Technical Report

efsa SUPPORTING PUBLICATIONS

APPROVED: 30 June 2025
doi: 10.2903/sp.efsa.2025.EN-9562

Biology, husbandry systems and farm practices for American mink, red and Arctic foxes, raccoon dog and chinchilla kept for fur production

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Abstract

This Technical Report was prepared in response to a mandate from the European Commission under Article 31 of Regulation (EC) No 178/2002. The request focused on updating the literature review from the 2001 report "The Welfare of Animals Kept for Fur Production" (SCAHAW, 2001), specifically addressing Section 4 (general aspects of carnivore biology—mink, foxes, and raccoon dog) and Section 5 (general aspects of rodent biology—chinchilla). Using information obtained from a review of literature, a call for evidence from stakeholders, field visits and consideration by experts in an EFSA working group, this report reviews the most up to date information on the species' biology, production cycles, most common husbandry systems, including field-tested systems, and farming practices used for the commercial fur production of the following species: i) American mink (*Neogale vison* or *Neovison vison*, previously classified as *Mustela vison*), ii) Red fox (*Vulpes vulpes*, and 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*).

Key words: animal welfare, mink, fox, raccoon dog, chinchilla, fur animals, cage system

Requestor: European Commission
Question number: EFSA-Q-2024-00126
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Acknowledgements: EFSA wishes to thank the members of the EFSA Panel on Animal Health and Welfare for their endorsement of the scientific output, and the WG hearing experts for their valuable support provided to this scientific output: Bo Algers, Per Jensen, Stanisław Łapiński, Jens Malmkvist; the contractor Gabrielle Clark (under contract PO/EFSA/BIOHAW/2024/02) for conducting preparatory work, and the EFSA trainee Roxane Delacourt for her support to the call for evidence. EFSA extends its appreciation to the hearing experts involved in the technical hearing meeting in representation of their organisation: Mark Glover, Johanna Korpela, Bethania Malmberg, Steen Henrik Møller, Jaakko Mononen, Jussi Peura, Heather Pickett, Thomas Pietsch, Markus Sjöholm, Jyrki Sura, and all European competent institutions, Member State bodies, and other stakeholders for their information provided through public calls for evidence, stakeholder meetings, and field visits.

Suggested citation: EFSA (European Food Safety Authority), Díez-León M., Dippel S., Edwards S., Schwarzer A., Candiani D., Hempen M., Lima E., Millán Caravaca C., Tirchett NJ., Van der Stede Y., Vitali M. and Herskin M., 2025. Biology, husbandry systems and farm practices for mink, foxes, raccoon dog and chinchilla kept for fur production. EFSA supporting publication 2025:EN-9562. 115 pp. doi:10.2903/sp.efsa.2025.EN-9562

ISSN: 2397-8325

Summary

This technical report was prepared in response to a mandate from the European Commission under Article 31 of Regulation (EC) No 178/2002. The request focused on updating the literature review from the 2001 report "The Welfare of Animals Kept for Fur Production" (SCAHAW, 2001), specifically addressing Section 4 (general aspects of carnivore biology—mink, foxes, and raccoon dogs) and Section 5 (general aspects of rodent biology—chinchillas).

To address the mandate, an extensive literature review was conducted, covering scientific and technical publications from 2000 to 2024. The available scientific and technical literature was considered by experts in an ad-hoc EFSA working group. A call for evidence addressing the mandate's questions was conducted via a web-based platform including a specific questionnaire prepared by the EFSA experts. This technical report details the approach and results of these activities complemented with experts' knowledge and group discussion.

The species considered in this technical report are: i) American mink (*Neogale vison* or *Neovison vison*, previously classified as *Mustela vison*, ii) Red fox (*Vulpes vulpes*, and 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*). Available data show that in 2023 there were around 1,100 active fur farms in the EU producing mink, foxes and raccoon dogs, with a total animal population of around 7.7 million distributed across these farms. With regard to chinchilla, the EU produces around 220,000 pelts per year, but no accurate data are available on either number of farms or animals produced. The EU population of animals kept for fur production has shown a declining trend over the past years.

The American mink is a mustelid, native to North America, which inhabits a variety of landscapes, from rivers and wetlands to marshes and coastal habitats. Adult mink are solitary for most of the year and their home ranges have been reported to be up to almost 2 Km2. They are obligate carnivores, hunting for prey both on land and in water and consuming a variety of prey items. They have a promiscuous/polygamous mating system, with breeding controlled by photoperiod and occurring once a year. Females build and maintain dens and rear the altricial offspring alone until they disperse at around 12 weeks of age.

The production cycle of farmed mink begins with the 'premating season' in January-February. Breeding typically lasts for approximately 2 weeks in March, with kits born in April-May and weaned in June-July, when they are 6-10 weeks of age. On-farm killing (followed by 'pelting') takes place following the autumn moulting in November. Kits typically remain either in sibling groups or male-female sibling pairs after removal of the dam, until young adults when they are separated and housed individually. The timing of such separation differs across farms. Mink are typically housed individually by 7 months of age and as adults. Farmed mink are generally kept in wire mesh cages sheltered by open-walled sheds, thus exposed to ambient temperatures, and other factors such as lighting, wind and humidity. Farmed mink have continuous access to a nest box, with variable amounts of bedding. Various fixed or manipulable items may be provided in cages as environmental enrichment. Feed consists of a meat-based paste delivered on the mesh top

of cages. The quantity of feed provided changes through the production cycle, varying from *ad libitum* feeding to feed restriction periods. Water is provided via nipple drinkers or bowls.

Foxes kept for fur include two species: the Arctic fox and red fox, including their hybrids. Differences among the species in biology and production cycle are summarized below. Husbandry systems and farm practices are common to all fox species, therefore described only once.

Arctic foxes inhabit the circumpolar and arctic regions of Eurasia, North America, Greenland, and Iceland. Their habitat includes coastal and inland arctic as well as mountainous tundra, where they select landscapes with variable topography for their multi-generational den sites. Arctic foxes are generally solitary outside the breeding season but may live in breeding pairs. They have a variable home range reported to be from 4 to 125 km^2 and undertake seasonal migrations but maintain territories during the breeding season. Arctic foxes have a generalist/opportunistic diet. They are typically socially monogamous, with biparental care sometimes reported. Mating takes place in March-May, and cub dispersal typically starts in the early autumn, at around 9 weeks of age. Dispersing siblings remain associated during their first winter, particularly if female.

Breeding of farmed Arctic foxes occurs in spring, with cubs born in May-June. Weaning occurs between June and August, when cubs are approximately 7 weeks old. Foxes are typically killed and pelted in November or December, once the winter coats have developed. Cubs are typically housed with their siblings, but practices of splitting litters into pairs or individual housing differ across farms. Reproductive adults of at least 1 year old are housed individually.

Red foxes have a wide geographical distribution and occupy a variety of habitats, from woodland to urban areas. Their territories can range up to approximately 1 km^2, with several different dens within the territory, each having multiple entrances, tunnels and chambers. Red foxes are opportunistic feeders with a varied diet, ranging from hunted prey to scavenging on carcasses, and also eating vegetable matter. Although solitary animals, they display flexible social behaviour, and male-female pairs or family groups may stay together during the mating and breeding period, though maintaining separate territories. Altricial cubs are born after a gestation period of around 52-53 days, and gradual weaning and dispersal occur once cubs are approximately 10 weeks old.

The breeding season of farmed red foxes occurs slightly earlier than in arctic foxes, in late January-March. Cubs are born in April-May and weaning occurs around 8 weeks of age. Killing and pelting is typically performed in winter (December or January), once the winter coats have developed. As suckling cubs, red foxes are maintained in groups with their mother and siblings, and at weaning they are split into individual housing or male-female sibling pairs. All animals are housed individually upon sexual maturity.

Hybrid foxes are offspring of male red foxes and female Arctic foxes. Crossing these species is done to obtain various fur types in terms of colour and hair structure. Despite differences in chromosome numbers, the two species can reproduce successfully. Hybrid offspring have an intermediate chromosome count and appearance and are sterile (so they cannot reproduce) and are killed and pelted at around 6 months of age. Natural mating between the two species is challenging and artificial insemination is the preferred method, although detailed management descriptions are lacking.

Farmed foxes are all generally housed in wire mesh cages sheltered by open-walled sheds, with access to a nest box within the cage or on top of the cage only during late pregnancy and during lactation. Fox cages may be supplemented with one environmental enrichment item at any period, such as a wooden block, bone, hay/straw, or some other non-harmful chewing material. Feed consists of a meat-based paste deposited on the mesh top of cages or in feed trays. Feed amounts differ across the production cycle, varying from periods of restricted feeding to ad libitum feeding. Drinking water is provided via nipple drinkers or bowls.

Raccoon dogs are a canid species native to eastern Asia, found across a range of habitats but preferring areas densely vegetated near rivers and meadows. Raccoon dog home ranges can be 9.5 km^2 or more. Raccoon dogs do not actively defend a territory and are tolerant towards other individuals of the same species. They use a variety of dens made by other species and experience a period of winter dormancy where they decrease their activity levels and can be intermittently dormant. Raccoon dogs have an omnivorous diet, including small mammals, birds, fish, amphibians, vegetation, and even carrion. Racoon dogs are monogamous, can live both solitary or in family groups, and display biparental care of young. Cubs are born after a gestation period of 59-64 days and are self-sustaining at an age of 4-5 months, with the majority staying in close proximity to their natal habitat after weaning.

Breeding of farmed raccoon dogs begins in late winter (February-March), with cubs born in spring (typically May). Offspring are weaned in July-August at 5-9 weeks of age. Killing and pelting generally takes place in late autumn or early winter, when the winter fur has matured. After weaning, littermates are split into male-female sibling pairs or kept in quartet groups and may be transferred to pair or individual housing at 10-11 weeks of age. The animals are considered subadult by November of their first year when, if not already housed alone, they are split into single housing. Farmed raccoon dogs are housed in cages in open-walled sheds, with a wooden nest box provided inside or on top of the cage for females and their cubs during late pregnancy and during lactation. Environmental enrichment, including one manipulable object and one shelf or platform, is typically provided in each cage. Feed is delivered in the form of meat paste on the mesh top of cages or on feeding trays. Feed amounts differ across the production cycle, including the period of controlled fattening in Autumn. Drinking water is available via nipple drinkers or in the form of water, ice, or snow in water bowls.

Chinchillas are a species of rodent endemic to Chile, where they preferentially inhabit steep, rocky, and dry mountain slopes. They live in extensive burrow systems near streams with boulders and sparse vegetation. Chinchillas have a generalist folivorous diet. They 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. In the wild (southern hemisphere), there are two marked mating periods (in mid-winter and mid-summer). There is lack of information on reproductive patterns, lactation or weaning process in the wild.

In farmed chinchillas, the mating season may span the entire year. In the northern hemisphere, the mating season typically begins in January or February. Continuous polyoestrous-type cyclical activity is observed in captive breeding settings, with post-partum oestrus also occurring. Births can occur all year round, but two birth seasons are typically distinguished in farm practices: from March to August or from September to

February. Precocial kits are born after a 105–115-day gestation. Weaning occurs at 7-9 weeks of age. Fur is densest and of the highest quality by 8-12 months of age, but killing and pelting can occur at any point in the year after 7 months of age. Weaned kits are split into groups of two or three. If females are retained beyond 8 months of age, they are moved into individual cages in polygamous breeding groups and allowed to begin interacting with males. Breeding chinchillas are housed in a 1:4, 1:5, or 1:6 male to female ratio, providing corridors for the male to access the females' cages for natural mating. Male access is controlled, though, either by the opening of corridor gates by staff, or by preventing females' access to the corridor using neck collars to block them from exiting their cage so that the male can interact with each of the females at will but not *vice versa*. Farmed chinchillas are housed in temperature-controlled buildings under natural or artificial lighting and kept in solid or wire mesh cages, which may be stacked in rows/tiers. Sand baths and environmental enrichment items intended to allow animals to chew, jump, and hide may be provided in cages. Chinchillas are fed a commercial pelletized diet supplemented with hay or straw. Access to water is maintained by drinking nipples or water bottles.

Contents

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. The resultant scientific opinion was requested to be provided in two separate publications: one with the description of the biology and current husbandry systems and practices to keep these species (Art. 31), and another with the welfare assessment, that is, an evaluation of the impact of such systems and practices on the welfare of the species mentioned above (Art. 29). The present document corresponds to the Art. 31 publication.

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.
- main arguments to ban fur farming and the farmed fur products invoked by the organizers of the ECI relate 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, 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 they are covered by Directive 98/58/EC[1].

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

[1] Council Directive 98/58/EC of 20th July 1998 concerning the protection of animals kept for farming purposes. OJ L 221, 8.8.1998, p. 23.

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[2] for mink, foxes, raccoon dogs and chinchillas:

- 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.

1.1.3. Interpretation of the Terms of Reference

This Technical Report aims at addressing the terms of reference (ToRs) 1a and 1b of the mandate relevant to the scientific and technical assistance in accordance with Article 31 of Regulation (EC) No 178/2002 (see section 1.1.2 Terms of reference).

[2] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28th January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31, 1.2.2002, p. 1–24.

Response to the ToR2a and ToR2b of the mandate of fur production, was instead addressed in the Scientific Opinion on the welfare of animals kept for fur production (EFSA AHAW Panel, 2025).

In ToR 1a EFSA was requested to update sections 4 and 5 of the SCAHAW (2001) report ("General aspects of carnivore and rodent biology") for the species mink, foxes, raccoon dog and chinchilla with up-to-date information and scientific evidence.

ToR 1b requires to review information on the most common husbandry systems (including field-tested systems) and rearing practices currently in place for the keeping of the above-mentioned animals for fur production. "Field-tested systems" are defined as husbandry systems and practices complete and verified in commercial fur farming in the EU, at the time of writing this technical report, and not older than 10 years.

As mentioned in the mandate background, this is the first mandate in EFSA requesting the assessment of the welfare of animals kept for fur production. For this reason, this technical report 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 fur animals at the time of the report.

The species being considered in this technical report 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*).

For all the species, it was decided to use one 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 foxes," 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 is 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.

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 in this technical report.

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

Wild animals are not within the scope of this mandate; however, some consideration on the wild conspecifics is included in Sections 3.2.1, 3.3.1, 3.3.1.1., 3.3.2.1., 3.4.1 and 3.5.1 for the purpose of describing animal biology in the context of this technical report and in response to the ToR1a of this mandate. Assessment of environmental impact of wild, farmed or escaped/feral mink, foxes, raccoon dogs and chinchillas are out of the scope of this mandate.

The list of animal categories and their definition is reported in Table 1.

Table 1: Summary of the categories of animals involved in fur production as referred to in the Scientific Opinion and in this Technical Report, with indication of the production purposes.

Animal category	Definition
Male breeders	Includes adult or subadult males kept for breeding (natural mating and/or artificial insemination).
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.
Lactating females	Female breeder between parturition and the weaning of her kits/cubs.
Suckling kits/cubs	Kits/cubs from birth to weaning.
Juveniles	Weaned kits/cubs after separation from the mother and until age of pelting

2. Data and Methodologies

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

According to the protocol, EFSA translated the assessment questions listed in the mandate for Art. 31 (see ToR1a and ToR1b in 1.1.2) into more specific sub-questions. Table 2 shows an overview of the sub-questions for the two ToRs of the mandate. Per each sub-question, the aim and the methodological approach are defined. Overall, to address the sub-questions, the data obtained from the literature were complemented by information provided by stakeholders (see Sections 2.1 and 2.2) and further reviewed and complemented by the EFSA experts (see Section 2.1.3).

Table 2: Overview of translation of the Terms of references (ToRs) of the mandate assessment questions into sub-questions

Assessment Questions Translation of the mandate ToRs		**Sub-questions**	
ToR1a	Describe carnivore and rodent biology in relation to American mink, red and Arctic foxes, raccoon dog and chinchilla	*1. Identify the most updated information on the biology of the relevant carnivore and rodent species after the publication of "The welfare of animals kept for fur production" (SCAHAW, 2001), on the relevant topics of sections 4 and 5*	*2. Describe biology of American mink, red and Arctic foxes, raccoon dog and chinchilla*

Assessment Questions Translation of the mandate ToRs		Sub-questions	
		Aim: Updated information on the biology of American mink, red and Arctic foxes, raccoon dog and chinchilla are reviewed. Approach: literature review, consultation with stakeholders via the calls for evidence, and expert opinion via group discussion. Relationship with assessment question: this sub-question is necessary for the overall assessment question requiring the description of the biology of the relevant carnivore and rodent species of this mandate	Aim: All the information on the biology of American mink, red and Arctic foxes, raccoon dog and chinchilla identified and selected from sub-question 1 are described narratively. Approach: review of literature and information from the calls for evidence and expert opinion via group discussion. Relationship with assessment question: this corresponds to the assessment question.
ToR1b	Describe the current husbandry systems and farm practices	*3. Identify the most common husbandry systems and farm practices for American mink, red and Arctic foxes, raccoon dog and chinchilla for each descriptive category.*	*4. Describe the husbandry systems and farm practices.*
		Aim: Husbandry systems and farm practices to be considered in the assessment are identified and selected to be representative of the currently used systems in the EU. Approach: literature review, consultation with stakeholders via the calls for evidence, and expert opinion via group discussion. Relationship with assessment question: this sub-question is necessary for the overall assessment question requiring the description of the husbandry systems.	Aim: All the husbandry systems for each descriptive category identified and selected from sub-question 1 are described narratively. Approach: review of literature and information from the calls for evidence, expert opinion via group discussion. Relationship with assessment question: this corresponds to the assessment question.

2.1. Literature search

A broad literature search was performed in Scopus (Elsevier) to identify peer-reviewed articles providing information on American mink, Arctic and red foxes, raccoon dogs, and chinchillas used for farming in the fur industry, particularly to address the production cycles of fur farms. Information on hybrid foxes was included in a later stage but the hybrids were not explicitly included in the literature search.

The search was restricted to articles published between the years 2000 and 2024 (search conducted in April 2024). Records from the search were documented and screened for relevance at a later stage, which involved checking article titles, keywords, and abstracts and

including the articles in the review if considered relevant. Details of the literature search strategy and number of records retrieved are provided in Appendix A.

Additional articles were occasionally added to the post-screening collection if deemed relevant. Grey literature was also considered when no scientific literature was found on a certain topic upon consideration of the EFSA experts.

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[3].

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 dog and chinchilla, and welfare protocols was requested by EFSA via four calls for evidence[4,5,6,7] 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 dog and chinchilla. The purpose of these calls for evidence was to offer interested parties (e.g., fur farming operators, national

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

authorities, research institutions, academia) and/or other stakeholders the opportunity to submit documented information (published or unpublished) relevant to the welfare of these animals.

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 17th of 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 organized by EC in September 2024, and included visits to Ministries, Competent Authorities and fur farms. The second visit was organized 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, organized 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 report have been cited in the text and published under Supporting information. 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)[8].

This technical report was developed based on information retrieved through literature searches (see section 2.1) and on information provided by consultation of stakeholders (see Section 2.2). For the latter, it presents a compilation of information submitted by stakeholders in response to four public calls for data launched by EFSA[9,10,11,12] (see 2.2.3) and to the technical hearing meeting (see 2.2.4). The data were provided through an open consultation and reflect a variety of information reported by interested parties concerning the welfare of American mink, red and Arctic foxes, raccoon dog and chinchilla. The data provided are hereby presented as received and were not verified or validated by EFSA.

2.3. Experts' opinion through group discussion

To address ToR-1a and ToR-1b, as explained in Table 2, expert opinion was mainly elicited via group discussion on the basis of EFSA experts' own knowledge and the information retrieved from the available literature and the consultation of stakeholders (see Section 2.1 and 2.3).

2.4. 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 organized by EC in September 2024, and included visits to Ministries, Competent Authorities and fur farms. The second visit was organized 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, organized within an EC mission in Finland.

3. Assessment

3.1. Population of fur animals in EU

The production animals kept for fur production is unevenly spread across EU Member States. The most recent official data were included in the EC Communication (C/2023/1559)[13] in 2023. Data included in the EC communication have been provided by industry, and EU Member States (C/2023/1559). The data provided show that between 2022 and 2023 there were around 1,100 active fur farms in the EU to produce mink, foxes and raccoon dogs, with a population of approximately 7.7 million animals distributed among them (C/2023/1559). In

[8] 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

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

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

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

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

[13] Communication from the Commission on the European Citizens' Initiative (ECI) 'Fur Free Europe' (C/2023/1559).

Table 3, values can be seen specific for the population and farm numbers of American mink, foxes and raccoon dog across Member States.

Table 3: Number of fur farms and animals produced in EU, specifically mink, foxes, and raccoon dogs. Based on the available information, countries not listed do not engage in the farming of these species for fur production. Empty cells indicate that no farms or animals were identified.

	Mink farms	Mink production		Fox farms	Fox production	Raccoon dog farms	Raccoon dog production
	2023[(a)]	**2022**[(a)]	**2023**	**2023**[(a)]	**2022**[(a)]	**2023**[(a)]	**2022**[(a)]
Bulgaria	1	90,000					
Denmark	4		34,044[(b)]				
Finland	157	500,000		365	700,000	60	70,000
Greece	91	1,400,000					
Latvia	4	360,000					
Lithuania	88	1,160,000					
Poland	234	3,400,000		35	30,000	-[(c)]	-[(c)]
Romania	2	207,601					
Spain	28	450,000					
Sweden	19	200,000					
Total per species	628	7,767,601		400	730,000	60	70,000

(a): Source: Fur Europe and Member States (as found in C/2023/1559),
(b): Data obtained from Denmark Central Husbandry Register (2024), data accessed on 2 October 2024: https://chr.fvst.dk/chri/faces/frontpage
(c): Expert knowledge reports presence of active Raccoon dog farms in Poland for fur production; however, the number is not available

With regard to chinchilla, according to the same Communication, the EU produces around 220,000 pelts per year, but no accurate data from all MSs are available. Countries keeping chinchillas in 2023 included: Estonia (4 farms with a total of 231 chinchillas), Denmark (34 farms in 2024, with a total of approximately 25,000 chinchillas)[14], Hungary, Lithuania, Poland (no information on numbers in the latter 3 countries mentioned), Romania (7 farms with 7,514 chinchillas) and Spain (3 chinchilla farms) (C/2023/1559). Data on 2024 production were not available at the time of publication of this technical report.

No specific numbers were found for different species of foxes (including their hybrids). Additionally, raccoon dogs are also raised in Poland, despite the country lacking in the sources of Table 3 (Dr S. Łapiński, Researcher at University of Agriculture in Krakow, communication in a WG meeting, 2024a).

The population of animals kept for fur production in the EU has been declining over the past five years. According to the European Commission (2023), several factors have contributed

[14] Danish central husbandry register: https://chr.fvst.dk/chri/faces/frontpage [Accessed on 16th September 2024]

to this downward trend. These include zoonotic risks such as SARS-CoV-2 outbreaks in mink farms. Other contributing factors are considerations about animal welfare and ethics, as well as the need to protect biodiversity and native species. These issues are increasingly being viewed through the lens of the One Health approach, which recognizes the interconnected health of people, animals, and the environment.

3.2. American mink

3.2.1 Biology

The term 'mink' in the text refers to the farmed American mink, not to be confused with the European mink (*Mustela lutreola*), a species that is not farmed and is native to parts of Europe. American mink is a dark brown mustelid, with a characteristic white chin marking. Based on data collected in 1995-2011, Melero et al. (2012) described morphological characteristics (such as body length) of established populations of feral American mink in Spain (without knowledge about involved sub-species) and described sexual dimorphism and body lengths. According to their results, the body lengths varied from 59-65 cm for males and 46-62 cm for females, with an additional tail length of 17-21 cm. A Danish study reported an average body length of 45 (September) to 49 cm (at pelting in November) in males (average weight 3,470 g at pelting, n= 544) and 37 cm (September) to 41 cm (at pelting) in females (average weight 1,868 g at pelting, n=413) (Villumsen et al., 2019), excluding the tail from the length measurement (note that all mink in this study were of the white colour type).

The size and shape of (adult) mink tracks are comparable to that from polecats (*Mustela putorius*; Bang and Dahlström, 2000). On relatively solid floor, the forefoot tracks are 3-3.5 cm long and 2.5-4 cm wide, the hind foot tracks are slightly longer. The tread area of the toes is approximately 5-7 x 3-4 mm (size estimated from track identification drawings). The stride length varies from 35-50 cm in loose snow to 50-60 cm on more solid floor (Bang and Dahlström, 2000).

