was used to construct demand functions for each of the two resources using operant conditioning techniques. The mink had to press a lever to gain access for 2 mins to the open water or to the running wheel. The study consisted of four experiments where: (1) mink had access to only one of the two resources; (2) mink had access to both resources at the same time; (3) mink had to work for one of the resources while they were given free access to the alternative resource; (4) running wheel was tested in comparison to full or empty water box as a control. Hansen and Jensen (2006a) concluded that mink value these two types of resources equally highly, and both were valued higher than an empty box. Simultaneous access to both resources did not affect the elasticity (i.e. the value of the resource, as the cost animals were willing to incur to access the resource did not vary) of either swimming water or running wheel.

Moreover, mink did not increase their use of the free running wheel as the price of open water was increased, or their use of free open water as the price of the running wheel increased. Therefore, the two resources did not appear to substitute each other. Additionally, mink used the wheel more than the open water. Thus, the results obtained in this way (testing work to access resources and time spent using them) provided additional insights on the type of underlying motivation. Use of the running wheel appeared more linked to sustained locomotory activity, while open water seemed to fulfil other motivations such as the possibility to perform exploratory behaviours and to provide opportunity for complex cognitive stimulation.

Hansen and Jensen (2006a) also tested motivation to access running wheel, straw and open water when the reward was only 1 min of access. The results confirmed that mink are willing to work equally hard for running wheel and open water, but less for straw. Additionally, the two resources (running wheel and open water) did not appear to substitute for each other, even if the running wheel was used more by mink than open water.

Studies comparing behaviour of mink with or without access to open water and effects on SB

While motivational studies have highlighted the motivation for mink to access open water, studies comparing housing with and without access to open water show varying results in terms of the beneficial effects of access to open water quantified by ABMs such as SB.

As described above, Hansen and Jeppesen (2001a) kept adult mink in cages constructed of either three combined mink cages (total cage area 0.81 m^2) or 3 combined fox cages (total cage area 2.34 m^2) rebuilt so that the floor of the middle cage was changed into a 15 cm deep open water basin. Half of the animals had access to water in the basin, the others had access to an empty basin. Based on the behavioural scans described above, and a detailed ethogram defining different types of SB, the authors recorded behaviour in the following categories: active, inactive, eating, scratching or performing stereotypy. On average, the animals were active for 17.5% of the observations and spent 71.2% of the observations in the nest box. The mink were observed to perform stereotypy in 13.5% of their active period, and 3.9% of the total observations were classified as SB. No differences in the occurrence of SB were found between mink with and without access to the open water resources.

Similarly, Vinke et al. (2006) measured anticipatory behaviour and SB in mink raised and housed in the presence and absence of open water. The experiment included 56 mink, each housed in three connected cages (total area of 0.77 m^2) with access to a straw-filled nest box, a platform and a plastic cylinder. From 6 weeks of age, half of the animals had access to a water basin made of aluminium (measuring 103 cm L × 75 cm W ×, 45 cm water depth). Each basin was shared by two mink, but they could not mix and could not see each other use the open water. The observations of anticipatory behaviour and SB were done when the mink were 16 and 22 weeks of age for the anticipatory behaviour, and in February–March the following year for the observations of SB. For half of the 28 animals raised with access to the open water, the behavioural observations of SB took place after 2.5 months of deprivation from the water. The major findings of the experiment were: (1) no difference in anticipatory behaviour between mink reared and housed in the presence or absence of open water; and no significant difference in anticipatory behaviour after removing the water for 2.5 weeks, (2) no significant difference in SB in the presence, absence or after 2.5 months of deprivation from open water. Regarding anticipatory behaviour, a

[17]In ethology, elasticity refers to the degree to which a behaviour can change in response to environmental or developmental factors, such as experience, learning or social context. It reflects the flexibility or adaptability of a behavioural trait, as opposed to being rigid or fixed.

reduction in this behaviour in the presence of open water would have indicated that animals were less sensitive to rewards than water-deprived animals, thereby indicating better welfare.

Conversely, other studies showed a reduced occurrence of SB in mink provided with open water compared to mink without this resource. Mononen et al. (2008) observed that mink housed with access to open water (approximately 1.2 m^2 and 17 cm deep basin) performed significantly less SB than mink housed in cages without this access. Ahola et al. (2011) found that mink provided with 0.61 m^2 approximately 30 cm deep open water from approx. 10 weeks of age developed less SB and spent less time performing SB (10% vs. 29% of active time, respectively) than mink raised similarly but without access to such an open water resource.

Studies that investigate use of smaller open water sources across seasons showed that mink use the water in a higher percentage of observations when the water is frozen over as opposed to during hot seasons (e.g. 0.35% and 0.60% in July and September–October increasing to 9.5% when the basins were partially frozen, Mohaibes et al., 2003). Unfrozen water may be used for only brief durations at a time as well, with average swimming bout durations of 2–55 s observed by Hansen and Jeppesen (2001a), and mink may be reluctant to cross water-filled portions of the cage or limit their number of cage crossings when crossing entails entering the water (Hansen & Jeppesen, 2000a). These results informed that, when open water is provided, it should be placed such that the mink can move around it to access the other enclosure compartments or reach other enclosure resources without having to cross into the water.

The reported results of behavioural differences, or lack of differences, between animals kept in cages with or without access to open water should be interpreted with caution, as the cage environment may still be inadequate despite the addition of open water (as other studies that have provided open water in addition to increasing enclosure size and availability of resources might suggest (Díez-León et al., 2016; Schwarzer et al., 2016). It is essential to consider not only the presence or absence of open water, but also its specific characteristics, accessibility, and the extent to which mink are able to utilise it and move around and also avoid it. Moreover, the type of observational method employed may influence the outcomes and potentially lead to misleading conclusions. A thorough evaluation of the multiple variables in the reviewed studies is therefore necessary.

In **summary**, when mink have the opportunity, they may interact behaviourally with sources of open water (e.g. swim or explore at the water edge), and have been found to pay a high cost for access to open water, indicating a high motivation for accessing this resource (Hansen & Jensen, 2006a; Mason et al., 2001), highlighting that mink value access to open water.

At least one study indicates that the strength of motivation for accessing open water is higher than for other resources and similar to feed, whereas others have indicated that the intensity of motivation for access to open water did not differ from that for a nest box with hay and social contact with another mink. Another study showed that the work paid to access a running wheel or open water did not differ, but mink worked harder for both of these than for an open cage. Additional results suggest that the two resources (running wheel and open water) cannot substitute each other, and that the motivation to reach a resource was not related to the time spent in active behaviours with the resource.

The absence of open water, and the type and accessibility of open water, can to some extent influence the WC Restriction of movement due to the type and quantity of behaviours that mink then do not express in or near the water. It is currently unclear whether these behaviours are specific needs or rather means of assessing resources or exploring open water sources. Some studies comparing the occurrence of ABMs such as SB in mink with or without access to open water show that access to open water is associated with less SB, but there are also inconclusive studies.

From the data reported, locomotory activity in open water (e.g. swimming) is limited in mink (not swimming on a daily basis), but the role of open water on exploratory behaviour and in providing cognitive stimulation seems more predominant. Open water seems to fulfil motivations such as the possibility to perform exploratory behaviours and provide opportunity for complex cognitive stimulation.

Therefore, the absence of open water, and the type and accessibility of open water, can influence the WCs Inability to perform exploratory or foraging behaviour, inability to perform play and sensorial understimulation due to the lack/limitation of water-related stimuli to exhibit species-specific exploratory behaviours. The absence of open water, and the type and accessibility of open water, can influence the WC Restriction of movement due to the type and quantity of behaviours that can be expressed in or near the water.

3.3.4.2 | *Hazards leading to the welfare consequences associated with lack of open water*

The selected WCs, as well as the linked ones, in relation to lack of open water are listed in Section 3.4.4.1. The hazard lack of open water involved two aspects discussed below: (i) insufficient space for behaviours in or near water; (ii) lack of physical complexity of the cage, including substrate and open water.

- **Insufficient space for behaviours in or near water**

In the current system, the available space is not enough to allow the addition of open water resources. The provision of open water is directly linked to the space provided for animals and for more complex resources. Even if it is not possible to completely disentangle these two aspects, the latter is discussed under the hazard 'Lack of physical complexity of the cage, including substrate and open water'.

An overview of the types of behaviours that can be performed near or in open water is reported in Table 7. It should not be considered as an exhaustive list. The size of open water may have welfare implications for mink, but most studies are made with access to small and shallow water baths and only a few with access to larger and more complex water resources. There is a lack of studies systematically comparing access to open water of different sizes without confounding from other factors. This is a gap in knowledge.

- **Lack of physical complexity of the cage, including substrate and open water**

Overall, the results of the studies presented above on behaviour of mink with or without access to open water indicate that general exploration and e.g. object play – rather than specific behavioural patterns such as head dipping or swimming per se – may add to the enrichment value of the open water. In addition, the studies suggest that open water fulfils other motivations than simply locomotion (e.g. exploratory and foraging), and that changes in the water status (e.g. freezing) provide elements of novelty to mink.

As introduced above, to investigate negative effects of absence of open water, studies compared the effects of deprivation from access to open water. Deprivation from open water has been shown to have adverse effects on the performance of SB and signs of fur chewing: during a 4 month period of deprivation from access to a water resource (a 25 cm diameter water bowl) after having been raised with it, mink showed more SB and more signs of fur chewing on the tail than mink raised without access to such open water resource (Vinke & Spruijt, 2001). This finding is thought to indicate that depriving animals of access to open water can be more harmful to their welfare than never experiencing this resource. In the same line of thinking, Warburton and Mason (2003) showed the strong effect of resource cues on the motivation of animals to access a certain resource. Similarly, SB levels were increased following temporary removal of access to a 0.61 m^2, 30 cm deep open water and then relieved by renewed access to the water, compared to renewed access to large, empty cage components, which had no relief effect (Ahola et al., 2011). This possibly indicates that frustration (and hence SB) is increased more acutely when the revoked resources have more enrichment value (Ahola et al., 2011). Interestingly, though, the authors note that no such increases in SB were observed when the water resource froze over, which may be because the mink still had access to the extra cage component in which the water was located, and thus a maintained increase in cage space may dampen the effects of water removal and provide elements of novelty to the environment. Similarly, scrabbling/digging behaviour of mink when blocked from either a 0.27 m^2, 15 cm deep water source or an extra cage compartment indicated that the animals may experience similar frustration when either of these resources is revoked (Hansen & Jeppesen, 2000a).

3.3.5 | Soft tissue lesion and integument damage

3.3.5.1 | *Description of soft tissue lesion and integument damage and linked WC*

Definition from EFSA AHAW Panel (2022): *'The animal experiences negative affective states such as pain, discomfort and/or distress due to physical damage to the integument or underlying tissues, e.g. multiple scratches, open or scabbed wounds, bruises, ulcers, abscesses and feather or hair loss. Across farmed animals, this WC may result from negative social interactions such as aggression, tail-biting or feather pecking, from handling or from damaging environmental features or from mutilation practices (e.g. beak trimming, de-toeing, de-horning, tail docking)'.*

Interpretation for mink. In mink, this WC may result from for example negative social interactions such as aggression and be recognised as, for example, scratches, open or scabbed wounds, bruises, ulcers or abscesses. Other causes for the soft tissue lesions and integument damage might be related to the housing of mink.

Regarding fur chewing, despite hair being part of the integument, for the purpose of this SO, hair loss/damage in itself is not considered an ABM of this WC unless the removal of hair is associated with lesions causing these negative affective states. Therefore, hair loss or damage caused by fur chewing is considered the result of an abnormal behaviour and is described in Section 3.2.1 and used as ABM (Table 5) when relevant for a certain WC.

Hazards related to cage structures (e.g. floor type) apply to all scenarios.

Aggressive interactions in mink can cause hazards when mink not kept individually because it results in bite-related injuries (Hansen & Houbak, 2004; Møller et al., 2003). In Scenario 2, the occurrence of skin lesions on kits before weaning increases with the age. Identified hazards for kit skin lesions are large litters, limited access to drinking water and being female (Hansen et al., 2015; Malmkvist, Schou, et al., 2016; Malmkvist, 2019).

In Scenario 3 (juveniles), particularly when mink are housed in groups (i.e. more than two animals per cage), there is an increased risk of bite marks on the leather side of the pelt observed after pelting.

These lesions can be identified either as visible scratches, wounds or scars on live animals, or in the pelts.

According to the scores of 2014 mink farms during WelFur assessment between 2017 and 2019, mink farms achieved an average score of 92.4 (sd 6.81) for the absence of injuries, i.e. skin lesions or injuries on the body (score from 0 to 100 from worst to best per mink farm for the criterion (Henriksen et al., 2022). The prevalence of animals showing injuries, based on direct observations conducted during the WelFur assessments in the same study, was reported for three distinct periods: Period 1 (adult breeders during winter) showed an injury prevalence of 0.7% (n = 281,013 mink assessed); Period 2 (adults and kits during reproduction) had a prevalence of 0.5% (n = 1,215,368); and Period 3 (adults and juveniles from late September to pelting) recorded the highest prevalence at 1.7% (n = 447,991).

It is important to note that the scoring method used involves observing mink from outside the cage. Combined with the presence of dense fur, this approach may decrease the visibility of lesions and therefore underestimate prevalence of the lesions.

Other studies instead reported the prevalence of bite marks in the pelts, characterised by tooth punctures and melanocyte-related black spots, on the leather side of the pelt, as detailed by Alemu et al. (2016), see also Figure 5. Such bite marks are a clear indicator of aggression and represent a significant welfare issue in farmed mink.

Linked WC: Group stress

The WCs Soft tissue lesions and integument damage is linked to the WC Group stress. Group stress is defined as the animal experiencing negative affective states resulting from a high incidence of aggressive and other types of negative social interactions in animals, often due to competition for resources, e.g. feed (EFSA AHAW Panel, 2022).

As explained above, when mink are kept in groups, group stress may increase the risk of soft tissue lesions and integument damage, as aggressive behaviour among cage-mates can result in lesions of the skin or other parts of the body (Hansen, 2011).

Although, as reviewed by EFSA (2025), in certain periods of the year, mink have a social tolerance (e.g. during the mating season, dams with litters pre-weaning), in nature the animal is solitary living during adulthood. For adult mink, as mentioned above, the WCs Sensorial overstimulation and Group stress may result from the proximity of conspecifics in neighbouring cages (Polanco et al., 2018). However, evidence of stress caused by social proximity in farmed mink is limited. Especially group housing of more than two individuals (male and female) post-weaning in the same cage without the possibility to retreat is a hazard for the WC Group stress and consequently for lesions and wounds caused by biting (Hansen & Damgaard, 1991; Pedersen et al., 2004). Pair-housing of juvenile male–female pairs is less problematic, probably due to the difference in body size, and as in nature males and females may also share the same territory.

3.3.5.2 | *Hazards leading to soft tissue lesion and integument damage and linked WC*

- **Overcrowding in standard cages before weaning**

This hazard applies to Scenario 2 (dam with kits). During pre-weaning, when mink kits are still suckling, mink kits from large litters show more signs of aggression measured as number of bite marks scored at pelting (Hansen, 2011; Malmkvist, Schou, et al., 2016) as a result of competition for resources. This effect is compounded by the inability to escape conspecific aggression (from siblings or dam; see Section 3.3.1). Crusts and lesions (see Figure 4) can probably be a risk for pre-weaning mortality in kits; however, large-scale data are not available. After weaning crusts and lesions typically heal after a couple of weeks (Hansen et al., 2015), and are not visible at pelting, taking place several months later.

FIGURE 4 Example of mink kit before weaning with skin lesions/crusts, typically located in the neck region (©Aarhus University, Denmark).

- **Lack of additional drinking water easily accessible for kits before weaning**

This hazard applies to Scenario 2 (dam with kits). Malmkvist et al. (2016) report that while mink are still suckling (i.e. before artificial weaning), providing mink – particularly those from large litters – with additional drinking sources reduced the number of injured kits. Further, Brink et al. (2004), and Brink and Jeppesen (2005) studied 432 kits (equally divided in male and female) from 72 litters in standard cages. In half of the cages, the drinking point was located next to the entrance of the nest box; in the other half, it was located at the far end of the cage. All nipple drinkers had a system that made it easier for the kits to use and released water into a small drinking cup when activated. This system led to the kits starting to use the nipple drinkers earlier and to less saliva licking from the mother. Each litter was observed until day 56. Saliva licking was reported from the age of 21 to 26 days, increased from 21 to 38 days, entered a stable level from 33 to 44 days, after which it declined. A similar pattern appeared for agonistic behaviour (threats, aggression or submissive behaviour) of the kits, with an increasing phase from 27 to 38 days, followed by a stable phase from 33 to 44 and a declining phase from 39 to 56 days.

- **Same sex pair housing and group housing**

This hazard applies to Scenario 3 (juveniles). Pair-housing of juvenile and sub-adult mink with a sibling, or with the mother, is currently the standard in most European farms (EFSA, 2025), as this type of housing has been shown to have benefits for juveniles mink instead of individual housing. This is particularly the case if male–female juveniles pairs are housed together, as it aids in sexual behaviour development (Ahloy-Dallaire & Mason, 2017), as well as reducing the risk of aggression (de Jonge et al., 1986; Hansen & Houbak, 2004). In a comparison of mink kept in for these reasons, housing male–female juveniles is also the norm in the current system (EFSA, 2025).

Studies have shown that group housing of mink in the growing season increases aggression, and the occurrence of bite marks observed on the leather side of the skin after pelting (Figure 5). Hansen et al. (2014) validated this ABM as indicator of aggression by showing that experimentally applied pressure on the skin can be recognised as bite marks at pelting.

FIGURE 5 Pelts of dead mink, shown from the leather side (turned inside out). The top picture shows tooth punctures and melanocyte-related black spots which are bite marks from other mink. The top picture is from a group housed mink, the picture in the bottom from a mink kept with only one other mink in the weeks up to pelting (©Steen H. Møller, Aarhus University, Denmark).

As part of their validation of bite marks as an ABM of aggression in mink, Hansen et al. (2014) examined to what extent the marks accumulate over time by placing 120 brown and 40 white juvenile mink in groups of four in climbing cages after weaning. Every second week (at the age of 20, 22, 24, 26 and 28 weeks) group housed mink were moved to single housing in standard cages in order to prevent further bites from cage mates. At the age of 29 weeks, all mink were killed individually by CO_2 and the pelts were examined for bite marks. The results showed that the longer time mink were kept in groups, the more bite marks could be observed on the leather side of the pelt.

Pedersen et al. (2004) shows results from a comparison of mink housed from weaning and until pelting in a standard cage ($N=24$ pairs of M + F sibling with one wooden nest box, one platform and one drinking point), three cages connected horizontally ($N=24$ litters of 4–10 animals per group and access to three nest boxes, one platform and three drinking points) or a climbing cage ($N=24$ groups of 2M + 3F siblings with access to one nest box, two platforms and one drinking point per group). The space allowance (cm^2 per animal) varied considerably across the three systems: space allowance per animal was 1350 cm^2 in the standard cages, 900 cm^2 in the climbing cages, and between 2025 and 810 cm^2 in the horizontally connected cages. All mink were fed for ad libitum intake. During visual inspection in October, juvenile mink housed in pairs showed lower rates of tail injuries (29% vs. 42% and 50%) and no mortality (0% vs. 11% and 9%) compared to those housed in groups. However, total body injuries (including hind and fore parts/neck) were similar across all housing types, with about half of the animals affected in each group. Based on their findings, the authors concluded that juveniles kept in group housing systems had worse welfare due to aggression and lesions and proposed that further research should be conducted on both the space allowance and the availability of resources, including feeding places and nest boxes.

In a study involving 798 mink kept in groups of four (either same sex or mixed sexes) in stacked cages with different resources such as platform, tube) or in pairs (always same sex) in standard cages (all cages provided with at least one nest box), Hansen and Houbak (2004) counted bite marks on the leather side of pelts after pelting and observed lower scores for mink kept in pairs as compared to the group-housed animals and higher scores for same sex groups than for groups of mixed sexes. In addition, Vinke et al. (2005) compared pair housing in standard cages with group housing in a row cage consisting of three standard cages and found more bite marks among the group housed individuals. However, in this study there was not more aggressive behaviour observed, and aggression did not lead to a higher mortality or severe injuries in the group housed animals.

Later, Hänninen, Ahola, et al. (2008) compared a total of 156 juvenile mink kept in either pair housing (1M + 1F sibling in standard cage) or groups kept in three standard cages connected horizontally (3M + 3F siblings with access to three nest boxes and fed on each of the three cages) ($N=39$ animals of each sex in each treatment). Social interactions of the animals, including fights, threatening or biting another animal as well as social play, were observed during 24 h in August (dispersal time) and in November, but only analysed as one behavioural category. Taking both observation months together, there was no overall difference in the frequency of social interactions between the groups, but the frequency decreased more from August to November in pair-housed than in group housed mink, leading to difference between the groups in

November where a larger number of social interactions were observed among the pair-housed animals. In addition, at pelting, scars on the leather side of the pelts were counted on a scale from 0 to 5.

Group housed animals had more scars (average score 2.9 ± 0.25) in the pelts than pair-housed (average score 1.7 ± 0.21) mink. In a somewhat comparable study, Hänninen, Mononen, et al. (2008) compared families of mink kept either as juveniles and the dam in connected cages (6–10 animals per group, three to five connected cages depending on group size, from 6 weeks of age, nest box with each cage and feeding on each cage) or as dam with sibling pair (M + F) from weaning at 8 weeks of age. The behaviour of the mink was observed during 5 days between August and November, always involving 3 h of daytime observation. No aggressive acts were observed. At pelting, severity of scars assumed to be caused by biting, was scored following same methodology as described in Hänninen, Ahola, et al. (2008). The group housed kits had more bite scars (score 3.5 ± 0.2 for males and 4.3 ± 0.2 for females) than the kits housed in a pair with the dam (males 1.1 ± 0.1, females 1.3 ± 0.1), indicating that aggression may have been more common in family-housed than pair-housed kits, despite the lack of observation of the behaviour as such.

In one study, no difference between group housing and pair housing in terms of bite marks were found. Axelsson et al. (2017) studied the effect of group housing on the occurrence of bite marks in 330 juvenile mink on a commercial farm. From approximately 8 weeks of age, all mink in the study were kept in one of four types of group housing: The groups consisted of pairs of mink (1M and 1F) in standard cages, pairs of mink (1M and 1F) in climbing cages, groups of three (1M and 2F) and groups of four (2M and 2F) in climbing cages. The climbing cages consisted of a standard cage with a similar cage on top. All standard cages were equipped with a wire mesh platform and a plastic cylinder placed loosely on the wire mesh floor. In addition, the upper floor of the climbing cages was fitted with a wire mesh platform. All cages were provided with a nest box and drinking water for ad libitum intake. For scoring the skins were divided into four parts. On each part, bite marks were graded as: 0, 1–5, 5–20 or > 20 and then summarised into an ordinal scale from 0 to 12. No pelt reached a score higher than 4. For the statistical analysis the authors report that the data were grouped into a binomial scale (0 = no black spots, 1 = black spots from 1 to 4). With this simplification of the data, no differences were found in the number of bite marks on the leather side of the skin between standard and climbing cages or between group sizes.

Housing mink in trios (1M-2F) in vertically interconnected cages (climbing cages, as described in EFSA (2025) was also found to result in more bite marks than housing mink in male–female sibling pairs in similar cages (Olofsson et al., 2014).

A scientific report (Møller et al., 2013) summarises the advantages and disadvantages of group housing in mink, which is relevant to adult and juvenile mink from the age of 12 weeks. The report concludes – in relation to welfare – that avoiding group housing would: (a) reduce aggression; (b) reduce competition for cage resources such as feed and nest box; (c) result in fewer lesions; (d) reduce mortality during the group housing period, including less need for human-intervention or killing of affected mink; (e) give easier surveillance of the individual mink, making preventive interventions easier; (f) reduce infection pressure. This conclusion reflects that group housing is associated with a higher level of severe aggression (fighting) (Møller et al., 2013).

Bite wounds from cage mates in the growth period have been reported as a cause of mortality in group housing of mink after the age of dispersal. In comparison, mink housed in pairs have mortality rates due to bite wounds between 0% and 0.1% (Møller and Berg, 2011).

The variability in the studies of group housing versus pair housing has been discussed considerably in the scientific literature. Hänninen, Mononen, et al. (2008) suggested that discrepancies across studies may be due to mink skin colour type and farm stock differences in temperament (e.g. colour type differences in bite mark frequencies were found by Pedersen and Jeppesen (2001)). Overall, scientific evidence suggests that group housing in the current system, which typically involves climbing cages or three standard cages in a row, increases the risk of bite marks and may lead to mortality due to increased aggression.

- **Lack of sufficient space and lack of resources to avoid competition and provide escape opportunities**

This hazard applies to Scenario 2 and 3. Lack of sufficient resources per mink, particularly for dam and juveniles in large litters during the pre-weaning period, increases the risk of agonistic interactions that might lead to integument damage. For example, Hansen et al. (2011) found that distributing food more evenly (in three locations rather than one) resulted in reduced number of bite marks (assessed at pelting). Provision of multiple resources (e.g. platforms that can allow mink to distance from each other, as in Buob et al., 2013; or highly valued enrichment items, as reported by Hansen et al., 2011) might have similar consequences on risk of integument damage, although this remains unstudied. However, in the current system, the limited space available might not be enough to allow for the provision of additional resources while accommodating large litter sizes.

- **Floor type**

This hazard applies to all scenarios. According to Jespersen et al. (2016), performing postmortem (after pelting) pathological examination of mink from 4 Danish farms (selected for a history of foot lesion problems) 425 out of 808 male mink and 93 out of 254 female mink had foot lesions predominantly at the plantar metatarsus at the time of pelting. The majority were hyperkeratosis (36%), followed by hair loss and crusting. The (heavier) males were more affected than females. Juveniles before pelting (thus after fattening), and light colour types were more affected than adults and dark colour types, respectively.

Jespersen et al. (2016) proposed an apparent mechanical pathogenesis due to physical external pressure resulting from the bearing of body weight on wire mesh floors. The authors assumed that the wire mesh floor of the mink cages was a major contributor to the changed conditions of the foot pads, and although the authors acknowledged hyperkeratosis to be multifactorial (e.g. dietary deficiencies or irritation by free hairs in the environment), these factors were ruled less likely to have caused the specific pattern and location of callusing observed. As callosities in humans and other animal species tend to worsen with age if mechanical causes persist, the authors suggest that affected animals are excluded from (further) breeding. As this was a study on the foot pathology, information on restriction of movement, locomotory disorders and lameness of the animals was not reported. Based on recordings from the WelFur protocol, involving data from 261,655 animals, Henriksen et al. (2021) reported that 28 of the animals (0.001%) were scored as being lame or showing signs of impaired movement (defined binary as yes/no to '*moving normally including all clinical signs of lameness, impaired movement or paralysis*' and not discriminating between levels of severity). The scoring in the WelFur protocol is not done as part of a gait test as such but takes place when the animals are outside the nest box. From the results of Jespersen et al. (2016), highly active and heavy animals – rather than more inactive mink - are expected to be at risk, if the movement is induced on wire-mesh only (due to pressure and friction between foot and surface).

3.3.6 | Handling stress

3.3.6.1 | *Description of handling stress and linked WCs*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as pain and/or fear resulting from human or mechanical handling (e.g. sorting and vaccination of newly hatched chicks, loading/unloading, catching and crating of animals to be transported, inversion)'.*

Interpretation for mink. In mink, this WC results from human handling in all scenarios of this SO. In addition, EFSA experts agreed that it is linked to the WC **Separation stress** (as defined by the (EFSA AHAW Panel, 2022) for Scenario 2. In this SO, Handling stress was identified among the five most relevant WCs for Scenario 1 (male and female adult breeders) only, as animals are exposed to more types and more frequent handling than those in the other scenarios. However, it was considered a relevant WC for all mink kept for fur production due to potential fearfulness and the lack of habituation towards sporadic, adverse handling procedures (Bak & Malmkvist, 2020; Korhonen et al., 2000; Malmkvist & Hansen, 2001, 2002). It was also linked to the WC Inability to avoid unwanted sexual behaviour in Scenario 1 (male and female adult breeders) because of handling required for moving females repeatedly to males' cages.

On farm, most experience with human is based on a positive event (daily feeding) rather than negative contact. In terms of physical contact with humans, mink are subjected to procedures such as weaning, relocation, mating, vaccination, toe clipping for medical reasons, disease surveillance and fur grading (Mathiesen et al., 2019; Supporting information SF1; EFSA, 2025), which all involve human handling and likely induce stress (Hansen & Damgaard, 1991; Korhonen et al., 2000) and potentially also fear (Bak & Malmkvist, 2020). Some procedures, like toe clipping and vaccination, are acute stressors and may be temporarily painful. Methods for obtaining blood samples, as venous puncture, are not used in mink in current farming conditions, although they have been described for laboratory settings (Hem et al., 1998).

Mink vary in their response to handling but will show resistance to it and may try to avoid or escape from it. Forced handling may induce defensive aggression towards the human handler (Malmkvist & Hansen, 2002). Therefore, catching mink over a certain body size and age for handling is usually performed using a sturdy leather glove into which the mink may bite without harming the handler (Figure 6) (Supporting information SF1, SF2). Oher reported practices are the use of cages (Figure 6) or grasping with metal body tongs (Supporting information SF2). Across all scenarios, the duration of each handling event is usually relatively short and the prevalence varies (EFSA, 2025).

Mink kits (up to 4–5 weeks or older) are easier to handle (Nowak, 2014), as young kits lack the ability to move away from a human handler, e.g. during counting and sexing of the litter. From day 1 of age, repeated handling of these young kits combined with being away from the dam/siblings induces distress call (Brandt et al., 2013). From approximately day 26 after birth, it is possible to see signs of habituation in terms of reduced distress calling in response to handling in retested vs. naïve mink kits (Brandt et al., 2013). Thus, mink have the capacity to habituate to human handling; however, this may be of little relevance in practice given the sporadic, non-identical handling events typically seen under production conditions.

In a study involving female mink, Bak and Malmkvist (2020) reported that a short-term negative handling experience (being caught and kept in a small trapping cage for 15 min) resulted in a shift towards a more fearful temperament score as evidenced by a lower approach score in a standardised stick test the following day. In contrast, positive experience induced signs of curiosity and reduced fear. The same study reported a 27% increase in avoidance distance during a 30 s standard test after the annual fur grading procedure, indicating heightened fear responses to routine farm handling. Thus, negative handling results in more avoidance in mink. Fearfulness (in contrast to curiosity and exploration) has in other studies been linked to a higher HPA-axis activation in terms of plasma cortisol and FCM, e.g. (Malmkvist et al., 2003, 2019; Malmkvist, 2015).

3.3.6.2 | *Hazards leading to handling stress and linked WCs*

- **Handling and restraint during production procedures in the farm setting**

Catching, trapping and immobilisation

Catching, trapping and immobilisation of mink are known to elicit physiological responses indicative of stress. For example, trapping and handling can elevate stress markers, such as FCM and induce hyperthermia, as measured by increased rectal temperatures (Korhonen et al., 2000; Malmkvist et al., 2011). Particularly, animals selected (by a stick test) for high level of fearfulness on a research farm showed persistent temperature increase across repeated trapping and handling events, while the confident ones showed decreased temperatures (Korhonen et al., 2000), suggesting that fearful animals are more reactive towards the stress of handling and do not adapt as well to repeated handlings as confident counterparts. These findings highlight the responses associated with trapping and immobilisation and the need for welfare-focused handling protocols.

Kits are currently dewormed and vaccinated against multiple diseases around the time of weaning or just before (6–7 weeks of age), e.g. botulism (Vinke et al., 2004, 2005, 2006), viral haemorrhagic enteritis and haemorrhagic pneumonia (Wlazło et al., 2021). All these procedures, alongside re-vaccination for animals intended for breeding and toe clipping for blood samples for medical reasons (Mathiesen et al., 2019), represent handling events, the total frequency of which is relatively high.

Toe clipping

The procedure is used to obtain blood as part of programmes for farm control of infectious diseases such as plasmacytosis and is a veterinary procedure performed in mink. Frequency and prevalence of toe clipping seems largely variable, depending on disease surveillance practices in the different countries or on veterinary needs, but not rare or uncommon.

FIGURE 6 Example of handling practices in mink for fur grading and moving (©Stanisław Łapiński).

Handling and relocating females

The practice of repeatedly catching and relocating females (i.e. placing them in males' cages) throughout the breeding season for natural mating is a stressor and especially if the female is not receptive. Females are paired with the same male or different males several times over the weeks of the breeding season, sometimes twice in 1 day and males may be paired with up to four females in 1 day (EFSA, 2025).

In a study performed in a Polish commercial farm Seremak, Pilarczyk, et al. (2023), Seremak, Wojciechowska, et al. (2023) observed behaviour of female and male mink during mating. The authors describe that males may demonstrate varying levels of interest in the female, resulting in varying lengths of time between the entry of the female to the start of copulation. The precopulatory behaviour focused mainly on mutual sniffing, rubbing and the mink chasing each other around in the cage. Some females were described to take a defensive posture, trying to avoid contact with the male, making it difficult for him to grasp the neck with the teeth or trying to free themselves from his grip during copulation. Others demonstrated an interest in the male and a willingness to mate. These behaved calmly and allowed the male to mount them. Some females seemed to try to encourage the male by rubbing against him with their whole body, despite him not being interested. It cannot be excluded that unwilling females experience affective states such as fear (Korhonen, Jauhiainen, & Rekilä, 2002; Meagher et al., 2013), associated with the inability to escape an unwanted conspecific in the cage environment. This requires timely intervention from farm staff to avoid undue stress and fear. Based on observations of standard mating sessions, the occurrence of overt aggression during mating trials was low and noted in less than 0.5% of 908 observed mating trials (Spangberg & Malmkvist, 2010).

Mink selected for low levels of fear are easier to mate than unselected or mink with a high level of fearfulness, as observed in 269 mink during their first breeding season (Malmkvist et al., 1997). In case of non-willing females, both the male and the female mink may react with aggression and hisses/scream, keeping a distance between each other. In results based on direct observations in Spangberg and Malmkvist (2010), the duration of copulation was longer during 2nd (mean 78 min) than during 1st (mean 50 min) mating attempt. Signs of negative welfare were mainly evident in non-successful attempts and shown by for example hisses/screams (3.9% of scanning observations), flight (0.8%), aggression (0.5%) or SB (7.2%). Chuckling sounds (interpreted as positive signs) and explorative sniffing were also part of the mating trial events.

- **Fearful mink temperament**

McMahon et al. (2022) stated that biological mechanisms allow behavioural traits to persist or be flexible within an individual, stressing the relevance to know the physiological profile of temperaments. Korhonen, Jauhiainen, and Rekilä (2002) tested the effect of fearful or confident temperament on whelping, by identifying two groups of mink ($n = 100$ per group). Animals pertaining to each group were selected using the stick test (i.e. fear response measured by a standard-sized wooden tongue spatula introduced through the cage wire by a human standing outside the cage) (Hansen & Møller, 2001). After analysing video-recorded behaviours, two main differences were identified between the temperament groups: (a) fearful mink were more likely to stay in the nest box at the approach and during the proximity of the experimenter and (b) confident mink tended to show more stationary behaviours (Korhonen, Jauhiainen, & Rekilä, 2002).

Also, a moderate negative correlation was found between whelping results (i.e. litter size) and frequency of SB in multiparous fearful females, whereas the opposite occurred in primiparous fearful ones (Korhonen, Jauhiainen, & Rekilä, 2002). Data showed that a relevant dichotomy in temperament (i.e. confident vs. fearful) remains in farmed mink, with better whelping results in confident individuals. Thus, it was advised to encourage selection for temperament on farms to produce more confident animals (Korhonen, Jauhiainen, & Rekilä, 2002). However, other researchers have broadened the categories of the above-mentioned stick test into fearful, explorative, aggressive or unresponsive (Hansen & Jeppesen, 2006; Meagher et al., 2011), or validated an alternative version called the glove test, utilised for example to investigate fearfulness among mink of different coat colours (Meagher et al., 2011).

In another study, after an initial testing (54-times scan over 4 days for SB and one stick test), 48 confident female mink were allocated to Pavlovian conditioning (i.e. 12 high and 12 low SB individuals were conditioned to get cat food on a spoon, whereas another 12 high and 12 low SB individuals were being caught in a trap, taken out of the cage and released back to it again). The results confirm that the temperament is a rather stable individual characteristic (Hansen & Jeppesen, 2006). Regarding the linkage between SB and fearfulness, high SB animals were more confident (Hansen & Jeppesen, 2006), as noted by previous studies that mentioned their lower base levels of plasma cortisol.

Thirstrup et al. (2019) analysed the heritability of exploratory/fearful behaviour and the identification of genetic correlations with other relevant traits in over 26,000 mink, born in three consecutive years, by live grading them in November in their first year of life. Male and female behaviour was considered as the same trait due to their close genetic correlation, although males exhibited a nonsignificant tendency to be more exploratory. Moreover, no genetic correlation between behaviour and fertility, litter size or kit survival was found, with a minor effect of common litter variation on phenotypic variation (5%), suggesting that nest environment affects post-weaning exploratory or fearful behaviour. It was also noted that mothers' age had an effect on offspring's behaviour since kits from experienced mothers (i.e. at least 2 years old) tended to be more exploratory than those from primiparous ones (Thirstrup et al., 2019). Similar results can be found in a master thesis in which confident mink had shorter latency to contact stimulus conspecifics, fewer showed agonistic exploration and less time in a 'half out of nest box' position (Gjøen, 2019).

In terms of environmental enrichment, Bak and Malmkvist (2020) investigated the influences of the provision of simple cage resources and short-term events (i.e. negative, neutral or positive) on fearfulness and exploratory behaviour. Six hundred pair-wise housed mink were allocated to barren or enriched conditions for 4 weeks prior to exposure to one of three short-term events (neutral, positive or negative). Findings showed that mink in the enriched group had a more exploratory behaviour, indicating that physically enriched housing reduces negative states such as fearfulness. Another study was carried out by Clark et al. (2025), dividing almost 250 dams into three experimental groups: standard housing, enriched at whelping or enriched kits. All of them were given standard nest-building materials, while those enriched at whelping received additional premium materials and a hanging sisal rope. The study measured animal temperaments with a stick test, showing no apparent differences between the three treatments. In general, there was a relatively low occurrence of fear behaviours in the sample, with approximately 20% of kits demonstrating struggling, biting or urinating during handling (Clark et al., 2025).

- **Lack of habituation to humans**

SCAHAW (2001) pointed out the relevance of forming a positive human–animal relationship (HAR) in both adults and kits, reducing fearfulness and, thus, improving animal welfare. Waiblinger et al. (2006) argued that a high quality HAR would require a certain level of positive human contact, most likely to happen in husbandry systems with regular, intense and long-term human contact. In a report to the Norwegian authorities, Akre et al. (2008) discussed possibilities for positive HAR in mink and emphasised the importance of predictability. In Denmark, mink farmers are legally required to select breeding animals based on temperament, specifically favouring confident and exploratory individuals while excluding fearful ones.

3.4 | Preventive and mitigating measures

This Section addresses preventive and mitigating measures for the WCs identified in Section 3.3.

In the following sections, mitigating measures for each WC are described, taking into consideration their individual hazards. In general, addressing individual hazards delivers only limited mitigation of the overall WC, and only changes addressing several individual hazards can provide substantial mitigation, as summarised at the end of each WC section.

3.4.1 | Restriction of movement and linked WC

In the current system, the WC Restriction of movement **cannot be prevented or substantially mitigated** because of lack of space, wire mesh floors on the entirety of the cage floor surface, and inability to access the nestbox for large individuals and/or limited number of resting places available.

- **Insufficient floor area to allow motivated types of active behaviours, including locomotion and play, and insufficient cage height and structural complexity of the cage**

In addition to space required for static behaviours, mink have a requirement for space to perform dynamic behaviours such as various types of locomotion. Where juvenile mink or dams with their litters are housed with conspecifics, space to perform appropriate social behaviours (including social play, escape and avoidance of aggression) is also required.

Since locomotion (including running) is a key component of foraging and exploratory behaviour and locomotor play, these behavioural patterns would appear to be highly motivated. Therefore, how much space is required for this needs to be considered. This section tackles increases in floor area that address the needs for (i) general active behaviours and locomotion; and (ii) specific exploratory and foraging behaviours.

Assessing the potential for increasing floor area to mitigate the WC Restriction of movement is not straightforward, as most studies that compare the welfare effects of different floor areas on mink welfare also modify other aspects of the cage environment (e.g. animal density, enrichment, etc.) and thus introduce confounding factors. There are only a handful of studies that have investigated whether the provision of additional floor area per se improves the welfare of farmed mink. In the only studies available considering European standards, free access to additional space (up to four times increase compared to the current floor area (Hansen et al., 1994, 1998) did not significantly impact mink welfare.

Hansen et al. (2007) provided free access to an additional cage to both enriched and non-enriched mink (from the juvenile period until mating) and neither SB, signs of fur-chewing or plasma cortisol levels were affected compared to animals housed at the standard floor areas. Further, when access to the second cage was removed, the animals did not show signs of reduced welfare measured by the same ABMs. Ahola et al. (2011) compared whether the welfare of single-housed juvenile mink (from weaning until pelting) differed in cages with standard floor areas or cages with access to larger floor areas (0.61 m^2) without additional resources. Their third treatment involved access to larger and enriched floor areas. The mink in the larger, barren cages showed intermediate levels of SB compared to the other two treatments, suggesting that tripling floor areas provides mitigation, but it is not enough to substantially mitigate the WC of Restriction of movement which requires combining floor area increases with access to resources enrichment (e.g. open water, tubes). In operant conditioning tests, mink value access to an empty cage (0.18 m^2) relatively less than compartments with other resources (e.g. open water, nest boxes, food, (Mason et al., 2001). However, the tested additional space was very limited, and with no additional resources to promote the mink's interest, which can explain the results obtained in the study.

Hänninen, Ahola, et al. (2008) studied whether group-housed (group size of six) juveniles kept in three interconnected cages (and with access also to three nestboxes) experienced improvements in ABMs of welfare (SB, bite marks, adrenal function) compared to pair-housed juveniles in standard floor areas (thus confounding density and group size). Mink housed in the interconnected cages showed a lower incidence of SB and bite marks, although no differences in adrenal function were found. Jonasen (1987), cited by Nimon and Broom (1999), found no such effects of cage size, and de Jonge and Stufken (1999) also found that females in standard or experimental, double-size, two-level cages did not differ in SB or in signs of fur chewing.

The available data, based on the reduction in SB, suggest that doubling or even tripling the size of current cages does not promote substantial reduction of SB (see Section 3.3.1), and therefore does not provide substantial mitigation of this WC. Based on the review of all available studies, EFSA experts are of the opinion that even if floor areas were to increase to the areas used in experiments (Jeppesen et al., 2004), and experimental settings of Díez-León et al. (2013, 2016), Díez-León and Mason (2016), Meagher and Mason (2012) or those in Nowak (2014) (see Section 3.3.1.1 for details) an increase in floor size alone without adding further complexity would not substantially mitigate this WC.

In contrast, the provision of enriched spaces contributes to mitigating the WC Restriction of movement by allowing mink to engage in qualitative and quantitative aspects of active behaviour and locomotion. Main motivators for movement in mink are access to resources, e.g. for foraging (Hansen et al., 2007), and possibilities to interact with conspecifics and explore their surroundings.

Some qualitative aspects of active behaviour can be mitigated in the current system without the need for additional space by adding resources that fulfil components of foraging or nesting behaviours (e.g. biting rope and other chewing items, straw). Beneficial effects of such enrichment have been shown, for example by Jeppesen et al. (2004). The study reported less SB and reduced signs of fur chewing on ears and tail (reduced from 60% to 20%), as well as reduced fearfulness scores in animals having a combination of platforms, a loose tube/biting rope or biting briquettes for 6 weeks before/after weaning (Scenario 2, 3 – weaning at 8 weeks in the study). However, confounding factors such as breeding for temperament and different management should be accounted for (Hansen et al., 2007).

The EFSA experts recognise that only a few hazards of Restriction of movement can be mitigated to a limited extent by enrichment added to the current cages. To allow the expression of other active behaviours and especially locomotion, space limitations become critical. Enabling active behaviours and locomotion and thereby mitigating Restriction of movement requires more functional space for resources and free space for locomotion than is available in the current system.

One example of a means that would contribute to substantially mitigate the WC Restriction of movement is the addition of running wheels, which, due to the needed diameter to allow free walking and running in the wheel, cannot be fitted within the width of the wall in the current cage. The provision of a running wheel has been demonstrated to reduce SB in adult females in Scenario 1 (SB 12%–17% in controls to 0% in running-wheel group, based on 24 h video recording (Hansen & Damgaard, 2009). Likewise, Malmkvist et al. (2024) – using a non-SB control group, and before-after temporary access to running wheels rather than a non-enriched control – reported that all forms of SB, except licking SB, were significantly reduced in the SB group during 10 days of running wheel access (Scenario 3; single-housed adult females). Control mink (not expressing abnormal behaviour before the study started) also used wheels for running activity, showing motivation to use running wheel also in non-SB mink.

In both the study by Malmkvist et al. (2024) and a study by Hansen and Damgaard (2009), running wheels were used by 100% of the animals under study, but not by all to the same extent. High-stereotyping females were observed to use running wheels more than low-stereotyping females (with use peaking at the end of the feed-restriction period in winter and reaching the lowest points when mink were fed ad libitum in summer), and greater running wheel use was reflected by higher plasma cortisol levels in both high-stereotypy and low-stereotypy mink (Hansen & Damgaard, 2009). This result is thought to be attributed to increases in activity (as cortisol is involved in energy mobilisation during activity; Mormède et al., 2007).

Provision of running wheels can prevent (Hansen & Damgaard, 2009) or at least reduce the development of several forms of SBs (except for oral types; Malmkvist et al., 2024), including pacing. However, whether it truly prevents the development of SB or simply relocates SB into the running wheel is discussed (both in mink and other species, e.g. Joshi & Pillay, 2018; Mason & Würbel, 2016). Noteworthy, as mentioned above, running wheels are also used by non-SB animals for active locomotion (Malmkvist et al., 2024).

Moreover, mink are willing to work more/pay greater costs to access running wheels than additional empty compartments, which indicates a high motivation to use the wheels in the absence of any other stimulation. Two studies examined the effects of providing mink with access to a running wheel or open water. The results showed that mink displayed sustained motivation for both resources, though they spent more time using the running wheel than accessing open water (Hansen & Jeppesen, 2001a, 2001b).

The extent to which the provision of a running wheel can meet the need for sustained locomotion in cages has not been conclusively demonstrated (Hansen & Damgaard, 2009; Malmkvist et al., 2024), but it could be part of a mitigation strategy if implemented along with additional cage complexity (e.g. additional nest boxes and other resources). It should also be noted that all studies on running wheels have been done on individually housed juveniles (i.e. post-weaning) or adult mink, thus whether more than one mink may share the resource is unknown.

Studies that support further mitigation of the WC Restriction of movement by the provision of other resources (whether singly or in combination) and have at the same time increased floor area are discussed in Section 3.4.2, as they cover the expression of behaviours other than running and share the same hazards. In the opinion of EFSA experts, access to an outdoor run (intended as access to an extra area with possibility to experience a terrestrial surface made of natural ground substrate and outdoor view), can be provided to mink to mitigate the WC Restriction of movement, but this has not been studied in commercial settings. The study by Schwarzer et al. (2016) shows that mink can be kept in outdoor enclosures (e.g. aviary). However, these alternative housing systems have not been tested under production conditions or compared directly with the behaviour and health of mink kept in the current system.

When considering cage dimensions in mink, the current cage height is not enough to allow the animals to stand bipedally on their hind legs fully stretched, and therefore not enough to perform species-specific behaviour in the three dimensions. Cage height is not only relevant for standing but also for enabling more complex movements and behaviours. Even if the horizontal dimension seems more relevant to mink than the vertical one (EFSA, 2025), higher cages allow for the inclusion of elevated platforms, which are known to improve welfare (Buob et al., 2013; Dawson et al., 2013), by increasing the complexity of the enclosure space.

The provision of elevated platforms, either alone or in combination with other resources such as tubes, can help mitigate restriction of movement by providing opportunity for vertical movement. Reduction of SB and signs of fur chewing in juveniles (in Scenario 3, Jeppesen, 2004) as well as SB in dams with litters (in Scenario 2, Buob et al., 2013) have been reported in comparative studies of standard cages equipped with platforms. Cage height is also closely linked to feeding practices, as feed is typically delivered on top of the cage (EFSA, 2025). Increasing cage height may require modifications to feeding methods, which could offer additional welfare benefits. In addition, due to the proposed relationship between tail tip lesions and cage height (Heimberg et al., 2018), research is required to investigate causes for tail tip lesions and to optimise cage design to prevent injury.

- **Inadequate floor material**

It is unknown to which extent a shift to solid floor can mitigate the described foot pad conditions (characterised by hyperkeratosis and callus formation), however, EFSA experts consider that solid floor types (preferably softer than concrete floor) present in at least part of the enclosure will allow mink to avoid prolonged active contact with wire mesh floor. If wire mesh floor is used, mesh size needs to be suitable for the age (foot size) and weight of the animal. When kits are present (Scenario 2), false bottoms (plastic inserts with smaller gaps than the wire mesh flooring) are sometimes added to minimise these risks (and that of kits falling through the mesh) by providing a more stable and comfortable resting and walking area. In case of larger enclosures and some kinds of resources (e.g. running wheels, platforms), the choice of floor type should also consider the risk of foot lesions, avoiding unsuitable materials that can increase friction when animals move.

According to the findings in Section 3.3.1, as mink in all scenarios are kept on wire mesh floor (excluding the nest box), the possibility to perform effective comfort behaviour (i.e. rubbing) can be limited. In the opinion of EFSA experts, to mitigate this, having part of the enclosure made of solid floor with mouldable and adsorbent underground or a structure like a box filled with adsorbent material (e.g. straw, sawdust) will allow effective rubbing behaviour. According to anecdotal reports, the addition of areas of wire mesh (e.g. platforms) with a smaller mesh size might be used by mink for body rubbing and appears to increase overall usage of said areas. However, there are no studies comparing different mesh sizes or proportions of wire mesh and adsorbent material to allow effective comfort behaviour in mink. Provision of solid flooring would allow the distribution of solid feed and promote more natural feeding behaviour than the current feeding on the cage roof and contribute to a more enriched living environment. Across floor types, research is needed to clarify the pros and cons of each type, and how floor types can eventually be mixed. If wire mesh is used, research is needed to determine the best mesh size for different age categories of mink and to allow different behaviours.

- **Nestbox with too small floor area and/or size of openings, insufficient number of nests**

To allow resting and hiding behaviour, a nest box large enough to accommodate even the largest animals (in both single, pair and group housing), and the largest litter sizes in the case of the lactation phase, is needed. Adjustable nest boxes have been proposed commercially, but research on their impact on mink welfare remains limited.

One way to mitigate restriction of movement during lactation can be to increase the nest area, which will also positively impact maternal behaviour (Rørvang & Hansen, 2013). For enclosures housing multiple animals, providing larger nest boxes that accommodate a greater range of postures (such as fully extended resting and nursing positions) can enhance comfort, thermoregulation and overall environmental control. The availability of high-quality straw is also essential to optimise these benefits (Schou et al., 2018).

In the other scenarios, nest boxes serve multiple purposes, such as resting and feeding areas, which can lead to wet and dirty conditions. Some farms have experimented with partitioning nests to create functional areas, improving nest hygiene and comfort. For juveniles housed in pairs or groups, allowing adequate size and number of nests would give the animals the option to rest or sleep together comfortably and perform allohuddling (as observed by Hagn, 2009), and provide an area to move away from conspecifics if needed.

To mitigate the negative impact of restricted nest box access, nest box design needs to have adequately sized entrances to allow access to larger individuals, including the largest adult males and juveniles before pelting. For solitary large males, providing a nest box with wider entrance and increased floor area can prevent movement restriction and negative welfare derived from nest access hindrance. To support natural behaviours and improve welfare, permanent access to suitable nesting materials, such as straw, needs to be present in all the scenarios.

Substantial mitigation

Substantially mitigating the WC Restriction of movement in farmed mink requires a multifaceted approach. This involves not only increasing the three-dimensional space of the enclosures but also enhancing environmental complexity, such as through the provision of diverse resources that cater to various behavioural motivations, including different floor types. Additionally, when considering enclosure dimensions, floor area needs to be determined independently from height, as horizontal movement cannot be replaced by vertical movement.

3.4.2 | Inability to perform exploratory or foraging behaviour and linked WCs

This WC (linked to Inability to perform play behaviour, inability to chew and prolonged hunger) was identified as highly relevant for mink. The WC is multifactorial and closely interlinked with other WCs, especially Restriction of movement and Sensorial under-stimulation.

The WC Inability to perform exploratory or foraging behaviour **cannot be prevented** or **substantially mitigated in the current system** due to insufficient structural (including lack of open water) and manipulable resources, as well as limited space to accommodate these, lack of feeding enrichment and inadequate feed texture and management.

The primary mitigation is the provision of enrichment, and, in particular, manipulable resources or resources (i.e. open water) designed to fulfil exploratory as well as the appetitive and consummatory phases of foraging behaviour. This approach is inherently complex due to the wide range of exploratory and foraging behaviours that mink exhibit in natural and semi-natural environments (EFSA, 2025; Schwarzer et al., 2016). The WC Inability to perform exploratory and foraging behaviour can be mitigated in the current system by addressing the following hazards:

- **Lack of physical complexity of the cage**

Using reduction in SB, fur chewing reduction or signs of high motivation to access a resource as ABMs, studies indicate that providing cage complexity and manipulable substrates/objects are more effective mitigation measures than simply increasing space (Cooper & Mason, 2000; Hansen et al., 2007). More complex environments can be provided by linking different cages, either horizontally or vertically, but providing more diverse cage structures (such as nest boxes, platforms, tubes) and manipulation possibilities (multiple substrates/objects) allows for more effective mitigation. Provision of simple resources such as those in widespread current use (a plastic ball, a plastic cylinder, a wire net platform or all three combined) is not always sufficient to decrease or prevent SBs (Axelsson et al., 2009; Hansen et al., 2007). The properties required for effective enrichment of farmed mink have been discussed by Clark et al. (2023).

Utilised resources such as biting ropes, straw and chewing items require renewal to address the continued possibility of mink to interact with them. Positive effects of changing between items (novelty) may exist (Clark et al., 2023), but this area is largely understudied and needs to consider the risk of introducing frustration by replacing valued resources (Mason et al., 2001). Diversity can be included by provision of mobile resources which stimulate chasing, e.g. hanging items stimulating tugging and chewing (e.g. interconnected ropes (Díez-León et al., 2013, 2016; Meagher et al., 2014). Items such as fixed or hanging platforms and tunnels also function as additional resting places, offering opportunities to reach a higher vantage point and/or escape conspecifics in the cage. Hence, resources with more numerous uses, greater malleability or greater controllability are most effective at promoting interaction. Further research is needed to clarify whether control or predictability of resource access or removal have benefits for item use and measures of welfare.

In relation to other enrichment possibilities, providing opportunities for visual exploration seems important since a higher platform was used more often than a lower platform in a climbing cage (Axelsson et al., 2017).

There is some support that the existing cage resources, like those provided on farms, above barren cages, mitigate the WC. For example, providing a platform and tube is shown to reduce SB (Hansen et al., 1994) and induce curiosity and/or decrease fear responses to a test stimulus compared to housing with no enrichment (Bak & Malmkvist, 2020).

- **Limited cage size (both horizontal and vertical space) to perform exploratory and foraging behaviours**

Provision of enrichment is strictly related to the space available in the cage or enclosure in which mink are kept. In this sense, standard cages do provide limited opportunities. The provision of point-source resources that are chewable or destructible is often feasible, however more complex structural/design enrichment would be very difficult or even impossible to include. The separation of functional areas is also very limited in the current cage systems (See Section 3.4.1). A mitigating measure is to considerably increase the size of the enclosure to include adequate enrichments (See Section 3.4.1). The same consideration applies to the linked WC Inability to perform play behaviour. The provision of enrichment, particularly complex enrichment, has been shown to stimulate play behaviour in juvenile mink in several studies (Brink & Jeppesen, 2005; Vinke et al., 2004).

- **Lack of enrichment and inadequate feed structure and delivery, not providing stimuli for appetitive and consummatory foraging behaviour**

In relation to the aspects of the linked WC **Inability to chew**, where hazards are shared with Inability to perform exploration or foraging behaviour, hazard correction can be achieved by increasing textural variety of feed (e.g. offering chunky food or offering alternative chewing materials such as straw briquettes or rope (Malmkvist et al., 2013), pig ears or hide strips (Clark et al., 2023), and resources that stimulate appetitive and consummatory aspects of foraging behaviour (e.g. interconnected biting-ropes activated by mink in neighbouring enclosures that trigger hunting-like behaviours, provision of open water to perform species-specific foraging behaviours, etc. (Díez-León et al., 2016; Schwarzer et al., 2016). The provision of a more texturally complex daily diet, as opposed to the typical meat-based paste, reduced fur chewing and SB even during the growth season, a period where SB is already quite low (Malmkvist et al., 2013).

Providing a more texturally complex diet, as opposed to standard meat-based paste, also has the potential to reduce signs of fur chewing and SB in mink during winter, likely by offering greater opportunities for functional chewing and engagement in species-typical feeding behaviours (Malmkvist et al., 2013). Supporting natural foraging and feeding behaviours may play a key role in promoting welfare, particularly if animals are fed restrictively. Supporting natural foraging and feeding behaviours may play a key role in promoting behavioural health, particularly during periods of feed restriction. The provision of food enrichments (such as food-dispensing puzzles designed for dogs to provide stimulation and encourage exploratory and foraging behaviours) has not been fully investigated under commercial settings for mink and remains a gap in knowledge with potential to further decrease this WC.

For mink in all scenarios, enhancing feeding systems to allow for a more natural posture, such as enabling mink to eat in a low, crouched position rather than standing on their hind legs, has also been shown to align with their preferences (Díez-León et al., 2017). In addition, ensuring appropriate floor substrate and feed consistency can improve the consummatory phase of foraging by preventing food loss and reducing the likelihood of food caching in the nest box. These refinements may correct the hazards shared with the linked WC of Inability to chew in relation to feeding practices.

- **Feed restriction (increasing foraging motivation and/or prolonged hunger)**

As motivation to perform foraging behaviour increases with hunger, reducing hunger levels represents an important mitigation of this WC. This can be done by avoiding marked loss in body condition, especially during the production practice of slimming (Henriksen & Møller, 2021). It is also suggested that farmers should manage females at moderate body weights year-round (rather than oscillating between obesity and slim or skinny body conditions depending on the production phase) and select for factors other than body weight in order to also alleviate nursing sickness (Rouvinen-Watt & Hynes, 2004). Further research is needed to quantify the acceptable minimum body condition and rate of body condition loss and variation.

