The Old School, Brewhouse Hill, Wheathampstead,
Hertfordshire AL4 8AN, UK
www.ufaw.org.uk

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Classification of animal welfare on mink farms differs between three annual production periods

BIF Henriksen*, JT Sørensen and SH Møller

Aarhus University, Dept of Animal Science, Blichers Allé 20, Postboks 50, DK-8830 Tjele, Denmark
* Contact for correspondence and request for reprints: Britt.Henriksen@anis.au.dk

Abstract

According to the WelFur assessment protocol for mink, welfare is assessed via three one-day visits; one during each of the three main annual production phases. If one of these three assessments could provide a representative description of the welfare on a mink farm throughout the year, not only would much time and money be saved, it would also provide the farmer with an immediate result. As the same manager is usually in place for all three production phases and as most of the welfare problems associated with mink production are related to management, we hypothesise that assessment in one of the three phases should be sufficient for predicting the overall annual classification of welfare on a farm. Based on the WelFur protocol for mink, data from 19 farms were collected in each of the three production phases: breeders during winter (assessment period one); females and kits in lactation (assessment period two); and juveniles during late growth (assessment period three). The data were recorded by two external assessors per farm, on nine farms in 2011 and ten other farms in 2013, and an aggregated welfare assessment at farm level was calculated for each of the three visits. Data from the three assessments per farm were compared both at criteria, principle, and at overall classification level according to the Welfur mink concept. It appears that the estimated WelFur classification of farms differs between assessment periods, especially as regards to low score-value of the principal 'Good Feeding' in the summer period. Scores from periods two and three are needed to predict the full annual score of the four WelFur principles. Based on the results found, we reject the hypothesis that the overall annual classification of welfare of a farm in the WelFur system can be based on one period. A simplification of the WelFur-assessment system may be possible, with the exclusion of the welfare assessment in period one.

Keywords: *animal welfare, labelling system, mink production, welfare assessment, welfare score, WelFur*

Introduction

Mink production has a fixed annual cycle with three major production phases: preparation of breeders from selection in November to mating in March (phase one); reproduction from mating in March to separation in July (phase two); and growth from separation to pelting or selection (phase three). There are different animal welfare challenges in each of the different phases of production. In phase one there is a risk of very thin animals due to conditioning of juveniles before flushing and mating (Møller 1992; Tauson 1993). There is also a risk of very thin animals at the end of phase two, due to high milk production and mobilisation of body reserves (Hansen 1999; Henriksen & Møller 2015), and a risk of injured kits (Brink & Jeppesen 2005; Clausen & Larsen 2012, 2015). In phase three, there is a risk of injuries, especially after the autumn equinox in group-housed mink (Hansen *et al* 2014). The time windows for assessing mink welfare within these phases have therefore been defined as the last 6–8 weeks of each phase, eg conditioning of breeders in January–February as assessment period 1, lactation and weaning in May–July as assessment period 2, and moulting and priming of the winter pelt in October–November as assessment period 3 (Mononen *et al* 2012).

WelFur is an on-farm welfare assessment system for foxes and mink, developed both for certification and advisory purposes (Botreau *et al* 2012; Mononen *et al* 2012). There are many different welfare assessment systems developed for different animals (Bartussek 1999; Sorensen *et al* 2001; Lievaart *et al* 2005; Main *et al* 2007; Blokhuis *et al* 2010; Edgar *et al* 2013; de Vries *et al* 2014; Vasseur *et al* 2015). Most of the welfare assessment systems, such as Welfare Quality® (Blokhuis *et al* 2010), are based on only one visit per farm in cattle, pig and poultry production. Kirchner *et al* (2014) claim that animal welfare classification should not be based on single assessments, but suggest repeated assessment to generate rolling averages or to verify assessments that would cause reclassification of farms. In strictly seasonal production systems, the result from a welfare assessment is very dependent on the time of visit (Møller *et al* 2003), and several visits will often be necessary to provide an overview of the welfare in the different phases of production. A welfare assessment system for management and advisory purposes was developed and tested in Denmark from 1998 to 2002 (Møller *et al* 2003). The development of WelFur mink was initiated by the European Fur Breeders' Association (EFBA) in 2009, in order to create a

solid certification programme to cover all European mink and fox farms. The system uses information from all the three phases of mink production, and is based on the principles developed in Welfare Quality® (Botreau *et al* 2007; Blokhuis *et al* 2010; Mononen *et al* 2012). Three annual assessments are time-consuming and expensive, and there are still only few WelFur assessments conducted on the same farms in all three production phases, and mainly as part of research and development. If assessment in one of the three main production phases reflects the welfare in the other production phases, one visit would be enough to classify the farm in a labelling system such as WelFur.