Naturally distributed across most of Canada and the United States, with the exception of extreme Northern and semi-arid areas (SCAHAW, 2001), mink have established populations outside their original distribution range through feralization from fur farm escapees in Europe (Brzeziński and Marzec, 2003; Vada et al., 2023) and South America (e.g., Chile; Häussermann et al., 2012). Hence, they inhabit a variety of landscapes, from rivers and wetlands to marshes and coastal habitats, being versatile to switch back and forth between terrestrial and aquatic habitats. While American mink do not have skeletal adaptations to water, they possess some soft tissue adaptations, such as slightly webbed feet (webbing size and shape between that of an otter and a polecat), vasoconstriction in their paws facilitating heat retention underwater and, unlike fully terrestrial mustelids (such as ferrets), American mink are better adapted to diving, but less so than otters (e.g., they are less buoyant and their coat has relatively low insulation properties, reviewed in SCAHAW (2001)). While not dependent on water to hunt as otters, mink are able to hunt/retrieve prey in water (see below) and swim as a means of travelling (Harrington et al., 2012).

Regarding their adaptations for terrestrial living, mink typically travel their territories by walking or employing a bounding gait and have also been reported to climb trees (Larivière, 1995; Agnvall et al., 2018). Mink can hear sounds up to, at least, 70 kHz (Brandt et al.,

2013), have a very rapid response to moving objects, and a powerful kill bite, all of them pointing at opportunistic predation on rodent prey.

Although crepuscular (i.e., they show peaks of activity at dusk and dawn; Schwarzer et al., 2017), or nocturnal animals, mink may adjust their activity patterns to prey availability and competition for it (Harrington et al., 2012). Related to dens, mink occupy (but do not build) several ones within their territories, often located within 10 m from water bodies and used for resting as well as caching food. As obligate carnivores, mink hunt for prey both on land and in water, diving quickly in short prey-chases after having spotted vulnerable individuals from land (Larivière, 1999; SCAHAW, 2001; Skierczyński et al., 2008; Harrington et al., 2012; Bagniewska et al., 2015) or nocturnal animals, they may adjust their activity patterns to prey availability and competition for it (Harrington et al., 2012).

Within their carnivore and scavenger diet, mink are generalists and consume a variety of prey items: mammals (primarily rodents and lagomorphs), birds (and their eggs), reptiles, amphibians (which appear least preferred), fish, and invertebrates (mostly crayfish, some snails) (Larivière, 1999; Bonesi et al., 2004; Wolff et al., 2015; Kiseleva, 2016). Mink also adapt their dietary preferences in case of intraguild competition (e.g., in the presence of otters, mink will eat less fish; Bonesi et al., 2004), season (e.g., more crayfish in summer; Wolff et al., 2015), weather conditions (e.g., harsher winter diets less varied than mild winter ones, which include primarily amphibians and mammals; Skierczyński and Wiśniewska, 2010), and general prey availability (Skierczyński et al., 2008). Mink are generally solitary animals, and their population density ranges between 10-22 individuals over 10 km of river in the most favourable Russian habitats (Oleinikov, 2013), and 1.4-3.8 individuals over 10 km of river in Polish wetlands (Skierczyński et al., 2008).

The centre of their territories is typically relatively close to water, with exact distance and shape of the territory varying depending on the type of body of water present (i.e., more linear if inhabiting territories with streams or rivers, more diffused if on marshes or wetlands (Skierczyński et al., 2008; Oleinikov, 2013). In terms of territory range, linear territories have been estimated to span 1-6 km in length, and the home ranges are reported to cover reported to be up to almost 2 km^2 with an average of 0.7-1 km^2 (Halbrook and Petach, 2018). Females hold smaller linear territories than males (Haan and Halbrook, 2015), tend to vacate them less and favour smaller streams compared to males (Zuberogoitia et al., 2006; Zabala et al., 2007). Males' territories overlap with those of females, for example with reports of one male overlapping with 3 females' territories (Yamaguchi et al., 2004), and up to 10 females during breeding season (SCAHAW, 2001). This has been explained as niche differentiation since males are typically twice the size of females, measuring about 10 cm more in length, and weighing about double (Thom et al., 2004a).

Based on data from 23 minks living along the Hudson River and 33 minks living along its tributaries, Haan and Halbrook (2015) report mean daily distance travelled of 532 m and 732 m, respectively, and suggest differences in daily movements could be due to differences in prey density. In the same study, males and females travelled more than 2.0 km daily on 8% and 0.4% of occasions, respectively, and the farthest single daily movement was 3.1 km by a male. Mink along the Hudson River were located on the opposite shoreline as the previous day on 9.5% of telemetry locations with a mean river width of 164 m (range 52–229 m) at

crossings. Territories are established during dispersal of young, i.e., August-October. At this point in time, mink can travel up to 50 km from their natal territory (SCAHAW, 2001).

Regarding mating, mink are promiscuous/polygamous, with males and females mating with several individuals of the opposite sex during the same breeding season in the wild (SCAHAW, 2001), and also in captivity (Thom et al., 2004b; Díez-León et al., 2013). The onset of breeding season is photoperiod related (Amstislavsky and Ternovskaya, 2000) and takes place once a year around March (Yamaguchi et al, 2004). Females are induced ovulators and courtship behaviour has been described as 'vigorous'. The male chases the female while producing clucking/chuckling vocalizations, and grasps her by the neck, with copulation lasting from few minutes to hours (Skierczyński et al., 2008; Harrington et al., 2012; Bagniewska et al., 2015). During the mating season, fights between males occur, though wounds (to head and neck regions) are rarely fatal (SCAHAW, 2001).

Females may experience super foetation (i.e., they ovulate several times during breeding season) and a delayed implantation of between 42-70 days (Axelsson et al., 2009). Based on data from 96 wild-born mink sent for necropsy at the Danish National Veterinary Institute, Pagh et al. (2021) reported litter sizes varying from 5-11 kits with an average of 7.6±0.9. Nest building and early maternal care are unstudied in the wild. According to Dunstone and Davies (1993), in the wild, the female mink may locate and take over a nest in dens of suitably sized prey animals, such as rodents, muskrats and rabbits. However, studies conducted in captivity, reported that female mink will build and maintain a nest using available materials, for instance straw (Malmkvist and Palme, 2015; Schou et al., 2018) and rear the offspring alone (SCAHAW, 2001). Kits are born altricial and fully dependent on maternal care for the first 4-6 weeks of life (Brink and Jeppesen, 2005; Malmkvist et al., 2016a). In the wild, kits will leave the natal territory at around 10-12 weeks of age, with male kits dispersing earlier and further than female kits (SCAHAW, 2001).

In terms of morbidity and mortality in the wild, American mink have been reported to have few endo- or ectoparasites (Schulte-Hostedde and Elsasser, 2011; Stuart et al., 2013), with mortality rates ranging between 0.34 and 0.59 in feral Danish populations (Andersen et al., 2023). Similar to several other mammalian species, infant mortality is highest during the first month of life (Ludwiczak and Stanisz, 2019). As adults, mink have few predators. Mink avoid open spaces (Macdonald et al., 2015), with human activities been cited as the main cause of mortality in the wild (Luxon et al., 2014; Elliott et al., 2018). Other causes of mortality include toxoplasmosis (Ahlers et al., 2015) and canine distemper (Taylor et al., 2021), as well as displacement due to territorial behaviour to suboptimal habitats, with weight loss and mortality being higher in winter and spring (SCAHAW, 2001).

3.2.2 Production cycle

Mink are seasonal breeders, and, when kept for fur production, the production cycle (see Figure 1) usually begins with the ‘premating season’ in January-February in the Northern hemisphere (Bis-Wencel et al., 2018; Zielinski et al., 2019). Mating occurs naturally (i.e., no artificial insemination is performed).

Standard breeding procedures on farms may involve a period of restricted feeding (i.e. slimming), with e.g., a reduction of up to 20% of *ad libitum* feed consumption (Damgaard et

al., 2004; Hansen and Damgaard, 2009) to slim females from October (Hansen and Damgaard, 2009) or December (Damgaard et al., 2003a, 2003b, 2004; Schou et al., 2018). The mating period on-farm typically lasts for approximately 2 weeks in March (Malmkvist and Palme, 2015; Felska-Błaszczyk et al., 2016b; Schou et al., 2018, 2019; Honoré et al., 2020; Seremak et al., 2023a, 2023b).

Due to the delayed implantation, the period from mating to parturition in mink has been reported to vary from 40-69 days (Felska-Błaszczyk et al., 2018) or 35-86 days (Ludwiczak and Stanisz, 2019). Kits are born in April-May (Jeppesen et al., 2000b; Korhonen et al., 2002a; Damgaard et al., 2003a; Ryökkynen et al., 2003; Pedersen et al., 2004; Mustonen et al., 2005a; Hänninen et al., 2008a, 2008b; Ahola et al., 2011; Malmkvist et al., 2016b; Birch et al., 2017; Malmkvist, 2019; Ahlstrøm and Skrede, 2020; Honoré et al., 2020). The mean birth date across a sample of Danish farms was determined to be April 30 and 95% of births occurred within 7 days of this date (Henriksen and Møller, 2015).

Litter sizes have been reported to vary with dam's age and colour type, ranging from 2 or 3 (Święcicka, 2013) and up to 10 (Pedersen et al., 2004; Houbak and Malmkvist, 2008; Ludwiczak and Stanisz, 2019), with an average of 6-9. Occasionally litter sizes can be higher, up to 15 kits (Dr J. Malmkvist, Researcher at Aarhus University, communication in a WG meeting, 2024a). Kits are born weighing up to 10-12 g, with large litters having usually lighter kits (Malmkvist, 2020). Malmkvist (2020) reported a growth rate of 13 g/day on average in individual kits from birth to 56 days of age. After the first months of life, kit growth is slowed and at the age of 5 months (in October) kits reach adult weight (Hunter and Lemieux, 1996; Hänninen et al., 2008b; Lohi et al., 2015; Kowalska et al., 2016; Brzozowski, 2018).

As in the wild, adult farmed mink are characterised by sexual dimorphism, with adult females weighing 2-3.5 kg and males weighing 3.5-5 kg (Supporting information – SF1). Mink kits are solely reliant on their mother for nutrition until 4 weeks of age (Tauson et al., 2006) and thereafter begin to consume solid feed and drink water. Dam and kits are separated (weaning) in June-July, when kits are 6-10 weeks of age (Jeppesen et al., 2000b; Damgaard et al., 2003a, 2004; Brink et al., 2004; Pedersen et al., 2004; Hänninen et al., 2008a, 2008b; Hansen and Damgaard, 2009; Ahola et al., 2011; Vesterdorf et al., 2014; Malmkvist et al., 2016a; Axelsson et al., 2017; Ahlstrøm and Skrede, 2020; Bak and Malmkvist, 2020; Supporting information – SF6, SF8). Dams are thereafter housed in individual cages (Malmkvist et al., 2016a). The period from parturition to weaning is referred to as the 'lactation period' (Ahlstrøm and Skrede, 2020).

After weaning, the whole or part of the litter remains in the whelping cage for a period, depending on litter size. Kits are housed together in sibling groups in one or more cages or in male-female sibling pairs after removal of the dam. The timing of sibling separation and housing them pairwise and later individually (individuals selected for breeding only) differs across farms. Regardless of intermediate social housing stages, mink are typically housed individually from 7 months of age (Damgaard et al., 2004; Axelsson et al., 2009; Ahola et al., 2011). In some EU Member States, the latter is a legal requirement, e.g., Denmark (BEK No 1553)[15].

[15] BEK No 1553 of 11/12/2015. Executive Order on the Protection of Fur Animals.

The subsequent phase, from approximately 10-11 weeks of age, is referred to as the juvenile growth period on the farm. This is considered to last from June to November (Ahlstrøm et al., 2006; Ahlstrøm and Skrede, 2020), during which feed is provided for *ad libitum* intake two to three times per day (Vinke et al., 2004, 2006; Axelsson et al., 2017) and thereafter (from November onwards) provided once per day (Vinke et al., 2004, 2006; Hänninen et al., 2008a, 2008b). As mink transition to their winter coat, their growth rate slows, fat deposition increases, and the fur begins to prime (Canadian NFACC, 2013a). Farmed mink have a strict annual fur production due to seasonal changes in daylight hours during the year. The growth and maturation of the dense winter fur is initiated by decreasing daylight hours, beginning around the autumn equinox, and ending in early November (Bassett and Llewellyn, 1949; Blomstedt, 1989; Hansen et al., 2014).

In late fall/early winter (e.g., November according to Bak and Malmkvist, 2020), the pelt quality may be assessed via live pelt grading (including individual handling and close visual examination of the fur by a human assessor) to determine which individuals to kill and pelt and which will be kept for breeding stock. This follows the autumn moulting, also in November (Ljøkjel et al., 2004). Killing and pelting begins during November (Vinke et al., 2004; Ahlstrøm et al., 2006; Hänninen et al., 2008a, 2008b; Hansen and Damgaard, 2009; Axelsson et al., 2017). Females with good reproductive success may be retained as breeders over consecutive years; for example, reproductive females were kept for three (Święcicka, 2013) or four (Felska-Błaszczyk et al., 2016a) breeding seasons across two Polish farms. Breeding females of up to 5 years were reported on a Finnish farm (Hänninen et al., 2008a).

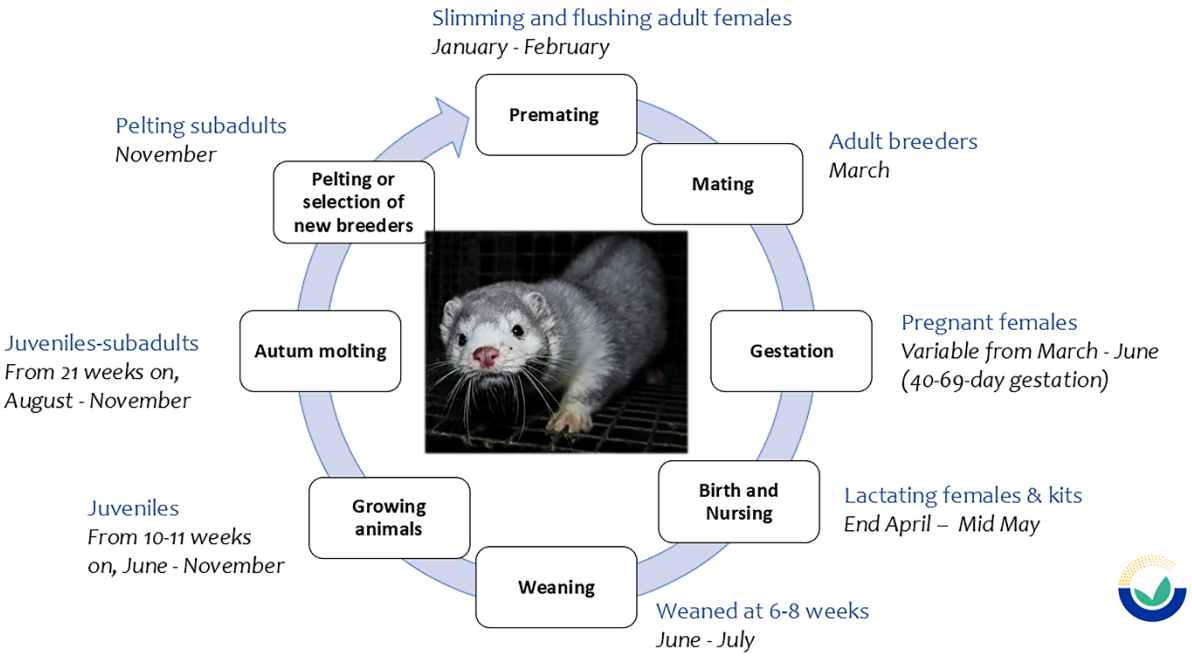

Figure 1: Typical production cycle for American mink (*Neogale vison*) farmed in Europe

3.2.3 Husbandry systems

Farmed mink are generally kept in wire mesh cages sheltered by open-walled sheds (thus they experience some degree of ambient temperatures and other factors such as lighting, wind and humidity, however, are sheltered from extreme fluctuations and from most precipitation and solar radiation). The details of physical housing are outlined in Section 3.2.3.1, though in brief, floor area of the cage is at least 0.210 m^2 and there is continuous access to a nest box with variable amounts of bedding (ranging from no material to an a*d libitum* supply of material). Standard-sized cages usually hold a maximum of 3 mink (Supporting information – SF1). Various fixed or manipulable items may be provided in cages as environmental enrichment. Some EU Member States have clear regulations on resource provision and thus it is common for one fixed resource item (a shelf or platform) and one manipulable resource (loose plastic tubes, mugs, or golf balls) to be included in cages. However, in some EU Member States, these requirements are unclear and there may be no cage resources or very minimal cage resources (straw). This is further discussed in Section 3.2.3.2.

Mink are generally housed individually as adults, though variable social housing conditions may be applied for juveniles and non-pregnant female breeders. Kits are kept in sibling groups with the mother at least until weaning (further detailed in Section 3.2.3.3). Feed amounts differ across the production cycle (see Section 3.2.3.4), though in any period mink are fed once per day at minimum. Feed consists of a meat-based paste delivered on the mesh tops of cages, and water is provided continuously in water pipes with nipple drinkers, or several times per day in water bowls; feeding and watering practices are outlined in Section 3.2.3.4. All other relevant aspects of mink husbandry including breeding practices, handling practices and routine vaccinations are discussed in Section 3.2.3.5.

3.2.3.1 Physical aspects of housing

Stakeholders report that mink cages are mainly kept in open-walled sheds year-round to maximise cross ventilation and exposure to natural light (Supporting information – SF2, SF6, SF8). As such, cages are sheltered overhead by a roof with skylights while the sides are open (Supporting information – SF2, SF3) (Figure 2). Other types of housing are closed-barn buildings (Figure 3). The exact proportion of open-walled sheds and closed barn buildings is not known.

Figure 2: Example of an open-walled shed for keeping minks

Figure 3**:** Examples of closed barns used in mink farms

There may additionally be ventilators attached to the shed roof and sunblock/windblock nets attached to the shed sides that may be rolled up or down depending on the climate, but there is no heating as the animals' fur serves as their insulation (Supporting information – SF2).

Sheds may also be equipped with water shower systems for cooling the animals (involving either a high line under the centre of the roof or a low line on top of the cages; Supporting information – SF2). The amount of environmental protection may vary from open-sided to more closed barn-buildings (WelFur, 2015a) depending for example on regions (Supporting information – SF3). Cages are elevated rather than being placed on the ground (Supporting information – SF2, SF3). The cages are mesh on all sides; mesh floors allow waste to fall through cage bottoms. The size of the openings in the wire mesh is reported to be equal to or smaller than 8.8 cm^2 with wire thicknesses of at least 1.8 mm^2 (Supporting information – SF4; also described in Jespersen et al. (2016)).

An additional coated fine mesh floor is in place while kits are young i.e., suckling age (Supporting information - SF2; also described in Schou et al. (2018) and Tauson et al. (2004). Urine may still pass through this fine mesh, but faeces will accumulate and are to be manually cleaned out of cages. It is additionally mandatory in Denmark to keep one empty cage between neighbouring lactating females during the lactation period (BEK No 1734[16] as cited in Malmkvist (2019); also reported in Malmkvist et al. (2016a) and Schou et al. (2018).

In EU Member States, all mink have continuous access to a nest box that is external to the main cage (Figure 4) and does not count as floor area of the main cage. Nest boxes may be made of wood, plywood, chipboard, plastic, or other materials with different properties for insulation, moisture absorbance and diffusion (Supporting information – SF2). Nest box walls are solid to allow physical and visual shelter. The nest box dimensions most commonly used are reported in Table 4.

Figure 4: Example of a nest box for mink external to the cage and without the mesh top, allowing to see its interior

Differing amounts of straw can be placed on the mesh top of the nest box to allow/prevent air flow depending on the climate, and it is possible to attach an extra wind blocker to the nest box entrance while females are pregnant to make the climate more controlled (Supporting information – SF2). Most of the articles reviewed corroborate the provision of one nest box per cage for farmed mink in standard commercial conditions (Ljøkjel et al., 2004; Denstadli et al., 2010; Felska-Błaszczyk et al., 2011, 2013, 2016a; Lasota et al., 2019), although multiple or large nest boxes can be used during group housing, according to a report by Møller et al. (2013).

Bedding for the nest box is reportedly provided (usually placed on the mesh tops of nest boxes to be pulled down by mink or embedded in the box itself) and may be hay, straw, flax or other straw-like material, shredded straw/paper, wood or other soft shavings, wool or comparable, with different properties for insulation and as nest building material (Supporting information – SF2, SF3, SF4). These materials are reported to be mandatory year-round in much of EU (Supporting information – SF2, SF3, SF4) and access is evaluated in all periods

[16] BEK No 1734 of 22/12/2006. Executive Order on the Protection of Fur Animals.

by the European Welfare Assessment protocol for mink (hereinafter called 'WelFur protocol') (WelFur, 2015a). Straw and straw-like materials are considered most important during the perinatal period, with declining importance as kits age (Henriksen and Møller, 2015). Mink dams use straw for nest building, most effectively when straw is delivered at the floor of the cage rather than on the top of the nest box lid (Malmkvist and Palme, 2008).

It is less clear from research whether bedding access is maintained in other periods of the production cycle. For example, reports of best-known practices in EU state that bedding is provided to pregnant females beginning in March (Malmkvist and Palme, 2015; Schou et al., 2018) or that nest boxes are embedded/topped with straw in the winter period to protect from low temperatures (Ludwiczak and Stanisz, 2019), which is beneficial for periparturient nest building and thermoregulation, but suggests that adult males and females go without bedding before and after this period. Straw can also serve as environmental enrichment, and it is therefore discussed also in Section 3.2.3.2.

Similarly, towards the end of the lactation period, it was reported that bedding was lacking for kits across commercial farms. This responds to the fact that during the transition to solid feed (from four weeks of age), feed is placed on the wire top of nest boxes, thereby limiting the room for dry straw (Henriksen and Møller, 2015). On-farm bedding in the nest box for juveniles, immature breeders, and adult male breeders is not described in the retrieved studies under commercial or experimental conditions (Hansen and Jeppesen, 2000a, 2000b, 2001; Jeppesen et al., 2000; Korhonen et al., 2000b; Ryökkynen et al., 2003; Tauson et al., 2004; Mustonen et al., 2005b; Ahlstrøm et al., 2006; Jespersen et al., 2016; Zieliński et al., 2019; Ahlstrøm and Skrede, 2020; Wlazło et al., 2021; Seremak et al., 2023a) though in the articles listed, mink reportedly had access to nest boxes.

Several Dutch and Danish (Damgaard et al., 2003a, 2003b, 2004; Pedersen et al., 2004; Vinke et al., 2004, 2005, 2006; Svendsen et al., 2007; Hansen and Damgaard, 2009; Malmkvist et al., 2013, 2016c; Bak and Malmkvist, 2020; Henriksen et al., 2020), Finnish (Korhonen et al., 2002a; Hänninen et al., 2008a, 2008b), Norwegian (Heimberg et al., 2018), and Swedish (Axelsson et al., 2009, 2017) studies report the provision of bedding during non-reproductive periods, including summer, fall, and winter. According to the current legislation in Denmark (i.e., BEK No 1553), mink should have permanent access to straw, and the nest box should be provided with ample amounts of straw, particularly during the birth period and in periods of winter-like weather.

Standard cages are adjacent to one another in single-row tiers (i.e., not stacked one on top of another) (Figure 5), though it is possible for two-tiered cages to be joined and used for juveniles in group housing. In these cases, the animals may or may not have access to both tiers; this is unclear from some stakeholder reports (Supporting information – SF2). Meanwhile, other stakeholders report that such vertically stacked cages may be used for animals of any age and not only for juveniles (Supporting information – SF3) (Figure 6). This is corroborated by articles reporting research with farmed mink (Pedersen et al., 2004; Ahola et al., 2011; Axelsson et al., 2017; Heimberg et al., 2018), though the animals were typically juveniles at the time of research. Juvenile mink may also be group-housed in horizontally interconnected cages (Hansen and Jeppesen, 2000a, 2000b, 2001; Pedersen et al., 2004;

Vinke et al., 2005, 2006; Hänninen et al., 2008a, 2008b) but this is not reported by stakeholders to be typical in standard farm settings (Supporting information – SF2, SF3, SF4).