Where a reduction in caloric intake is desirable for health or production reasons, achieving this by a generous portion of low-energy feed can reduce SB in comparison with restricting portion size of a normal-density feed. Damgaard et al. (2004) demonstrated that it is possible to reduce the body weight of females by providing low-energy feed for ad libitum intake rather than by restricting portions of feed, and that this diet can prevent winter increases in SB performance: 53% of females on restricted feed performed stereotypies compared to 27% of females on the ad libitum diet. This may be due to continued mechanical eating opportunities throughout the day, although further research is needed to understand the extent of hunger due to the lower energy availability.

- **Lack of open water**

Open water is a highly valued enrichment for mink demonstrated by their willingness to work for access to it. As the lack of open water is a hazard for several of the identified most relevant WCs, it is separately discussed in Section 3.4.5.

Substantial mitigation

To achieve **substantial mitigation** of the WC Inability to perform exploratory or foraging behaviour, the current system needs to be changed into an enclosure that can accommodate resources to increase its complexity, including resources specifically designed to allow for a range of foraging appetitive and consummatory behaviours. Further research is essential to provide quantitative information on which combination and replacement of resources allows for substantial mitigation of exploratory and foraging behaviours for mink.

Concerning shared hazards (lack of physical complexity of the cage and limited cage size), the same considerations as described above apply to the linked WC **Inability to perform play behaviour**. The provision of enrichment, in particular complex enrichment, has been shown to stimulate play behaviour in juvenile mink in several studies (Brink & Jeppesen, 2005; Vinke et al., 2004). The shared hazard with the WC **Inability to chew** (inadequate feed texture and delivery) can be corrected according to the mitigating measures discussed above. The shared hazard with the linked WC Prolonged hunger (Feed restriction) can also be corrected according to the mitigating strategies described above.

3.4.3 | Sensorial understimulation

Sensorial understimulation relates to the barren housing conditions and limited space (floor area and cage height) available within standard cages in the current system. This WC **cannot be prevented or substantially mitigated** in the current system due to limited cage size and relatively barren environments lacking stimulation; it can only be **substantially mitigated** in alternative systems through the combination of all measures outlined for addressing the lack of opportunity to perform exploratory and foraging behaviours and restriction of movement (see Section 3.4.1 and 3.4.2).

3.4.4 | Sensorial overstimulation and linked WC

Sensorial overstimulation **cannot be prevented** in the current system due to current management and husbandry practices, and high density of mink in farms, combined with relative lack of places to retreat from disturbances and/or limited cage size. It can be mitigated by following the considerations for the hazards indicated in the following text and the cross-referenced sections.

- **Disturbance of the diurnal rhythm of activity and rest, including human disturbance**

Sensorial overstimulation may result from external disturbance from both within the shed (presence of workers or visitors) and outside the shed (from machinery, aircrafts, etc.) through exposure to sudden or continuous noise or visual or olfactory stimuli. Such disturbance can be mitigated by avoiding inappropriate farm locations, minimising activity within the shed and adopting predictable work routines.

- **Handling**

Sensorial overstimulation can also be caused by handling of the animals by humans due to necessary production procedures. For mitigating strategies, see Section 3.3.6 on the WC Handling stress.

- **Small cage size resulting in overcrowding when dams are kept with their litter**

See Section 3.4.6 on the WC Soft tissue lesions and integument damage.

- **Close proximity of conspecifics in adjacent cages**

Sensorial overstimulation may also result from unwanted social interactions when housed with conspecifics, or from the enforced close proximity of conspecifics in surrounding cages. Such over-stimulation may be mitigated by avoiding group housing (2 minks or more or pairs of same-sex individuals after a certain age) after weaning and by providing animals with a retreat area in addition to the nest box, giving them more choice and control over their environment. Further details on the mitigation effect of elevated platforms are discussed in Section 3.4.1

- **Same-sex pair housing and group housing of juveniles**

See Section 3.4.6 on the WC Soft tissue lesions and integument damage.

3.4.5 | Preventive and mitigating measures of welfare consequences in relation to absence of open water

Preventative and mitigating measures regarding the lack of open water relate to the following WCs: **Restriction of movement, inability to perform exploratory and foraging behaviour, sensorial understimulation** and the **Linked WC Inability to perform play behaviour**. These WC **Cannot be prevented or substantially mitigated** due to limited floor area and lack of physical complexity of the cage. Lack of access to open water is one of the factors to be considered. Consequently, the addition of open water to an enclosure is one of the factors to be considered for substantial mitigation. The measures needed to address lack of open water are related to the following hazards:

- **Insufficient space for behaviours in or near water**

In terms of access to open water, space in an enclosure holding mink will need to be increased, as compared to the current system, to enable the inclusion of diverse and effective enrichments (e.g. running wheel, open water or other resources) and to allow the animals opportunities to perform active behaviours and locomotion. Open water will then function as a dynamic enrichment. Some studies have made a direct comparison of the occurrence of ABMs in mink housed with and without access to a source of open water. Results from these studies on mitigating ABMs such as SB are not consistent, possibly because the types of open water offered have differed.

In relation to the possibility to express different types of active behaviours, such as exploratory and foraging behaviours (e.g. allowing swimming, diving, head dipping and patrolling near the water) access to open water will contribute to mitigate restriction of movement, inability to perform exploratory or foraging behaviour, sensorial understimulation (both fluid and frozen water represent additional stimuli) and the linked WC Inability to perform play behaviours.

- **Lack of physical complexity of the cage, including substrate and presence of open water**

Provision of open water in several studies involved outdoor access and contemporary provision of a more complex and enriched environment, as compared to the current system. Therefore, it is difficult to disentangle the mitigating effect of open water from the effect of the whole system tested.

When mink are provided with open water, a focus on hygiene (in water, nest boxes and elsewhere) is needed. In a study by Skovgaard et al. (1997), where female mink were kept with access to open water for 2 years (methodology described as for Hansen and Jeppesen (2001a, 2001b)), the authors reported a higher pre-weaning kit mortality during one of the years. Causal factors for this finding, which has not been replicated, are not discussed in the study.

One general concern about open water is wet nestboxes, particularly for unweaned kits and juvenile mink. In studies in large outdoor enclosures, mink were randomly observed to perform rubbing behaviour on bark mulch (floor substrate of the enclosure) after using the open water, and to dry themselves in that way. Rubbing behaviour can be observed also in a wire mesh cage (Díez-León et al., 2016). However, the drying capacity of wire mesh or different substrates and the link to an increased risk of wet nest box has not yet been studied.

As mentioned above, studies comparing different sizes and volumes of open water are lacking, except Schwarzer et al. (2016), however, all open water basins used in their study were rather large. Further studies are required to examine what minimum size/volume of open water is required to achieve its mitigating effects.

3.4.6 | Soft tissue lesions and integument damage

If more than one animal is kept in one cage, the WC Soft tissue lesions and integument damage is linked to the WC Group stress due to shared hazards. Hazards for soft tissue lesions and integument damage are either related to intraspecific aggression or to the floor material of the cages. These hazards vary depending on the scenarios; however, all scenarios are affected by either one or more hazards. As the floor material is inherent to the current system and intraspecific aggression cannot be avoided if two or more animals are kept in one cage, the WC Soft tissue lesions and integument damage **cannot be prevented** in the current system. Mitigation can be achieved in the current system by implementing changes outlined below and in the cross-referenced Sections.

- **Floor material**

A category of lesions, which affects all scenarios, is caused by cage structures or materials (Jespersen et al., 2016). In the opinion of EFSA experts, to mitigate potential changes in foot pad condition (such as hyperkeratosis and callus formation), a good design and maintenance of the wire mesh floor is essential. It is unknown to what extent a solid floor can mitigate these effects, however, EFSA experts considered that solid flooring in at least part of the enclosure will allow animals to avoid prolonged contact on a wire mesh floor. If wire mesh floor is used, – the use of mesh size suitable for the age (foot size) and weight of the animals is advantageous. In kits, false bottoms are sometimes added to mitigate risks by providing a more stable and comfortable resting area. In case of larger enclosure and e.g. running wheels, choice of floor type should consider also the risk of foot lesions, avoiding unsuitable floor materials that can increase pressure when animals move. Presently, farm-level mitigation has not been studied, and further research is needed to determine suitable floor types which prevent the foot pad lesions seen on wire mesh floors, whilst maintaining floor hygiene.

Toe clipping is used to take blood samples from mink when required for veterinary indications. This procedure is likely painful and is further discussed in the WC Handling stress, as it is part of handling procedures.

There are two hazards specific for Scenario 2 (Mink dam with litter):

- **Overcrowding in standard cages before weaning**

In the suckling phase, aggression which occurs due to competition between kits in large litters can be mitigated by the provision of additional resources such as extra drinking water (Malmkvist, Schou, et al., 2016) and wider area for feed distribution (Hansen, 2011). The weaning age also needs to be considered: 7–8 weeks of life is recommended according to Brink and Jeppesen (2005). However, even if more resources are provided, standard cages (EFSA, 2025) do not provide sufficient space for the dam and her kits to retreat from each other if desired, especially at the end of the rearing period, when the kits are mobile and able to access, e.g. an elevated platform (see Section 3.4.1).

In the suckling phase, aggression due to competition between kits in large litters can be mitigated by the provision of additional resources such as extra drinkers (Malmkvist, Schou, et al., 2016).

- **Lack of additional drinking water easily accessible for kits before weaning**

According to Brink and Jeppesen (2005), kits started to use nipple drinkers earlier and showed less saliva licking from the mother if extra nipple drinkers were provided close to the nest box. Additionally, all nipple drinkers in this study had a system that made it easier for the kits to use them and released water into a small drinking cup when activated.

Therefore, for Scenario 2 (dam and kits) in the current system, **substantial mitigation for this WC is not possible**, as overcrowding cannot be avoided in current cages, but the provision of additional drinkers as described above can provide some mitigation.

To substantially mitigate this WC, enclosures with increased space not only allow for greater freedom of movement and lower animal density, but also to accommodate structures, such as elevated platforms or designated retreat areas that enable the dam to withdraw from her litter when desired. See also mitigation strategies related to Restriction of movement (Section 3.4.1).

For juveniles (Scenario 3), slightly different hazards are relevant for this WC and are described below.

- **Same-sex pair housing and group housing**

Lesions and integument damage mainly arise from aggression between conspecifics in the same cage. Keeping juvenile mink in group housing after weaning has been linked to increased observations of aggressive behaviour and/or bite marks on the skin observed after pelting (see Section 3.3.5). Pair-housing of male–female juvenile pairs reduces the risk of aggression (de Jonge et al., 1986).

- **Lack of sufficient space and lack of resources to avoid competition and provide escape opportunities**

Similar to the mitigation strategies discussed for overcrowding at the end of the suckling period, the provision of additional resources such as extra drinking water (Malmkvist, Schou, et al., 2016) and wider distribution of feed (Hansen, 2011) should have a mitigating effect on juvenile mink, too.

Substantial mitigation

Therefore, the WC **Soft tissue lesions and integument damage** as well as the WC **Group stress** (considering the shared hazards) **can be substantially mitigated** in Scenario 3 (Juveniles) if both of the following measures are applied: Juveniles should be housed in male–female pairs until the natural dispersal time (approx. Sep–Oct), and individually afterwards. Additionally, sufficient resources for each animal need to be provided to avoid competition (e.g. feeding places, enrichment items, platforms etc.). However, further research is needed to quantify the amount of resources in this context. The limited space of the standard cages might not be enough to allow for the additionally required resources, see Section 3.4.1.

3.4.7 | Handling stress

The WC Handling stress is linked to the WC Inability to avoid unwanted sexual behaviour due to shared hazards associated with the transfer to the mating cages. Therefore, mitigating measures for handling stress apply to this WC as well considering the shared hazards. As handling is unavoidable for mink farm procedures, this WC **cannot be prevented** on fur farms. Mitigation in the current system can be achieved by addressing the following hazards:

- **Handling and restraint during production procedures in the farm setting**

Since all handling of mink kept for fur production would appear to be stressful for the animals, the relevant mitigation measures are to minimise the number of handling occasions and to carry out any essential handling in the least aversive way possible. Staff should be trained in correct handling procedures. Equipment used for handling and moving animals between cages is to be appropriately designed, with suitable handling tools, including hand protective gloves and handling cages, provided to farm staff.

When mink are kept in enclosures, trapping facilities and protocols enabling proper daily animal inspection are to be in place. Separation and capture of the mink needs to be carried out in a manner that minimises stress.

- **Fearful mink temperament**

Since handling can be associated with a longer-term increase in fearfulness of humans, measures which might mitigate this are also important. These include the genetic selection of mink with reduced fearfulness, and consideration of other measures influencing temperament such as maternal effect (Malmkvist et al., 2019) and cage enrichment (Bak & Malmkvist, 2020).

- **Lack of habituation to humans**

The influence of handling stress on poor human-animal relationships cannot be prevented in the current system due to the necessity for some on-farm procedures. However, as stated by previous studies (Section 3.3.6), it can be mitigated to a limited extent by habituating mink to human presence and handling.

Linked WC: Inability to avoid unwanted sexual behaviour

To mitigate the hazard shared with the linked WC Inability to avoid unwanted sexual behaviour, the number of mating trials in unwilling females during breeding needs to be limited.

Substantial mitigation

In summary, mitigation can be achieved in the current system, if all of the following measures are applied at the same time for all handling events: The number of handling occasions is to be kept to a minimum, and appropriate equipment is to be used during the handling events. All handlers need to have an appropriate ability, knowledge and professional competence for their tasks.

Furthermore, genetic selection for less fearful and aggressive animals can reduce the stress associated with human handling. Further research is required to evaluate whether **substantial mitigation** of the WC handling stress could be achieved in the current system by incorporating, in addition to the measures described above, procedures that promote habituation to human presence.

4 | WELFARE ASSESSMENT OF FOXES

4.1 | Most relevant WCs for foxes

4.1.1 | Scenarios used for the selection of the most relevant WCs in Arctic and red foxes

The scenarios selected to answer TOR2a and 2b for foxes are shown in Table 8 and are based on information on the production cycle of foxes kept for fur production, as described in EFSA (2025). For all scenarios, each age category is represented by a single distinct scenario.

TABLE 8 List of the identified scenarios used for the selection of the most relevant WCs in foxes.

Scenario no.	Name	Farm practices included
#1	Adult and future breeders in individual cages without nest box during the breeding season	• Slimming and flushing* • Heat detection, natural mating, semen collection and artificial insemination • Handling
#2	Dam and cubs in family cages with nest box	• Handling • Weaning (to also consider the dam)
#3	Juveniles kept in pairs or groups after weaning until pelting (or selection as future breeders) in cages without nest box	• Handling (including fur grading, vaccination and separation)
#4	Adult breeders kept in individual cages without nest box outside the breeding season	• Handling

*Slimming is a period of diet restriction. Slimming is followed by ad libitum feeding (flushing). These practices can be applied in foxes, although prevalence is unknown (EFSA, 2025).

4.1.2 | Outcome of the selection of WCs in Arctic and red foxes

As an outcome of the selection process described in Section 2.4, four WCs were identified as most relevant for both species (Tables 9 and 10): (1) Restriction of movement, (2) Inability to perform exploratory or foraging behaviour, (3) Sensory under- and/or overstimulation and (4) Handling stress. In addition, locomotory disorders was identified as another most relevant WC for Arctic foxes and Group stress for red foxes.

TABLE 9 Outcome of the process of selection of the five most relevant WCs, including the linked ones, in Arctic fox.

Most relevant WC	Scenarios	WCs linked to the most relevant WCs listed in the first column
Restriction of movement	All except cubs in the first 4 weeks of life in Scenario 2	• Inability to perform play behaviour
Inability to perform exploratory or foraging behaviour	All	• Inability to chew**
Sensorial under-stimulation[a]	All	• Inability to perform play behaviour
Sensorial overstimulation[a]	All	• Resting problems • Group stress
Handling stress	1,2	• Inability to avoid unwanted sexual behaviour • Resting problems
Locomotory disorders including lameness	All except cubs in the first 4 weeks of life in Scenario 2	• No WCs identified as linked

**The original WC is 'Inability to chew and ruminate' but rumination was removed as this is not applicable to foxes.

[a]This WC is originally called 'Sensorial under- and/or overstimulation' in the EFSA guidance (EFSA AHAW Panel, 2022) but is here subdivided to enhance clarity of the content.

TABLE 10 Outcome of the selection of the five most relevant WCs, including the linked ones, in red fox.

Most relevant WC	Scenarios	WCs linked to the most relevant WCs listed in the first column
Restriction of movement	All except cubs in the first 4 weeks of life in Scenario 2	• Inability to perform play behaviour
Sensorial under-stimulation[a]	All	• No WCs identified as linked
Sensorial overstimulation[a]	All	• Resting problems

TABLE 10 (Continued)

Most relevant WC	Scenarios	WCs linked to the most relevant WCs listed in the first column
Inability to perform exploratory or foraging behaviour	All	• Inability to chew**
Handling stress	Scenario 1 and 2	• Inability to avoid unwanted sexual behaviour • Resting problems
Group stress	Scenarios 3 and 4	• No WCs identified as linked

[a]This welfare consequence is originally called 'Sensorial under- and/or overstimulation' in the EFSA guidance (EFSA AHAW Panel, 2022) but is here subdivided to enhance clarity of the content.

**The original WC is 'inability to chew and ruminate' but rumination was removed as this is not applicable to foxes.

4.2 | Animal-based measures (ABMs) related to the most relevant WCs

The Table 11 summarises the ABMs used for the assessment of the most relevant WCs (including the linked WCs) in farmed red foxes and Arctic foxes. ABMs were retrieved during a literature review and by consultation of stakeholders (Sections 2.1 and 2.2). The list should not be considered as an exhaustive list of ABMs.

Additionally, further details on abnormal behaviours are reported below (see Section 4.2.1), since the need to address them separately emerged following discussions with stakeholders (see Section 1.2).

TABLE 11 Summary of ABMs of farmed red and Arctic foxes referenced in Section 4. The list includes ABMs that have been recorded in studies testing the effects of housing modifications on the behaviour and welfare of farmed foxes, as well as ABMs that might not have been tested in this context but can indicate the presence of welfare consequences.

ABM	Definition	Interpretation of the measure	Welfare consequence(s)[a]
Agonistic behaviours	Agonistic behaviour covers signals or attacks directed towards another fox and/or physical fights between two or more foxes, e.g. back arching, blocking, bodily contact between two foxes including mounting, pawing, pushing and upright wrestling, or moving quickly towards and chasing another fox resulting in retreat of the other fox (adapted from Hovland et al., 2010, 2011).	The presence of the WC is shown by an increase in this behaviour in terms of duration and/or number of repetitions following the presence of one/more hazards.	• Restriction of movement • Group stress (red foxes)
Bent feet	Also called 'bowed legs' or 'leg weakness'. It is a flexural deformity due to carpal laxity (Kempe et al., 2010). It is documented in Arctic foxes and red foxes. This condition is measured on farms with visual scales (WelFur 2015b; Peura et al., 2020). Even if the most common area in which this laxity is manifested is the carpal joint, it can occur also in the elbow joint (Korhonen et al., 2015).	The presence of the WC is shown by the presence of the condition in one or both front legs.	• Locomotory disorders
Bite wounds	Wounds caused by bites between foxes (Ahola, Mononen, & Pyykkönen, 2002).	The presence of the WC is shown by the presence of the condition in animals.	• Restriction of movement • Group stress (red foxes)
Concentration of cortisol in plasma or faeces*	Intended as change of cortisol concentration, considered an indirect measure of stress. In foxes, cortisol is mainly studied as: • Faecal cortisol metabolites (FCM) (Larm et al., 2021, Ojala et al., 2025) • Plasma cortisol after ACTH challenge e.g. (Ahola, Mononen, & Pyykkönen, 2002)	The presence of the WC is deduced from by the increase of cortisol concentration following the presence of one/more hazards.	• All, but see*
Exploratory and foraging behaviours	Group of behaviours such as: • Use and manipulation of different types of resources (e.g. bones, straw) • Digging and caching food (also called 'hoarding') (Careau et al., 2007; Clermont et al., 2021; Sklepkovych & Montevecchi, 1996; Thomson & Kok, 2002)	The presence of the WC is deduced from the reduction of expression of exploratory and foraging behaviours following the presence of one/more hazards.	• Sensory under stimulation • Inability to perform exploratory or foraging behaviours
Fearful behaviour	Withdrawal or flight (e.g. in response to human approach (Pedersen, 1993); crouching with ears backwards (Pedersen, 1994); not eating in the presence of a human (Rekilä et al., 1998)	The presence of the WC is deduced from the presence of the ABM in animals following the presence of one/more hazards.	• Sensorial overstimulation • Handling stress

(Continues)

TABLE 11 (Continued)

ABM	Definition	Interpretation of the measure	Welfare consequence(s)[a]
Foot/paw lesions	Conditions that affect the feet or paws, including swelling, hyperkeratosis, crusting, wounds, infections, broken claws and any other conditions that can impair the health of the feet or paws.	The presence of the WC is shown by the presence of the condition on one or more feet or paws.	• Locomotory disorders
Front leg turn	Also called 'abduction/adduction of forelegs'. It is a structural deformity consisting of an outward or inward rotation of the front legs starting from the carpal joint (Peura et al., 2020). The condition can be associated with bent feet. Abduction of forelegs was documented in Arctic foxes (Peura et al., 2020).	The presence of the WC is shown by the presence of the condition on one or both front legs.	• Locomotory disorders
Fur chewing/fur damage	Removal of hair, by oral manipulation, i.e. suckling or biting pelt of tail or body parts (adapted from (Korhonen, Niemelä, & Wikman, 2001; Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen et al., 2003).	The presence of the WC is shown by an increasing amount of animals performing fur or tail chewing behaviour or increased areas and severity of the damage following the presence of one/more hazards.	• Inability to perform exploratory or foraging behaviour • Restriction of movement • Sensorial under-stimulation
Lameness	Difficulty or complete inability to move actively in the cage, even when solicited from the outside. Impairment in the locomotion of the animal. It was reported in Arctic foxes (Ahola et al., 2020).	The presence of the WC is shown by the presence of clinical the condition.	• Locomotory disorders
Locomotory behaviours (non-abnormal)	Range of active, locomotory behaviours such as: – Walking (also called 'circling' or 'pacing') – Trotting – Galloping – Jumping (some publications) (Kistler et al., 2009, Korhonen et al., 1999, Korhonen, Jauhiainen, & Niemelä, 2001)	The presence of the WC is deduced from a reduction or impossibility to perform one or more of these behaviours following the presence of one/more hazards.	• Restriction of movement
Motivation to access resource/time spent using a resource	Resource use is measured as efforts expended to access resources (e.g. pressing a lever; (Koistinen et al., 2007); crossing through a weighted door; (Hovland et al., 2011; Koistinen et al., 2016) or sustain resource use (e.g. re-scheduling of behaviour to spend more time with the resource (Koistinen et al., 2016).	The WC is present when the animal cannot perform the functional behaviours that indicates motivation for a resource, due to the inability to access/absence of the resource or limitation in space.	• Restriction of movement • Inability to perform exploratory and/or foraging behaviours • Resting problems
Osteochondrosis	Condition that affects the process of endochondral ossification during the growth of bones (Olstad et al., 2015). May lead to lameness or walking difficulty.	The presence of the WC is deduced from clinical signs such as lameness or walking difficulty or after pathological examination of fox legs.	• Locomotory disorders
Play behaviours	Play can be seen as: – object play (carrying objects and/or throwing them into the air), – locomotor play (running and jumping) or – social play (interaction between two foxes including pouncing, play wrestling, face pawing, play bowing) (Hovland et al., 2010; Koistinen et al., 2016, 2017; Rudert, 2008).	The presence of the WC is deduced from a reduction or impossibility to perform one or more of these behaviours following the presence of one/more hazards	• Restriction of movement • Sensorial understimulation • Inability to perform play behaviour
Stereotypic behaviours (SB)	Repetitive behaviours as described in Section 4.2.1.	The presence of the WC is deduced from an increase in SB in terms of duration, number of repetitions and/or difficulty to interrupt, following the presence of one/more hazards at some point in the life of the animals	• Restriction of movement • Inability to perform exploratory or foraging behaviour • Sensorial understi-mulation

[a]It includes also linked WCs.

*In recent years, the construct validity of the use of cortisol (faecal, saliva or plasma) as ABM for aspects of animal welfare across animal species is being discussed (e.g. as reviewed by Tiemann et al., 2023; Cobb et al., 2025). Among the challenges are large individual differences, sex differences, circadian variation, hormonal status, level of activity etc. Results should therefore be interpreted carefully, and in combination with other ABMs (e.g. behavioural, clinical).

4.2.1 | Abnormal behaviour of farmed foxes

As described in Section 1.2.1.3, abnormal behaviours (e.g. fur chewing and SBs) are acknowledged to be a welfare concern for foxes kept for fur production (Hovland et al., 2017), and they are considered ABMs of reduced welfare (Mason

& Rushen, 2006). The occurrence of abnormal behaviours including SB in captive carnivores is thought to be mainly related to the restriction of their natural ranging and foraging/hunting behaviour, but the relationship is not direct (Kroshko et al., 2016) and may be more complex for omnivorous foxes due to their different home range use (Bandeli et al., 2023).

Fur chewing involves the animal damaging its own hair with its teeth, exposing the underfur (Vergneau-Grosset & Ruel, 2021). Injuries to skin or underlying tissue caused by self-chewing/–biting have not been mentioned in farmed foxes. According to the WelFur (2015b) protocol for foxes, cage mates may also perform mutual fur chewing.

Fur chewing occurs in farmed Arctic and red foxes (Korhonen, Niemelä, & Wikman, 2001; Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen et al., 2003), but the causes of this abnormal behaviour are not understood in detail in foxes and reports on prevalence across farms or countries have not been published.

Data collected in 2012–2014 suggest that signs of fur chewing were present in up to 93% of Finnish fox farms, affecting up to 30% of animals on a farm (Ahola et al., 2014). In more than 80 farms assessed during winter (when only adults for breeding are present on the farm), fur chewing was observed in 10 ± 7% of the estimated total number of foxes (Ahola et al., 2014).

More recently, Mononen et al. (2021) observed breeding female Arctic foxes on a private Finnish farm in February–March ($N = 660$ in 2017; 156 in 2018 and 577 in 2019). Each fox was observed only once in the study, and signs of fur chewing were scored according to WelFur (2015b). The authors did not report the overall occurrence of the ABM but split the population of foxes according to their type of response in a behavioural challenge. When reported in this way, signs of fur chewing were found in approximately 30% of the animals.

In a questionnaire survey sent to approximately 900 members of the Finnish Fur Breeders Association, and with a response rate of less than 10%, fur farmers reported that fur chewing most typically occurs in 0%–10% of Arctic foxes (Koistinen et al., 2021), which seems to be less than reported by Ahola et al. (2014) and Mononen et al. (2021) from observation of animals on-farm. Answers to the occurrence of fur chewing in red foxes and hybrids were highly variable. Signs of fur chewing was reported to be found most often in the tail, hips and flanks in Arctic foxes. Fur chewing was evaluated by the survey's respondents to be most severe in the tip of the tail. The respondents evaluated that fur chewing behaviour steadily increases as the autumn proceeds and it is most intense in winter, decreasing thereafter with advancing spring. It was often mentioned by respondents that fur chewing starts when restricted feeding starts, i.e. slimming of breeding females before breeding.

FIGURE 7 Fox in an elevated platform in a cage with extensive signs of severe fur chewing on the tail and back part of body (©Animalia, Supporting information SF3).

In foxes, SB (Table 11) includes locomotor stereotypies (repeated pacing or jumping, partly combined with head twirling) performed independently as well as together with an animal in a neighbouring cage, manipulative (scratching, digging) and oral (licking, biting) stereotypies and tail-chasing (Ojala et al., 2025), although classification may vary between studies. When foxes are hungry and anticipate food, they become more active including showing more (locomotory) SB (Korhonen, Jauhiainen, & Niemelä, 2001; Moe et al., 2006). SB was recorded in up to 10% of foxes on over 80 farms assessed in Finland in 2012–2014 (Ahola et al., 2014). For farmed Arctic foxes, items like bones or wooden blocks stimulate gnawing (Koistinen, Turunen, et al., 2009) and reduce oral SB. For example, eight pairs of juvenile Arctic foxes with bones showed oral SB at an average of 7% of scans during 24h compared to 12% for eight pairs without bones (data for November; Koistinen, Turunen, et al., 2009).

As part of their work to evaluate behavioural tests and measures of SB for a welfare assessment tool (WelFur), Koistinen et al. (2012) presented data from 10 Finnish and five Norwegian farms visited in January or February. In their conference abstract, it is described that the percentage of foxes performing SB ranged from 0% to 13% on the farms. No methodological details about, for example, time of day of the observations or the number of animals assessed are presented. In the protocol, developed to compare the level of animal welfare between fur farms in Europe, SB is scored as binary outcome when farms are visited (WelFur, 2015b).

Also in a conference abstract, Huuki et al. (2011) presented data from six Norwegian farms and four Finnish farms, visited in June–July 2011, which is the whelping season. The study included 862 foxes (of which 5% were Arctic foxes and 95% red foxes) in Norway and 831 foxes (77% Arctic foxes and 23% red foxes) in Finland. Out of all observed animals, 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%). The percentage of foxes showing SB (Norway: 2.1%, Finland: 1.8%) did not differ between the countries. The percentage of foxes showing SB was higher in red foxes than in Arctic foxes (2.8% vs. 0.7%).

Another behaviour often referred to as abnormal is infanticide (vixens killing their own offspring), which is observed in farmed red foxes but not in Arctic foxes and thought to be caused by social stressors in the cub rearing environment, such as high housing density or low dominance status of the vixens in comparison to neighbouring vixens (Bakken et al., 1999; Section 4.3.5). Farmed red fox vixens may also bite off part of or the whole tail of their cubs (Braastad, 1987).

4.3 | Description of WCs selected as the most relevant for foxes and associated hazards

This section describes the highly relevant WCs identified according to the methods described above. Although not specifically requested in the mandate, for these WCs, ABMs that have been recorded in studies testing the effects of housing modifications on the behaviour and welfare of farmed foxes, as well as ABMs that might not have been tested in this context but can indicate the presence of WCs have been identified and interpreted in Section 4.2.

4.3.1 | Restriction of movement

4.3.1.1 | *Description of restriction of movement and linked WCs*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as pain, fear, discomfort and/or frustration due to the fact that it is unable to move freely or to walk comfortably (e.g. due to overcrowding, unsuitable floors, gates, barriers)'.*

Interpretation for foxes

The confined living conditions of farmed Arctic and red foxes (EFSA, 2025) limit the quantity of movements (cumulative time spent in active behaviours) as well as the type and quality of movements. This WC applies to all animal categories and thus all scenarios in this SO (excluding immobile cubs inside the nest box; Table 10).

Arctic and red foxes have a large behavioural repertoire (EFSA, 2025), which includes running, jumping, vole jumps (mousing) for catching small rodents, as well as digging for hunting, for creating food caches (see Section 4.3.2) or for building dens. Moving (approx. 30%), exploring (approx. 25%) and playing (approx. 13%) are the most frequent behaviours shown by cubs in the wild after emerging from den at around 4 weeks old (Meyer & Weber, 1996). Moving, locomoting, exploring and foraging often overlap and thus cannot be clearly distinguished. Data reported on wild foxes show that they move approximately 12 h per day - mostly during twilight and nighttime hours - and may travel considerable distances for foraging and exploring (EFSA, 2025). The performance of these behaviours is severely restricted in the current system, where some cages are little longer than body length and wire mesh is the typical flooring material.

Linked WC: Inability to perform play behaviour

The WC Inability to perform play behaviour is defined as (EFSA AHAW Panel, 2022): '*The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to engage in social/locomotor or object play*'.

Play behaviour is common, especially in young mammals (Held & Špinka, 2011), and in most cases indicates absence of poor welfare (Ahloy-Dallaire et al., 2018; see Section 3.3.1). Young foxes play from around 24 days of age (Fox et al., 1976), using over 20 different behavioural elements (Yachmennikova & Korenkova, 2015) including locomotory, object and social play (Buhler et al., 2024; EFSA, 2025). Adult red foxes (particularly males) are mainly solitary outside of the breeding season; however, they may show social play with other adults, e.g. during the mating season (Wooster et al., 2019). Inability to perform play behaviour is linked with the WC Restriction of movement, because especially locomotory play (running, jumping) and social play require more space than available in the current system, as well as more adequate flooring, while object play depends on the presence of suitable objects to play with.

4.3.1.2 | *Hazards leading to restriction of movement and linked WC*

For possible effects of these hazards on social behaviour see the WC Group stress (Section 4.3.5), and for those regarding human-animal relationship see the WC Handling stress (Section 4.3.6).

As reviewed in EFSA (2025), typical cage areas for Arctic and red foxes are: 0.75 m^2, 0.80 m^2 or 1.2 m^2 for single-housed male and female breeding foxes, 2.0 m^2 for one lactating female with cubs (occasionally with additional 0.35 m^2 roof nest box) and 1.2 m^2 for pair-housed juveniles (plus 0.5 m^2 for each additional juvenile). Typical cage height is 70 cm but may be lower on some farms. These dimensions for floor area and height of the cage were recommended more than 25 years ago by The Standing Committee of the European Convention for the Protection of Animals kept for Farming Purposes (Council of Europe, 1999[18]), however without the presentation of underlying evidence.

- **Insufficient floor area to allow motivated types of active behaviours, including locomotion and play**

Wild Arctic foxes are up to approximately 65 cm long (with an additional tail length of up to 33 cm; Østbye et al., 1976), and wild red foxes up to 72 cm (with an additional tail length of 43 cm; Cavallini, 1995). Shoulder height of wild Arctic foxes is approximately 30 cm, and that of red foxes up to 52 cm (Østbye et al., 1976). One study showed that farmed red foxes have a longer head-body length (without tail) than wild foxes (median 71 vs. 68 cm; $n=199$ vs. 127; Zatoń-Dobrowolska et al., 2016). This presumably also applies to Arctic foxes, but no body dimension data for farmed Arctic foxes have been found. The stride length of red foxes is approximately 25–80 cm (Bang et al., 2000).

Cages typically used for single breeding animals are 100, 107 or 115 cm long and 75, 76 or 105 cm wide (EFSA, 2025). Thus, single cages are sometimes shorter than the total body length of a red fox and usually narrower than the total length of an Arctic fox. Cages used for lactating dams and for juveniles (typically kept in pairs) are larger than single cages (nursing: 240 × 107 cm; juveniles: 107 × 116 cm; EFSA, 2025). The severe two-dimensional movement restrictions are aggravated by unsuitable flooring material (wire mesh), as well as low cage height (approximately 70 cm; see below) and little to no structure for movement in three dimensions. In addition, current cage sizes also severely restrict the possibilities of including enrichment in the cages as well as the establishment of functional areas (e.g. for activity, resting, elimination) (Figure 8).

FIGURE 8 Husbandry system for foxes (© Oikeutta eläimille, Supporting information SF4).

When 18 pairs of male and female juvenile red foxes were kept in 1.2 m^2 cages with a nest box placed inside the cage leaving 0.48 m^2 floor area per fox, the pairs spent all of their inactive/resting time together on the nest box roof but most of the active time alone on the cage floor (median proportion of time spent active on cage floor alone vs. together: October: 39 vs. 2%, November: 43 vs. 1%; Mononen et al., 1995), apparently because the floor space was too small.

Three studies with Arctic foxes (Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen, Niemelä, & Jauhiainen, 2001; Ahola et al., 2005) and one with red foxes (Ahola, Mononen, & Pyykkönen, 2002) in their home cages had group size replicates at different space allowances (0.3–7.5 m^2/fox across experiments), which allowed some conclusions on the effect of space without group size confounding. The study designs are summarised here, and the results outlined below.

Ahola et al. (2005) kept one, two or four Arctic or red (Ahola, Mononen, & Pyykkönen, 2002) foxes in connected standard cages of 115 cm length × 105 cm width × 70 cm height: one fox per cage at 1.2 m^2/fox (L1), two foxes per cage at 0.6 m^2/fox (S2), two foxes in two connected cages at 1.2 m^2/fox (L2), four foxes in two connected cages at 0.6 m^2/fox (S4) and four foxes in four connected cages at 1.2 m^2/fox (L4). Each cage (= compartment) contained one platform and one feeding tray. Ahola, Mononen, and Pyykkönen (2002) assessed activity from three 24 h videos in August, October and December with 5-min sampling and abnormal behaviour only from the December recording. Ahola et al. (2005) assessed activity and locomotor stereotypies from two 24h recordings in August and November with 5-min sampling. There were seven units per treatment.

[18]Council of Europe. (1999). Recommendation concerning fur animals, adopted by the Standing Committee of the European Convention for the Protection of Animals kept for Farming Purposes on 22 June 1999. https://www.coe.int/en/web/cdcj/1999-rec-fur-animals (Accessed 27 June 2025).

Korhonen, Jauhiainen, and Niemelä (2001) kept single male juvenile Arctic foxes in 105 cm wide and 70 cm high wire mesh cages that were 80, 120 or 240 cm long (CL) and in 240 cm long wire mesh cages (CLE) with access to earth below the cage (CL80, CL120, CL240, CL240E, respectively). Space allowances were 0.84, 1.26, 2.52 and 3.36 m^2/fox for CL80, CL120, CL240, CL240E, respectively. The cages did not contain any platform or nest box, except for CL240E in which foxes could reach the earth compartment below their cage (80 × 105 × 70 cm high) via a platform. Behaviour was assessed from six 24 h video recordings from August to November using 1-min sampling. There were 10 units per treatment.

Korhonen, Niemelä, and Jauhiainen (2001) kept pairs of male juvenile Arctic foxes in 50 × 105 cm (W50) and 120 × 105 cm (W120) wire mesh cages (70 cm high), as well as in 5 × 3 m ground enclosures in which access to earth was denied by wire mesh flooring (W500), and in 5 × 3 m enclosures with free access to earth (E500; 1.8 m high). Space allowances were 0.3, 0.6, 7.5 and 7.5 m^2/fox for W50, W120, W500 and E500, respectively. Cages and enclosures did not contain any platform or nest box. Behaviour was assessed from five 24 h video recordings from August to November using 2-min sampling. There were 10 units per treatment.

Across the four experiments (Ahola, Mononen, & Pyykkönen, 2002; Ahola et al., 2005; Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen, Niemelä, & Jauhiainen, 2001), overall, 24-hour activity levels, which partially included SB were generally low, ranging from approximately 20%–30%. These levels are notably lower than those observed in wild foxes or captive foxes housed in large, enriched enclosures, where daily activity typically ranges from 40% to 50% (Anthony, 1997; Clermont et al., 2021; Kistler et al., 2010; Schwemmer et al., 2021).

In three of the four studies, overall activity did not differ significantly across different space allowances or group sizes, with reported values of 26%–30% (including SB; Ahola, Mononen, & Pyykkönen, 2002), an average of 22% (range: ~15%–35%; Ahola et al., 2005) and 32%–34% including or 30%–32% excluding SB (Korhonen, Jauhiainen, & Niemelä, 2001). However, in the fourth study (Korhonen, Niemelä, & Jauhiainen, 2001), comparing 0.3, 0.6 and 7.5 m^2/fox, juvenile male Arctic foxes housed in pairs showed a clear effect of space allowance on activity levels: 24-hour activity (including SB) increased with more space, from 17% in 50 × 105 cm cages to 22% in 120 × 105 cm cages, 27% in a 5 × 3 m enclosure with wire mesh floor and 28% in 5 × 3 m ground enclosures. Corresponding values excluding SB were 16%, 20%, 24% and 26%, respectively ($n = 40$). Thus, when cages/enclosures were barren, increasing the floor areas up to approximately 3 m^2 did not lead to mitigation of the behaviour of the foxes. This was only seen in significantly larger areas.

Differences in the occurrence of SB among foxes provided with different floor areas have been reported as quite small and not consistently reflecting the space allowance. There was high inter-individual variation for locomotory behaviours in the three studies that assessed this (Korhonen et al., 1999; Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen, Niemelä, & Jauhiainen, 2001). Foxes in smaller cages spent less time locomoting per day in two studies (Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen, Niemelä, & Jauhiainen, 2001) and comparable amounts of time across treatments in one study (Korhonen et al., 1999). There may, thus, be opposite effects of space on different locomotory elements (e.g. slow pacing, non-stereotypic pacing with a neighbour) (Korhonen, Jauhiainen, & Niemelä, 2001).

The results for other behaviours recorded in two of the studies were inconclusive and mostly did not differ between space allowances (e.g. standing, sitting, auto-grooming, jumping, licking, social behaviours) (Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen, Niemelä, & Jauhiainen, 2001). There was no clear influence of space allowance on physical fitness. Red, but not Arctic, foxes kept at 0.6 m^2/fox had lighter hearts compared to those housed at 1.2 m^2/fox (Ahola, Mononen, & Pyykkönen, 2002; Ahola et al., 2005), which according to the authors may indicate lower fitness at lower space allowance.

In **summary**, the insufficient floor area in cages of the current system severely restricts the movement of foxes. Available evidence shows that the tested increase in floor area has only limited effects on restriction of movement, but that an additional improvement is observed if the increase is combined with adding structures and resources like platforms and nest boxes or substrate like earth or sand (see also Section 4.3.2). Connecting existing cages may add structural complexity in addition to increasing usable floor area. However, overall, the available evidence is limited and more robust evidence from well-designed studies with sufficient numbers of observations and balanced testing of dimensions beyond the current system is needed to draw firm conclusions regarding the mitigation of Restriction of movement and associated welfare hazards in these species.

Insufficient floor area to perform play behaviour

Insufficient floor area is a hazard for the linked WC Inability to perform play behaviour in the same way as for Restriction of movement, i.e. the available space is insufficient for performing play behaviours. Play behaviour was not assessed in three of the above studies on space allowance (Ahola, Mononen, & Pyykkönen, 2002; Ahola et al., 2005; Korhonen et al., 1999). In the two studies where it was assessed, it depended on access to earth floor but not on space allowance (Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen, Niemelä, & Jauhiainen, 2001). Further research is needed to clarify relations between cage/enclosure space and play behaviour in foxes kept for fur production.

- **Insufficient cage height and structures to facilitate movement in three dimensions**

The height of cages typically used for farmed Arctic and red foxes is 70 cm (may be lower in some farms) (EFSA, 2025), which is less than twice the shoulder height of wild red foxes (approximately 35–52 cm; Østbye et al., 1976, Figure 7). Even though some foxes also show vole jumps in 70 cm high cages (Koistinen & Mononen, 2008), the cage height limits the height of the jumps, which in wild foxes may be more than shoulder high (EFSA, 2025). The available experiments did not test cages of different height but compared cages of standard height with earth floor enclosures (Korhonen & Niemelä, 1997; Korhonen, Jauhiainen, & Niemelä, 2001). Cage height can be considered as a potential hazard for Restriction of movement and the linked WC Inability to perform play behaviour, involving vole jumps. Further research is needed to clarify this.

Foxes prefer to observe their surroundings, especially points of activity such as shed entrances (Mononen et al., 1993). An enclosure height of 70 cm impairs the use of resting platforms or roofs of nest boxes, because a space of 23 to 32 cm between platform/roof and enclosure ceiling does not allow the foxes to sit in an upright canine position or stand without bending their legs (Mononen et al., 1995).

The space above the platforms varies slightly which can influence the use by foxes. Adult female Arctic foxes were detected on the platform less often during daytime scans, if the platform was 23 cm below the ceiling than if it was 30 cm below the ceiling (e.g. 50% vs. 61% of scans in November; $n=29$ for 23 cm, 19 for 30 cm); use did not differ in adult males (Korhonen et al., 1995). The difference between sexes may be because the height difference is less relevant for males because they are taller, or it may be an assessment effect, because males and females use platforms differently across the day (Korhonen & Niemelä, 1996a) and the study only used daytime observation.

Platform use often varies greatly between individuals within as well as across experiments (Korhonen et al., 1995, 1996; Korhonen & Niemelä, 1996b; Mononen et al., 1993). Overall, however, the absence of elevated structures restricts opportunities for vertical exploration and three-dimensional movement. For example, 40 adult Arctic foxes spent 13 min over 24 h jumping up and down a platform (Korhonen et al., 1996). Triangular platforms in a corner are more difficult to jump on or off and may increase the risk of injuries in foxes without preweaning platform experience (Korhonen et al., 1995). Foxes preferred nest box roofs over wire mesh platforms in most studies (Koistinen & Korhonen, 2013; Koistinen, Jauhiainen, & Korhonen, 2009; Koistinen et al., 2016) but not in all (no difference; Koistinen & Korhonen, 2013). There is insufficient evidence for estimating the effect of enclosure height on the linked WC Inability to perform play behaviour.

- **Inadequate floor material**

According to EFSA (2025), floor mesh size in fox cages is equal to or smaller than 11.5 cm^2 with wire thickness of at least 2.1 mm^2. Adult red fox feet are approximately 5 × 4–4.5 cm, and the toes approximately 17–19 × 8–10 mm (Bang et al., 2000). Inadequate floor material impairs movements through inadequate grip and discomfort while moving. Flooring materials like sand and earth additionally influence foxes' behaviour by enabling exploratory and foraging behaviour including digging, which is discussed in Section 4.3.2.

Sand boxes soiled with faeces or frozen sand are generally used less than clean sand boxes (Korhonen et al., 2003; Koistinen et al., 2008). However, locomotion data in relation to sand flooring may be confounded by non-locomotory factors, such as the substrate's (sand) inherent attractiveness for exploratory behaviours. Twelve juvenile male Arctic foxes without a sand box in their cage spent more time locomoting than 12 foxes with a sandbox (Korhonen et al., 2003). Likewise, eight pairs of male and female Arctic foxes kept in cages with two compartments with wire mesh flooring spent more time walking in September (but not in October or December) than eight pairs with wire mesh in one and sand flooring in the other compartment (Koistinen et al., 2008). The cages of the foxes with wire mesh flooring only were in between the cages with sand access, so that all foxes could see each other. During and after 14 days of sand deprivation (access to a wire mesh compartment instead of the sand flooring compartment), the deprived foxes spent more time walking than before the deprivation (Koistinen et al., 2008). These results suggest that access to sand boxes does not increase locomotory behaviour but may influence other active behaviours (see below).

Jumping requires flooring that provides sufficient friction and does not pose a risk of injury. However, it is difficult to draw definitive conclusions about flooring-related hazards from existing studies, as assessments often conflate general jumping behaviour with vole jumps – a specific, foraging-related activity that is influenced by other floor characteristics (see Section 4.3.2). Thus, the result that foxes with a sandbox inside their wire mesh cage spent more time jumping than foxes without a sand box, even though the sand box was underneath a wire mesh platform and thus allowed little room for jumping (24 male juvenile Arctic foxes; Korhonen et al., 2003) may be related to exploratory behaviour rather than locomotion. This is supported by foxes performing more vole jumps on deep sand compared to shallow sand, concrete or wire mesh flooring (Koistinen & Mononen, 2008). In other studies, the effect of flooring type may have been confounded by the influence of space allowance, though the effects are varied (Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen, Niemelä, & Jauhiainen, 2001).

Operant conditioning has been applied in studies of motivation in foxes (see Section 3.3.4 for an introduction to the methodology). In two operant experiments, six (Koistinen et al., 2007) and seven (Koistinen & Mononen, 2008) male juvenile Arctic foxes housed on wire mesh flooring had to press a lever for 4-min access to 15–30 cm deep sand which was frozen in winter (Koistinen et al., 2007), or to 15–30 cm deep dry sand, 3–4 cm shallow sand on concrete, concrete without sand or wire mesh floor. In the study by Koistinen & Mononen (2008), the foxes demonstrated a higher motivation to access deep and shallow sand flooring compared to concrete or wire mesh as indicated by the higher intercepts of the demand functions. However, the slopes of these demand functions – which reflect sensitivity to increasing effort (lever presses) – and the time spent walking on various flooring types, did not differ significantly across the different flooring materials. In the experiment by Koistinen et al. (2007), the slope and intercept of the demand functions for access to sand floor did not differ between autumn, winter (sand was frozen) and spring. Twenty-seven male juvenile Arctic foxes in cages with two compartments with weighted connecting doors showed the same overall level of activity when there was wire-mesh flooring in both compartments, or wire mesh in one and sand flooring in the other compartment (Koistinen, Orjala, et al., 2009). The animals with a wire mesh and a sand floor compartment spent approximately 35%–70% of total activity in the compartment with sand floor (Koistinen, Orjala, et al., 2009). Thus, foxes are more motivated to access sand than concrete or wire mesh, but the exact effect of the different flooring types on behaviour cannot be concluded from the studies.

Another way to examine animal wants is by the performance of preference studies, as choice is considered a critical component of captive animal welfare (Rust et al., 2024). This methodology has also been used to examine preferences for floor types in foxes. Twelve adult male and female red foxes that could choose between four compartments which either had wire mesh, plywood, 5 cm deep sand, or wet plywood in spring and wet sand in winter as flooring, spent the least of their active time on wire mesh flooring (Harri et al., 1999). Twelve adult Arctic foxes that could choose between wire mesh, plywood, 5 cm deep dry sand and 5 cm deep wet sand, which was frozen in winter, spent comparable proportions of active time on all flooring types in January/February, but in July spent less active time on wet sand than on plywood or dry sand, with wire mesh being intermediate (Harri et al., 2000 same setup as Harri et al., 1999). These results suggest that foxes prefer dry sand or solid surfaces (concrete, plywood) over wire mesh or wet sand for active behaviours.

In a choice experiment involving two connected cages of which one was positioned 50 cm higher than the other and differing in flooring material (sand vs. wire mesh), cage height appeared to be a more influential factor for active behaviours than flooring type in both male and female Arctic foxes: In January to February ($n = 12$), foxes spent approximately 60% of their active time in the upper cage when the upper cage had wire mesh and the lower cage sand floor. When the upper cage had sand floor and the lower wire mesh, the foxes spent approximately 73% of their active time in the upper cage. When upper and lower cage had wire mesh floor, foxes spent approximately 65% of active time in upper cage. In April ($n = 8$), the preferences were similar but less clear (Harri et al., 2000). An even stronger preference for height was apparent in an experiment with differently sized wire mesh cages, of which the largest cage was tested with and without access to earth (80 × 105 cm) below the wire mesh cage (Korhonen et al., 1999). Here, foxes spent a mean of 78% of locomotion time on the wire mesh level, 19% in the earth compartment and 3% going up/down between the wire mesh and the earth level. A high between-individual variation was observed (Korhonen et al., 1999). When a raised 110 × 107 cm wire mesh cage was connected to a 2 × 4m ground level earth enclosure with a nest box, five adult male red foxes spent similar times locomoting in the wire mesh cage and in the earth enclosure (average ± standard deviation 178 ± 105 vs. 147 ± 48 min/24 h), even though they spent 73% of overall time in the raised wire mesh cage (Korhonen & Niemelä, 1997).

Overall, these results suggest that both access to elevated places for surveillance as well as access to sand or earth flooring are important. In summary, studies providing evidence on effects of floor material on active behaviours of foxes including locomotion suggest that foxes spend less time in active behaviours on wire mesh compared to solid surfaces (e.g. concrete, sand) and more on dry loose substrate (sand, earth), with interindividual differences regarding preference and use.

Inadequate flooring material to allow play behaviour

During operant tests, more play behaviour was observed on sand. Seven male juvenile Arctic foxes played more than three times as long on deep (15–30 cm) or shallow (3–4 cm) sand than on concrete or wire mesh, when they were given 4 min access to one of the flooring materials after pressing a lever (Koistinen et al., 2007). Similarly, 15 male juvenile Arctic foxes with a wire mesh and a sand floor compartment spent more than 80% of their total playing time in the sand floor compartment, and this did not change when weight was added to the connecting doors (Koistinen, Orjala, et al., 2009). However, the overall proportion of time spent playing did not differ between foxes with or without access to sand (27 foxes total; Koistinen, Orjala, et al., 2009).

Male juvenile Arctic foxes played more when kept in 3.4 m^2 cages with access to 80 × 105 cm earth floor below the cage than when kept in 0.84–3.4 m^2 wire mesh cages without earth access (40 foxes; Korhonen, Jauhiainen, & Niemelä, 2001). Similarly, 40 pairs of male juvenile Arctic foxes kept in a 5 × 3 m enclosure with access to earth played longer (1.5 min/day) compared to those in an identical enclosure where the earth was covered with wire mesh (0.9 min/day), or in wire mesh cages of 0.3–0.6 m^2 (0.8 and 0.6–0.9 min/day, respectively; Korhonen, Niemelä, & Jauhiainen, 2001).

Contrastingly, 16 pairs of male and female juvenile Arctic foxes with access to a sand floor compartment played less than pairs with wire mesh only (approximately 2.5 vs. 3.4%) and spent less than 50% of their total playing time on sand (Koistinen et al., 2008). Playing behaviour did not change during or after 14 days of sand deprivation (Koistinen et al., 2008). This could be because foxes in this experiment used the sand compartment as latrine. Overall, these results suggest that clean loose substrate such as sand or earth promote play behaviour in foxes.

4.3.2 | Inability to perform exploratory or foraging behaviour

4.3.2.1 | *Description of inability to perform exploratory or foraging behaviour and linked WC*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as frustration and/or boredom resulting from the thwarting of the motivation to investigate the environment or to seek for food (i.e. extrinsically, and intrinsically motivated exploration)'.*

Interpretation for foxes

The barrenness of typical fox cages (EFSA, 2025) severely impedes the performance of highly motivated foraging and exploration behaviours through sensory understimulation as well as lack of necessary space and/or material (substrate, object, structure). This WC applies to all scenarios in this SO (excluding immobile cubs inside the nest box; Table 10).

Foraging and exploration are often indistinguishable. While foraging refers to the search for and acquisition of food, exploratory behaviour includes searching for any resource, including shelters or partners for mating. Both are highly motivated due to their biological relevance and reinforced by appetitive stimuli, related to possibly positive outcomes, especially in relation to food, for example, edible objects or substrate for digging. Moving (approx. 30%), exploring (approx. 25%) and playing (approx. 13%) are the most frequent behaviours shown by cubs in the wild after emerging from den at approx. 4 weeks old (Meyer & Weber, 1996). Wild foxes spend approximately 12 h per day moving for foraging and exploring, including considerable time **digging** (e.g. 1.9 h/day in a sample of 16 Arctic foxes; Clermont et al., 2021; see also EFSA, 2025). Foxes dig out burrow-nesting birds (Sklepkovych & Montevecchi, 1996) or rodents, especially during snow cover in winter (Willebrand et al., 2017). For instance, 16 Arctic foxes in Canada spent 8% of their daily time digging (Clermont et al., 2021). In the current system without digging material, foxes have been observed to perform sham-digging (without functional consequences of the behaviour) on wire mesh or concrete floor (Koistinen & Mononen, 2008).

In the wild, foxes use dens dug by other animals (e.g. badgers; Kowalczyk et al., 2000) but also dig extensively for creating and maintaining dens, which can be considered as exploration for resting and breeding resources. The mean area covered by 77 Arctic fox dens was 277 ± 237 m^2 (Dalerum et al., 2002), and the amount of earth moved by den burrowing of red foxes was sufficient to change the plant societies in a 100 m^2 area around the dens (n = 9 dens; Kurek et al., 2014). There is lack of evidence regarding the motivation of foxes to dig or modify their own dens, especially in the absence of nest boxes as artificial dens in the current system (which only provided to nursing females). Six male juvenile arctic foxes in a 60 m^2 earth enclosure with two (August) to four (October) 40 × 40 × 70 cm nest boxes spent on average 2.2 min/digging but they did not dig tunnels or dens (Korhonen, Niemelä, & Wikman, 2001).

Foxes also dig for **caching** food (also called 'hoarding') in earth caches outside of their dens. It is a common behaviour that increases with food abundance. Often, food is cached close to where it was found and later moved to longer storage caches throughout the territory (Arctic foxes: Careau et al., 2007; Arctic + red: Sklepkovych & Montevecchi, 1996; red: Thomson & Kok, 2002). A variety of findings indicate that farmed foxes are motivated to cache food (e.g. they seem to attempt to cache food in wire mesh flooring; Korhonen, Jauhiainen, & Niemelä, 2001) see the hazard Lack of enrichment that allows digging) but it has not been formally investigated, so the extent of motivation is unclear. Further research is thus needed to clarify the consequences of inability to cache food in terms of welfare of foxes kept for fur production.

Linked WC: Inability to chew

The WC Inability to chew considers also rumination as defined in (EFSA AHAW Panel, 2022): *'The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to ingest sufficient amounts of fibrous feed or the inhibition of rumination'.*

For the purpose of this SO, the WC will be referred to as 'Inability to chew' without the addition of rumination (not applicable in foxes). For foxes, chewing can be interpreted as *'chewing of food with the consistency of animal carcasses as part of natural consummatory behaviour'*. Inability to chew applies to the whole period foxes are kept on farm and, thus, to all scenarios apart from cubs during the first 4 weeks of life in Scenario 2.

Inability to chew is linked with the WC Inability to perform exploratory or foraging behaviour because chewing is part of foraging behaviour. Most dietary components of wild foxes require chewing for acquisition and/or consumption, such as rodents, birds or carcasses from e.g. reindeer or deer, which is reflected in the skull and teeth anatomy of foxes (EFSA, 2025) and may contribute to dental health. Farmed Arctic and red foxes are not given the opportunity to chew while eating their feed because it has a paste-like consistency (EFSA, 2025).

4.3.2.2 | *Hazards leading to inability to perform exploratory or foraging behaviour and linked WC*

- **Limited cage size (both horizontal and vertical space) to perform exploratory and foraging inclusion of structural enrichment or to allow exploratory or foraging behaviour**

Exploration and foraging behaviour are severely restricted in cages or enclosures without structures that add physical complexity because of lack of stimuli. There is a lack of evidence for establishing the effects of simple structures like screens (visual barriers), platforms or compartments, because exploratory and foraging behaviour was not assessed in most studies with the respective structures as treatments (e.g. a study with foxes in cages, on, two and four compartments; Ahola, Mononen, & Pyykkönen, 2002). Studies in which exploratory behaviour was assessed, either did so during short-time exposure in an operant test (Koistinen & Mononen, 2008; Koistinen, Orjala, et al., 2009; Koistinen et al., 2016), or in connection with sand or earth (Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen et al., 2003; Koistinen et al., 2008). Thus, further research is needed to determine whether addition of simple structures can mitigate the WC Inability to perform exploration or foraging behaviour.