Previous studies have shown that management plays an important role for animal welfare on farms (Sandøe *et al* 1997; Hemsworth & Coleman 2010). In mink production, management procedures such as inspection of the mink, number of mink per farm hand, strategies for feeding, separation and grouping of kits after weaning, and for treating or euthanising sick or injured animals are found to be of great importance for the animals' welfare (Møller & Hansen 2000). Despite the different challenges in the three production phases, the farming system, the manager, and the farm hands are the same. These factors are paramount for the welfare of animals and we therefore expect the welfare in the three phases to be highly related.

The aim of the present study was to investigate whether a welfare assessment according to the WelFur mink protocol in only one of the three production phases, produces a reliable assessment of the welfare in a full annual production of a mink farm. The objective of the study was therefore to test the hypothesis: The overall annual classification of welfare of a mink farm in the welfare assessment system, WelFur, can be based on assessment in just one of the three annual production phases.

Materials and methods

Farms and study sample

The result of the study is relevant for all the approximately 1,450 mink farms in Denmark (2014). The study population was 19 mink farms in Central Jutland. Ten of the farms were visited in 2013 as part of a PhD project. They were selected based on information regarding the farm management and the farmers' interest or need for improving animal welfare, and motivation for joining a Stable school (knowledge exchange between farmers, a concept adjusted from Vaarst *et al* [2007] for testing in mink farms [Henriksen *et al* 2015]). The farms should vary in size and in farmers' experience of mink farming. All ten farms had sections with climbing cages, which could house three or four animals in the growth period until pelting. The other nine farms were tested as part of the development of the WelFur protocol in 2011 (Møller *et al* 2012; Mononen *et al* 2012; Rousing *et al* 2012). The data from all 19 farms were recorded as cross-sectional data based on one visit to each farm in the assessment period within each of the three major phases of production.

The study sample consisted of approximately 120 cages per farm per visit in assessment period one and two, and 90 cages in assessment period three due to more animals per cage in this period. A sample of 120 cages is considered sufficient to obtain a representative sample of animals from a mink farm, independent of farm size (Rousing *et al* 2012). The study sample was representative regarding colour type of mink, primi- or multiparous dams, and differing housing conditions on the farm at the day of visit. In assessment period one there tends only to be one animal per cage while in period two it is typically a dam and her kits. In assessment period three there are typically two juveniles or a dam with one or two male juveniles in the cage, or three or four group-housed juvenile females. Most farms pelt most of the males after the mating period, but one of the study farms had kept enough male breeders to be included in the study sample in assessment period two. The study unit was a farm.

Assessment, scoring and aggregation

Data were collected once per farm, in each of the three assessment periods according to the WelFur Mink protocol. The data were obtained by two external assessors per farm, on nine farms in 2011 and on ten in 2013, and aggregated at herd level. One assessor carried out the main assessment, while the other recorded the results. Both assessors observed stereotypic behaviour. The assessors met to calibrate their assessment before each assessment period. Data from the three assessments per farm were compared both at criteria and principle level and on the overall WelFur classification as described below.

Each welfare measurement in WelFur attains a score based on the registrations on each farm in each assessment period. The measurement scores are aggregated into scores within and across periods by use of Choquet integrals based on expert opinions as described in EFBA (2013), then into 12 criteria scores and a score for the four principles (Botreau *et al* 2012) (Table 1).

The scores have values between 0 (worst) and 100 (best). The overall classification of a farm in WelFur is based on the combination of the four principle scores into four categories: 'Best current practice', 'Good current practice', 'Acceptable current practice' or 'Unacceptable current practice'. The principle score values required for classification into the different categories are shown in Table 2. The model for aggregation of the different principle scores into classification of welfare is dependent on data from the assessment period in all three production phases. A correction factor is used to adjust for the differences in importance of measurements as regards each assessment period. In order to evaluate the effect of a single period on the classification of farms, we estimated the score values per period without weighing the measures between periods. The criterion 'Expression of social behaviours' is based on information from assessment period two and three only. In the estimation of the seasonal principle score for 'Appropriate behaviour' in assessment period one the criterion was set to the value 100.