Figure 5: Example of a building with mink cages in single-row tiers (©Jens Malmkvist)

Figure 6: Example of vertically stacked cages for mink

Standard cage dimensions reported by stakeholders are specified in Table 4 and are usually 70, 80 or 90 cm × 30 or 31 cm (l × w) cm. Comparable dimensions (i.e., ±1 cm in any dimension) are provided in studies done at commercial farms (Jeppesen et al., 2000b; Korhonen et al., 2000b, 2002a; Damgaard et al., 2003a, 2003b, 2004; Ryökkynen et al., 2003; Brink et al., 2004; Pedersen et al., 2004; Vinke et al., 2004; Brink and Jeppesen, 2005; Mustonen et al., 2005b; Svendsen et al., 2007; Hänninen et al., 2008a; Malmkvist and Palme, 2008, 2015; Axelsson et al., 2009; Hansen and Damgaard, 2009; Malmkvist et al., 2013, 2016b; Heimberg et al., 2018; Malmkvist, 2019; Schou et al., 2019; Zielinski et al., 2019; Henriksen et al., 2020; Wlazło et al., 2021; Seremak et al., 2023a, 2023b), though slightly larger top compartments in climbing cages (given in l x w x h: 66 x 39 x 46 cm; Ahlstrøm and Skrede, 2020); 70 x 30 x 45 cm (Heimberg et al., 2018); 60 x 30 x 45 cm (Pedersen et al., 2004), slightly larger main cages (l x w x h: 78 x 38 x 30 cm; Ahlstrøm *et al.*, 2006), or slightly larger nest boxes (l x w x h: 27 x 31 x 39 cm; Ahola et al., 2011) are also reported from research in commercial settings. Examples of cage units for mink are provided in Figure 7.

Figure 7: Example of standard cage for mink: (A) Adult mink, and (B) Dam with kits close to weaning. All cages give access to a permanent nest box at the front that is not visible in the pictures (©Jens Malmkvist, Aarhus University, Denmark)

Table 4: Standard husbandry systems for farmed American mink. Information provided by stakeholder umbrella organisations reflecting current practices (Supporting information – SF2, SF3, SF4). Where cells are empty or specifications are not provided, the information was either not available or not applicable.

Descriptive category	Social housing system (% of animals in category)	Duration	Number of animals	Cage dimensions in cm (l x w x h)[a]	Total floor space (m^2)	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h)[a]	Source
Male breeders	Individual (100%)	Whole life from adulthood	2	80 x 30 x 45 Occasionally additional upper compartment of 30 x 30 x 45[b]	0.240 Occasionally additional 0.090 upper compartment [(b)]		Yes, minimum 30 x 20 x 18 or at least 20 cm at shortest side	SF3
	Individual (100%)	Whole life from adulthood	1	90 x 31 x 45	0.279 (minimum 0.255)		Yes, continuous access 31 x 24 x 24 May also be 28 x 24 x 22 30 x 20 x 20	SF2
	Individual (100%)	Whole life after weaning	1	70 x 30 x 45	0.210		Yes	SF4
Non-pregnant female breeders	Individual (95%), or paired with kit from previous pregnancy (5%)	Approx. 6 months with one kit, until slaughter	2	80 x 30 x 45 Occasionally additional 30 x 30 x 45 upper compartment [(b)]	0.240 Occasionally additional 0.090 upper compartment [(b)]		Minimum 30 x 20 x 18 or at least 20 cm at shortest side	SF3
	Individual (95%), or paired with kit from previous pregnancy (5%)	Whole life from adulthood during non-reproductive season	1	90 x 31 x 45	0.279		Yes, continuous access May also be 31 x 24 x 24 28 x 24 x 22 30 x 20 x 20	SF2

Descriptive category	Social housing system (% of animals in category)	Duration	Number of animals	Cage dimensions in cm (l x w x h)[a]	Total floor space (m^2)	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h)[a]	Source
	Individual (100%)	Whole life after weaning		70 x 30 x 45	0.210			SF4
Pregnant females	Individual (100%)	2 months or until delivery		80 x 30 x 45 Occasionally additional 30 x 30 x 45 upper compartment[b]	0.240 Occasionally additional 0.090 upper compartment[b]		Minimum 30 x 20 x 18 or at least 20cm at shortest side	SF3
	Individual (100%)	36-85 days	1	90 x 31 x 45	0.279		Yes, continuous access May also be 31 x 24 x 24 28 x 24 x 22 30 x 20 x 20	SF2
	Individual (100%)	Whole life after weaning	1	70 x 30 x 45	0.210			SF4
Lactating females	Grouped with kits (100%)	2 months or until weaning	2 Usually six (one female and five kits)	80 x 30 x 45 Occasionally additional 30 x 30 x 45 upper compartment[b]	0.240 Occasionally additional 0.090 upper compartment[b]		Minimum 30 x 20 x 18 or at least 20 cm at shortest side	SF3
	Individual (100%)	2 months	1	90 x 31 x 45	0.279		Yes, continuous access May also be 31 x 24 x 24 28 x 24 x 22 30 x 20 x 20	SF2

Descriptive category	Social housing system (% of animals in category)	Duration	Number of animals	Cage dimensions in cm (l x w x h)[(a)]	Total floor space (m^2)	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h)[(a)]	Source
	Grouped with kits (100%)	All life besides giving birth and weaning the cubs	1	70 x 30 x 45	0.210			SF4
Suckling kits	Grouped with littermates and mother (100%)	2 months until weaning	2 Usually six (one female and five kits)	80 x 30 x 45 Occasionally additional 30 x 30 x 45 upper compartment[b]	0.240 Occasionally additional 0.090 upper compartment[b]		Minimum 30 x 20 x 18 or at least 20cm at shortest side	SF3
	Grouped with littermates and mother (100%)	2 months	1-4	90 x 31 x 45	0.279 Min 0.255m^2	Variable (whole litter with dam)	Yes, continuous access May also be 31 x 24 x 24 28 x 24 x 22 30 x 20 x 20	SF2
	In groups (100%)	Minimum 7-8 weeks	2	70 x 30 x 45	0.210 + 0.085 per each extra kit			SF4
Juveniles	Grouped with littermates and mother (100%)	3 months until moulting	2	80 x 30 x 45 Occasionally additional 30 x 30 x 45 upper compartment[(b)]	0.240 Occasionally additional 0.090 upper compartment[(b)]		Minimum 30 x 20 x 18 or at least 20 cm at shortest side	SF3
	Grouped with littermates and mother (100%)	2.5 months	1-2	90 x 31 x 45	0.279 + 0.085 per each extra kit	1M:1F, or 1M:2F	Yes, continuous access May also be 31 x 24 x 24 28 x 24 x 22 30 x 20 x 20	SF2

Descriptive category	Social housing system (% of animals in category)	Duration	Number of animals	Cage dimensions in cm (l x w x h)[(a)]	Total floor space (m^2)	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h)[(a)]	Source
	Grouped with littermates and mother (100%)	All life after weaning	2	70 x 30 x 45	0.210 + 0.085 per animal above 2			SF4

(a): l = length, w = width, h = height.

(b): Climbing cages involve the vertical stacking of two or more interconnected cages (mink have access to all compartments).

3.2.3.2 Environmental enrichment

According to stakeholders, mink might have access to a number of resources aimed to enrich their environment during the entire production cycle: platforms (or attached tubes) at least 20 cm above the cage floor, big enough to allow the animal to rest on the platform or in the tube: biting ropes, soft plastic tubes (loose on the cage floor), straw (straw-like material and straw briquettes), hard plastic tubes, plastic mugs, plastic chains, golf balls, or water-based resources (e.g., swimming basins) (Supporting information – SF2, SF3, SF5, SF6, SF8). Providing some form of resources to enrich the environment is mandatory in several mink-farming EU Member States, including Sweden (Supporting information – SF3, SF6), Finland (Supporting information – SF4, SF6), and Denmark (Supporting information – SF6). In Germany, an elevated platform, a non-wire climbing object and access to a 30 cm deep water basin are mandatory items for mink kept for fur farming purposes (Tiererzeugnisse-Handels-Verbotsgesetz, 2008[17], Supporting information – SF6). These resources can be divided into fixed and manipulable or loose resources for ease of discussion.

Regarding manipulable items that are loose on the cage floor, research sometimes reports the use of such items in standard housing in EU Member States where regulations are unclear (e.g., in Norway; Heimberg et al., 2018), in the Netherlands (Vinke et al., 2004, 2005, 2006) and in commercial European production conditions generally (Henriksen et al., 2020). Items such as loose and fixed tubes were included in the 2015 legal act in, e.g., Denmark, explaining why some report these items as mandatory (e.g., Bak and Malmkvist, 2020), while some report these types of resources as absent in cages (e.g., in Denmark; Pedersen et al., 2004; Malmkvist et al., 2013, 2016c; Malmkvist and Palme, 2015), in Poland (Zieliński et al., 2019; Wlazło et al., 2021; Seremak et al., 2023b), or where standard cages without such resources are reportedly used as controls in older studies (e.g., in Sweden; Axelsson et al., 2009). These publications cover housing at all stages of the production cycle, but it should be noted that during gestation and lactation in particular, loose resources might possibly be removed from cages due to safety/sanitary risks associated with asphyxiation of suckling kits or contamination of the items with faeces, as in Canada (Canadian NFACC, 2013a).

Fixed resources, such as mesh platforms or mounted wire tube cylinders for climbing/resting, may also be included in cages. These are elevated a minimum of 20 cm above the cage floor and span the width of the cage. Such platforms are mandatory for weaned mink in EU Member States such as Sweden (Supporting information – SF3), Denmark[9] (Pedersen et al., 2004; Malmkvist et al., 2013, 2016b; Malmkvist and Palme, 2015) and Poland[18] (Wlazło et al., 2021). Platforms are also reported to be used in commercial European production by Henriksen et al. (2020). However, in research taking place on a Polish research farm (Zielinski et al., 2019), it was specifically stated that shelves were not provided in cages. Stacked cages are usually provided with two platforms, accessible to the mink (Supporting information – SF3).

[17] Gesetz zur Durchführung unionsrechtlicher Vorschriften über Verbote und Beschränkungen hinsichtlich des Handels mit bestimmten tierischen Erzeugnissen sowie zu Haltungs- und Abgabeverboten in bestimmten Fällen (Tiererzeugnisse-Handels-Verbotsgesetz).

[18] Załącznik do obwieszczenia Ministra Rolnictwa i Rozwoju Wsi z dnia 19 września 2019 r. (poz. 1966).

3.2.3.3 GROUP SIZE

During the lactation period, the whole litter is housed with the dam (typically weaned at 7-8 weeks as reported by stakeholders; Supporting information – SF2, SF3, SF4). This practice is corroborated by the literature reviewed; however, farms may also practice equalizing group sizes into about 6 kits per cage by fostering kits from large litters with other, smaller litters (Brink et al., 2004; Fink et al., 2004; Brink and Jeppesen, 2005). After weaning, kits are split into individual housing, male-female sibling pairs, mother-kit pairs (i.e., without weaning), or sibling groups (Supporting information – SF2, SF3, SF4).

The practice of splitting weaned kits into pair housing is most often reported in research with commercially farmed mink (Jeppesen et al., 2000b; Ryökkynen et al., 2003; Damgaard et al., 2004; Pedersen et al., 2004; Hänninen et al., 2008a, 2008b; Axelsson et al., 2009; Hansen and Damgaard, 2009; Ahola et al., 2011; Bak and Malmkvist, 2020; Henriksen et al., 2020; Mundbjerg et al., 2021). Rarely, and possibly only in research farm settings (Vinke et al., 2004), kits may be housed in family groups with the mother without separation until they are killed and pelted.

Litters are further divided into individual housing, pairs, or groups of three (if not already housed as such) at approximately 6.5 months of age and housed this way for another 2 months until approximately 8.5 months of age when considered "immature breeders". Thereafter, all mink are housed individually (Supporting information – SF2) or remain in pairs until breeding or killing and pelting (Supporting information – SF3). Some stakeholders alternatively report that juveniles are kept only in individual housing from weaning onwards (Supporting information – SF4).

Male breeders are housed individually beginning at sexual maturity (Supporting information – SF2, SF3). Non-pregnant female breeders are also typically housed individually, unless a kit from their previous litter was not killed and pelted in which case these two may be housed together (Supporting information – SF3). When pregnant, all adult females are housed individually until after birth (Supporting information – SF3). This is corroborated by the literature reviewed and listed above.

3.2.3.4 FEEDING AND WATERING

Water is provided to all cages via automatic nipple drinkers on a water pipe system. Pipes are usually insulated, but this is not mandatory in all countries, e.g., Sweden (Supporting information – SF3). Water is circulated through pipes 24/7 with a pump to prevent freezing and to keep water cool in hot weather (Supporting information – SF2). However, in Finland, continuous access to drinking water is not legally required and water may freeze during the winter months on farms that lack heating systems (Supporting information – SF4). If pipes freeze, farmers provide water in dishes approximately twice per day (Hänninen et al., 2008a).

Feed (i.e., a paste based on chicken, fish, or other non-mink animal offal-based materials; Ljøkjel et al., 2004; Hänninen et al., 2008b; Denstadli et al., 2010; Felska-Błaszczyk et al., 2011, 2013, 2016a; Lasota et al., 2019; Seremak et al., 2023a, 2023b) is delivered on the mesh top of cages (Supporting information – SF2, SF3, SF4). It is most often delivered using a truck driven down the aisles of cage rows (Malmkvist et al., 2016b) but may also be

automatically dosed by machine feeders on the tops of cages (Felska-Błaszczyk et al., 2013; Lasota et al., 2019; Seremak et al., 2023a). Management of uneaten feed showed some variability depending on the farm, with the feed removed from the wire and discarded, or re-distributed among cages, or left on the top. Average frequency of removal (days or in-between meal distribution) is currently not known.

Feeding practices differ by time of year and/or point in the production cycle for mink. In females, sometimes the feeding strategy includes approximately 2 weeks of restricted energy supply right before the flushing period (Damgaard et al., 2004). The period of restricted feeding (i.e. 'slimming') is followed by a period of food availability *ad libitum* (i.e. 'flushing') beginning in late February, at least 5 days prior to mating (Damgaard et al., 2003a, 2003b, 2004; Hansen and Damgaard, 2009; Schou et al., 2018). Flushing significantly impacts reproductive hormone production (Fink and Tauson, 1998) and therefore litter size (Tauson, 1988). In order to reduce the body weight of females, feed ingredient and nutritional content are changed to contain less fat and the quantity of daily meal is gradually reduced of approx. 53-61% of the amount of feed provided for *ad libitum* intake (Schou et al., 2018). Then, females are fed amounts close to *ad libitum* during lactation. Some periods of feed restriction may also be applied to males to be used as breeders (Damgaard et al., 2003a, 2003b, 2004; Hansen and Damgaard, 2009; Schou et al., 2018; Lasota et al., 2019).

3.2.3.5 Other management practices

Handling can be defined as "catching or trapping mink and removing them from their cages or nest boxes" (WelFur, 2015a) and is typically conducted by hand (normally wearing hand protective gloves) or by use of a handling cage (Figure 8). Mink are handled for breeding selection, weaning, when pelt quality is evaluated, vaccination and, maybe, testing for specific diseases (e.g., Aleutian disease), and when rearranging the animals within the sheds is needed (Supporting information – SF1).

Related to handling for vaccination, according to field information, changes have been reported in the prevalence of vaccination of mink across producing countries, and current prevalence is uncertain. Kits can be vaccinated (subcutaneous injection) against botulism (Vinke et al., 2004, 2005, 2006), viral haemorrhagic enteritis, and haemorrhagic pneumonia (Wlazło et al., 2021) around the time of weaning or just before (6-7 weeks of age), along with deworming treatment (Wlazło et al., 2021). Mink can be vaccinated against canine distemper (Vinke et al., 2004, 2005, 2006) and dewormed a second time at 9-10 weeks of age (Wlazło et al., 2021). A single dose is sufficient for kits destined for pelting. However, animals intended for breeding may be re-vaccinated in the winter preceding the breeding season, depending on national requirements.

Handling is also necessary for the practice of 'toe clipping'. The procedure is used to test plasmacytosis in mink and any time blood testing is required (Dobson et al., 2008).

Related to handling for breeding, animals may be re-organised with breeding males distributed in cages among several females (typically 1 male per 5-6 females). The female is tried for mating with one nearby male or other males if needed (Malmkvist and Palme, 2015; Honoré et al., 2020). To enhance breeding goals, males may be matched with groups of

females selected beforehand (Lasota et al., 2019; Ludwiczak and Stanisz, 2019; Seremak et al., 2023a, 2023b). Regardless of the type of breeding practice, matches aim to reduce inbreeding (Ludwiczak and Stanisz, 2019). Females are caught in their cages or nest boxes and placed in a designated male's cage one at a time to allow for natural mating (Korhonen et al., 2002a; Schou et al., 2019; Honoré et al., 2020, Seremak et al., 2023a).

Copulatory behaviour involves scent marking/rubbing on the cage, chasing partner, sniffing partner, the male grasping the female's neck with his teeth, and mounting and intromission, though aggression and female rejection of the male may occur (Seremak *et al.*, 2023b). Farmers typically consider mating successful if copulation (i.e., neck grasping, rounding of the back, and intromission; Korhonen et al., 2002a) lasts more than 10 minutes (Seremak et al., 2023a).

The female is left in the cage of the male for some hours; then, removed after successful copulation. If mating is not successful, she is moved back into her home cage. Another female may be introduced to the male's cage later in the day (i.e., males can typically manage to mate once in the morning and once in the afternoon (Seremak et al., 2023a, 2023b). Thus, a male may typically be introduced to one-two different females per day, while a female often only is tried once (can be twice) per day, usually with a pause between mating attempt days, until successful mating is obtained.

Adult female breeders are often "double mated", meaning mated and re-mated with the same male 9 days after the first mating (i.e., the 1+9 system; Damgaard et al., 2003b, 2004; Schou et al., 2018), 8 days after the first mating (i.e., the 1+8 system; Korhonen et al., 2002a, Malmkvist and Palme, 2015; Schou et al., 2018), or at 1-week intervals (Felska-Błaszczyk et al., 2011). Mating may also be more frequent, e.g., triple mating (re-mating at the 8th and 9th day; reviewed by Ludwiczak and Stanisz (2019) or quadruple mating (re-mating at the 2nd, 3rd, and 4th consecutive day or 2nd, 8th, and 9th consecutive day; Ślaska and Rozempolska-Rucińska, 2011; Seremak et al., 2023a, 2023b). Re-mating with a new male the next day (Seremak et al., 2023a) or at 3-day intervals (Korhonen et al., 2002a) might also be practiced if mating with the first male did not meet the farmer's success criterion (i.e., 10+ min in the copulation posture; Malmkvist et al., 1997).

Figure 8: Example of a handling cage for mink in a farm (©Stanisław Łapiński)

Another practice requiring handling of mink is the provision of melatonin implants, even though there are countries in EU that have prohibited its use in animals (e.g., Denmark[19], Finland[20] and Sweden[21]) (Supporting information – SF6).

Melatonin implants are used to induce earlier fur maturation (moulting) in Autumn as the furring cycle is regulated by day length modifying levels of hormones. Silastic melatonin implants deliver melatonin to mink at a constant rate for a certain period and are implanted in mid-July under the skin of the nape of the neck, where they release melatonin into the bloodstream to mimic a shortened photoperiod, and the fur maturation period is then shortened by over two months. The use of melatonin implants is not a standard annual practice in mink farms and is not applied in all animals. Animals intended for breeding in the following year are typically excluded from implantation. Instead, melatonin implants are selectively used on specific groups, such as females that did not give birth in the previous season, late-born kits, or sick animals, to be able to initiate the pelting process earlier (Supporting information – SF8).

[19] Decree on the Protection of Fur Animals. BEK no 1553 of 11/12/2015.

[20] Government regulation on the protection of fur animals 20.10.2011/1084.

[21] Regulations on changes to the Swedish Agricultural Agency's regulations and general advice (SJVFS 2019:16) on the breeding and keeping of fur animals (SJVFS 2020:23).

Mink may also be handled for transportation to another farm, but this is typically not conducted as most mink live their entire lives at the farm where they are born and killing is conducted on-site before pelts are transferred elsewhere (WelFur, 2015a).

Farmers do not handle mink for physical mutilations such as castration or modifications for the purpose of identification, as individuals are largely identified by their cage number (WelFur, 2015a).

3.3. Foxes

3.3.1 Arctic fox

3.3.1.1 BIOLOGY

Arctic foxes (*Vulpes lagopus*) inhabit the Arctic regions of Eurasia and North America (Angerbjörn and Tannerfeldt, 2014) and the southern edge of their distribution overlaps with that of red foxes (*Vulpes vulpes*) (Elmhagen et al., 2002; Warret Rodrigues and Roth, 2023). Arctic foxes have been declared critically endangered in parts of their range due to climate change (Landa et al., 2017). Their habitats include coastal and inland Arctic as well as mountainous tundra (Berthelot et al., 2023) and they routinely use sea ice for long-distance dispersal as well as foraging (Gagnon and Berteaux, 2009; Lai et al., 2015). Arctic foxes sometimes also live close to human settlements (Norén et al., 2023).

Arctic foxes' adaptations to arctic living conditions include a more compact body shape preserving heat, dense fur around the paws facilitating walking on snow, smaller ears preventing frost damage (Prestrud, 1991) and retina cell compositions suited to high light levels (Malkemper and Peichl, 2018) and they can smell carrion from several kilometres away as well as rodents under snow cover (Lai et al., 2015).

The total body length of the adult artic fox ranges between 78-98 cm (50-65 cm without tail) and the shoulder height is approximately 30 cm (Østbye et al., 1976). They finish growing at six to seven months of age (Prestrud and Nilssen, 1995). Animals in the south of the range are larger than those in the north (Audet et al., 2002).

Body weight ranges from 2.5 to 8 kg (Østbye et al., 1976), with males being ca. 1 kg heavier than females (Goltsman et al., 2005). The basal metabolic rates are lower in winter than in summer, which facilitates the accumulation of fat reserves, and leads to higher body mass in winter than in summer if fed *ad libitum* (Fuglei and Øritsland, 1999; Fuglesteg et al., 2006). The basal metabolic rate decreases further during feed withdrawal, which is an adaptation to the long periods without food that often occur during arctic winters (Fuglei and Øritsland, 1999; Fuglesteg et al., 2006). Life expectancy is typically three to four years, but may be up to ten years (Audet et al., 2002).

Arctic foxes establish dens in soil as well as in rocky areas (Dalerum et al., 2002). Breeding dens are sometimes used over decades (Goltsman et al., 2005), and their physical characteristics are more important than short distances to food sources (Gallant et al., 2013; Moizan et al., 2023). Den selection furthermore depends on seasonal food availability (Gallant et al., 2013), and presence of red foxes or humans (Selås et al., 2010). Foxes dig extensively

for den establishment and upkeeping: dens have been reported to have on average 44 ± 32 openings and cover an area of 277 ± 237 m^2 (77 arctic fox dens; Dalerum et al., 2002).

Den density varies greatly from around 9 dens per 100 km^2 (Goltsman et al., 2005) to more than 60 dens per 100 km^2 (Pletenev et al., 2021), depending on resource availability. Accordingly, home range sizes have been reported to vary from 0.5 to 125 km^2 (Pletenev et al., 2021), with females usually having smaller home ranges than males (Anthony, 1997). Home range size is mainly influenced by food availability (e.g., lemming abundance; Kokorev and Kuksov, 2002), but other factors such as high population pressure on islands (Pletenev et al., 2021) or reproductive stage play a role as well. Home ranges of red and Arctic foxes on islands may overlap without apparent negative effects for the Arctic foxes (Lai et al., 2022). Territories are most strongly defended during the breeding season (Goltsman et al., 2005), when foxes may travel approximately 25 to 80 km per day within their territory (based on data from 8 Arctic foxes on an island; Poulin et al., 2021). Some individuals also show sporadic medium to long-distance movements (Audet et al., 2002). Arctic foxes in some regions also migrate seasonally; one female was tracked up to 600 km away from her summer home range (Audet et al., 2002; Tarroux et al., 2010).

Arctic foxes tend to be most active during the night including dusk and dawn (Anthony, 1997), with their daily rhythm being influenced by human or prey activity (Audet et al., 2002; Fuglei et al., 2017; Larm et al., 2021). In the summer, Arctic foxes are active approximately 12 h per day (Anthony, 1997; Clermont et al., 2021).

Arctic foxes are opportunistic generalists with a varied diet similar to that of red foxes, though somewhat more restricted due to the more limited range of food available in their habitat and competition with other predators (Elmhagen et al., 2000; 2002). The main food source are lemmings, but also birds, voles, shrews, hares, eggs, invertebrates, carcases (reindeer, seals, sheep), plants and fruits (Hersteinsson and Macdonald, 1996; Elmhagen et al., 2000).