The limited space in the current system severely restricts the performance of exploratory and foraging behaviours (see Section 4.3.1) and is a strong limitation for the provision of structural enrichment. The typical cage **height** of 70 cm

(EFSA, 2025) does not allow a fox to stand straight underneath and on top of a platform (shoulder height of wild red foxes up to 52 cm; Østbye et al., 1976). Similarly, the **floor sizes** typically used for single breeding animals are 100, 107 or 115 cm long and 75, 76 or 105 cm wide (EFSA, 2025), which is very close to the head-body length (without tail) of farmed red foxes (approximately 71 cm; Zatoń-Dobrowolska et al., 2016) and thus severely restricts the possibilities for furnishing the cage.

Even for pairs of juvenile foxes the typical cages with 1.2 m^2 floor area (EFSA, 2025) do not leave much room for adding structure. For example, when a nest box of 40 × 60 cm is added inside the cage, the floor area per fox is reduced from 0.6 to 0.48 m^2. This resulted in severe restriction of the simultaneous use of the cage floor in 18 pairs of red foxes, which only spent 1%–2% of active time together on the cage floor (Mononen et al., 1995). Similarly, the available floor area is too small for adding a sand box.

In summary, the cage dimensions of the current system prevent extensive movements that are part of foraging behaviour, such as running or jumping (see Section 4.3.1), as well as the addition of physical complexity, which would be required for foxes to be able to perform exploratory and foraging behaviour.

- **Lack of physical complexity of the cage**

Platforms are common in the current system for foxes (EFSA, 2025), but the space between the platform and the ceiling is usually so low that foxes can only crouch or lie on top (Ahola et al., 2014; Figure 7). Increasing the space between the platform and ceiling will increase their use by animals (Korhonen et al., 1995, 1996), and if the space allows foxes to stand without having to bend their legs or lower their head, it will permit more exploratory and foraging behaviours. Increased platform use has been reported for 30 vs. 23 cm space between platform and ceiling (Korhonen et al., 1995, 1996), but comparisons of larger spaces are required. See Section 4.3.1 for further information on platforms.

It has been hypothesised that locations which cannot be constantly monitored by the fox encourage exploration. Such areas can be provided by including **screens (visual barriers)** underneath a platform. However, a study involving 38 juvenile female Arctic foxes with and without screens underneath the platform found no differences in mean activity level, fur chewing oral SB, abnormal scrabbling or FCM (Ojala et al., 2025). There were no results for the combination of screens with extra enrichment objects. Thus, evidence for prevention or mitigation of this hazard by addition of visual barriers was not verified.

Nest boxes or similar den-like structures besides providing shelter (Section 4.3.1) also provide areas to explore. However, evidence of the behaviour performed inside nest boxes is lacking and there is limited data on how often foxes enter a nest box for short (exploration) visits. Foxes in the studies used the nest box roof more than the inside, though effects of age and season are unclear.

Other ways of adding structure to cages are difficult to implement in the current system due to small cage sizes and have not been investigated regarding exploratory and foraging behaviour. In **summary**, platforms are the only permanent items adding physical complexity in the current system, but their use is limited by low cage height. Inclusion of other structures is prevented by small cage sizes.

- **Lack of enrichment providing stimuli for appetitive and consummatory foraging behaviour**

Enrichment objects and materials for foraging

Oral manipulation is an important aspect of exploration and foraging in foxes. **Bones** can be explored and chewed and have some nutritional value. The bones used in the studies below were defrosted cattle femur bones.

In an experiment with 16 male–female sibling pairs of Arctic foxes in cages with two compartments (1.2 m^2/fox), eight of the pairs had two **bones** in one of the compartments and eight pairs had no bones (data published in Ahola et al. (2010) and Koistinen, Turunen, et al. (2009)). There were two bone deprivation periods of 10 days at 11 and at 14 weeks of age. Interactions with the bone involved gnawing, sniffing or licking the bones, using in social and scratching them with forepaws (Koistinen, Turunen, et al., 2009). When bones became soiled with faeces over time, their use for exploratory/foraging behaviour decreased (43 min/day in November vs. 57 min/day in August and September; Koistinen, Turunen, et al., 2009).

Foxes without bones showed more maintenance behaviour (eating, drinking, grooming, elimination) than foxes with bones (approx. five observations more per 24 h). During deprivation, maintenance behaviours in bone treatment foxes increased by approx. 30% (Koistinen, Turunen, et al., 2009). In the same study, foxes without access to bones showed more oral SB than foxes with access to a bone (locomotor SB were rare and did not differ; Koistinen, Turunen, et al., 2009). Foxes without access to bones showed less overall play behaviour than those with bones, with the difference being made up of playing with it. In another study, foxes with access to bones tended to have more, but not more severe, bite marks in their hides (25% of males and 75% of females with access to bones had bite marks vs. 12.5% of males and 50% of females without a bone; total 16 male–female sibling pairs; Ahola et al., 2010). Thus, providing fewer point-source resources (like bones) than the number of animals in the enclosure increases the risk for WC Group stress due to limited resources.

Foxes with access to bones were free of gingivitis or oral ulcers, while one fox without bones had mild gingivitis and three had small oral ulcers (Ahola et al., 2010). Foxes with bones also had less severe dental calculus (mean calculus severity in males|females, scale 0–3): with bone 0.4|0.7, without bone 1.6|1.1; Ahola et al., 2010). Thus, when provided, bones were used about 1 h per day and their use resulted in improved dental health and decrease in abnormal behaviours, while creating a potential source for agonistic interactions.

Some studies have examined effects of simultaneous access to more than one resource. Thirty single-housed juvenile male and female red foxes were given simultaneous access to one cattle **bone**, one pressed **rawhide** dog 'bone', one **pulling device** between neighbouring cages, one hard **plastic** cube and **straw** in a rack on the cage wall for 10 days. Then, the animals were kept with a wooden stick only for 8 days, before the previous resources were reintroduced (Hovland et al., 2016). After reintroduction, the bones (20 s) and longest for straw (2450 s). The bone and the most used resources during one observation hour on days 1, 2 and 4 after reintroduction.

In another study, the only one involving rope, bones were used less than pulling ropes by 12 adult female Arctic foxes kept for 26 days in cages (107 × 115 × 70 cm) with access to the following: one wire mesh **platform** (105 × 25 cm, 23 cm from ceiling), one **bone** (30 × 7 cm), one **top nest box** with wire-mesh floor (40 × 70 × 40 cm high), **straw** (between the walls of neighbouring cages), one wooden **scratching plate** against the wall (45 × 45 cm), one sisal **wall rope** into neighbour cage (11 mm × 30–40 cm), one sisal **ceiling rope** (11 mm, hanging 30 cm from ceiling) and one **hockey puck** (rubber, 76 × 25 mm) (Korhonen & Eskeli, 2015). The use of the resources varied from 2.2 ± 1.4% of 3 h observation time on 4 days) to 0.2 ± 0.2% with wall rope being used the most and scratching plate and straw used the least.

Wooden cylinders have also been tested as a resource for foxes kept for fur production. In a study involving eight adult male Arctic foxes, the animals interacted with a 30 × 7 cm birch **wood cylinder** by several behavioural elements, such as carrying (27 times/fox/day), chewing (20), poking (11), sniffing (9), urinating (6) and playing (3) (Korhonen & Niemelä, 2000). Urination frequency was highest during the breeding season, thus enabling the foxes to show territorial scent marking, which is a basic fox behaviour shown by males and females from around 4 weeks of age (Meyer & Weber, 1996; Norén et al., 2023; Soulsbury & Statham, 2024). The foxes interacted with the wood cylinder on average for 16 ± 3 min/day out of approximately 6.5 h total active time (Korhonen & Niemelä, 2000).

In another study, the reproductive results for 50 female Arctic foxes with a wooden cylinder tended to be better than for 49 females without a wooden cylinder: median proportion giving birth 85% versus 76%, median number of cubs born 12 versus 11 and median number of cubs weaned per mated vixen 9 versus 7 (Korhonen & Niemelä, 2000). When performing several behavioural tests, examining the responses of foxes towards for example novel objects, an open field and social confrontation, no effects of access to a wooden cylinder were found for 32 male and 99 female adult Arctic foxes were (Korhonen & Niemelä, 2000). In other studies, wooden cylinders were used for shorter times than simultaneously provided sand (28 vs. 37 min/24 h; 12 juvenile male Arctic foxes; Korhonen et al., 2003).

These cylinders were used more than **straw** in an experiment where male Arctic foxes were given either no resources, one 30 × 4 cm birch wood cylinder from 7 or from 15 weeks of age, or straw from 7 or from 15 weeks of age (16 foxes per treatment; Korhonen, Jauhiainen, Niemelä, & Sauna-aho, 2002). The straw as well as the wood cylinder were mostly used for playing as 93% of straw interactions and 94% of interactions with wooden cylinder was play, but also used for example holding or urination (Korhonen, Jauhiainen, Niemelä, & Sauna-aho, 2002). Wooden cylinders were used more when given to foxes at 15 weeks of age than when given at 7 weeks which may indicate that the cylinder was too large for the younger foxes. Straw use was similar when provided from 7 weeks or 15 weeks of age.

The foxes without access to wood or straw had less hyperaemia in the mucous membrane of the stomach and intestines than foxes with birch wood cylinders or with straw, respectively (stomach: 13% vs. 31%–50%, intestine 0% vs. 7%–23%). The authors attributed the hyperaemia to the ingestion of fibres and linked it to the lower weight gain of foxes in three of the groups with access to resources.

The foxes without resources or with straw had more gingivitis, hypertropia gingiva and dental plaque than the foxes with a wooden cylinder (maximum prevalences: gingivitis no resources: 13%, straw: 21%, wood: 6%; hypertropia gingiva no enrichment: 81%, straw: 93%, wood: 13%; dental plaque no enrichment: 56%, straw: 69%, wood: 15%; Korhonen, Jauhiainen, Niemelä, & Sauna-aho, 2002). It is, however, important to emphasise that $N = 16$ per treatment is a relatively low sample size for a study of the occurrence of health ABMs.

Overall, the results from studies examining effects of access to a wooden cylinder suggest that they elicit several behaviours including playing, scent marking and oral manipulation. The latter improves dental health, though overall effects on oral and gastro-intestinal health warrant further investigation. Studies furthermore suggest that bones are preferred over wooden cylinders for the same behaviours while having fewer potential side-effects.

Inadequate feed texture for consummatory behaviour

In the wild, most of the food items consumed by foxes (from invertebrates or amphibians to ungulate carcases) require significant chewing for consumption, a trait that is mirrored in the anatomy of the skull and dentition of the foxes (EFSA, 2025). The importance of chewing for foxes is also apparent from the time they spend using chewable objects, especially those of nutritive value such as bones (see above), and their positive anticipation of food-related and not-food-related chewable objects (Moe et al., 2006).

In all available studies, foxes were fed commercial feed of paste-like texture. Thus, there is lack of evidence on the effect of the texture of the main food on fox health, but there are indications from access to chewable resources. In addition, lack of opportunity to chew on solid organic material may weaken foxes' oral/dental health (Korhonen, Jauhiainen, Niemelä, & Sauna-aho, 2002). Further research is needed to examine the consequences of this hazard in terms of animal welfare.

Lack of resources that allow/promote seeking, working for food, hunting, scavenging

Exploratory and foraging behaviour also includes seeking, scavenging, hunting and working for food. While bones with some meat and connective tissue attached address scavenging and to some level working for food (with positive effects on behaviour (Koistinen, Turunen, et al., 2009), seeking and hunting require more complex food-related enrichment like that used in zoos or wildlife parks, which has not been investigated in farmed foxes yet. For example, in a case study, four captive red foxes in a large enclosure fed once per day at the same time and in the same place were less active and showed less behavioural diversity than when they were fed by three electronic feeders in different locations that delivered feed at a random time (Kistler et al., 2009). Combining the electronic feeders with a self-service food box or scattered/hidden food did not have additional effects but were only investigated together with the dispensers. In the current system used for foxes kept for fur production, pulling ropes between neighbouring cages may involve aspects of working for food or scavenging, but they also trigger agonistic interactions between neighbouring animals (Hovland et al., 2016) and thus may contribute to the WC Group stress (Section 4.3.5).

Thus, the use of paste-like feed and lack of edible resources significantly restrict the foraging component of chewing, may affect oral health and generally limit or prevent the expression of exploratory and foraging behaviours.

- **Flooring substrate not suitable for digging and vole jumps**

Digging constitutes a significant part of the time budget of wild foxes (see Section 4.3.2). Digging behaviour requires access to lose substrates such as sand or soil, which are not available in the current housing system for foxes kept for fur production. The limited cage dimensions substantially constrain the feasibility of incorporating a sand box. Out of five studies investigating access to sand (excluding operant condition tests), three investigated whole compartments with sand flooring (115 × 105 cm) but assessed digging either as proportion of observations on sand (Koistinen et al., 2008) or not at all (Harri et al., 1999, 2000). The other two studies investigated 80 × 40 cm sand boxes inside a 115 × 105 cm (Koistinen & Korhonen, 2013) or 120 × 105 cm (Korhonen et al., 2003) wire mesh cage.

The different methodologies used to record digging or digging-like movements across studies do not allow to estimate the prevalence of sham-digging in the current housing system. Digging in substrate involves the paws as well as the snout, though the snout movements are usually not (explicitly) included in the provided definitions. Furthermore, the results of operant studies may be influenced by a variety of factors that change the motivation to use the sand (see Section 3.3.4 for a discussion of operant tests).

Foxes with sand were observed to dig for 1–2 min/24 h (24 juvenile male and female Arctic foxes (Koistinen & Korhonen, 2013) or dig for 1 to 6 min/24 h (24 juvenile male Arctic foxes (Korhonen et al., 2003). In both studies, sand box use decreased over time, which correlated with increased soiling of the sand box with faeces and temperatures falling below 0°C. While 16 juvenile male and female Arctic foxes with access to 35–40 cm deep sand floor in one of two cage compartments had similar claw lengths to 16 foxes with wire mesh floor in both compartments, the foxes with access to sand had fewer broken claws (1.2, 1.3 s.d.) broken claws per animal versus 1.7 (3.9 s.d.) (Ahola et al., 2009). Thus, foxes use clean, dry and unfrozen sand for digging, which may improve foot health.

Juvenile male Arctic foxes in operant tests were willing to move up to 8 kg weight on a door for unlimited access to a 20 cm deep unfrozen sand floor (Koistinen et al., 2016). Nine adult male Arctic foxes during the breeding season who had to push a weighted door for unlimited access to a compartment with either a nest box, sand flooring or nothing (wire mesh floor) spent approximately 45%, 60% and 42% in the resource compartment, respectively, when there was no weight on the door, and approximately 50%, 45% and 35%, respectively, at the highest weight of 5 kg (Koistinen, Jauhiainen, & Korhonen, 2009). This relatively high use of the empty compartment may be the result of the adult male foxes being tested during breeding season, when they move and explore a lot in the wild (Poulin et al., 2021). Even though seven juvenile male Arctic foxes worked the same for 3–4 cm deep sand as for 15–30 cm sand, the foxes spent more time digging in the deeper than in shallower sand during the 3 h operant test sessions, where they had access for 4 min per reward (Koistinen & Mononen, 2008).

In a preference study, 12 juvenile male Arctic foxes in cages with wire mesh flooring in two compartments connected with push-doors were active for the same proportion of time as 15 foxes with 30 cm deep sand floor in one of the compartments (Koistinen, Orjala, et al., 2009). Those with sand spent approximately 35%–70% of total activity in the compartment with sand floor (i.e. some spent more active time on wire mesh) and, approximately, 2.8%–9.0% of total time sniffing or digging (in) the sand (Koistinen, Orjala, et al., 2009). When eight adult male Arctic foxes were given access to an 80 × 105 cm area with earth access below their shed cage, they spent approximately 90% of total time on the upper wire mesh level and 10% below on earth (high between-individual variation, not all foxes went down (Korhonen et al., 1999).

Studies have also observed the behaviour of foxes with free access to material for digging. In the study by Korhonen et al. (1999), the three foxes accessing earth during the first week spent 27, 70 and 191 min/day digging during the first two or 3 days. In another experiment, 10 juvenile male Arctic foxes who could access an 80 × 105 cm earth area underneath their shed cage spent 11 min/24 h digging in the earth (Korhonen, Jauhiainen, & Niemelä, 2001).

Six juvenile Arctic foxes in a 6 × 10 m earth enclosure showed digging behaviour (though not observed to do so on each day) (Korhonen, Niemelä, & Wikman, 2001). Digging behaviour ranged from 0 to 15 min/h. The results were obtained by direct observations Mon–Fri 07:30–08:30h on 17 days. These results suggest that access to sand has value for foxes, though the relative value may depend on context and other factors. Also, even though foxes will use frozen sand for oral exploration (Koistinen & Korhonen, 2013), loose sand will be used more. Six juvenile to adult male Arctic foxes worked as much (number of lever presses at different weights on lever) for 4 min access to 15–30 cm deep wet sand in autumn or spring as for access to frozen sand in winter (Koistinen et al., 2007). The foxes performed more **vole jumps** and spent a higher proportion of the time on sand digging on the unfrozen sand, though they dug 'a few centimetres' deep holes in the frozen sand. The time spent sniffing the sand did not differ between autumn, winter (sand frozen) or spring, and the proportion of time spent sniffing or digging stayed the same even when foxes had to work more for gaining access (Koistinen et al., 2007). The time spent on sand decreased from approximately 40% in September to 20% in October and 10% in December, while the sand became increasingly soiled with faeces and icier and thus less attractive (Koistinen et al., 2008). In addition, 12 juvenile male Arctic foxes with access to a box with 10 cm deep sand spent decreasing time digging or scratching in the sand box from July over August to October with a slight increase in November (sand boxes were very dirty from August onwards; Korhonen et al., 2003).

Studies have combined the access to sand with the observation of abnormal behaviours. Eight pairs of juvenile male and female Arctic foxes with access to a cage compartment with 30–40 cm deep sand spent less time on oral SB than those without sand (estimated 1.6 vs. 3.5% of 24 h), while time spent on locomotor SB did not differ (Koistinen et al., 2008). When access to sand was reopened after 14 days of deprivation, the time spent on locomotor and oral SB decreased in the sand treatment (no change in the treatment without sand). The difference regarding abnormal behaviour is not consistent across studies, though as Korhonen et al. (2003) found same levels of abnormal behaviour in 24 juvenile male Arctic foxes with and without access to a box with 10 cm deep sand.

Throughout the studies there are large differences between individual foxes regarding digging in sand or earth. There are also frequent issues with sand boxes being used as a latrine, which decreases their use for exploration including digging over time (Korhonen et al., 2003). A study on endoparasites (*Isospora* sp. and *T. leonina*) in the sand boxes did not show clear health risks (12 juvenile male Arctic foxes with and 12 without a sand box; Korhonen et al., 2003). Overall, the available results suggest that digging material at the same level or higher than the main enclosure part will be used more. Some foxes, especially young ones, will not use earth provided below standard shed cages or use it considerably less (Korhonen & Niemelä, 1997; Korhonen et al., 1999). This may indicate that the preference for height/overview of the surroundings is stronger than the preference for digging substrate (Harri et al., 2000).

One motivation to dig is to **cache** food, which is part of foxes' foraging behaviour (see Interpretation for this WC). Foxes in wire mesh cages spent a mean 0.1 min/24 h trying to cache food in the wire mesh floor (30 juvenile male Arctic foxes fed without excess food; Korhonen, Jauhiainen, & Niemelä, 2001), the same time as 10 juvenile male Arctic foxes in an earth floor pen (food caching 0.1 min/24 h in foxes with access to earth (Korhonen, Niemelä, & Jauhiainen, 2001), while 12 juvenile male Arctic foxes with a sand box in their cage were not observed to cache food, but food remains were found in the sand boxes, even though foxes were fed standard paste-like feed (Korhonen et al., 2003). Twenty-six juvenile Arctic foxes in 6 × 10 m or 3 × 5 m earth enclosures were observed to dig for caching food or trying to bury a stick on 5 out of 11 observation days (Korhonen, Niemelä, & Wikman, 2001). These results suggest that farmed foxes are motivated to perform food caching behaviour, but this can only be fully performed in loose substrate (sand, earth), that is not provided in the current system.

Vole jumps (also called 'mousing') are a typical foraging behaviour of foxes, during which the fox jumps to approximately shoulder height to catch rodent-sized prey from above (Červený et al., 2011; Yuk et al., 2024). Foxes in the wild perform on average seven vole jumps (range 1–31; hunting series duration a few seconds to 88 min) during which they use the earth's magnetic field to improve success rate (Červený et al., 2011). Seven juvenile male Arctic foxes that gained access to one different floor type at a time by pressing a lever a specified number of times showed fewer vole jumps on wire mesh and concrete than on 3–5 cm or 15–30 cm deep sand (mean 1.0, 3.1, 8.1 and 12.4 jumps, respectively, during 4 min access rewards in 3 h test sessions in a 70 cm high cage without 'prey objects' (Koistinen & Mononen, 2008). Six adolescent male Arctic foxes who also had to press a lever to gain 4 min access to 15–30 cm deep wet sand showed fewer vole jumps in winter when the sand was frozen compared to autumn or spring (70 cm high cage; Koistinen et al., 2007). The mean number of vole jumps remained constant when the workload (number of lever presses required for access) was increased (12 jumps on 4 lever presses, 10 jumps on 64 presses; Koistinen et al., 2007). There is lack of evidence for the performance of vole jumps in the current system, because most studies did not explicitly assess this behaviour, and many studies used scan sampling for recording behaviour which is less suitable for short events such as vole jumps. Further research is needed to clarify the potential effects of this hazard on animal welfare of foxes kept for fur production.

In **summary**, lack of clean substrate such as sand or earth deprives foxes of the possibility to perform digging and caching behaviour and limits the possibility to perform vole jumps and play behaviour. This is shown by foxes' motivation to access substrate in operant tests.

4.3.3 | Sensorial under- and overstimulation

As explained in Table 10, this WC is originally called 'Sensorial under- and/or overstimulation' in the EFSA guidance (EFSA AHAW Panel, 2022) but is here subdivided into two separate sections (sensorial understimulation and sensorial overstimulation) to enhance clarity of the content.

4.3.3.1 | *Description of sensorial understimulation and linked WC (selected for Arctic and red fox)*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as fear, discomfort due to visual, auditory or olfactory understimulation by the physical environment'.*

Interpretation for foxes

Sensorial understimulation is related to the barren cages of farmed Arctic and red foxes (EFSA, 2025) and, thus, virtually identical to Restriction of movement and Inability to perform exploratory or foraging behaviour (see Sections 4.3.1 and 4.3.2). This WC applies to all scenarios in this SO (Table 8).

Linked WC: Inability to perform play behaviour

Inability to perform play behaviour is defined as 'the animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to engage in social/locomotor or object play' (EFSA AHAW Panel, 2022). It is linked with Sensorial understimulation through common hazards.

4.3.3.2 | *Hazards leading to sensorial understimulation and linked WC*

The hazards for sensorial understimulation and inability to perform play behaviour are virtually identical with those described in the hazard Sections of restriction of movement, and inability to express exploratory and foraging behaviour (see Sections 4.3.1 and 4.3.2). Inability to perform play behaviour is addressed under restriction of movement (Section 4.3.1).

4.3.3.3 | *Description of sensorial overstimulation and linked WC (selected for Arctic and red foxes)*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as fear, discomfort due to visual, auditory or olfactory overstimulation by the physical environment'.*

Interpretation for foxes

In the wild, red foxes prefer areas with vegetation cover (Holmala & Kauhala, 2009; Márton et al., 2014), especially for resting, for which they typically retreat to dense cover or into a den (Meia & Weber, 1993; Schwemmer et al., 2021). As examined in a study of four adult male and female red foxes in a large outdoor enclosure, captive individuals also tend to spend more resting and active time near structures that provide cover (Kistler et al., 2010).

Sensorial overstimulation is mainly related to the absence of hiding places in the form of nest boxes or visual barriers, which applies to all Scenarios except number 2 (Table 8). If the nest box in Scenario 2 is removed before the cubs are weaned (EFSA, 2025), the WC also applies in this scenario. Breeding females (and their cubs) are typically provided with a nest box from before whelping (approximately 2 weeks before) until weaning (Supporting information SF5), though the nest box may also be removed approximately 1 week before weaning (EFSA, 2025). Nest boxes replace the den and, thus, are a resource for reproduction, resting and sleeping, and a retreat from perceived dangers. If there is no place to retreat, as mentioned, foxes prefer to monitor their surroundings from elevated places (vigilance behaviour; see below). Sensorial overstimulation may also arise from high animal density in a cage (Scenarios 2 and 3), and/or proximity of neighbours (adult animals; Scenarios 1 and 4), which are addressed in the Section on the WC Group stress (Section 4.3.5).

Linked WC: Resting problems

The WC Resting problems is defined by EFSA AHAW Panel (2022): 'The animal experiences stress and/or negative affective states such as discomfort, and/or frustration due to the inability to lie, rest comfortably or sleep (e.g. due to hard flooring, inability to perch or vibration during transport). This may eventually lead to fatigue'. In this case, Sensorial overstimulation due to absence of hiding places or due to disturbance from other animals may lead to this WC.

4.3.3.4 | *Hazards leading to sensorial overstimulation and linked WC*

- **Lack of nest box or den-like structure**

Lack of refuge (nest box or platform)

As mentioned, foxes use nest boxes as a refuge. When an observer placed a novel object in the home cage of juvenile female Arctic foxes, more than two thirds retreated into their nest box and stayed there (Pedersen et al., 2002). There is some indication that the presence of a potential refuge makes foxes react less fearfully in behavioural tests, e.g. a study carried out with 99 adult female red foxes with and without next boxes in the home cage (Jeppesen & Pedersen, 1991). When offered several options to withdraw from a human hitting the cage with a stick, there are individual and species differences regarding the choice of 'escape' route. For instance, Pedersen and Jeppesen (1993) kept individual adult female Arctic or red foxes each in a 195 × 120 × 95 cm wire mesh cage with two compartments. One of the compartments contained an open box (52 × 47 × 48 cm frame with open top and bottom and side entrance), a side box mounted outside the cage (48 × 48 × 48 cm with entrance hole, wooden shelf inside, wire mesh covered solid floor) and a box on top of the cage (60 × 60 × 38 cm solid floor with 30 × 42 cm entrance tunnel) accessible via a 42 × 42 cm wooden platform 25 cm below the ceiling inside the cage. Vixens had access to all three boxes throughout the experiment. When a human hit the cage with a stick and waved her arms, Arctic foxes mainly fled into the top box while red ones mostly fled to the compartment away from the human approach direction, irrespective of whether it was the compartment with or without the nest boxes (Pedersen & Jeppesen, 1993).

In another study, out of a total of 60 juvenile Arctic foxes with an open platform without walls or one with three walls, the proportion of animals jumping on the platform when a human hit the cage with a stick was higher if the foxes had an open platform compared to the walled one (approximately 75% with open, 31% with walled; 16 males +14 females each with walled or open platform, Korhonen & Niemelä, 1996b). These results suggest that nest boxes or similar structures may be important as refuges from strong sudden overstimulation.

Resting inside the nest box

Overall, farmed foxes spend more time resting on a platform or on a nest box roof than inside the nest box. For example, eight single-housed juvenile male and female red foxes spent a median 67%, 75% and 52% of their daily time on the nest box roof in August, September and October, respectively, and a median 9%, 0% and 3% of their daily time inside the nest box, more so during the night than during the day (with a high inter-individual variation; Mononen et al., 1995). Twenty-four juvenile male and female Arctic foxes also spent more time on a platform than inside the nest box (Koistinen & Korhonen, 2013). Foxes in an operant test used the nest box roof 28%–51% and the inside of the nest box 0.2%–22% of the time spent in the compartment with the nest box (when a platform was tested, it was used 1%–6% of time inside the compartment with the platform; $n = 5$ to 8 foxes due to missing data; Koistinen, Jauhiainen, & Korhonen, 2009). Similarly, 18 pair-housed juvenile red foxes spent a median of 1.5% of their time inside a nest box (all of which one fox at a time) and ≥ 39% on the nest box roof (mostly both foxes together; Mononen et al., 1995). These results suggest that the inside of nest boxes is less important for resting than the nest box roof.

The Arctic and red foxes in the experiment of Pedersen and Jeppesen (1993) (see above for experiment details) differed in their preferences for resting places. Arctic foxes preferred the platform during the first three observation periods and thereafter the top box (Pedersen & Jeppesen, 1993). Red foxes used the platform most, followed by the top or the open nest box. There was individual variation in the use of the nest box and platform in both species, with some individuals not using any nest box (Pedersen & Jeppesen, 1993).

General nest box effects

Lack of nest boxes outside the breeding season can have negative effects on fox behaviour and physiology and thus welfare. Fifty adult female red foxes without nest boxes in their home cage moved less in open field tests and approached a novel object in the open field slower than 49 vixens with nest boxes (Jeppesen & Pedersen, 1991). Furthermore, vixens without nest boxes in the home cage had higher serum cortisol and eosinophils, and lower lymphocytes than those with nest boxes (Jeppesen & Pedersen, 1991). However, behaviour tests and cortisol results in other experiments were inconclusive (Łapiński et al., 2019; Ojala et al., 2025; Pedersen et al., 2002). Abnormal behaviour in relation to shelter was little studied outside of operant tests and either rare (Koistinen & Korhonen, 2013) or inconclusive (Ojala et al., 2025). Overall, these results suggest that nest boxes may also be important as refuges during mid- to long-term overstimulation.

- **Lack of elevated place for surveillance and resting**

Platforms or nest box roofs used by foxes for sleeping, resting and vigilance behaviour. The use durations vary considerably between individuals within studies, as well as between studies. The latter variation is mostly due to methodological differences (assessment method, definition of behaviour categories). Platform (or box roof) use also depend on the distance between the platform and the ceiling. Platforms 30 cm below the ceiling tended to be used more than those 23 cm below ceiling (in a study with 18 male and 19 female adult red foxes; Korhonen et al., 1996). Age and sex of the animals may also play a role (e.g. platforms 20 cm from ceiling used by 20 juvenile red foxes: 70 ± 10 min/day; Mononen et al., 1993); 23 cm from ceiling, 40 adult red foxes (male and female): 270 min/day; Korhonen et al., 1996); 572 min/day by 56 female and 317 min/day by 20 male red foxes; Korhonen & Niemelä, 1996a; and 779 ± 40 min/day by eight male Arctic foxes; Korhonen & Niemelä, 2000).

Five adult male red and ten adult male Arctic foxes were active for similar proportions of time in wire mesh cage and a ground-level earth enclosure below, but spent most of their resting time in the cage (Korhonen & Niemelä, 1997), while 10 juvenile Arctic foxes not only rested more in the cage but also spent more than twice as much of their active time in the cage, especially during staff working hours (Korhonen & Niemelä, 1997). When given a choice of platforms at different heights, 48 juvenile red foxes in outdoor enclosures spent most resting time on the highest platform (Ahola et al., 2000b). Eight adult male Arctic foxes in raised cages with access to ground-level earth compartments below, similarly, spent 90%

of total time on the upper wire mesh level and only 10% below on earth (high between-individual variation; Korhonen et al., 1999). Adult male and female Arctic foxes in a choice test with connected cages at different heights with alternating wire mesh or sand flooring had a stronger preference for the higher cage than for a flooring type (8–12 foxes tested; Harri et al., 2000). These results suggest that foxes generally prefer high places, especially when they are young.

The main motivation to be in a higher place is the better overview and/or view of locations with potential sources of danger, such as shed entrances. Platforms that offered a direct view of the shed door were used longer than those with a wall that obstructed it by 20 juvenile male and female red foxes (Mononen et al., 1993). Juvenile Arctic foxes with three-wall platforms spent significantly less lying time on the platform compared to individuals with platforms without walls before pelting (Korhonen & Niemelä, 1996b). A total of 47 adult and juvenile male and female Arctic foxes in three experiments displayed high inter-individual variation regarding the preference for wire-mesh versus wood platforms, but less variation in the preference for a platform without walls versus board walls on three sides (Harri et al., 1991). The distance between platform and ceiling was only 20 cm, which may explain some of the variation. Both red and Arctic foxes tended to use the platform for longer bouts (indicating resting) outside working hours (Harri et al., 1991; Mononen et al., 1993). These results suggest that fear of humans influences use of platforms and space within cage. This may confound the interpretation of the data obtained through direct visual observation.

In **summary**, the studies suggests that elevated places with a good view of the surroundings are very important for foxes. Current cage dimensions severely limit the performance of surveillance behaviour because foxes cannot sit up or stand on the platform.

Functional areas

Inability to establish functional areas can also contribute to Sensorial overstimulation. For example, unlike mink, foxes in the wild do not cache food inside their dens (see Section 4.3.2) and this is also apparent in farmed foxes. If they have a choice, they spend more time, especially resting time, in a cage compartment that does not contain food (five adult male red foxes; Hovland et al., 2007) or bones (eight pairs of juvenile male and female Arctic foxes (Koistinen, Turunen, et al., 2009). Furthermore, foxes have a highly developed sense of smell and use scent marking for defining territorial borders (EFSA, 2025). The accumulation of faeces underneath the cages over weeks or months may thus contribute to Sensorial overstimulation in foxes.

- **Disturbance by neighbouring animals and group housing**

See Section 4.3.5 on Group stress for further discussion on these hazards.

4.3.4 | Locomotory disorders including lameness (selected only in Arctic foxes)

4.3.4.1 | *Description of locomotory disorders*

Definition from EFSA AHAW Panel (2022): *'This WC is characterised by the animal experiencing negative affective states such as pain, discomfort and/or due to impaired locomotion induced by, e.g. bone, joint, skin or muscle damage'.*

Interpretation for farmed foxes

Locomotory disorders (including lameness) in farmed foxes are related to the health problems explained below, which depend predominantly on genetics, housing and management, and generally reach increased severity with time. Thus, this WC applies to all scenarios in this SO (Table 8).

Locomotory disorders are caused by several conditions (including lameness) in farmed foxes that impair their ability to move to different degrees and potentially cause pain and discomfort. From the information found, conditions leading to Locomotory disorders in foxes include bent feet (also called bowed legs or leg weakness) found in Arctic foxes, red foxes and their hybrids; front leg turn (also called abduction of the forelegs), osteochondrosis and foot lesions documented in Arctic foxes (see Table 11 for description of these ABMs).

Bent feet (Figure 9) have been reported in farmed red foxes (Harris et al., 1951) and Arctic foxes (Kempe et al., 2010) as well as in hybrid foxes (Ahola et al., 2020). Even if the condition is reported in the previously mentioned species, the prevalence is only reported in farmed Arctic foxes. A study in a Finnish research station reported bent feet prevalences of 67% (876 foxes in 2005 and 1200 in 2006, selected for heritability study) (Kempe et al., 2010). Furthermore, in a study where 84 Finnish farms were visited three times in 2012 to 2014, bent feet were found in each of the visits on all farms, with prevalences ranging from 6% to 100% of animals affected per farm (mean period 1: 63%, period 2: 50%, period 3: 78%; Ahola et al., 2014). This SO refers to 'bent feet' even though the condition is mainly reported as carpal laxity, because the tendon laxness can also affect the hind limbs (Figure 9). Further research is needed to inform about prevalence and effects of bent feet affecting hind limbs.

As mentioned, front leg turn is another condition that can occur simultaneously with bent feet (Kempe et al., 2021). This condition has been associated with premature closure of the growth plates, leading to asynchronous development of the radius and ulna (Svenns, 2018). Front leg turn was found to be less prevalent than bent feet, with a prevalence of 6%–7% in Arctic foxes (Kempe et al., 2021). Nevertheless, both bent feet and front leg deviation are considered significant welfare and breeding concerns. The Finnish Fur Breeders' Association (FIFUR), for instance, recommends excluding animals with front leg turn from breeding programmes (Supporting information SF6, SF7).

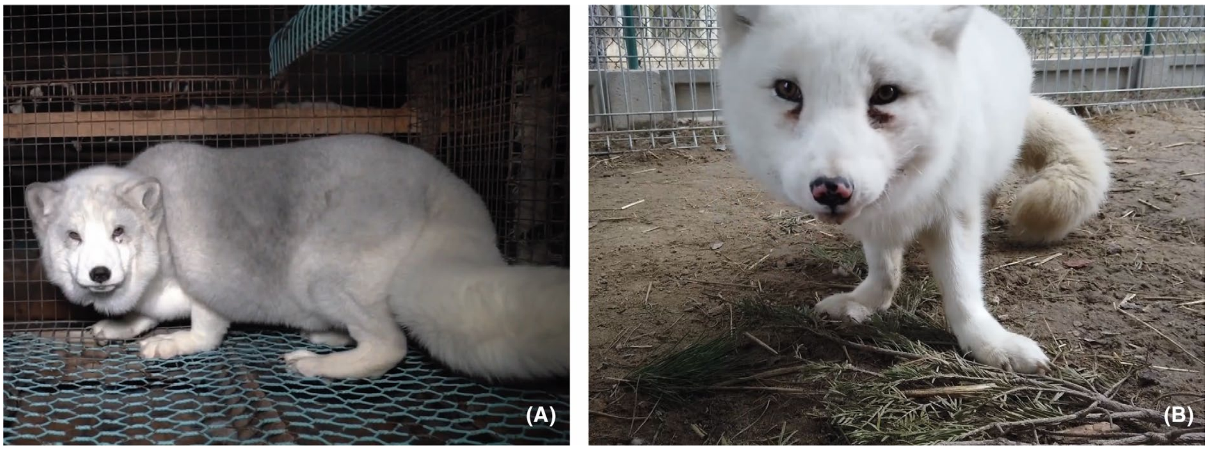

FIGURE 9 (A) Arctic fox with severely bent feet (© Human Society International, Supporting information SF8) and (B) front leg turn (© Otwarte Klatki, Supporting information SF9).

In a feeding experiment with 40 male juvenile Arctic foxes from parents with bent feet, all the foxes had bent feet and 70% had osteochondrosis as evaluated with X-ray (foxes were single-housed in 70 cm long × 105 cm wide × 60 cm high wire-mesh cages (Korhonen et al., 2005). There is no information on the prevalence of osteochondrosis in farmed Arctic or red foxes kept for fur production available in the literature. Korhonen et al. (2005) suggested that bent feet are an approximate visual manifestation of osteochondrosis, otherwise only visible with X-rays (Korhonen et al., 2005). However, further studies are required to better understand the pathogenesis of this condition.

Foot lesions such as swelling, hyperkeratosis, wounds and foot infections were reported to be present in farmed Arctic foxes in Poland by stakeholders (Otwarte Klatki, 2012). The EFSA experts expect foot lesions to also occur in red foxes in the current fox housing system, for example due to wire mesh floor as a hazard. However, scientific data on the prevalence and severity of these lesions in foxes is lacking.

4.3.4.2 | *Hazards leading to locomotory disorders*

- **Genetic predisposition as a side-effect of selection for production traits**

Farmed Arctic foxes have been selected in the last decades to enhance certain traits such as daily gain, rapid growth and greater size (Kempe et al., 2013) to obtain larger pelts (Svenns, 2018). In the 1990s, Arctic foxes weighed 7–8 kg at pelting, which had increased to 20 kg in 2014 (Korhonen et al., 2014) (most recent available data). This genetic selection indirectly brought predisposition for other conditions, such as bent feet, front leg turn and osteochondrosis (Kempe et al., 2021). However, all the above-mentioned conditions have a multifactorial aetiology which also includes several management factors as hazards (Korhonen et al., 2005).

Bent feet in Arctic foxes was reported to have a moderate heritability (0.25 ± 0.08) (Kempe et al., 2010). The heritability estimate was based on a study involving 2076 foxes observed over two consecutive production cycles. To control for genetic relatedness, the analysis included animals with a maximum sire-sire relationship of 40% and a maximum inbreeding coefficient of 10% between sires and their offspring. In the same study, a moderate grade of heritability (0.30 ± 0.08) was also found for body condition score (BCS) and for the ability of the animals to move (0.22 ± 0.07), indicating that fatness, mobility difficulties and bent feet in Arctic foxes have a genetic component (Kempe et al., 2010).

The study also gave information about the genetic and phenotypic correlations among the measured traits. Bent feet and high BCS were genetically (−0.40 ± 0.19) and phenotypically correlated (−0.28), which indicates that obese animals are more prone to have bent feet (Kempe et al., 2010). Furthermore, a genetic correlation was also found between bent feet and daily gain (0.42 ± 0.21). These correlations suggest that animals with higher fat deposition or faster daily weight gain are more susceptible to developing bent feet (Kempe et al., 2010).

Genetic (−0.66 ± 0.14) and phenotypic correlations (0.62) were also found between bent feet and the ability to move. Even though the authors concluded that these two traits share the same genetic background, a causal effect of bent feet on fox mobility reasonably explains these results. This result is similar to that observed in other species, where carpal laxity can impair the animals' ability to move (e.g. Equidae) (Kidd & Barr, 2002).

The extent to which bent feet cause pain in Arctic foxes has not been directly studied. However, insights from other species with similar conditions provide some context. In a 5-month-old dog puppy, carpal laxity syndrome seemed to be not painful (Yoo et al., 2018) while in horses the general laxity of ligaments and especially the laxity of the metacarpus-phalangeal (fetlock) joint (also called weak or sloping pastern) causes pain, lameness and reluctance to move (Kidd & Barr, 2002). All authors who have examined the condition of bent feet have suggested the possible involvement of pain (Ahola et al., 2020; Kempe et al., 2010; Korhonen et al., 2014, 2015; Peura et al., 2020, in Supporting information SF6). Therefore, it remains a potential welfare concern that requires further investigation.

Similarly to what is reported for bent feet, **front leg turn** also has a genetic component (Supporting information SF7). The condition is indeed reported to be present in combination with bent feet, indicating that the same predisposing factors and genetic components are involved (Kempe et al., 2021). Furthermore, Finnish breeders of Arctic foxes specifically reported to exclude from the breeding the animals that are affected by front leg turn (Supporting information SF6).

A similar condition with a markedly curved conformation of the front limbs is often present in chondrodysplastic dogs. Studies reveal that in dogs this deformity is caused by a premature closure of the distal ulnar growth plate, causing radial torsion and/or valgus position of the carpus (Knapp et al., 2016). In addition, this deformity was revealed to be an inherited trait in some dog breeds (i.e. Skye terriers and Basset hounds) (Lau, 1977; Rasmussen & Reimann, 1977), supporting findings from a study on Arctic foxes (Kempe et al., 2021).

Like bent feet, pain aspects of front leg turn has not been studied in foxes. However, similar conditions reported in chondrodysplastic dogs cause pain, lameness, limited range of motion and elbow joint osteoarthritis (Lappalainen et al., 2023). Hence, in the opinion of EFSA experts, it is reasonable to assume that front leg turn can cause pain in Arctic foxes too. Further studies are needed to clarify this.

Osteochondrosis has been studied in Arctic foxes (Korhonen et al., 2005) and was reported to be present in 67% of five-month-old Arctic foxes, however, without specifying the sample size for this finding (Kempe et al., 2010). While no studies have confirmed a genetic basis for osteochondrosis in Arctic foxes, a genetic predisposition is plausible, given evidence from other species where osteochondrosis is considered a heritable condition – such as in dogs (LaFond et al., 2002), pigs (Jørgensen & Andersen, 2000) and horses (Smith, 1991; Grandalen & Lingaas, 1991; Grφndahl & Dolvik, 1993; Ytrehus et al., 2007). The aetiology of this condition has not been precisely defined yet, but is reported to be multifactorial (Hernández Vidal et al., 2011), with genetic and environmental components reported in other species and no single factor accounting for all aspects of the condition (Ytrehus et al., 2007). Among the involved factors are genetic and environmental components (Ytrehus et al., 2007), such as growth rate, nutrition status, endocrine problems and defects in the epiphyseal-cartilage vascular flow (Hernández Vidal et al., 2011).

In **summary**, the available evidence suggests that a genetic predisposition as a side-effect of the genetic selection for production traits may contribute to the development of bent feet, front leg turn and osteochondrosis in Arctic foxes (Kempe et al., 2021), which in turn could impact the WC Locomotory disorders. Moreover, since the bent feet trait has been associated with high BCS and rapid growth, it is likely that animals inheriting both traits may be at an elevated risk of developing more severely conditions and the related WC (Kempe et al., 2010).

- **Inappropriate feeding management (mainly excess of energy content resulting in obesity)**

The diet of Arctic foxes living in the wild is different from the diet of farmed Arctic foxes (EFSA, 2025). The diet of wild Arctic foxes consists mainly of protein and fat of animal origin and very limited vegetable sources, while farmed foxes have been reported to be fed up to 35% of metabolisable energy from carbohydrates from grain or other vegetable sources (Enggaard Hansen et al., 1991; Ahlstrøm et al., 2003). This **excess of energy** can easily lead to **obesity** in growing Arctic foxes, especially during early autumn (Korhonen et al., 2005), also considering that by nature this species has the ability for extreme body fat deposition (Mustonen et al., 2005). Hence, while obesity is mentioned in the hazard section, an additional significant factor is the provision of an unbalanced diet.

Providing foxes with large amounts of energy rich feed is commonly employed to increase body size in foxes, thereby increasing fur yield (Svenns, 2018). The consequent obesity can worsen locomotory disorders as the animal has to bear more weight on the legs. Furthermore, the excess weight causes the animal to be reluctant to move, which will further worsen the condition. A relationship between obesity and bent feet was given by information retrieved from stakeholders (Supporting information SF6) where the body mass index (BMI) was related to bent feet, with an increase in the latter when the BMI increased.

Obesity was also studied in 10 male juvenile Arctic foxes (aged 7 months) in relation to skeletal pathologies (Mustonen et al., 2017). The authors selected five foxes with a BCS 3 or 4 (on a scale from 1 to 5 where 5 is obese) that had normal to mildly abnormal forelimb structure (WelFur score 0–1) and no clear locomotor deficit or unwillingness to move, as well as five foxes with a BCS 5 that had severely bent feet (WelFur score 2) and showed abnormal locomotion and/or unwillingness to move. The prevalence of pathological radiographic was slightly higher in the obese foxes (48% vs. 44%). As the diagnosed bone deformities were categorised as insufficient to cause locomotory problems, the condition of bent feet was considered mainly related to tendon and ligament stress related to excessive body weight (Mustonen et al., 2017).

Another dietary factor that has been studied is the **Ca:P ratio**, based on the findings in giant but also medium-sized breeds of dogs, where excessive amounts of Ca and energy in the feed can lead to skeletal growth disorders (Dobenecker et al., 2006).

Two studies were performed on the effect of Ca:P ratio on **bent feet** in Arctic foxes (Korhonen et al., 2005, 2014, 2015). The first study, performed on 40 juvenile male Arctic foxes, concluded that Ca:P ratio in the diet of the animals did not influence the development of bent feet condition (Korhonen et al., 2005). On the contrary, the second study from 2014 reported a tendency (*P* value = 0.057) for Ca:P levels in the diet to explain the feet bending. However, it should be mentioned that no sample size was reported in the materials and methods of the paper. Bent feet were scored in the study with a scale from 1 (no bent feet present) to 5 (worst scenario of bent feet, i.e. average angulation of carpus with the floor 70°–90°). Foxes that received a score of 4 for bent feet were 70% of the foxes on the 1.5:1 Ca:P ratio diet, 32% of the foxes on the 2.9:1 Ca:P ratio diet and 53% of the control ones (i.e. 2.0:1 Ca:P ratio diet). This tendency suggests that a low Ca:P ratio can predispose to bent feet (Korhonen et al., 2014).

Nevertheless, the authors correctly discussed, that the pathology is a multifactorial problem. In a second publication, X-rays were performed of the foreleg of the same animals (Korhonen et al., 2015). In particular, X-rays of the forelegs of Arctic foxes scored from 2 to 4 for foot bending were performed to examine possible differences in bone mineralisation between the different scores. No significant differences in mineralisation were found. However, it is important to note that the sample did not include individuals with scores of 1 (no deformity) or 5 (severe deformity), limiting the interpretability of the results. In summary, the influence of dietary Ca:P ratio on the development of bent feet in Arctic foxes remains inconclusive. Further studies are needed to clarify this.

In dogs, **front leg turn** nutritional imbalances, trauma or inflammatory processes, that could also be caused by obesity, were found to damage cartilage cells and cause early closure of growth plates, which seems to be responsible for front leg turn in dogs (Knapp et al., 2016). Based on this, it could be hypothesised that the same hazards could play a role in Arctic foxes, but no evidence was found and studies are needed to verify.

- **Inadequate flooring material**

No solid scientific evidence was found on the effect of wire mesh floor on foot health of farmed Arctic foxes. Nonetheless, EFSA experts consider wire mesh flooring a potential welfare concern. Continuous exposure to such flooring, without access to any solid surfaces, may increase the risk of foot lesions, particularly in obese individuals who place greater mechanical load on their limbs. Front legs of male juvenile arctic foxes kept in 50 × 105 cm wire mesh cages tended to be more bent than in foxes kept in an earth-floored 5 × 3 m enclosure (total of 80 foxes; Korhonen, Jauhiainen, Niemelä, Harri, & Saunaaho, 2001). In addition, stakeholders indicated that foxes living on wire mesh floors are more likely to break their claws, because of overgrowth as the animals do not have the possibility to wear them down (Otwarte Klatki, 2012). Supporting this, Ahola et al. (2009) compared 16 pairs of foxes housed with access to a sand box (Sand group) to 16 pairs without (No Sand group). Foxes without sand had significantly more broken claws, on average 3.9 (±1.7s.d.) per animal as compared to 1.3 (±1.2 s.d.) in the Sand group. The authors suggested this difference was due to the sand floor promoting natural claw wear, as foxes in the Sand group maintained shorter claws through to November. In addition to facilitating abrasion, activities like digging or walking on rough surfaces may also increase blood flow to the digits, potentially promoting claw growth and strength. Broken claws can cause inflammation and pain, influencing the willingness of the animals to move and potentially causing lameness (Otwarte Klatki, 2012).

4.3.5 | Group stress (selected only in red foxes)

4.3.5.1 | *Description of group stress*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as pain, fear and/or frustration resulting from a high incidence of aggressive and other types of negative social interactions, often due to hierarchy formation and competition for resources or mates'.*

Interpretation for red foxes

The WC Group stress is related to the high animal density on the farm and within group cages. It applies to all scenarios but is particularly relevant to adults housed in close proximity in Scenarios 1 and 2, and to pair or group-housed juveniles in Scenario 3.

EFSA (2025) reported that, although red foxes are often described as solitary, scientific literature and submitted evidence indicate that they exhibit flexible social behaviour. Male–female pairs or family groups may stay together during the mating and breeding season, though maintaining separate territories. In the wild, family groups consist of one male and several females (typically related) and communal denning among breeding females has been recorded. Gradual weaning and dispersal begin once cubs are approximately 10 weeks old, when fights between juveniles also increase. Population density in the wild has been reported to vary between 30 foxes per km^2 in resource-rich habitats, to 0.1 in resource-poor areas.

In farm conditions, adult red foxes are typically housed in adjacent wire mesh cages (0.7–1.2 m^2) and thus in close proximity. Pregnant females are typically given access to a wooden nest box approximately 2 weeks before whelping, but nest boxes are typically not provided for dams and cubs after weaning or for males (EFSA, 2025).

Red fox vixens have been characterised as performing poor maternal behaviours, such infanticide, as a result of social factors in the environment around whelping. According to Harri et al. (1999), there are two approaches to distributing adult females throughout sheds in European farms for foxes kept for fur, varying by country. The 'traditional' approach involves housing females in the same cages year-round and keeping female cages separated from one another, and the so-called 'Nordic' system involves transferring females to breeding cages prior to mating. Breeding cages have been described as in a separate shed and placed in close proximity to one another, with males sometimes placed among them (Harri et al., 1999; Ilukha et al., 1997). After weaning, the juveniles may be divided into sibling pairs or individual housing, or less frequently will be kept in sibling groups until the autumn (EFSA, 2025). For the weaned juveniles, the space typically provided is 1.2 m^2 per individual or pair +0.5 m^2 per additional animal.

4.3.5.2 | *Hazards leading to group stress in red foxes*

Disturbance by neighbouring animals mainly applies to single-housed adult foxes, while group housing mainly applies to juveniles.

- **Disturbance by neighbouring animals**

Close proximity of neighbouring animals has been observed to have negative impacts on fox welfare. Red foxes in single cages were observed becoming defensive of resources located closest to the wall of the neighbouring cage, i.e. pulling devices that were linked between cages such that one fox manipulating the object would cause movement in the other cage (Hovland et al., 2016). Foxes could interact with the pulling device simultaneously, and some of these mutual interactions were aggressive. Adult red fox vixens ($n=6$) were also found to experience stress-induced hyperthermia (increased core body temperatures measured by a surgically implanted intraperitoneal radio telemetry device) and fear- or anxiety-induced activity increases during a social experiment in which new animals were introduced to the neighbouring cage, or an unknown conspecific was placed into their own cage (Bakken et al., 1999). Core body temperatures and activity levels were highest when sharing the cage with an unknown male (Bakken et al., 1999). These results suggest that the inability to maintain social distance from unknown foxes in neighbouring cages or the same cage is stressful for red fox vixens.

Infanticide (females killing their own offspring) arising due to housing density and/or neighbouring females is of particular concern in red foxes. Braastad and Bakken (1993) determined from a sample of 21 litters of primiparous vixens that the probability a cub would be killed by a primiparous mother was 37%, and about 75% of the cubs lost before weaning were killed by their mothers. More recent studies were not found. Multiparous vixens may also be infanticidal, though to a lesser extent, and if it happens, the females has been described as tending to show normal maternal behaviours before killing their cubs later in lactation (Braastad & Bakken, 1993). The infanticidal behaviour is often repeated in successive years, and in a small dataset, vixens which were previously infanticidal ($n=3$) showed a greater stress-induced hyperthermia response to fear-inducing human or social stimuli than did vixens with previously normal maternal behaviour ($n=3$) (Bakken et al., 1999).

In a study of 39 vixens (Bakken, 1993a), dominant animals, as assessed in a feed competition test, with subordinate neighbours weaned more cubs than any of the other vixens, including dominant vixens with other dominants as neighbours. No subordinate vixen weaned cubs unharmed if her neighbours were of higher dominance, but they did so with other subordinate vixens as neighbours.

In groups of wild-living red foxes, subordinate vixens in the group have been reported to seldom raise cubs, failing to wean any cubs which are born (von Schantz, 1981, 1984). Evidence indicates that a reduction in enforced social stimuli can reduce infanticide. When previously cub-killing vixens ($n=16$) were kept visually and spatially isolated from other foxes by moving them into single sheds, they killed or injured fewer cubs, despite evidence from other investigations showing that farmed red fox vixens that kill or wound their cubs 1 year, under standard commercial farming conditions, will most probably repeat this behaviour during the following reproductive season under the same farming conditions (Bakken, 1993b).

Vixens housed in a standard cage system (wire mesh cage with floor area of 1.4 m^2) were given access to an additional adjacent breeding box of either traditional design (inner nest area of about 43 × 45 × 37 cm and an anteroom of 43 × (28–35) × 37 cm, without a separating wall) or a box with a narrow entrance tunnel measuring 18 × 20 cm in diameter, made by walls between the anteroom and inner area which had two entrances into the inner nest area and different designs (Braastad, 1996). Vixens which were given the more secluded breeding box with a tunnel entrance, rather than an open entrance, showed less restless behaviour, better maternal care and lower cub mortality. In the standard non-tunnel boxes, 15 of 22 litters experienced infanticide of one or more cubs or rejection of the whole litter, whereas this occurred for only three of 16 litters in tunnel boxes (Braastad, 1996). Furthermore, in a small-scale choice test reported without details in the discussion of this paper, 12 out of 15 multiparous vixens preferred the tunnel box to the non-tunnel box which they had previously experienced.

In summary, despite a lack of recent data and prevalence data across farms, these results suggest that close proximity to neighbouring foxes, especially when these have higher dominance status and retreat possibilities are limited, results in group stress in red fox vixens which can increase the risk of infanticide.

- **Group housing**

Red fox cubs ($n=98$) weaned into pairs or groups of four with 0.6 or 1.2 m^2/animal showed some benefit of social housing, such as reduced SB in comparison to singly housed animals, although by the late autumn (the natural dispersal age in red foxes), the individuals in the groups tended to stay apart from one another (Ahola, Harri, & Mononen, 2002). In addition, platform use in group-housed foxes was smaller when there was only one platform available per group (data from 35 juvenile male and female red foxes; Ahola, Mononen, & Pyykkönen, 2002).

Housing pairs or quartets of foxes with 1.2 m^2/animal reduced the occurrence of bite injuries and improved fur quality score (which might be indirectly affected by aggression between animals) in the female cubs compared to housing of the same group size in smaller space (0.6 m^2/animal) (Ahola, Harri, & Mononen, 2002), perhaps reflecting decreased aggression due to increased space allowance, but no differences were seen in male cubs. Furthermore, no significant effects were found on measures of adrenal activity. The authors suggested that group housing is important for young red fox cubs from weaning to autumn, but that cubs should be further split into pairs in late autumn before the onset of dispersal motivations and that adequate space should be provided for cubs housed in groups (Ahola, Harri, & Mononen, 2002). Whether the largest space allowance of 1.2 m^2/animal tested in this experiment can be considered adequate for group-housed juveniles is unknown (see following paragraph and also Section 4.3.1).

Ahola et al. (2000b) concluded that male red fox cubs were particularly affected by group stress in family housing with the mother and siblings (four families of vixen + four cubs in earth-floored enclosures of 7.5 × 15 m or 5 × 10 m with nest box and two roofed platforms), as demonstrated by greater HPA axis activity than for animals housed singly in cages (115 × 105 × 70 cm high), suggesting this might be due to being prevented from dispersing from their natal territory. However, in Ahola et al. (2001), housing sibling groups (six groups, each of four cubs) together in similar large enclosures without the vixen had no negative impact on adrenal mass or plasma cortisol response to ACTH administration compared to individually cage housed juveniles (n = 24), and thus it was argued that housing with older, dominant females might be a primary factor contributing to group stress in male cubs. However, as discussed in Table 11, the interpretation of cortisol responses is not simple, and these results would require other ABMs to provide a more certain interpretation. The authors still reported a high number of bite scars in the group-housed juveniles, however, indicating elevated aggression (Ahola et al., 2001).

In research by Ahola et al. (2006) with red fox cubs (90 cubs from 23 litters), both single housed cubs and cubs initially housed in litter groups, and then split into single housing in September, had fewer bite marks on the leather side of the pelts than cubs housed with their litters (mean litter size 3.9 ± 1.2 cubs) throughout the growing season (from weaning to late fall/winter, all treatments providing 1.2 m^2/animal). Prior studies also showed an effect of natural dispersal age on the occurrence of aggression in group-housed red foxes: aggression and tendency to avoid cage mates increased towards autumn in group-housed red fox cubs (four litters of vixen + five cubs) in Ahola and Mononen (2002). Furthermore, a calculated group preference index decreased over time in Ahola, Mononen, and Pyykkönen (2002), and some individuals appeared to have impacted welfare due to restriction of dispersal behaviour (Ahola et al., 2000a).