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Table 1 The WelFur principles of welfare, with the underlying criteria and measurements (Henriksen & Møller 2015).

Principle	Criterion	Measurements
1. Good feeding	1. Absence of prolonged hunger	Body condition score
	2. Absence of prolonged thirst	Continuous water availability; measured by: Type of watering system, Functioning and cleanliness of the water points
2. Good housing	3. Comfort around resting	Access to a nest-box, Resting quality of the nest-box/resting area
	4. Thermal comfort	Protection from exceptional weather conditions, Nest-box material and bedding/nesting material
	5. Ease of movement	Space available for moving (area and height)
3. Good health	6. Absence of injuries	Skin lesions or injuries to the body
	7. Absence of disease	Mortality, Diarrhoea, Lameness or impaired movement, Obviously sick animals
	8. Absence of pain induced by management procedures	Killing methods for pelting of mink, Killing methods for individual mink
4. Appropriate behaviour	9. Expression of social behaviours	Social housing in the growth period (period 3), Age and procedures at weaning in the summer period (period 2)
	10. Expression of other behaviours	Stereotypic behaviour, Cage enrichments, Fur chewing
	11. Good human-animal relationship & 12. Positive emotional state*	Frequency and duration of handling and transportation, Temperament test

* The two criteria are based on the same measurements.

Table 2 Welfur-classification of farms regarding welfare (revised from Mononen *et al* 2012).

Category	Required score values
Best current practice	Score 55 on all four principles, and more than 80 on at least two
Good current practice	Score 20 on all four principles, and more than 55 on at least two
Acceptable current practice	Score 10 on all four principles, and more than 20 on at least three
Unacceptable current practice	If the minimum standard 'Acceptable current practice' is not met

Statistical analysis

Outcome variables

• The overall classification of farms (ordinal outcome variables: best; good; acceptable; and not acceptable current practice).

• The four principle scores (pseudo-continuous outcome variables, with values bounded from 0 to 100). Both the seasonal scores per assessment period and the full annual score.

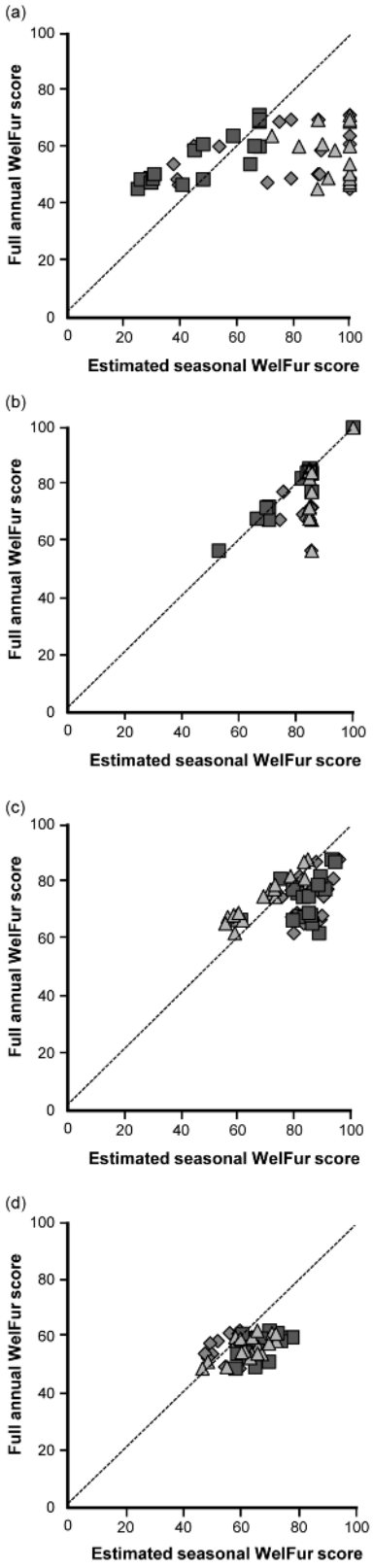
• The 12 criteria scores (pseudo-continuous outcome variables, with values bounded from 0 to 100). Both the seasonal scores per assessment period and the full annual score.