Foraging behaviour of Arctic foxes includes searching, digging, biting, pushing, pulling, lifting, chasing and killing (Ommundsen, 1994; Morton et al., 2023) as well as jumping mouse-sized prey from above (called "mousing" or "vole jumps"; Červený et al., 2011; Yuk et al., 2024). Food consumption involves biting, chewing, and tearing apart. All this is reflected anatomically in sufficient bite force for feeding on large mammal carrion (Forbes-Harper et al., 2017) and skulls well-suited for diving into snow (Yuk et al., 2024). During foraging, foxes dig out, e.g., burrow-nesting birds (Sklepkovych and Montevecchi, 1996) or rodents (Willebrand et al., 2017). They also dig for caching food (also called "hoarding") outside their dens throughout their territory (Sklepkovych and Montevecchi, 1996; Thomson and Kok, 2002; Clermont et al., 2021). Food is first cached close to where it was found (median 82 m, range 5 to 985 m) and then often carried to long storage cache locations (median 256 m, range 36 to 1,040 m from first cache; Careau et al., 2007). Caching also depends on food abundance. For example, foxes cached fewer eggs during years of very low lemming abundance because they needed them as an immediate food resource (Careau et al., 2007).

The exact proportion of time spent foraging and exploring by Arctic foxes is difficult to determine because they move long distances. Sixteen Arctic foxes equipped with GPS and

accelerometers spent 34% of their daily time running, 9% walking, and 8% digging (Clermont et al., 2021).

Arctic foxes typically live solitary outside the breeding season and in monogamous pairs during breeding season (Szuma, 2011; Nanova et al., 2017), though complex social relationships including polygamy (Norén et al., 2012), breeding repression in non-dominant females (Kullberg and Angerbjörn, 1992) and nonreproducing females helping to raise cubs occur (Goltsman et al., 2005). Mating season is March to April, and litters of typically 5 (up to 19) altricial cubs are born in a den after approximately 51-54 days of gestation (May; Norén et al., 2023). Birth weight is 60-90 g, and cubs are blind for the first 14-16 days (Audet et al., 2002).

Cubs emerge from the den around 3-4 weeks of age and are weaned at 6-7 weeks (Audet et al., 2002). They may start to disperse in August but they typically disperse from September (Audet et al., 2002) at around 6 months of age. Usually, half of the female and less than 1% of the male yearlings stay in their natal range during the first winter (Goltsman et al., 2005; Ehrich et al., 2012; Meijer et al., 2013; Landa et al., 2017).

Average juvenile mortality is around 13-30%. It strongly depends on food availability, especially lemmings (Norén et al., 2023), and predation (Choi et al., 2019), but also diseases, den abandonment, sibling aggression and climatic variations (Meijer et al., 2008, 2013; Unnsteinsdottir et al., 2016; Landa et al., 2017; Choi et al., 2019). Infanticide of unrelated (Norén et al., 2023) but not of own offspring has been observed.

Arctic foxes communicate with olfactory, auditory and visual signals (Goltsman et al., 2005), with males and females using faeces, urine and face rubbing to mark territorial borders (Norén et al., 2023). Social behaviour is apparent in cups that emerge from the den, including playing, agonistic interactions and territorial marking (Buhler et al., 2024).

3.3.1.2 Production cycle

The annual cycle of fox breeding begins with the breeding season (see Figure 9). Breeding farmed arctic foxes (usually of the 'blue' colour morph) occurs in spring in the northern hemisphere; vixens are either mated naturally (i.e., male-female copulation) or artificially inseminated in March-late April (Korhonen and Niemelä, 2000; Pyykönen et al., 2005, 2007; Sanson et al., 2005; Mononen et al., 2012). Farmed Arctic fox cubs are born between May-June (Ahola et al., 2000a, 2002a, 2005, 2009, 2010; Korhonen et al., 2000a, 2001c, 2003a; Korhonen and Niemelä, 2000; Mononen et al., 2001; Pyykönen et al., 2005; Koistinen et al., 2008, 2009a, 2009b, 2016; Koistinen and Korhonen, 2013) after a 52-day gestation period (Osadchuk, 2001; Osadchuk et al., 2003).

Litter sizes of 1 to 14 live cubs at birth have been reported (Pyykönen et al., 2005; Lindh et al., 2020) with a mean of approximately 9 (Pyykönen et al., 2010). Litter sizes including cups found dead at birth (i.e., at the first postpartum check by farm staff), meanwhile, have been reported to be around 8 ± 3.5 or 10.4 ± 2.6 cubs on average depending on housing and management factors (Pyykönen et al., 2009), or 8.1 ± 3.8 or 9.7 ± 3.8 on average depending on parity (primiparous and multiparous, respectively; Pyykönen et al., 2007).

Vixens are separated from their litter (weaned) between June and August when cubs are approximately 7 weeks old (Pedersen et al., 2002; Koistinen and Mononen, 2008; Koistinen et al., 2009a, 2009b, 2016; Przysiecki et al., 2010; Koistinen and Korhonen, 2013) or 8 weeks old (Ahola et al., 2000a, 2005, 2010; Korhonen et al., 2000a, 2001b, 2001c, 2003a; Koistinen et al., 2007). The period from parturition to weaning is considered the 'lactation period' (Burlikowska et al., 2013), though lactation generally ceases around 5 or 6 weeks postpartum (WelFur, 2015b).

The juvenile growth period in farmed Arctic foxes lasts through the late summer and fall in the northern hemisphere, when foxes are between approximately 10 and 17 weeks of age – e.g., July-September in Poland (Gugołek et al., 2012; Zawiślak et al., 2017) and August-September (Dahlman et al., 2003) or August-December in Finland (Ahola et al., 2000a). Cubs may be fed twice per day during this time (Korhonen et al., 2000a, 2003a; Ahola et al., 2002a, 2005; Pedersen et al., 2002; Koistinen et al., 2008) to pursue maximum growth and fur quality.

Depending on diet and feeding regimen, foxes have been shown to gain around 6 to 8 kg during the postweaning growth period (Zawiślak et al., 2017). Dahlman et al. (2003) determined that growth of arctic fox cubs largely concludes by 14 weeks of age. Cubs are typically housed with their siblings for all/some of this time, but practices of splitting the litter into pair or individual housing differ across farms. Adult breeders at least 1 year old are housed individually, and for such adults these months may be referred to as the 'regeneration after reproduction period' (Szymeczko and Bogusławska-Tryk, 2005; Burlikowska et al., 2013).

The juvenile growth period is followed by (and may overlap with) the fur growth period, during which the winter fur develops. This period has been attributed to the months of July-December (Szymeczko and Bogusławska-Tryk, 2005), September-November (Dahlman et al., 2003), September-December (Burlikowska et al., 2013), or October-November (Zawiślak et al., 2017). Arctic foxes are considered 'sub-adults' at this time (Ojala et al., 2021) and may be fed once per day (Korhonen et al., 2000a, 2003a; Ahola et al., 2002a, 2005; Pedersen et al., 2002; Koistinen et al., 2008).

Males' testicles may be checked in December to ensure that they are developed/of normal size for the upcoming breeding season (Pyykönen et al., 2009). Vixens may be fed a restricted diet beginning in January to induce slimming for optimising breeding results (Lindh et al., 2020). According to a field study by Koskinen et al. (2007), the body weight of the vixen at the time of artificial insemination (AI) had an effect on the number of eggs ovulated and thus on litter size. The litter size was significantly lower in the weight category over 11 kg at insemination time (1.74 cubs per inseminated female). Only 41% of females weighing over 11 kg at the time of AI weaned their cubs.

Pelting is typically performed in winter – i.e., November (Dahlman et al., 2003) or December (Ahola *et al.,* 2000a, 2002a, 2005, 2009; Korhonen et al., 2000a, 2003a; Pyykönen et al., 2010, Ylinen et al., 2018; Liu et al., 2019) – once the winter pelt has fully developed and matured. Individuals chosen to be retained for breeding are not killed and pelted and can be bred a few months later, at 10-11 months of age (Pyykönen et al., 2010).

Females may be kept as breeders for multiple years; the mean dam vixen age was 2.40 ± 0.23 years and 1.35 ± 0.18 years across two Norwegian farms (Sanson et al., 2005) and reproductive females ranged from 1-5 years on a Finnish farm (Pyykönen et al., 2005). Similarly, multiparous vixens in a Finnish study ranged from 2-5 years of age (Pyykönen et al., 2010). From the time of killing and pelting to the gestation period, there are only breeding animals on the farm. Typically, farms will retain one male for every 15-20 females if AI is used (most common method on fox farms), or one male for every 5 females if natural mating is used (less common; Mononen et al., 2012).

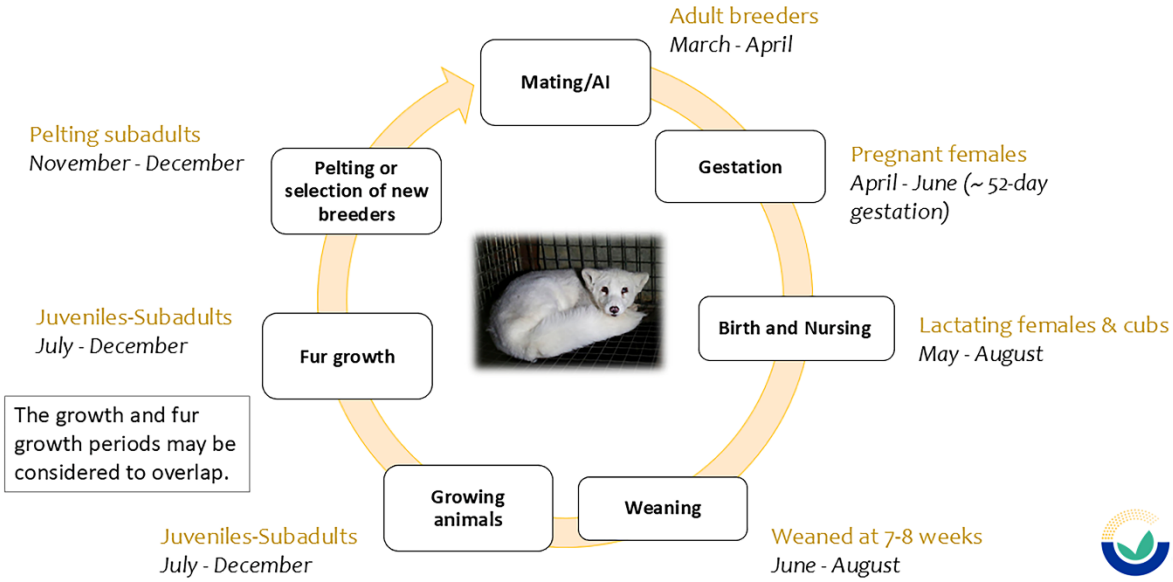

Figure 9: Typical production cycle for Arctic foxes (*Vulpes lagopus*) farmed in Europe

3.3.2 Red fox

3.3.2.1 Biology

Red foxes (*Vulpes vulpes*) are distributed across the entire northern hemisphere except Iceland and Greenland, have been introduced in Australia (Hoffmann and Sillero-Zubiri, 2021), and overlap with the southern range of Arctic foxes (Elmhagen et al., 2002; Warret Rodrigues and Roth, 2023). Red foxes occupy a variety of habitats, from semi-deserts to woodland and farmland to cities (Larivière and Pasitschniak-Arts, 1996; Holmala and Kauhala, 2009; Márton et al., 2014). Their presence is closely associated with that of small mammals (Carricondo-Sánchez et al., 2016), and they typically avoid large open areas (Holmala and Kauhala, 2009; Márton et al., 2014).

Red fox retinas are adapted to low light conditions (Malkemper and Peichl, 2018). They have very high absolute hearing sensitivity (Malkemper et al., 2015) and a highly developed sense of smell (Ortiz-Leal et al., 2023) which they use for foraging and olfactory communication (Soulsbury and Fawcett, 2015; McLean et al., 2021).

Both body size and weight vary, with larger and heavier individuals found in the northern distribution range and in good quality habitats (Gortázar et al., 2000; Takeuchi, 2010). Total body length ranges from 87 to 140 cm (Østbye et al., 1976; Cavallini, 1995) and length without tail (head-body length) from 45 to 85 cm (Østbye et al., 1976; Cavallini, 1995; Soulsbury and Statham, 2024). Shoulder height is approximately 35 to 52 cm (Østbye et al., 1976). Red foxes grow until around 6 months of age (Soulsbury and Statham, 2024). Adult red fox tracks are approximately 5 cm long and 4-4.5 cm wide, with forefoot tracks slightly larger than hindfoot tracks (Bang and Dahlström, 2000). The tread area of the toes is approximately 17-19 x 8-10 mm (size estimated from track identification drawings). The stride length is approximately 25-35 cm while walking and 70-80 cm while trotting (Bang and Dahlström, 2000).

Body weight ranges from 2.1 to 14 kg (Østbye et al., 1976; Cavallini, 1995). Males are heavier than females, and their weight is higher in winter (Iossa et al., 2008), at low population densities (Pagh et al., 2018a) and later in life (Pagh et al., 2018b). Average life expectancy is 12-18 months (maximum 12-14 years; Gortázar et al., 2000; Takeuchi, 2010; Soulsbury and Statham, 2024).

Red foxes use several dens throughout their territory (Weber, 1985). These are preferentially located in areas with low neighbour density (Moizan et al., 2023) and in sheltered areas (Barrull et al., 2014; Petrov et al., 2016; Karssene et al., 2019; Tsunoda et al., 2020; Ruíz-Villar et al., 2021). Foxes dig their own dens, use those built by other species, sometimes in cohabitation (Nowakowski et al., 2020), or occupy natural crevices (Nowakowski et al., 2020). Red foxes dig extensively for den establishment and upkeeping. Foxes at nine fox dens in a Polish forest dug up so much earth that they changed the soil characteristics and thus plant society in a 100 m^2 area around the den (Kurek et al., 2014). Dens are used more for resting during wet and cold weather, and less in areas with humans hunt at dens (Weber, 1985).

Population density varies between 0.08 to 37 foxes per km^2, with more foxes in resource-rich habitats (Soulsbury and Statham, 2024). Home range size varies from approximately 0.3 ha and reported up to 52 km^2, with smallest ranges at high food availability (e.g., urban) and for females at birthing time (Larivière and Pasitschniak-Arts, 1996; Soulsbury and Statham, 2024). Ranges are defended as territories, with some overlap between relatives or between males and females (Larivière and Pasitschniak-Arts, 1996). Urban red foxes travel (mostly at walking pace) around 4-7 km per night and rural foxes 6-10 km or more (Larivière and Pasitschniak-Arts, 1996; Soulsbury and Statham, 2024). Males move longer distances than females especially in autumn and winter (Soulsbury and Statham, 2024). Straight-line dispersal distances of around 300 km have been recorded (juveniles and adults; Soulsbury and Statham, 2024).

Red foxes are mostly nocturnal and crepuscular but adjust activity patterns to that of humans or intraguild competitors, or to prey accessibility (Barrull et al., 2014; Díaz-Ruíz et al., 2016; Petrov et al., 2016; Maheshwari, 2018; Karssene et al., 2019; Tsunoda et al., 2020; Ruíz-Villar et al., 2021). They often rest for a few short periods during the main activity times (Meia and Weber, 1993).

Red foxes are opportunistic generalists with a very varied diet that includes hunted prey (primarily small mammals, but also birds, fish and invertebrates), carcasses (e.g., deer) and fruit (Padial et al., 2002; Remonti et al., 2005; Lanszki et al., 2019; Windell et al., 2019; Nakane et al., 2022).

The foraging behaviour of red foxes includes the same behaviours as that of Arctic foxes (searching, biting, pushing, pulling, lifting, chasing, killing, vole jumps and digging; Ommundsen, 1994; Červený et al., 2011; Morton et al., 2023; Yuk et al., 2024) and they bite, chew and tear apart for consumption, with similar skull characteristics as Arctic foxes. Red foxes also cache food by digging caches outside their den, on which they may rely during winter (Sklepkovych and Montevecchi, 1996). They cached 25% of baits laid out above and below ground, with baits from below ground being more likely to be cached (Thomson and Kok, 2002). One fox that caught 10 spawning carps in 1:33 h cached all of them in the vicinity (Tobajas and Díaz-Ruíz, 2022). Time spent foraging and exploring is around 7-8 h per day (night) in urban foxes (Saunders et al., 1993; Doncaster and Macdonald, 1997).

Red foxes live in flexible social structures that range from monogamous pairs to polyandrous/ polygynous mating (Baker et al., 2004). Heavier males tend to hold larger territories and sire more extra-pair offspring (Iossa et al., 2008). Family groups typically consist of one male and several (related) females, with usually only one female reproducing and the male helping to raise the cubs (Macdonald, 1979; Baker and Harris, 2000; Vergara, 2001). Mating season is in January to February, and litters of 1 to 6 altricial cubs are born in a den after 49-55 days of gestation (Soulsbury and Statham, 2024). Birth weight is 100 g or more, and cubs are blind for 10-14 days (Larivière and Pasitschniak-Arts, 1996; Soulsbury and Statham, 2024).

Cubs emerge from the den around 4 weeks of age, which coincides with the start of weaning (Soulsbury and Statham, 2024). Dispersal may start at 10 weeks old (Robertson et al., 2000) but the main dispersal period is September to January (Larivière and Pasitschniak-Arts, 1996; Robertson et al., 2000). Males disperse earlier and further than females, with distances depending on population density and food availability (typically 2 to 31 km; Larivière and Pasitschniak-Arts, 1996; Walton et al., 2018).

Annual (juvenile) mortality is around 50% and causes include predation, parasites, diseases, collisions and hunting (Soulsbury and Statham, 2024), and in some areas bioaccumulation of heavy metals (Pérez-López et al., 2016). Infanticide of unrelated (Vergara, 2001) but not of own offspring has been reported in wild red foxes.

Red foxes communicate with olfactory, auditory and visual signals, with scent marking playing an important role in social group affiliation (Soulsbury and Fawcett, 2015). Cubs show a variety of social interactions at 4 weeks of age, including playing, scent marking and agonistic interactions (Meyer and Weber, 1996).

3.3.2.2 Production cycle

The production cycle of farmed red foxes (on farms typically termed "silver" after the main used dark-coated colour morph) (see Figure 10) is almost similar to that of Arctic foxes. The breeding season occurs slightly earlier than in Arctic foxes, in late January-February (Tong'ao et al., 2023) or February-late March (Hovland et al., 2006; Mononen et al., 2012). Likewise,

cubs are born earlier, in April-May (Ahola and Mononen, 2002; Ahola et al., 2002b, 2006; Schøyen et al., 2007). Weaning (as previously described for farmed Arctic foxes) occurs around 8 weeks of age on farms (Ahola et al., 2002b; Akre et al., 2010; Hovland et al., 2016). Vixens are typically removed from their breeding cages with a nest box and returned to standard cages without a nest box at this point (Ahola et al., 2000b). Mean litter sizes of 3.9 ± 1.2 cubs have been reported on farms (Ahola et al., 2006). After weaning, cubs may be fed twice per day during the preweaning juvenile growth season (i.e., the summer and early fall) and hereafter typically once per day (Ahola et al., 2000b; Ahola and Mononen, 2002).

Farmed red foxes can begin to reproduce shortly after the autumn of their first year of life (Jeppesen et al., 2000a) which is earlier than Arctic foxes. Like Arctic foxes, red foxes may be bred across subsequent years. Farmers tend to select animals with good reproductive success, but also particular pelt colour/quality and inbreeding factors are taken into account. Across three studies, males aged 2-4 years and females aged 1.5-3.5 years on Norwegian farms (Hovland et al., 2006, 2010, 2011). Killing and pelting occurs at a similar time of year as in Arctic foxes. Pelt quality is visually/tactually graded to determine the selection of animals to be killed and pelted or kept as breeders in November (Schøyen et al., 2007) or December (Kenttämies et al., 2006), and pelting is performed shortly thereafter, e.g., in January (Ahola et al., 2000b, 2002b, 2006).

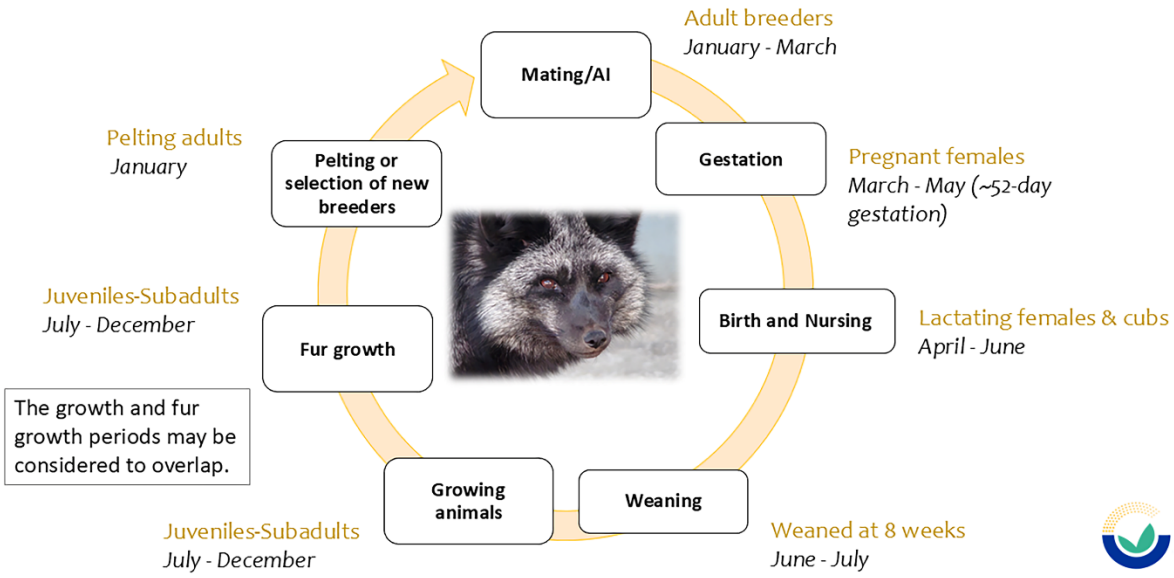

Figure 10: Typical production cycle for red foxes (*Vulpes vulpes*) farmed in Europe

3.3.3 Hybrid foxes

Crossbreeding between farmed Arctic and red foxes was first reported to occur in USA around 1946 and in Norway since 1949 (Wenzel, 1990). Crossing occurs between male red fox and female Arctic fox, to obtain the higher reproductive performance of the Arctic fox in terms of litter size and maternal behaviour, as indicated in the European Welfare Assessment protocol for foxes (WelFur, 2015b). Several new fur types can be produced through this hybridization,

both in coat colour and hair type. Despite differences in chromosome numbers — silver foxes (2n = 34) and blue foxes (2n = 48, 49, or 50) — the structural similarity of their chromosomes allows fertilization to occur and foetal development to proceed. The hybrid offspring is an intermediate form of the parents, both in the number of chromosomes (2n = 41 or 42) and in phenotype. Hybrid foxes are sterile and cannot reproduce (Wenzel, 1990). As a result, all hybrids are killed and pelted during their first season, at about 6 months of age (Norodd et al., 1988; Lohi et al., 2015; Supporting information – SF7). The hybrid fox can be produced either by natural mating or by insemination (Supporting information – SF8). However, natural mating between the two species can be difficult, for example because the breeding season does not coincide perfectly. Therefore, hybrids are obtained mainly through artificial insemination.

3.3.4 Husbandry systems of foxes

Farmed foxes are generally kept in wire mesh cages sheltered by open-walled sheds (thus experience some degree of ambient temperatures and other factors such as lighting, wind, and humidity, however, sheltered from extreme fluctuations and from most precipitation and solar radiation). Physical housing specifications are outlined in Section 3.3.4.1. In brief, the floor area of the cage is 0.75 m^2 at minimum at any period. There is additional access to a nest box within the cage or on top of the cage during (late) pregnancy and during the lactation/suckling period.

On EU farms, fox cages may be supplemented with one resource to enrich the environment in any phase of the production cycle, such as a wooden block, bone, hay/straw, or some other non-dangerous chewing material (Supporting information – SF9, SF10). This is further discussed in Section 3.3.4.2. As suckling cubs, foxes are maintained in groups with their mother and siblings. At weaning the female is removed from the cage and the cubs are housed in groups or male-female pairs (Supporting information – SF6, SF8).