Overall, these results suggest that whilst housing with social companions is beneficial for young red fox cubs from weaning to autumn, group-housed cubs should be further split into pairs in late autumn to mitigate group stress arising from the onset of dispersal motivation. When red fox adults were socially housed in groups of three (on each of six farms, 9–10 groups were housed with 3x the space of individually housed animals, and all animals had access to their own resting platform, a shelter, a gnawing stick, a drinking nipple and a food tray), 36% of the grouped vixens had scabs or injuries 3 weeks following the start of the experiment, as compared with only 2% in the single housed group (cage size 75 × 80 × 106 cm; Hovland & Bakken, 2010). Furthermore, ~2% (n = 6) of the group housed vixens had infectious bite wounds and were excluded from the study (Hovland & Bakken, 2010). Bite wound severity differed significantly between farms, which reflects farm-level differences in the ability of the foxes to adapt to social housing. Vixen injuries were least prevalent on a farm that left one empty cage between each triplet, suggesting an influence of neighbouring foxes on aggression (Hovland & Bakken, 2010).

Hovland et al. (2010) recorded animal injury proportions of 42% and 30% at 2 and 3 weeks following the start of a group housing experiment (Hovland et al., unpublished data cited in Hovland & Bakken, 2010), supporting the findings of Hovland and Bakken (2010). Aggression seemed to be highest in the first hours after mixing of adults (during which time dominance hierarchies were likely being established), and then decreased over time (Hovland et al., 2010); however, scabs and/or bite injuries were still found throughout the first and second week after mixing (recorded in 58% and 42% of animals, respectively, with 24% of animals having worse wound scores or fresh bite injuries in the second week; Hovland et al., 2010).

The severity of aggression is influenced by the availability of important resources. Pair housed vixens (n = 40) when housed in coupled cages (total area 2.00 × 1.10 × 0.75 m) but with limited resources (plentiful feed but on a single tray, single nest box) had more bite injuries and lower weight gain than those housed in cages with more resources (feed distributed across the two cages, two nest boxes) in the first 25 days after mixing (Akre et al., 2010) In addition, vixens housed with one food tray and one nest box spent much less of their synchronous resting time inside a nest box than vixens with two food trays and two nest boxes, who rested simultaneously but separately in both nest boxes (Akre et al., 2010). This indicates that co-resting in a single nest box may be a compromise due to limited resources and that providing separate resting areas may better reflect the animals' preferences.

The observed aggression levels throughout the day decreased with subsequent observation days, indicating that it took between 5 and 19 days to establish a stable social relationship within the pair. After 33 days, the observed aggressive behaviour across the whole day was similar in both treatments. Vixens with two nest boxes available spent more time inside a nest box compared to vixens in the environment with limited resources (73% vs. 20% of the total synchronous resting time), indicating that vixens prefer to rest alone if they have the opportunity (Akre et al., 2010). Earlier research indicated that offering more than one platform for pair- or group-housed foxes increased platform use and reduced agonistic interactions (Ahola, Mononen, & Pyykkönen, 2002). Similarly, as mentioned above competition for access to resources such as bones may lead to increased biting behaviour (more bite marks in the skin of foxes with than without bones) (Ahola et al., 2010). Thus, providing fewer point-source resources than animals in an enclosure increases the risk for Group stress.

In summary, the number of animals per area and per cage, and especially the number of animals per resource (nest box, platform, feeing place) creates competition which contributes to Sensorial overstimulation through Group stress as well as to Resting problems.

4.3.6 | Handling stress

4.3.6.1 | *Description of handling stress and linked WC*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as pain and/or fear resulting from human or mechanical handling (e.g. sorting and vaccination of newly hatched chicks, loading/unloading, catching and crating of animals to be transported, inversion)'.*

Interpretation for foxes

Farmed foxes are handled repeatedly for production procedures. The WC Handling stress applies to all scenarios in this SO, but especially to breeding females, which are handled multiple times across their lifetime, in particular for heat detection and natural mating or artificial insemination (Scenarios 1 and 2). Males may be handled for semen collection if artificial insemination is practiced on the farm.

Foxes are handled by humans, but not mechanically. When handled, foxes kept for fur production are caught and restrained with neck tongs (most common) (Figure 10) or by hand (EFSA, 2025).

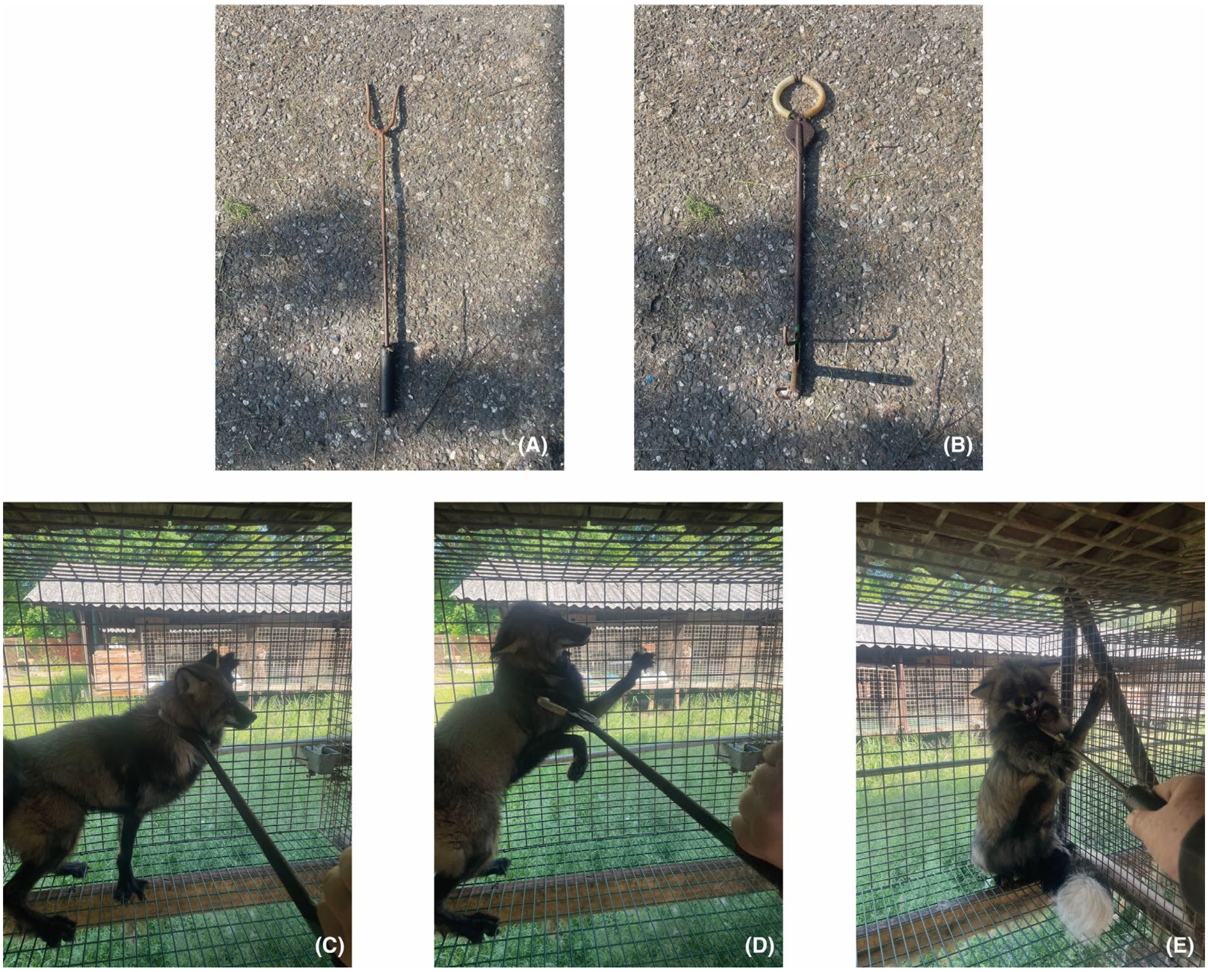

FIGURE 10 Examples of neck tongs used to catch and immobilise foxes for handling procedures. Tongs can be (A) without or (B) with rubber coating. The photos C-D illustrate how the tong is used when a fox is handled in a cage: Fox standing still displaying a freezing posture (C); fox showing avoidance behaviour by rearing sideways against the cage wall with ears pinned down (D); fox showing avoidance and fear behaviour by rearing upwards against the cage wall, with ears pinned down and mouth open (panting and/or vocalising) (E) (©Tomasz Zoń).

Breeding females are caught in their home cages and restrained in place for checking heat with a device that is inserted into the vagina ('rut gauge'; see explanation below). The females may also be caught and transported to the cage of the male for natural mating and then caught again and returned to their home cage. Breeding males are caught in their home cages and restrained in place for checking status of testicles. For the purposes of artificial insemination, both breeding males and females are caught in their home cage and transferred with a transport cage to a breeding room, where they are caught from the transport cage and restrained to be ejaculated or inseminated, respectively, before being transferred back with the transport cage. On farm, juvenile foxes (Scenario 3) are handled at weaning, for weighing or fur grading (some of the animals), for splitting litters after weaning (on some farms) and for killing at pelting time (EFSA, 2025). Foxes may also be caught and restrained for veterinary procedures, including health checks and treatments.

Procedures involving handling have been shown to cause stress to the animals during the process and can contribute to a more long-term fearfulness of humans. Unwanted human proximity due to normal farm management procedures is stressful for the animals when they are fearful of humans.

Red foxes

The experience of capture, removal from the home cage and weighing (an overall 2-minute duration) caused elevations in faecal cortisol metabolites (FCM) of farmed red foxes (Hovland et al., 2017). Repeated handling at 5-min intervals is also known to activate the HPA-axis in red foxes, wherein plasma cortisol levels doubled after 1 h of this handling sequence compared to baseline pre-handling levels (Moe & Bakken, 1997) as cited in (Hovland et al., 2017). Bakken et al. (1999) also showed that human presence can stimulate increased activity and stress-induced hyperthermia (interpreted to reflect fear or anxiety; (Moe & Bakken, 1998) in red fox vixens. The highest core body temperatures and activity were observed both after handling vixens for 5 mins and when a human was present for a 90-min observation period (Bakken et al., 1999). Red foxes also showed fear-related vocalisations in a human approach test (Gogoleva et al., 2010) and increased their SB in anticipation of capture with neck tongs (Figure 10) (Moe et al., 2006).

Arctic foxes

Capture and 2-minute handling outside of the home cage similarly caused elevated FCM in farmed Arctic foxes (Larm, Hovland, 2021). Moreover, applying daily handling stressors to pregnant Arctic fox vixens increased their plasma cortisol concentrations and adrenal corticosteroid production, along with decreasing their body and ovarian weights and the body weights of their viable fetuses (Osadchuk et al., 2001a). The offspring of vixens handled during gestation also showed effects of prenatal stress. These effects may include reduced gonadal weights (Osadchuk et al., 2000) and adrenal weights (Braastad et al., 1998; Osadchuk et al., 2001b, 2004), decreased ovarian oestradiol production simultaneously with increased testicular testosterone (Osadchuk et al., 2000), decreased plasma concentrations of cortisol and progesterone (female offspring, Osadchuk et al., 2003), increased plasma progesterone (Braastad et al., 1998; Osadchuk et al., 2004), increased cortisol and progesterone production by the adrenals in vitro (female offspring, Braastad et al., 1998; Osadchuk et al., 2004), lower fetal ACTH levels and increased fetal plasma cortisol concentrations (Osadchuk et al., 2001b). Thus, prenatal handling stress can dysregulate offspring HPA axis activity, and this effect is more pronounced in female offspring (Osadchuk et al., 2000, 2003, 2004). According to behavioural tests, offspring subjected to prenatal handling stress may also be more reactive in novel situations (e.g. more active during human encounters and novel open field tests in Braastad et al., 1998). This may be of particular concern since females often live longer on farms than males (i.e. more females than males are retained on the farm for long-term breeding (EFSA, 2025), and, therefore, females would in general experience larger cumulative welfare impacts of prenatal/gestational handling stress.

Linked WC: Inability to avoid unwanted sexual behaviour

The WC Inability to avoid unwanted sexual behaviour is defined by EFSA AHAW Panel (2022) as: *'The animal experiences stress and/or negative affective states such as pain and/or fear resulting from inability to avoid forced mating'.*

For natural mating, females are relocated to male cages, which may result in this WC. There was little reference to natural mating practices in the literature reviewed, so the WCs of this breeding system for farmed foxes appear to be understudied. As outlined in the EFSA (2025), natural mating is not as common in farm practice as artificial insemination; therefore, the relocation of foxes to unknown conspecifics' cages and the risk of forced experiences of sexual behaviour may be less often a welfare concern. However, this practice does occur on some EU farms (e.g. there are reports of its implementation on Norwegian farms; (EFSA, 2025). For systems involving artificial insemination, inability to avoid this procedure may add additional welfare concerns to the handling stress.

Linked WC: Resting problems

The WC Resting problems is defined by EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as discomfort, and/or frustration due to the inability to lie, rest comfortably or sleep (e.g. due to hard flooring, inability to perch or vibration during transport). This may eventually lead to fatigue'.*

In foxes, the fear of humans may lead to disruption of rest when people are seen or heard within the vicinity, particularly when there are no hiding places or vantage points for vigilance behaviour.

4.3.6.2 | *Hazards leading to handling stress and linked WCs*

- **Handling and restraint during production procedures in the farm setting**

Since any handling is stressful to foxes kept for fur production, as detailed previously, any production procedures which involve handling and restraint will be a hazard for this WC. These include transportation to another cage, heat evaluation, semen collection, artificial insemination, vaccinations, health checks, medical treatments, live fur grading and killing. Bakken et al. (1994) estimated that breeding animals are moved out of their cage approximately 20 times per year and cubs up to five times before pelting.

Akre et al. (2008) described the procedures used during breeding. As mentioned, most foxes are subjected to artificial insemination, though natural mating is often used for animals coming into heat early or late. Heat is evaluated by visual detection of vulva swelling and/or by a heat-detection device (a rut gauge – a commercial device 5 cm long, 1 cm diameter measuring electrical conductivity) inserted into the vagina (Supporting information SF5, SF10). Foxes are usually restrained with neck tongs while being evaluated. The use of heat-detecting devices inserted into the vagina can cause injury and pain if the device is used incorrectly (Akre et al., 2008).

Since many vixens exhibit late or weak signs of oestrus, repeated handling occurs in order to determine the optimum insemination time in relation to ovulation. Artificial insemination is carried out while the fox is restrained by the neck with her feet on a bench. A metal intrauterine catheter is inserted into the vagina and passed through the cervical canal during abdominal fixation of the cervix, as described by Fougner (1989). Intra vaginal insemination may also be used but is less common. Approximately 70% of the females are inseminated twice, usually with a 2-day interval; the remaining 30% are only inseminated once, due to the rapid development of heat. In males, semen is collected by digital manipulation during restraint; electroejaculation is not used. The semen is evaluated and diluted; semen from one male can be utilised to inseminate up to 15–20 females. The insemination procedures were reported to be carried out by trained staff after moving the foxes in transport cages to a dedicated room (Akre et al., 2008; Supporting information SF5,SF10).

Studies have examined consequences of handling outside mating and/or insemination. The effect of forceful vs. gentle handling was evaluated by Pedersen (1993) in a study of early handling effects in red fox cubs (17–18 pairs of cubs per treatment). Cubs were handled twice daily for 3 weeks after weaning at 8 weeks of age. Forceful handling involved capturing the cub with one hand on the tail and one under the stomach, transporting the cub to a smaller cage for 2 minutes, then capturing the animal in the same manner and returning the cub to the home cage. Gentle handling involved the human making no fast movements, while slowly opening the cage door, fondling the cub, offering scraps of food and withdrawing if the cub showed signs of fear. During the handling period, the gently handled group showed an increasing number of animals responding in a calm or exploratory way towards the human. In contrast, in the group handled forcefully, the majority of animals continued responding fearfully to capture and recapture. The longer-term consequences of the different handling methods were assessed by behavioural tests at 18, 24, 30 and 32 weeks of age. Both handled groups responded less fearfully than unhandled control animals in a human proximity and human confrontation test, but no significant difference between the animals previously handled gently or forcefully was found. Thus, while gentle handling seems less stressful in the short term, all handling types seem to have similar consequences for longer term habituation to humans.

Whilst cubs and young animals are usually held by hand, the most frequent method of handling older foxes is to secure a pair of tongs around the neck, hold the fox by the tail and lift it under the chest. The **neck tongs** (see Figure 10) are made of steel and are about 50 cm long. At one end they have a handle with which the operator can open and close the other end, which consists of a rounded pair of tongs. The rounded tongs have a diameter of about 7.5 cm for females and 8.5 cm for males (Akre et al., 2008). Bakken et al. (1994) described the different handling methods for foxes. Once outside the cage, the foxes secured by tongs are held in such a way that their abdomen is resting on the leg of the operator. Animals that resist handling will often bite at the tongs and, in rare cases, hit their gums on the tongs or break a tooth; this can be mitigated by putting rubber tubing on the tongs. Bakken et al. (1994) stated that catching foxes without tongs requires more time and handling skill. The method used is to grab with one hand under the chest and the other around the tail. However, when using this method outside the cage, the fox is held close to the handler's chest, which creates a potential risk for biting injuries to the face of the handler. Catching without tongs was also reported as more difficult if foxes are in larger cages.

Bakken et al. (1994) also reviewed the impact of different handling methods on welfare. They reported great individual variation in the animals' acute stress reaction, measured as heart rate change and this variation was only marginally affected by the two capture methods. Red foxes were somewhat more stressed when they were caught with the tongs, and Arctic foxes were somewhat less stressed when caught with tongs. The red foxes posed a greater risk for the caretaker when they were caught by hand, but there was no difference in the capture methods for the caretaker's safety with Arctic foxes.

- **Fearful temperament**

Akre et al. (2008) reported findings from a 2004 KSP-investigation (Quality systems on fur farms) covering 98% of the fur farms in Norway, at that time. 44% of red foxes and 36% of Arctic foxes approached a test person holding a titbit and 22% and 13%, respectively, took the titbit. Thus, over 50% of the foxes avoided contact with a human. Other studies also highlight that fearful temperaments are prevalent in farmed foxes. The overall mean temperament score in 60 juvenile red foxes in pair cages was 'fearful', when assessed by a feeding test (Łapiński et al., 2019). Ahola et al. (2014) reported

WelFur assessments made at three different periods of the year on 84, 81 and 83 Finnish farms, with mostly Arctic but some red foxes. One hundred foxes per farm, mainly adults, were subject to the 'feeding test' to assess fear of humans. The authors report that the average number of foxes who approached food in the presence of a human within 30 s was 42.5 ± 18.9, 42.5 ± 20.8, 49.4 ± 1 8.9 for each period. These results suggest that the majority of farmed foxes are fearful of human presence.

Various tests of fearfulness have been used in foxes. These include open field and novel object tests. For example, a 'stick test' consists of putting a stick into the cage through a net perforation, without opening the door. The stick, which is different in detail in different studies, is placed at the level of the animal's nose, in its range of sight. The person performing the test stands about 50 cm away from the cage. The observation lasts 15–20 s and relates to the first reaction of the animal to something new that does not raise excessive signs of fear (Łapiński et al., 2019). However, the most common test in relation to fear of humans is some form of feed test. Significant correlations between the results of a feeding test (whether the animal started eating within 30 s when feed was delivered by hand on the roof of the cage, with the experimenter staying 0.5–0.7 m in front of the cage) and other behavioural measures of fear in foxes were shown by Rekilä et al. (1997), together with significant correlations between the results of the feeding test and measures of adrenocortical response to handling in red foxes, and to a lesser extent in Arctic foxes (Rekilä et al., 1998). These results suggest that the feeding test is a reliable indicator of fear of humans.

Although the feeding test showed good repeatability, there may be other influencing factors. For example, in one series of studies, a portion of feed was placed on one feed tray per housing unit, the person stepped back and recorded the proportion of animals that came to the feed (somewhat different calculations in the two studies (Ahola, Mononen, & Pyykkönen, 2002; Ahola et al., 2005). The results were mainly influenced by group size (Ahola, Mononen, & Pyykkönen, 2002; Ahola et al., 2005), as can be expected when feed is placed in one location only, especially when animals with access to multiple compartments are usually fed in each compartment. The WelFur (2015b) protocol for foxes uses a similar tray feeding test in which 50–100 g of feed is placed manually on the feeding tray. If there is no feeding tray in the cage, feed is placed where the animals in the cage are usually fed. In the cages with several feeding plates, feed is placed on the plate closest to the assessor. Separate feed portions are delivered for each animal in the cage. After the delivery of feed, the assessor stays in front of the cages that are being assessed (at a distance of 0.5–0.7 m from each cage) and records whether each animal tested eat or not within 30 s.

Fearful temperament might increase the handling stress experienced by foxes. In a study involving 10 vixens, 10 juvenile females and 10 juvenile males, red foxes which were more confident in being hand-fed from humans showed a trend towards reduced latencies to reach peak FCM concentration in samples collected every 2 h for 24 h after handling compared to fearful animals (Hovland et al., 2017). The authors speculate that this may represent prolonged HPA axis activation in fearful animals, however no difference in peak FCM was found. Although basal FCM in a sample of 15 Arctic foxes was found to be negatively correlated with 'boldness' in a novel object test, and concentrations following handling tended to show the same relationship, there was no relationship between boldness and the increase in mean concentrations from baseline to handling (Larm, Hovland, et al., 2021). Furthermore, although this 'boldness score' and a 'confidence score' in a hand feeding test were significantly correlated, no correlation of the latter with FCM measures was found in Arctic foxes. Taken together, these results suggest that while elevated FCM concentrations support the stressfulness of handling in foxes, their interpretation in relation to temperament is still unclear.

Genetic selection for a less fearful temperament has been applied in several studies, and results suggest that foxes from these selection lines have better welfare under standard farm conditions when it comes to coping with close human contact. This selection approach was first demonstrated in the pioneering research of Belyaev (1979) in red foxes (see Section 1.2.1.2). When investigating offspring of red foxes from a line that had been selected for tameness (as a trait based on response to approach and attempted contact by a strange human on a scale with negative weighting for fearfulness and positive weighting for contact seeking) for more than 30 generations (Harri et al., 2003), it was found that foxes from the selection line ($n = 12–19$) had higher domestication indexes (based on tests of fearfulness or contact seeking with humans), greater willingness to feed in the presence of a human and to accept food from their hand, lower levels of serum cortisol both before and after a stressful situation (catching and restraint) and showed lower stress-induced hyperthermia than the offspring from non-selected normal Finnish farmed foxes ($n = 9–10$), with hybrids ($n = 8–13$) showing intermediate results.

Red foxes from genetic lines selected for tameness for 35–40 generations at the Institute of Cytology and Genetics, Novosibirsk, have also been identified as having lower plasma cortisol and ACTH levels in response to capture and handling, compared to foxes from a genetic line not selected for tameness ($n = 9–14$ per group) (Gulevich et al., 2004). Furthermore, red foxes selected for tameness at this institute were noted altering their vocal behaviour (i.e. short bursts of vocalisation) to attract humans' attention, which the authors propose to be a behaviour linked to domestication (Gogoleva et al., 2011). In this study, aggressive foxes and those unselected for temperament ($n = 15$ per group) showed more consistent levels of vocalisation in the presence of humans. The behaviour change in selection for tameness can only be associated with limited changes in the brain transcriptome in red foxes (Lindberg et al., 2005). However, a candidate gene for this trait was identified in a study using the fox population from the Belyaev Russian fox experiment (Kukekova et al., 2018). These results demonstrate that genetic selection for a tameness trait is possible and reduces the stressfulness of capture and handling.

A four-year study of selection for more confident Arctic foxes in Norway and Finland (based on 11,172 evaluations of 3332 cubs) showed that it is possible to improve the confidence of these animals towards humans (Kenttämies et al., 2002). In Finland, confidence was measured by the feeding test validated by Rekilä et al. (1997). In Norway, the titbit test based on the animal's position in the cage was used. These methods measure the same features of behaviour, fear and curiosity (Rekilä, 1999). In the different populations, a low to moderate heritability estimate with low standard error was achieved for confident behaviour ($h^2 = 0.20 \pm 0.03$ in Finland, $h^2 = 0.12 \pm 0.04$ in Norway), and in both experiments similar positive genetic responses were achieved in a short time (3 years) despite differences in genetic background, experimental design and testing methods. Thus, genetic selection for reduced fearfulness towards humans can be effective on a relatively short timescale and using relatively simple methods.

In other species, it has been shown that living in a more enriched environment can result in reduced fearfulness. However, evidence that this occurs in foxes is lacking. Łapiński et al. (2019) used behavioural and physiological tests to compare fearfulness in pair-housed juvenile red foxes ($n = 10$ pairs per treatment) which were given either an observation platform, wooden gnawing sticks or no additional cage resources. Behaviour in a feeding test and stick test, and measures of salivary cortisol, did not show any consistent treatment difference indicative of reduced fearfulness. Similarly, Korhonen and Niemelä (2000) found that provision of wooden blocks did not affect fearful behaviour of adult Arctic foxes in a stick test, feeding test or human confrontation test (16 males and 49–50 females per treatment). However, video recording of a sample of animals showed that there was relatively little interaction with the blocks (16 min per 24 h), suggesting that their enrichment value was poor (see also Section 4.3.2).

Korhonen et al. (2003), in a study involving 24 juvenile male Arctic foxes, showed that inclusion of in-cage sand boxes (80 cm long × 40 cm wide × 14 cm high) for the individually housed animals did not affect the cortisol: creatinine ratio in a blood sample after capture or showing signs of fearfulness in a feeding test, although the test foxes were more active than control animals in an open field test and had significantly shorter latency to contact a novel object. It was concluded that the added resources did not affect fear of humans but caused foxes to be more inquisitive of their environment.

Finally, Korhonen and Eskeli (2015) investigated the effects of a multi-resource strategy (addition of a bone, a scratching plate, a rubber hockey puck, a ceiling rope and a wall rope and straw, as well as a wire-mesh platform and a nest box situated above the cage) provided to 12 adult Arctic fox vixens previously housed in standard cages with only a platform and a bone. Fearful behaviour of foxes during capture with neck tongs was not affected by 26 days in the environment with the resources added. Taken together, these results suggest that simple environmental enrichment approaches are unlikely to lead to reduced fear of humans.

- **Lack of habituation to humans**

Lack of positive early handling

Early handling, particularly complex handling or play with humans, during the cubs' sensitive periods for socialisation may reduce fear responses during later handling. Tennessen (1988) as cited by Nimon and Broom (2001) showed that cubs who were played with for 5 mins each weekday had reduced fear responses to the presence of a human outside the home cage and showed more exploratory behaviour in a novel situation than foxes which were picked up briefly each weekday or not handled aside from routine husbandry. This effect is also supported by subsequent research: red fox cubs fondled and/or talked to (implying close human proximity and handling unless fearful withdrawal) twice daily for 10 mins total, 5 days a week for 3 continuous weeks during weaning (Pedersen, 1992) had significantly reduced fear responses at later ages towards all humans (not only those who performed the handling). This reduction in fear applied to all later weeks of testing, excluding when the foxes were 30 weeks of age, which the authors suggest may have been due to preceding blood withdrawal a few weeks earlier, causing a temporary negative association between human handling and pain.

Other studies also examined effects of handling of young foxes. Overall, these results confirm the above - that early experience of handling can reduce fearfulness during human presence or contact in later life, although results on this are not fully consistent. For example, Pedersen and Jeppesen (1990) found that a higher proportion of handled (fondled and talked to in nest box from 2 to 8 weeks of age) vs. control red foxes responded by screaming, hissing and biting at neck tong during capture and showed a higher level of plasma cortisol after an open field test at 20 weeks of age.

In addition, studies have also compared effects of positive vs. negative handling, and not always been able to separate their effects. For example, after being handled either 'forcibly' or 'gently' for 3 mins twice daily for 3 weeks after weaning, red fox cubs (17–18 pairs per treatment group) showed reduced fear and increased exploratory behaviour in both handling groups compared to a non-handled group (Pedersen, 1993).

Pedersen (1993) did not find sufficient differences between the groups to conclude if one handling method was more beneficial than another when studying the foxes up to 32 weeks of age. However, when retesting 51 of these vixens again as adults at 10, 13, 15 and 18 months of age, it was found that forceful handling resulted in more pervasive long-term reductions in fear responses towards humans (Pedersen, 1994). Gently handled animals showed reduced responses to humans standing outside the home cage and placing a novel object in the cage, whereas forcibly handled animals also had lesser reactions to humans opening the cage door and reaching for the animal (Pedersen, 1994). Both types of handling also reduced the adrenal weights of foxes at 22 months of age, suggesting reduced long-term stress; non-handled animals had significantly higher adrenal weights and high levels of fear, which may indicate chronic stress from the farm environment (Pedersen, 1994).

In Arctic foxes, early handling was found by Ahola, Mononen, and Pyykkönen (2002) to have only temporary benefits for cubs (a higher body mass only in the early juvenile phase). Handled cubs ($n = 40$) in their home cage were touched gently 3 times per day for the first 8 days and then once daily until weaning at 8 weeks. In total, cubs were handled 73 times, with 11 of these including weighing. Control cubs were handled only for 7 weekly weighings before weaning. In subsequent feeding tests, performed in late August, September and October, there was no difference in fear reactions towards humans, and handling appeared to have negative impacts on stress indicators measured at the time of pelting (heavier adrenals at post-mortem analyses and higher serum cortisol levels after ACTH challenges).

In contrast to the study above, Pedersen et al. (2002) reported a benefit of post-weaning handling of Arctic foxes. In a 2 × 2 factorial experiment of nest box provision and a handling treatment involving 94 juvenile females, a lower proportion of foxes handled once per day for 2.5 min between 7 and 10 weeks of age showed a fearful response in a handling test involving capture with neck tongs and transport to an arena and back. This was not associated with a difference in plasma cortisol response when compared to control animals, and behavioural responses to human presence showed only a lesser tendency for the same effect.

Thus, overall, early experience of handling can reduce fearfulness in foxes during human presence or contact in later life, but methods and results on this are not consistent and further research is needed to fully understand the relationship between early handling experience and fear responses later in life in these species.

Housing which reduces the degree of habituation to humans

In a study involving 90 cubs from 23 litters, red fox cubs housed with their litters from weaning to late autumn were noted to be more focused on relationships within their own social group and to react more aversively to human presence (thus demonstrating less habituation to humans) as well as to respond more strongly to acute stress than cubs who were singly housed from weaning onward, or from September onward (Ahola et al., 2006). Furthermore, Ahola et al. (2000b) observed that juvenile red foxes housed in family groups with the vixen in large outdoor enclosures (four families of vixen + four cubs in enclosures of 50–112 m^2) had higher HPA axis activity and increased rectal temperatures in response to handling than animals housed singly in cages, indicating reduced habituation to humans and therefore greater fear in response to human interactions.

A similar result was found in a subsequent study (Ahola et al., 2001) where group housed Arctic fox juveniles (six groups of four) in these large enclosures, but without the vixen, also exhibited greater stress-induced hyperthermia responses to acute handling stress, which the authors again hypothesised to be due to lesser habituation to humans. When juvenile Arctic foxes were housed either singly, in pairs, or in quartets at a space allowance of either 0.6 or 1.2 m^2 per animal ($n = 7$ groups per treatment), stress-induced hyperthermia in response to catching increased with increasing group size and space allowance (Ahola et al., 2005), suggesting poorer habituation to humans in these groups. These results indicate that enforced experience of human proximity results in a degree of habituation to humans which may reduce subsequent handling stress. The implications of this for more extensive housing systems require further investigation.

If foxes are fearful in the presence of humans, the possibility to hide may reduce the stressfulness of this situation and improve welfare. Red fox vixens without nest boxes in the home cage ($n = 50$) had higher serum cortisol, higher eosinophils and lower lymphocytes than vixens with nest boxes (Jeppesen & Pedersen, 1991). Similarly, provision of a shelter screen in the cage of juvenile female Arctic foxes ($n = 20$) tended to reduce FCM in comparison with a control group (Ojala et al., 2025). However, housing with a shelter may also reduce the degree of familiarisation that foxes have with humans and thus make any necessary contact more stressful. This did not appear to be the case, though, in the experiment of Jeppesen and Pedersen (1991). However, in an experiment involving four groups of 24 Arctic fox juveniles between weaning and pelting, Harri et al. (1998) found that more animals in groups reared with a nest box situated above the cage showed fear responses in feeding and disturbance tests, irrespective of whether the front wall towards the aisle of the shed was solid or wire mesh. Similarly, in a 2 × 2 factorial experiment of nest box provision and a handling treatment involving 94 juvenile female Arctic foxes, Pedersen et al. (2002) found that more animals given access to a shelter were fearful in tests of human presence or human confrontation which mimicked every-day routines. However, behavioural response to capture with neck tongs and blood cortisol after capture and transport did not differ between groups.

4.4 | Preventive and mitigating measures

This chapter addresses preventive and mitigating measures for the WCs identified in Section 4.1.2.

In the following sections, mitigating measures for each WC are described, taking into consideration their individual hazards. In general, addressing individual hazards delivers only limited mitigation of the overall WC, and only changes addressing several individual hazards can provide substantial mitigation, as summarised at the end of each WC section.

4.4.1 | Restriction of movement and linked WC

Restriction of movement is linked with the WC **Inability to perform play behaviour** because of shared hazards. It also shares some hazards with the WC Inability to perform exploratory or foraging behaviour (see Section 4.4.2).

The WC Restriction of movement **cannot be prevented or substantially mitigated** in the current system due to the hazards listed below.

- **Insufficient floor area to allow motivated types of active behaviours, including locomotion**

The cage sizes in the current system (100, 107 or 115 cm of length and 75, 76 or 105 cm of width, EFSA (2025) allow standing (with tail unstretched) and turning, however, the latter only by bending the body to some degree. Using longer and wider cages also allows larger individuals to stand without bending their tails and turn with less bending of the body. In addition, foxes require space to perform dynamic behaviours, including locomotion and jumping. When juvenile foxes are housed with conspecifics, free space to perform appropriate social behaviours, including social play, escape and avoidance of aggression, is also required (see Section 4.3.1). Further research is needed regarding space requirements for stationary and dynamic behaviours.

Irrespective of the space allowance, the available literature is insufficient to conclude on the extent to which enclosure size or area per animal alone can mitigate restriction of movement in foxes. This is because experimenters usually investigated combinations of absolute cage sizes and/or space allowances per animal with different levels of cage complexity and/or group sizes, which was often combined with additional or confounding factors, low numbers of observations per treatment or other methodological issues.

Compared to smaller space allowances, offering at least 1.2 m^2 floor area per fox to pair-housed juvenile red foxes will allow both foxes to be active on the floor at the same time (which is not possible at all at 0.48 m^2 per fox; Mononen et al., 1995). In addition, offering at least 1.2 m^2 floor area will reduce biting lesions and physiological indicators of stress in female juveniles kept in mixed-sex groups (compared to 0.6 m^2 per fox; Ahola, Mononen, & Pyykkönen, 2002). Increasing the space allowance to at least 1.2 m^2 floor area per fox may be achieved by connecting currently existing cages, if resources like feed, water, platforms and nest boxes are available in each compartment (Ahola, Mononen, & Pyykkönen, 2002; Ahola et al., 2005).

However, despite the improvement compared to smaller cages, a floor area of 1.2 m^2 per fox is still small in relation to the animals' body size. The available studies that investigated space allowances above 1.2 m^2 per animal are too diverse to conclude on specific mitigation measures. Overall, the EFSA experts recognise that restriction of movement will only be mitigated if considerably more space is added in combination with resources such as platforms, nest boxes or sand, which in turn require space to fit them in. Therefore, it is expected that significantly more space than 1.2 m^2 per fox is necessary to allow different types of locomotor activity (e.g. jumping, exploratory locomotion) in foxes and that mitigation of this hazard involves increases in floor area that address (i) general active behaviours and locomotion; and (ii) specifically the ability to perform exploratory and foraging behaviours. Also, different recommendations for Arctic and red foxes may be necessary due to their species-specific body sizes and behaviour (EFSA, 2025). Further research is needed to clarify how much space foxes need to be able to express motivated behaviours and thus not experience the WC Restriction of movement.

Additionally, providing larger floor areas to farmed foxes will facilitate the expression of locomotory play behaviour, indirectly addressing some of the hazards for the linked WC Inability to perform play behaviour, as it allows for the inclusion of resources that promote play behaviour, especially substrates like earth or sand (Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen, Niemelä, & Jauhiainen, 2001). Further research is needed to clarify the relationship between flooring characteristics and play behaviour, and to generate quantitative data.

- **Insufficient cage height and structure to facilitate movement in three dimensions**

The current cage height (approximately 70 cm) limits the possibility to include elevated structures (e.g. platform or nest box roof) that can be used for three-dimensional movements, for resting in an elevated place and for vigilance behaviour (Mononen et al., 1993). Space above platforms is limited to around 23 cm (as reported in most experiments), which prevents foxes from sitting upright or standing comfortably (Mononen et al., 1995). Foxes tend to use platforms with 30 cm of headroom for longer times than those with only 23 cm (Korhonen et al., 1995). EFSA experts agreed that enclosures need to be sufficiently high to accommodate a platform or nest box, while providing adequate space both beneath the platform and above it to enable foxes to sit or stand in a normal posture without crouching. More space above the structure will encourage activity because foxes jump up and down from elevated structures throughout the day (Korhonen et al., 1996). Foxes prefer platforms with a good view of the surroundings (i.e. without walls), and rectangular platforms over triangular corner platforms (Mononen et al., 1993; Korhonen et al., 1995; Korhonen & Niemelä, 1996b). Offering more than the current cage height of 70 cm furthermore allows foxes to stand upright on their hind legs and to fully express extensive movements such as vole jumps (see Section 4.3.2). While foxes can still perform some jumps in current cages of 70 cm height, their range and thus the expression of movements are limited in the current system.

- **Inadequate floor material**

The available studies do not allow a general ranking of flooring materials in relation to active behaviour but rather indicate that foxes prefer different floors for different activities, with a tendency to prefer non-wire mesh flooring to perform active behaviours. For example, 12 adult male and female red foxes given access to four compartments with different flooring types (wire mesh, plywood, 5 cm of sand and wet plywood in spring or wet sand in winter) spent the least amount of their active time on the wire mesh flooring (Harri et al., 1999). Offering flooring types of different qualities allows animals to choose the appropriate flooring for a given activity. Flooring material in relation to mitigation of the WC Inability to perform exploratory or foraging behaviours is addressed in Section 4.4.2.

Male juvenile Arctic foxes play more on sand than on concrete or wire mesh during operant tests (in test cage; Koistinen & Mononen, 2008) in home cage, (Koistinen, Orjala, et al., 2009). Similarly, access to earth increases play in male juvenile Arctic foxes (Korhonen, Jauhiainen, & Niemelä, 2001; Korhonen, Niemelä, & Jauhiainen, 2001). However, the effect of substrate type on play behaviour is not entirely clear, as the overall proportion of time spent playing may not differ between foxes with or without access to sand and may even be lower in foxes with sand access, with sand cleanliness seemingly having an effect on usage. More experiments that account for confounding factors are needed. Sand and earth floors needs to be managed properly to keep them attractive for foxes.

Substantial mitigation

In general, to achieve **substantial mitigation**, current systems need to be changed to enclosures that provide additional space in three dimensions to include additional structures to increase complexity, as well as adequate flooring materials. Further research is essential to provide quantitative information on fox enclosure sizes that allow for substantial mitigation of Restriction of movement.

4.4.2 | Inability to perform exploratory or foraging behaviour and linked WC

Inability to perform exploratory or foraging behaviour is linked with the WC **Inability to chew** because of shared hazards.

Inability to perform exploratory or foraging behaviour **cannot be prevented** or **substantially mitigated** in the current system due to the hazards listed below.

- **Lack of physical complexity of the cage and limited cage size (both horizontal and vertical space) to perform exploratory or foraging behaviour**

The WC can be mitigated by increasing the size and complexity of the enclosure beyond the current system. Structuring the two-dimensional space and making the third dimension accessible (e.g. with platforms or nest box roofs allowing sufficient space above and below to stand straight) encourages exploration and foraging by creating locations to explore, although the effect of additional manipulable material/objects or digging substrate is usually stronger (see Section 4.3.2). There is insufficient evidence to conclude on minimum space or structure requirements. In general, the enclosure needs to be of sufficient size to allow the inclusion of enrichment of different types while still leaving sufficient space for the unrestricted performance of space-demanding exploration and foraging behaviours such as running or vole jumps. Also, further research is needed to establish recommendations for the characteristics of enrichments addressing the same functions, such as comparing different versions of chewable objects rather than, e.g. comparing a wooden object with a sand box (Koistinen & Korhonen, 2013).

- **Lack of enrichment providing stimuli for appetitive and consummatory foraging behaviour**

Inability to perform exploratory or foraging behaviour can be mitigated in the current system by providing chewable objects. Overall, objects from organic material that can be orally manipulated and either have a relation to feed (e.g. bones) or are destroyable (e.g. sisal ropes attached to the wall) have the strongest mitigation effect (see Section 4.3.2). Novelty and cleanliness furthermore improve mitigation (e.g. fresh bones are used more than bones that have been in the cage for weeks), which means that objects that are frequently replaced or exchanged promote exploratory and foraging behaviour (Korhonen & Eskeli, 2015). Providing several items in cages with more than one fox reduces agonistic behaviours. The mitigating effect of straw without other enrichment seems to be sparse.

While bones also address the scavenging aspect of foraging, the inability to display all the behavioural elements of hunting cannot be addressed in the current system. It is unclear whether food provision in the current system could address seeking or working for food as part of foraging. Providing feed at different times in different locations, which partly required work for access, did address this in a large enclosure (Kistler et al., 2009), but it is doubtful whether this could be implemented with a mitigating effect within the space available in the current system. Aspects to be considered include that unpredictable food provision can also have negative welfare impacts (Mason et al., 2007), and that interaction between foxes in different cages can be a hazard for Group stress (Section 4.3.5.2).

Changing the feed texture to contain more animal fibre/chunks and providing resources suitable for chewing, such as bones, addresses aspects of foraging behaviour and may correct the hazard for **Inability to chew**. This may necessitate a change in the feed delivery system. Currently, the paste-like feed is usually placed outside the cage and moved through the wire mesh by the foxes, which will not be possible with chunky feed. Research is required to formulate recommendations regarding the best feed texture that allows chewing without any negative effects.

- **Flooring substrate not suitable for digging and vole jumps**

Offering loose and clean substrate, such as sand or earth, allows the performance of digging behaviour. Substrates deeper than 15 cm will have a stronger mitigating effect because foxes will spend more time interacting with them (Koistinen & Mononen, 2008). It is unclear to what extent this hazard could be corrected in the current system. The limited cage dimensions prevent the inclusion of sand boxes inside most cages, and even in the largest cages of the current system, the available space is probably too small to include a sand box without potential side effects (e.g. high risk of being used as latrine). Access to the earth below the cage was used relatively little (Korhonen et al., 1999), probably because foxes cannot survey their surroundings when located below the cage level and possibly because of the closeness to the faeces accumulating underneath the cages.

Substantial mitigation

In general, to achieve **substantial mitigation**, the current system needs to be changed to enclosures that provide multiple and diverse resources to increase complexity, as well as additional space in the three dimensions to allow the use of complex enrichment. Further research is essential to provide quantitative information on fox enclosure size and environmental stimulation levels that allow for substantial mitigation of Inability to perform exploratory or foraging behaviour.

4.4.3 | Sensorial under-stimulation

Overall, Sensorial understimulation as well as the linked WC Inability to perform play behaviour relate to the barren housing conditions and very limited space (floor area and cage height) in the current system and therefore **cannot be prevented**. In the current system, both WCs can be **mitigated to a limited extent** through the enrichment measures outlined for addressing the WCs Restriction of movement (Section 4.4.1) and Inability to perform exploratory or foraging behaviour (Section 4.4.2).

4.4.4 | Sensorial overstimulation and linked WC

- **Lack of nest box or den-like structure and Lack of elevated place for surveillance and resting**

Sensorial overstimulation and Resting problems can be mitigated by offering places to retreat and raised locations with a good view of the surroundings for performing surveillance behaviour. Providing a nest box offers a refuge in case of perceived danger or group stress. Additionally, a nest box inside the enclosure offers an elevated place for vigilance behaviour, if the space between the nest box roof and enclosure ceiling is sufficiently high for the fox to sit without having to bend the head. The same applies to platforms.

In a study by Pedersen and Jeppesen (1993), Arctic foxes made frequent use of a nest box positioned on top of the cage, while red foxes preferred the intermediate platform used to access the box. Providing animals with both a resting site and an elevated observation point can help reduce agonistic interactions, particularly in adult animals.

- **High animal density within cage**

See mitigation Section for Group stress (Section 4.4.5).

Substantial mitigation

To achieve **substantial mitigation**, the current system needs to be changed to enclosures that provide additional space in three dimensions, to allow provision of resources for retreating and resting, for vigilance behaviour and to reduce animal density.

4.4.5 | Locomotory disorders (including lameness) (Arctic fox)

It is **unknown whether this WC can be prevented** in the current system because there is lack of epidemiological data. Locomotory disorders (including lameness) can be mitigated in the current system by addressing the following hazards:

- **Genetic predisposition as a side-effect of selection for production traits**

One way to mitigate and, in the long term (after several generations), also possibly prevent this WC is to adopt selection programmes that aim to eliminate animals with bent feet, front leg turn and osteochondrosis from the population. Moderate heritability for bent feet has been reported in the current system (Kempe et al., 2010), and Finnish Arctic fox breeders recommend and perform such selection in the current system, though based solely on macroscopic (i.e. phenotypic) evaluation (Peura et al., 2020), which is known to have low inter-observer reliability (Ahola et al., 2012). Therefore, although phenotypic selection is a useful starting point, the development and implementation of genetic selection programmes are essential for long-term and more effective reduction of this WC (Supporting information SF7).

As the risk for locomotory disorders such as bent feet correlate with and is exacerbated by rapid growth and large body volume/weight (Kempe et al., 2010), a balanced selection for those production traits will also decrease locomotory disorders.

- **Unbalanced diet**

Using a balanced diet, especially with adequate amounts of energy and carbohydrates (Enggaard Hansen et al., 1991), helps to mitigate locomotory disorders by reducing obesity. More research is needed for quantitative recommendations regarding adequate nutrient and trace element content of the feed. Large amounts of energy-rich feed are provided to obtain larger animals and thus more fur (Mustonen et al., 2017). This leads to obese animals and thus increases the risk of locomotory disorders.

- **Inadequate flooring material**

The call for evidence revealed the presence of bent feet and front leg turn in farmed Arctic foxes, which in the current system are kept on wire mesh flooring only. Wire mesh flooring needs to have optimal mesh size (see adult paw size in Section 4.3.4) to avoid or at least reduce the occurrence of claw injuries and to avoid impaired locomotion of cubs. However, only limited information on the appropriate size of mesh was found, and only related to adult foxes (Canadian National Farm Animal Care Council, 2013), highlighting that more research on the topic is needed. In addition, solid floor in at least part of the enclosure is required to reduce the amount of time foxes spend on wire mesh flooring, though research is needed regarding the type, size and placement of solid flooring in order to mitigate Locomotory disorders.

Substantial mitigation

Substantial mitigation of Locomotory disorders requires a multifaceted approach, including the consideration of factors such as (i) Genetic selection against traits like bent feet, front leg turn, osteochondrosis, including the associated traits fast growth and obesity, which are genotypically and phenotypically correlated with bent feet; (ii) Careful management of body condition including ensuring nutritionally balanced diets; and, (iii) Improving housing conditions by providing at least some area with solid flooring and sufficient floor area and enclosure height to allow comfortable movement. Further research is essential to provide quantitative information about measures and their potential effects on this WC for foxes.

4.4.6 | Group stress (red fox)

The WC Group stress **cannot be prevented** in the current system due to the hazards listed below.

- **Disturbance by neighbouring animals (individually-housed adults)**

Group stress from close proximity to neighbours particularly affects parturient and lactating vixens and low-status females (e.g. primiparous vixens). To mitigate the effects of group stress, including infanticide, vixens can be given better possibility to hide from neighbours (Bakken, 1993b) or the social status of neighbouring females can be manipulated to avoid close proximity between high- and low-ranking individuals (Braastad & Bakken, 1993). A hiding possibility might be provided by partial screening between adjacent enclosures to permit some visual isolation, or provision of nest boxes year-round. Breeding boxes with a tunnel entrance provide a greater sense of security and can reduce infanticide by their own mother (Braastad, 1996). These measures could be adopted in the current system.

Vixens categorised as infanticidal (or cub killers) are often observed repeating this behaviour in subsequent litters (Braastad & Bakken, 1993) and can therefore be omitted from further breeding if the behaviour arises in their first breeding season.

Due to lack of evidence, it is unknown whether **substantial mitigation** in the current system might be achieved by simultaneously providing hiding possibilities, avoiding close proximity between older and primiparous vixens, and increasing the space between individuals.

- **Group housing (group-housed juveniles)**

Group stress in group-housed juveniles may be mitigated by increasing space allowance to 1.2 m^2/animal or more. However, **substantial mitigation** of the WC Group stress in group-housed juvenile foxes requires a multifaceted approach to include all the listed aspects of the hazard of group housing, including enlargement of the available space in the enclosure. This is based on findings that, for example, housing quartets of foxes in larger cages (1.2 m^2/animal) reduced the occurrence of bite injuries and improved fur quality in female cubs compared to housing the same group size in smaller cages (0.6 m^2/animal) (Ahola, Harri, & Mononen, 2002). Ahola, Harri, and Mononen (2002) suggested that group housing is important for young red fox cubs from weaning to autumn and that adequate space should be provided for cubs housed in groups (Ahola, Harri, & Mononen, 2002). However, the ideal space for group-housed animals is unknown, and more bite scars at pelting were still seen in groups of four foxes housed in larger enclosures (50–112 m^2) than in single-housed animals (Ahola et al., 2001). This would suggest that providing adequate space to prevent group stress after the onset of dispersal motivation is unlikely to be possible with group-housed animals in the current system, but it might be possible for sibling pairs.

Ahola, Harri, and Mononen (2002) suggested that group housing is important for young red fox cubs from weaning to autumn, reducing SB, but recommended that cubs should be further split into pairs in late autumn after the onset of dispersal motivation.

Providing more and well-spaced important resources such as feed, enrichment items, platforms and nest boxes for group-housed animals, so that each individual has uncontested access, is also beneficial in reducing aggression and allowing animals to choose isolated resting locations (Ahola, Mononen, & Pyykkönen, 2002; Ahola et al., 2010; Akre et al., 2010).

Mixing of unfamiliar animals induces aggression and should be avoided. This aggression can be serious and prolonged in adult vixens (Hovland & Bakken, 2010) but is less severe and of shorter duration in sub-adult vixens (Hovland et al., 2008).

4.4.7 | Handling stress and linked WCs

Handling stress is linked with the WCs **Inability to avoid unwanted sexual behaviour** and **Resting problems**. Due to the necessity for handling and restraint during essential production procedures, the WC **cannot be prevented or substantially mitigated** in the current system.

Handling stress can be mitigated in the current system by addressing the following hazards:

- **Handling and restraint during production procedures in the farm setting**

Since all handling is stressful for foxes, the WC can only be mitigated by minimising as much as possible the number of handling occasions. In addition, during natural mating, observation of signs of heat in the females before transferring them to the mating cage might contribute to the correction of the hazard shared with the linked WC **Inability to avoid unwanted sexual behaviour**.

Farmed red foxes respond very well to positive rewards like dog biscuits or salmon pieces (Moe et al., 2006), and further research is needed to investigate whether training animals to associate handling with such rewards might mitigate the handling stress caused by production procedures.

When neck tongs are used, handling stress due to possible injuries can be mitigated by covering the gripping surfaces with rubber tubing. In addition, training of handlers can mitigate handling stress.

When foxes are kept in enclosures, trapping facilities and protocols need to allow for proper daily animal inspection. It should be possible to separate and catch the foxes with minimum stress when required.

- **Fearful temperament**

Results from several studies suggest that genetic selection may reduce fearful temperament after several generations.

- **Lack of habituation to humans**

Handling foxes during juvenile development may have beneficial effects by habituating them to human presence and potentially desensitising them to handling in later life. However, such routines of early handling are time-intensive for staff and have consequently not been adopted as a standard practice on commercial farms.

Although the presence of a shelter enables foxes to retreat and hide, making proximity to humans less stressful and reducing the WC Resting problems, their provision can also reduce habituation of the animals to humans and increase handling stress when capture and interventions take place. Further research on shelter design and management protocols which enable adaptation of growing foxes to human proximity and routine management needs therefore to be developed and implemented.

Substantial mitigation

Substantial mitigation might be achieved after several generations by also addressing the hazard of fearful temperament by combining measures to address the other hazards described with selective breeding against fearfulness.

5 | WELFARE ASSESSMENT OF RACCOON DOGS

5.1 | Most relevant WCs for raccoon dogs

5.1.1 | Scenarios used for the selection of the most relevant WCs

The scenarios selected to answer TOR2a and 2b for raccoon dogs are shown in Table 12 and are based on information on the production cycle of raccoon dogs kept for fur production, as described in EFSA (2025). The two Scenarios #4.1 and #4.2 cover the same age category of animals (juvenile animals that are weaned and up to the age of pelting or selection as future breeders) kept under two different housing arrangements: in pairs or in a group of at least 3 individuals. For the remaining scenarios, each age category is represented by a single distinct scenario.

TABLE 12 List of the identified scenarios used for the selection of the most relevant WCs in raccoon dogs.

Scenario No.	Name	Farm practices included
1	Male breeders kept in individual cages without nest box	• Slimming and flushing* • Mating and other handling
2	Female breeders kept in individual cages without nest box	
3	Dam and cubs kept in family cages with nest box	• Weaning (to also consider the dam) and related handling
4.1	Juveniles kept in pairs after weaning until pelting in cages without nest box	• Fur grading and other handling
4.2	Juveniles kept in group (> 3) after weaning until pelting in cages without nest box	• Fur grading and other handling

*Slimming is a period of diet restriction. Slimming is followed by ad libitum feeding (flushing). These practices can be applied in raccoon dogs, although prevalence is unknown (EFSA, 2025).

5.1.2 | Outcome of the selection of WCs in raccoon dogs

As an outcome of the selection process described in Section 2.4, five WCs were identified as most relevant (Table 13): (1) Restriction of movement, (2) Inability to perform exploratory or foraging behaviour, (3) Sensorial under- and/or overstimulation, (4) Isolation stress and (5) Locomotory disorders including lameness).

TABLE 13 Outcome of the selection of the five most relevant WCs including the linked WCs and involved scenarios (see Section 5.1.1).

Most relevant WC	Scenarios	WCs linked to the most relevant WCs listed in the first column
Restriction of movement	All (except non-mobile cubs in Scenario 3)	• Inability to perform play behaviour
Inability to perform exploratory or foraging behaviour	All	• Inability to chew • Gastro-enteric disorders
Sensorial understimulation[a]	All	None
Sensorial overstimulation[a]	All	• Resting problems • Handling stress
Isolation stress	1 and 2	None
Locomotory disorders including lameness	1, 2 (and dams + very young cubs in 3)	None

[a]This welfare consequence is originally called 'Sensorial under- and/or overstimulation' in the EFSA guidance (EFSA AHAW Panel, 2022) but is here subdivided to enhance clarity of the content.

5.2 | Animal-based measures (ABMs) related to the most relevant WCs in farmed raccoon dogs

The Table 14 summarises the ABMs used for the assessment of the most relevant WCs (including the linked WCs) in farmed raccoon dogs. ABMs were retrieved through a literature review and by consultation of stakeholders (Sections 2.1 and 2.2). The list should not be considered as an exhaustive list of ABMs.

Additionally, further details on abnormal behaviours are reported below (see Section 5.2.1), since the need to address them emerged following discussions with stakeholders (see Section 1.2).

TABLE 14 Summary of ABMs of farmed raccoon dog welfare referenced in Section 5. The list includes ABMs that have been recorded in studies testing the effects of housing modifications on the behaviour and welfare of farmed raccoon dogs, as well as ABMs that might not have been tested in this context but can indicate the presence of welfare consequences.