Each farm will have one score value per principle and per criteria, and an overall classification of the farm. This is both estimated per period (estimated seasonal scores) and calculated for the whole year (full annual WelFur score). The main intention was to compare the correlation between score values of each of the outcome variables between the estimated seasonal scores per assessment period and the full annual WelFur scores. This was done by using 'Pearson's product-moment correlation' in the statistical software R (R Core Team 2014). Consistency of the seasonal criterion and principle scores with the full annual WelFur scores was judged as acceptable if correlation coefficients were equal or higher than 0.7 (Martin & Bateson 2007), and the associated *P*-values less than or equal to 0.05. The statistical power of the Pearson's correlation to detect a correlation of 0.7 with 95% confidence and a sample size of 19 is 93%.

Missing data

To calculate the WelFur score on criterion level and principle level all measurement values assessed on the farm are needed. Missing data were treated as follows: If information regarding social weaning (one farm) were missing, the mean value from the other farms in the same year of assessment was included. By using the mean score value of other farms, the value will have minimum influence on the further calculation of criterion and principle scores. If information concerning thermal comfort was missing from one of the assessment periods (two farms in period one, three farms in period two and one farm in period three), the value from another assessment period was included. The missing information was about protection from wind and sunlight, and bedding or nesting material. 'Protection from wind' is

Figure 1



The estimated seasonal WelFur scores and the full annual WelFur score of the principles of (a) Good feeding, (b) Good housing, (c) Good health and (d) Appropriate behaviour in the assessments of the three annual production phases and the full annual score. The WelFur scores for assessment period 1 = ♦, assessment period 2 = ■, assessment period 3 =▲.

based on general protection from the wind by landscape, fencing, closed sheds, wind shields or similar. This will be typically similar for all three periods, and the data showed very low variation between periods within farm. Many farmers will try to reduce the exposure to sunlight by, for example, whitewashing the sheds' windows, which will often be similar in both period two and three. Missing information from one of these two periods on a farm was therefore replaced by the score value of the other period. The information about bedding or nesting material may differ. The results showed, however, low variation between farms and periods. Replacing missing information about thermal comfort with information from another period is therefore expected to have minor influence.

Results

Principle score and overall classification of welfare

The relationship between the full annual WelFur score and the estimated WelFur scores from assessments in the three annual production phases for the 19 farms is illustrated for each of the four WelFur principles in Figure 1. The hypothesis is illustrated by a correlation of one and the deviation from this is illustrated as the distance of the scores from the straight line. The distance seems to be lowest for values in assessment period two for the principle of 'Good feeding' and 'Good housing', and in period three for the principle of 'Good health'. It is difficult to see which assessment period has the lowest distance for the principle 'Appropriate behaviour'. The estimated WelFur classification of farms, based on the mean principle scores of the 19 farms, in the three production phases, was 'Best current practice' in phase one and three, and 'Good current practice' in phase two (see Tables 2 and 3). The overall annual WelFur classification was 'Good current practice' for all farms.

The mean principle score values of the 19 farms for the different assessment periods and correlations between the estimated seasonal score values and the full annual WelFur scores are shown in Table 3. The assessment period with the lowest mean seasonal score value for the different principles is the assessment period that has the highest correlation with the full annual WelFur score, except for the principle of 'Appropriate behaviour'.

The estimated score values for the principle 'Good feeding' in assessment period two were correlated with the full annual WelFur scores, while the estimated score values for the principle 'Good housing' were correlated with the full annual WelFur scores in both assessment period one, two and three, with the highest correlation with period two. The estimated score values of the principle 'Good health' in assessment period one and three were correlated with the full annual WelFur scores, with the highest correlation with period two. Period two and three in relation to the principle of 'Appropriate behaviour' were correlated with the full annual WelFur scores.