Foxes are fed once per day at minimum, though feed amounts and/or feeding frequencies may differ across the production cycle. Feed consists of a meat-based paste deposited on the mesh top of cages or on feeding trays. Drinking water is provided continuously in water pipes with nipple drinkers or in water bowls. Feeding and watering practices are outlined in Section 3.3.4.4. Other management practices for farmed foxes (e.g., breeding and handling practices) are discussed in Section 3.3.4.4.

3.3.4.1 Physical aspects of housing

Farmed foxes are kept in wire mesh cages in open-walled roofed sheds (Supporting information – SF9; Ahola, 2002 and Koistinen, 2009 in Supporting information – SF11, SF12). The sheds allow natural ventilation and shelter, and cage sides may additionally be covered by netting or curtains to protect from direct sun or wind permanently or in periods (Supporting information – SF9). The cardinal directions of the shed may be chosen to prevent exposure of animals to direct sun (presumably at sunrise and sunset; Supporting information – SF9), some barns use trees or other vegetation to protect from wind. Shed roofs may also have openings to aid air circulation, and in warm weather, farmers may use a truck to disperse sprinkled water over foxes (Supporting information – SF9). Foxes are observed to perform

behavioural thermoregulation, such as moving into shaded areas if available or lying stretched out, to cope with excessive heat (Mononen et al., 2012).

In cold climates, stakeholders report that Arctic foxes do not need additional shelter since their fur serves as insulation, whereas red foxes benefit from additional wind protection (Supporting information – SF9). According to stakeholders, keeping fox cages in this type of shed exposes them to ambient/natural lighting, thereby favouring the natural maturation process of the juveniles, allowing development of the winter fur, and eliciting the onset of the reproduction cycle in mature male and female foxes (Supporting information – SF9). However, some farms have closed-wall unheated barns as well (WelFur, 2015b), where natural light and ventilation are achieved through side/ceiling windows and doors.

Cages are typically elevated 100 cm off the ground (Supporting information – SF9, SF10). Wire mesh floors allow urine, faeces and water to fall through the cage bottom (Supporting information – SF12). Mesh size is equal to or smaller than 11.5 cm² with wire thickness of at least 2.1 mm², according to legal requirements in Finland (Koistinen et al., 2009a, 2016; Supporting information – SF10, SF12). Similarly to mink (see Section 3.2.3), faeces can accumulate on the cage floor and need to be removed periodically, although frequency is unknown, but reported by stakeholders as occurring once or twice per year at least (Supporting information –SF6, SF8). On another topic, pregnant females are reportedly given access to a wooden nest box approximately 2 weeks before whelping (Korhonen and Niemelä, 2000; Pyykönen et al., 2010; Supporting information – SF9, SF10, SF12).

Nest boxes are typically placed inside the cage, though in some cases (about 5%), the nest box is placed on top of the cage (i.e., a "roof nest box"; Supporting information – SF9). Nest box design reportedly differs between red and Arctic foxes: nest boxes for red foxes may have a separate entrance room/vestibule to protect them from wind and promote optimal nest climates, while nest boxes for Arctic foxes do not have this additional protection (Supporting information – SF9). In either species, some farmers may open the nest box lid or remove it during warm weather to cool the nest. Nest boxes that cannot be opened were used mainly in the past, and to the best of expert knowledge, no information on the current use/non-use has been found. Litter/bedding for nest boxes is not provided according to stakeholders (Supporting information – SF9), and this is corroborated by the literature.

Nest box access is maintained while mothers are lactating/while cubs are nursing (Supporting information – SF9, SF10), but nest boxes are typically not provided for dams and cubs after weaning (Supporting information – SF8). There are examples in the literature of nest boxes being removed from cages when juveniles are 7 or 8 weeks old, shortly before or at weaning (Ahola et al., 2009, 2010; Koistinen et al., 2009c). Adult male breeders and non-pregnant adult female breeders also do not have nest boxes according to stakeholder reports (Korhonen and Niemelä, 2000; Supporting information – SF9, SF10, SF12).

Standard cage and nest box dimensions according to stakeholders are detailed in Table 5 (Supporting information – SF9, SF10, SF12). Comparable dimensions (i.e., ±1 cm in any dimension) have been used on commercial farms or research farms with practices resembling commercial conditions (Ahlstrøm and Wamberg, 2000; Ahola et al., 2000a, 2000b, 2002a, 2002b, 2006, 2009, 2010; Harri et al., 2000; Mononen et al., 2001; Dahlman et al., 2003;

Pyykönen et al., 2005, 2010; Hovland et al., 2006; Koistinen et al., 2008, 2009b; Koistinen and Mononen, 2008; Akre et al., 2009; Koistinen and Korhonen, 2013). However, slightly larger cages (given in l x w x h: 120 x 106 x 76 cm (Hovland et al., 2010, 2011); 120 x 105 x 70 cm (Korhonen and Niemelä, 2000; Korhonen et al., 2001a, 2003a); 113 x 108 x 72 cm (Mustonen et al., 2005a); 120 x 100 x 75 cm (Pedersen et al., 2002) or nest boxes (l x w x h: 98 x 55 x 48 cm (Hovland et al., 2010, 2011, 2016); 70 x 45 x 40 cm (Koistinen et al., 2009a, 2016) have also reportedly been used in such studies, as well as smaller cages for individual animals, e.g., floor areas of 0.6 m^2 (Zawiślak et al., 2017) or for litters housed with their mothers during lactation (l x w x h: 120 x 100 x 75 cm; Jeppesen et al., 2000a; 120 x 105 x 70 cm; Korhonen et al., 2001b, 2003a). In 2012-2014, 87 out of 88 Finnish farms had cage heights between 70 and 77 cm, while on one farm, most of the foxes were kept in 58 to 70 cm high cages (Ahola et al., 2014).

According to the information provided by stakeholders, it should be noted that the cage dimensions laid out in Table 5 may be updated shortly, particularly in Finland, where a decree renewal is expected. This decree renewal suggests that cage dimensions should be 107 x 116 cm (1.2 m^2) for immature females and non-pregnant adult female breeders and 238 x 107 cm (2.4 m^2) for immature males and adult male breeders (Supporting information – SF9). Increases in cage size to 238 x 107 cm (2.4 m^2) are also suggested for pregnant females, lactating females, and suckling cubs, and 2.4 m^2 for three juveniles or growing animals plus 0.8 m^2 for each additional animal (Supporting information – SF9).

Table 5: Standard husbandry systems for farmed foxes. Information provided by stakeholder umbrella organisations reflecting current practices (Supporting information – SF9, SF10, SF12). Where cells are empty or specifications are not provided, the information was either not available or not applicable.

Descriptive category	Social housing system (% of animals in category)	Duration in system	Number of animals per cage	Cage dimensions in cm (l x w x h)[(a)]	Total floor space (m^2)	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h) [(a)]	Source
Male breeders	Individual (100%)	Whole life from adulthood	1	107 x 76 x 70	0.8132		No	SF9
	Individual (100%)	Whole life from adulthood	1	100 x 75 x 70	0.75			SF10
			1	115 x 105 x 70	1.2			SF12
Non-pregnant female breeders	Individual (100%)	Whole life from adulthood during non-reproductive season	1	107 x 76 x 70	0.8132		No	SF9
	Individual (100%)	Whole life from adulthood	1	100 x 75 x 70	0.75			SF10
			1	115 x 105 x 70	1.2			SF12
Pregnant females	Individual (100%)	3 months or until delivery	1	107 x 76 x 70	0.8132 Occasionally additional		Yes, in late pregnancy 60 x 50	SF9

Descriptive category	Social housing system (% of animals in category)	Duration in system	Number of animals per cage	Cage dimensions in cm (l x w x h)[a]	Total floor space (m^2)	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h) [a]	Source
					0.35 roof nest box[b]		50 x 70 x 60	
	Individual (100%)	Whole life from adulthood	1	100 x 75 x 70	0.75		Yes	SF10
			1	115 x 105 x 70	1.2		Yes, in late pregnancy 50 x 60	SF12
Lactating females	Grouped with cubs (100%)	3 months or until weaning	1	240 x 107	2.568 Occasionally additional 0.35 roof nest box[b]	Variable (whole litter with vixen)	Yes 60 x 50 50 x 70 x 60	SF9
	Grouped with cubs (100%)	All life besides giving birth and weaning the cubs	Vixen with litter	100 x 75 x 70	0.75		Yes	SF10
							50 x 60	SF12
Suckling cubs	Grouped with mother and littermates (100%)	3 months or until weaning	1	240 x 107	2.568 Occasionally additional 0.35 roof nest box[b]	Variable (whole litter with vixen)	Yes 60 x 50 50 x 70 x 60	SF9

Descriptive category	Social housing system (% of animals in category)	Duration in system	Number of animals per cage	Cage dimensions in cm (l x w x h)[(a)]	Total floor space (m^2)	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h) [(a)]	Source
	Grouped with mother and littermates (100%)	Minimum 7-8 weeks						SF10
			Vixen with litter				50 x 60	SF12
Juvenile cubs	Paired with sibling (% unknown)	3 months	1-2	107 x 116	1.2412 + 0.5 per animal above 2	2M 1M:1F 2F	No	SF9
	Individual or paired with sibling (% unknown)	Whole life from adulthood	1-2		0,8 in group + 0,5 per animal above 2			SF10

(a): l = length, w = width, h = height.

(b): Roof nest boxes involve placement of the nest box on top of the cage

3.3.4.2 ENVIRONMENTAL ENRICHMENT

Legislation in certain EU Member States (e.g., Finnish Decree 1084/2011[22]) requires one resource intended as enrichment or "activity object" per cage, which can be a wood block, bone, or some other non-dangerous chewing material (Supporting information – SF9, SF10). The WelFur protocol for farmed foxes also evaluates access to these items and defines enrichment as an "object or material inside the cage, or with regard to straw or such material also outside the cage so that it is available for the animal, which allows species-specific manipulation and/or interaction with it, e.g., gnawing, carrying or digging" (WelFur, 2015b). Additional objects can be provided, such as digging substrates, scratching surfaces, or straw.

Stakeholders report that resources intended as enrichment is provided in all phases of the production cycle (Supporting information – SF9, SF10). However, there are cases in the scientific literature where resources were not provided in standard or "control" housing (i.e., groups with unmodified housing, comparable to that of standard farm housing) prior to or during the study period (Ahola et al., 2000b, 2002a, 2002b, 2006, 2010; Korhonen and Niemelä, 2000; Mononen et al., 2001; Ahola and Mononen, 2002; Pedersen et al., 2002; Koistinen et al., 2008, 2009c; Koistinen and Mononen, 2008; Łapiński et al., 2019), particularly in research taking place during lactation/suckling.

This may be due to differing national legislation in the years these studies were conducted or in the EU Member States where the research took place. However, in certain studies carried out in Finland and Norway, where several of the above studies were based, resources intended as enrichment were provided to weaned juveniles (Korhonen et al., 2003a; Koistinen and Mononen, 2008; Akre et al., 2009; Ahola et al., 2010; Koistinen and Korhonen, 2013; Hovland et al., 2016), to the whole litter and lactating vixen (Ahola et al., 2009; Koistinen et al., 2009a, 2016), or to adult males and females (Hovland et al., 2010, 2011, 2016) in housing that was stated to resemble standard farm housing (note: descriptions of enrichment provided to foxes in "experimental housing" were excluded as these are often above-standard for commercial conditions).

Shelves or "observation platforms" (Supporting information – SF9, SF10, SF11) are also required by legislation in some EU Member States (e.g., Finland; Mononen et al., 2012). Further, availability of a platform is evaluated in the WelFur fox protocol at all stages of the production cycle under the category "Comfort around resting" (Mononen et al., 2012; WelFur, 2015b). Stakeholders report that one platform per cage is provided for stocking densities of 1 or 2 individuals per cage, and two platforms per cage are provided for stocking densities of 4 or 5 per cage (Supporting information – SF9). Shelves measure approximately 107 x 30 cm and are made of wire mesh (Supporting information – SF9). For pregnant and lactating females, however, a nest box is considered to substitute the platform because foxes can rest on top of the nest box (Supporting information – SF9, SF10).

The literature reviewed corroborates the provision of platform in farmed fox cages, primarily during the lactation/suckling period and in weaned juveniles' cages (Ahola et al., 2000a, 2000b, 2002a, 2002b, 2006, 2009, 2010; Ahola and Mononen, 2002; Pedersen et al., 2002;

[22] Government Decree on the protection of fur animals 1084/2011.

Korhonen et al., 2003a; Koistinen et al., 2008, 2009b, 2009c; Koistinen and Mononen, 2008; Akre et al., 2009; Koistinen and Korhonen, 2013; Hovland et al., 2016; Koistinen et al., 2016), or the provision of only a nest box in the lactation period, of which the top may be suitable for climbing/elevated resting (Ahlstrøm and Wamberg, 2000). Shelf provision has also been reported in research with adult males and females (Korhonen and Niemelä, 2000; Hovland et al., 2010, 2011, 2016; Pyykönen et al., 2010). Occasionally, research articles report that no shelves or platforms were provided for weaned juveniles in standard housing, i.e., control groups in experimental studies (e.g., a Polish study: Łapiński et al., 2019; a Finnish study: Mononen et al., 2001).

3.3.4.3 Group size

Siblings may be pair housed immediately after weaning (Supporting information – SF9, SF10, SF11), or will be kept in large sibling groups until the fall (Supporting information – SF6, SF8, SF12). Division into male-female sibling pairs (Ahola et al., 2000b, 2002a, 2002b, 2006, 2009, 2010; Korhonen et al., 2001a; Rikula et al., 2001; Kempe et al., 2009; Koistinen et al., 2009b; Gugołek et al., 2010, 2012; Hovland et al., 2016; Ylinen et al., 2018; Łapiński et al., 2019), single housing (Harri et al., 2000; Korhonen et al., 2001b, 2003a; Mononen et al., 2001; Rikula et al., 2001; Ahola et al., 2002b, 2006; Pedersen et al., 2002; Dahlman et al., 2003; Przysiecki et al., 2010; Zawiślak et al., 2017), or, in some cases, sibling groups of three (Schøyen et al., 2007) from weaning is most often reported in research taking place on commercial farms/research farms with practices that are stated to resemble commercial conditions.

Male breeders are housed individually from their first winter of sexual maturity (Supporting information – SF9, SF10, SF11). Adult females (non-pregnant adult female breeders) are similarly housed individually after their first winter of sexual maturity, aside from the cub-rearing season during which they are housed with cubs or juveniles (but not other adults). As such, individual housing also varies in duration depending on the parity of the females (Supporting information – SF9, SF10).

3.3.4.4 Feeding and watering

For adults (immature breeders, adult male breeders, non-pregnant adult female breeders, and pregnant females), water is usually delivered through frost-protected water nipples or in water bowls depending on the season (water pipes may freeze in winter, in which case bowls are provided a minimum of three times per day (Supporting information – SF9; also demonstrated in Koistinen *et al.* (2009c)). For lactating females, suckling cubs and juveniles, water is most often provided in water bowls and sometimes in water nipples (no frost protection needed as these periods only occur in summer; Supporting information – SF9). It was reported by stakeholders that animals should have access to liquid (not frozen) water all year round according to legal requirements (like in Finland), except for animals that are going to be killed and pelted that year (Supporting information –SF10).

Feed may be delivered in several ways: deposited on the mesh top of cages using a feeding truck (Korhonen and Niemelä, 2000), deposited by an automatic feeder (Kempe et al., 2009), or in feeding trays, typically one per cage (Ahola et al., 2000a, 2002b, 2006, 2009, 2010; Harri et al., 2000; Ahola and Mononen, 2002). Feed is a paste composed of fishmeal/fish

scraps and slaughterhouse products (Ahlstrøm and Wamberg, 2000; Korhonen and Niemelä, 2000; Korhonen et al., 2001a, 2001b, 2003a; Dahlman et al., 2003; Cybulski et al., 2009; Szymeczko et al., 2009; Przysiecki et al., 2010). According to one scientific article, farms may omit feeding on Sundays as a standard practice (Korhonen and Niemelä, 2000).

Vixens may be fed a restricted diet beginning in January to obtain slimming before the reproduction (mating and delivery season). The degree of feed restriction is unclear, but daily feed amounts for the period from January-June have reportedly ranged from 150 g to 600 g per vixen (Lindh et al., 2020). Pregnant females may also be fed a restricted diet until parturition, after which they typically will have *ad libitum* access to feed (Ahlstrøm and Wamberg 2000). Increased feeding for vixens during the lactation period is a common practice in Europe and in Canada (Canadian NFACC, 2013b) to meet the higher metabolic demands experienced by the lactating dam, however this practice is not overly clear in the literature reviewed. Juveniles may be fed twice per day from the late summer through fall, and thereafter typically once per day (Ahola et al., 2002a, 2005; Koistinen et al., 2008; Korhonen et al., 2000a, 2003a; Pedersen et al., 2002). Adult animals are usually fed once per day. Additional information about feeding practices are reported by stakeholders (see Supporting information – SF6, SF8).

3.3.4.5 Other management practices

Little information is available in the available literature about breeding practices in farmed foxes. Likely artificial insemination (e.g., Pyykönen et al. 2005, 2010; Stasiak et al., 2021) is used more frequently than natural mating (Mononen et al., 2012). The technique of artificial insemination with freshly collected semen is a breeding technique used in Norway and Finland, with conception rates of approximately 80% and numbers of weaned pups (approximately four for red foxes and eight for blue foxes) that are comparable to those observed in natural mating (Farstad, 1998).

Female foxes come into heat in February (red fox) and March (Arctic fox). The heat is assessed by using a rut gauge. The rut gauge is a device commercially developed for heat detection in foxes and raccoon dogs. The rut gauge measures the electrical resistance in the wall of the vagina. At peak value, the wall is at its most keratinised and this indicates the optimal insemination time. Optimally the heat is measured 1-5 times during the breeding season (Supporting information – SF8).

Semen is collected from the males through manual stimulation in a dedicated room used exclusively for this purpose. The collected semen is then evaluated and diluted prior to use (Supporting information – SF8).

The insemination is performed in special premises. The animals are restrained during handling. The diluted semen is transferred into the uterus of the female by an insemination capillary. Sterile equipment is used for every female. Approximately 70% of the females are inseminated twice routinely, usually with a 2-day interval. The remaining 30% is only inseminated once, due to rapid development of heat (Supporting information – SF8, SF13).

On farms where natural mating is used, e.g., in research conducted across non-EU (Russian) and Norwegian farms (Osadchuk, 2001; Osadchuk et al., 2003), respectively, it is reported

that females are mated once with a male, and the day of mating is considered the first day of gestation. The female is placed into the male's cage until a mating is confirmed either by the presence of spermatozoa in vaginal smears (Boue et al., 2000) or by simply observing the copulatory mating behaviour and cohesion of the male and female (Dr J. Malmkvist, Researcher at Aarhus University, communication in a WG meeting, 2024b).

Foxes are generally not physically mutilated or surgically modified for the purpose of identification, castration, or other management procedures (individuals can be identified with respect to their cage number). The animals are subjected to handling for different purposes during their lifetime. Foxes may be caught by hand or with the aid of neck tongs for procedures such as weighing, cage transfer, mating/insemination, or vaccination (Mononen et al., 2012; WelFur, 2015b). There may also be handling for testicle checks in December to ensure that males are fit for the upcoming breeding season (Pyykönen et al., 2009).

Foxes will typically live their entire lives on the farm where they are born (WelFur, 2015b). Other than a study reporting the annual administration of injection of distemper vaccinations on a farm housing both foxes and raccoon dogs (Rikula et al., 2001), there is little information regarding vaccinations or other routine health management procedures in the available literature.

3.4 Racoon dog

3.4.1 Biology

Native from Eastern Asia, raccoon dogs (*Nyctereutes procyonoides*) are a canid species with rounded ears and body, a bushy, black-tipped tail, and yellow to grey/brown/reddish fur (SCAHAW, 2001). Adults present a demarcation line that separates the darker under and lighter upper parts of their pelage (Naderi *et al.*, 2020), measure on average 50-80 cm (plus a 15-25 cm tail) and oscillate between 4-6 kg in winter and 6-10 kg in summer (Asikainen et al., 2002; Kauhala and Saeki, 2004; Seki and Koganezawa, 2011). Kowalska and Piórkowska (2014) described raccoon dogs as medium-sized dogs, but with a stockier build. They are often mistaken for raccoons due to their facial markings. Raccoon dogs have short legs, a long torso, a fluffy short tail, and long whisker-like fur on the sides of their heads.

While males are slightly bigger than females, the species has been reported to not have marked sexual dimorphism (Kauhala and Saeki, 2004; Seki and Koganezawa, 2011). In a comparison between farmed and wild-caught raccoon dogs from Poland (16 of each sex of farmed animals, 10 wild animals in total), and animals killed in November, Kowalska et al. (2014) reported an average weight of farmed males of 6.4 kg±0.4 and 6.5± 1 kg for wild-caught males, and 12±0.6 kg and 10.5±0.6 for the females, respectively.

Adult raccoon dog forefoot tracks are 4-5 cm long and 5-6cm wide, while the hind foot track is slightly smaller. The tread area of the toes is approximately 13-15 mm x 7-9 mm (size estimated from track identification drawings; Bang and Dahlström 2000).

Originally introduced for hunting purposes in the former Soviet Union between the 1920s and the 1950s (Supporting information – SF14, SF15, SF16), raccoon dogs rapidly dispersed throughout Northern, Eastern and Central Europe (Ćirović, 2006; Wooldridge et al., 2024).

Raccoon dogs are primarily nocturnal (Ogurtsov et al., 2018) although they can shift activity patterns in response to temperature changes (Seki and Koganezawa, 2011) and availability of thick vegetation as refuge (Wooldridge et al., 2024). Accordingly, racoon dogs are found across a range of habitats (Drygala et al., 2008b), and appear to prefer moist, densely vegetated areas (Sutor, 2008) and meadows (Drygala et al., 2008b); especially in more natural areas (Hwang et al., 2014; Rhim et al., 2015). Habitat use by raccoon dogs is affected by the availability of food, shelter and suitable den sites (Wooldridge et al., 2024).

Raccoon dogs are opportunistic generalists (Wooldridge et al., 2024), with a truly omnivore diet that includes small mammals, birds, fish, amphibians, vegetation, and carrion. Based on data from 42 animals trapped in Finland between 1957-1978, Viro and Mikkola (1981) reported finding plastic, paper, aluminium and sausages in the stomachs of some of the animals and suggested that raccoon dogs will also feed from garbage dumps. Accordingly, the skull and dental features of raccoon dogs show this variety of dietary niches, from carnivorous to mainly frugivorous diets (Drygala et al., 2000; Haba et al., 2008; Kurihara, 2023) such as for example small, weak canines and flattened molars adapted to the mechanical processing of vegetable matter. In addition, raccoon dogs have longer intestines than most canids relative to body size. This is believed to allow for efficient digestion of plant material (Supporting information – SF15). Recently, Pagh et al. (2025) examined stomach content of raccoon dogs from wetlands and described a high degree of diversity including fruits, grass and other plants.

One study compared farmed and wild-caught raccoon dogs from Poland (16 of each sex), kept in standard cages (dimensions not specified) for at least 2 weeks after catching and fed by a compound feed consistent with the nutritional requirements of this group of animals, prepared from typical components available on the Polish feed market (percentage distribution of macronutrients: protein: 30%, fat: 35%, carbohydrates: 35; Kowalska et al., 2014). These animals were compared with 10 wild animals shot by hunters. The average digesta passage rate (in minutes) was significantly longer for the wild-caught raccoon dogs (686±15 vs. 602±11). Barabasz et al. (1995), as cited by Kowalska et al. (2014), reported that the passage of food through the digestive tract is longest in raccoon dogs among all fur-bearing carnivores, as in about 80% of individuals tested, the first undigested food remnants are excreted only after 11-12 hours.

In the study by Kowalska et al. (2014), the rate of passage was similar to previous results, but longer in wild animals. The authors also reported significant differences between wild-caught and farmed animals, for example regarding the total length of different aspects of the gastrointestinal tract. The authors discuss that in wild animals, because their food is heterogeneous and often not reduced to small particles, digestion in the duodenum is much slower, and thus the duodenum is markedly longer. Similarly, food of plant origin, which is an important part of wild raccoon dog diet, is broken down more slowly than meat. The type of food influences the quantity and pH of the gastric juice, its digestive capacity and the duration of the secretion process. The observed differences may be linked not only to the food ingested, but also to the cyclical nature of its intake. Wild animals often take in food occasionally, when it is available in a given area, and at a specific time, completely filling their stomach. The authors discuss that, because of the intake of plants, the ratio of body length

to intestinal length of raccoon dogs is more similar to that of the badger, which prefers plant foods, than to that of the fox or wolf.