ABM	Definition	Interpretation of the measure	Welfare consequence(s)[a]
Affiliative social behaviours	Affiliative social behaviours (except play behaviour) such as: – Grooming – Nose-to-nose contact – Muzzle-nibbing – Parenting (Korhonen et al., 1991)	The WC is present when the animal cannot express affiliative social behaviour or the amount of affiliative social behaviour is reduced due to hazards such as isolation or abrupt weaning.	• Isolation stress • Separation stress
Allohuddling	Raccoon dogs (especially juveniles) resting in physical contact with conspecifics in summer and autumn. This behaviour is considered species-specific (WelFur, 2020)	The presence of the WC is deduced from a reduction of allohuddling.	• Resting problems • Isolation stress • Sensorial understimulation
Bent feet	Also called 'bowed legs' or 'leg weakness'. It is a flexural deformity due to carpal laxity (Kempe et al., 2010). The condition is measured by an observational scale. According to the protocol, the condition is scored as not present (0), slightly bent feet (1) or severely bent feet (2). To give a score of 2, the angle of the carpal joint has to be close to 90°. The feet are considered slightly bent (score 1), when carpal laxity is evident, but the angle is clearly above 90° (WelFur, 2020).	The presence of the WC is shown by the presence of the condition in one or both front legs.	• Locomotory disorders
Concentration of cortisol in plasma*	Intended as change of cortisol concentration, considered an indirect measure of stress. (Asikainen et al., 2004)	The presence of the WC is deduced from the increase of cortisol concentration following the presence of one/more hazards.	• All
Diarrhoea	Diarrhoea is defined as grey, green, red or yellowish mucoid stools, in or under the cage. Loose faeces are defined as brown or brownish stools that lack firm structure (WelFur, 2020)	The presence of the WC is deduced from the presence of loose faeces or diarrhoea in or under the cage.	• Gastroenteric disorders
Eliminative behaviour	Biological eliminative behaviour of the raccoon dog with functional and social role. The raccoon dog defecates and creates piles of faeces (Yamamoto, 1984)	The presence of the WC is deduced from a reduction in the possibility to choose where to defecate and to create and distance between piles and the animals.	• Restriction of movement • Sensorial overstimulation
Exploratory and foraging behaviours	Group of behaviours such as: – Use and manipulation of different types of enrichments (e.g. bone, straw, chain, rope, tube) – Opportunity to explore the surroundings (Koistinen et al., 2017; WelFur, 2020)	The presence of the WC is deduced from a reduction of expression of exploratory and foraging behaviours following the presence of one/more hazards	• Inability to perform exploratory or foraging behaviours
Foot/paw lesions	Conditions that affect the feet including hyperkeratosis, hair loss, crusting, wounds, infections and all the other conditions that can impair the health of the paws and foot (WelFur, 2020).	The presence of the WC is shown by the presence of the condition on one or more paws.	• Locomotory disorders
Front leg turn	Also called 'abduction/adduction of forelegs'. It is a structural deformity represented by an outward or inward rotation of the front legs starting from the carpal joint (breeders document on foot health). The condition could be associated with a severe grade of bent feet (WelFur, 2020).	The presence of the WC is shown by the presence of the condition in one or both front legs.	• Locomotory disorders
Fur chewing/fur damage	Damage of the fur as a consequence of fur chewing or pulling (Koistinen, 2016; WelFur, 2020)	The presence of the WC is shown by an increasing amount of animals performing fur-chewing behaviour or increased areas and severity of the fur damage, following the presence of one/more hazards.	• Restriction of movement • Inability to perform exploratory or foraging behaviour • Sensorial under- stimulation
Lying behaviour	The raccoon dog is lying when the limbs do not bear weight. Lying postures can vary as e.g. sternal, lateral or curled up. In literature, often termed 'inactive' (e.g. Koistinen et al., 2018, 2020). The animal might or might not sleep while lying.	Raccoon dogs are lying more if the space available for locomotion is restricted and if the level of sensorial input is low.	• Restriction of movement • Inability to perform exploratory and/or foraging behaviours • Sensorial understimulation

TABLE 14 (Continued)

ABM	Definition	Interpretation of the measure	Welfare consequence(s)[a]
Mobility difficulties	Difficulty or complete inability to move actively in the cage, even when solicited from the outside. Impairment in the locomotion of the animal. The following categories are used: 0 – No moving difficulties: The animal moves in the cage actively and uses all four feet evenly while moving; 1 – Difficulty in moving: The animal moves in the cage but the locomotion is somehow impaired and/or the animal does not use all four feet evenly while moving; and 2 – Unable to move: The animal is unable to move (WelFur , 2020)	The presence of the WC is shown by the presence of the condition to different extent.	• Locomotory disorders
Osteochondrosis	Condition that affects the process of endochondral ossification during the growth of bones (Olstad et al., 2015). May lead to lameness or walking difficulty.	The presence of the WC is deduced from clinical signs such as lameness or walking difficulty or after pathological examination of raccoon dog legs.	• Locomotory disorders
Play behaviours	Play can be seen as: – object play (manipulating or exploring objects), – locomotor play (running, leaping or chasing in a seemingly purposeless but joyous manner) or – social play (engaging in mock fighting or chasing conspecifics) (Rudert, 2008; Koistinen et al., 2017)	The presence of the WC is deduced from a reduction or impossibility to perform one or more of these behaviours following the presence of one/more hazards	• Inability to perform play behaviour • Restriction of movement • Inability to perform exploratory or foraging behaviour • Sensorial understimulation • Isolation stress
Stereotypic behaviours (SB)	Repetitive behaviours as described in Section 5.2.1, such as: – Locomotory stereotypy (e.g. pacing or jumping) – Head twirling – Oral stereotypies (persistent biting/licking) – Persistent scratching or scrabbling (Ahola et al., 2007; Koistinen et al., 2018, 2020; WelFur, 2020)	The presence of the WC is deduced from an increase in SB in terms of proportion of animals showing the behaviours, the duration, number of repetitions and/or difficulty to interrupt, following the presence of one/more hazards at some point in the life of the animals	• Restriction of movement • Inability to perform exploratory or foraging behaviour • Sensorial understimulation

[a]It includes also linked WCs.

*In recent years, the construct validity of the use of cortisol (faecal, saliva or plasma) as ABM for aspects of animal welfare across animal species are being discussed (e.g. as reviewed by Tiemann et al., 2023; Cobb et al., 2025). Among the challenges are large individual differences, sex differences, circadian variation, hormonal status, level of activity etc. Results should therefore be interpreted carefully, and in combination with other ABMs (e.g. behavioural, clinical).

5.2.1 | Abnormal behaviour of farmed raccoon dogs

Abnormal behaviours (e.g. fur chewing and stereotypic behaviour (SB) such as pacing) are acknowledged to be a welfare concern for raccoon dogs kept for fur production (Brzozowski et al., 2010; Koistinen et al., 2018). However, in this species, abnormal behaviours have not been as well studied as in other species farmed for fur (as also reported by stakeholders, see Section 2.2). Therefore, the motivational basis of these behaviours is not yet fully understood in raccoon dogs, although they are presumed to be comparable to those of other species kept for fur and in cages such as mink and foxes (Clubb & Vickery, 2006). The literature reviewed on fur chewing and SB in raccoon dogs is summarised below.

In literature involving raccoon dogs, fur chewing has mainly been identified from damage to the fur of the animals rather than through direct behavioural observations of chewing the fur (Koistinen & Mononen, 2023). The aetiology of fur chewing behaviour is not well known in raccoon dogs. Comparable behaviours have been studied in other species, such as mink kept for fur production, in which risk factors include for example early weaning (Mason, 1994). This type of abnormal behaviour may have a genetic component as also shown in other species e.g. mink (Malmkvist & Hansen, 2001) and cats (Borns-Weil et al., 2015). Only cover hairs are typically affected and the underfur and skin remain intact. The first signs of fur chewing can be observed anywhere on the body where the animal can reach itself. According to a review by Koistinen and Mononen (2023), signs of fur chewing are seen most in late autumn and in winter, which may be partly because it is hard to observe during moult in spring and from the tenuous pelage in summer. The reported occurrence of signs of fur chewing in published studies varies from 0% in Koistinen et al. (2020) (observing 152 animals over months kept in different group size, different cage size and different level of resources) to almost a quarter of raccoon dog litters and 15% of juveniles showing signs of this ABM at pelting time (Brzozowski et al., 2010) observing 986 animals in one Polish breeding farm).

WelFur (2020) reports the existence of skin lesions which can be self-inflicted and caused by, for example, excessive grooming or self-biting. However, no indication of the prevalence of these types of abnormal behaviours was found, and in the protocol these types of lesions are recorded within the welfare criteria of 'absence of injuries' and the measure 'skin lesions and other injuries to the body', with no specification of the origin of the lesions.

Koistinen et al. (2020) observed SB in raccoon dogs kept in pairs or groups of four. The ethogram included locomotor stereotypy (pacing), head twirling and other head movements, persistent biting/licking and persistent scratching or 'scrabbling'. In the reporting, all these were combined into one overall SB category. In his descriptive study, conducted over several years and including animals kept in different group sizes (including single housing) and different cage sizes, Korhonen (1988b) mentions that SB was 'observed sometimes' in the form of animals moving to and from along the side of the cage in bouts lasting 15–25 min.

In a conference presentation, Koistinen et al. (2013) reported preliminary results from an on-farm welfare assessment performed in 12 commercial raccoon dog farms (farm populations varied from 324 to 4735 animals) in Finland in October and November 2012. Without presenting definitions of 'stereotypy', the authors report that, based on observations of 26–145 adult individuals and 84–286 juveniles per farm, an average of 12% of adults and 3% of juveniles were observed to perform stereotypies. SB was observed using a method designed for foxes. Shortly, the assessor walked slowly into the shed, stood in the middle of the aisle and let the animals habituate to her presence for 3 mins before observing the general activity (active/resting) and the occurrence of SB (yes/no) in the animals. The prevalence of SB was calculated as the percentage of stereotyping animals out of all active animals.

Koistinen and Mononen (2023) reviewed SB in raccoon dogs as the presence of locomotor stereotypies, like pacing and circling the cage. These behavioural patterns may include repeated head-twirling-like movement against the wall or ceiling of the cage. Other stereotypies like scrabbling (digging-like movements) and oral stereotypies (described as extensive licking or biting of an object, other than food or toy) were reported by other authors (Koistinen & Korhonen, 2018; Koistinen et al., 2018).

Based on analyses of the behaviour of sister pairs of raccoon dogs during 2 × 24 h in January and February (when raccoon dogs were inactive for approximately 70% of the time), Koistinen et al. (2018) found that SBs (the sum of locomotor, head twirling, oral and scratching), occupied up to 7% of the active time of the animals. Out of all observations of SB, 92% were locomotor stereotypies, 5% oral stereotypies, and scratching and head twirling accounted for 1.5% each.

Ahola et al. (2007) observed the behaviour of 96 raccoon dog juveniles kept in either pairs or groups of six siblings at a space allowance of 0.6 m^2/animal. The behaviour of the animals was observed in mid-August and late October by scanning every 4 min for locomotor SB (defined as repeated pacing or jumping along the cage wall without any obvious goal or function) and scoring of the presence/absence of the behaviour. Similar to the results reported by Koistinen et al. (2018), the animals were inactive for approximately 70% of the time. In August, when comparing the percentage of the time budget spent stereotyping, the juveniles housed in pairs showed more SB than the groups of 6 (3.2 ± 2.3 vs. 0.1 ± 0.1% of observations, respectively). The percentage of observations with SB decreased from August to October in the animals kept in pairs but not in the raccoon dogs kept in groups of 6 where the prevalence was already very low. In August, SB peaked especially after sunrise and after sunset as well as before and after feeding.

In another study, involving 16 pairs of juvenile female raccoon dogs (observed during 6 × 24 h from early September to December, and being inactive for approximately 70% of the time throughout this period), the level of SB (calculated as a percentage of total time budget) tended to decrease from September (1%–2%) to December (< 1%). SB was not observed at all in five pairs but was observed in the other five pairs (in all six recordings). The animals in one particular pair were highly stereotypic, performing SB a mean of 23% of their active behaviours. In other pairs, the percentage of SB varied from 0 to 12% of all activities. Three out of the 672 observations of SB were head twirling, and all other observations were locomotor stereotypies (pacing). Oral or other types of SB were not observed.

Thus, the most prevalent type of SB appears to be pacing. There seems to be large individual variability in the prevalence of SB even among animals in the same environment. Overall, the occurrence of SB may be affected by the social environment and vary over the year as well as over the course of the day, with more SB at crepuscular times (around dawn and dusk) but also a peak around feeding/watering (Ahola et al., 2007).

5.3 | Description of WCs selected as the most relevant for raccoon dogs and associated hazards

This section describes the highly relevant WCs identified for raccoon dogs according to the methods described in Section 2.4. Although not specifically requested in the mandate, for these WCs, ABMs that have been recorded in studies testing the effects of housing modifications on the behaviour and welfare of farmed raccoon dogs, as well as ABMs that might not have been tested in this context but can indicate the presence of WCs have been identified and interpreted in Section 4.2. In addition, this section describes the associated hazards.

5.3.1 | Restriction of movement

5.3.1.1 | *Description of restriction of movement and linked WC*

Definition from EFSA AHAW Panel (2022): *'This WC is characterised by the animal experiencing stress and/or negative affective states such as pain, fear, discomfort and/or frustration due to the fact that it is unable to move freely or is unable to walk comfortably (e.g. due to overcrowding, unsuitable floors, gates, barriers)'.*

Interpretation for raccoon dogs

Restriction of movement relates not only to the quantity of movement (cumulative time spent in active behaviours) but also to the quality (type) of movement, particularly in relation to species-specific behaviours and motivations of an animal. There is some evidence that SB in Canidae is related to their natural ranging behaviour, though this relation may also be influenced by foraging patterns and resources available in their environment (see Section 5.3.2). The type and quantity of movements which raccoon dogs can perform are not only related to the space availability but also to the presence of environmental complexity that will allow the animals to express these species-specific behaviours in relation to their needs or motivations (Clubb & Mason, 2007).

In farmed raccoon dogs, this WC is related to the confined living conditions and lack of ability to move freely. Thus, for the purpose of this scientific opinion, this WC applies to all scenarios (i.e. all animal categories) and the whole period the animals are kept on farm.

As mentioned, lack of environmental complexity may, due to lack of input from stimuli, indirectly lead to increased levels of inactivity. Therefore, the level of environmental complexity is considered relevant for this WC. In addition, it is important to consider seasonal variability when interpreting activity/inactivity levels in raccoon dogs, considering that this species can express winter dormancy. As reviewed in EFSA (2025), wild adult raccoon dogs show significant annual variability in activity level – with a mean overall level of activity of 58% ± 10%, ranging from a mean value of 70% ± 19% during cub rearing to 47% ± 32% in winter (Zoller & Drygala, 2013).

As reviewed by EFSA (2025), wild raccoon dogs may use dens (up to 5 different ones). Reported home ranges for male and female raccoon dogs vary from 0.15 to 9.5 km^2 (or more) depending on factors such as reproduction phase, availability of food and anthropogenic activity. These data suggest that cages in the current system severely restrict natural locomotory behaviour. However, except for a few studies comparing effects of cage size on behaviour (see Section 5.3.1.2), the consequences of this restriction in terms of thwarted motivational states are not precisely evaluated.

In addition, Restriction of movement is also related to the somewhat ritualised eliminative behaviour (defecation and urination) performed by raccoon dogs. The animals tend to eliminate in specific areas (latrines) where the droppings will pile up (Korhonen et al., 1991) (see Section 5.3.1.2). Thus, in order to be able to perform this behaviour as well as to distance themselves from the piles, raccoon dogs need space.

Linked WC: Inability to perform play behaviour

Restriction of movement share hazards with other WCs, such as Inability to perform play behaviour. Play is widespread among vertebrates (and has even been described in some invertebrates), particularly in young animals (Held & Špinka, 2011). Play can be categorised as object play (manipulating or exploring objects), locomotor play (running, leaping or chasing in a seemingly purposeless but joyous manner) or social play (engaging in mock fighting or chasing conspecifics), with all types of play requiring space and/or resources.

Only few studies have focused on play behaviour in raccoon dogs. Juveniles were described to perform various forms of play behaviour and to perform more social play than adult animals (Korhonen, 1988b). In her unpublished thesis involving observations of 12 adult animals in four zoos in Germany, Rudert (2008) mentions that play behaviour was only observed rarely, but listed social play (involving running and hopping) and object play with small sticks. In addition, Rudert (2008) cites another German thesis (Wüstenhagen, 2003) for observations of social play in juveniles, such as chasing and mock fighting. In addition, Koistinen and Korhonen (2016) and Koistinen et al. (2017) mention behaviours that could be categorised as object play, such as manipulation of chewing bones with the paws and mouth.

5.3.1.2 | *Hazards leading to restriction of movement and linked WC*

- **Insufficient floor area, floor material potentially limiting proper walking and other movement, insufficient cage height as well as lack of cage complexity**

As reviewed by EFSA (2025), most of the raccoon dog's behavioural repertoire requires more space than available in the current cage system for fur production. One main hazard for Restriction of movement and the linked WC of Inability to perform play behaviour is the dimensions of the cage, including an **inadequate floor area** to allow motivated types of active behaviour and locomotion, as well as **inadequate cage height and structure** to facilitate three-dimensional movement. In the current system, the floor is made of wire mesh with variable mesh size (as reviewed in EFSA, 2025). Adult raccoon dog feet are approximately 4–5 × 5–6 cm, and the toes approximately 13–15 × 7–9 mm (Bang & Dahlström, 2000). A wire mesh floor is considered a hazard for proper walking, but no studies examining this have been found. This constitutes a gap in knowledge. Inadequate floor material may impair movements through inadequate grip and discomfort while moving. For young cubs, an inadequate mesh size is considered a hazard for movement and a potential hazard for locomotory disorders as the grid can be too large to support their feet (Figure 11). Also, for larger raccoon dogs, inappropriate floor material may be associated with locomotory disorders. This is further discussed in Section 5.3.5.

FIGURE 11 Raccoon dog cubs on mesh floor and unable to move (© Oikeutta eläimille, Supporting information SF11).

Based on the housing and biology information provided by EFSA (2025), the home ranges of raccoon dogs in the wild may cover several square kilometres, and the mean daily distance travelled has been reported to be 3–4 km. In the current system, the standard cage size for individually kept animals (see EFSA, 2025) is equivalent in width to an adult raccoon dog's body length without tail (body length on average 50–80 cm + 15–25 cm tail). Therefore, cages of 0.75 or 0.8 m^2 enable lying down, rising up, turning around and taking some steps but not walking for more than 1 m.

A lack of information was found on space requirements for raccoon dogs and related animal welfare implications. Only a few studies have examined the consequences of floor area, and the available ones often have included experimental treatments involving one floor area (for example 1.2 m^2) compared with double floor area (2.4 m^2), and involved other factors at the same time, such as availability of resources and group size (Koistinen et al., 2020), making it difficult to conclude separately on the welfare relevance of floor area alone. For example, Koistinen et al. (2020) compared the behaviour of raccoon dogs kept in pairs in cages of 1.2 m^2 (provided with a platform, a wooden block and access to straw) vs. animals kept at 2.4 m^2, in a pair (confounding floor area with stocking density and group size) or in groups of four (confounding floor area with group size). In the study, all animals with a floor area of 2.4 m^2 were provided with two platforms, two wooden blocks and access to straw. In addition, in the 2.4 m^2 treatment holding four animals, the raccoon dogs had access to a plastic tube and a nest box.

Korhonen et al. (1991) observed the behaviour of raccoon dogs (either post-weaning sibling groups or adult mixed-sex pairs with/without offspring) in outdoor enclosures measuring either 5 × 6 m (30 m^2) or 8 × 17 m (136 m^2) with multiple nest boxes and feed trays. The study included one repetition of each of the conditions, performed in two different geographical locations. Based on 24h observation periods during the summer, the authors found that adult raccoon dogs were inactive approximately 700 min/24 h (51% of total time observed), and juveniles almost 500 min (65%). No data from the winter period were presented.

Koistinen et al. (2018) compared the behaviour of female raccoon dogs of less than 1 year of age (studied from mid-December to mid-February). The animals were kept in cages of either 0.8 m^2 (alone), 1.2 m^2 (either alone or in pairs) or 1.2 m^2 (alone) with a nest box. All animals had access to straw on top of their cage, to a platform and a bone. The study included 8 replicates per treatment. The results show that an increase in cage size for individual animals from 0.8 to 1.2 m^2 (corresponding to a 50% increase in floor area) is insufficient to address WCs, as it fails to reduce for example level of inactivity (69%–75% of the observations, no difference between treatments) or SB (shown for less than 2% of the 24 h observations, corresponding to 1%–7% of the active time) (Koistinen et al., 2018).

In the study by Koistinen et al. (2020) described above, the authors focused on only a few pairwise comparisons between treatments, of which one was the effect of available floor area, comparing the two treatments of pairs of raccoon dogs kept in cages of 1.2 m^2 (provided with a platform, a wooden block and access to straw) vs. pairs kept at 2.4 m^2 with the same access to resources. Five main behavioural categories were measured (resting, sitting, standing, activity and SB) and no differences were found between the treatments. When active behaviours were split into different types, the category called locomotion (a combination of walking, running and jumping on the cage floor) was more frequent during daytime (from 6 to 22 h) in the animals kept in cages of 2.4 m^2 as compared to 1.2 m^2. The occurrence of these behaviours differed between the months observed as well (Sep, Oct, Dec), but the direction of the effect of floor area was consistent throughout the study (occurrence of locomotion in 1.2 m^2 cages during the 3 months: 5.4%, 3.8% and 2.4%, in 2.4 m^2 6.4%, 6.2% and 3.7% for the same months, respectively).

There is also some information available from experiments involving combinations of cages and access to enclosures larger than the standard cages. In a case study performed over months, but involving only one pair of adult raccoon dogs and their offspring, Korhonen and Alasuutari (1993) observed the behaviour of the animals when kept in a system consisting of an 8 m^2 enclosure (2 × 4 m, 1.5 m height) combined with three cages of 60 × 105 cm joined into one (1.89 m^2). The cages were kept in a traditional shed for raccoon dogs. The two parts were connected by a 1 m wooden tube of 30 cm in diameter. The enclosure contained two wooden nest boxes, and another similar nest box was placed in the cage. No information on resources, vegetation etc. in the enclosure is provided. The animals were 4 years old when introduced in the system and had previous experience with enclosures as well as cages. The animals were introduced in February and their behaviour was observed for 4–6 days per week. The results are presented in a descriptive way, reporting that the raccoon dogs showed a stable diurnal pattern of use of the two parts: they spent the day resting in the cage and late in the evening they entered the enclosure and were active in there for several hours. The authors conclude that this pair of raccoon dogs used both parts of the system and that the enclosure was mainly used for locomotion, suggesting the identification of functional areas.

Regarding cage height, the relevance for raccoon dog welfare has not been studied, but absence of elevated places deprives the animals from possibilities for three-dimensional movements. Koistinen et al. (2018) did include for example standing on hind legs to take straw from the cage top in their ethogram (the authors then pooled this behavioural element with others into overall activity for analyses). The occurrence of the behaviour might reflect farmed raccoon dogs needing to adopt postures not typically seen during feeding in the wild (as reviewed by EFSA (2025) due to the straw delivery method. See Sections 5.3.2 and 5.3.3 respectively, for a discussion on the cage height to allow other behaviours than movement, e.g. exploration and resting.

- **Lack of possibility for animals to distance from faeces and lack of opportunity to establish latrines**

As discussed by Yamamoto (1984), some carnivore species deposit their faeces at definite sites, and such defecation sites have been suggested to be of social significance. By studying the behaviour of farmed raccoon dogs (10 animals of different ages kept in pens of different sizes), Yamamoto (1984) found that raccoon dogs in the same pen mainly used one communal latrine. In the study by Yamamoto (1984), removal of the latrine disturbed the eliminative behaviour of the animals for days. The study concluded that for raccoon dogs the choice of a defecation site depends more on the presence of a dung pile than on where the pile is located. The author suggests that latrines serve as a place of information exchange about conspecifics and that olfactory memorisation of the faeces adjusts the social behaviour of raccoon dogs when they encounter each other. Thus, in order to be able to perform this behaviour and to maintain the piles by distancing themselves from the piles, raccoon dogs need space. The consequences of lack of this opportunity have only received very little scientific attention and remain a gap in knowledge. Kauhala and Salonen (2012) investigated latrine surveys as a non-invasive method to reveal habitat preferences of raccoon dogs in the wild, as compared to telemetry studies. The authors found latrines to be located both in the core areas of the home ranges of the animals and on home range borders.

As mentioned above, as part of a behavioural study, Korhonen et al. (1991) observed farmed raccoon dogs (either post-weaning sibling groups or adult mixed-sex pairs with/without offspring) in outdoor enclosures measuring either 5 × 6 m (30 m^2) or 8 × 17 m (136 m^2) with multiple nest boxes and feed trays, on ground floor. The results were based on a few animals and replicates. To better understand latrine use, the authors mapped the position and size of latrines.

Taken together, despite very limited evidence, lack of possibility to maintain space between an animal and the faeces and lack of opportunity to establish latrines are considered hazards for Restriction of movement in raccoon dogs, as the use of latrines is supposed to have social significance, and because the animals need space to maintain a pile and to distance themselves from it.

Inadequate floor area and insufficient cage height in relation to inability to perform play behaviour

Regarding the linked WC Inability to perform play behaviour, the only description of play found in the available literature on raccoon dogs when kept in cages is from Korhonen (1988b), where juveniles were described to perform various forms of play behaviour and to perform more social play than adult animals. However, behaviours that could be categorised as object play were noted by Koistinen and Korhonen (2016) and Koistinen et al. (2017), i.e. manipulation of chewing bones with the paws and mouth. In addition, in her master thesis, Raatikainen (2018) described that straw was used as a substrate for play behaviour. It is, thus, not evidenced whether farmed raccoon dogs would perform greater or lesser play behaviour if cage environments were enlarged, enriched and/or diversified above standard levels, but due to the limited possibility for especially locomotory play behaviour, the inadequate floor area and insufficient cage height are considered hazards for this WC.

5.3.2 | Inability to perform exploratory or foraging behaviour

5.3.2.1 | *Description of inability to perform exploratory or foraging behaviour and linked WC*

Definition from EFSA AHAW Panel (2022):*'This WC is characterised by stress and/or negative affective states such as frustration and/or boredom resulting from the thwarting of the motivation to investigate the environment or to seek for food (i.e. extrinsically and intrinsically motivated exploration)'.*

Interpretation for raccoon dogs. As reviewed by EFSA (2025), raccoon dogs are opportunistic generalists with a truly omnivorous diet that includes small mammals, birds, fish, amphibians, vegetation and also scavenged food. Across animal species, exploration is closely linked to the search for food and other resources, such as mating possibilities or shelter. In practice, foraging and exploratory behaviours can often not be distinguished.

In general, the current cages do not allow natural exploration and foraging behaviours due to the lack of complexity of the environment, lack of stimuli favouring the motivation to explore or forage and lack of adequate space to perform some of the behaviours.

In farmed raccoon dogs, this WC is related to Sensorial understimulation due to the inability to perform highly motivated behaviours such as hunting. For the purpose of the SO, this WC applies to all scenarios (i.e. all age groups) and the whole period the animals are kept on farm.

Linked WCs: Inability to chew and gastroenteric disorders

The consummatory component of foraging behaviour in raccoon dogs is linked to two other WCs: Inability to chew and gastroenteric disorders.

Inability to chew is defined as the animal experiencing negative affective states such as frustration resulting from thwarting of the motivation to chew and to perform the complete consummatory behaviour (EFSA AHAW Panel, 2022). For predators like raccoon dogs, eating usually includes chewing the whole or parts of the prey (EFSA, 2025). Farmed individuals do not have the possibility to chew on prey items (e.g. muscle, bone), as they are typically fed a paste-like feed, which they lick and nibble through wire mesh, as the feed is usually located on a feed tray placed outside of the cage (Figure 12) as reported in EFSA (2025).

FIGURE 12 Farmed raccoon dogs (here in outdoor cages) drinking water from their trough. On the cage front, the external feed tray (see yellow circle), where the paste-like feed is provided, can be seen (modified from ©KsiegarniaRolnicza.pl).

The WC Gastroenteric disorders is characterised by animals experiencing negative affective states such as discomfort, pain and/or distress due to impaired function or lesion of the gastro-intestinal tract resulting from, for instance, nutritional deficiency, infectious, parasitic or toxigenic agents (EFSA AHAW Panel, 2022).

The gastroenteric health status of raccoon dogs kept for fur is not well described. In a conference presentation, Koistinen et al. (2013) reported preliminary results from an on-farm welfare assessment performed in 12 commercial raccoon dog farms (farm populations varied from 324 to 4735 animals) in Finland in October and November 2012. Without presenting definitions of 'diarrhoea', the authors report that an average of 27% of 724 examined animals (variation between farms:

3%–43%) were categorised as having diarrhoea. The authors describe that '*in order to prevent overestimating the results, only 50% of pair- and group housed animals were considered having diarrhoea in cages where signs of diarrhoea were found*'. The study by Koistinen et al. (2012) was part of the development of the WelFur protocol, but it is not clear whether the indicator was scored as in WelFur (2020). In the protocol, diarrhoea is scored as 0 (no evidence of loose faeces or diarrhoea), 1 (loose faeces in or under the cage) or 2 (diarrhoea in or under the cage). The definition of diarrhoea used in WelFur (2020) is shown in Table 14.

For farmed raccoon dogs, the lack of opportunities to chew or perform other consummatory behavioural elements associated with foraging, and thereby take up a variety of food sources, can challenge their gastrointestinal health. As reviewed by EFSA (2025), differences exist between farmed and wild-caught raccoon dogs in terms of metric traits of the gastrointestinal tract. For example, Kowalska et al. (2014) reported that, in a population of wild raccoon dogs (10 animals), compared to 16 farmed animals, a significantly higher duodenal length to trunk length ratio was observed. This may be linked to the different type of feed ingested by each group.

5.3.2.2 | *Hazards leading to inability to perform exploratory or foraging behaviour and linked WCs*

- **Limited cage size and lack of physical complexity (including lack of resources) providing stimuli for exploratory, appetitive and consummatory foraging behaviour**

For this WC, the floor area is a hazard as the type and quantity of behaviours that are possible in a given environment relate to the space availability. Also, the environmental complexity is important to allow animals to express their species-specific behaviours in relation to their needs and motivations (Clubb & Mason, 2007). Therefore, another main hazard for Inability to perform exploratory or foraging behaviour and the linked WC of Inability to chew in the current system, used to keep raccoon dogs for fur production, is the lack of physical complexity in the cages. Especially focusing on the opportunity to perform foraging behaviour such as digging, lack of enrichment providing stimuli for appetitive and consummatory foraging behaviour is also considered a hazard.

Resources such as bones, wooden blocks or straw may be provided to farmed raccoon dogs (EFSA, 2025). According to Koistinen and Mononen (2023), the more complex the housing facility and the more resources that are provided to enable a wider behavioural repertoire, the better it is for the welfare of raccoon dogs. However, it is unclear how frequently such resources are provided to raccoon dogs. Moreover, these items are often not replaced throughout the animals' lifetime. As acknowledged in WelFur (2020), there is limited information available on the consequences of the lack of resources in cages of farmed raccoon dogs. As part of an unpublished thesis, Raatikainen (2018) described the behaviour of juvenile raccoon dogs provided with a wooden block and straw. The animals were kept in groups of 2 or 4 in cages of 1.2 or 2.4 m^2. Without mentioning possible treatment differences, the author reports that the wooden block was used mainly for oral manipulation and pawing, but also for elimination. The behaviours involving straw consisted of manipulation, eating and play. Even though the resources were used for only a limited proportion of the day, the raccoon dogs used them for different behaviours.

One study examined access to chewing bones for 16 sibling pairs of juvenile, pair-housed raccoon dogs from July to December and found that the objects were used approximately 2%–3% of the time (based on 24 h video recordings on four occasions from September to December and behaviour sampling and continuous recording of the first 15 min of each hour, corresponding to a total period of data collection of 6h per observation day). In addition, the use of the bones increased to approximately 8% of the time after periods (14 days) of deprivation, thus potentially reflecting a build-up of motivation (Koistinen et al., 2017).

Some studies have combined the provision of structures and/or resources (e.g. use of platforms and interaction with bones) with different group sizes and/or larger cages (e.g. Koistinen et al., 2018). These confounding factors do not allow to clearly distinguish the effect of resources from the other tested factors. In one of the few available studies, that allow comparison of the level of resources without confounding factors from group or cage size, Koistinen et al. (2020) found no difference, when the animals were killed in mid-December, in selected haematological (haemoglobin, haematocrit, red blood cell count, differential white blood cell count) and morphological measures (e.g. organ weight) between groups of raccoon dogs kept in cages with two platforms, two wooden blocks and straw vs. two platforms, two wooden blocks, straw, a nest box and a plastic tube. The animals were born in cages of 2 m^2 (equipped with a wooden, two-room nest box, platform, activity object and bale of straw on the top of the cage) and transferred to the experimental cages at weaning at 9 weeks of age.

- **Insufficient feed texture and delivery method for consummatory behaviour**

One part of foraging behaviour in predatory species like raccoon dogs is the chewing of food. However, the type of feed used on farm, with a paste-like texture, prevents mastication. When feed is provided through the cage wire mesh (Figure 12), the delivery method further prevents aspects of consummatory behaviour. Thus, lack of feed texture and delivery method adequate to allow for consummatory behaviour is also a hazard for the WC Inability to chew, which is linked to Inability to perform exploratory or foraging behaviour. In farmed raccoon dogs, consequences of the low level of texture of the feed have not been discussed in the literature reviewed.

- **Feed being inappropriate and not fulfilling dietary requirements**

Raccoon dogs have different nutritional requirements throughout the year. As reviewed by EFSA (2025), some autumnal fat accumulation is natural for this species, e.g. it has been observed that raccoon dogs consume more feed and deposit more fat prior to the potential winter dormancy period (Korhonen, 1988a). According to Koistinen et al. (2016), weight regulation peptides regulated by photoperiod, with melatonin as a signal, are involved in the fluctuation of the activity level and appetite of the animals, as well as retention and mobilisation of fat reserves. This may lead to obese animals (the risk of which is discussed in Section 5.3.5 under Locomotory disorders).

According to the WelFur protocol for Finnraccoon, it is current practice to feed them food designed to meet primarily foxes and/or mink's nutritional requirements (Koistinen & Mononen, 2023). However, as reviewed by EFSA (2025), the natural feeding habits, dentition, digestive physiology and morphology, and better ability to digest carbohydrates, indicate that raccoon dogs are more omnivorous than foxes and mink (Koistinen & Mononen, 2023). As a result, feeding raccoon dogs a diet designed for more carnivorous species may lead to an insufficient fibre intake (Koistinen & Mononen, 2023). The raccoon dogs are omnivorous, and bulky plant material is part of their natural diet (as reviewed by EFSA, 2025), to which they are dentally and intestinally adapted. In a study of metric features of the gastrointestinal tract of 27 male and 29 female raccoon dogs (source of animals not described), Brudnicki et al. (2001) concluded that the ratio between intestinal length and content capacity relates to some adaptation to the intake of considerable amounts of plant feed. Recently, Pagh et al. (2025) examined the stomach content of 473 adult raccoon dogs from wetland areas in Denmark and found grass in 49% of the stomachs, and other plants than grass in 36% of the examined stomachs.

In addition to the low fibre intake, if the animals are fed a diet designed for more carnivorous species, this may cause digestive disorders, and may, thus, indirectly constitute a hazard for the WC Gastroenteric disorders, that is linked to Inability to perform exploratory or foraging behaviour. However, no information was found on the type of gastroenteric disorders that can be caused by this.

5.3.3 | Sensorial under- and overstimulation and linked WCs

As explained in Table 14, this WC is originally called 'Sensorial under- and/or overstimulation' in the EFSA guidance (EFSA AHAW Panel, 2022) but is here subdivided into two separate sections (sensorial understimulation and sensorial overstimulation) to enhance clarity of the content.

5.3.3.1 | *Description of sensorial understimulation*

Definition from EFSA AHAW Panel (2022): *'This WC is characterised by the animal experiencing stress and/or negative affective states such as fear or discomfort due to visual, auditory or olfactory understimulation from the physical environment'.*

Interpretation for raccoon dogs. In farmed raccoon dogs, similar to the WC Inability to perform exploration and foraging (Section 5.3.2), this WC is related to cage barrenness in the current housing system and it applies to all scenarios of the SO.

5.3.3.2 | *Hazards related to sensorial understimulation*

- **Lack of physical complexity (including space) in cages**

In standard farm cages, sensory variability is limited, since available space and resources provided are small and few (EFSA, 2025). In other carnivores kept in cages, understimulation has been shown to constitute a risk for the development of abnormal behaviour, such as SB (Díez-León et al., 2016) and fur-chewing behaviour (Malmkvist et al., 2013). This is likely also the case for raccoon dogs but has only been studied to a limited extent.

See Section 5.3.2.1 regarding the lack of physical complexity (including space) in cages.

Negative affective states such as boredom (defined by EFSA as an unpleasant emotional state including suboptimal arousal levels and a thwarted motivation to experience almost anything different or more arousing than the behaviours and sensations currently possible (EFSA AHAW Panel, 2022) have not been discussed in the literature reviewed on raccoon dog welfare.

5.3.3.3 | *Description of sensorial overstimulation and linked WCs*

Definition from EFSA AHAW Panel (2022): *'This WC is characterised by the animal experiencing stress and/or negative affective states such as fear or discomfort due to visual, auditory or olfactory overstimulation from the physical environment'.*

Interpretation for raccoon dogs. In farmed raccoon dogs, this WC is related to the lack of opportunity to hide as no nest box is provided. The hazard applies to Scenarios 1, 2 and 4 of this SO. In addition, the WC is related to potential overstimulation from the presence of faeces from own and neighbouring cages. As mentioned above, raccoon dog biology is characterised by their elimination behaviour being somewhat ritualised. Communal defecation, including anal sniffing, is observed (Korhonen et al., 1991) and scent marking by latrines is considered important for raccoon dog olfactory communication (Korhonen et al., 1997).

Linked WCs: Resting problems and Handling stress

Due to the stimulation from neighbouring raccoon dogs and cage mates, lack of a nest box might lead to sensorial overstimulation when animals are motivated to rest, thus linking the WC Sensorial overstimulation to Resting problems. According to the guidance from EFSA AHAW Panel (2022), this WC is characterised by the animal experiencing stress and/or negative affective states such as discomfort, and/or frustration due to the inability to lie, rest comfortably or sleep.

In addition, for the purpose of this SO, the WC Handling stress has been linked to Sensorial overstimulation. Handling of farmed raccoon dogs involves elements of sensorial overstimulation and may entail the WC Handling stress as well. According to EFSA AHAW Panel (2022), this WC is characterised by the animal experiencing stress and/or negative affective states such as pain and/or fear resulting from human or mechanical handling.

5.3.3.4 | *Hazards leading to sensorial overstimulation and linked WCs*

- **Lack of nest box**

Like farmed foxes, farmed raccoon dogs are not usually provided with nest boxes outside the cub-rearing period (EFSA, 2025).

However, WelFur (2020) places value on the presence of a shelter with at least 3 solid walls at any time in the production cycle, since these are expected to provide more comfort around resting and will reduce exposure of the raccoon dogs to sensory inputs. The authors specify that shelters have additional value when increased cover is provided (WelFur, 2020). Different from mink and foxes, raccoon dogs are also a species that may go into winter dormancy (EFSA, 2025). The presence of a nest box during wintertime has been considered linked to the possibility for the raccoon dogs to choose to perform winter dormancy (Asikainen et al., 2002).

Based on observation of juvenile raccoon dogs kept in groups of two or four in cages of 1.2 or 2.4 m^2 and provided with different resources and structures, but without mentioning additional differences between treatments, as part of an unpublished thesis, Raatikainen (2018) reported that the animals, when given the opportunity, prefer a nest box or a tube for resting, which may indicate a motivation to seek shelter while resting. The author concluded that a nest box appears to be a versatile and pleasant resource for raccoon dogs.

Thus, based on the results from these studies, elevated platforms seem not to be able to replace nest boxes for resting and lack of nest box constitutes a hazard for the WCs Sensorial overstimulation and the linked WC Resting problems.

Winter nest box provision has been recommended to promote the natural winter dormancy of this species (Asikainen et al., 2002; Asikainen, 2013). This recommendation has been based on reports of raccoon dogs exhibiting species-typical autumnal fattening in farm conditions, but not winter dormancy as such. The lack of winter dormancy has been proposed to be associated with lack of access to a nest box (Asikainen et al., 2002). Other factors have been proposed to be involved as well, such as continuous provision of feed, lack of opportunity for allohuddling (see definition of this ABM in Table 14) and human disturbance. Therefore, this hazard may be particularly relevant during wintertime.

- **Close presence of excessive amount of own faeces and faeces from neighbouring animals**

In raccoon dog farms, the floor mesh of cages is spot-welded, galvanised mesh with openings of different size (EFSA, 2025). Droppings will fall through the openings and accumulate under the cages. The close presence of own faeces (falling beneath the cage floor) and faeces from neighbouring animals can be considered a potential hazard for Sensorial overstimulation in the current system. However, no studies have examined this, which constitutes a gap in knowledge.

- **Handling and inexperienced and/or untrained handlers**

Farmed raccoon dogs are handled manually throughout the production cycle for a variety of reasons and thus, handling and inexperienced and/or untrained handlers constitute a hazard for this WC. For example, males and females may be paired for natural mating (Zon et al., 1987) or artificially inseminated (Jarosz et al., 2016). According to stakeholder input (Supporting information SF5), the majority of the animals are mated naturally. Consequences of artificial insemination in terms of handling stress have not been studied. This constitutes a gap in knowledge since for both females and males, artificial insemination requires more complex handling than natural mating. Other routine reasons for handling include vaccinations, weaning and cage transfers and although the literature does not provide a great amount of detail on handling methods in raccoon dogs, handling devices or neck tongs (see Figure 10 for neck tong use in foxes) may be employed (EFSA, 2025). The welfare impacts of these various handling methods appear understudied in raccoon dogs, which may be less fearful of humans than the other species covered in this SO (Barabasz et al., 2011; Brzozowski et al., 2010; Korhonen et al., 2023; Łapiński et al., 2013). Korhonen (1988b) did, however, describe that fearful juveniles might hide in the nest box during working hours. More recently, Łapiński et al. (2013) suggested that fearful/aggressive animals with a low tolerance for farm conditions are excluded from breeding.

5.3.4 | Isolation stress

5.3.4.1 | *Description of isolation stress*

Definition from EFSA AHAW Panel (2022): *'This WC is characterised by the animal experiencing stress and/or negative affective states such as frustration and/or fear resulting from the absence of or from limited social contact with conspecifics'.*

Interpretation for raccoon dogs. As reviewed by EFSA (2025), raccoon dogs are tolerant towards individuals of their own and other carnivore species (Drygala et al., 2008; Koistinen et al., 2020; Sutor & Schwarz, 2012), with agonistic behaviour being rarely observed. They have been reported as strictly monogamous and pairing for life, but a study of wild raccoon dogs in Japan suggests that males may mate with more than one female (Sugiura et al., 2020). The animals can live both as a pair or in family groups, displaying biparental care of cubs (as reviewed by EFSA, 2025). According to Korhonen et al. (1991), who studied the behaviour of farm-born animals kept in groups in enclosures, the animals are very social. Koistinen et al. (2016) describes that raccoon dogs use olfactory signals, vocalisation, body gestures and behaviour for social communication. Korhonen et al. (1991) describes affiliative behaviours among animals kept together, i.e. nose-to-nose contact and muzzle nibbling or muzzle licking. According to Korhonen et al. (1991), males were found to spend more time than females in the nest with the cubs.

Thus, for raccoon dogs, this WC is related to the keeping of animals alone and applies to Scenarios 1 and 2, but potentially also to Scenario 3, where females and young are kept without the cubs' father.

5.3.4.2 | *Hazards leading to isolation stress*

- **Single housing**

According to WelFur (2020), raccoon dogs and especially juveniles, possess strong social motivations, and single housing for animals, especially of this age, is considered to limit their expression of social behaviours such as allogrooming and social play (WelFur, 2020). The proportion of juveniles kept in individual housing is not known, and juveniles are more often kept in pairs or groups (Scenarios 4.1 and 4.2). In relation to adult animals (scenarios 1–3), little is known about the welfare impact of solitary housing when kept for fur production (as acknowledged by (WelFur, 2020).

5.3.5 | Locomotory disorders including lameness

5.3.5.1 | *Description of locomotory disorders*

Definition from EFSA AHAW Panel (2022): *'This welfare consequence is characterised by the animal experiencing negative affective states such as pain, discomfort and/or due to impaired locomotion induced by, e.g. bone, joint, skin or muscle damage'.*

Interpretation for raccoon dogs. Locomotory disorders and lameness relate to the different conditions that can affect raccoon dogs during their lives, impairing their locomotory apparatus and potentially causing pain, lameness and/or partial or total inability to move.

In a conference presentation, Koistinen et al. (2013) report preliminary results from an on-farm welfare assessment performed in 12 commercial raccoon dog farms (farm populations varied from 324 to 4735 animals) in Finland in October and November 2012. Without presenting definitions of 'paw health' and 'bent feet', the authors report that an average of 1.5% of 785 examined animals (farm prevalence range: 0%–6.3%) were categorised as having bent feet, and an average of 0.6% of 699 examined animals (variation between farms: 0%–3.2%) (not described whether the examined population was the same for all indicators recorded) showed signs of reduced paw health. In addition, 668 animals were examined for mobility difficulties. Of these, an average of 1.3% (variation between farms: 0%–6.6%) showed 'some' signs of mobility difficulty, 0.4% were categorised as having major difficulties moving (variation between farms: 0%–1.9%) and 0.3% did not move (variation between farms: 0%–1.9%). The substantial variation between farms suggests possible differences in management practices that could influence the occurrence of locomotory disorders.

From the study by Koistinen et al. (2013), it is not clear whether the indicators were scored as in the WelFur protocol for Finnraccoon. In the protocol, mobility difficulties are scored while the animal is in the cage and it may be encouraged to move. According to the guidance text, if the raccoon dog is mainly sitting during the observation, or tends to sit down after walking a few steps, it may have difficulty in moving. If the animal cannot stand up, it is scored as being unable to move. It is noted that an animal which has been resting for some time and stands up may show signs of impaired mobility in the beginning but will soon move normally. The protocol states that this kind of numbness should not be recorded as mobility difficulty.

Regarding bent feet, this condition is reported as a welfare indicator to be measured in the WelFur protocol for Finnraccoon (see definition of this ABM in Table 14) According to the guidance text, bent feet cannot be assessed while the animal is resting. An example of this condition was shared by stakeholders (Supporting information SF6).

Furthermore, the WelFur protocol for Finnraccoon, describes that severely bent feet can be seen together with front leg turn (WelFur, 2020), either with an inward rotation (abduction) or an outward rotation (adduction) (see definition of ABM in Table 16). Hence, these two conditions seem to be associated, as no information is reported on the presence of front leg turn alone. In Arctic foxes, these conditions are usually found simultaneously in the same animals (see Section 4.3.4). Knowledge about the prevalence, severity and potential association between these conditions in raccoon dogs is lacking. This constitutes a gap in knowledge.

Concerning osteochondrosis, a condition known to lead to pain on extension and flexion of affected joints, the only study that mentions this pathology in raccoon dogs was done analysing 16 museum skeletons of unknown origin and age. The authors report osteochondrosis in 34% of shoulder joints analysed (Lawler et al., 2012). The paper reports that other joint diseases were also present in the sample of raccoon dog skeletons analysed, such as osteoarthritis and hip dysplasia. However, no knowledge exists on the prevalence of such pathology in farmed raccoon dogs.

Damaged feet, including infection and impaired health of the paws and feet, are mentioned in the WelFur protocol for Finnraccoon under the indicator 'other disease' (assessed on a scale from 0 to 3), which also includes non-feet-related clinical conditions such as breathing difficulties. The assessment of this indicator is done from outside the cage and is not a gait test as such. Among the reported conditions, the protocol provides some examples (WelFur, 2020). However, data on the prevalence of foot lesions in farmed raccoon dogs are not published.

In farmed raccoon dogs, Locomotory disorders is related to conditions as exemplified above. Thus, for the purpose of this SO, this WC applies to all scenarios with particular attention to long-living animals (Scenarios 1, 2 and 3) due to longer exposure to the hazards.

5.3.5.2 | *Hazards leading to locomotory disorders (including lameness)*

- **Genetic predisposition as a consequence of selection for production traits**

Despite lack of knowledge about raccoon dogs, genetic predisposition as a side-effect of selection for production traits is considered a hazard for locomotory disorders. This can be hypothesised also considering that the raccoon dog population is quite small, which can lead to accumulating inbreeding and increased harmful gene combinations in the population (Supporting information SF7). Similar relations have been found to be important in other canids, such as Arctic foxes (Kempe et al., 2010) and dogs (Grandalen & Lingaas, 1991; Vaughan, 1992). In addition, genetic selection for larger body size is in itself considered a hazard for the WC.

- **Inappropriate feed**

As mentioned above, it has been reported as a typical practice to feed raccoon dogs feed designed to meet primarily foxes and/or mink's nutritional requirements (Koistinen & Mononen, 2023). No evidence has been found on the potential relation between dietary factors and locomotory disorders in this species. This constitutes a gap in knowledge. In another canid, i.e. dogs, dietary factors, such as the Ca:P ratio, have been suggested to lead to skeletal growth disorders (Dobenecker et al., 2006). Studies on this relation in Arctic foxes seem to be inconclusive (Korhonen et al., 2005, 2014, 2015). Research is needed to clarify this in raccoon dogs.

- **Inappropriate floor material potentially leading to locomotory disorders and/or lameness**

An inadequate floor material may predispose the animals to locomotory disorders, particularly when continuously exposed to this hazard, without having the possibility to choose a solid floor. Obese animals may be at higher risk due to the higher weight load. However, no evidence was found on the effect of wire mesh flooring or wire mesh size on the health of paws and feet in farmed raccoon dogs. This constitutes a gap in knowledge.

5.4 | Preventive and mitigating measures

This section addresses preventive and mitigating measures for the WCs identified in Section 5.1.2. In the following sections, mitigating measures for each WC are described, taking into consideration their individual hazards. In general, addressing individual hazards delivers only limited mitigation of the overall WC, and only changes addressing several individual hazards can provide substantial mitigation, as summarised at the end of each WC section.

5.4.1 | Restriction of movement and linked WC

Restriction of movement is linked with the WC **Inability to perform play behaviour** because of shared hazards.

In the current system, the WC Restriction of movement **cannot be prevented or substantially mitigated** because of hazards related to insufficient floor area and cage height, and floor material potentially limiting proper movement. Another hazard is the lack of possibility for animals to distance from faeces and lack of opportunity to establish latrines.

Raccoon dogs require space for static behaviours such as standing, turning and resting, which depends on the raccoon dog's body size. In addition, raccoon dogs also require space to perform dynamic behaviours including locomotion. In the current system, cage floor area and height do not allow raccoon dogs to perform all motivated behaviours, such as exploration and foraging. Possibilities to add resources (e.g. manipulable objects, see Section 5.4.1) and cage structures in the current system are limited by the cage dimensions. Such additions are expected to stimulate active behaviours and some locomotion, but not to allow sustained locomotion or all motivated types of active behaviours. When juvenile raccoon dogs are housed with conspecifics, space to perform appropriate social behaviours (including social play, escape and avoidance of aggression) is required.

Despite possible confounding effects from group size, environmental complexity, season and animal category, as well as a very small sample size in some studies, the different levels of activity observed in the available studies suggest that raccoon dogs kept in pairs in cages of 2.4 m^2 (1.2 m^2 per animal) are slightly more active than raccoon dog pairs kept at 1.2 m^2 (0.6 m^2 per animal) (Koistinen et al., 2020), whereas a considerable space increase can positively affect the level of activity in raccoon dogs, as indicated by case studies done in enriched enclosures of more than 30 m^2 (e.g. Korhonen, Jauhiainen, & Niemelä, 2001).

To allow behaviours such as vigilance (e.g. on elevated platforms), enclosures need to be high enough to contain structures such as platforms with sufficient space above and below to allow raccoon dogs to sit in an upright canine position or stand without bending their legs (Figure 13). In order to adopt stretched out postures (e.g. stand bipedally on the hind legs), an enclosure height allowing the largest adults to stand vertically is required. Research is needed to provide numeric evidence on the required enclosure heights. Resources offered on top of the enclosure (as done, e.g. for straw in the current system) still need to be reachable by all animals, also in higher cages. To allow resting and hiding behaviours, one or more nest boxes large enough for allohuddling of all individuals kept in an enclosure, and provided throughout the year, are required (see Section 5.3.1).

FIGURE 13 Raccoon dog on a platform (©Animalia, Supporting information SF12).

The effect of different flooring materials or mesh size on the ability of raccoon dogs to move freely has not been adequately studied (see Sections 5.3.1, 5.3.5), but flooring materials like sand and earth may enable exploratory and foraging behaviour, including digging. Furthermore, the establishment of latrines requires solid flooring as well as sufficient space in the enclosure to separate the latrine from other functional areas (especially distancing from the resting area). The lack of latrine use is also discussed in Section 5.4.3 in relation to the WC Sensorial overstimulation.

Regarding the linked WC **Inability to perform play behaviour**, only a few studies have investigated raccoon dog play behaviour (locomotory, object or social play). Despite this lack of studies, due to the limited possibility especially for locomotory play behaviour in current housing, it is considered likely that farmed raccoon dogs would perform more play behaviour if offered considerably larger, enriched and/or diversified enclosures compared to the standard cages. Thereby aspects of Inability to perform play behaviour, where hazards are shared with Restriction of movement, would be mitigated. Further research is needed to assess this.

Substantial mitigation

To achieve **substantial mitigation** the current system needs to be changed to enclosures providing additional space in the three dimensions, including space required to add structures to increase complexity and space to allow the animals to establish latrines as well as to keep a distance from them. Further research is essential to provide quantitative information on raccoon dog enclosure size that allows for substantial mitigation of Restriction of movement.

5.4.2 | Inability to perform exploratory or foraging behaviour and linked WCs

Inability to perform exploratory or foraging behaviour is linked with the WCs **Inability to chew** and **Gastroenteric disorders** because of shared hazards.

Inability to perform exploratory or foraging behaviour **cannot be prevented** or **substantially mitigated** in the current system due to the hazards listed below.

Hazards for Inability to perform exploratory or foraging behaviours and hazards shared with the linked WCs are identified considering animal needs in relation to the performance of exploratory as well as appetitive and consummatory behaviours, and they are: (i) Limited cage size and lack of physical complexity (including lack of resources) providing stimuli for exploratory, appetitive and consummatory foraging behaviours; (ii) Insufficient feed texture and delivery for consummatory behaviours including chewing; (iii) Feed being inappropriate and not fulfilling the dietary requirements.

Scored as one of the most relevant for raccoon dogs, this is a challenging WC to assess because of its interactions with others, particularly Restriction of movement and Sensorial understimulation. **Enclosure enrichment**, as the principal mitigation measure, is in itself complex because of the expected diversity of exploratory and foraging behaviour in raccoon dogs due to their omnivorous diet and opportunistic nature (EFSA, 2025). An additional challenge is the low number of studies conducted aiming to mitigate this WC in current housing systems, combined with a lack of studies on raccoon dog behaviour and underlying motivations when living under conditions differing from standard farm practices.

Koistinen et al. (2020) describe the most complex experimental housing tested in raccoon dogs under production conditions and exemplify how more complex environments can be provided by linking cages horizontally, by supplying cage furnishing (such as nest boxes, platforms, tubes) and manipulation possibilities (multiple resources/objects). In the study, the authors compared factors such as **cage size** (1.2 m^2 or 2.4 m^2) and group size (2 or 4 animals). Animals in all treatment groups had access to a platform, a wooden block and straw. In addition, one treatment group had access to a nest box and a tube. Based on the findings from the study, the authors concluded that space, physical complexity and resources are important aspects of the welfare of juvenile raccoon dogs. However, no studies have analysed which properties of different items/objects are important to achieve effective enrichment.

There is research showing that the provision of bovine bones stimulates oral activity combined with active paw manipulation (Koistinen & Korhonen, 2016; Koistinen et al., 2017). Koistinen et al. (2017) showed that raccoon dogs maintain interest in bovine bones and that deprivation of access led to subsequent increased interaction with the bone. The WelFur (2020) protocol for Finnraccoon also considers the provision of resources such as objects beneficial in terms of animal welfare. In addition, in her master's thesis, Raatikainen (2018) describes how young raccoon dogs use diverse resources such as straw, a resting platform and a wooden object. These findings indicate that raccoon dogs utilise resources for different behaviours.

The provision of resources is strictly related to the space available in the raccoon dogs' enclosure. In this sense, standard cages only provide opportunities for limited mitigation of the WC. The provision of point-source resources that are chewable or destructible is often feasible in the current system, however, more complex structural additions would be difficult or even impossible to include. Based on knowledge from other species, it can be said that introducing types of resources that can maintain attractiveness, and ensuring the continuous presence of the resource would be needed to mitigate the WC of Inability to perform exploration and foraging behaviour.

Mitigation of aspects of the shared WC Inability to chew would most probably require changing the feed delivery method from the current feed trays external to the cages (shown in Figure 12), to feed provided inside enclosures or with easier access to larger feed items. Thereby, the animals would be allowed to interact physically with the feed to a higher degree than is currently the case. Available feed texture studies from other canids may be taken as a starting point for raccoon dogs, but further research is needed in this species to document how feed texture can be effectively changed.

According to literature and information from stakeholders, raccoon dogs may be fed diets too low in fibre content, and adapted to other species kept for fur, such as mink or foxes. This may lead to the linked WC Gastroenteric disorders. Provision of feed (including straw) that meets the nutritional requirements of raccoon dogs (Koistinen & Mononen, 2023) can correct the shared hazards. In the WelFur protocol for Finnraccoon, hay, straw or other edible plant materials are recommended as fibre sources. The protocol describes how the material, in the current system, may be available inside the cage or can be pulled through the wire mesh, i.e. the straw may be placed in a rack outside the cage, in between the cages or on the top of the cage (WelFur, 2020). If the material is placed inside the cage, and is fully soiled with faeces, it is not considered by WelFur (2020) to be available as a nutritional fibre. None of the available studies have provided data on gastroenteric disorders; therefore, further studies are required.

Substantial mitigation

To achieve **substantial mitigation**, the current system needs to be changed to enclosures that provide additional space in the three dimensions and inclusion of multiple and diverse resources to increase complexity. In addition, changes in feed texture, delivery and feeding management, including the provision of resources suitable for chewing and provision of feed that meets the nutritional requirements of raccoon dogs considering also straw is required. Based on knowledge from other species, it can be said that introducing types of resources that can maintain attractiveness, and ensuring continuous presence of the resource would be needed to mitigate the WC of Inability to perform exploration and foraging behaviour. Knowledge from other canids, e.g. dogs kept as laboratory animals, on possibilities such as cognitive enrichment via the provision of hidden feed, might be a starting point (Overall & Dyer, 2005).

Further research is essential to provide quantitative information on raccoon dog enclosure size and stimulation level that allow for substantial mitigation of the WC Inability to perform exploratory and foraging behaviour, as well as correction of the hazards shared with the linked WCs Inability to chew and Gastroenteric disorders.

5.4.3 | Sensorial under-stimulation

Sensorial understimulation is caused by the barren housing conditions in the current cage system. Thus, Sensorial understimulation is caused by the same factors as the WCs Inability to perform explorative and foraging behaviour and Restriction of movement. Sensorial under-stimulation can be mitigated by the measures discussed in relation to these two WCs (see Section 5.4.1 and 5.4.2).

5.4.4 | Sensorial overstimulation and linked WCs

Sensorial overstimulation is linked with the WCs **Resting problems** and **Handling stress and cannot be prevented** in the current system due to the hazards mentioned below. For mitigation of the WC Sensorial overstimulation, the following hazards need to be addressed:

- **Lack of nest box for resting and to function as a retreat**

In addition to providing more comfort, a nestbox allows raccoon dogs to retreat from sensory input. Female raccoon dogs housed with a nest box during their first winter (from January to February) spent 90% of their resting time inside it (Koistinen et al., 2018). Due to the species' natural winter dormancy (Asikainen, 2013; Asikainen et al., 2002), this may be particularly relevant during wintertime. In support of this, Koistinen et al. (2018) showed that a group provided with nest boxes also demonstrated greater employment of species-typical passive wintering behaviours via reduced activity levels and feed intake compared to groups housed without them. The fur of females with nest boxes also remained clean, contrary to reports from other studies where nest boxes, among other resources, were not provided (Koistinen et al., 2020). However, SB and organ weights did not differ between groups (Koistinen et al., 2018).

Even though raccoon dogs are highly social animals, sensorial overstimulation may also result from unwanted social interactions when housed with conspecifics, or from their enforced close proximity in surrounding cages, especially when a nest box is not available. Such overstimulation may be mitigated by providing animals with a retreat area (e.g. den or nest box), giving them more choice and control over their environment.