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Table 3 Mean WelFur principle score values with standard deviation and correlations between the estimated seasonal scores and the full annual WelFur score for the 19 farms in the minks three annual production periods

Principle	Full annual score	Period 1	r_1	Period 2	r_2	Period 3	r_3
Good feeding	56 (± 9)	78 (± 23)	0.17^{ns}	48 (± 17)	0.86***	95 (± 8)	–0.23^{ns}
Good housing	78 (± 10)	84 (± 5)	0.50*	78 (± 11)	0.96***	86 (± 3)	0.56*
Good health	74 (± 7)	87 (± 5)	0.49*	84 (± 7)	0.40^{ns}	69 (± 10)	0.96***
Appropriate behaviour	56 (± 4)	57 (± 6)	0.15^{ns}	66 (± 6)	0.53*	63 (± 7)	0.68**

Production period 1: Conditioning of breeders in February; production period 2: Lactation and weaning in May-July; production period 3: Moulting and priming of the winter pelt in October-November, and the full annual WelFur score. WelFur score 100 is the best score indicating high welfare, and score 0 is the lowest.* $P < 0.05$, ** $P < 0.001$, *** $P < 0.0001$, ns = not significant

Table 4 Mean WelFur criterion score values and standard deviation and correlations between the estimated seasonal scores and the full annual WelFur score for the 19 farms in the minks three annual production periods

Criterion	Full	Period 1	r_1	Period 2	r_2	Period 3	r_3
Absence of prolonged hunger	56 (± 20)	70 (± 33)	0.25^{ns}	51 (± 36)	0.85**	93 (± 11)	–0.069^{ns}
Absence of prolonged thirst	68 (± 0)[1]	99 (± 6)[1]	–	64 (± 0)[1]	–	100 (± 0)[1]	–
Comfort around resting	98 (± 4)	99 (± 1)	0.15^{ns}	99 (± 5)	0.99***	100 (± 0)	–0.074^{ns}
Thermal comfort	76 (± 20)	92 (± 12)	0.29^{ns}	78 (± 23)	0.90**	98 (± 2)	0.12^{ns}
Ease of movement	79 (± 5)	79 (± 5)	1***	79 (± 5)	1***	79 (± 5)	1***
Absence of injuries	86 (± 4)	89 (± 8)	0.73**	90 (± 6)	0.65*	88 (± 6)	0.71**
Absence of disease	70 (± 8)	88 (± 6)	0.42^{ns}	82 (± 9)	0.40^{ns}	64 (± 11)	0.96***
Absence of pain induced by management procedures	100 (± 0)[1]	100 (± 0)[1]	–	100 (± 0)[1]	–	100 (± 0)[1]	–
Expression of social behaviours[2]	64 (± 14)	–	–	80 (± 9)	0.64*	62 (± 5)	0.58*
Expression of other behaviours	46 (± 8)	32 (± 7)	0.86***	60 (± 15)	0.85***	72 (± 10)	0.75***
Good human-animal relationship	65 (± 8)	70 (± 9)	–0.29^{ns}	73 (± 7)	–0.078^{ns}	67 (± 12)	0.94***
Positive emotional state	65 (± 8)	70 (± 9)	–0.29^{ns}	73 (± 7)	–0.078^{ns}	67 (± 12)	0.94***

* $P < 0.05$, ** $P < 0.001$, *** $P < 0.0001$, ns = not significant.
[1] Not tested for correlations due to no variation in data.
[2] Expression of social behaviours is only relevant in period 2 and 3, and is not measured in period 1.

Criteria scores of welfare

An overview of the mean WelFur criteria-score values from assessment of the 19 farms in the three production phases and the full annual scores, and the correlations between the seasonal scores and the full annual scores are given in Table 4.

The criterion scores of 'Absence of prolonged hunger', 'Comfort around resting' and 'Thermal comfort' in assessment period two were correlated with the full annual WelFur scores.

The estimated criterion scores of 'Absence of disease' and 'Good human animal relationship/Positive emotional state' in assessment period three were correlated with the full annual WelFur scores.

The estimated score values of criterion scores of 'Absence of injuries' correlated with the full annual WelFur score for all assessment periods.

The criterion score 'Expression of social behaviour' was measured only in assessment period two in relation to the weaning procedure, and in period three in relation to social housing. The seasonal scores were correlated with the full annual score.

The estimated criterion scores of 'Expression of other behaviours' in assessment period one, two and three were correlated with the full annual WelFur score.

The criterion scores of 'Absence of prolonged thirst' did not differ between farms, except one farm in assessment period one (Table 4). Due to a lack of variation in data in assessment period two and three we could not calculate any correlations.

The criteria 'Ease of movement' and 'Absence of pain induced by management procedures' did not differ between farms or periods.