The activity level of raccoon dogs has been studied by telemetry. Data from Northeast Germany, collected from 26 wild-caught adults (13 males and 13 females) followed over 24 h periods, showed significant annual variability in activity level (Figure 11; Zoller and Drygala, 2013), with a mean overall activity level of 58±10%, ranging from a mean value of 70±19 during cub rearing to 47±32 in winter. Regarding the circadian activity rhythm, the study indicates that raccoon dogs are mainly crepuscular and nocturnal with a mean activity level of 86.8% during the night and a mean diurnal activity level varying from 15.0% in winter to 56.6% during the cub rearing period.

In her unpublished thesis, Rudert (2008) observed the behaviour of 12 raccoon dogs in four different zoos in Germany. Based on observations done at different seasons (not specified), the author describes two to three activity periods per day, the duration of which depended on the season and the weather. In summer the animals were half diurnal and half nocturnal, but predominantly crepuscular, and nocturnal in winter. The most common way of locomotion is walking (subdivided by the author into purposeful walking towards a goal and ambling). Trot and gallop are only shown by the animals in phases of excitement, escape or play. The raccoon dogs are described as being able to jump over small obstacles or jump onto them. The highest obstacle overcome had a height of approx. 0.5 m. Trees or stones lying on the ground are climbed over, but vertical climbing as in raccoons was not observed.

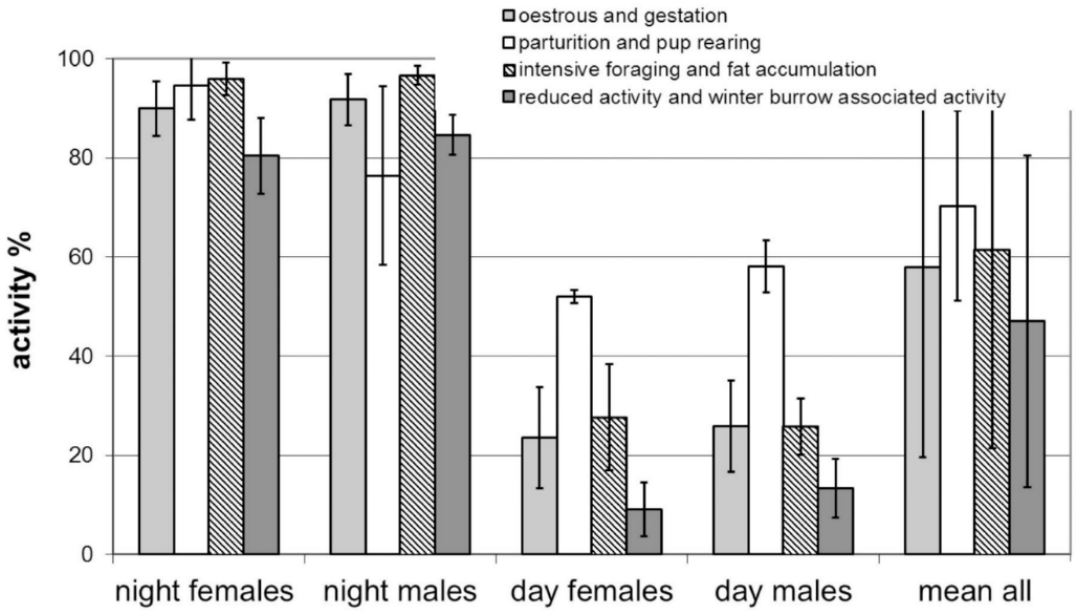

Figure 11: Activity level of adult raccoon dogs across seasons in Northeast Germany (©Zoller and Drygala, 2013 ©Journal of Vertebrate Biology)

Unlike other members of the Canidae family, raccoon dogs in the wild experience a period of winter dormancy or 'carnivore lethargy' whereby they decrease their activity levels and can be intermittently dormant, relying on deposited fat layers in particularly harsh winters or colder latitudes (Kauhala and Saeki, 2004; Ogurtsov et al., 2018). In areas where snowfall

exceeds 20 cm, raccoon dogs will stay in their dens/hiding places. As reported by Wooldridge et al. (2024), in Finland, the lowest activity levels occur between November and February, corresponding to a period of winter dormancy or intermittent passivity. During autumn, raccoon dogs build up significant fat reserves in preparation for their winter dormancy (Kauhala and Saeki, 2004). Raccoon dogs are known to use latrines situated higher than ground level i.e. at sites with gentle slopes (SCAHAW, 2001) within their home range, although location can vary with the type of vegetation cover and season to maximise odour dispersal (Watanabe et al., 2021).

Early reports of average home range were 9.5 km^2 (reviewed in SCAHAW, 2001), and home range is reported to change in size for example in response to anthropogenic activity, temperature and snow coverage, being smaller in winter (Seki and Koganezawa, 2011) and in undisturbed areas (Süld et al., 2017). Home range size is comparable for males and females, with complete overlap, except for females in the cub-rearing season, where home range has been reported to expand considerably, namely 0.98 km^2 for females vs. 0.15 km^2 for males (Drygala et al., 2008a, 2008c) based on data from 3 pairs of animals. A mean daily distance travelled of 3 km (females) - 4 km (males) has been reported (Herfindal et al., 2016). Raccoon dogs do not actively defend a territory and are tolerant towards individuals of the same and other carnivore species (Drygala et al., 2008a; Sutor and Schwarz, 2012; Koistinen et al., 2020), with agonistic behaviour rarely being observed. They may use dens - up to five different ones during winter have been reported (Kauhala and Saeki, 2004) - made by other species (e.g., foxes, badgers; SCAHAW, 2001) and have been observed cohabitating with these species during the breeding season (Nowakowski et al., 2020). Territories are maintained with markings and patrolling (Supporting information – SF17).

Raccoon dogs are reported to be strictly monogamous, and pairs might last for life. Raccoon dogs can live both as a solitary pair or in family groups (since they are social animals), displaying biparental care of young; Supporting information – SF15, SF16, SF17), with males spending more time alone with cubs while females forage (Drygala et al., 2000, 2008a). A Japanese study, though, based on data from 3 wild raccoon dog females, and determined by the occurrence of paternal alleles, suggested that multiple paternity occurred in two of three of their examined animals (Sugiura et al., 2020).

Litters are often born in May-July and contain 5-7 altricial cubs, with an average of 10.8 (range 1-16, based on data from 89 adult females observed for placental scars) reported in wild Danish populations (Pagh et al., 2020). The gestation period lasts 59-64 days; young are weaned at 30-40 days, self-sustaining at 4-5 months and reach sexual maturity at 9-11 months (Ward and Wurster-Hill, 1990, in Supporting information – SF16). In Germany, behaviour of three pairs of raccoon dogs showed parents and young abandoned the den area in the cubs' 6th week of life (Drygala et al., 2008a), although staying in close proximity to their natal habitat after weaning (Sutor, 2008). Mean dispersal distances are similar for male and female offspring, reported to be around 13.5 km (Drygala et al., 2010), and range between 4.7-108 km (Sutor, 2008). Infant mortality is high (50% in the first summer, up to 77% by the first winter), with hunting and traffic collision being primary causes (Drygala et al., 2010).

3.4.2 Production cycle

Production of raccoon dogs follows an annual cycle (see Figure 12). The reproductive period, including pre-mating, mating, gestation, and lactation, occurs from January-June (Asikainen et al., 2003). Natural mating or, less frequently, artificial insemination begins in late winter, specifically in February (Koistinen et al., 2018, Koistinen and Mononen, 2023, Supporting information – SF8). Further details regarding raccoon dog breeding practices in farm systems are reviewed in Section 3.4.3.5. Under farmed conditions, raccoon dog cubs are born in the spring (Mustonen et al., 2001; Nieminen et al., 2004, 2005), with most birth dates in May (Nieminen et al., 2002; Asikainen et al., 2003, 2005; Mustonen et al., 2004a, 2004b; Koistinen et al., 2017, 2020; Korhonen et al., 2023). Studies of litter sizes at birth have reported averages from 2.5 ± 0.5 to 5.6 ± 0.8 cubs depending on maternal age, i.e., 1 and 3 years old, respectively (Łapiński et al., 2013). Szeleszczuk et al. (2021) similarly found that 2–3-year-old females nursed 6 cubs on average. Larger litter size was also reported in literature, up to 15 cubs (Ślaska, 2002).

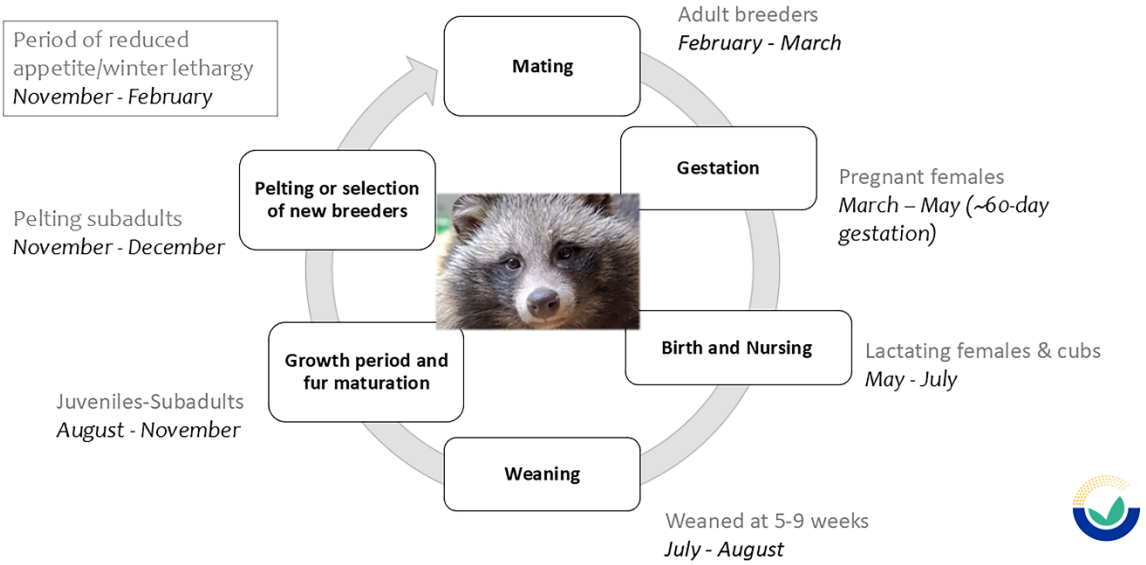

Figure 12: Typical production cycle for raccoon dogs (*Nyctereutes procyonoides*) farmed in Europe, with the vast majority being farmed in Finland

The lactation period lasts through June-July (Koistinen and Mononen, 2023), and offspring are weaned at 5-7 (Rikula et al., 2001), 8 (Ahola et al., 2007), or 9 weeks of age (Koistinen et al., 2017, 2020; Korhonen et al., 2023). Littermates are split into male-female sibling pairs or kept in quartet groups after weaning (Koistinen et al., 2018; Korhonen et al., 2023) and may be transferred to pair or individual housing at 10-11 weeks of age (Rikula et al., 2001), depending on the management and facilities on specific farms (Supporting information – SF16). The growing season occurs from weaning until late September or October (Ahola et al., 2007; Koistinen et al., 2020). Cubs are fed once in the morning and once in the afternoon as needed to ensure food availability close to ad libitum during this period. From September they are fed once per day but with the same daily feed allowance (Ahola et al., 2007). The

animals' body weight increases steadily from August to October (Mustonen et al., 2001; Nieminen et al., 2002; Asikainen et al., 2003).

As a difference from the other canids, raccoon dogs accumulate seasonal body mass in the form of fat in preparation for the winter dormancy (Nieminen et al., 2002), as metabolism slows down in winter months and the animals show considerable lethargy during this period (Supporting information – SF14, SF16). However, the extent to which farmed raccoon dogs show winter dormancy varies depending on the climate of the region. Under farming condition, winter dormancy seems reduced by the daily provision of feed and lack of nestbox (Asikainen et al., 2002 in Supporting information – SF16). Irrespectively, under farmed conditions, body weight decreases from November to February due to a voluntary decrease in feed intake corresponding with the natural seasonal dormancy (Nieminen et al., 2002, 2004; Asikainen et al., 2003).

Winter fur growth occurs in September-November (Asikainen et al., 2003), and raccoon dog fur may be visually and tactually graded during this period. Underfur and guard hairs have been observed to mature between mid-October and late November, with fur on different body parts maturing at different times (Asikainen et al., 2003; Seremak et al., 2011). The animals are considered subadult by November of their first year (Mustonen et al., 2001). If not already housed alone, groups or pairs are split into single housing at this time (Koistinen and Mononen, 2023). Winter moulting occurs after fur maturation, and raccoon dogs are in their summer pelage by June (Asikainen et al., 2003).

Killing and pelting mainly takes place in November (Seremak et al., 2011; Sergina et al., 2013) or December (Koistinen et al., 2020), when the winter fur has matured (Koistinen and Mononen, 2023). As such, only breeding animals are present on the farm during mid-winter (Koistinen and Mononen, 2023). Females demonstrating good reproduction may be kept as breeders for multiple years; for example, females on a Polish farm were up to 8 years old (Łapiński et al., 2013). According to information received by stakeholders, females are bred 1-4 times before being culled/pelted (Supporting information – SF15). Adult breeders might be killed and pelted also in March after cessation of breeding or in August after offspring are weaned (Asikainen et al., 2003; Mustonen et al., 2004b; Koistinen et al., 2018).

3.4.3 Husbandry systems

Farmed raccoon dogs, like farmed mink and foxes, are housed in cages in open-walled sheds. Cages (typically square-shaped) are made of wire mesh with floor areas of 0.8 m^2 at minimum, and a wooden nest box is provided inside or on top of the cage for females and their cubs during pregnancy and lactation. Housing is further described in Section 3.4.3.1. Resources intended as environmental enrichment, including one manipulable object and one shelf or platform, are typically provided in each cage. Manipulable objects (or "activity" objects as they are called in most of the literature) may resemble those provided tor foxes, and straw or hay may additionally be available on the roof of cages. Enrichment practices are detailed in Section 3.4.3.2.

Suckling cubs are kept with their mothers until weaning, at which point juveniles are typically divided into individual or pair housing, as explained above. Animals are then housed individually for their entire adult lives, aside from when cubs are present in lactating females'

cages or if natural mating is used (see Section 3.4.3.3 for information regarding group size and social housing).

Feeding of adult animals occurs once per day at minimum, and lactating females are typically fed *ad libitum.* Juveniles are fed twice per day as mentioned above. Feed is delivered on the mesh top of cages or on feeding trays and drinking water is available continuously in water pipes with nipple drinkers or in the form of water, ice, or snow in water bowls. Feeding and watering practices are further outlined in Section 3.4.3.4. Mating can occur naturally or using artificial insemination. Reproduction and other management practices such as breeding, handling, and vaccination are described in Section 3.4.3.5.

3.4.3.1 PHYSICAL ASPECTS OF HOUSING

According to stakeholders, raccoon dog management is comparable to that of farmed foxes, with slight husbandry modifications (Supporting information – SF6, SF8, SF18). The animals are housed in wire mesh cages in open-walled sheds, exposed to ambient temperature and lighting. Exposure to natural light is argued to be important for the sexual maturation process and development of winter fur, as in foxes, since these processes are controlled by photoperiod (Supporting information – SF18). Descriptions of sheds and methods of temperature control are the same as in foxes, described in Section 3.3.4.1.

Cages are elevated approximately 100 cm off the ground and typically kept in single-row tiers (occasionally there may be a second tier comprised of a nest box on the roof of the cage; Supporting information – SF18) (Figure 13). As in mink and foxes, wire mesh allows waste to fall through the cage bottom. No information is available on how often waste is removed but is reported to be minimum once per year (Supporting information- SF8). No information was found on the size of the openings of the wire mesh. However, according to the requirements in Finland (the main European country where raccoon dogs are farmed; Koistinen and Mononen, 2023), wire mesh requires to be smaller than 11.5 cm^2 and wire thickness needs to be at least 2.1 mm^2 as reported by stakeholders (Koistinen et al., 2020; Supporting information – SF19).

Figure 13: Example of raccoon dog facilities, including a two-row shed without walls (©Stanisław Łapiński)

Wooden nest boxes are provided to pregnant females approximately two weeks before whelping and remain in the cage until cubs are weaned (i.e., during the rest of pregnancy and lactation) to provide visual and physical shelter (Supporting information – SF18). This practice is reportedly required by the Finnish legislation[23] (Supporting information – SF19). Two-room nest boxes (described as having an anteroom and a main room) were reported to be used in some studies in Koistinen et al. (2017) and Korhonen et al. (2023) for natal cages, and although straw as nesting material was not explicitly mentioned, bales of straw were reportedly placed on top of the cage to be pulled through the wire mesh. According to stakeholders, nesting material is not always present or required by national legislations, but pregnant females, lactating females and their cubs have usually access to hay, likely on the roof of the cage (Supporting information – SF18).

Stakeholders do not report nest box access for juveniles or adults aside from pregnant and lactating females (Supporting information – SF18), but on research farms nest boxes have been provided to male and/or female subadults beginning in the late fall or winter season, with straw (Nieminen et al., 2002; Asikainen et al., 2003, 2005; Mustonen et al., 2004a, 2004b) or straw not being mentioned (Nieminen et al., 2004, 2005; Kinnunen et al., 2016). This may, thus, have been above-standard conditions. Similarly, as part of raccoon dog research, nest boxes were described only in an enriched housing condition for juveniles by Koistinen et al. (2020) and for non-pregnant adult females by Koistinen et al. (2018). In the latter study, it was also stated that the nest box floor was packed with straw as bedding, but

[23] Government regulation on the protection of fur animals 20.10.2011/1084.

this does not appear to be a common practice. Rather, hay or straw is usually placed on the roof of the cage to be pulled through the wire mesh by the animals.

The standard cage dimensions reported by stakeholders for farmed raccoon dogs are outlined in Table 6 and vary from 100 cm to 107 cm in length x 75 to 76 cm in width for individually housed raccoon dogs. Animals have been housed in comparable cage sizes in studies taking place on commercial farms or research farms with commercial conditions (Koistinen et al., 2017, 2018, 2020; Korhonen et al., 2023). Slightly larger cages (given in l x w x h) of 115 x 105 x 70 cm (Ahola et al., 2007); 150 x 107 x 70 cm (Nieminen et al., 2002, 2004, 2005; Asikainen et al., 2003, 2005; Mustonen et al., 2004a, 2004b; Kinnunen et al., 2016) have reportedly been used as standard cages on research farms. Meanwhile, smaller nest boxes (l x w x h: 67 x 41 x 36 cm) have been used for non-pregnant adult females on research farms (Koistinen et al., 2018).

In Poland, a national regulation produced by the Minister of Agriculture and Rural Development[24] mandates the following cage dimensions for raccoon dogs (same as for foxes):

1) foxes and raccoon dogs kept individually:

    a) height – at least 0.5 m,

    b) floor area – at least 0.6 m^2, with a width of at least 0.6 m, and a length of at least 0.9 m;

2) female foxes and raccoon dogs with young:

    a) height – at least 0.5 m,

    b) floor area – at least 1.2 m^2, with a width of at least 0.75 m, and a length of at least 0.8 m

[24] Rozporządzenie ministra rolnictwa i rozwoju wsi1) z dnia 28 czerwca 2010 r. w sprawie minimalnych warunków utrzymywania gatunków zwierząt gospodarskich innych niż te, dla których normy ochrony zostały określone w przepisach Unii Europejskiej).

Table 6: Standard husbandry systems for farmed raccoon dogs. Information provided by stakeholder umbrella organisations reflecting current practices (Supporting information – SF18, SF19). Where cells are empty or specifications are not provided, the information was either not available or not applicable.

Descriptive category	Social housing system (% of animals in category)	Duration in system	Number of animals per cage	Cage dimensions in cm (l x w x h)[a]	Total floor space (m^2)	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h) [a]	Source
Adult male breeders	Individual (100%)	Whole life from adulthood	1	107 x 76 x 70	0.81		No	SF18
	Individual (100%)	Whole life from adulthood	1	100 x 75 x 70	0.75			SF19
Non-pregnant adult female breeders	Individual (100%)	Whole life from adulthood outside of reproductive season	1	107 x 76 x 70	0.81		No	SF18
	Individual (100%)	Whole life from adulthood	1	100 x 75 x 70	0.75			SF19
Pregnant females	Individual (100%)	3 months	1	107 x 76 x 70	0.81		Yes Usually inside cage (95%) but may be on top of cage (5%; i.e., a roof nest box[b]) 60 x 50, or 50 x 70 x 50	SF18

Descriptive category	Social housing system (% of animals in category)	Duration in system	Number of animals per cage	Cage dimensions in cm (l x w x h)[a]	Total floor space (m^2)	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h) [a]	Source
	Individual (100%)	Whole life from adulthood	1	100 x 75 x 70	0.75		Yes	SF19
Lactating females	Grouped with cubs (100%)	3 months	Dam with litter	240 x 107 x 70	2.56	Variable (whole litter with dam)	Yes Usually inside cage (95%) but may be on top of cage (5%; i.e. a roof nest box[b]) 60 x 50, or 50 x 70 x 50	SF18
	Grouped with cubs	Whole life from adulthood outside of reproductive season	Dam with litter				Yes	SF19
Suckling cubs	Grouped with littermates (100%)	3 months	Dam with litter	240 x 107 x 70	2.56	Variable (whole litter with dam)	Yes Usually inside cage (95%) but may be on top of cage (5%; i.e. a roof nest box[b]) 60 x 50, or 50 x 70 x 50	SF18
	Grouped with littermates (100%)	7-8 weeks minimum					No	SF19

Descriptive category	Social housing system (% of animals in category)	Duration in system	Number of animals per cage	Cage dimensions in cm (l x w x h)[a]	Total floor space (m^2)	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h) [a]	Source
Juvenile cubs	Paired/grouped with siblings (% unknown)	3 months	1-2	107 x 116 x 70	1.2 + additional 0.5 per each extra animal	2M, 1M:1F, or 2F	No	SF18
	Individual/ paired/grouped with siblings (% unknown)	Whole life after weaning	1-2		0.8 in group + additional 0.5 per each extra animal			SF19

(a): l = length, w = width, h = height.

(b): Roof nest boxes involve placement of the nest box on top of the cage.

3.4.3.2 ENVIRONMENTAL ENRICHMENT

Raccoon dogs are housed with one resource intended for enrichment per cage, which can be a wooden block, a bone or some other chewing material not considered dangerous (Supporting information – SF18). The presence of resources was reported by stakeholders as required by legislation in Finland[25] (Supporting information – SF19), and similar information was found in literature (Koistinen and Mononen, 2023). If bones are provided as a chewing material (e.g., bovine cortical bones), they can be re-used between animals on commercial farms and do not include edible substances like meat, gristle, or marrow (Koistinen et al., 2017).

Raccoon dogs additionally have access to hay or bales of straw placed on top of the cage to be pulled through the mesh top (Supporting information – SF18). This is also mentioned in scientific studies performed on private farms or research farms with practices resembling commercial farms (Koistinen et al., 2017, 2018, 2020; Korhonen et al., 2023). This may be considered an enrichment under the WelFur protocol for farmed raccoon dogs (Koistinen and Mononen, 2023; Welfur, 2020) but is mentioned by stakeholders as holding two purposes: environmental enrichment and to increase fibre intake of the animals (Supporting information – SF15).

The shelves or platforms provided in cages are reported by stakeholders to resemble those given to foxes (Supporting information – SF18); i.e., shelves have similar dimensions and 1 shelf per cage is provided for stocking densities of 1 or 2, with an additional shelf for stocking densities of 4 or 5 animals per cage (see Section 3.4.3.1). Such shelves have been reported to be required by legislation in Finland (Koistinen and Mononen, 2023). This is corroborated by research with animals in commercial farm conditions (Koistinen et al., 2017, 2018, 2020; Korhonen et al., 2023). Nest boxes can also substitute for a shelf in pregnancy and/or lactation since the nest box top offers an elevated resting place (Supporting information – SF18).