Resting behaviour can also be performed on platforms. However, in a review of raccoon dog welfare, Koistinen et al. (2016) stated that raccoon dogs seem not to favour elevated platforms, or a wooden plate placed on the cage floor as a resting site, but instead will use a nest box when provided. This was based on results from e.g. Korhonen (1987), who observed the use of a sleeping plate (measuring 60 × 30 × 1.3 cm) made of wallboard in 53 single caged adult raccoon dogs (of both sexes) kept in cages of 120 × 105 × 60 cm (floor area of 1.26 m^2), without a nest box, during January when temperatures ranged from −13 to −28°C. The use of the plate was checked twice daily at approximately 09:00 and 15:00 for 12 days. The percentage of animals observed lying on the plates ranged from 17% to 29% during the morning observation and from 17% to 30% during the afternoon observation. The plates are described as getting dirtier during the experiment and absorbing moisture.

In addition, Korhonen et al. (1997) studied the use of platforms (130 × 5 cm, placed 25 cm below the top of cages -their size not specified-) in juvenile raccoon dogs (50 animals kept with a platform, 50 without) from July to October. The use of the platforms was assessed by counting the number of animals on the platform two to three times per working day at approximately 8, 12 and 15h. In July, raccoon dogs were observed using the platform for 4.8% of the observations, and this increased to 12.5% in October. The platforms were not cleaned during this period and were observed to get soiled by faeces (decreasing from 60%–36% clean platforms from August onwards). No observations were done at night.

Overall, platforms have been reported to be used for 2%–17% of total observation time, including for active behaviours and may be utilised for surveillance of humans on the farm (Harri et al., 1988; Koistinen & Korhonen, 2018). Raccoon dogs, therefore, appear to value platforms, at least as an opportunity to reach higher points in the cage. For future mitigation of WCs caused by lack of possibility to move to and spend time on elevated structures, knowledge from other canids, e.g. foxes, who are also known to prefer to observe their surroundings (Mononen et al., 1993), might be a starting point. EFSA experts agree that enclosures high enough to fit a platform or nestbox while leaving sufficient space below the shelf and on top of the shelf or roof to allow raccoon dogs to sit or stand normally without crouching will be advantageous, combined with platforms that are managed properly to keep them clean and attractive for the raccoon dogs.

- **Close presence of excessive amount of own faeces and faeces from neighbouring animals**

As mentioned above, the close presence of own faeces (falling beneath the cage floor) and faeces from neighbouring animals can be considered a potential hazard for Sensorial overstimulation in the current system. It relates also to the space in the cage, as discussed in Section 5.4.1. However, no studies have examined this. Regular removal of manure can mitigate these aspects of the WC.

- **Handling**

In general, all handling is probably stressful for the animals in terms of Sensorial overstimulation. Thus, the most important mitigation measures are to minimise the number of handling occasions and always carry them out in the least aversive way possible. When raccoon dogs are kept in enclosures, trapping facilities and protocols which allow for proper daily animal inspection needs to be provided. It should be possible to separate and catch the raccoon dogs with minimum stress when required.

Substantial mitigation

To achieve **substantial mitigation** in the current system, all of the following is required: Provision of an all-year retreat area (e.g. nest box), which will give raccoon dogs more choice and control over their environment and allow them to perform the species-typical winter dormancy behaviour. Regular removal of manure is also required, as well as minimising the number of handling occasions (including artificial insemination) and only using appropriate handling methods and equipment, as well as training of handlers.

Further research is required to develop quantitative recommendations for this mitigation, including research to determine the required thoroughness and frequency of manure removal procedures.

5.4.5 | Isolation stress

Due to lack of space in the current system, the WC **cannot be prevented or mitigated** in the current system.

Keeping raccoon dogs in social or group housing is essential to mitigate the WC Isolation stress, although the social needs of this species are relatively understudied. Little is known about the welfare impacts of solitary housing, the importance of the male–female bond and the possibility to spend time together during cub-rearing. Further research is needed to clarify this. For juveniles, the benefits of increased group sizes above pair housing have been presented. Ahola et al. (2007) reported resting behaviour in approximately 70% of observations in young siblings kept in either pairs (in a cage of 1.2 m^2) or sextets (in three combined cages with a total area of 3.6 m^2) – thus 0.6 m^2/animal in both treatments – from weaning and until pelting. Statistically significant changes in the level of activity were reported (pairs were less active than sextets), although the low effect size indicates that the biological relevance remains to be established.

In addition, for the pair-housed juveniles, stereotypic behaviour (pacing, jumping) was reported for an increased proportion of the observations ($3.2 \pm 2.3\%$) during August compared to the juveniles kept in sextets ($0.1 \pm 0.1\%$). In October, no differences in stereotypies were found as the level had decreased for the pair-housed animals.

Farmed raccoon dogs are known to perform extensive allohuddling when housed with conspecifics (Koistinen et al., 2020). According to WelFur (2020), this behaviour is considered a species-specific resting behaviour, especially in young individuals. Therefore, single housing is considered the main hazard for this WC when raccoon dogs are kept alone, and/or not provided with a nest box throughout the year and without room enough to allow allohuddling with at least one conspecific. From the results of Koistinen et al. (2020), where the animals were kept in pairs or in groups of four, it seems allohuddling can involve all cage-mates but also, for example, two or three out of four animals sharing a cage. No studies have analysed the potential mitigation from nest boxes allowing all animals living together in an enclosure to allohuddle together vs. the provision of smaller nest boxes allowing animals to allohuddle in smaller groups. This constitutes a gap in knowledge.

Substantial mitigation

To achieve **substantial mitigation or even prevention**, the current system needs to be changed to enclosures, the space of which can permit pair or group housing. Further research is essential to provide quantitative information on floor size (to mitigate Restriction of movement) and resources allowing pair or group housing.

5.4.6 | Locomotory disorders (including lameness)

For raccoon dogs, it is **unknown** whether this WC can be **prevented** or **substantially mitigated** in the current system because of lack of epidemiological data.

The hazards for the WC Locomotory disorders (including lameness) are inadequate flooring material, inappropriate feed, not fulfilling the dietary requirements of raccoon dogs and genetic predisposition as a side-effect of selection for production traits.

Based on knowledge from another canid, the Arctic fox (Kempe et al., 2010), one possible way to mitigate, and in the long term potentially also prevent the WC is to adopt selection programmes that aim to eliminate animals with bent feet, front leg turn and osteochondrosis from the population. This needs to be verified based on genetic data from raccoon dogs.

Another potential mitigating measure is to provide raccoon dogs with flooring of a more suitable material, including correct mesh size, as well as the possibility to choose between wire mesh and solid floor. Further studies are needed to document this.

Provision of feed according to nutritional requirements for raccoon dogs, as well as careful monitoring of body condition scores of the animals, may ensure a balanced diet and avoid obesity.

Substantial mitigation

Considering that the conditions leading to locomotory disorders in raccoon dogs, such as bent feet, likely arise from a combination of genetic and environmental hazards, effective prevention and mitigation most likely require a multifaceted approach: implementing genetic selection against traits like bent feet, front leg turn and osteochondrosis, including the potentially associated traits fast growth and obesity; careful management of body condition, ensuring nutritionally balanced diets, improving housing conditions by providing solid flooring areas and increase floor area and enclosure height to allow comfortable movement. Further research to document this is needed.

6 | WELFARE ASSESSMENT OF CHINCHILLA

6.1 | Most relevant WCs for chinchilla

6.1.1 | Scenarios used for the selection of most relevant WCs

The scenarios selected to answer TOR2a and 2b for chinchilla are shown in Table 15 and based on information on the production cycle of chinchilla kept for fur production, as described in EFSA (2025). Scenarios 3.1 and 3.2 cover the same age category of animals (juvenile animals that are weaned and up to the age of pelting or selection as future breeders) but kept under two different housing arrangements: individually housed or socially housed with at least two individuals. For the remaining scenarios, each age category is represented by a single distinct scenario.

TABLE 15 List of the identified scenarios used for the selection of the most relevant WCs in chinchilla.

Scenario no.	Name	Farm practices included
1	Breeding females in indoor cages (in polygamy system, see EFSA, 2025)	• Mating • Collar wearing in females
2	Dam and kits in indoor family cages	• Weaning (to also consider the dam) • Handling
3.1	Juveniles after weaning in individual cages	• Handling, incl. fur grading
3.2	Juveniles kept in pair or group cages until 5–6 months and then in individual cages until pelting (for the last 3 months)	
4	Breeding male kept in corridor with access to female cages in polygamy system	• Mating

6.1.2 | Outcome of the selection of WCs in chinchilla

As an outcome of the selection process described in Section 2.4, six WCs were identified as most relevant: (1) Restriction of movement, (2) Predation stress, (3) Inability to perform exploratory or foraging behaviour, (4) Sensorial under- and/or overstimulation, (5) Inability to perform comfort behaviour and (6) Resting problems.

Table 16 presents the outcomes of the selection of the six most relevant WCs, including the linked WCs and involved scenarios. These WCs apply to all scenarios (i.e. all age groups) and the whole period the animals are kept on farm.

TABLE 16 Outcome of the selection of the six most relevant WCs for chinchilla, including the linked WCs and involved scenarios (see Section 6.1.1).

Most relevant WC	Scenario	WCs linked to the most relevant WCs listed in the first column
Restriction of movement	All	• Inability to perform play behaviour
Predation stress	All	• Handling stress
Inability to perform exploratory or foraging behaviour	All	• Inability to chew • Gastroenteric disorders
Sensorial under-stimulation[a]	All	• Isolation stress • Inability to perform play behaviour
Sensorial overstimulation[a]	All	None
Inability to perform comfort behaviour	All	None
Resting problems	All	None

[a]This WC was originally called 'Sensorial under and/or overstimulation' in the EFSA guidance (EFSA AHAW Panel, 2022) but is here subdivided to enhance clarity of the content.

6.2 | Animal-based measures (ABMs) related to the most relevant WCs in farmed chinchillas

The following Table 17 summarises the ABMs used for the assessment of the most relevant WCs (including the linked WCs) in farmed chinchillas. ABMs were retrieved through a literature review and by consultation of stakeholders (Sections 2.1 and 2.2). The list should not be considered as an exhaustive list of ABMs.

Some ABMs (e.g. reproductive outcome, susceptibility to disease) may also reflect factors other than poor welfare (e.g. deficiencies in management), but because of their proven link to stress physiology, they are relevant to consider in any welfare assessment.

Additionally, further details on abnormal behaviours are reported below (see Section 5.2.1), since the need to address them emerged following discussions with stakeholders (see Section 1.1.2).

TABLE 17 Summary of animal-based measures (ABMs) of farmed chinchilla welfare referenced in Section 6. The list includes ABMs that have been recorded in studies testing the effects of housing modifications on the behaviour and welfare of farmed chinchillas, as well as ABMs that might not have been tested in this context but can indicate the presence of welfare consequences.

ABM	Definition	Interpretation	Welfare consequence (s)[a]
Aggressive behaviour	Sequences of behaviour may include trying to bite humans (e.g. (Łapiński, Niedbała, et al., 2023) or biting and kicking kits/cage mates (e.g. (Donnelly & Brown, 2004; Galeano et al., 2014) Tooth chattering may be exhibited in response to a threat or overt conflict (Donnelly & Brown, 2004)	The presence of the WC is shown by an increasing performance of aggressive behaviour.	Restriction of movement Sensorial understimulation and/or resting problems Predation stress and handling stress
Cortisol[#]	Intended as change of cortisol concentration in plasma or urine (Ponzio et al., 2012)	The presence of the WC is shown by the increase of cortisol concentration following the presence of certain hazard.	
Fearful behaviour	May include 'alert' behaviour (characterised by erect body posture and open eyes), decreased resting, increased jumping and increased movement (adapted from Baskir et al., 2020); may also urinate.	The presence of the WC is shown by an increasing performance of fearful behaviours.	Restriction of movement Sensorial overstimulation, resting problems or inability to perform comfort behaviour Isolation stress/separation stress
Fur chewing	Animal chew their own fur from the lumbar area down to the tail, (Franchi et al., 2016). Animals chew on the fur of a conspecific (see Section 6.2.1)	The presence of the WC is shown by an increasing amount of fur-chewing behaviour or increased fur damage (see Section 6.2.1)	Sensorial under- and overstimulation, resting problems and/or inability to perform comfort behaviour Inability to perform exploratory or foraging behaviour Isolation stress/separation stress
Reproductive failure	Measured as, e.g. increased fetal loss (Mans & Donnelly, 2013) or poor pup survival rates (Galeano et al., 2014)	The presence of the WC may be indicated by poor reproductive success because of the proven effects of stress physiology on reproductive endocrinology. However, this outcome can also occur due to other factors unrelated to poor welfare.	
Stereotypic behaviour (SB)	Repetitive behaviour such as biting the cage, licking the paws or running around the cage, which is invariant in form and with no apparent function (Święcicka et al., 2022)	The presence of the WC is shown by an increase in SB in terms of proportion of animals showing the behaviours, the duration, number of repetitions and/or difficulty to interrupt, following the presence of one/more hazards at some point in the life of the animals	Restriction of movement Inability to perform exploratory or foraging behaviour Sensorial overstimulation and/or resting problems or inability to perform comfort behaviour Isolation stress/separation stress Inability to chew
Time spent in a relevant behaviour or location (indicating motivation for a resource)	Resource use is measured and quantified as duration of associated behaviours (e.g. (Stern & Merari, 1969); or percentages of observed time in a location, e.g. in a specific cage area (Kersten, 1996)	A greater time performing functional behaviour or occupying a preferred location indicates motivation for a resource. Inability to access that resource/location results in a WC.	Inability to perform exploratory or foraging behaviour Sensorial overstimulation, resting problems or inability to perform comfort behaviour

TABLE 17 (Continued)

ABM	Definition	Interpretation	Welfare consequence (s)[a]
Vocalisation	Different types of vocalisation may indicate alarm or aggression (Bartl, 2006).	The 'alarm call' is attributed to predator avoidance. Defensive agonistic behaviour is associated with the 'snort sound' and the 'blocking call', while the 'scream' and the 'teeth chatter' occur in the context of offensive agonistic behaviour.	Predation stress

[a]It includes also linked WCs.

[#]In recent years, the construct validity of the use of cortisol (faecal, saliva or plasma) as ABM for aspects of animal welfare across animal species are being discussed (e.g. as reviewed by Tiemann et al., 2023). Among the challenges are large individual differences, sex differences, circadian variation, hormonal status, level of activity etc. Results should therefore be interpreted carefully, and in combination with other ABMs (e.g. behavioural, clinical).

6.2.1 | Abnormal behaviour in farmed chinchillas

Abnormal behaviours (e.g. fur chewing and stereotypic behaviour) are acknowledged to be a major welfare concern among captive chinchillas; however, their causal basis is not yet fully understood in this species (reviewed in Würbel, 2006). Therefore, little is known about possible hazards for their development and/or how to prevent or mitigate them in farm settings. The literature reviewed on fur chewing and SB in chinchillas is summarised below.

Among rodents, chinchillas appear particularly susceptible to fur chewing (Figure 14): studies on pet chinchillas report the incidence of this problem to be higher in chinchillas than in guinea pigs or rabbits (Jekl et al., 2008).

FIGURE 14 Chinchilla in cage with signs of fur chewing on the tail.

An estimate of fur chewing prevalence on farms in Chile (derived from the records of 10,196 farmed chinchillas between 1990 and 2011) was 5% and was thus considered relatively low, although the animals' furs were affected significantly enough to reduce profits from fur-chewed pelts (González et al., 2018). Similar prevalences of fur chewing were shown in Poland by Łapiński et al. (2014); anonymous surveys found the problem to be widespread, occurring on 85% of respondent farms, but only 3.5 ± 0.55% of animals were reported to fur chew on average. This survey study found the problem to be more often reported on smaller farms with less than 200 animals (Łapiński et al., 2014), with authors speculating that this result may have been due to underreporting in large farms because of breeders paying less attention to their animals.

In contrast, in older reports, chinchilla farms in Croatia were reported to have fur chewing prevalences of 15%–20% (Tišljar et al., 2002), and the 2001 report of the Scientific Committee on Animal Health and Animal Welfare (SCAHAW, 2001) reported that 10%–30% of farm stock exhibit signs of damage from fur chewing inflicted by themselves or conspecifics. Other reports have claimed that on farms 3%–10% of pelts may be found to be damaged due to fur chewing (Haferbeck, 1982; Kersten, 1996 as cited in SCAHAW, 2001). No newer material has been found. Fur chewing females have been reported to have poorer pup survival rates than females who do not fur chew (Galeano et al., 2014). This was proposed to indicate that fur chewing mothers provide a lower quality of maternal care for their offspring (Galeano et al., 2014) because fur chewing occupied large portions their daily time budgets or it neurologically reduced the performance of functional behaviours.

Regarding the aetiology of fur chewing, some proposed causal factors include the absence of chewing materials, heredity, malnutrition, boredom or environmental stressors such as noise and high stocking densities (SCAHAW, 2001). Recent evidence links chinchillas' fur chewing to physiological stress: higher urinary cortisol metabolite levels were reported in females that expressed severe fur-chewing behaviour and fur-chewing females exhibited increased anxiety-like behaviour in an elevated plus maze test in comparison with non-chewers (Ponzio et al., 2012). Female chinchillas may also be more susceptible to this behaviour, since in one study by Ponzio et al. (2007), 58.7% of fur chewers were female and in the abovementioned study (Ponzio et al., 2012), only females showed this difference in physiological stress markers depending on the severity of fur chewing. However, the behaviour is said to develop at similar ages in chinchillas of either sex (6–8 months; Tišljar et al., 2002).

Fur chewing may be treatable to some extent with SSRIs[19] like fluoxetine (e.g. 46% of fluoxetine-treated animals showed a reduction in the body area affected by fur chewing; Galeano et al., 2013). This medication seems to be effective mainly in reducing the progression of the behaviour, since control animals not treated with fluoxetine showed a greater increase in fur chewing over the course of the experiment than fluoxetine treated animals (Galeano et al., 2013). However, there may be a down-regulation of serotonin after prolonged fluoxetine administration, as the treated animals showed a significant increase in the percentage of body area affected by the fur chewing 50 days after the study had concluded and treatment had been gradually ceased (Galeano et al., 2013); thus, fluoxetine treatment is not presented as an effective long-term treatment.

Relatedly, in sampled fur-chewing chinchillas from a chinchilla 'buying up' station in Croatia, changes typical of Cushing's syndrome were evidenced in the histopathology of the adrenal glands and chewed skin (Tišljar et al., 2002). Chewed fur was often absent in the gastrointestinal tracts of sampled animals, indicating that the animals were not eating the fur (which would attribute the behaviour to potential nutritional deficiencies), but may instead have been over-grooming themselves (Tišljar et al., 2002). All chinchillas showed clinical signs of hyperadrenocorticism and Cushing's syndrome, which are also associated with self-mutilation and aggressive behaviours. They propose that fur-chewing animals are less resilient to stress and are therefore susceptible to stress-induced Cushing's syndrome (Tišljar et al., 2002).

A genetic component in chinchillas' fur chewing may exist (González et al., 2018). It is proposed that animals with a predisposition to fur chewing will express this behaviour when exposed to certain negative environmental experiences such as barren, restrictive environments or early/abrupt weaning, whereas animals without this predisposition may not develop the behaviour in the same environments (González et al., 2018), although this has not been demonstrated empirically. Franchi et al. (2016) suggested that fur chewing may be recognised and reported more often by farmers than other abnormal behaviours since it has a direct impact on pelts and their profitability, in addition to obvious thermal consequences (i.e. reduced heat retention found to result in increased food, water and metabolic energy intakes (Łapiński et al., 2020). Meanwhile, other abnormal behaviours such as bar chewing, cage scratching and backflipping are welfare concerns which receive less attention from farmers. Abnormal repetitive behaviours are mostly performed during the dark (active) period in chinchillas and therefore may be missed by stockpeople (Franchi et al., 2016; Kersten, 1997). Farmed chinchillas have been observed to stereotypically pace corresponding to up to 21% of their active behaviour (Kersten, 1996; SCAHAW, 2001).

Based on 24-hour timelapse video recordings of 19 animals on three commercial farms in the Netherlands, 2 animals (11%) were observed to perform stereotypies, mostly involving rapid and repeated locomotion along one of the cage walls, while 7 animals (37%) performed 'routine behaviour' (Kersten, 1997). The latter consists of a combination of several behaviours repeated for long periods of time. Although the frequency and sequence of the behavioural elements vary, these routine behaviours can also be considered as stereotypies. In research by Franchi et al. (2016), both fur-chewing and non-fur-chewing chinchillas spent more time over a 24 h period performing abnormal repetitive behaviours than performing locomotory, self-directed, play and exploratory behaviours. Bar chewing was the most common abnormal behaviour (4.6% of time), which has been associated with frustrated motivation to escape in other rodents but scratching (0.05%) and back-flipping (0.2%) were also observed (Franchi et al., 2016). The largest portion of time was dedicated to resting (~60%) and feeding (~20%) (Franchi et al., 2016).

Fur chewing and locomotor/oral forms of SBs are also thought to be linked to temperament: chinchillas of a fearful or hyper-excitable temperament were found to spend the most time performing SB in a study by Święcicka et al. (2022). The most performed abnormal behaviour in fearful animals was paw licking or fur chewing, whereas hyperactive animals showed mostly locomotor forms of SBs (Święcicka et al., 2022). This shows that temperament might be linked to different forms of abnormal behaviour in welfare-compromised chinchillas. Bar chewing was also an abnormal behaviour observed in these chinchillas (Święcicka et al., 2022).

Environmental and management factors identified thus far which may relate to the aetiology of the behaviour also include breeder experience, size of the facility and number of changes of bedding (wood shavings) per week (these were

[19]SSRIs = Selective Serotonin Reuptake Inhibitors.

negatively related to fur chewing prevalence in Ponzio et al. (2007)'s survey study on Argentinian fur farmers). Positive correlations have also been found between fur chewing prevalence and space index (total volume of the breeding facility in m^3 divided by number of animals in stock), number of rooms in the breeding facility, and the use of different rooms for fur production and reproduction (Ponzio et al., 2007), all of which contribute to isolation of chinchillas from the larger farm population, indicating there may be an isolation stress component (further discussed in Section xxx). Farms with more sound disturbance are also reported to have more fur chewing animals, and increased sand bath availability appears to reduce fur chewing prevalence (Ponzio et al., 2007). However, for each of these factors, it should be noted that there is a lack of experimental evidence demonstrating the role of isolated environmental conditions in the development of fur chewing in this species.

6.3 | Description of WCs selected as the most relevant for chinchillas and associated hazards

This Section describes the highly relevant WCs identified for chinchillas according to the methods described in Sections 2.4 and 6.2. Although not specifically requested in the mandate, for these WCs, ABMs that have been recorded in studies testing the effects of housing modifications on the behaviour and welfare of farmed chinchillas, as well as ABMs that might not have been tested in this context but can indicate the presence of WCs have been identified and interpreted in Section 6.2. In addition, this Section describes the associated hazards.

6.3.1 | Restriction of movement

6.3.1.1 | *Description of restriction of movement and linked WC*

Definition from EFSA AHAW Panel (2022): *'This WC is characterised by the animal experiencing stress and/or negative affective states such as pain, fear, discomfort and/or frustration due to the fact that it is unable to move freely or walk comfortably (e.g. linked to overcrowding, unsuitable floors, gates, barriers)'*.

Restriction of movement relates not only to the quantity of movement (cumulative time spent in active behaviours) but also to the type of movement, in relation to the species-specific behaviours and motivations of an animal.

Interpretation for chinchilla. In the wild, chinchillas preferentially inhabit steep, rocky and dry mountain slopes (EFSA, 2025). *Chinchilla lanigera* is a social species (Spotorno et al., 2004). Colonies of approximately 100 individuals are common (Albert, 1900) and occupy an area ranging from 1.5 to 113.5 ha in size (Jiménez, 1995). Isolated colonies form a metapopulation, with frequent local extinctions and colonisations of suitable habitat patches within the overall area. Population density in one study was found to be approximately 4 individuals/ha (Jiménez et al., 1992). They are quiet, shy, but active animals, which ricochet on their long hind legs across rocks in their usual habitat with remarkable agility and use prominent rocks for resting and as lookouts (Jiménez, 1990). Their species-typical locomotory behaviours, therefore, include running and jumping. In farmed chinchillas, the restriction of movement is related to their confined living conditions and lack of ability to move freely and carry out species-specific running and jumping behaviours.

Linked WC: Inability to perform play behaviour

Restriction of movement may increase the magnitude of other welfare consequences such as Inability to perform play behaviour, which is defined as the negative affective state of frustration resulting from the thwarting of the motivation to engage in social, locomotor or object play (EFSA AHAW Panel, 2022).

Play can be seen as object play (manipulating or exploring objects), locomotor play (running, leaping or chasing in a seemingly purposeless but joyous manner) or social play (engaging in mock fighting or chasing conspecifics), with all types of play requiring space and/or resources. Juvenile play in chinchillas includes vertical leaps, body twisting, racing and prancing, with kicking back their hind feet (Spotorno et al., 2004). Therefore, restriction of movement due to low space allowance (both horizontal and vertical) and lack of adequate environmental complexity within the space available have an influence on the possibility to perform play behaviour.

6.3.1.2 | *Hazards leading to restriction of movement and linked WC*

- **Insufficient floor area, cage height and structure**

Farmed chinchillas have a body length of 23–50 cm (mean 41.6 cm) and a tail length of about 15 cm based on pelt measurements (Barabasz et al., 2010). The Council of Europe (1999) suggests that chinchillas should be housed in enclosures with recommended floor areas of 0.5 m^2 for up to two adult animals or a female and litter and minimum height of 1 m, though cages this large are often not used in commercial practice. Literature reports and fact findings reported that individual cages of 50 × 40 × 35 cm or 50 × 40 × 40 cm (l × w × h) are used on commercial farms, resulting in floor areas of 0.2 m^2/animal (EFSA, 2025) (Figure 15). There is little research regarding the welfare impacts of keeping chinchillas in these or other cage sizes, and the available studies are summarised below.

FIGURE 15 Example of husbandry system for chinchillas: (A) cage tiers (©Stanisław Łapiński), (B) resources in the cage including 25% solid floor (removable), (C) elevated structure.

In the only factorial experiment on cage dimensions retrieved, Szendrő et al. (2024) investigated the cage size preferred by chinchillas when given a free choice between cages of different sizes. The experiment compared barren cages without enrichment or other resources such as a box, tube or platform (i.e. typical farmed chinchilla cages (EFSA, 2025). In each experiment, after 1 day adaptation period, daily 24-h video recordings were taken for 5 days and the location of chinchillas was registered every half an hour. When given a choice between a cage with a floor area of 0.5 m^2 (1 m × 0.5 m) and two smaller ones of 0.25 m^2 (0.5 × 0.5 m) with the same cage height of 0.4 m, the time spent by adult chinchilla in each cage was similar (32% in the 0.5 m^2 cage and 68% in one of the small cages). Cage use depended on the diurnal pattern, as they rested more in one of the small cages during the light period (73%) than in the active (dark) period (65%). In a similar comparison of the two cage sizes but with a cage height of 1 m, the preference to spend time in a smaller cage was more marked (82%), though with a decreasing preference over the 5-day period. Once again, use of the larger cage increased in the dark (active) period, reaching 30%.

Repeating the experiment with groups of 3 young chinchillas, where the larger cage was 0.3 m^2 and the two smaller ones were 0.15 m^2, all with a height of 0.4 m, a similar preference for the smaller cages was shown. When cage height was 0.4 m, time spent in one of the smaller cages increased from 52% to 76% between days 1 and 5, with little difference between the light and dark periods of day. When cage height was 1 m, young chinchillas were six times more frequently observed in the small cages than in the large one during the light period, while the difference was only twofold in the dark period of the day.

When cages of the same floor area (0.5 m^2) but different heights were compared, adult chinchillas spent twice as much time (70%) in a low cage (0.4 m) than in a high one (1 m). The preference for a low cage was higher during the light (rest) period (81%) than the dark (active) period (64%). Very similar results were obtained in a further height comparison with adult chinchillas when cages had 0.25 m^2 floor area and with groups of three juvenile chinchillas in cages of 0.15 m^2).

In a final comparison, chinchillas were given the choice between two small-low cages (0.5 × 0.5 × 0.4 m) and a large-high cage (1.0 × 0.5 × 1.0 m). A very marked preference for the small-low cages was observed in the light (resting) period (99%) whereas use of the large-high cage was much greater during the active period (39%). Repeating the experiment with groups of juvenile chinchillas (small-low 0.3 × 0.5 × 0.4 m; large-high 0.6 × 0.5 × 1.0 m) gave a very similar diurnal pattern of preference.

The cages in these experimental comparisons had wire mesh floors and sides, with solid sides only between adjacent cages and as a roof, and each cage was equipped with only feeders and drinkers of the same type (no platforms, boxes or other enrichment were present). The EFSA experts consider that the lack of cover, elevated platforms or hiding possibility is likely to explain the strong preference for smaller and more enclosed cages, particularly during the rest period (i.e. chinchillas might have perceived the smaller cage as a nest/den area within the wider floor area that they now had access to). The significant use of the larger cages during the activity period suggests that a large housing facility containing an enclosed resting/hiding area might best meet all needs.

In another experiment, chinchillas kept experimentally in above-standard sized cages (L60 × W50 × H68 cm), with wood shavings rather than a bare wire mesh floor, showed reduced fear, in a standard 'hand test', compared to a group kept in small (40 × 50 × 34 cm), barren wire mesh cages or small cages with shavings (Łapiński, Niedbała, et al., 2023), indicating that increased cage size and availability of litter may reduce fear. However, no difference in resting or activity time occurred in relation to cage size.

It is also noted that chinchillas' intestinal peristalsis is stimulated by running and other activities such as jumping, and therefore they need regular exercise to facilitate proper digestion (Bartl, 2024). However, there appears to be no research on possible impaired digestion in farmed chinchillas due to movement restriction. It was also stated in the SCAHAW (2001) report that chinchillas do not have enough space to jump in their cages, which may pose a hazard when the animals jump in response to being frightened. Chinchillas are very agile and can jump up to 1.5 m vertically or horizontally (Saunders, 2009), suggesting that cages on fur farms do not provide enough space, including vertical space, to meet the needs of chinchillas.

Akre et al. (2008) indicated that nest boxes, shelves and other enrichments are often not provided for farmed chinchillas; the absence of these resources would limit chinchillas' ability to jump, hide and climb, though there is a lack of recent research investigating the welfare impacts of restricting these behaviours. Research reported in a student thesis by Kersten (1996) indicates that chinchillas use shelves frequently. In one commercial facility where cages were 38 cm high and had both a wooden perch on the mesh floor and an elevated wooden shelf at half the cage height, three individually housed chinchillas observed for 24 h spent 17, 41% and 88% of time, respectively, on the shelf. In another commercial facility where cages were 34–36 cm high with a mesh floor and a mesh shelf at half the cage height, two individually housed chinchillas spent 10 and 19% of time, respectively, on the shelf (Kersten, 1996).

In another student thesis study of chinchillas housed in enriched climbing cages, animals were housed either singly or in pairs in cages which were 195 cm high × 103 cm wide × 72 cm deep and had a solid, littered floor and an open sandbath (Weiss, 2005). Each cage had three wooden sleeping boxes (internal dimensions: 16 cm height × 15 cm width × 50 cm length, which were on walking boards (15 cm board width) mounted at three different levels on two sides of the climbing cages and ran along the entire side of the climbing cage. In addition, the animals also had a running board without a sleeping box (height of the boards: 27 cm, 53 cm, 84 cm, 106 cm) and a large, barked deciduous tree branch for gnawing and climbing. Behaviour was recorded over 21 h (excluding the 3 h when daily cleaning tasks in the house were in progress). In all climbing cages, the animals stayed in the sleeping boxes for more than 70% of the day. Detailed observations on four cages made over 3 h periods during the active nighttime phase showed that animals spent 22%–80% of time in the boxes, 8%–26% of time on the elevated walkways and 10%–50% of time on the ground, indicating extended use of the elevated locations when available (Weiss, 2005).

Although abnormal behaviours such as fur chewing in chinchillas may result from improper cages that are too small or lack enrichment promoting movement (Wojciechowski, 2014), there was a lack of evidence in the scientific literature comparing conventional cage setups with alternative housing systems including more space and enrichment such as boxes/tubes and elevated platforms.

Regarding the WC Inability to perform play behaviour, no discussion on the effect of cage conditions on play behaviour (locomotory, object or social play) in farmed chinchillas was found in the literature reviewed.

Regarding the use of running wheels and running plates (see Figure 16) to enhance exercise and locomotion activities, Gilhofer et al. (2024) reported opinion from chinchilla pet owners on the use of different types of running wheels. The study reported a preference towards closed running wheel for chinchilla instead of open ones, and on increased risk of injuries associated to the wheel fabric (plastic). However, no choice studies were found, and no studies exist about the employment of running wheels or plates in commercial chinchilla fur farms. The use of a running plate was attempted in experimental settings with chinchilla kept for fur production, but their usage was not further investigated since the device was considered unstable and thus posing some injury risk for the chinchilla, while horizontal running wheels were not tested as not fitting the current cage size (Dr S. Łapiński, Researcher at University of Krakow, communication in a WG meeting, 2025a).

However, similar to what is discussed in other species (and in mink at Section 3.4.1), whether the use of running wheel truly prevents the development of SB or simply relocates SB into the running wheel is discussed (e.g. Joshi & Pillay, 2018; Mason & Würbel, 2016), and further studies are required in chinchilla. The study of Gilhofer et al. (2024) reported also the use in 58% of cases, of additional running area in pet chinchillas, to allow locomotory activity and sustained movement, however, this area would require additional space (dimension were not reported in the study) to that provided in current cage system for chinchilla kept for fur production, and no studies were found in fur-producing chinchillas.

FIGURE 16 Example of running wheel used for active locomotory behaviour in pet chinchilla.

It is, thus, not evidenced how play behaviour in farmed chinchillas changes if cage environments are enlarged, enriched and/or diversified above standard levels, but due to the limited possibility for locomotory play behaviour, the limited floor area and cage height are considered a hazard for this WC.

- **Flooring material impairing locomotion due to foot and limb injury**

Solid flooring is stated by the RVC Exotics Service (2022) to avoid limb injuries in chinchillas, although floors for commercially farmed animals commonly include wire mesh and a minimum of 25% of the floor surface of solid floor, constituted by metal or wooden material (EFSA, 2025). Donnelly and Brown (2004) report that traumatic fractures of the tibia commonly occur due to catching of the hind limb in cage bars, though it is not clear if this pertains to findings from farmed or pet chinchillas. Saunders (2009) reports in an article referring to chinchillas kept in fur farms, as pets, or for research, that limb fractures occur due to chinchillas' lively nature, fragile legs and relatively large bodies when kept on wire mesh. Comprehensive data on such injuries in farmed chinchillas and comparative studies of different flooring materials were absent in the literature reviewed.

Bartl (2024) also reports in a veterinary non-peer-reviewed publication that chinchillas often require treatment for sole pad ulcers. This article apparently relates to pet animals, and it is unknown if this condition is common on farms. Sand baths or rough/zinc-stained cage floors (wooden boards) can apparently be the cause of these lesions. However, the author emphasises the need for sand baths to remove harmful humidity from the fur (see Section 6.3.6). Additionally, Bartl (2024) notes that chinchillas' footpads are often lesioned due to bearing the weight of obese animals (obesity being common due to inappropriate, carbohydrate-rich dry food and lack of exercise).

- **Collars restricting free movement**

In polygamous housing systems, female chinchillas are fitted with collars to prevent them from leaving their cages, whilst allowing access for a male. These collars therefore restrict their free movement, but no detailed studies on other possible welfare implications of collars have been found.

Industry stakeholders stated that females seem unbothered by well-fitted collars, although if not checked regularly they can cause lesions as reported in one case in the United States (Wadman, 2020). This would pertain to the WC Soft tissue lesions and integument damage, which was not selected as a relevant WC for chinchilla. No references on EU chinchillas were found on this topic.

6.3.2 | Predation stress

6.3.2.1 | *Description of predation stress and linked WC*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as fear and/or pain resulting from being attacked or perceiving a high predation risk'.*

Interpretation for chinchilla. Chinchillas are a prey species, with their main predators being fox species and, occasionally, owls (EFSA, 2025). Bartl (2006) describes for this species a typical vocalisation called 'alarm call' that can be attributed to predator avoidance. As a prey species, chinchillas may consider humans to be a predator. In their natural environment, they spend most of their time hidden in burrows or rock crevices. The Chinchilla Production Standard, produced by the Baltic Academy in 2023, (Supporting information SF13), recommends that, among enrichment types, pipes (20–25 cm in diameter) or boxes should be supplied in cages to provide the animals with the possibility to hide or rest, but such items are often lacking in practice (Łapiński et al., 2020; Panina et al., 2021).

Linked WC: Handling stress, defined by EFSA AHAW Panel (2022) as the animal experiencing stress and/or negative affective states such as pain and/or fear resulting from human or mechanical handling. Tišljar et al. (2002) state that, 'in most cases, humans are the main cause of fear' in farmed chinchillas. They are handled on several occasions in the production cycle, including weaning, assessment of fur quality, transfer to a polygamous set, pelting, medical treatments and annual veterinary checks (Supporting information SF14). Video clips provided by stakeholders reported examples of rough handling of chinchillas (Supporting information SF14, SF16). There are reports of physical traumatic injuries and infections in necropsied chinchillas from Argentinian fur farms; trauma was often associated with incorrect handling of the animals by inexperienced handlers (Martino et al., 2017). However, time, frequency and occurrence of the different types of handling in the EU are unknown and do not allow to provide a comprehensive picture. Although chinchillas can be readily tamed by regular, gentle handling when they are young, this does not happen on fur farms and there has been no systematic selection of farmed chinchillas for tameness (Supporting information SF15).

6.3.2.2 | *Hazards leading to predation stress and linked WC*

- **Lack of shelter for hiding**

Although enrichment types such as tubes or boxes are recommended in the Chinchilla Production Standard (Supporting information SF13), cage structures or additional resources allowing the animal to hide are not commonly provided in practice (EFSA, 2025). In a study utilising facilities typical of Polish commercial practice, cages were furnished only with a sand bath and a wooden chewing block (Łapiński et al., 2020). Similarly, in a non-EU study (from Russia), only wooden chewing blocks were provided in cages (Panina et al., 2021). The choice experiment detailed in Section 6.3.1 (Szendrő et al., 2024) also highlights the importance of an enclosed space for chinchilla.

- **Barren environment**

Female chinchillas (8 months old) from a commercial breeding farm in Poland were rotated between various experimental cages (standard cage of 40 × 50 × 34 cm with wire floor, standard cage with a deep litter floor and shelf, enlarged cage of 60 × 50 × 68 cm) with a deep litter floor and shelf) and their responses to the hand test (i.e. a human inserting and circling a hand in the cage, with the option to touch the animal if possible) were recorded once per week over an 8-month study period (Łapiński, Niedbała, et al., 2023). The authors state that all animals in this study were already accustomed to handling, so it would be expected that these animals would be less fearful than chinchillas on commercial farms. Responses were scored on a 5-point scale. Only chinchillas with a score of 1 would allow themselves to be stroked; those with a score of 2 or more would not allow themselves to be touched (and showed increasing levels of fear/aggression as the score increased above 2). Although cage enrichment generally reduced fear reactions, the average chinchilla response to the hand test was classified as 'cautious' in all cage types: 2.4 ± 1.08 in standard wire-floored cages, 2.3 ± 0.99 in standard deep litter cages and 1.9 ± 0.81 in enlarged deep litter cages. In conclusion, although chinchillas remained generally fearful of humans, increasing cage size and enrichment showed a tendency to reduce handling stress.

- **Production procedures**

Chinchilla farming procedures such as weighing, veterinary procedures or cage transfers are reported to cause stress which persists for some days after the procedure has ended (Wojciechowski, 2014). This sensitivity may even cause stress exhaustion to the point of bodily failure in the first days of acclimation to new conditions, such as new cages or cage mates (Wojciechowski, 2014). One example of chinchillas' sensitivity to handling is given in Łapiński, Niedbała, et al. (2023), where chinchillas were subjected to the 'hand test'. Early in the study, chinchillas showed increased fear responses to the hand test, which decreased as the study progressed/as the animals aged (Łapiński, Niedbała, et al., 2023), suggesting habituation to the test. Thus, older animals may be calmer than younger animals in response to handling due to greater adaptation to farm procedures (Łapiński, Niedbała, et al., 2023).

In a study with zoo-housed chinchillas, it was shown that chinchillas can associate the colour of humans' gloves with the events that they precede (i.e. brown for handling and green for cage cleaning), and are less reactive to handling when the brown gloves associated with handling events are worn (Baskir et al., 2020). Meanwhile, the animals in this study demonstrated more reactivity (i.e. showing more movement) when handled using green gloves associated with cage cleaning, which can be interpreted as increased stress when handling is not anticipated. The authors therefore propose that providing chinchillas with a visual sign that precedes handling can reduce stress-related behaviours in response to handling (Baskir et al., 2020) (Figure 17).

FIGURE 17 Example of handling practices in chinchillas kept for fur production. Pictures show chinchillas being restrained by grabbing their tails unsupported (left) or supported (right).

Regardless, chinchillas showed consistent fear responses to the keeper opening the habitats and attempting to touch them (resting for shorter periods, jumping more frequently, behaving alertly and showing prolonged bouts of movement during and following handling attempts by the keeper) (Baskir et al., 2020), demonstrating that chinchillas are fearful of handling even when habituated to the experience, as they might be in a zoo setting.

6.3.3 | Inability to perform exploratory or foraging behaviour

6.3.3.1 | *Description of inability to perform exploratory or foraging behaviour and linked WC*

Definition from EFSA AHAW Panel (2022): *'This WC is characterised by stress and/or negative affective states such as frustration and/or boredom resulting from the thwarting of the motivation to investigate the environment or to seek for food (i.e. extrinsically and intrinsically motivated exploration)'.*

Interpretation for chinchilla. As reviewed by EFSA (2025), chinchillas in the wild have a folivorous diet and seek out and select from a wide variety of plant species. They also dig and inhabit complex burrow systems. The current standard cages for farmed chinchillas do not allow natural exploratory and foraging behaviours due to the lack of complexity of the environment and the lack of stimuli favouring the motivation to explore or forage.

Linked WCs: Inability to chew and Gastro-enteric disorders

The consummatory component of foraging behaviour in chinchillas is linked to additional WCs: Inability to chew and Gastro-enteric disorders.

The Inability to chew is defined as the animal experiencing negative affective states such as frustration resulting from thwarting of the motivation to chew and to perform the complete consummatory behaviour (EFSA AHAW Panel, 2022). The natural diet of wild chinchillas is mostly composed of dry herbage of the vegetation of the higher parts of the Andes; this diet of very coarse food with low energy requires much gnawing, which abrades the teeth (Frączak et al., 2010), as cited in Supporting information SF15). Farmed chinchillas are typically fed a commercial pelletised diet which may or may not be supplemented with hay or straw (EFSA, 2025). Jekl et al. (2008) reported chinchillas to be more sensitive to pain from dental disease compared to rabbits or other small mammals such as guinea pigs, and to show reduced appetite more rapidly than these other species in case of dental disease; thus, dental disease represents an important welfare concern for chinchillas. Heavy metal intoxication may be the outcome if chinchillas ingest heavy metals (e.g. lead or zinc) by gnawing inappropriate items such as poor-quality galvanised wire mesh (Saunders, 2009).

The WC **Gastro-enteric disorders** is characterised by animals experiencing negative affective states such as discomfort, pain and/or distress due to impaired function or lesion of the gastro-intestinal tract resulting from, for example, nutritional deficiency, infectious, parasitic or toxigenic agents (EFSA AHAW Panel, 2022). Chinchillas are particularly susceptible to gastro-enteric problems, which are often diet-related and may be exacerbated by lack of exercise (Bartl, 2024). Akre et al. (2008) and Martino et al. (2017) reported that gastrointestinal diseases, including enteritis, are the most commonly occurring cause of death in chinchillas (associated with stress, poor hygiene, vitamin deficiency, decayed feed, dirty water or water cups, chemical pollution in feed, etc.).

In this SO, the discussion is focussed on gastro-enteric disorders linked to feeding management or cage structure. However, bacteriological and parasitic agents may also be involved. Farmed chinchillas show a very high *Giardia* spp. infection level, with 61.4% of 531 chinchilla faecal samples from across Europe testing positive in one study (Pantchev et al., 2014). These parasites have not been found in wild chinchillas (Gherman et al., 2018), indicating a strong role of husbandry and captivity stressors in their development. Predisposing factors for infection with parasites such as *Giardia* spp. in farmed chinchillas are the age of animals (juveniles are more prone), stress, poor water quality, overcrowding of cages and close contact between the animals and their faeces (Gherman et al., 2018). Similarly, the occurrence of *Pseudomonas aeruginosa* infection in fur-farmed chinchillas is thought to be transmitted by equipment such as water and water bottles (Mans & Donnelly, 2013). Other reported parasites include *Hymenolepis (Rodentolepis) nana* tapeworm eggs, detected in 39.4% of faecal samples from breeding facilities in Italy (Brustenga et al., 2023), and *Cryptosporidium ubiquitum*, reported on chinchilla farms in the Czech Republic and Poland (Kellnerová et al., 2017). *Listeria, Salmonella* or *Pseudomonas* infections in farmed chinchillas have been associated with increased abortion rates and high mortality (Mans & Donnelly, 2013).

6.3.3.2 | *Hazards leading to inability to perform exploratory or foraging behaviour and linked WCs*

- **Combination of cage dimensions and lack of physical complexity including enrichment providing stimuli for appetitive and consummatory foraging behaviour**

Stakeholders recommend (EFSA (2025) to provide farmed chinchillas with at least three types of enrichment allowing them to jump and hide (such as shelves, pipes and boxes) and to chew (such as wooden blocks). However, as summarised in EFSA (2025), there is little evidence to support that this array of enrichments is routinely provided on farms. Continual access to straw or hay for eating is apparently provided, and this can act as a substrate for consummatory behaviour.

Some veterinarians attribute chinchillas' fur chewing to boredom (resulting from inability to occupy themselves with foraging behaviours) or lack of movement (Bartl, 2024), although there was limited literature found that evaluated the association of these factors with the development of fur chewing.

Although sand baths and litter are not necessarily related to foraging behaviours in chinchillas, they may be sensorially stimulating and stimulate play and exploration as in other species (see Section 6.3.1). The proportion of chinchillas performing fur chewing was 2.8 times higher in Polish farms which had a wire floor or mixed flooring system, compared with those housing chinchillas on deep litter of wood shavings (Łapiński et al., 2014). Fur chewing incidence also decreased with increasing number of wood shavings changes per week in a survey study of Argentinian fur farmers (Ponzio et al., 2007).

The effects of above-standard litter provision on exploratory behaviours in chinchillas is largely unstudied, and research on the effects of sand deprivation is limited (further discussed in Section 6.3.6).

- **Lack of feed texture for consummatory behaviour**

Commercial chinchilla diets are comprised mainly of concentrated food pellets, with some sources reporting occasional hay supplementation and other sources reporting 24-hour straw or hay access for browsing (summarised in EFSA, 2025). These diets appear inadequate to facilitate chewing, since tooth elongation and other dental diseases (e.g. gingivitis and gingival erosions) are considered major problems in captive chinchillas while such diseases are absent in wild animals (Crossley, 2001; Crossley & Miguélez, 2001). The occurrence of such dental defects was reported to be widespread and increasing on fur farms (Sulik et al., 2005), but more recent data are lacking.

When the skulls of farmed and wild chinchillas were compared, it was found that wild chinchillas had longer viscerocranial bases, longer maxillary cheek-tooth rows and greater palatal breadth; these differences were suggested by the authors to derive from the granular feed provided on farms, which offers relatively low fibre content (12%–18%) compared to wild diets (almost 66%; Baranowski et al., 2013). Similarly, in a comparison of wild, zoo and captive-bred animals, wild-caught animals had minimal dental disease and the teeth were maintained at short lengths, while the teeth in zoo specimens and captive-bred animals were significantly elongated and subjects had more dental disease (Crossley & Miguélez, 2001). The authors propose that the composition and physical form of commercial chinchilla diets are the primary factors causing the development of dental disease in captive animals. Muszczyński et al. (2010) point out that wild chinchillas consume coarse plant matter, which requires extensive chewing and that these plants often carry tiny quartz particles, which abrade the teeth and facilitate tooth wear. The 'mono-diet' of pelletised food may not provide farmed animals with sufficient minerals and is too soft to facilitate mastication to the same extent. It was similarly noted by Frączak et al. (2010) that the low-protein commercial diets for chinchillas likely reduce mastication opportunities, thus reducing tooth wear. This concept was also supported by a review by Reiter (2008) in captive rodents, including chinchillas.

Further research is needed regarding whether increased chewing opportunities can improve stress and welfare-related behaviours in chinchillas, in addition to improving their dental and gastrointestinal health.

- **Inappropriate feed**

Relationships between nutritional deficiencies and fur chewing have been proposed in farmed chinchillas, e.g. that fur chewing arises due to crude fibre deficiency (Fehr, 2009 as cited in Łapiński et al., 2014). However, no correlation was found by Łapiński et al. (2014) between the prevalence of fur chewing and type of feed (i.e. pellets provided from different producers), although the surveyed farmers also reported that feeding with optimised complete pelleted diets usually eliminates cases of fur chewing (Łapiński et al., 2014). Tišljar et al. (2002) found that fur-chewing animals did not have fur in their gastrointestinal tract, which indicates they were not consuming their fur and therefore the behaviour was not due to nutritional deficiencies.

Meanwhile, the sensitivity of chinchillas' digestive systems can result in a variety of digestive health issues. Feeding of concentrated pellets with insufficient roughage can contribute to respiratory and digestive disturbances (Bautista et al., 2007). In extreme cases, mass mortality can occur. For example, a case of chronic intoxication with sodium carbonate was reported on a Polish chinchilla farm, in which sodium carbonate was added to feed instead of sodium bicarbonate (often added to balance dietary electrolytes, (Wojtacka et al., 2014). Fatal infection with *Proteus mirabilis* and *Enterobacter aerogenes* was also reported in a farm in Argentina, which resulted in the death of 29% of the farm's herd (Bautista et al., 2007). The infections were attributed to diets composed of concentrated pellets with insufficient roughage and poor ventilation with high humidity in the farm environment, triggering respiratory and caeco-colic digestive disturbances (Bautista et al., 2007).

Chinchillas are also highly sensitive to aflatoxins and outbreaks of toxicosis often result in significant mortality. A study by González Pereyra et al. (2008) described an acute aflatoxicosis outbreak on a chinchilla farm in Argentina, where all 200 animals present on the farm at the time died after consuming contaminated commercial feed. Aflatoxins B1, B2, G1 and G2 were detected in the feed and histological lesions in the liver were consistent with aflatoxin exposure.

In veterinary settings, chinchillas are also reported to show higher prevalence of constipation than guinea pigs or rabbits; constipated chinchillas are described as being apathetic, having reduced skin elasticity and being under poor nutrition (Jekl et al., 2008). This condition was reported as a common concern in farmed chinchillas in the SCAHAW (2001) report.

6.3.4 | Sensorial under- and overstimulation and linked WC

As explained in Table 16, this WC is originally called 'Sensorial under- and/or overstimulation' in the EFSA guidance (EFSA AHAW Panel, 2022) but is here subdivided into two separate sections (sensorial understimulation and sensorial overstimulation) to enhance clarity of the content.

6.3.4.1 | *Description of sensorial understimulation and linked WC*

Definition from EFSA AHAW Panel (2022): This WC is characterised by the animal experiencing stress and/or negative affective states such as fear or discomfort due to understimulation from the physical environment.

Interpretation for chinchilla. In farmed chinchillas, this welfare consequence is related to the barrenness of the cages in the current housing system.

Linked WCs: Isolation stress and Inability to perform play behaviour

According to the guidance from EFSA AHAW Panel (2022), **Isolation stress** is characterised by the animal experiencing stress and/or negative affective states such as frustration and/or fear resulting from the absence of or from limited social contact with conspecifics. In the wild, chinchillas are gregarious and social, forming large colonies of over 100 individuals, with a population density varying from 0.9 to 10.7 individuals per 10,000 m^2 per colony (EFSA, 2025). In farmed conditions, weaned kits are split into groups of two or three or can be individually housed. If females are retained beyond 8 months of age, they are moved into individual cages in polygamous breeding groups. An environment lacking stimulation is also likely to impair **play behaviour** (see Section 6.3.1).

6.3.4.2 | *Hazards leading to sensorial understimulation and linked WCs*

- **Lack of physical complexity of cages and enrichment**

See Section 6.3.3 regarding lack of physical complexity and enrichment providing stimuli for appetitive and consummatory foraging behaviour.

Understimulation in chinchillas (including boredom) was not discussed in the literature reviewed, aside from a brief statement in a non-peer-reviewed veterinary publication by Bartl (2024) that suggested allowing chinchillas to occupy themselves with the selection of hay stalks and leaves to prevent boredom. This does not appear to be supported by empirical evidence from research.

- **Single housing**

As discussed in EFSA (2025), chinchilla kits are kept in sibling groups with the dam during lactation/suckling. At around 7 weeks of age, they can be separated into juvenile pairs or housed individually (as described in (EFSA, 2025). If not transferred to individual cages at weaning, this transfer typically occurs approximately 2 months later. Females selected for breeding, usually at around 8 months of age, are moved to a cage within a polygamous breeding group. From this point on, females remain housed individually within the breeding group for the rest of their lives, unless they give birth, in which case they share their cage with their kits until weaning. Males may enter the females' cages voluntarily, but their entry and exit are not controlled. Therefore, in the typical polygamous mating system, only one female can be accompanied by a male at any one time and other females may be alone for extended periods of time.

Although no published scientific evidence was found on the possibility that individually housed chinchillas experience isolation stress, the EFSA experts consider that this could constitute a welfare problem by analogy to other communally-living rodent species (see review chapters in Coleman & Schapiro, 2021). Weiss (2005) reported significantly more active behaviour in pairs compared to single-housed chinchillas and pair-housed chinchillas spent significantly more time resting together than resting alone, although this was not the case for many active behaviours like eating hay or moving around. According to experts of the Tierärztliche Vereinigung für Tierschutz e.V. (RSPCA, 2024); RVC Exotics (online); Veterinary Association for Animal Welfare TVT, 2012), keeping chinchillas alone is not acceptable and they should be kept in pairs at minimum. The importance of familiarising grouped animals before they reach sexual maturity to avoid the serious aggression that can occur between unfamiliar mature animals is emphasised (TVT, 2012).

6.3.4.3 | *Description of sensorial overstimulation*

Definition from EFSA AHAW Panel (2022): *'This WC is characterised by the animal experiencing stress and/or negative affective states such as fear or discomfort due to overstimulation from the physical environment'.*

Interpretation for chinchilla. In farmed chinchillas, sensory overstimulation is closely linked to their sensitivity to noise, which can arise from other animals, machinery or interactions with caretakers (SCAHAW, 2001).

In their natural habitat, chinchillas seek shelter in narrow rock crevices that provide them with a sense of security. This contrasts with the situation on farms, where the open cages lack hiding opportunities can contribute to chronic stress. Research by Szendrő et al. (2024) and Weiss (2005) highlighted how chinchillas spend more time in smaller spaces, particularly during the light period of the day, suggesting that these animals feel more secure in protected spaces where they can hide and rest more easily (see Section 6.3.1).

Chinchillas are nocturnal animals, primarily active during the night in their natural environment. In farmed conditions, excessive lighting that disrupts their natural circadian rhythm can lead to disturbances in their activity cycle. According to Kersten (1996), appropriate lighting conditions are crucial for chinchillas' health and welfare, as they influence their natural rhythms, including reproductive cycles and stress levels. Sensory overstimulation in farmed chinchillas is therefore the result of multiple factors, including excessive noise, lack of suitable hiding spaces, over-interaction with caretakers and inappropriate lighting. These factors can contribute to chronic stress, negatively impacting animal welfare and potentially leading to abnormal behaviours, such as fur chewing (Łapiński, Pałka, & Otwinowska-Mindur, 2023; Ponzio et al., 2007; SCAHAW, 2001).

6.3.4.4 | *Hazards leading to sensorial overstimulation*

- **Unpredictable environmental noise**

The acoustic environment of a chinchilla farm plays a crucial role for their welfare. Chronic exposure to high-frequency noise, common in environments with machinery or other animals, can lead to heightened stress. Sudden loud noises, such as from machinery or human activity, can startle chinchillas, making them more anxious and agitated (SCAHAW, 2001). Research has shown a direct correlation between higher levels of noise disturbance in farms and increased instances of fur chewing among chinchillas (Ponzio et al., 2007). Fur chewing is considered a stress-related abnormal behaviour suggested to be associated with anxiety (Ponzio et al., 2012). The more erratic and unpredictable the noise, the greater the likelihood that chinchillas will engage in this behaviour, suggesting that environmental noise is a significant stressor (Ponzio et al., 2012).

- **Unsuitable cage design**

The Tierärztliche Vereinigung für Tierschutz e.V. (Veterinary Association for Animal Welfare) states that if at least two sides of the chinchillas' enclosure are opaque this can reduce the animals' stress due to overstimulation from the view of the surroundings (TVT, 2012). There is a lack of empirical evidence to support this, but it is in accordance with the results of the study on cage sizes discussed in Section 6.3.1 (Szendrő et al., 2024), and the extensive use made of sleeping boxes discussed in Section 6.3.6 regarding chinchillas' ability to hide and reduce their view of the surroundings, aside from any boxes or tubes potentially provided as enrichment, which is not common commercial practice, they do not have enclosed places to hide and rest secluded (EFSA, 2025).

- **Inability to escape from undesired social contact with cage mates**

Farmed chinchillas are seldom housed in large groups, and no experiments were found regarding the possible hazard of overcrowding within cages and aggressive behaviours. Since Weiss (2005) found that pair housed chinchillas in enriched climbing cages (195 cm high × 103 cm wide × 72 cm deep) performed active behaviours like locomotion and feeding separately rather than together, it can be suggested that both horizonal and vertical space (with platforms) should be adequate to allow such separation.

The social group sizes in farmed chinchillas are much smaller than those in the wild and this has been suggested to reduce their perceived safety from predators. Ponzio et al. (2007) reported that a lower 'space index' (total volume of the breeding facility in m^3 divided by number of animals in stock) was associated with a reduction in the incidence of fur chewing in an epidemiological study of Argentinian farms. Increasing the perception of being in a bigger group may therefore be beneficial. However, there is concern that group-housed chinchillas can become aggressive, and any increase in group size would need to be accompanied by changes in the housing system (RSPCA, 2024).