Discussion

The present study shows that the overall WelFur classification differs between the three production phases. This was due, in particular, to farms with very thin animals and a resultant low score value for the principal 'Good feeding' in observation period two. The hypothesis that assessment in just one of the minks' three production phases can predict the overall annual WelFur classification of welfare is therefore rejected.

It seems possible to predict the full annual score of the four WelFur principles from the two seasonal scores in production phase two and three, without information from production phase one. This is due to the high correlation found between the seasonal scores in assessment period two and the full annual WelFur scores for the principles of 'Good feeding' and 'Good housing', and between the seasonal scores in assessment period three and the full annual WelFur scores for the principle of 'Good health' and 'Appropriate behaviour'. The correlation between the seasonal score in period one and the full annual score is significant for the principle of 'Good housing' and 'Good health', but the correlations are fairly low.

The complexity of welfare qualification may be illustrated by the lower WelFur score in assessment period two compared to assessment period one and three, which is due primarily to the principle 'Good feeding' (Table 3), including the criterion 'Absence of prolonged hunger' and 'Absence of prolonged thirst' (Table 4). Prolonged hunger is measured via body condition, for which the general recommendation in assessment period one is animals in moderate body condition score (BCS) 2 before mating, in order to be able to reproduce well and respond to flushing (Tauson 1993). If the farmer manages to avoid overly thin animals (BCS 1) this will give a high WelFur score in period one. At the same time, this can increase litter size thereby increasing the risk of very thin animals in assessment period two (Hansen & Berg 1998; Hansen 1999) resulting in a low WelFur score. This implies that good management practice in one phase of production can increase the risk of low welfare in another, and thus that the WelFur scores in different assessment periods are not necessarily positively correlated.

A management focus and interest within production may also result in a differing impact of management on the animals' welfare in the three production phases in different criteria and principle. The high profitability of a large litter size and big pelts (Lagerkvist 1997) might lead to a focus on feeding in production phase one to ensure successful reproduction and large litters and a high feed level in period three. Feeding for large litter size in phase one might, as already mentioned, potentially increase the risk of thin dams in production phase two. Feeding for large pelts by a high feed level in production phase three might increase the risk of obesity and fatty liver (Dick *et al* 2014), which might increase the risk of mortality. So, to focus on feeding management might have different effects on the WelFur score in different phases of production.

The WelFur assessment of mink merges information from the assessed welfare of adult dams and males selected for breeding, nursing dams and their kits before weaning, and juveniles and dams during the growth season into a common welfare score per measurement per farm. This differs from other welfare assessment systems, such as the Welfare Quality®'s assessment system for pig (Welfare Quality® 2009) in which different phases of production, eg reproduction (sows and piglets) and growing animals (growing and finishing pigs) are looked at separately in different welfare assessments. Another difference is that different types of animals are included in each phase of the WelFur mink assessment, ie period three includes mainly juveniles but adult dams are also present at the farms and included in the assessment. In pig production units, sows and piglets are usually separated from growing and finishing pigs, sometimes on different farms and often with different stockmen, and a common welfare score is less relevant. In mink production, however, the whole production cycle occurs on the same farm, and the same animals are present in different periods and therefore a correlation between the assessments could have been expected.

Although it's impossible for assessment in one production phase to tell the complete story about welfare in mink, some reduction of the assessment procedure might be possible due to correlations between the full annual WelFur score and several criteria scores related to the different principles (Table 1). As shown in Table 4, the criterion 'Absence of prolonged hunger' in assessment period two was highly correlated with the full annual score, and the criterion 'Absence of prolonged thirst' was similar for all three assessment periods. Therefore, assessment of body condition and parameters related to 'Absence of prolonged thirst' might be reduced to assessment only in period two. The seasonal score values in assessment period two were highly correlated with the full annual WelFur scores for the criterion 'Thermal comfort', indicating that for this criterion assessment only in period two might be sufficient.

The criterion 'Comfort around resting' is based on information about access to a nest-box and resting quality of the nest box/resting area, and the scores in period two were highly correlated with the full annual WelFur score. Access to the nest-box can be a problem in the growth period for very large mink in group housing. This was not a problem at the farms in our study, and may therefore be an argument for not including 'Comfort around resting' in assessment period three.