3.4.3.3 GROUP SIZE

At weaning (typically 7-8 weeks of age but reported from 5-9 weeks, see above), cubs may be divided into pairs and kept as such until sexual maturity (Supporting information – SF18, SF19), at which point they are further split into individual housing. Cubs may also be housed individually directly from weaning (Supporting information – SF19). Division into male-female sibling pairs at weaning is most often reported on research farms with practices resembling commercial farms (Rikula et al., 2001; Nieminen et al., 2002; Asikainen et al., 2003; Ahola et al., 2007; Koistinen et al., 2017, 2018; Korhonen et al., 2023), followed by later division into single housing in adulthood (Nieminen et al., 2004, 2005; Koistinen et al., 2018), but research farms may also divide cubs into individual housing from weaning (Mustonen et al., 2001; Rikula et al., 2001). Housing as sibling quartets after weaning is also reported (Korhonen et al., 2023). Rarely, female pairs or male-female pairs may be housed together on research farms into adulthood (Mustonen et al., 2004b; Kinnunen et al., 2016; Koistinen et al., 2018).

[25] Two Government regulations on the protection of fur animals 20.10.2011/1084.

3.4.3.4 FEEDING AND WATERING

Water can be provided automatically via nipple drinkers or manually by water cups (Supporting information – SF6, SF8). Older reports from research farms with practices resembling commercial conditions stated that water, ice, or snow was available for animals for *ad libitum* intake (Mustonen et al., 2001; Nieminen et al., 2002, 2004; Asikainen et al., 2003, 2005; Mustonen et al., 2004a, 2004b; Kinnunen et al., 2016). More recent information received by stakeholders report that for immature breeders and adults, water is predominantly available for *ad libitum* intake through water nipples, and these are frost-protected (Supporting information – SF18).

Water nipples are less prevalent for lactating females, suckling cubs and juveniles, with most animals of these categories being watered via water cups. However, for cubs and juveniles, cups are used only during the summer, so no frost protection is needed (Supporting information – SF18). Water may occasionally be given to adults in water cups and then cannot be prevented from freezing (Supporting information – SF17), but if cups are used, water is provided a minimum of 3 times per day (Supporting information – SF8, SF18). This is also recommended by the recent legislation adopted in Finland in 2024 which will enter into force in 2030 (Supporting information – SF6, SF19).

Feed in the form of paste is deposited on the mesh top of cages using a feeding truck (Supporting information – SF18), or, probably most commonly, as reported by researchers and other stakeholders, deposited on a feeding tray outside the cage (Koistinen et al., 2020; Korhonen et al., 2023; Supporting information- SF6, SF8), which may be provided by a feeding machine rather than a truck (Korhonen et al., 2023). Feed mainly includes fish, slaughterhouse offal, and cereals (Korhonen et al., 2023) or poultry and beef slaughter by-products (Seremak et al., 2011). Korhonen (1988) studied voluntary feed intake of farmed raccoon dogs and reported significant variation over the year. As part of a study of adaptation to wintering in farmed raccoon dogs, Asikainen et al. (2005) fed raccoon dogs 600 g of feed (with 1,730 kcal/kg feed) per day. In periods of high energy requirement, such as during lactation, the daily portion for raccoon dogs may change and also the number of daily feedings (e.g., from 1 to 2). Weaned juveniles are fed twice per day through the summer until autumn (Kinnunen et al., 2016) or specifically until September, October, or November (Asikainen et al., 2003, 2005; Ahola et al., 2007, respectively) and thereafter once per day throughout winter.

It is currently unclear to what extent the pre-mating management involving slimming and flushing is used for raccoon dogs. In his textbook on fur production, Gugołek (2011) mentions that it takes longer to slim raccoon dogs than mink. It is specified that for raccoon dogs, restoring the condition of fall-overweight may take 2-3 months. The text describes that slimming consists of providing a feed mixture with reduced energy value and full-value protein content. One method of controlling the body condition of animals is administering feed portions reduced by 20% to 50% of their usual volume. In the last two weeks before the first mating, the full portion is usually reinstated.

Based on the description from Barabasz (2008), it seems to be a regular management practice. It is described that on farms, raccoon dogs undergo controlled fattening during

autumn. This process involves strategic feeding regimens that increase body mass by up to 50%. Controlled fattening is often implemented on raccoon dog farms to increase body condition before killing and pelting. Further information on feeding of raccoon dogs can be found in Supporting information (SF6, SF8).

3.4.3.5 Other management practices

Natural mating is the most common mating in racoon dogs according to stakeholders (Supporting information- SF8). In case artificial insemination is carried out, females are handled to detect heat and to be artificially inseminated or transferred between cages for mating (Koistinen and Mononen, 2023).

According to information provided by stakeholders (Supporting information – SF15), flushing of females is carried out by increasing the feed portion by approximately 25-50% for two weeks, starting 10 days before the mating season. Older females come into heat earlier than young ones, so flushing begins sooner for them. Heat detection is monitored using a rut gauge 1 to 5 times per oestrus cycle (annually).

In natural mating, the female is placed in the male's cage, and the mating act lasts between 5 and 10 minutes. For artificial insemination, semen is manually collected from males, diluted, and then introduced to the female through intrauterine insemination using a catheter and speculum. In cases where artificial insemination is used, males are manually handled for semen collection. Stakeholders have reported that adult animals are handled using neck tongs, a technique that immobilizes the animal's head, preventing biting or aggressive behaviour towards handlers during the process (Supporting information – SF15).

Females are apparently mated up to three times with the same male in one breeding season (Asikainen et al., 2005). Neither the literature reviewed, or the information provided by stakeholders contains details regarding natural mating or artificial insemination practices on farms. According to stakeholder input in response to the EFSA call for evidence, cross-fostering of cubs is not a common procedure to standardise litter size but may be performed if dams are sick or for other reasons not able to take care of the young (Supporting information – SF15).

Raccoon dogs may be vaccinated annually for distemper (subcutaneous injection in the neck) (Rikula et al., 2001). Handling for vaccination or other veterinary purposes will also be performed using neck tongs for adults and by wearing gloves for juveniles/cubs (Supporting information – SF15). Handling methods were not described in detail in the literature reviewed, but "handling devices" (Koistinen and Mononen, 2023) or neck tongs (Koistinen et al., 2020) have been mentioned. Like other farmed fur animals, raccoon dogs typically spend their entire lives on the farm where they are born (Koistinen and Mononen, 2023). Mutilation (e.g., for castration, marking, etc.) is not practiced (Koistinen and Mononen, 2023), though they may be handled several times per year for procedures like cage moves, vaccinations, weighing, mating/insemination and pelt grading.

3.5 Chinchilla

3.5.1 Biology

As a rodent endemic to North-central Chile, Chinchilla (*Chinchilla lanigera*) can be found in the Andean mountains at 3,000-5,000 m of altitude, though its presence at lower altitudes has also been reported (Villarroel et al., 2021). Considered under threat in some areas (i.e., critically endangered EDGE species) (Busso et al., 2012), its distribution is restricted to small and fragmented colonies (Valladares Faúndez et al., 2014). Gregarious and social, these animals form large colonies of over 100 individuals, with varying densities from 0.9 to 10.7 individuals per 10,000 m^2. Regarding body size, chinchillas measure 22.5-38 cm (±7.5 cm including their tail) (SCAHAW, 2001), with relatively long vibrissae (9.2-13.2 cm; Chernova and Zherebtsova, 2023), and females are heavier than males, approximately 800 g vs. 500 g (SCAHAW, 2001). Barabasz et al. (2010) reported a body length of 23-50 cm (mean 41.6 cm) and a tail length of about 15 cm based on pelt measure.

Chinchilla fur is quite dense, up to 60 hairs per follicle (SCAHAW, 2001) and although their natural, wild-type colour is of a bluish-grey hue, dark blue grey is the most common farmed colour type (Mans and Donnelly, 2021). As with other rodent species, their dentition experiences continuous growth throughout the lifetime of the animals (SCAHAW, 2001). Unlike the carnivore species farmed for fur, chinchillas have precocious kits (born fully furred and mobile within 1h post-partum (Mans and Donnelly, 2021), with neonates being able to feed on solid food at one week of age (Busso et al., 2012). Unlike carnivores, they are a prey species. Main predators are fox species and occasionally owls (Valladares Faúndez et al., 2014). In their natural environment, chinchillas spend most of their time hidden in burrows or rock crevices (Supporting information – SF20, SF21, SF22). Under test conditions, on average they react cautiously upon presentation of fearful stimuli (Łapiński et al., 2023a). The maximum lifespan in the wild is approximately 10 years (SCAHAW, 2001).

The climates they have evolved to live in are dry mountain climates, with extreme and sudden fluctuations in temperature (Busso et al., 2012). Thus, chinchillas show morphological, physiological, and behavioural adaptations to desertic, arid habitats, as well as high altitudes. In particular, their eyes and ears are relatively large (ears can be up to 7 cm long), as are their hind legs and limbs (SCAHAW, 2001). They have higher hemoglobin oxygen affinities compared to other rodent species (Ostojic et al., 2002), and significantly lower water intake per unit of metabolic body weight (Hagen et al., 2014). Behaviourally, chinchillas show sand-bathing behaviour (Stern and Merari, 1969; Barber and Thompson, 1990; SCAHAW, 2001) as cited in Supporting information – SF20) and burrowing behaviour (SCAHAW, 2001), and they are primarily active at night (Panina et al., 2021a; Łapiński et al., 2023b). Behavioural observations in Chile have shown that the majority of chinchillas are active between 11:00 p.m. and 2:00 a.m. (Deane et al., 2020, as cited in Supporting information – SF21).

Chinchillas have a generalist folivorous diet including cacti, which also serves as water source (Valladares Faúndez et al., 2014), which broadens during rainy years, when seasonal dietary differences are also less marked (Cortés et al., 2002). Wild chinchillas have been reported to feed on up to 24 plant species (Cortés et al., 2002, in Supporting information – SF21).

In terms of mating system, there is little information on reproductive patterns in the wild, although differences in female and male body size would suggest that chinchillas have a polyandrous mating system, and possibly also monogamy (SCAHAW, 2001). Adult males show paternal behaviour in captivity (Mans and Donnelly, 2021). Females have been reported to be aggressive towards one another (SCAHAW, 2001). In the wild, in the southern hemisphere, there are two marked mating periods (in mid-winter and mid-summer; Celiberti et al., 2013). In captivity, reproductive season appears to change with latitude and external environmental factors, with mating activity tending to decrease in summer months in the northern hemisphere (Celiberti et al., 2013), or show no marked seasonal variation (Dominchin et al., 2014; Gramajo-Bühler et al., 2016). Little is known about wild morbidity and mortality for this species (Spotorno et al., 2004). It is worth noting that reintroduction and translocation attempts conducted to date in the wild have failed (Jiménez et al., 2022).

3.5.2 Production cycle

The cycle of chinchillas kept for fur production is not as seasonally constrained as that of the carnivore furbearing species (see Figure 14). Farmed chinchillas may be bred from 6-7 months of age (Ślaska and Rozempolska-Rucińska, 2010b), though age at first effective mating has been reported to range from 7-16 months for farmed males (Kania-Gierdziewicz et al., 2020). In clinical/veterinary literature, males are reported to become reproductively mature towards their eighth month (Celiberti et al., 2013). The onset of puberty in females occurs after having reached the final adult weight, occurring around 240 days; however, data from literature on the onset of sexual maturity are not consistent and the reported range varies from 240 days (about 2 months) to 540 days (about 18 months) (Celiberti et al., 2013). A body weight of approximately 500 g has been reported as criterion for first mating in females (Dr S. Łapiński, Researcher at University of Krakow, communication in a WG meeting, 2024a).

The Chinchilla Production Standard is a product certification standard for companies trading in chinchilla pelts produced in Europe, which has been issued in 2023 by the Baltic Academy for the International Fur Federation and validated by independent experts on chinchilla production in Europe (see in Supporting information – SF24). The Chinchilla Production Standard states that male and female chinchillas become sexually mature at 4 months, but the animals should not be introduced to one another (i.e., for breeding) until at least 8 months of age (Supporting information – SF24). As mentioned, males are allowed free access to females for natural mating, presumably year-round (Kania-Gierdziewicz et al., 2020). In a multi-year study of commercial farm data from Poland, males were mated to 1-17 dams over their breeding lifetime (typically 5 years), though the majority were only mated to 1-6 dams, meaning they only participated in one so-called breeding set (Kania-Gierdziewicz et al., 2020). A lesser percentage participated in 2-6 breeding sets in their lifetime (Kania-Gierdziewicz et al., 2020). In captivity, females have on average 1.4 litters per year, with litter sizes of 2-3 kits (average of 1.87, limited by females only having four mature follicles in both ovaries in each oestrus cycle (Kania-Gierdziewicz et al., 2020), and weaning success varying greatly (1.9 - 88.9%; Galeano et al., 2014b). In captivity, dams nurse their kits in a standing position (Mans and Donnelly, 2021) for 6-9 weeks (Spotorno et al., 2004), with a minimum of 3.5 weeks being deemed necessary for kit survival (Mans and Donnelly, 2021).

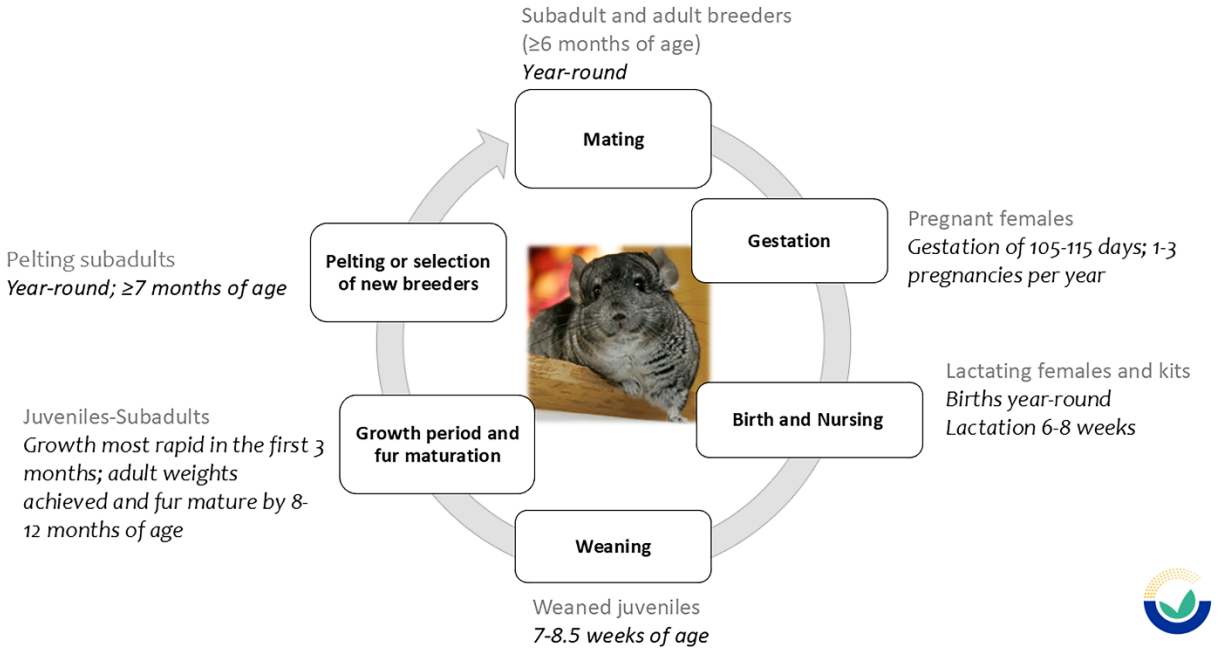

Figure 14: Typical production cycle for chinchillas (*Chinchilla lanigera*) farmed in Europe

The mating season in chinchillas is difficult to isolate and may span the entire year due to long female oestrus cycles, ranging from 15 to 69 days (Busso et al., 2012), though most typically 34-43 days (Seremak, 2007; Barabasz, 2008). Post-partum oestrus is possible. The typical onset of the mating season is January or February in the northern hemisphere, but earlier (e.g., October) or later (e.g., July and August) mating activity can occur (Celiberti et al., 2013). Continuous polyoestrous-type cyclical activity is observed more commonly in captive breeding settings (Celiberti et al., 2013). Breeding adults are housed in individual cages; however, farms often organize cages into "polygamous groups" in a 1:4, 1:5, or 1:6 male to female ratio throughout the year, providing corridors for the male to access the females' cages for natural mating (Supporting information – SF24). Such a group can be termed a breeding set.

Male access is then controlled either by the opening of corridor gates by staff, or by physically preventing females' access to the corridor using neck collars (Figure 15) so the male can interact with each of the females at will (Supporting information – SF25). Gestation has been reported to last from 105-115 days (Spotorno et al., 2004) or 111 days on average (Kania-Gierdziewicz et al., 2020), and thus two pregnancies per year are commonly achieved per female (i.e., average of 1.4 ± 0.05 or 2.2 ± 0.5 litters/female/year in an Argentinian breeding facility), depending on behavioural characteristics of females though this may be increased to three pregnancies by breeding at the post-partum oestrus (Święcicka et al., 2018). The reproductive productivity in chinchilla farms worldwide shows a range of 1.2 to 2.4 deliveries per female per year (with up to 2.1 weaned kits per female per year; Busso et al., 2012).

Figure 15161718: Examples of female chinchillas wearing plastic collar (Supporting information – SF25, SF26) (©Human Society International)

Since mating may occur at any time of the year, births can similarly occur all year long. Ślaska and Rozempolska-Rucińska (2010b) reported that most births occurred in the summer season in a Polish farm, followed by spring, autumn, and winter (i.e., 32.8%, 27.8%, 25.3%, and 14.1% of births, respectively). However, two birth seasons are typically distinguished on commercial farms: from March to August and from September to February (Kania-Gierdziewicz et al., 2020). Farmed females may deliver 1-7 live kits per litter (Ślaska and Rozempolska-Rucińska, 2010b), though the higher litter sizes are rarely observed, and single or twin kits are most common (Barabasz and Łapiński, 2008; Ślaska and Rozempolska-Rucińska, 2010b; Święcicka et al., 2018; Kania-Gierdziewicz et al., 2020).

The number of kits born per litter tends to decrease across the second and third litters born per year (from 3.5 to 2.5 kits within one year and 4.3 to 2.6 within a subsequent year; Święcicka et al., 2018). Similarly, litter size decreases with female age (from 4.2 kits in 2-year-old females to 2.9 kits in 6-year-old females; Święcicka et al., 2018). The largest farm-bred litters are obtained from females 2 years of age (Święcicka et al., 2018), which aligns with another study reporting that females be 1.5 years or older for best reproductive results (Celiberti et al., 2013). Cross-fostering of kits to create more even litter sizes is utilized when kits are under 10 days old and, in the event of a female with kits younger than seven days old dying, another female's kits may be weaned a few days early so she can foster the orphans (Supporting information – SF23).

Chinchilla kits rely exclusively on maternal milk until 3 weeks of age and can then begin to consume solid feeds, but lactation generally lasts 6-8 weeks (Barabasz and Łapiński, 2008). Offspring are weaned by separation from the dam at 56-60 days (8-8.5 weeks) of age according to some sources (Lammers et al., 2001; Barabasz and Łapiński, 2008) and as early as 7 weeks according to others (Supporting information – SF24). Weaned kits are split into groups of two or three (only females are housed together if the individuals are genetically related; Supporting information – SF24) or housed singly thereafter (Lammers et al., 2001). The number of kits per litter surviving to weaning age ranges from 0-5, and in one year of production, females most often raise 2-5 kits (Ślaska and Rozempolska-Rucińska, 2010b). Kit mortality has been reported to average 19.5%, with birthweight being a major influential factor (Dzierzanowska-Goryn et al., 2014). In a Hungarian study, mortality from birth to

weaning was 34% for kits with a birth weight of less than 41 g, 14.7% for kits 41-50g, and 10.7% for kits weighing more than 50 g (Lanszki, 1996).

Kit growth is most rapid in the first 90 days of life (Lammers et al., 2001). The fur growth period extends beyond this, as the fur is densest and of the highest quality by 8-12 months of age (Panina et al., 2021b) but killing and pelting can occur at any time in the year (e.g., pelts of 7-8-month-old chinchillas were described in a Russian study; Novikov et al., 2019). If female chinchillas are retained beyond 8 months of age, they are moved into single housing in polygamous systems (see Section 3.5.3) and allowed to begin interacting with males (Supporting information – SF24). Females may be retained for breeding over multiple years – e.g., bred females were 1-8 years old on a Polish farm (Święcicka et al., 2018). Similarly, males in a multi-year dataset from a Polish farm were used in reproduction for about 5 years (Kania-Gierdziewicz et al., 2020), and males in a 'sexually mature' study population from various farms were 29-44 months old (approximately 2.4-3.6 years) (Łapiński et al., 2020).

3.5.3 Husbandry systems

Farmed chinchillas are housed in temperature-controlled buildings and kept in wire mesh cages, with recommended floor areas of 0.5 m^2 and minimum height of 100 cm (T-AP Recommendation concerning fur animals, 1999[26]; though cages this large are often not used in commercial practice, see later under 3.5.3.1.). Cages may be stacked in rows/tiers. Stakeholders report that heating pads or boxes may be provided instead of nest boxes for lactating females and their kits. In farm practice, for lactating females with kits, cardboard placed in the wire floor cage or a solid floor cage with sand can be used (Barabasz, 2008). Physical housing specifications are further detailed in Section 3.5.3.1 and in Table 7.

Sand baths and resources intended for environmental enrichment that allow animals to chew, jump and hide may be provided in cages; this is further discussed in Section 3.5.3.2. The social housing practices on farms are outlined in Section 3.5.3.3. In brief, juvenile animals are typically housed together in pairs. Adult females are kept in individual cages that may be visited by an adult male (see above). The male usually does not have his own cage but uses a corridor between cages to freely visit each female. Chinchillas are fed a commercial pelletized diet supplemented with hay or straw. Access to water is maintained by drinking nipples or water bottles. Feeding and watering practices are further described in Section 3.5.3.4.

3.5.3.1 PHYSICAL ASPECTS OF HOUSING

Chinchillas are kept in indoor buildings, as reported by stakeholders (Supporting information – SF27) and literature on commercial farms (Święcicka et al., 2018; Kania-Gierdziewicz et al., 2020). These buildings may also be described as "closed sheds" (Święcicka et al., 2018). Temperature is controlled by opening windows or doors of the unit (Supporting information – SF27) or by using ventilation systems with air conditioning (Kania-Gierdziewicz et al., 2020). Temperatures are kept between 15°C and 26°C, with humidity below 70% (Supporting information – SF27).

[26] Standing Committee of the European Convention for the protection of animals kept for farming purposes (T-AP). Recommendation concerning fur animals adopted by the Standing Committee on 22nd June 1999.

It is recommended that units are ventilated at least once per day during all seasons to avoid the build-up of ammonia gases and dust according to the Chinchilla Production Standard produced by the Baltic Academy (Supporting information – SF24). In Hungary, following breeding standards, chinchillas are required to have access to fresh air and appropriate ventilation. Similarly, the International Fur Federation require the production unit to be ventilated at least once per day but there is no exact measuring standard for the amount of ammonia (Supporting information – SF6, SF8). In Sweden, air quality limits used to be: ammonia 10 ppm, CO_2 3000 ppm, H_2S 0.50 ppm and dust 10 mg/m³ (Supporting information – SF6). Stakeholders report that in common practice farmers rely on natural ventilation. The animals and the ventilation in the unit are checked as part of the daily routine (Supporting information – SF8).

Lighting may be partially or completely artificial (Ślaska and Rozempolska-Rucińska, 2010a, 2010b; Polit et al., 2018; Kania-Gierdziewicz et al., 2020; Łapiński et al., 2020). Regardless of lighting type, stakeholders report that a 12-hour day/night cycle is used in commercial practices (Supporting information – SF8, SF24). In Hungary, chinchilla breeding standards require that light cycles reflect natural day-night rhythms, with at least 10 hours of daylight for monitoring animals (Supporting information – SF6). An example of housing system is shown in Figure 16.

Figure 161920: Example of housing systems for chinchilla (Supporting information – SF28) (©Human Society International)

Cages are elevated off the ground and may be stacked in multiple tiers, in a maximum of four rows according to some sources (Wojtacka et al., 2014; Supporting information – SF27) and five rows according to others (Święcicka et al., 2018). Cage floors are rarely fully solid (material not specified), most often made of wire mesh, or a mixture of both (in the latter case at least 25% of the cage floor space is solid, made of a removable wooden, plastic or metal panel placed on the wire mesh used as a false bottom; Supporting information – SF6, SF27). No information on standard procedures to remove faeces from the wire mesh was retrieved. On commercial

breeding farms in Poland, animals are reportedly kept in standard wire mesh cages (Barabasz and Łapiński, 2008) or steel cages (Polit et al., 2018; Łapiński et al., 2020, 2023b).