6.3.5 | Inability to perform comfort behaviour

6.3.5.1 | *Description of inability to perform comfort behaviour*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as discomfort and/or frustration resulting from the thwarting of the motivation to maintain the function and integrity of the integument (e.g. cannot keep clean, scratch, dust bathe)'.*

Interpretation for chinchilla. The bathing behaviour of the chinchilla in sand is described in detail by Stern and Merari (1969). Lack of bathing substrate leads to dirty and greasy fur (Donnelly & Brown, 2004). Sand baths are necessary for chinchillas to remove moisture and lipids from their fur and are helpful in treating and preventing dermatomycoses (manifesting as scaly skin with hair loss on the paws, mouth, nose and anogenital region, (Bartl, 2024). Dermatomycoses are very common in chinchillas and are reported by Bartl (2024) to primarily be related to stress-induced immunosuppression. These outbreaks of skin fungal disease are resistant to treatment with antifungal agents but are most effectively treated with sand baths (Bartl, 2024).

An early study showed that after periods of deprivation from sand baths, chinchillas increased their use of sand (Stern & Merari, 1969), supporting that sand bathing is an essential and motivated behaviour (Figure 18). Another study found that sand baths were used for nearly all of the available time when provided for 4 h daily (Kersten, 1996). However, unrestricted access to bathing substrate is rarely provided in commercial practice (EFSA, 2025).

FIGURE 18 Provision of sand baths to each cage in farmed chinchillas. The external metal boxes are sand baths attached to each cage (A) that are used by the chinchillas (B) and are filled with sand (C).

6.3.5.2 | *Hazards leading to inability to perform comfort behaviour*

- **Lack of bathing substrate**

Akre et al. (2008) describe in their report to the Norwegian Scientific Committee for Food Safety that a sand bath and some types of litter are usually provided for farmed chinchillas, but that access to such items can be restricted to reduce spilling of substrate. This aligns with stakeholder information presented in EFSA (2025); i.e. that access to sand baths is reportedly facilitated for 30 min per day at minimum, but not necessarily for longer. A tendency towards reduced fur chewing was reported with increased sand bath availability in a survey of 101 Argentinian fur farms (Ponzio et al., 2007), thus chinchillas' ability to maintain the cleanliness of their fur may contribute to the prevention of this behaviour. However, in a similar survey study by Łapiński et al. (2014) of 47 Polish farms, no correlation was found between sand bath frequency and fur chewing, so there is mixed evidence for this welfare benefit.

Regarding litter substrate, Ponzio et al. (2007) also found a significant negative association between the number of wood shaving changes per week and the incidence of fur chewing. Chinchillas kept in large cages with a deep layer of shavings also showed reduced fear in a human hand test compared to animals kept in small, barren wire mesh cages or small cages with shavings (Łapiński, Niedbała, et al., 2023), so the availability of clean litter and/or abundance of litter may benefit welfare. In this study, chinchillas were also observed rolling in the sawdust, replicating their sandbathing behaviours. Stakeholders report that litter or wood shavings are sometimes provided for farmed chinchillas, though cage floors may be made entirely of wire mesh, which renders use of litter impractical; alternatively, cage floors may be entirely solid or a combination of each floor type (EFSA, 2025). For females with kits, stakeholders report that a heated box or pad is sometimes provided, and/or a cardboard insert is placed over the wire mesh. Females might also be transferred to solid-floored cages with shavings at whelping (EFSA, 2025). It is unclear from farm-level reports how commonly chinchillas are provided with litter, how much litter is provided and/or how often it is cleaned or refreshed. Furthermore, no studies were found comparing different litter/bathing substrates for chinchillas.

6.3.6 | Resting problems

6.3.6.1 | *Description of resting problems*

Definition from EFSA AHAW Panel (2022): *'The animal experiences stress and/or negative affective states such as discomfort, and/or frustration due to the inability to lie, rest comfortably or sleep. This may eventually lead to fatigue'.*

Interpretation for chinchilla. Chinchillas are mostly active at night. Resting and caecotrophy occur during the daytime (Lanszki & Szepesi, 1996). In the wild, when not in their burrows, they use conspicuous rocks for resting and observing their range (Jiménez, 1990).

As Kersten (1996) notes, being nocturnal, chinchillas require long, undisturbed rest periods during the day. However, on fur farms they are fed and inspected during the day and often have no hiding possibilities such as boxes or tunnels. Without sufficient sleep, they become more vulnerable to additional stressors, such as noise, temperature fluctuations or social tension, which worsen their welfare. This compounded stress can result in more pronounced health and behavioural problems (Grauvogl, 1990; Łapiński, Niedbała, et al., 2023).

6.3.6.2 | *Hazards leading to resting problems*

- **Lack of suitable resting area**

One of the primary factors contributing to resting problems in farmed chinchillas is inadequate dedicated space. Chinchillas in the wild are accustomed to living in rock crevices, where they can find protection from predators and environmental stressors. These spaces also provide a quiet, secure location for them to rest and sleep. In captivity, however, many farms house chinchillas in cages that are too small or poorly designed, limiting their ability to rest in a natural and comfortable manner. See Sections 6.3.1.2 and 6.3.2 where the research on preference for cage size by Szendrő et al. (2024) is discussed in the context of a need for an enclosed resting place. Chinchillas will also use shelves for resting if they are available (Kersten, 1996), perhaps analogous to rocks used in the wild for this purpose. In a study of chinchilla housed in enriched climbing cages (Weiss, 2005), each cage had three wooden sleeping boxes (internal dimensions 16 cm height × 15 cm width × 50 cm length, which were on walking boards (15 cm board width) mounted at three different levels on two sides of the climbing cages and ran along the entire side of the climbing cage (height of the boxes 53 cm, 84 cm, 106 cm). Behaviour was recorded over 21 h (excluding the 3h when daily cleaning tasks were in progress). In all climbing cages, the animals stayed in the sleeping boxes for more than 70% of the day (Weiss, 2005).

When chinchillas are confined in cages where they cannot escape unwanted social interactions through overcrowding, their ability to rest will be hindered. Chinchillas housed in groups can experience aggression (TVT, 2012) or competition for resources such as resting spots, leading to disrupted sleep and feelings of insecurity. However, no scientific studies on this subject were retrieved.

The physical environment of the cage is another critical factor influencing resting problems. Chinchillas are highly sensitive to temperature and humidity and require appropriate microclimatic conditions to maintain comfort while resting (Supporting information SF13; Wojciechowski, 2014). In farmed environments, where temperature control may be inadequate, chinchillas can experience thermal stress, making it difficult for them to find a comfortable resting position. Chinchillas may also experience mortality from heat stroke in regions with hot climates since farm buildings often do not have air conditioning units, in which case entire farm stocks may die (Martino et al., 2017).

Inadequate bedding is another important environmental factor. Discomfort from inappropriate bedding materials also impairs proper resting. Chinchillas naturally seek soft and absorbent materials to rest on. The lack of proper bedding or the presence of wire mesh floor can exacerbate discomfort and frustration, resulting in increased stress (Ponzio et al., 2007).

- **Improper lighting conditions**

Similarly, improper lighting conditions can also affect chinchillas' rest. Inadequate lighting, such as bright, continuous light or disruption of their natural light–dark cycles, can prevent chinchillas from resting or sleeping as they would do naturally. Studies by Kersten (1996) highlight the importance of maintaining appropriate lighting conditions to align with chinchillas' circadian rhythms. Light pollution and irregular light cycles can contribute to fatigue, stress and disrupted sleep, thereby exacerbating resting problems.

- **External disturbance**

Increased incidence of fur chewing has been associated with proximity to highways/other sources of constant noise, soiled cages and inadequate temperatures or humidity (Grauvogl, 1990; Merry, 1990 as cited in Tadich et al., 2013; Mösslacher, 1986).

6.4 | Preventive and mitigating measures

This Section addresses preventive and mitigating measures for the WCs identified in Section 6.1.2. In the following sections, mitigating measures for each WC are described, taking into consideration their individual hazards. In general, addressing individual hazards delivers only limited mitigation of the overall WC, and only changes addressing several individual hazards can provide substantial mitigation, as summarised at the end of each WC section.

6.4.1 | Restriction of movement and linked WC

The main hazards for the WC Restriction of movement are insufficient floor area, insufficient height and structures of the cage and inadequate flooring material that hinders locomotion. The same prevention and mitigation measures will apply to the linked WC Inability to perform play behaviour when the common hazards are considered.

In the current system, restriction of movement **cannot be prevented or substantially mitigated** because of lack of space.

Restriction of movement can be mitigated in the current system by providing elevated platforms and ensuring suitable floor materials (see below, i.e. at least a portion of solid floor). When present, elevated platforms allow chinchillas to jump up and rest at elevated locations and are extensively used (Kersten, 1996; Weiss, 2005). Since chinchillas show a preference to sit on solid flooring (Łapiński, 2025b), at least a portion of solid floor could be provided in the current system to achieve mitigation.

Substantial mitigation

To substantially mitigate restriction of movement, enclosures would need to have sufficient floor area and height to allow animals to run and jump freely. Whilst the present cages are too small to accommodate this and are often below the current Council of Europe's recommendation (free space provision of 0.5 m^2 for up to two adults, 0.5 m^2 for a female + litter and 0.3 + 0.16 m^2 per extra animal for juveniles), there is no scientific literature to indicate what size of enclosure would provide substantial mitigation of restriction of movement.

In addition, the enclosure needs to be large enough to accommodate any additional platforms and enrichment necessary to mitigate other welfare consequences (e.g. hiding places to mitigate predation stress, sand boxes).

Although horizontal space cannot be substituted by vertical space, chinchillas make extensive use of increased vertical complexity provided by elevated structures (e.g. platforms, tubes, boxes). Disturbed chinchillas can jump horizontally and vertically for up to 1–1.5 m (Saunders, 2009).

Related to floor material, this needs to be chosen to minimise the risk of limb injury, which would impair locomotion. The correct mesh size of flooring is particularly important for young animals with smaller foot size. To achieve substantial mitigation, provision of a solid floor combined with adequate bedding or soft material in at least part of the enclosure will allow chinchillas to choose among different floor types suitable for movement and rest, but more research on the best substrates is needed.

6.4.2 | Predation stress and linked WC

Although farmed chinchillas are not exposed to natural predation, they are likely to view humans as potential predators. Therefore, the WC Handling stress is linked to this WC due to shared hazards. The main hazards relate to the lack of shelter for hiding, the barren cage environment and the production procedures involving handling or close human contact.

The WC Predation stress **cannot be prevented or substantially mitigated** in the current system since some essential tasks on farms require animals to be handled.

Predation stress can be mitigated in the current system by the provision of boxes or tubes allowing animals to hide. Enrichment, such as permanent sand baths and sawdust bedding (see Sections 6.4.6), could also be provided because this can reduce fearfulness.

The linked WC of Handling stress can be mitigated in the current system by training staff in correct, gentle handling methods. For adaptation to handling to occur, handling/engagement with the animals needs to be sufficiently frequent and consist of relatively positive experiences. Brzozowski and Grzeszczak-Pytlak (2021) showed that young chinchillas can be habituated to human contact, and that this reduces their reaction to handling: a routine of removing the animals from their cages several times per week and touching/caressing them for a 5-min period from 30 days of age onward resulted in calmer behaviours during subsequent human handling, compared to a control group that was subjected to minimal human contact from 30 days of age onward. This level of time input may be less achievable in farm practice compared to experimental settings.

Substantial mitigation

In addition to the above-mentioned mitigating measures, further research is required to gain knowledge on whether genetic selection for less fearfulness and appropriate strategies to promote habituation to humans can mitigate this WC to a substantial degree.

When chinchillas are kept in enclosures, trapping facilities and protocols which allow for proper daily animal inspection needs to be provided. It should be possible to separate and catch the animals with minimum stress when required.

6.4.3 | Inability to perform exploratory or foraging behaviour and linked WCs

The WC Inability to perform foraging and exploratory behaviour is linked to the WCs Inability to chew and Gastro-enteric disorders because of shared hazards. The main hazards are a combination of cage dimensions and lack of physical complexity, including enrichment providing stimuli for appetitive and consummatory foraging behaviour, the lack of feed texture for consummatory behaviour and inappropriate feed. The WC Inability to perform exploratory and foraging behaviours **cannot be prevented or substantially mitigated** in the current system due to lack of physical complexity of the cage, and to space restriction.

Inability to perform exploratory and foraging behaviour can be mitigated in the current system with the provision of enrichment that allows chinchillas to express appropriate behaviours. To facilitate performance of some exploratory behaviour, the housing needs to have increased complexity, which could be provided by greater space and inclusion of platforms, shelves, tunnels, tree branches and enrichment materials such as hanging wooden toys, cardboard tubes and boxes to chew and hide in, unpeeled willow or fruit branches or objects made from woven willow, and carefully positioned hammocks and suspended tubes (Saunders, 2009).

Foraging behaviour could be stimulated by providing a greater variety of food types. Chinchillas are known to spend time selecting hay to consume, and thus, large pots/bowls of hay are ideal for the chinchilla to sit among the hay and select stalks and leaves (Bartl, 2024). A traditional hay rack or compacted hay bricks may not allow hay selection to the same extent as bowls or pots of hay and may therefore not be as beneficial in eliciting foraging behaviour. Again, however, there is limited research on foraging behaviours and the welfare consequences of their restriction in chinchillas.

Hazards shared with the **linked WCs of Inability to chew** and **Gastro-enteric disorders can be reduced** by correct diet and feeding management. It was recommended by Crossley (2001) and Crossley and Miguélez (2001) that captive chinchillas be fed a diet closely matching the form and nutritional content of their natural diets, which would require more feed consumption/mastication to meet nutritional demands. The Tierärztliche Vereinigung für Tierschutz e.V. (Veterinary Association for Animal Welfare) states that chinchillas need gnawing materials such as fresh, unsprayed branches of deciduous trees (TVT, 2012). Similarly, the RVC Exotics Service (online) states that chinchillas require hay to continually wear down their continuously growing teeth and maintain good gut function. This is also supported in an editorial by Hess (2017) on behalf of PetMD. Hess states that feeding hay is the best way to prevent tooth overgrowth in chinchillas since it is coarse and promotes prolonged chewing. In addition, hay promotes gastrointestinal tract health in chinchillas by helping to establish healthy bacteria populations to aid in digestion (Bartl, 2024; Hess, 2017) and helps to prevent constipation by binding ingested hair in the intestines and helping to excrete it (Bartl, 2024).

Substantial mitigation

To achieve substantial mitigation, current systems need to be changed to provide chinchillas with larger, complex enclosures. These would allow inclusion of a greater variety of vertical structures (i.e. elevated platforms or shelves) and tunnels/tubes, and of plentiful foraging materials (i.e. hay and varied plant material). Further research is essential to provide quantitative information on the amount of provision of these elements and the space needed to accommodate them.

6.4.4 | Sensorial understimulation and linked WCs

The main hazards for this WC are the lack of physical complexity of the cage, the absence of foraging substrates and the use of single housing systems.

The WC Sensorial understimulation **cannot be prevented or substantially mitigated** in the current system due to lack of physical complexity of the cage and to space restrictions. Sensorial understimulation can be mitigated in the current system by the adoption of the same measures as those proposed to promote exploratory and foraging behaviour. The same considerations would also be applicable to any alternative system designed to achieve **substantial mitigation**.

Greater social stimulation is provided when animals are housed in groups, thus providing mitigation of Sensorial understimulation. Juvenile animals could always be housed at least in pairs, as is common in the current system and this would also **prevent the linked WC Isolation stress**. It may be undesirable for females in a polygamous mating system to be housed together because of the risk of aggression. Social housing could be possible if monogamous pair housing of a male and female were adopted, as in the past, but this would require more space in comparison with the current system, since larger enclosures would be needed. Thus, the linked WC of Isolation stress **cannot be prevented or substantially mitigated** in the current system in adult animals and juveniles at the end of the growing period because the space in the cage is insufficient to keep pair or group housed adults but might be achieved if the system were changed to provide chinchillas with an enclosure size large enough for more than one animal.

The same considerations apply for the linked WC Inability to perform play behaviour regarding prevention, limited and substantial mitigation.

6.4.5 | Sensorial overstimulation

The main hazards for Sensorial overstimulation are the lack of shelter, the presence of aversive and unpredictable noises and the inability to escape from undesired social contact with cage mates.

Sensorial overstimulation **cannot be prevented** in the current system due to the inability to prevent all external disturbances.

Substantial mitigation

To achieve **substantial mitigation** of sensorial overstimulation, a combination of different measures is needed. Literature suggests that it is vital to create an environment that provides adequate space, minimises unexpected noise and allows chinchillas to maintain their natural daily and social rhythms (Łapiński, Pałka, & Otwinowska-Mindur, 2023; Ponzio et al., 2007; SCAHAW, 2001). Farms could provide lighting conditions that align farm activity with the species' natural activity patterns. The acoustic environment needs to be considered when choosing a farm location and planning work routines in order to minimise loud, unpredictable sounds and introduce a more controlled and consistent noise level (Trevino et al., 2019). In some cases, playing continuous background noise, like a radio, can help mask disruptive sounds and create a more stable auditory environment (Wojciechowski, 2014). Chinchillas have a hearing range similar to that of humans, and their inner ear shares significant anatomical and physiological similarities with the human inner ear (Hsu et al., 2015; Trevino et al., 2019). However, there is limited scientific evidence clearly demonstrating that a continuous acoustic background effectively masks sudden noise and reduces stress in chinchillas.

Further mitigation of sensory overstimulation can be delivered by giving animals shelter and hiding possibilities such as a box (25 cm per side; Saunders, 2009) or a tube/tunnel within the enclosure.

To mitigate social overstimulation and prevent bullying, the provision of sufficient space, resources and hiding places for chinchillas housed in groups needs to be adequate. For pet chinchillas, RSPCA (2024) recommends that the cage be equipped with enough nest boxes and hiding places to allow one per animal, and that at least one box be provided that is large enough for all the chinchillas to rest together. However, no studies on stocking density in farmed chinchillas have been retrieved, and this constitutes a gap in knowledge.

6.4.6 | Inability to perform comfort behaviour

The WC Inability to perform comfort behaviour in the current system results from the lack of, or insufficient access to, sand bathing substrate.

Inability to perform comfort behaviour **can be prevented** in the current system by the provision of permanent access to a sand bath containing fine-ground pumice or silver sand (a fine-grained sand differing from coarse sand, which has sharper and more angular grains) (Saunders, 2009). In the absence of a hiding box, chinchillas spend much time in an enclosed sand box (Kersten, 1996), but this may be motivated by a preference for enclosure rather than just for sand bathing. It is also reported that animals may use the box as a latrine and thus cause hygiene problems (Dr V. Michel, Senior Researcher at ANSES, communication in a Panel meeting, 2025).

Substantial mitigation

Based on the above, it seems that while access to sand baths should ideally be maintained ad libitum, with daily cleaning, a more restricted daily provision may be adequate for substantial mitigation if suitable alternative facilities for shelter and resting are provided, or in case of eye or respiratory irritation or infection (Quesenberry et al., 2012). There is no scientific literature to indicate the duration of daily access which would be adequate in these circumstances. Quality and type of sand is also important to ensure health safety of chinchilla (Quesenberry et al., 2012). Dust or sand especially made for chinchilla should be used (e.g. quartz-free sand).

6.4.7 | Resting problems

The main hazards for the WC Resting problems in the current system result from the lack of a suitable resting area, improper light conditions and disturbances linked to production procedures.

The WC Resting problems **cannot be prevented** in the current system due to the necessary production procedures during the working day.

Substantial mitigation

To achieve substantial mitigation of resting problems in the current system, it is crucial to provide adequate space, proper bedding and a quiet, secure environment that allows chinchillas to rest comfortably and maintain their natural circadian rhythms (Franchi et al., 2016; Ponzio et al., 2007). This includes a building environment with a diurnal lighting pattern and minimal disturbance during the light period, and an enclosure which includes an enclosed resting place. When nest boxes were provided, they were occupied for the great majority of the 21 h period studied, particularly during the inactive (light) phase of the day (Weiss, 2005). It is recommended that the resting area has a solid floor with soft absorbent bedding such as shavings or hay (Saunders, 2009). Elevated platforms can additionally be provided, as these are also used for resting by chinchillas (Kersten, 1996).

7 | CONCLUSIONS

The conclusions listed here pertain to the current system for housing animals kept for the production of fur. The term 'current system' refers to the cage system and cage dimensions described in the technical report (EFSA, 2025), which is based on information from the call for evidence and literature on husbandry systems and farm practices for the relevant animal species. When not referring specifically to the 'current system' or 'cage system' the mitigating measures apply to any type of enclosure in which the animals may be kept. The definitions of preventive and mitigating measures (including substantial mitigation and mitigation to a limited extent) are explained in Section 2.6.

Certainty assessments are provided in brackets only for key conclusions addressing the requests in the mandate, i.e. those concerning preventive or substantially mitigating measures within the current system.

This opinion focuses on the five welfare consequences (six in chinchilla) identified as most relevant for American mink, red and Arctic foxes, raccoon dog and chinchilla, as requested in the mandate. This does not exclude that other welfare consequences exist and may impact the welfare of the animals when kept for fur production.

As the process of domestication does not affect the fundamental needs of the species, for the purposes of this SO it was considered that the EFSA methodology applied for the other farmed species (EFSA AHAW Panel, 2012, 2022) is also applicable to fur animals.

For the species kept for fur production, there was no or very limited information available on animals kept in different farming systems. Studies evaluating animal welfare comparing the current system with alternative housing systems, taking into account the biological background of the species, are therefore lacking. Such studies would provide valuable insights to guide future improvements in the husbandry systems and improve knowledge and interpretation of behaviours and needs, allowing to better assess the impact on WCs.

7.1 | Conclusions on mink

7.1.1 | General conclusions

1. The most relevant WCs in mink kept for fur production are **inability to perform exploratory or foraging behaviour, restriction of movement, sensorial under- and/or overstimulation, soft tissue lesions and integument damage and handling stress.**
2. Restriction of movement, Inability to perform exploratory or foraging behaviour and Sensorial understimulation share common hazards linked to current cage barrenness and size, i.e. lack of environmental complexity and space restriction in the cages in which mink are kept (as described in EFSA, 2025).

7.1.2 | Restriction of movement and linked WCs

1. Restriction of movement is linked with the WCs Inability to perform play behaviour and Resting problems, because of shared hazards. Consequently, the conclusions made in relation to the mitigation of restriction of movement applies as well to these hazards causing the linked WCs.
2. Hazards for Restriction of movement and the linked WCs are identified considering animal needs in relation to quantitative and qualitative movement and they are:

   (i) Insufficient floor area to allow motivated types of active behaviours, including locomotion and play, and insufficient cage height and structural complexity;
   (ii) Inadequate floor material;
   (iii) Nestbox with too small floor area and/or size of openings, insufficient number of nests;
   (iv) Lack of open water.

3. Restriction of movement applies to all animal categories of mink and thus to all scenarios considered in this Scientific Opinion except kits during the first 4 weeks of life (i.e. until independently able to leave the nestbox) in Scenario 2 (dams with kits).
4. Due to limited floor area and cage height, and lack of structural complexity, the WC Restriction of movement **cannot be prevented** (90%–100% certainty – very likely) or **substantially mitigated** (90%–100% certainty – very likely) in the current system.
5. The dimensions of the cage in the current system severely restrict the size, the amount and type of resources which can be provided (limiting it to only e.g. platforms and hanging ropes), and in turn restrict both the qualitative and quantitative expression of active behaviours and locomotion. This also applies to the dimensions of the current nest boxes, which restrict the ability of the largest individuals or groups to access them and rest in comfortable positions. The quantity and type of resources that can be added within the current system **provide only limited mitigation** of the restriction of movement and linked WCs.
6. To **achieve substantial mitigation**, the current system would need to be changed into an enclosure with sufficient three-dimensional space to add resources/structures that increase its complexity and allow for qualitative and quantitative expression of active behaviours and locomotion. Further research is essential to provide quantitative information on the enclosure size that allows for substantial mitigation of restriction of movement in mink. Factors to be considered are:

   6.1. Increasing floor area by up to three times the current cage size, but without additional enrichment, does not reduce the ABMs indicative of WCs. There is no evidence on whether an even larger, but barren, enclosure would be beneficial for mink.

6.2. The current cage height of 45–50 cm is insufficient to allow the largest mink to stand on their hind legs fully stretched, due to their body length. If cage height is increased to accommodate this need, the method of feed provision needs to be changed to ensure that all animals can still reach the feed.
6.3. Although horizontal space cannot be substituted by vertical space, the addition of elevated platforms (one per animal) to allow increased vertical complexity is beneficial to the mink, especially in the case of dams kept with offspring.
6.4. Enclosures that provide space for resources supporting active behaviours and sustained movement (e.g. a running wheel) have been shown to reduce ABMs like stereotypic behaviours and fur chewing. This cannot be achieved with the current dimensions of the cages.
6.5. Provision of solid floor and adequate quality of bedding or soft material in at least part of the enclosure will allow mink to choose among different floor types. This could also help reduce the risk of foot pad damage caused by repetitive friction or pressure on wire mesh flooring, particularly for heavier mink.
6.6. Ensuring that nest boxes are of adequate size to allow the largest individual – or all members of the largest group – enough space to enter the nest box and to accommodate a comfortable resting posture. Additionally, the provision of elevated platform(s) (one per individual, each with a floor area that allows the largest mink to lie down fully stretched on it) would further mitigate this WC.
6.7. Access to an outdoor run is expected to provide mink with additional sensory and motor stimulation to promote active behaviours. However, there are no experimental studies testing whether outdoor access alone, without the presence of enrichments that increase the complexity of the system (including open water), impacts mink welfare.
6.8. Providing open water can mitigate Restriction of movement because it enables mink to exhibit motivated, species-specific behaviours linked to open water use, both in the water and at the water edge. Evidence indicates that the motivation to access open water is distinct from the motivation to access other types of resources.
6.9. The mitigation effect of open water depends on the size, depth and other characteristics of the water available for the mink to perform all or some of those behaviours.
6.10. The welfare benefits of open water on mink are clear, but it remains unstudied whether Restriction of movement can be substantially mitigated by providing only non-water stimuli (e.g. structures and resources that facilitate the expression of other species-specific behaviours through physical exercise, manipulative and exploratory opportunities, and cognitive challenges).

7.1.3 | Inability to perform exploratory or foraging behaviour and linked WCs

1. Inability to perform exploratory or foraging behaviour is linked with WCs Inability to perform play behaviour, inability to chew and prolonged hunger because of shared hazards. Consequently, the conclusions made in relation to the mitigation of Inability to perform exploratory and foraging behaviour apply as well to the hazards causing the linked WCs.
2. The main hazards for Inability to perform exploratory or foraging behaviour are:

   (i) Lack of physical complexity of the cage;
   (ii) Limited cage size (both horizontal and vertical space) to perform exploratory and foraging behaviours;
   (iii) Lack of enrichment and inadequate feed texture and delivery, not providing stimuli for appetitive and consummatory foraging behaviour;
   (iv) Feed restriction (increasing foraging motivation and/or prolonged hunger);
   (v) Lack of open water.

3. Inability to perform exploratory or foraging behaviour applies to all animal categories of mink and thus to all scenarios in this Scientific Opinion, apart from kits during the first 4 weeks of life (i.e. until independently able to leave the nestbox) in Scenario 2.
4. The WC Inability to perform exploratory or foraging behaviour **cannot be prevented** (90%–100% certainty – very likely) or **substantially mitigated** (66%–100% certainty – likely) in the current system due to insufficient structural and manipulable resources (including lack of open water) as well as limited space to accommodate these, lack of feeding enrichment and inadequate feed texture and management.
5. To achieve **limited mitigation**, the following measures can be taken:

   5.1. Changes to the texture of feed, system of delivery that favours natural feeding postures (including solid areas to deliver feed on) and provision of choice between additional chewable resources that stimulate consummatory elements of foraging behaviour. This will correct the hazard shared with WC Inability to chew.
   5.2. Changes in feeding management (including avoiding the provision of more feed than the animals can consume, followed by slimming and flushing) and avoiding genetic selection strategies which promote extremes of body condition or too large litters (which impact on dam energetic requirements) will correct the hazard shared with the linked WC Prolonged hunger.

5.3. Provide animals with quantity and type of enrichment (including feed-related) that can be supplied within the current system. However, due to the current limited space in horizontal and vertical dimensions, the qualitative and quantitative expression of exploratory and foraging behaviour remains restricted.

6. To achieve **substantial mitigation**, the current system needs to be changed into an enclosure that can accommodate resources to increase its complexity, including resources specifically designed to allow for a range of foraging appetitive and consummatory behaviours. Further research is essential to provide quantitative information on which combination and replacement of resources allows for substantial mitigation of exploratory and foraging behaviours for mink. Factors to be considered are:

   6.1. Manipulable resources that elicit exploratory and foraging behaviours.
   6.2. Resources that allow for the fulfilment of multiple motivations and/or engage multiple sensory modalities are more successful at mitigating the WC than resources that fulfil only one motivation/sensory modality.
   6.3. Changes in feed texture, delivery and feeding management as indicated in Points 5.1 and 5.2.
   6.4. Enclosures that both provide more space (at least three times the current system) and multiple resources (e.g. interconnected tugging ropes, platforms, several nestboxes, open water, loose objects) favour exploratory and foraging behaviours, as they increase mink agency over their environment.
   6.5. The mitigating effects of access to an outdoor run and provision of open water for Inability to perform exploratory or foraging behaviour follow the same considerations listed in the conclusion on the WC Restriction of movement.

7.1.4 | Sensorial understimulation

1. The main hazards for the WC Sensorial **understimulation** apply to all scenarios and overlap with the WCs **Restriction of movement** and **Inability to perform exploratory or foraging behaviour** (see conclusions 7.1.2 and 7.1.3);
2. Preventive and mitigating measures for Sensorial understimulation are similar to those for the WCs Inability to perform exploratory or foraging behaviour and Restriction of movement, as a more complex, structured enclosure provides a variety of olfactory, visual and auditory stimuli to mink. Therefore, this **WC cannot be prevented** or **substantially mitigated** in the current system.

7.1.5 | Sensorial overstimulation and linked WCs

1. The WC **Sensorial overstimulation** is linked with the WCs **Handling stress, Soft tissue lesions and integument damage, and Group stress** because of shared hazards for mink kept in group housing.
2. The main hazards for the WC **sensorial overstimulation** apply to all scenarios and are:

   (i) Disturbance of the diurnal rhythm of activity and rest, including human disturbance;
   (ii) Handling;
   (iii) Small cage size resulting in overcrowding when dams are kept with their litter;
   (iv) Close proximity of conspecifics in adjacent cages;
   (v) Same-sex pair housing and group housing of juveniles

3. Preventive and mitigating measures for Sensorial overstimulation are similar to those for the WCs **Handling stress** (see 7.1.6), **Soft tissue lesions and integument damage** (see7.1.5), **and Restriction of movement** (see 7.1.2).

7.1.6 | Soft tissue lesions and integument damage and linked WCs

1. Soft tissue lesion and integument damage is linked with the WC **Group stress** because of shared hazards if more than one mink is kept per cage or enclosure.
2. Hazards for Soft tissue lesions and integument damage are either related to intraspecific aggression or to floor material, and vary depending on the scenarios; however, all scenarios are affected.
3. Soft tissue lesions **cannot be prevented** in the current system, because of intraspecific aggression and cage components (66%–100% certainty – likely.)
4. Hazards specific to dams with kits (Scenario 2) are:

   (i) Overcrowding in standard cages before weaning;
   (ii) Lack of additional drinking water easily accessible for kits before weaning.

   4.1. For Scenario 2, this WC **cannot be substantially mitigated** in the current system, due to overcrowding in standard cages, especially with large litters before weaning (66%–100% certainty – likely).

4.2. **Limited mitigation** for Scenario 2 can be achieved by providing additional drinking water close to the nest box.
4.3. To **achieve substantial mitigation** in the dam with kits (Scenario 2), in addition to the provision of extra drinkers close to the nest box, the enclosure requires an increase in space and provision of structures (e.g. platforms) to allow the dam to retreat from the litter if needed and reduce overcrowding.

5. Hazards for juveniles (Scenario 3) are:

(i) Same-sex pair housing and group housing;
(ii) Lack of sufficient space and lack of resources to avoid competition and provide escape opportunities;

5.1. Soft tissue lesions and integument damage **can be substantially mitigated** in Scenario 3 (juveniles kept in pairs or groups) in the current system (i.e. vertically stacked cages for groups, see EFSA, 2025) if measures mentioned in 5.1.1 and 5.1.2 are taken (90%–100% certainty – very likely). This will also apply to shared hazards of the linked WC Group stress:
5.1.1. Juveniles are kept in pairs of one male and one female (instead of same-sex pairs or group housing) until Sept–Oct (dispersion time) and then individually;
5.1.2. Sufficient resources are provided (i.e. nest boxes, feeding places, enrichment items, platforms) to avoid competition. Further research is required to define and quantify what constitutes 'sufficient' provision in this context.

6. Research is needed to determine the increase in floor space (see Restriction of movement in 6.4.1) and provision of suitable floor types, which prevent the foot pad lesions (e.g. hyperkeratosis, crust and callosities) seen on wire mesh floor, whilst maintaining floor hygiene in an enclosure in all scenarios.

7.1.7 | Handling stress and linked WC

1. Handling stress can under some circumstances, e.g. when females are not receptive, be linked with the WCs **Inability to avoid unwanted sexual behaviour** because of shared hazards associated with handling to repeated transfer of female mink to the mating cages. Consequently, the conclusions made in relation to mitigation of Handling stress apply as well to the hazards causing the linked WC.
2. This WC applies to all age groups of mink and the whole period the animals are kept on farm.
3. Hazards for Handling stress are:

(i) Handling and restraint during production procedures in the farm setting;
(ii) Fearful mink temperament;
(iii) Lack of habituation to humans.

4. Because handling is necessary for certain unavoidable production activities, the WC **cannot be prevented** when mink are kept for fur (90%–100% certainty – very likely).
5. Handling stress **can be mitigated to a limited extent** in the current system if the following measures are applied:

5.1. Minimising the number of handling occasions,
5.2. Using appropriate equipment when handling occurs,
5.3. Training of handlers to have appropriate ability, knowledge and professional competence.
5.4. Reducing the stress associated with human contact through genetic selection for animals responding in a less fearful and aggressive way towards humans.

6. Further research is required to evaluate whether **substantial mitigation** of this WC could be achieved in the current system by incorporating, in addition to the measures listed in point 5, procedures that promote habituation to human presence, potentially through genetic selection for animals with less fearful and aggressive in responses to human interactions.

7.2 | Conclusions on foxes

7.2.1 | General conclusions

1. The most relevant WCs in both Arctic and red foxes kept for fur production are **Restriction of movement, Inability to perform exploratory or foraging behaviour, Sensorial under- or overstimulation** and **Handling stress**, in addition to **Locomotory disorders** for Arctic foxes and **Group stress** for red foxes.

2. Restriction of movement, Inability to perform exploratory or foraging behaviours and Sensorial understimulation share common hazards linked to cage size and barrenness, i.e. space restrictions and lack of environmental complexity of the cages in which foxes are currently kept (as described in EFSA, 2025).

7.2.2 | Restriction of movement and linked WC

1. Restriction of movement is linked with the WC **Inability to perform play behaviour** because of shared hazards. It also shares some hazards with the WC **Inability to perform exploratory or foraging behaviour** (see conclusions 7.2.3). Consequently, the conclusions made regarding the mitigation of Restriction of movement also apply to the hazards causing the linked WCs.
2. This WC applies to all scenarios in this SO.
3. The main hazards are:

   (i) Insufficient floor area to allow motivated types of active behaviours, including locomotion and play;
   (ii) Insufficient cage height and structures to facilitate movement in three dimensions;
   (iii) Inadequate floor material.
4. The dimensions of the cages in the current system severely restrict the movement, as well as the amount and type of resources that can be provided, thereby severely restricting both the qualitative and quantitative expression of active behaviours and sustained locomotion. Therefore, the WC Restriction of movement **cannot be prevented** (90%–100% certainty – very likely) **or substantially mitigated** (90%–100% certainty – very likely) in the current system.
5. Some modifications (such as the provision of a bone) can be done in the current system and may stimulate certain active types of behaviour, but they are insufficient to support sustained locomotion or the full range of motivated active behaviours. Thus, Restriction of movement **can only be mitigated to a limited extent** in the current system.
6. **To achieve substantial mitigation**, the current system needs to be changed to enclosures that provide additional space in three dimensions, including space required to add more structures to increase complexity. Further research is essential to provide quantitative information on fox enclosure sizes that allow for substantial mitigation of Restriction of movement. Factors to be considered are:

   6.1. While providing more than 1.2 m^2 of floor space per animal for pair- or group-housed juvenile red foxes increased synchronised activity and reduced bite marks in females compared to 0.6 m^2, this area remains insufficient to support sustained species-specific active behaviours and locomotion. A substantially longer and wider enclosure than those currently in use is necessary to meet the behavioural needs of the species. More research is needed to indicate how much the floor area for a fox enclosure needs to be increased to provide substantial mitigation of Restriction of movement in all scenarios.
   6.2. The addition of elevated structures is beneficial because it allows foxes to reach elevated positions, e.g. for vigilance behaviour, which involves sitting upright. The height of the enclosure needs to accommodate this.
   6.3. To accommodate species-specific postures and vertical movement, enclosures need to allow foxes to stand fully upright on their hind legs, walk, jump and stand beneath platforms, and sit or stand on top of platforms without bending their legs or head. However, further research is needed to define quantitative cage height requirements.
   6.4. Elevated platforms with sufficient horizontal surface area(s) to accommodate the simultaneous resting of all individuals support group resting behaviour.
   6.5. The addition of objects and structures, as well as space for functional areas, is expected to promote activity and to help reduce abnormal behaviours. The dimensions of the current cages do not allow the inclusion of enrichment, such as sand boxes and a permanent nest box, or the establishment of functional areas. Further research is needed to provide substantiated information on the mitigating effect of combinations of additional space and complexity.
   6.6. Provision of solid floor and adequate substrate in at least part of the enclosure will allow foxes to choose among different floor types that support movement and other active behaviours. The available evidence indicates that access to natural substrates such as sand (or earth) increases the occurrence of play behaviour.

7.2.3 | Inability to perform exploratory or foraging behaviour and linked WC

1. Inability to perform exploratory or foraging behaviour is linked with the WC **Inability to chew** because of shared hazards.
2. This WC applies to all scenarios in this SO.
3. Hazards for Inability to perform exploratory or foraging behaviour and linked WC are identified considering animal needs in relation to the performance of appetitive and consummatory behaviours and are:

   (i) Lack of physical complexity of the cage;
   (ii) Limited cage size (both horizontal and vertical space) to perform exploratory and foraging behaviour;
   (iii) Lack of enrichment providing stimuli for appetitive and consummatory foraging behaviour (including inadequate

feed texture for consummatory behaviour and lack of resources that allow/promote seeking, working for food, hunting and scavenging);
(iv) Flooring substrate not suitable for digging and vole jumps.

4. The dimensions of the cages in the current system severely restrict the size, amount and type of resources that can be provided, thereby severely restricting the possibility to perform exploratory and foraging behaviours. Therefore, Inability to perform exploratory or foraging behaviour **cannot be prevented** (90%–100% certainty – very likely) **or substantially mitigated** (90%–100% certainty – very likely) in the current system.
5. Foxes have a highly diverse repertoire of exploratory and foraging behaviours. Therefore, given the dimensions of current cages, to achieve **limited mitigation** the following measures can be taken:

5.1. Provision of basic resources and structural enrichments that promote exploratory and foraging behaviour, especially if it is related to feed (e.g. bones, which also allow chewing), replaced before they are destroyed or varied to sustain interest. More research is needed regarding the characteristics of enrichment facilitating the full behavioural repertoire of foraging and exploration.
5.2. Changing the texture of feed and providing resources suitable for chewing. Often, this will require a change of feed delivery method. This would correct the hazard shared with the linked WC Inability to chew. Further research is needed to document how feed texture can be efficiently changed.

6. To achieve **substantial mitigation**, the current system needs to be changed to enclosures that provide multiple and diverse resources to increase complexity, as well as additional space in the three dimensions to allow the use of complex enrichment. Further research is essential to provide quantitative information on fox enclosure size and environmental stimulation levels that allow for substantial mitigation of Inability to perform exploratory or foraging behaviour. Factors to be considered are:

6.1. The enclosure needs to be of sufficient size in the three dimensions to accommodate the inclusion of enrichments of different types and allow the fox to perform active exploratory and foraging movements.
6.2. The addition of elevated structures (e.g. platforms) is beneficial because it allows foxes to access elevated positions, e.g. for vigilance behaviour, which involves sitting upright.
6.3. To accommodate species-specific postures and vertical movement, enclosures need to allow foxes to stand fully upright on their hind legs, walk, jump and stand beneath platforms, and sit or stand on top of platforms without bending their legs or head. However, further research is needed to define quantitative cage height requirements.
6.4. Digging substrate (i.e. sand or earth) has a mitigating effect on the WC. The strength of the mitigating effect depends on the quality and quantity of the substrate. Clean, loose substrate with a depth of at least 15 cm will have a stronger mitigating effect than a shallower layer. Foxes use 80 × 40 cm boxes for digging, but comparative studies on sand box size effects on the behaviour are lacking.
6.5. Changes in feed texture, delivery and feeding management as indicated in point 5.2.

7.2.4 | Sensorial understimulation

1. The main hazards for **Sensorial understimulation** overlap with the WCs **Restriction of movement** and **Inability to perform exploratory or foraging behaviour** (see conclusions 7.2.2 and 7.2.3)
2. The WC Sensorial understimulation applies to all scenarios in this SO.
3. Prevention and mitigation measures for sensorial understimulation, including their uncertainty assessment, are virtually identical to those for the WCs **Inability to perform exploratory or foraging behaviour** and **Restriction of movement**, as a more complex, structured enclosure provides a variety of olfactory, visual and auditory stimuli to foxes. Therefore, this WC cannot be **prevented** or **substantially mitigated** in the current system.

7.2.5 | Sensorial overstimulation and linked WCs

1. **Sensorial overstimulation** is linked with the WC **Resting problems** and **Group stress** because of shared hazards. Consequently, the conclusions made in relation to the mitigation of Sensorial overstimulation also apply to the hazards causing the linked WC.
2. This WC applies to all scenarios of this SO.
3. Hazards for Sensorial overstimulation and the linked WC are:

(i) Lack of nest box or den-like structure for resting and to function as a retreat,
(ii) Lack of an elevated place for surveillance and resting,
(iii) Disturbance by neighbouring animals and group housing.

4. Due to dimension of the cage that does not allow to correct all the hazards listed, this WC **cannot be prevented** (90%–100% certainty – very likely) **or substantially mitigated** (66%–100% certainty – likely) in the current system.
5. This WC **can be mitigated to a limited extent in the current system** by providing one or more of the following measures:

   5.1. All-year availability of a nest box or a den-like structure (which has a tunnel entrance);
   5.2. Manipulating the relative social status of neighbouring vixens (avoiding close proximity of older dominant to subordinate primiparous animals);
   5.3. Increasing the space between individuals kept in different cages.
   5.4. Research is needed to clarify the requirements of 4.2 and 4.3.

6. To achieve **substantial mitigation**, the current system needs to be changed to enclosures that provide additional space in three dimensions, to allow provision of resources for retreating and resting, for vigilance behaviour and to reduce animal density. Further research is essential to provide quantitative information. Factors to be considered are:
   6.1. Reduce animal density by increasing the floor size of the enclosure beyond the space currently provided (see conclusions 7.2.6).
   6.2. Adding nest boxes or den-like structures all year round.
   6.3. Increase the height of the enclosure to allow vigilance behaviour (See conclusions 7.2.2 and 7.2.3).

7.2.6 | Locomotory disorders (including lameness) in Arctic foxes

1. The WC Locomotory disorders (including lameness) applies to all scenarios in this SO.
2. Several disorders that may impact the locomotion and welfare of farmed Arctic foxes have been recorded in the current system. These include bent feet (also called bowed legs or leg weakness), front leg turn (also called abduction or adduction of the forelegs), osteochondrosis and foot lesions. Further studies are needed to determine the extent, severity and pathogenesis of the disorders.
3. Hazards for the WC Locomotory disorders (including lameness) are:

   (i) Genetic predisposition as a side-effect of selection for production traits,
   (ii) Inappropriate feeding management (mainly excess of energy content resulting in obesity),
   (iii) Inadequate floor material.

4. Locomotory disorders were found to be most relevant in Arctic foxes but can also occur in red foxes, with similar hazards. The prevalence of locomotory disorders was found to be lower in red foxes than in Arctic foxes. More studies are needed to determine the extent, severity and pathogenesis of the disorder in red foxes.
5. Whether this WC can be **prevented** in the current system is **unknown**.
6. The WC can be **mitigated to a limited extent** in the current system by addressing individual hazards, i.e. adjusting nutrition to avoid obesity, or applying an effective selection scheme to select breeding animals free from conditions like bent feet, or providing solid flooring in at least part of the cage.
7. **Substantial mitigation** of the WC requires a multifaceted approach. Further research is essential to provide quantitative information about these measures and their potential effects on fox welfare. Factors to be considered (of which the points 7.1, 7.2, 7.3 can be done in the current system) are:

   7.1. Implementing genetic selection against traits like bent feet, front leg turn, osteochondrosis, including the associated traits fast growth and obesity, which are genotypically and phenotypically correlated with bent feet.
   7.2. Careful management of body condition.
   7.3. Ensuring nutritionally balanced diets.
   7.4. Improving housing conditions by providing at least some area with solid flooring and sufficient floor area and enclosure height to allow comfortable movement.

8. Providing appropriate veterinary care to affected animals would mitigate the impact, although not the causes.

7.2.7 | Group stress in red foxes

1. The WC **Group stress** applies to all red fox scenarios in this SO.
2. The main hazards are:

   (i) Disturbance by neighbouring animals
   (ii) Group housing, especially after the onset of dispersal motivation.

3. The WC Group stress **cannot be prevented** in the current system due to high animal density on the farm and within group cages (90%–100% certainty – very likely).
4. In individually housed adult foxes, measures which can individually provide **limited mitigation** of Group stress in the current system are:

    4.1. Providing the possibility for hiding from near neighbours by enabling visual isolation (e.g. year-round availability of nest boxes which have a tunnel entrance),
    4.2. Manipulating the relative social status of neighbouring vixens (avoiding close proximity between older dominant and subordinate primiparous animals).

5. In juvenile foxes kept in pairs or groups, housing at 1.2 m^2/animal reduces the WC compared to 0.6 m^2/animal, which provides **limited mitigation** in the current system, although optimal space is unknown.
6. In individually-housed adult foxes, it is **unknown** if **substantial mitigation** of group stress can be achieved in the current system by applying the combination of all individual mitigating factors and increasing the space between individuals. Further research is needed to understand the amount of space and whether it can be achieved in the current system.
7. In juvenile foxes kept in pairs or groups, Group stress can be **substantially mitigated** in enclosures by:

    7.1. Moving them from larger litter groups to sibling pairs or individual housing after the onset of dispersal motivation in autumn.
    7.2. Providing a greater number and distribution of important resources such as feed, enrichment items, platforms and nest boxes, so that each individual has uncontested access.
    7.3. Increasing enclosure size to accommodate the number of animals and reduce animal density beyond the space currently provided. The optimal space is unknown.

7.2.8 | Handling stress and linked WCs

1. Handling stress can under some circumstances, e.g. when females are not receptive and in the process of artificial insemination, be linked with the WCs **Inability to avoid unwanted sexual behaviour**. Handling stress is linked also to the WC **Resting problems** because of shared hazards.
2. This WC applies to all scenarios of this SO.
3. Hazards for Handling stress and linked WCs are:

    (i) Handling and restraint during production procedures in the farm setting,
    (ii) Fearful temperament,
    (iii) Lack of habituation to humans.

4. Due to the necessity for handling and restraint during essential production procedures, the WC **cannot be prevented** (90%–100% certainty – very likely) **or substantially mitigated** (90%–100% certainty – very likely) in the current system.
5. Handling stress can be **mitigated to a limited extent** in the current system by:

    5.1. Minimising the number of handling occasions,
    5.2. Using appropriate methods and equipment,
    5.3. Training of handlers to have appropriate ability, knowledge and professional competence.
    5.4. Habituation to human presence can also be beneficial.

6. These measures, when applied during handling for reproductive management, will also address the hazards related to Inability to avoid unwanted sexual behaviour.
7. Provision of a retreat area may reduce stress associated with fear of humans, and also addresses the hazards associated with Resting problems, but other measures should be implemented to ensure adequate habituation to human presence.
8. Further research is required to evaluate whether **substantial mitigation** of this WC could be achieved in the current system by combining selective breeding against fearful temperament with measures to address the other hazards described in points 5 and 6.

7.3 | Conclusions on raccoon dogs

7.3.1 | General conclusions

1. For raccoon dogs, evidence for specific behavioural needs (as defined in this SO) and motivations underlying their behaviour and welfare of this species is extremely limited. Knowledge from other species, e.g. other canids, can,

to some extent, be used due to shared phylogeny, although important differences exist between species (see EFSA, 2025). This is a critical, highly relevant gap in knowledge and more research is needed.
2. The five most relevant WCs in raccoon dogs kept for fur production are **Restriction of movement**, **Inability to perform exploratory or foraging behaviour**, **Sensorial under- and/or overstimulation**, **Isolation stress** and **Locomotory disorders (including lameness)**.

7.3.2 | Restriction of movement

1. Restriction of movement is linked with the WC **Inability to perform play behaviour** because of shared hazards. Consequently, the conclusions made in relation to mitigation of Restriction of movement also apply to the hazards causing the linked WCs.
2. The WC Restriction of movement **applies to all scenarios** (i.e. all age groups) and the whole period the animals are kept on farm.
3. Hazards for Restriction of movement and the linked WC are identified considering animal needs in relation to quantitative and qualitative movement, and they are:

   (i) Insufficient floor area to allow motivated types of active behaviours, including locomotion and play,
   (ii) Insufficient cage height and structures to facilitate movement in three dimensions,
   (iii) Floor material (wire mesh) potentially limiting proper walking and other movement.
   (iv) Lack of possibility for animals to distance themselves from faeces and lack of opportunity to establish latrines

4. Due to limited floor area, cage height and lack of structural complexity, the WC Restriction of movement **cannot be prevented** (90%–100% certainty – very likely) **or substantially mitigated** (90%–100% certainty – very likely) in the current system.
5. In the current system, Restriction of movement can be **mitigated to a limited extent** by the addition of resources and cage structures. Such changes are expected to stimulate active behaviours and some locomotion, but not to allow sustained locomotion or all motivated types of active behaviours.
6. To achieve **substantial mitigation**, the current system needs to be changed to enclosures providing additional space in the three dimensions, including space required to add structures (e.g. tubes, platforms, etc.) to increase complexity and allow species-specific behaviours. Further research is essential to provide quantitative information on raccoon dog enclosure size that allows for substantial mitigation of restriction of movement. Factors to be considered are:

   6.1. Limited available data suggest that doubling the floor area from 1.2 to 2.4 m^2 has minor mitigating effects on the level of activity. Case studies suggest that the level of activity in raccoon dogs kept in enriched enclosures of more than 30 m^2 will approach the level of activity reported in the wild.
   6.2. To allow raccoon dogs to reach elevated positions, e.g. for vigilance, the addition of elevated structures (e.g. platforms) is beneficial. The height of the enclosure needs to allow raccoon dogs to stand and sit comfortably at all levels provided. There is no scientific information to indicate the increase in height of a raccoon dog enclosure that will provide substantial mitigation of Restriction of movement.
   6.3. The addition of objects (e.g. manipulable objects for biting) and other structures (e.g. tubes or platforms large enough for the animal to lie, sit or stand on) will stimulate activity.
   6.4. Provision of solid floor and adequate substrate in at least part of the enclosure will allow raccoon dogs to choose among different floor types suitable for movement.
   6.5. Sufficient floor area and suitable flooring type in the enclosure are required for establishing latrines.

7.3.3 | Inability to perform exploratory or foraging behaviours and linked WCs

1. Inability to perform foraging or exploratory behaviour is linked with the WCs **Inability to chew** and **Gastroenteric disorders** because of shared hazards.
2. The WC Inability to perform exploration and foraging behaviour **applies to all scenarios** (i.e. all age groups) and the whole period the animals are kept on farm.
3. Hazards for Inability to perform exploratory or foraging behaviours and hazards shared with the linked WCs are identified considering animal needs in relation to the performance of explorative as well as appetitive and consummatory foraging behaviours, and they are:

   (i) Limited cage size and lack of physical complexity (including lack of resources) providing stimuli for exploratory, appetitive and consummatory foraging behaviour;
   (ii) Insufficient feed texture and delivery method for consummatory behaviours including chewing;
   (iii) Feed being inappropriate and not fulfilling the dietary requirements.

4. The dimensions of the cages in the current system severely restrict the size, amount and type of resources that can be provided, thereby severely restricting the possibility to perform exploratory and foraging behaviours. Because of that, inability to perform exploratory and foraging behaviour **cannot be prevented** (90%–100% certainty – very likely) or **substantially mitigated** (66%–100% certainty – likely) in the current system, due to the hazards mentioned.
5. The omnivorous diet and opportunistic foraging nature of raccoon dogs suggest that their exploratory and foraging behaviours are highly diverse. Therefore, given the dimension of current cages, to achieve **limited mitigation**, the following measures can be taken:

   5.1. Provision of enriching resources and structures within the space available, that have the properties of maintaining attraction and are replaced as necessary to maintain engagement over time. More research is needed regarding the characteristics of enrichment facilitating the full behavioural repertoire of foraging and exploration.
   5.2. Changing the texture of feed and providing resources suitable for chewing. Often, this will require a change in the feeding method from trays placed outside cages, forcing the animal to eat through wire mesh. This will correct the hazard linked to the WC Inability to chew. Further research is needed to document how feed texture can be efficiently changed.
   5.3. Providing feed that meets the nutritional requirements of raccoon dogs, including straw. This will correct the hazard linked to the WC Gastroenteric disorders.

6. To achieve **substantial mitigation**, the current system needs to be changed to enclosures that provide additional space in the three dimensions and inclusion of multiple and diverse resources to increase complexity. In addition, changes in feed texture, delivery and feeding management as indicated in Points 5.2 and 5.3, are required. Further research is essential to provide quantitative information on raccoon dog enclosure size and stimulation level that allow for substantial mitigation of Inability to perform exploratory and foraging behaviour.

7.3.4 | Sensorial understimulation

1. The main hazards identified for Sensorial understimulation are similar to the hazards for the WC Restriction of movement and **Inability to perform exploratory or foraging behaviour**.
2. Prevention and mitigation possibilities and measures for sensorial understimulation are similar to those for the WCs Inability to perform exploratory or foraging behaviour and Restriction of movement, as a more complex, structured enclosure provides a variety of olfactory, visual and auditory stimuli to raccoon dogs. Therefore, this WC cannot be **prevented** or **substantially mitigated** in the current system.

7.3.5 | Sensorial overstimulation and linked WCs

1. Sensorial overstimulation is linked with the WCs **Handling stress** and **Resting problems** because of shared hazards.
2. The WC Sensorial over-stimulation **applies to all scenarios** of this SO.
3. Hazards for Sensorial over-stimulation and linked WCs, Handling stress and Resting problems are:

   (i) Lack of nest box for resting and to function as retreat.
   (ii) Close presence of own faeces and faeces from neighbouring animals.
   (iii) Handling.
4. Sensorial overstimulation **cannot be prevented** (66%–100% certainty – likely) due to the hazards listed above.
5. Sensorial overstimulation **can be substantially mitigated** (50%–100% certainty - more likely than not) in the current system by providing all of the following measures:

   5.1. Permanent provision of a retreat area (e.g. nest box), giving animals more choice and control over the environment and allowing to perform the species-typical winter dormancy behaviour. Further research is required to develop quantitative recommendations for this mitigation.
   5.2. Regular removal of manure. Further research is needed to know the required thoroughness and frequency of the removal procedures.
   5.3. Minimising the number of handling occasions (including artificial insemination), and using of appropriate gentle methods and equipment, as well as training of handlers to have appropriate competence.

7.3.6 | Isolation stress

1. The WC Isolation stress **applies to Scenarios 1 and 2** (adult breeders) of this SO.
2. The main hazard for this WC is Single housing.

3. Raccoon dogs are highly social, and both parents are involved in the rearing of offspring and express parental behaviour. The social needs of raccoon dogs in captivity are unstudied, except for juveniles, where benefits of increased group sizes above pair housing have been shown.
4. Mitigation of the WC requires that animals are not single-housed. Due to lack of space in the current system, the welfare consequence **cannot be prevented** (90%–100% certainty – very likely) **or substantially mitigated** (90%–100% certainty – very likely) **or can be mitigated to a limited extent** in the current system. Further research is essential to provide quantitative information on floor size (to mitigate Restriction of movement) and resources allowing withdrawal from conspecifics in the enclosure.

7.3.7 | Locomotory disorders (including lameness)

1. The WC Locomotory disorders (including lameness) apply to all scenarios in this SO.
2. There is evidence that bent feet and other disorders that may impact the locomotion and welfare of raccoon dogs exist in farmed raccoon dogs. Further prevalence studies are needed to determine the extent, severity and causality of the problem.
3. Hazards for the WC Locomotory disorders (including lameness) are:

   (i) Genetic predisposition as a side-effect of selection for production traits;
   (ii) Inappropriate feeding management, not fulfilling the dietary requirements of raccoon dogs and potentially leading to obesity;
   (iii) Inadequate floor material.

4. Whether this WC can be **prevented or substantially mitigated** in the current system is **unknown**. Measures proposed in conclusion for foxes (see 7.2.5) can likely be applied to raccoon dogs.
5. **Substantial mitigation** of the WC most likely requires a multifaceted approach. Further research is essential to provide quantitative information about these measures and their potential effects in raccoon enclosures. Factors to be considered are:

   5.1. Implementing genetic selection against traits like bent feet, front leg turn and osteochondrosis, including the potentially associated traits fast growth and obesity,
   5.2. Careful management of body condition,
   5.3. Ensuring nutritionally balanced diets,
   5.4. Improving housing conditions by providing at least some solid floor areas, and increasing floor area and enclosure height to allow comfortable movement.

6. Providing appropriate veterinary care to affected animals would mitigate the impact, although not the causes.

7.4 | Conclusions on chinchilla

7.4.1 | General conclusions

1. The most relevant WCs in chinchillas kept for fur production are **Restriction of movement, Predation stress, Inability to perform exploratory or foraging behaviour, Sensorial under- and/or overstimulation, Inability to perform comfort behaviour** and **Resting problems.**
2. These WCs apply to all scenarios (i.e. all age groups) and the whole period the animals are kept on farm (from birth until pelting).