The criterion 'Ease of movement' had the same value in all three assessment periods, and could, therefore, be measured in one period only. The best choice would be period three where there might be mink in cages for group housing where this measurement is the most demanding to fulfil. The full annual WelFur scores of the criterion 'Absence of disease' are highly correlated with the estimated score values in assessment period three. The correlation with period one is small and parameters related to the criterion might be unnecessary to measure in assessment period one or two. The criterion 'Absence of pain induced by management procedures' had the same value in

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all three periods. The measures related to this criterion are killing methods for pelting and for individual mink and might, therefore, be most relevant to measure in assessment period three where the mink are going to be pelted. The full annual WelFur scores of the criteria 'Good human animal relationship/positive emotional state' are highly correlated with the estimated score values in assessment period three, and might be unnecessary to measure in assessment period one or two. The criterion 'Expression of social behaviours' seems to be dependent on information from both assessment period two and three, and the criterion 'Expression of other behaviours' on information from all three assessment periods.

The assessment period with the lowest criterion score was, in most cases, the period with the highest correlation with the full annual score. This was expected due to the method of aggregation of sub-scores where the lowest sub-score will have the highest influence on the full score value (Botreau *et al* 2012; EFBA 2013). The criteria scores that are more or less unchanged between the three annual seasons, as shown in Table 4, have their basis in resource-based measures that are not very dependent on daily farm management throughout the year.

The present study did not find any farms classified as 'Unacceptable current practice'. This might indicate that the variation between farms in the study was small for investigating the effect of farm-specific management. The farms were selected based on the farmers' interest in or need for improving animal welfare. This might have led to a selection of farmers with earlier sanctions or general problems regarding animal welfare on their farm, and/or farmers that are generally interested in new knowledge. Ten of the farmers in the study were interested in joining a Stable school, which is knowledge exchange between farmers with a focus on animal welfare. Farmers with great animal welfare problems often hide their production problems both for their surroundings and themselves (Andrade & Anneberg 2014) and would probably not join such a group where problems are displayed and discussed in order to find solutions with other farmers. This could favour farmers with good animal welfare and low variation in score values between farms and periods, and make it easier to find a correlation between seasonal score values and the full annual score. Although the variation between farms may not fully represent Danish production we did find a significant variation in score values between both farms and assessment periods. Large-scale assessments in Denmark will be needed in order to display the true variation between farms, and thus how representative our sample was.

The fact that ten of the farms were joining a Stable school where specific problems regarding welfare on the respective farms were discussed, could have led to an improvement in welfare from the first to the last visit. The nine farms from 2011 would adjust for this, and the results from the ten farms did not differ from the nine in welfare change from the first to the last visit.

The present study indicates that the WelFur-Mink assessment procedure might be simplified to be more feasible in a future version. Reducing the number of animal-based measurements assessed per period will reduce the time spent per assessment. Excluding assessment in period 1 will also make the system less time-consuming. The total costs of implementing WelFur-Mink in the mink industry will also be reduced. The present study is the first to aggregate results from WelFur assessments of farms into the different WelFur scores and the overall classification into one of the four categories of welfare. Future assessments and aggregations into WelFur-scores are therefore needed before we know if the results of the present study can be generalised across Danish and European farms.

Animal welfare implications

The results of this study augment existing knowledge to help simplify the welfare assessment procedure of mink farms with the assessment system WelFur. An easy and effective assessment of farms is important if the system is to be implemented in practical mink production. WelFur assessment of mink farms can help farmers in revealing challenges regarding the welfare of their mink, and what to change in order to improve this. Comparing results between farms, or between years, might motivate farmers to aim for the highest animal welfare on their own farm.

Conclusion

The hypothesis that 'The overall annual classification of welfare of a farm in the welfare assessment system WelFur can be based on assessment in just one of the minks' three production phases' was rejected. The results indicate that the overall classification of mink farms regarding animal welfare, with the assessment system WelFur, can be estimated from welfare assessment in production phase two and three, and that further simplification of the WelFur assessment might be possible. The assessment of measures related to the criteria 'Absence of prolonged hunger', 'Absence of prolonged thirst', 'Thermal comfort', and 'Comfort around resting' might be reduced to assessment only in period two and assessment of measures related to the criteria 'Ease of movement', 'Absence of disease', 'Absence of pain', and 'Good human animal relationship/positive emotional state' only in period three.

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