The proportion of solid flooring is not always specified. If wire mesh is used, commercial practices reported that the void area should not exceed 25 x 50 mm (Supporting information – SF27) or 19 x 19 mm (Barabasz, 2008). Litter/wood shavings may be used on the cage floor (Supporting information – SF27). This is also demonstrated in reports from Poland (i.e., "standard bedding cages" (Ślaska and Rozempolska-Rucińska, 2010a, 2010b), or from outside the EU (Galeano et al., 2014b; Mastromonaco et al., 2015; Brustenga et al., 2023). Examples of cages for chinchillas are reported in Figure 17.

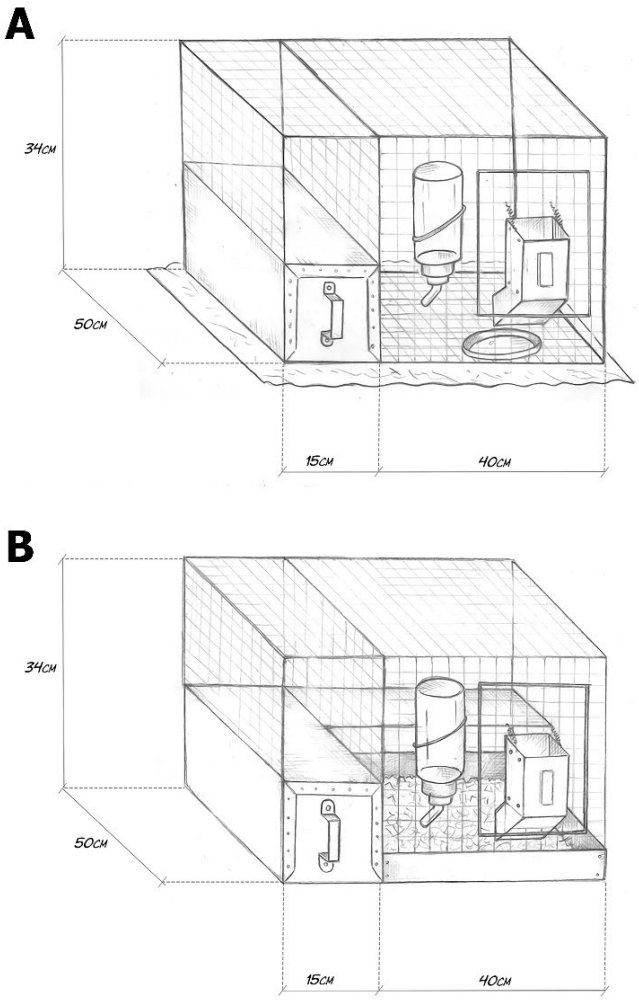

Figure 17: Example of commercial cages for chinchillas from after weaning to pelting. (A) Standard cage with a wire floor, equipped with a ceramic plate under the feeder to reduce feed loss. (B) Enriched standard cage with deep litter floor of shavings and a grid platform on the rear wall (©Łapiński et al., 2023b ©Scientific Reports, CC license, figure modified by only including schemes "A" and "B").

Female chinchillas do not make nests and thus, instead of a nest box with bedding material, stakeholders report that a heated box or pad is provided (applies to pregnant females, lactating females, and suckling kits; Supporting information – SF27). Alternatively, females may be housed with a cardboard inserted over the wire mesh floor or a solid floor with wood shavings (Barabasz, 2008). Recommended floor areas, stocking densities, etc., as reported by stakeholders, are outlined in Table 7. Cage sizes aligning with stakeholder reports (i.e., 0.5 m^2) are reported without specific cage dimensions in research from commercial Polish farms (Kania-Gierdziewicz et al., 2020).

However, cages of this size are uncommon in commercial practice. Literature reports that individual cages of 50 x 40 x 35 cm or 50 x 40 x 40 cm (l x w x h) are used on Polish farms, resulting in floor areas of 0.2 m^2 (Polit et al., 2018; Łapiński et al., 2020, 2023b). These floor areas are smaller than those reported by stakeholders (i.e., 0.5 m^2; Supporting information – SF27) and larger than those reported by the Chinchilla Production Standard produced by the Baltic Academy (i.e., 50 cm^2 per animal; Supporting information – SF24), though this may be a misprint meaning 50 x 50 cm (0.25 m^2), so it is not clear what cage size is predominantly used on commercial farms.

According to stakeholders, males are not provided with individual cages (Supporting information – SF27), but rather a barren corridor to move between females' cages. From field visits, corridors measuring 12 x 12 cm with variations ranging from 2 to 3 cm smaller or larger were observed, and similar dimension are reported by stakeholders in Supporting information (SF8). It was reported in a study from commercial farms from outside EU (Argentina) that males can have their own cages, the same size as females', while still having access to female cages through a corridor, but no information on this practice has been found in European literature.

Table 7: Husbandry systems for farmed chinchillas. Information provided by stakeholder umbrella organizations reflecting current recommendations (Supporting information – SF27) are given, but it is not known if these are widely adopted. Where cells are empty or specifications are not provided, the information was either not available or not applicable.

Descriptive category	Type of housing system (% of animals in category)	Duration in system	Number of animals per cage	Total floor space (m^2)[(a)]	Sex ratio (M:F)	Nest box provision and dimensions in cm (l x w x h)[(b)]	Source
Male breeders	Polygamous system: Corridor having access to 1-6 female cages (100%)	Whole life from approx. 8 months onward	No separate cage, male moves between female cages in a corridor	Minimum 0.5 per animal	1M:6F (females individually housed) At most 1M:1F in a cage at any given time	Not provided	SF27
Female breeders	Individual with occasional access to male (100%)	Whole life from approx. 8 months onward outside of reproductive season	1	Minimum 0.5 per animal	At most 1M:1F in a cage at any given time	Not provided	SF27
Pregnant females	Individual with occasional access to male (100%)	3.5 months	1	Minimum 0.5 per animal	At most 1M:1F in a cage at any given time	No But heated box or pad may be provided	SF27
Female with kits	Grouped with kits (100%)	2 months	Mother with kits	Minimum 0.5 per female + kit	Variable (whole litter with dam)	No But heated box or pad may be provided	SF27
Juvenile/ subadults kits	Individual or Paired (unknown)	1-5 month	2	Minimum 0.5 per animal (single) or 0.3 per animal (paired)	1M:1F or 2F	No	SF27

(a): Measures indicated are the one reported from the call for evidence. However, variability from other sources of literature reports different dimensions. See Section 3.5.3.1 in the text.
(b): l = length, w = width, h = height.

3.5.3.2 ENVIRONMENTAL ENRICHMENT

Sand baths and at least three types of resources intended as enrichment are often used (e.g., shelves, loose plastic tubes and boxes to meet chinchillas' motivation to jump, hide, and chew) as reported by stakeholders (Supporting information – SF21, SF22, SF27). Sand baths aid in moisture and lipid removal from animals' fur, may facilitate play, and in some systems can provide the animals with undisturbed resting spots as recommended in the Chinchilla Production Standard produced by the Baltic Academy (Supporting information – SF24). In addition, it is recommended that animals have access to these baths for a minimum of 30 minutes per day (Supporting information – SF23) in either a drawer or a shallow pan. However, field practices may largely vary depending on farm management from 10-15 minutes, 2-3 times a week, to full night access (Dr S. Łapiński, Researcher at University of Agriculture in Krakow, communication in a WG meeting, 2024b). Sand baths would need to be emptied and cleaned whenever animals are moved, and then refilled (2-3 cm deep) with sanitized chinchilla sand (i.e., clay mineral sand; Supporting information – SF24). It is not known to what extent the recommendations for enrichment provision and management are currently implemented on chinchilla fur farms.

As one of the three types of resources intended as enrichment, the Chinchilla Production Standard recommends providing items that allow animals to hide or isolate themselves — such as pipes (20–25 cm in diameter) or boxes — within their cages (Supporting information – SF24). In research from a commercial farm setting in Poland, however, only a sand bath and wooden chewing block were provided in cages (Łapiński et al., 2020). Similarly, in a non-EU study (i.e., from Russia), it was only specified that wooden chewing blocks were provided in cages (Panina et al., 2021b). No other information was found on the frequency of use of different use of resources intended as enrichment in EU farms. Straw or hay does not count as one of the 3 enriching resources according to the Chinchilla Production Standard produced by the Baltic Academy (Supporting information – SF24), probably as these two materials qualify as bedding material or feed addition in this species. However, straw and hay have been reported in literature and by stakeholder also as enrichment for this species (Łapiński et al., 2023b, Supporting information – SF8).

3.5.3.3 GROUP SIZE

During lactation, chinchillas are kept in groups comprising the mother and her kits (Supporting information – SF27). The "splitting" of kits (similar to cross-fostering in other farmed animals) to create more even litter sizes across all breeding females may be practiced if the kits are less than 10 days old when moved (Supporting information – SF24). This practice may, however, be difficult to implement in farm practice since females give birth at varying times throughout the year. According to the Chinchilla Production Standard, kits are regrouped into pairs (at minimum) at seven weeks of age, when they are weaned (Supporting information – SF24).

Pairs may consist of related females, unrelated females, or an unrelated male and female. Chinchilla pairs are reported to remain together for several months as juveniles or alternatively, to be housed individually until killing and pelting at 7-9 months of age. In the case of future breeders, they are housed individually until they are included in a polygamous breeding group (Supporting information – SF27). Immature breeders are moved into individual housing in the polygamous breeding group configuration (described

below); however, males and females are not typically introduced before eight months of age (Supporting information – SF24).

The polygamous breeding groups for adult animals consist of individual female cages connected by a corridor through which a male can enter (Supporting information – SF24). As shown above, females are fitted with a disc-like collar, made of plastic or metal (Figure 15), to prevent them from entering this corridor (Supporting information – SF24), and thus they cannot leave their own cage. Solitary housing is not recommended unless animals are sick (Supporting information – SF24). Females can, however, not enter each other's cages and may only have social contact while the male is in their cage.

As reported on commercial Polish farms, the male has free access to approximately four (Ślaska and Rozempolska-Rucińska, 2010a, 2010b) or six (Kania-Gierdziewicz et al., 2020) females in this manner (i.e., a polygamous breeding set). Polygamous cage groups are also reported in use on commercial Polish farms by Polit et al. (2018) and Święcicka et al. (2018), but housing specifications are not provided (i.e., no description of corridors between cages or collars for females). Animals remain in these individual cages, nested in polygamous cage groups, for the remainder of their adult life, including the period when kits are present in lactating females' cages (Supporting information – SF27).

3.5.3.4 Feeding and watering

Water is provided via pipe systems with drinking nipples or manually by water bottles, with one drinker per cage; there is no need for frost protection since enclosures are indoors (Supporting information – SF24, SF27). On commercial Polish farms used for research, each cage was reported to be equipped with a polypropylene water feeding bottle (Łapiński et al., 2020). Breeding males usually don't have drinkers in the corridor, and need to access females' cages to drink, however some exceptions exist with a drinking nipple placed in the corridor (prevalence not known). Feed is reported by stakeholders to be given manually (Supporting information – SF26), at least once daily (Supporting information – SF24) in stainless steel gravity feeders (Łapiński et al., 2020).

Animals are fed a commercial pelletized diet (Barabasz and Łapiński, 2008; Święcicka et al., 2018; Kania-Gierdziewicz et al., 2020; Łapiński et al., 2020) sometimes supplemented with hay (Święcicka et al., 2018; Kania-Gierdziewicz et al., 2020). According to the available literature, the formula for the composition of chinchilla pellets is 10–20% protein, 2–5% fat, and 15–35% bulk fibre (Spotorno et al., 2004, in Supporting information – SF20). Commercially available pellets formulated for chinchillas contain ingredients, such as bran (wheat, barley, oats), alfalfa meal, soy hulls, beet pulp, oilseed expeller, and are enriched with minerals and vitamins (Supporting information – SF20). In fact, farmed chinchillas need 24-hour access to hay or straw for eating according to the Chinchilla Production Standard, which can be provided in loose form or as compacted bricks (Supporting information – SF24). Alfalfa may also be provided in non-EU breeding facilities (Galeano et al., 2014a; Brustenga et al., 2023), though information has not been found in European sources.

3.5.3.5 Other management practices

The reviewed literature provides limited information on handling practices or their frequency, though the Chinchilla Production Standard states that chinchillas should be picked up at the base of the tail with one hand while the body is supported under the chest

with the other (Supporting information – SF24). Chinchillas are handled on several occasions in the production cycle, including weaning, assessment of fur quality, transfer to a polygamous breeding set, or killing and pelting, and also during annual veterinary checks (Supporting information – SF24). Video clips provided through the EFSA call for evidence reported examples of rough handling of chinchillas (Supporting information – SF20, SF26). However, the frequency, duration and specific types of handling are not well-documented, making it impossible to provide a comprehensive overview. Other routine health management procedures such as vaccinations are not described in the literature reviewed and are reportedly not conducted in farmed chinchillas (Barabasz, 2008).

4. Conclusions

This report outlines biology aspects, current husbandry systems and rearing practices used in the farming of animals kept for fur production, and precisely: i) American mink, ii) Red fox, iii) Arctic fox, iv) Raccoon dog and v) Chinchilla. The assessment of the welfare of these animals is discussed in a separate EFSA publication (EFSA AHAW Panel, 2025).

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Appendix A – Search strings used for literature search

A.1. ToR 1a: The biology and species-specific behaviours of the animals (corresponding to section 4 and 5 of the SCAHAW report 2001)

A.1.1. Literature search protocol for the behavioural biology of American mink

Database: Scopus (Elsevier)

Date of the search: 08-04-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("American mink$") AND ("Neogale vison" OR "Neovison vison" OR "Mustela vison") AND its = ("biology" OR "behaviour*" OR "behavior*" OR "physical characteristic*" OR "ecology" OR "geographical distribution" OR "habitat" OR "foraging" OR "hunting" OR "territory" OR "reproduction" OR "social behaviour*" OR "communicat*") AND NOT ("cell*" OR "molec*" OR "gene*" OR "DNA") AND NOT ("predat*" OR "invasive" OR "alien" OR "threat*") AND NOT ("mink frog$")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result: 89. Result after screening for relevance: 46

A.1.2. Literature search protocol for the behavioural biology of Red fox

Database: Scopus (Elsevier)

Date of the search: 08-04-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("red fox$" OR "grey fox$") AND ("Vulpes vulpes" OR "Urocyon cinereoargenteus") AND its = ("biology" OR "behaviour*" OR "behavior*" OR "physical characteristic*" OR "ecology" OR "geographical distribution" OR "habitat" OR "foraging" OR "hunting" OR "territory" OR "reproduction" OR "social behaviour*" OR "communicat*") AND NOT ("molec*" OR "cell*" OR "gene*" OR "DNA") AND NOT ("predat*" OR "threat*" OR "invasive" OR "alien" OR "endanger*" OR "biological control" OR "risk" OR "reproductive control" OR "protect*" OR "extinct*" OR "seed" OR "plant species" OR "indicator" OR "host" OR "vaccin*") AND NOT ("wildlife cross*" OR "forest road" OR "overpass*" OR "tunnel*" OR "underpass*" OR "collision*" OR "model*" OR "GIS" OR "monitor*" OR "game" OR "bag" OR "human" OR "agricultur*" OR "shotgun*" OR "rifle*" OR "bullet*" OR "garden") AND NOT ("algorithm" OR "optimization" OR "diagnos*" OR "efficien*")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result: 104. Result after screening for relevance: 61

A.1.3. Literature search protocol for the behavioural biology of Arctic fox

Database: Scopus (Elsevier)

Date of the search: 08-04-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("arctic fox$" OR "polar fox$" OR "white fox$" OR "snow fox$") AND ("Vulpes lagopus") AND its = ("biology" OR "behaviour*" OR "behavior*" OR "physical characteristic*" OR "ecology" OR "geographical distribution" OR "habitat" OR "foraging" OR "hunting" OR "territory" OR "reproduction" OR "social behaviour*") AND NOT ("gene*" OR "cell*" OR "host" OR "predat*" OR "hunted")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result: 51. Result after screening for relevance: 21

A.1.4. Literature search protocol for the behavioural biology of Raccoon dog

Database: Scopus (Elsevier)

Date of the search: 08-04-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("raccoon dog$" OR "Finn raccoon$") AND ("Nyctereutes procyonoides") AND its = ("biology" OR "behaviour*" OR "behavior*" OR "physical characteristic*" OR "ecology" OR "geographical distribution" OR "habitat" OR "foraging" OR "territory" OR "reproduction" OR "social behaviour*") AND NOT ("gene*" OR "molec*" OR "chromosom*" OR "spread*" OR "host" OR "risk" OR "vaccin*" OR "enzym*" OR "seed" OR "predat*" OR "threat*" OR "invasive") AND NOT ("model" OR "forest road" OR "overpass" OR "underpass" OR "tunnel*" OR "roadkill" OR "collision" OR "human")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result: 44. Result after screening for relevance: 28

A.1.5. Literature search protocol for the behavioural biology of Chinchilla

Database: Scopus (Elsevier)

Date of the search: 08-04-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("chinchilla$") AND ("Chinchilla lanigera") AND its = ("biology" OR "behaviour*" OR "behavior*" OR "physical characteristic*" OR "ecology" OR "geographical distribution" OR "habitat" OR "foraging" OR "territory" OR "reproduction" OR "social behaviour*")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result = 56. Result after screening for relevance = 24

A.2 ToR 1b: Literature search for the description of the production cycles.

Database: Scopus (Elsevier)

Date of the search: 28-04-2024 (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 ("code of practice" OR "protocol*" OR "guide*" OR "manual" OR "farm*" OR "produc*" OR "production cycle*" OR "artificial" OR "captiv*" OR "fur farm*" OR "furbear*" OR "welfare" OR "grow*" OR "growth cycle" OR "furring" OR "breed*" OR "reproduc*") 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: 190. Result after screening for relevance: 81

A.2.2 Literature search protocol for production cycles of Arctic and Red foxes

Database: Scopus (Elsevier)

Date of the search: 23-04-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("farmed fox*" OR "red fox*" OR "silver fox*" OR "arctic fox*" OR "polar fox*" OR "blue fox*" OR "white fox*" OR "snow fox*") AND ("code of practice" OR "protocol*" OR "guide*" OR "manual" OR "farm*" OR "produc*" OR "production cycle*" OR "artificial" OR "captiv*" OR "fur farm*" OR "furbear*" OR "welfare") AND NOT ("molec*" OR "cell*" OR "algorithm") AND NOT ("predat*" OR "wild" OR "feral" OR "distribution")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result: 389. Result after screening for relevance: 89

A.2.3 Literature search protocol for production cycle of raccoon dog

Database: Scopus (Elsevier)

Date of the search: 28-04-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("raccoon dog*" OR "farmed raccoon dog*" OR "Finnraccoon" OR "Finn raccoon" OR "Nyctereutes procyonoides") AND ("code of practice" OR "protocol*" OR "guide*" OR "manual" OR "farm*" OR "produc*" OR "production cycle*" OR "artificial" OR "captiv*" OR "fur farm*" OR "furbear*" OR "welfare" OR "grow*" OR "growth cycle" OR "furring" OR "breed*" OR "reproduc*") AND NOT ("molec*" OR "cell*" OR "gene*") AND NOT ("predat*" OR "wild" OR "feral" OR "distribution" OR "native")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result: 97. Result after screening for relevance: 34

A.2.4 Literature search protocol for production cycle of chinchilla

Database: Scopus (Elsevier)

Date of the search: 28-04-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("chinchilla*" OR "farmed chinchilla*" OR "Chinchilla lanigera") AND ("code of practice" OR "protocol*" OR "guide*" OR "manual" OR "farm*" OR "produc*" OR "production cycle*" OR "artificial" OR "captiv*" OR "fur farm*" OR "furbear*" OR "welfare" OR "grow*" OR "growth cycle" OR "furring" OR "breed*" OR "reproduc*") AND NOT ("endanger*" OR "risk" OR "threat*" OR "conserv*" OR "distribution") AND NOT ("gene*" OR "DNA" OR "cell*" OR "molec*" OR "neur*" OR "brain" OR "aural" OR "clinic*" OR "drug" OR "wavelength" OR "ocular" OR "physics" OR "osteo*" OR "model" OR "evol*" OR "chinchilla rabbit")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result: 143. Result after screening for relevance: 32

A.3. ToR 1b: Literature search for the description of the husbandry systems.

A.3.1 Literature search protocol for housing and husbandry of American mink

Database: Scopus (Elsevier)

Date of the search: 15-05-2024 (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 ("code of practice" OR "protocol*" OR "guide*" OR "manual" OR "statute" OR "farm*" OR "produc*" OR "artificial" OR "captiv*" OR "fur farm*" OR "furbear*" OR "welfare" OR "grow*" OR "breed*" OR "reproduc*" OR "husbandry" OR "hous*" OR "space" OR "height" OR "floor*" OR "cage*" OR "nest*" OR "litter*" OR "enrichment*") 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: 203. Result after screening for relevance: 114

A.3.2 Literature search protocol for housing and husbandry of foxes

Database: Scopus (Elsevier)

Date of the search: 15-05-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("farmed fox*" OR "red fox*" OR "silver fox*" OR "arctic fox*" OR "polar fox*" OR "blue fox*" OR "white fox*" OR "snow fox*") AND ("code of practice" OR "protocol*" OR "guide*" OR "manual" OR "statute" OR "farm*" OR "produc*" OR "artificial" OR "captiv*" OR "fur farm*" OR "furbear*" OR "welfare" OR "husbandry" OR

"hous*" OR "space" OR "height" OR "floor*" OR "cage*" OR "nest*" OR "litter*" OR "enrichment*") AND NOT ("molec*" OR "cell*" OR "algorithm" OR "software" OR "econ*" OR "gene*" OR "DNA" OR "model" OR "sars*" OR "predat*" OR "wild" OR "feral" OR "distribution" OR "population" OR "endanger*" OR "inva*" OR "intrud*" OR "hunt*" OR "eco*")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result: 198. Result after screening for relevance: 78

A.3.3 Literature search protocol for housing and husbandry of raccoon dogs

Database: Scopus (Elsevier)

Date of the search: 15-05-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("raccoon dog*" OR "farmed raccoon dog*" OR "Finnraccoon" OR "Finn raccoon" OR "Nyctereutes procyonoides") AND ("code of practice" OR "protocol*" OR "guide*" OR "manual" OR "statute" OR "farm*" OR "produc*" OR "production cycle*" OR "artificial" OR "captiv*" OR "fur farm*" OR "furbear*" OR "welfare" OR "grow*" OR "breed*" OR "reproduc*" OR "husbandry" OR "hous*" OR "space" OR "height" OR "floor*" OR "cage*" OR "nest*" OR "litter*" OR "enrichment*") AND NOT ("molec*" OR "cell*" OR "gene*" OR "infec*" OR "diseas" OR "model" OR "threat*" OR "covid*" OR "sars*" OR "rabies" OR "predat*" OR "wild" OR "feral" OR "distribution" OR "native" OR "scavenge*" OR "forag*" OR "predat*" OR "ecol*" OR "urban*" OR "landscape*")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result: 65. Result after screening for relevance: 27

A.3.4 Literature search protocol for housing and husbandry of chinchillas

Database: Scopus (Elsevier)

Date of the search: 15-05-2024 (since 2000, All Databases, All types)

Search string: TITLE-ABS-KEY (("chinchilla*" OR "farmed chinchilla*" OR "Chinchilla lanigera") AND ("code of practice" OR "protocol*" OR "guide*" OR "manual" OR "statute" OR "farm*" OR "produc*" OR "artificial" OR "captiv*" OR "fur farm*" OR "furbear*" OR "welfare" OR "grow*" OR "breed*" OR "reproduc*" OR "husbandry" OR "hous*" OR "space" OR "height" OR "floor*" OR "cage*" OR "nest*" OR "litter*" OR "enrichment*") AND NOT ("endanger*" OR "risk" OR "threat*" OR "conserv*" OR "distribution" OR "ecol*" OR "gene*" OR "DNA" OR "cell*" OR "molec*" OR "neur*" OR "brain" OR "aural" OR "clinic*" OR "syndrome" OR "drug" OR "bacteria" OR "vir*" OR "wavelength" OR "ocular" OR "physics" OR "osteo*" OR "model" OR "evol*" OR "chinchilla rabbit" OR "rabbit")) AND PUBYEAR > 1999 AND PUBYEAR < 2024

Result: 81. Result after screening for relevance: 26