7.4.2 | Restriction of movement and linked WCs

1. Restriction of movement is linked with the WC **Inability to perform play behaviour** because of shared hazards. Consequently, the conclusions made in relation to the mitigation of Restriction of movement apply as well to the hazards causing the linked WC.
2. Hazards for Restriction of movement and the linked WC are identified considering animal needs in relation to quantitative and qualitative movement, and they are:

   (i) Insufficient floor area to allow motivated types of active behaviours, including locomotion and play,
   (ii) Insufficient height and complexity (i.e. presence of structures) in the cage,
   (iii) Inadequate floor material (hindering locomotion due to foot and limb injury).

3. Due to the limited cage floor area and height, restriction of movement **cannot be prevented** (90%–100% certainty – very likely) **or substantially mitigated** (66%–100% certainty – likely) in the current system.
4. Restriction of movement **can be mitigated to a limited extent** in the current system by providing elevated structures and ensuring suitable floor materials (at least a portion of solid floor).
5. **To achieve substantial mitigation**, current systems need to be changed to enclosures that provide additional space in three dimensions, including space required to add more structures to increase complexity. Further research is essential to provide quantitative information on chinchilla enclosure sizes that allow for substantial mitigation of restriction of movement. Factors to be considered are:

    5.1. There is no scientific information to indicate how great an increase of floor area for a chinchilla enclosure will provide substantial mitigation of restriction of movement.
    5.2. Increasing the floor area without additional complexity (particularly in the form of hiding places) is unlikely to substantially reduce ABMs indicative of welfare problems.
    5.3. The current cage height (approx. 40 cm) does not accommodate the height of jumps that chinchillas make when they are startled (up to 1–1.5 m).
    5.4. Although horizontal space cannot be substituted by vertical space, chinchillas make extensive use of increased vertical complexity provided by elevated structures (e.g. platforms, tubes, boxes).
    5.5. Enclosures need to provide sufficient room for resources such as hiding places and sand-baths that are important to mitigate other welfare consequences (i.e. predation stress, resting behaviour and inability to perform comfort behaviour).
    5.6. Further research is needed to elucidate the welfare consequences of collars worn by female chinchillas to restrict access to the male corridor, and the implications of these for the required dimensions of other resources (boxes, tubes).
    5.7. Chinchillas prefer to rest on a solid floor. Provision of a solid floor and adequate bedding or soft material in at least part of the enclosure will allow chinchillas to choose among different floor types suitable for movement and rest.

7.4.3 | Predation stress and linked WC

1. As a prey species, chinchillas may be susceptible to perceive humans as a predator. Therefore, **Predation stress** and the linked WC **Handling stress** resulting from human handling are highly relevant for chinchillas. Consequently, the conclusions made in relation to the mitigation of Predation stress apply as well to the hazards causing the linked WC.
2. The main hazards relate to:

    (i) Lack of shelter for hiding.
    (ii) Barren cage environment.
    (iii) Production procedures involving handling or close human contact.

3. Since production procedures involving handling are inherent to the current system, predation stress **cannot be prevented** (90%–100% certainty – very likely) or **substantially mitigated** (66%–100% certainty – likely).
4. Predation stress **can be mitigated to a limited extent** in the current system by providing a shelter for hiding, providing enrichment to the cage and ensuring that staff have appropriate ability, knowledge and professional competence. Knowledge is lacking on the potential of genetic selection for reduced fearfulness and appropriate strategies to promote habituation to humans.

7.4.4 | Inability to perform exploratory or foraging behaviours, and linked WCs

1. Inability to perform foraging and exploratory behaviours is linked with the WCs **Inability to chew** and **Gastroenteric disorders** because of shared common hazards.
2. The main hazards are:

    a. Combination of cage dimensions and lack of physical complexity, including enrichment providing stimuli for appetitive and consummatory foraging behaviour,
    b. Lack of feed texture for consummatory behaviour,
    c. Inappropriate feed.

3. Due to the combination of cage dimensions and lack of physical complexity the welfare consequence Inability to perform exploratory and foraging behaviours **cannot be prevented** (90%–100% certainty – very likely) **or substantially mitigated** (66%–100% certainty – likely) in the current system.

4. Inability to perform exploratory and foraging behaviour **can be mitigated to a limited extent** in the current system with:

   4.1. provision of enrichment that increases physical complexity (e.g. cage shelves, boxes, tubes, tunnels).
   4.2. provision of materials for foraging (i.e. hay and varied plant material).
   4.3. the consummatory aspects of exploratory and foraging behaviour as well as the common hazards of the linked WC Inability to chew and Gastro-enteric disorders can be corrected by changing the texture of feed and/or providing enrichment materials suitable for gnawing and by providing feed of good nutritional and hygienic quality.
5. To achieve **substantial mitigation**, current systems need to be changed to provide chinchillas with larger, complex enclosures with vertical structures (i.e. elevated platforms) and tunnels/tubes, and with plentiful foraging materials (i.e. hay and varied plant material), as well as measures listed in 4.3. Further research is essential to provide quantitative information on the amount of these elements to be provided and the space needed to accommodate them.

7.4.5 | Sensorial understimulation and linked WCs

1. Sensorial understimulation is linked with the WCs **Isolation stress** and **Inability to perform play behaviour** due to shared hazards.
2. The main hazards are:

   (i) Lack of physical complexity of the cage and enrichment,
   (ii) Use of single housing systems.

3. Due to lack of physical complexity of the cage, as well as to space restrictions, the welfare consequence sensorial understimulation **cannot be prevented** (90%–100% certainty – very likely) or **substantially mitigated** (66%–100% certainty – likely) in the current system.
4. To achieve **substantial mitigation**, current systems need to be changed to provide enclosures incorporating the same resources listed for addressing the inability to perform exploratory and foraging behaviour (see Conclusions in 7.4.4).
5. The hazards of single housing, which is shared with the linked WC Isolation stress can be corrected by housing pairs or groups for dams with kits and juveniles (Scenario 2 and 3, as it is currently a common practice).
6. In the case of adults (Scenarios 1 and 4), the same hazard cannot be corrected in the current system because the space in the cage is insufficient to keep pair- or group-housed adults.

7.4.6 | Sensorial overstimulation

1. Sensorial overstimulation is mainly due to:

   (i) lack of shelter,
   (ii) presence of aversive and unpredictable noises.
   (iii) inability to escape from undesired social contact with cage mates.

2. Sensorial overstimulation **cannot be prevented** (66%–100% certainty – likely) in the current system due to the inability to prevent all external disturbance.
3. Sensorial overstimulation **can be substantially mitigated** (66%–100% certainty – likely) by providing structural complexity allowing shelter for hiding and escape from undesired social contact in group cages, and by minimising sudden and aversive noises.
4. Further research is required to develop quantitative recommendations for enclosure conditions which provide adequate ability to escape from undesired social contact with cage mates.

7.4.7 | Inability to perform comfort behaviour

1. The WC Inability to perform comfort behaviour in the current system results from the lack of, or insufficient access to, sand-bathing substrate.
2. Inability to perform comfort behaviour **can be prevented** in the current system by the provision of permanent access to a bath with clean and appropriate sand (e.g. quartz-free sand) (90%–100% certainty – very likely).
3. **To achieve substantial mitigation** in the current system, daily access could be provided for a limited period. However, further research is needed to provide quantitative information about the period of access required.

7.4.8 | Resting problems

1. Resting problems in the current system result from:

    (i) Lack of a suitable resting area,
    (ii) Improper light conditions,
    (iii) Disturbances linked to production procedures.

2. Due to the necessary production procedures during the working day, the WC **cannot be prevented** in the current system (90%–100% certainty – very likely).
3. Resting problems **can be substantially mitigated** in the current system by the provision of an enclosed resting area (e.g. shelter, box or tube), elevated platforms, by the provision of a diurnal lighting pattern allowing the animals to maintain their natural circadian rhythms and by minimising noises and human presence at any time (66%–100% certainty – likely).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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APPENDIX A

TABLE A.1 Problem formulation (APRIO – Agent-Pathway-Receptor-Intervention-Output) for the assessment questions related to ToR2a and ToR2b for a scientific opinion on the welfare of animals kept for fur production.

Number as appeared in the mandate	Mandate element	Agent	Pathway	Receptor	Intervention	Output	Lower or higher order sub-questions
ToR2a	Identify the most relevant welfare consequences and corresponding hazards in relation to common husbandry systems and practices for fur production	The most common husbandry system(s) (including field-tested systems) and rearing practices identified in ToR1b	The theoretical relationships between the husbandry systems and practices identified in ToR1b that may lead to the welfare consequence(s)	All animal categories for the following species: American mink (*Neogale vison*) Red fox (*Vulpes vulpes*) Arctic fox (*Vulpes lagopus*) Raccoon dog (*Nyctereutes procyonoides*) Chinchilla (*Chinchilla lanigera*)	NA	To identify max 5 highly relevant welfare consequences for each common husbandry system and practices associated to the species and animal category	What are (and briefly describe) the common husbandry systems (including field-tested systems) and practices for keeping mink, foxes, raccoon dog and chinchilla in the EU? What are the most relevant welfare consequences affected by each of the agents (i.e. husbandry systems/practices) in terms of occurrence, duration and severity What are the hazards for each of the most relevant welfare consequence?
ToR2b	For the most relevant welfare consequences (maximum 5), assess whether the welfare consequences identified above can be prevented or substantially mitigated under current farming conditions or other field-tested farming systems. The welfare assessment will be focused on the welfare consequences considered highly relevant in a certain animal category	The most common husbandry system(s) (including field-tested systems) and rearing practices identified in ToR1b	The theoretical relationships between the husbandry systems and practices identified in ToR1b that lead to the welfare consequence(s)	Animal categories of the species listed above that have been associated with the 5 highly relevant welfare consequences	The possibility/existence of measures applied to the hazards with the objective to prevent or substantially mitigate the welfare consequences	Assessment of the effect of the interventions on the most relevant welfare consequences	Can interventions applied to the identified hazard(s), prevent each of the most relevant welfare consequence in the current husbandry system? If the welfare consequence(s) cannot be prevented, can it/they be substantially mitigated in the current husbandry system?

TABLE A.2 The approach for conducting the assessment related to ToR2a and ToR2b for a scientific opinion on the welfare of animals kept for fur production.

	Sub-question	Evidence needed	Data collection	Assessment method to be used	Output
ToR2a. Identify the most relevant welfare consequences and corresponding hazards in relation to common husbandry systems and practices for fur production	1. What are (and briefly describe) the common husbandry systems (including field-tested systems) and practices for keeping mink, foxes, raccoon dog and chinchilla in the EU? 2. What are the most relevant welfare consequences affected by each of the agents (i.e. husbandry systems/practices)? 3. What are the hazards for each of the most relevant welfare consequence?	(1) Description of the husbandry conditions and practices for mink, foxes, raccoon dogs and chinchilla in the EU. (2), (3) Information on welfare consequences and their relationship with the agents (i.e. hazards) included in the husbandry systems and practices described.	(1) Literature search has been outsourced. Contractor will synthetise literature search and briefly describe the husbandry systems and practices. Information will be complemented with expert knowledge and information retrieved by stakeholders. A public call for evidence and stakeholder consultation are planned to provide relevant information on husbandry systems and practices, included in ToR1a and b. (2), (3) Data will be obtained following: • Literature review in peer reviewed articles, grey literature, industry reports. • Expert knowledge • Information retrieved by the public call for evidence and ad hoc stakeholder consultation if needed	(1) Expert synthesis of data collected, with ad hoc stakeholders' consultation if needed (2) Expert elicitation via exercise on the selection of most relevant welfare consequences (max 5 per species, see ToR2b) (3) Expert synthesis of data collected, with ad hoc stakeholders' consultation if needed	(1) Selection of the most common husbandry systems and practices from Art 29 (ToR1b in the mandate). (2) A list of the most relevant welfare consequences in the defined housing systems for each of the five species. A description of the welfare consequences in accordance with the guidance (EFSA AHAW Panel, 2022) including species specificities related to the species in the mandate and relevant animal categories. (3) A list of the hazards for each of the most relevant welfare consequences.
ToR2b. For the most relevant welfare consequences (maximum 5), assess whether the welfare consequences identified above can be prevented or substantially mitigated under current farming conditions or other field-tested farming systems. The welfare assessment will be focused on the welfare consequences considered highly relevant in a certain animal category.	4. Can interventions applied to the identified hazard(s), prevent each of the most relevant welfare consequence in the current husbandry system? 5. If the welfare consequence(s) cannot be prevented, can it/they be substantially mitigated in the current husbandry system?	(4), (5) A demonstration or description of the effect of the measures on the relevant welfare consequences (previously selected).	(4), (5) Data will be obtained following: • Literature review of peer reviewed articles, grey literature, industry reports • Ad hoc stakeholders and member states consultation if needed • Expert knowledge and group discussion.	(4), (5) Expert synthesis of data collected, with ad hoc stakeholders' consultation if needed	(4), (5) Identify and describe the preventive and mitigative measures for the most relevant welfare consequences. (5) The effect of the measures will be described using a narrative text, figures and tables as appropriate.

APPENDIX B

B.1 | LITERATURE SEARCH CARRIED OUT FOR THE ASSESSMENT OF WELFARE CONSEQUENCES OF MINK

Database: Scopus

Date of the search: 9-15-2024 (All years,/since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY ((“farmed mink*” OR “American mink” OR “Neovison vison” OR “Mustela vison” OR “Neogale vison”) AND (“farm*” OR “captiv*” OR “welfare” OR “behaviour*” OR “behaviour” OR “health” OR “stress*” OR “distress” OR “fear*” OR “restrict*” OR “forag*” OR “explor*” OR “movement” OR “locomot*” OR “understim*” OR “overstim*” OR “boredom” OR “play*” OR “rest*” OR “social*” OR “group*” “handl*” OR “separat*” OR “pain” OR “injur*” OR “lesion$” OR “stereotyp*” OR “abnormal*” OR “fur chew*” OR “tail chew*” OR “mutil*” OR “enrich*” OR “slimming” OR “obes*” OR “pelt$” OR “carcass”) AND NOT (“molec*” OR “cell*” OR “drug” OR “vaccin*” OR “compute*” OR “model” OR “sars*” OR “virus” OR “viral” OR “gene*” OR “chromosom*”) AND NOT (“predat*” OR “wild” OR “feral” OR “distribution” OR “native” OR “European mink” OR “pollut*”)) AND PUBYEAR >1999 AND PUBYEAR <2024.

Result: 68. Result after screening for relevance: 47.

B.2 | LITERATURE SEARCH CARRIED OUT FOR THE ASSESSMENT OF WELFARE CONSEQUENCES OF FOXES

B.2.1 | Initial search

Database: Scopus

Date of the search: 2024-10-17

Search string: TITLE-ABS-KEY ((“farmed fox*” OR “red fox*” OR “Arctic fox*” OR “silver fox*” OR “white fox*” OR “blue fox*” OR “polar fox*” OR “Vulpes vulpes” OR “Alopex lagopus” OR “Vulpes lagopus”) AND (“farm*” OR “cage*” OR “captiv*”) AND (“welfare” OR “WelFur” OR “behaviour*” OR “"behavior" OR “health” OR “stress*” OR “distress” OR “fear*” OR “restrict*” OR “forag*” OR “explor*” OR “movement” OR “locomot*” OR “understim*” OR “overstim*” OR “bored*” OR “play*” OR “rest*” OR “social*” OR “group*” “handl*” OR “separat*” OR “pain” OR “injur*” OR “lesion$” OR “stereotyp*” OR “abnormal*” OR “fur chew*” OR “tail chew*” OR “mutil*” OR “enrich*” OR “food restrict*” OR “slim*” OR “obes*” OR “pelt$” OR “carcass”)).

Results: 117

Results included after screening: 65.

B.2.2 | Additional search

Database: Scopus

Date of the search: 2024-10-26

Search string: TITLE-ABS-KEY ((“farmed fox*” OR “red fox*” OR “Arctic fox*” OR “silver fox*” OR “white fox*” OR “blue fox*” OR “polar fox*” OR “Vulpes vulpes” OR “Alopex lagopus” OR “Vulpes lagopus”) AND (“farm*” OR “cage*” OR “captiv*”) AND (“eye lesion*” OR “eye disorder*” OR “disorder*” OR “bent feet” OR “foreleg weakness” OR “weak foreleg*” OR “lame*” OR “dig*” OR “cach*” OR “chew*” OR “human-animal”))

Results: 73

Results included after screening (non-duplicates from original search): 23.

B.3 | LITERATURE SEARCH CARRIED OUT FOR THE ASSESSMENT OF WELFARE CONSEQUENCES OF RACCOON DOGS

Database: Scopus

Date of the search: 2024-11-19

Search string: TITLE-ABS-KEY ((“raccoon dog*” OR “raccoon dog*” OR “Finnracoon*” OR “Finn racoon*” OR “Nyctereutes procyonoides”) AND (“farm*” OR “cage*” OR “captiv*”) AND (“welfare” OR “WelFur” OR “behaviour*” OR “"behavior" OR “health” OR “stress*” OR “distress” OR “fear*” OR “restrict*” OR “forag*” OR “explor*” OR “movement” OR “locomot*” OR “understim*” OR “overstim*” OR “bored*” OR “play*” OR “rest*” OR “social*” OR “group*” “handl*” OR “separat*” OR “pain” OR “injur*” OR “lesion$” OR “stereotyp*” OR “abnormal*” OR “fur chew*” OR “tail chew*” OR “mutil*” OR “enrich*” OR “food restrict*” OR “slim*” OR “obes*” OR “pelt$” OR “carcass” OR “disorder*” OR “bent feet” OR “foreleg weakness” OR “weak foreleg*” OR “lame*” OR “dig*” OR “cach*” OR “chew*” OR “human-animal” OR “space” OR “play” OR “gastroenter*” OR “gastroenteric disorder*” OR “isolation” OR “nutrition”)).

Results: 59

Results included after screening: 25 + 8 added from literature +11 added from stakeholder submissions (44 total); 3 of these with no full-text available.

B.4 | LITERATURE SEARCH CARRIED OUT FOR THE ASSESSMENT OF WELFARE CONSEQUENCES OF CHINCHILLA

Database: Scopus

Date of the search: 2024-12-8 (All years, All Databases, All types)

Search string: TITLE-ABS-KEY ((“chinchilla*” OR “farmed chinchilla*” OR “Chinchilla lanigera”) AND (“farm*” OR “cage*” OR “captiv*”) AND (“welfare” OR “behaviour*” OR “"behavior*" OR “health” OR “stress*” OR “distress” OR “fear*” OR “predat*” OR “restrict*” OR “forag*” OR “explor*” OR “move*” OR “locomot*” OR “understim*” OR “overstim*” OR “bored*” OR “play*” OR “rest*” OR “social*” OR “group*” OR “breed*” OR “mat*” OR “handl*” OR “separat*” OR “pain” OR “injur*” OR “lesion$” OR “stereotyp*” OR “abnormal*” OR “fur chew*” OR “tail chew*” OR “mutil*” OR “enrich*” OR “pelt$” OR “carcass” OR “eye lesion*” OR “eye disorder*” OR “disorder*” OR “lame*” OR “dig*” OR “cach*” OR “chew*” OR “human-animal” OR “space” OR “isolat*” OR “nutrition” OR “gastro*” OR “gastroenteric” OR “obes*” OR “dental” OR “infection*” OR “ammonia” OR “occlusion” OR “feet” OR “floor” OR “fur damage”)

Result: 164. Result after screening for relevance: 49 + 3 added +23 added from stakeholders (1 without full-text in English, 9 with no full-text available; total of 65 items).

APPENDIX C

TABLE C.1 List and description of 33 welfare consequences used for all animal species. (Adapted from EFSA AHAW Panel, 2022)

Welfare consequence	Definition
Bone lesions including fractures and dislocations	The animal experiences negative affective states such as pain, discomfort and/or distress due to fractures or dislocations of the bones (excluding those fractures leading to locomotory disorders).
Cold stress	The animal experiences stress and/or negative affective states such as discomfort and/or distress due to the difficulty to maintain body temperature in the thermoneutral zone when exposed to low effective temperature.
Eye disorders	The animal experiences negative affective states such as discomfort, pain and/or distress due irritation or lesion or lack of function of at least one eye.
Gastroenteric disorders	The animal experiences negative affective states such as inappetence, discomfort, pain and/or distress due to impaired function or lesion of the gastro-intestinal tract resulting from for example nutritional deficiency, infectious, parasitic or toxigenic agents.
Group stress	The animal experiences stress and/or negative affective states such as pain, fear and/or frustration resulting from a high incidence of aggressive and other types of negative social interactions, often due to hierarchy formation and competition for resources or mates.
Handling stress	The animal experiences stress and/or negative affective states such as pain and/or fear resulting from human or mechanical handling (e.g. sorting and vaccination of newly hatched chicks, loading/unloading, catching and crating of animals to be transported, inversion).
Heat stress	The animal experiences stress and/or negative affective states such as discomfort and/or distress due to the difficulty to maintain body temperature in the thermoneutral zone when exposed to high effective temperature.
Inability to avoid unwanted sexual behaviour	The animal experiences stress and/or negative affective states such as pain and/or fear resulting from inability to avoid forced mating.
Inability to chew and or ruminate	The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to ingest sufficient amounts of fibrous feed or the inhibition of rumination.
Inability to express maternal behaviour	The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to care for offspring, including during the pre-partum/pre-laying phase.
Inability to perform comfort behaviour	The animal experiences stress and/or negative affective states such as discomfort and/or frustration resulting from the thwarting of the motivation to maintain the function and integrity of the integument (e.g. cannot keep clean, scratch, dust bathe).
Inability to perform exploratory or foraging behaviour	The animal experiences stress and/or negative affective states such as frustration and/or boredom resulting from the thwarting of the motivation to investigate the environment or to seek for food (i.e. extrinsically and intrinsically motivated exploration).
Inability to perform play behaviour	The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to engage in social/locomotory or object play.
Inability to perform sexual behaviour	The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to engage in sexual activities.
Inability to perform sucking behaviour	The animal experiences stress and/or negative affective states such as frustration resulting from the thwarting of the motivation to suck from an udder.
Isolation stress	The animal experiences stress and/or negative affective states such as frustration and/or fear resulting from the absence of or from limited social contact with conspecific.
Locomotory disorders (including lameness)	The animal experiences negative affective states such as pain, discomfort and/or distress due to impaired locomotion induced by e.g. bone, joint, skin or muscle damage.
Mastitis	The animal experiences negative affective states such as pain and/or discomfort due to the inflammation of at least one of the mammary glands.
Metabolic disorders	The animal experiences negative affective states such as inappetence, weakness, fatigue, discomfort, pain and/or distress due to disturbed metabolism (e.g. acidosis and ketosis), deficiencies in several nutrients (e.g. anaemia) or induced by ectoparasites affecting metabolism (anaemia due to red mites) or poisoning.
Motion stress	The animal(s) experience motion sickness, stress and/or fatigue due to the forces exerted as a result of acceleration, braking, stopping, cornering, gear changing, vibrations and uneven road surfaces during transport.
Muscle disorders	The animal experiences negative affective states such as discomfort and/or pain due to a disorder or lack of function of the muscles (e.g. myopathy in broilers).
Predation stress	The animal experiences stress and/or negative affective states such as fear and/or pain resulting from being attacked or perceiving a high predation risk.

TABLE C.1 (Continued)

Welfare consequence	Definition
Prolonged hunger	The animal experiences craving or urgent need for food or a specific nutrient, accompanied by a negative affective state and eventually leading to a weakened condition as metabolic requirements are not met.
Prolonged thirst	The animal experiences craving or urgent need for water, accompanied by an uneasy sensation (a negative affective state) and eventually leading to dehydration as metabolic requirements are not met.
Reproductive disorders	The animal experiences negative affective states such as pain and/or discomfort due to a disorder of the reproductive system resulting from physical injury or infection (including dystocia and metritis).
Respiratory disorders	The animal experiences negative affective states such as discomfort, pain, air hunger and/or distress due to impaired function or lesion of the lungs or airways.
Resting problems	The animal experiences stress and/or negative affective states such as discomfort, and/or frustration due to the inability to lie/rest comfortably or sleep. (e.g. due to hard flooring, inability to perch or vibration during transport). This may eventually lead to fatigue.
Restriction of movement	The animal experiences stress and/or negative affective states such as pain, fear, discomfort and/or frustration due to the fact that it is unable to move freely or is unable to walk comfortably (e.g. due to overcrowding, unsuitable floors, gates, barriers).
Sensorial under and/or overstimulation	The animal experiences stress and/or negative affective states such as fear, discomfort due to visual, auditory or olfactory under/overstimulation by the physical environment.
Separation stress	The animal experiences stress and/or negative affective states such as fear and/or frustration resulting from separation from conspecifics.
Skin disorders (other than soft tissue lesions and integument damage)	The animal experiences negative affective states such as pain, discomfort and/or distress due to e.g. infections (e.g. dermatophytosis/ringworm, pseudomonosis, staphylococcosis, viral diseases), ectoparasites (e.g. mange or red mites), inflammation of the skin or sunburn.
Soft tissue lesions and integument damage	The animal experiences negative affective states such as pain, discomfort and/or distress due to physical damage to the integument or underlying tissues, e.g. multiple scratches, open or scabbed wounds, bruises, ulcers, abscesses and feather or hair loss. This welfare consequence may result from negative social interactions such as aggression, tail-biting or feather pecking, from handling or from damaging environmental features or from mutilation practices (e.g. beak trimming, de-toeing, de-horning, tail docking).
Umbilical disorders and hernias	The animal experiences negative affective states such as discomfort and/or pain due to inflammation of the navel or any type of hernias.

TABLE C.2 List and description of negative affective states (Adapted from EFSA AHAW Panel, 2022).

Negative affective state	Description
Boredom	Boredom is an unpleasant emotion including suboptimal arousal levels and a thwarted motivation to experience almost anything different or more arousing than the behaviours and sensations currently possible (adapted from Mason & Burn, 2011).
Discomfort	Discomfort can be physical or psychological and is characterised by an unpleasant feeling resulting in a natural response of avoidance or reduction of the source of the discomfort. Pain is one of the causes for discomfort, but not every discomfort can be attributed to pain. Discomfort in non-communicative patients is assessed and measured via behavioural expression, also used to describe pain and agitation, leading to discomfort being interpreted as pain in some conditions (Ashkenazy & DeKeyser, 2019).
Stress[a] and Distress	STRESS[a]: Stressors are events, internal or external to the body, involving real or potential threats to the maintenance of homeostasis. When stressors are present, the body will show stress responses (biological defence to re-establish homeostasis – for example behavioural, physiological, immunological, cognitive and emotional). Stress is a state of the body when stress responses are present (Sapolsky, 2002). DISTRESS: Distress is a conscious, negatively valenced, intensified affective motivational state that occurs in response to a perception that current coping mechanisms (involving physiological stress responses) are at risk of failing to alleviate the aversiveness of the current situation in a sufficient and timely manner (McMillan, 2020).
Fatigue	Physiological state representing extreme tiredness and exhaustion of an animal (EFSA AHAW Panel, 2020).
Fear	The animal experiences an unpleasant emotional affective state induced by the perception of a danger or a potential danger that threaten the integrity of the animal (Boissy, 1995).
Frustration	Negatively valenced emotional state consecutive to the impossibility to obtain what is expected or needed. Frustration is very often triggered by restriction of natural behaviours thus resulting in thwarted motivation to perform these behaviours.
Pain	An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage (Raja et al., 2020).

[a]The term stress does not describe a negative affective state in itself, but it is mentioned and defined in the Table C.2 as it is a prerequisite of distress.

APPENDIX D

Selection of most relevant welfare consequences

TABLE D.1 Outcome of the selection of most relevant welfare consequences for mink. In red, the welfare consequences selected as highly relevant in each scenario (Scenario 1 =; Scenario 2 =; Scenario 3.1 =; Scenario 3.2 =; Scenario 3.3. =; Scenario 4 =).

Welfare consequence	Scenario 1	Scenario 2	Scenario 3.1	Scenario 3.2	Scenario 3.3	Scenario 4
Group stress		■		■		
Handling stress	■					
Heat stress						
Inability to avoid unwanted sexual behaviour						
Inability to chew and or ruminate						
Inability to perform exploratory or foraging behaviour	■	■	■	■	■	■
Inability to perform play behaviour	■		■		■	
Metabolic disorders						
Prolonged hunger	■					
Prolonged thirst						
Resting problems						
Restriction of movement	■	■	■	■	■	■
Sensorial under and or overstimulation	■	■	■	■	■	■
Separation stress						
Soft tissue lesions and integument damage		■		■		■

TABLE D.2 Outcome of the selection of most relevant welfare consequences for Arctic fox. In red, the welfare consequences selected as highly relevant in each scenario (Scenario 1 =; Scenario 2 =; Scenario 3 =; Scenario 4 =).

Welfare consequence	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Restriction of movement	■	■	■	■
Inability to perform exploratory or foraging behaviour	■	■	■	■
Sensorial under and or overstimulation	■	■	■	■
Locomotory disorders including lameness	■	■	■	■
Handling stress	■	■	■	
Resting problems	■	■	■	■
Inability to perform play behaviour			■	■
Predation stress	■	■		■
Inability to avoid unwanted sexual behaviour	■	■		
Group stress				■

TABLE D.3 Outcome of the selection of most relevant welfare consequences for red fox. In red, the welfare consequences selected as highly relevant in each scenario (Scenario 1 =; Scenario 2 =; Scenario 3 =; Scenario 4 =).

Welfare consequence	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Restriction of movement	■	■	■	■
Sensorial under and or overstimulation	■	■	■	■
Inability to perform exploratory or foraging behaviour	■	■	■	■
Handling stress	■	■	■	■
Resting problems	■	■	■	■
Predation stress	■	■	■	■
Inability to perform play behaviour			■	■
Group stress			■	■
Inability to avoid unwanted sexual behaviour	■	■		

TABLE D.4 Outcome of the selection of most relevant welfare consequences for raccoon dogs. In red, the welfare consequences selected as highly relevant in each scenario (Scenario 1 =; Scenario 2 =; Scenario 3 =; Scenario 4.1 =; Scenario 4.2 =).

Welfare consequence	Scenario 1	Scenario 2	Scenario 3	Scenario 4.1	Scenario 4.2
Restriction of movement	■	■	■	■	■
Inability to perform exploratory or foraging behaviour	■	■	■	■	■
Sensorial under and or overstimulation	■	■	■	■	■
Resting problems	■	■	■	■	■
Inability to perform play behaviour			■	■	■
Isolation stress	■	■			
Inability to chew and or ruminate	■	■	■	■	■
Gastroenteric disorders	■	■	■	■	■
Group stress					■
Locomotory disorders including lameness	■	■			
Separation stress	■	■			
Restriction of movement	■	■	■	■	■
Inability to perform exploratory or foraging behaviour	■	■	■	■	■
Sensorial under and or overstimulation	■	■	■	■	■
Resting problems	■	■	■	■	■
Inability to perform play behaviour			■	■	■
Isolation stress	■	■			

TABLE D.5 Outcome of the selection of most relevant welfare consequences for chinchilla. In red, the welfare consequences selected as highly relevant in each scenario (Scenario 1 =; Scenario 2 =; Scenario 3.1 =; Scenario 3.2 =; Scenario 4 =).

Welfare consequence	Scenario 1	Scenario 2	Scenario 3.1	Scenario 3.2	Scenario 4
Isolation stress			■		
Restriction of movement	■	■	■	■	■
Predation stress	■	■	■	■	■
Inability to perform exploratory or foraging behaviour	■	■	■	■	■
Sensorial under and or overstimulation	■	■	■	■	■
Inability to perform comfort behaviour	■	■	■	■	■
Resting problems	■	■	■	■	■
Inability to avoid unwanted sexual behaviour	■				
Handling stress		■	■	■	
Inability to perform play behaviour		■	■	■	
Inability to chew and or ruminate	■	■	■	■	■
Cold stress		■	■	■	
Gastroenteric disorders	■	■	■	■	■
Respiratory disorders		■			
Group stress		■			
Locomotory disorders including lameness		■			
Soft tissue lesions and integument damage	■				

APPENDIX E

Sources of uncertainty

Source of uncertainty	Nature or cause of the uncertainty	Impact of the uncertainty on the assessment
Literature search – Understanding of different languages	The search was performed without restriction in language. However, challenges in accurately translating non-English publications – particularly those in languages not spoken by EFSA staff or Working Group experts – may have affected interpretation.	The description of type of husbandry systems and farm practices, ABMs and/or factors may have been biased with an impact on the assessment of WCs and preventive and mitigating measures.
Literature search – Publication type	Studies considered included primary research studies identified through the use of search strings and literature provided by the call for evidence, including peer-reviewed literature and grey literature (theses, guidelines, conference papers, EU reports, book chapters, etc.). Additional literature known to the EFSA Experts was also added if not retrieved by other sources. However, a comprehensive grey literature search was not performed, meaning some relevant documents may have been overlooked.	Possible underrepresentation of the published relevant papers. The description of type of husbandry systems and farm practices, ABMs and/or factors may have been biased with an impact on the assessment of WCs and preventive and mitigating measures.
Literature search – inclusion and exclusion criteria	The screening phase might have led to the exclusion of certain studies that could have included relevant information. Literature was primarily selected based on relevance to EU farming conditions, with few exceptions.	Risk of excluding evidence, possibly resulting in an underestimation of the published knowledge and a less comprehensive assessment of ABMs, WCs and preventive and mitigating measures.
Limited information available on certain species and animal categories	The lack of published information on the species of interest reflects limited knowledge on many aspects of these animals that may be of relevance for the welfare assessment.	Under or overestimation of the effect of specific hazard and husbandry systems on welfare consequences.
Lack of data on hazards	Although some information on the hazards leading to the welfare consequences considered in the assessment was retrieved in the scientific literature, the knowledge on the prevalence in the current husbandry system is too limited to draw quantitative conclusions. Also, no information on husbandry systems other than current (cage system) exists, so it is not possible to compare among systems. Conclusions relied largely on expert opinion.	Under or overestimation of the relevance of specific hazards in relation to welfare consequences.
Study design limitations	Several studies were limited by small sample sizes and cross-sectional designs, often lacking comprehensive control for potential confounding variables. In other cases, study designs involved multifactorial testing, increasing the risk of confounding and reducing the internal validity and interpretability of the findings. Additionally, heterogeneity in data collection protocols and analytical methodologies complicates cross-study comparisons and limits the generalisability of results.	Under or overestimation of the effect of specific hazard and husbandry systems on welfare consequences.
Expert group – number and type of experts	The fur animal field is a sector largely funded by private institutes. Based on EFSA's policy and conflict of interest regulations, experts with direct involvement in the fur animal sector were excluded. This may have limited the retrieval of sector-specific technical information.	The description of relevant welfare consequences, ABMs and/or hazards may have been incomplete, for species or categories object of the assessment.
Animal categories considered	Though the experts focused on collecting information relevant to the EU, the animals used in the information retrieved might not be the genotypes or categories currently used in the EU to study welfare consequences and ABMs, thus requiring an extrapolation exercise from the experts.	Potential under- or overestimation of the effect of specific factors, husbandry systems and welfare consequences on the species/categories under assessment.
Farming conditions and practices considered	When the information was not available in EU studied condition, EFSA experts considered information on farming from non-EU studies. Experts had therefore to extrapolate findings relevant to EU conditions in some cases.	Potential under- or overestimation of hazard prevalence and relevance of the welfare consequences in the considered husbandry systems.

(Continued)

Source of uncertainty	Nature or cause of the uncertainty	Impact of the uncertainty on the assessment
Time allocation	The time allocated to this opinion was limited, and considerable extra time and resources would have been needed for field data collection to provide quantitative information.	Potential limitations in the depth of the analysis, possibly leading to under- or overestimation of the effect of specific factors, husbandry systems and welfare consequences on the species/categories under assessment.
Approach/Type of assessment	The approach used to assess the Specific ToRs (EKE or narrative) might have led to different interpretation of the results, enhancing or limiting the understanding of findings.	The interpretation and perceived weight of outcomes may differ, leading to variability in the assessment of hazards and welfare consequences.

APPENDIX F

Results of uncertainty analysis

The following tables report the results of the uncertainty analysis divided by species.

TABLE F.1 Results for mink.

Mink			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Restriction of movement	Due to limited floor area and cage height and lack of structural complexity, restriction of movement **cannot be prevented** in the current system.	How certain are you that restriction of movement **cannot be prevented** in EU mink kept in the current system (due to limited cage floor area and height and lack of structural complexity)?	90%–100% The certainty range of 90%–100% reflects the evidence found, indicating that the dimensions of current cages are only slightly larger than the animals themselves. Such space is considered insufficient to allow the performance of essential species-specific behaviours, including movement.
Restriction of movement	Due to limited floor area and cage height and lack of structural complexity, restriction of movement **cannot be substantially mitigated** in the current system.	How certain are you that restriction of movement **cannot be substantially mitigated** in EU mink kept in the current system (due to limited cage floor area and height and lack of structural complexity)?	90%–100% As for prevention, space in the current cages is considered insufficient to allow the performance of essential species-specific behaviours, including movement.
Inability to perform exploratory or foraging behaviours	Due to insufficient structural and manipulable resources as well as limited space to accommodate these, lack of feeding enrichment and inadequate feed texture and management the WC Inability to perform exploratory or foraging behaviour **cannot be prevented** in the current system	How certain are you that inability to perform exploratory or foraging behaviours **cannot be prevented** in EU mink kept in the current system (due to insufficient structural and manipulable resources as well as limited space to accommodate these, lack of feeding enrichment and inadequate feed texture and management)?	90%–100% Reason for this certainty range is based on scientific evidence demonstrating that current cage systems are inadequate as they typically fail to provide sufficient space, environmental complexity or opportunities for species-specific behaviours.
Inability to perform exploratory or foraging behaviours	Due to insufficient structural and manipulable resources (including lack of open water) as well as limited space to accommodate these, lack of feeding enrichment and inadequate feed texture and management the WC Inability to perform exploratory or foraging behaviour **cannot be substantially mitigated** in the current system.	How certain are you that inability to perform exploratory or foraging behaviours **cannot be substantially mitigated** in EU mink kept in the current system (due to insufficient structural and manipulable resources as well as limited space to accommodate these, lack of feeding enrichment and inadequate feed texture and management)?	66%–100% The broader uncertainty range is due to the fact that this WC comprises two distinct behavioural components: foraging and exploratory behaviour. While the foraging component may be relatively straightforward to address (e.g. through the addition of foraging substrates within the cage), exploratory behaviour in mink is very important (more than in other species e.g. chinchilla) and the extent to which exploratory behaviour can be effectively supported without increasing spatial availability and access to open water remains unclear. As a result, a wider uncertainty range is selected.
Soft tissue lesions and integument damage	The WC **cannot be prevented** in the current system in all scenarios due to intraspecific aggression and cage components	How certain are you that soft tissue lesions and integument damage **cannot be prevented** in EU mink in the current system (due to intraspecific aggression and cage components)?	Consensus: 66%–100% The reason for a wide range is that, while the risk of lesions due to aggression cannot be prevented, the risks linked to lesions due to cage components might be (e.g. inventing a new less injurious floor, providing same hygienic conditions as wire-mesh).

TABLE F.1 (Continued)

Mink			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Soft tissue lesions and integument damage	For scenario 2 (dams with kits), the WC cannot be substantially mitigated in the current system, due to overcrowding in standard cages, especially with large litters before weaning.	How certain are you that soft tissue lesions and integument damage cannot be substantially mitigated in EU mink dams with kits kept in the current system (due to overcrowding in standard cages, especially with large litters before weaning)?	66%–100% The reason is that some aspects e.g. water provision and feeding strategy can be improved in the current system leading to less lesions due to competition for food and water, but space restrictions will still pertain.
Soft tissue lesions and integument damage	Soft tissue lesions and integument damage and group stress **can be substantially mitigated** in scenario 3 (juveniles kept in pairs or groups) in the current systems if both of the following measures are taken: – Juveniles are kept in pairs of one male and one female (instead of same sex pairs or group housing) until Sept- Oct (dispersion time) and then individually; – Sufficient resources are provided (i.e. nestboxes, feeding places, enrichment items, platforms) to avoid competition.	How certain are you that soft tissue lesions and integument damage **can be substantially mitigated** in EU mink juveniles kept in pairs or groups in the current systems if both of the measures are taken?	90%–100% The reason is that there is evidence that these measures, if put in place at the same time, can lead to substantial reduction in bite lesions.
Handling stress	Because handling is necessary for certain unavoidable production activities, the WC **cannot be prevented** when mink are kept for fur	How certain are you that handling stress **cannot be prevented i**n EU mink in the current system?	90%–100% The reason is that it is certain that some handling is always necessary and shown to be stressful.

TABLE F.2 Results for foxes.

Foxes			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Restriction of movement	The WC Restriction of movement **cannot be prevented** in the current system due to the hazards listed: • Insufficient floor area to allow motivated types of active behaviours including locomotion; • Insufficient cage height and structures to facilitate movement in three dimensions; • Inadequate floor material.	How certain are you that restriction of movement **cannot be prevented** in EU foxes kept in the current system (due to insufficient floor area; insufficient cage height and structures to facilitate movement in three dimensions; inadequate floor material)?	90%–100% The certainty range of 90%–100% reflects the evidence found, indicating that the dimensions of current cages are only slightly larger than the animals themselves. Such space is considered insufficient to allow the performance of essential species-specific behaviours, including movement.
Restriction of movement	The WC Restriction of movement **cannot be substantially mitigated** in the current system due to the hazards listed: • Insufficient floor area to allow motivated types of active behaviours including locomotion; • Insufficient cage height and structures to facilitate movement in three dimensions; • Inadequate floor material.	How certain are you that restriction of movement **cannot be substantially mitigated** in EU foxes kept in the current system (due to Insufficient floor area; Insufficient cage height and structures; Inadequate floor material)?	90%–100% As for prevention, space in the current cages is considered insufficient to allow the performance of essential species-specific behaviours, including movement.

(Continues)

TABLE F.2 (Continued)

Foxes			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Inability to perform exploratory or foraging behaviours	Inability to perform exploratory or foraging behaviour **cannot be prevented** in the current system due to the hazard mentioned: (i) Lack of physical complexity of the cage; (ii) Limited cage size (both horizontal and vertical space) to perform exploratory and foraging behaviour; (iii) Lack of enrichment providing stimuli for appetitive and consummatory foraging behaviour (including inadequate feed texture for consummatory behaviour and lack of resources that allow/ promote seeking, working for food, hunting scavenging); (iv) Flooring substrate not suitable for digging and vole jumps	How certain are you that inability to perform exploratory or foraging behaviour **cannot be prevented** in EU foxes kept in the current system (due to lack of physical complexity of the cage; limited cage size (both horizontal and vertical space) to perform exploratory and foraging behaviour; lack of enrichment providing stimuli for appetitive and consummatory foraging behaviour (including inadequate feed texture for consummatory behaviour and lack of resources that allow/promote seeking, working for food, hunting scavenging); flooring substrate not suitable for digging and vole jumps)?	90%–100% Reason for this certainty range is based on scientific evidence demonstrating that current cage systems are inadequate as they typically fail to provide sufficient space, environmental complexity or opportunities for species-specific behaviours.
Inability to perform exploratory or foraging behaviours	Inability to perform exploratory or foraging behaviour **cannot be substantially mitigated** in the current system due to the hazard mentioned: (i) Lack of physical complexity of the cage; (ii) Limited cage size (both horizontal and vertical space) to perform exploratory and foraging behaviour; (iii) Lack of enrichment providing stimuli for appetitive and consummatory foraging behaviour (including inadequate feed texture for consummatory behaviour and lack of resources that allow/ promote seeking, working for food, hunting scavenging); (iv) Flooring substrate not suitable for digging and vole jumps.	How certain are you that inability to perform exploratory or foraging behaviour **cannot be substantially mitigated** in EU foxes kept in the current system (due to lack of physical complexity of the cage; limited cage size (both horizontal and vertical space) to perform exploratory and foraging behaviour; lack of enrichment providing stimuli for appetitive and consummatory foraging behaviour (including inadequate feed texture for consummatory behaviour and lack of resources that allow/promote seeking, working for food, hunting scavenging); flooring substrate not suitable for digging and vole jumps)?	90%–100% As for prevention, evidence indicates that current cage systems are typically inadequate in size and complexity.
Sensorial overstimulation	Sensorial overstimulation **cannot be prevented** in the current system due to (i) Lack of nest box or den-like structure for resting and to function as a retreat, (ii) Lack of elevated place for surveillance and resting, (iii) disturbance by neighbouring animals and group housing.	How certain are you that sensorial overstimulation **cannot be prevented** in the current system in EU foxes kept in the current system (due to lack of nest box or den-like structure for resting and to function as a retreat, lack of elevated place for surveillance and resting, disturbance by neighbouring animals and group housing)?	90%–100% The reason is that disturbing events are inherently present in the current system.
Sensorial overstimulation	Sensorial overstimulation **cannot be substantially mitigated** in the current system due to (i) Lack of nest box or den-like structure for resting and to function as a retreat, (ii) Lack of elevated place for surveillance and resting, (iii) disturbance by neighbouring animals and group housing.	How certain are you that sensorial overstimulation **cannot be substantially mitigated** in the current system in EU foxes kept in the current system (due to lack of nest box or den-like structure for resting and to function as a retreat, lack of elevated place for surveillance and resting, disturbance by neighbouring animals and group housing)?	66%–100% The reason for greater uncertainty is that points i. and ii. might be implemented in the current system but it is unknown if the ability to retreat into a nest box or shelf can provide substantial mitigation in the context of an already overcrowded shed.

TABLE F.2 (Continued)

Foxes			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Group stress	The WC Group stress **cannot be prevented** in the current system due to high animal density in the shed and within group cages	How certain are you that group stress **cannot be prevented** in EU foxes kept in the current system (due to high animal density in the shed and within group cages)?	90%–100% The reason is that there is high certainty that it cannot be prevented due to inherent features of the current system.
Handling stress	Due to the necessity for handling and restraint during essential production procedures, the WC **cannot be prevented** in the current system.	How certain are you that handling stress **cannot be prevented** in EU foxes kept in the current system (due to the necessity for handling and restraint during essential production procedures)?	90%–100% The reason is that there is high certainty that handling stress cannot be prevented due to essential production procedures in the current system.
Handling stress	Due to the necessity for handling and restraint during essential production procedures, the WC **cannot be substantially mitigated** in the current system.	How certain are you that handling stress **cannot be substantially mitigated** in EU foxes kept in the current system (due to the necessity for handling and restraint during essential production procedures)?	90%–100% As for prevention, handling stress is well documented for essential production procedures in the current system.

TABLE F.3 Results for raccoon dog.

Raccoon dog			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Restriction of movement	Restriction of movement cannot be prevented in the current system due to (i) Insufficient floor area to allow motivated types of active behaviours including locomotion and play; (ii) Insufficient cage height and structures to facilitate movement in three dimensions; (iii) Floor material (wire mesh) potentially limiting proper walking and other movement; (iv) Lack of possibility to maintain space between animals and faeces; (v) Lack of opportunity to establish latrines.	How certain are you that restriction of movement **cannot be prevented** in EU raccoon dogs kept in the current system (due to listed hazards)?	90%–100% The certainty range of 90%–100% reflects the evidence found, indicating that the dimensions of current cages are only slightly larger than the animals themselves. Such space is considered insufficient to allow the performance of essential species-specific behaviours, including movement.
Restriction of movement	Restriction of movement **cannot be substantially mitigated** in the current system due to: (i) Insufficient floor area to allow motivated types of active behaviours including locomotion and play; (ii) Insufficient cage height and structures to facilitate movement in three dimensions; (iii) Floor material (wire mesh) potentially limiting proper walking and other movement; (iv) Lack of possibility to maintain space between animals and faeces; (v) Lack of opportunity to establish latrines.	How certain are you that restriction of movement **cannot be substantially mitigated** in EU raccoon dogs kept in the current system (due to listed hazards)?	90%–100% As for prevention, space in the current cages is considered insufficient to allow the performance of essential species-specific behaviours, including movement.

(Continues)

TABLE F.3 (Continued)

Raccoon dog			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Inability to perform exploratory or foraging behaviours	Inability to perform exploratory or foraging behaviours cannot be prevented in the current system due to the hazards mentioned: (i) Limited cage size and lack of physical complexity (including lack of resources) providing stimuli for exploratory, appetitive and consummatory foraging behaviour; (ii) Insufficient feed texture and delivery method for consummatory behaviours including chewing; (iii) Feed being inappropriate and not fulfilling the dietary requirements.	How certain are you that inability to perform exploratory or foraging behaviours **cannot be prevented** in EU raccoon dogs kept in the current system (due to the listed hazards)?	90%–100% Reason for this certainty range is based on scientific evidence demonstrating that current cage systems are inadequate as they typically fail to provide sufficient space, environmental complexity or opportunities for species-specific behaviours.
Inability to perform exploratory or foraging behaviours	Inability to perform exploratory or foraging behaviours **cannot be substantially mitigated** in the current system due to the following hazards: (iv) Limited cage size and lack of physical complexity (including lack of resources) providing stimuli for exploratory, appetitive and consummatory foraging behaviour; (v) Insufficient feed texture and delivery method for consummatory behaviours including chewing; (vi) Feed being inappropriate and not fulfilling the dietary requirements.	How certain are you that inability to perform exploratory or foraging behaviours **cannot be substantially mitigated** in EU raccoon dogs kept in the current system (Due to the hazards listed)?	66%–100% A lower certainty is given as, while aspects of foraging can be mitigated by addressing the listed hazards, it is unknown due to lack of evidence to which extent exploratory behaviour can be mitigated by addressing the hazards.
Sensorial overstimulation	Sensorial over-stimulation **cannot be prevented** in the current system due to: (i) Lack of nest box for resting and to function as retreat. (ii) Close presence of own faeces and faeces from neighbouring animals. (iii) Handling.	How certain are you that sensorial overstimulation **cannot be prevented** in EU raccoon dogs kept in the current system due to the listed hazards?	66%–100% Reason for higher uncertainty is lack of evidence in general about the extent of mitigating possibilities in this species.
Sensorial overstimulation	Sensorial over-stimulation **can be substantially mitigated in** the current system by providing all of the following measures: 4.1 Animals with an all-year retreat area (e.g. nest box), giving them more choice and control over their environment, and to perform the species-typical winter dormancy behaviour. Further research is required to develop quantitative recommendations for this mitigation. 4.2 Regular removal of manure but further research is needed to know the on the required thoroughness and frequency of the removal procedures. 4.3 Minimising the number of handling occasions (including artificial insemination), and by the use of appropriate gentle methods and equipment as well as training of handlers to have appropriate ability, knowledge and professional competence.	How certain are you that sensorial overstimulation **can be substantially mitigated** in EU raccoon dogs kept in the current system if all the listing measures are provided?	50%–100% The reason for very high uncertainty is the lack of studies on which the conclusion is based so the extent of mitigation provided is unknown.

TABLE F.3 (Continued)

Raccoon dog			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Isolation stress	Mitigation of the WC requires that animals are not single housed. Due to lack of space in the current system which do not allow group housing, the welfare consequence **cannot be prevented** in the current system	How certain are you that sensorial isolation stress **cannot be prevented** in EU raccoon dogs kept in the current system (due to lack of space)?	90%–100% Reason for this certainty range is that current cage systems are inadequate as they typically fail to provide sufficient space to allow group housing.
Isolation stress	Mitigation of the WC requires that animals are not single housed. Due to lack of space in the current system, the welfare consequence **cannot be substantially mitigated** in the current system	How certain are you that sensorial isolation stress **cannot be substantially mitigated** in EU raccoon dogs kept in the current system (due to lack of space)?	90%–100% As for prevention, current cage systems do not provide sufficient space to allow group housing.

TABLE F.4 Results for chinchilla.

Chinchilla			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Restriction of movement	Due to the limited cage floor area and height, restriction of movement **cannot be prevented** in the current system.	How certain are you that restriction of movement **cannot be prevented** in EU chinchillas kept in the current system (due to limited cage floor area and height)?	90%–100% The certainty range of 90%–100% reflects the evidence found, indicating that the dimensions of current cages are only slightly larger than the animals themselves. Such space is considered insufficient to allow the performance of essential species-specific behaviours, including movement.
Restriction of movement	Due to the limited cage floor area and height, restriction of movement **cannot be substantially mitigated** in the current system.	How certain are you that restriction of movement **cannot be substantially mitigated** in EU chinchillas kept in the current system (due to limited cage floor area and height)?	66%–100% Reason for this certainty range is that although the addition of complex cage furniture is expected to reduce this welfare consequence, there is currently no empirical data quantifying the extent of mitigation it provides within the current housing systems.
Predation and handling stress	Since production procedures involving handling are inherent to the current system, predation and handling stress **cannot be prevented**.	How certain are you that predation and handling stress **cannot be prevented** in EU chinchillas kept in the current system (due to inherent production procedures)?	90%–100% Reason is that good evidence of this WC exists.
Predation and handling stress	Since production procedures involving handling are inherent to the current system, predation and handling stress **cannot be substantially mitigated**.	How certain are you that predation and handling stress **cannot be substantially mitigated** in EU chinchillas kept in the current system (due to inherent production procedures)?	66%–100% Reason for wider uncertainty is that this WC could potentially be mitigated through high-quality handling practices and the provision of appropriate hiding places, but the extent of this mitigation remains unclear due to a lack of empirical studies.

(Continues)

TABLE F.4 (Continued)

Chinchilla			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Inability to perform exploratory or foraging behaviours	Due to lack of physical complexity of the cage, as well as space restrictions, the consequence Inability to perform exploratory or foraging behaviours **cannot be prevented** in the current system.	How certain are you that inability to perform exploratory or foraging behaviours **cannot be prevented** in EU chinchillas kept in the current system (due to lack of physical complexity of the cage and space restrictions)?	90%–100% Reason for this certainty range is based on scientific evidence demonstrating that current cage systems are inadequate as they typically fail to provide sufficient space, environmental complexity or opportunities for species-specific behaviours.
Inability to perform exploratory or foraging behaviours	Due to lack of physical complexity of the cage, as well as space restrictions, the welfare consequence Inability to perform exploratory or foraging behaviours **cannot be substantially mitigated** in the current system.	How certain are you that inability to perform exploratory or foraging behaviours **cannot be substantially mitigated** in EU chinchillas kept in the current system (due to lack of physical complexity of the cage and space restrictions)?	66%–100% The broader uncertainty range is due to the fact that this WC comprises two distinct behavioural components: foraging and exploratory behaviour. While the foraging component may be relatively straightforward to address (e.g. through the addition of foraging substrates within the cage) the extent to which exploratory behaviour can be effectively supported without increasing spatial availability remains unclear. As a result, a wider uncertainty range is selected and justified, reflecting the differing feasibility of mitigating these two behavioural needs under current systems.
Sensorial understimulation	Due to lack of physical complexity of the cage, as well as space restrictions, the welfare consequence sensorial understimulation **cannot be prevented** in the current system.	How certain are you that sensorial understimulation **cannot be prevented** in EU chinchillas kept in the current system (due to lack of physical complexity of the cage and space restrictions)?	90%–100% Reason for this certainty range is that there is existing evidence that current cages are inadequate to provide a good level of stimulation, which is essential for allowing species-specific behaviours.
Sensorial understimulation	Due to lack of physical complexity of the cage, as well as space restrictions, the welfare consequence sensorial understimulation **cannot be substantially mitigated** in the current system.	How certain are you that sensorial understimulation **cannot be substantially mitigated** in EU chinchillas kept in the current system (due to lack of physical complexity of the cage and space restrictions)?	66%–100% Elements providing stimulation can be put in the cage, but it is less certain what level of mitigation these can provide.
Sensorial overstimulation	Sensorial overstimulation **cannot be prevented** in the current system due to the inability to prevent all external disturbances.	How certain are you that sensorial overstimulation **cannot be prevented** in the current system in EU chinchillas kept in the current system (due to external disturbance)?	66%–100% Reason for the wider uncertainty is that although there could be some welfare improvement from provision of shelters for hiding in the cage, disturbing stimuli (noises and presence of humans and other chinchillas) are inherently present in the current system and may continue to impact chinchilla's welfare despite the availability of shelter for hiding.

TABLE F.4 (Continued)

Chinchilla			
Welfare consequence	**Conclusion**	**Question for uncertainty assessment**	**Certainty range**
Sensorial overstimulation	Sensorial overstimulation **can be substantially mitigated** in the current system by providing structural complexity allowing shelter for hiding and escape from undesired social contact in group cages, and by minimising sudden noises	How certain are you that the provision of structural complexity and the reduction of sudden noises **can substantially mitigate** sensorial overstimulation in EU chinchillas kept in the current system?	66%–100% Reason for the wider uncertainty is that while the provision of a shelter can mitigate the WC, the degree of protection it offers remains uncertain due to the potential for unpredictable external disturbances such as sudden noises, human activity, etc. These factors may reduce the shelter efficacy.
Inability to perform comfort behaviour	Inability to perform comfort behaviour **can be prevented** in the current system by the provision of permanent access to a bath with appropriate and clean sand (quartz-free sand).	How certain are you that the provision of permanent access to a bath with appropriate sand (quartz-free sand) **can prevent** inability to perform comfort behaviour in EU chinchillas kept in the current system?	90%–100% Evidence exists that a sand bath of good quality could prevent the WC. However, some uncertainty persists regarding the impact of collars, which may potentially hinder self-grooming behaviour - a component of natural maintenance activities in chinchilla. Further investigation is needed to clarify the extent to which collars may interfere with grooming and, consequently, the overall effectiveness of the sand bath as a preventive measure.
Resting problems	Due to the necessary production procedures during the working day, resting problems **cannot be prevented** in the current system.	How certain are you that resting problems **cannot be prevented** in EU chinchillas kept in the current system (due to production procedures)?	90%–100% Reason for this certainty range is that there is existing evidence of disturbance in current systems
Resting problems	Resting problems **can be substantially mitigated** in the current system by the provision of an enclosed resting area (e.g. shelter, box or tube), elevated platforms, by the provision of a diurnal lighting pattern allowing the animals to maintain their natural circadian rhythms and by minimising noises and human presence.	How certain are you that resting problems **can be substantially mitigated** in EU chinchillas kept in the current system by the provision of an enclosed resting area (e.g. shelter, box or tube), elevated platforms, by the provision of a diurnal lighting pattern and by minimising noises and human presence?	66%–100% The reason for the wider range is that the provision of resting areas and elevated platforms is generally feasible. However, effectively minimising external disturbances - such as noise, human activity or sudden environmental changes - presents significant challenges. These disturbances can compromise animal welfare and are often difficult to control in commercial farming environments, thereby limiting the overall efficacy of this measure.

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