WelFur

Welfare assessment protocol for mink

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Acknowledgement

The present document originates from the WelFur project which has been co-ordinated by the European Fur Breeders' Association EFBA (currently Fur Europe).

The consortium of experts, and universities involved are listed in Annex B 'Contributors to WelFur'.
This document presents the version 1 and 2nd edition of the assessment protocol for mink dated 1st May 2015.

Introduction to WelFur

Foreword

Animal welfare is a societal issue that most citizens and consumers are clearly concerned about. For the same reason animal welfare is a key priority in the European fur farming sector. The fur sector acknowledges however, that welfare standards on fur farms may not be sufficiently transparent to the general public and other stakeholders, just as the fur farming sector acknowledges that animal welfare standards are not fixed objectives, but the results of dynamic processes in which new knowledge and technologies must be considered as they appear.

In the preparation of the WelFur protocols for fur-farmed species (mink and fox), all existing scientific knowledge has been reviewed. Scientific research on animal welfare in farmed mink and fox have been conducted in a number of countries for more than 30 years. Consequently the WelFur protocols must be considered as the latest scientific reference with regard to animal welfare for fur-farmed species.

The overall aims of the WelFur project rest on three principles.
1) WelFur is a reliable and feasible system for animal welfare assessment based on scientifically proven measurements.
2) WelFur is designed to create transparency around the animal welfare standards.
3) WelFur works as a strategic tool for the individual fur farmer to identify and improve any areas on the fur farm where the welfare standards can potentially be improved.

Background

To promote a more objective and transparent view of the state of animal welfare on European fur farms, the European Fur Breeders' Association (EFBA), initiated the WelFur project, in 2009. WelFur is largely inspired by the Welfare Quality® project that the European Commission initiated in 2004 covering pigs, poultry and cattle. The welfare assessment relies on a sequential evaluation process, in which measurements are collected on farms to assess the welfare status of the farm within 12 criteria. Those criteria are then aggregated into four main welfare principles and finally an overall welfare classification is produced.

The objectives of WelFur

The main objective of WelFur is to check the level of animal welfare on European fur farms.

This can form the basis for a solid certification programme to cover all European fur farms. Assessments will be carried out by third-parties and results will be communicated to the fur farmer in order to encourage the farmer to take the most appropriate steps to improve animal welfare. This should be seen as a 'win-win' situation. It must be underlined that the WelFur assessment protocols evaluate the actual welfare of the fur animals and not primarily compliance with any national and/or EU legislation.

At present, national authorities carry out controls of fur farms with the objective of ensuring compliance with existing legislation on animal welfare. However, the levels of control and the basic legislation differ considerably from one member state to the other. Another potential benefit of the WelFur project is consequently to influence the reform of current controls and legislation on both national and EU levels. The industry proposes that WelFur could serve as an EU-based scientific reference for regulation and control.

WelFur structure and timeline

In 2009, EFBA appointed a consortium of 7 European universities and institutes (see Annex B 'Contributors to WelFur') to gather existing research in two protocols – one for mink and one for foxes. The senior scientist Dr. Steen Henrik Møller from Aarhus University and Prof. Jaakko Mononen from the University of Eastern Finland, were appointed project co-ordinators for mink and fox species.

To secure the validity and the independence of the research on the protocols, three external reviewers were appointed: Prof. Georgia Mason from Guelph University, Prof. Harry Blokhuis, from Swedish University of Agricultural Sciences and Prof. David Morton, member of the European Food Safety Authority (EFSA). The reviewers participated in all the review meetings of the project and will issue a report at the end of the development process.

The scientists identified and evaluated the possible welfare indicators and measurements to be included in the protocols following an in-depth review of the existing welfare research on fur animals. They selected a number of these on the basis of their scientific validity, reliability and feasibility. The description of the selected welfare measurements was finished in early 2011. The researchers decided on 23 measurements to assess the welfare of foxes and 22 measurements for mink. About half of the measurements are animal-based. The goal has never been to have 100% animal-based indicators but instead, to have an overall picture of the farm which includes a combination of animal-based, management-based and resource-based indicators.

With the support of INRA (French National Institute of Agronomic Research) and various consultations with scientists, the scoring of the welfare measurements was accomplished by the end of 2011. WelFur is designed to be implemented directly at the farm. That is why the protocols were then tested in a number of commercial fur farms in Denmark, Finland, The Netherlands, Norway and Sweden during 2011 and 2012, in order to get a first set of farm data covering the 3 periods of the annual production cycle. From these tests, the scientific team concluded that the assessment can be performed within one day (approx. 5-7 hours). The tests also showed that the measurements are sensitive enough to demonstrate variation between farms.

Transparency paper

The 22 and 23 specific measurements for mink and foxes respectively, have been chosen by the scientists for their scientific validity, reliability and feasibility. During the development of WelFur several hundred measurements have been considered, and, on completion of the WelFur protocols, the scientists will produce a transparency paper explaining in detail the reason for the final choice of measurements.

WelFur implementation

The WelFur implementation consists of 4 procedures:

- Publishing the WelFur assessment protocols presenting both the measurements and the way calculations are performed up to the final overall classification of farms (present document).

- Development of a software tool to calculate the scores and store the data. This work by INRA started in parallel with the development of the protocols. It is expected that the software tool will be finalised in the course of 2013. This tool will be available to both the assessors (for the tests) and the farmers (for information and improvement purposes).

- Development of the training material for the assessors was started in parallel with the development of the protocols. Training material (e.g. videos, pictures, farm visit, etc.) will be consolidated by the same scientific team. It should be ready in 2015.

- National implementation action plans will be developed in the course of 2016 with the support of each EFBA member association, including the third party selection to perform the assessments. There will not be a pan-European solution. Instead each member country will have to develop a solution suited for national circumstances. The implementation of WelFur started in 2017.

Ethical and societal aspects

WelFur differs from the Welfare Quality® project in that no social scientists were involved when setting the consolidation rules from the welfare criteria to principles and the overall assessment. Therefore, in WelFur, these two steps were extrapolated from the consolidated Welfare Quality® data. This situation is particular and mainly due to the fact that there is a polarisation of views when addressing the welfare of fur farm animals. Despite this there is general agreement within the scientific community about what represents good animal welfare. This consensus was expressed in the 'Five Freedoms' that Welfare Quality is based on.

In order to address citizens' concerns regarding the fur sector, the European Fur Breeders' Association currently Fur Europe has also launched a number of key initiatives in parallel with WelFur:

- In September 2010, Fur Europe undertook a public survey (conducted by independent market research company Ipsos) regarding fur farm animals in Belgium, Germany and The Netherlands in order to get a clear understanding of the public's concerns.

- Following this survey, Fur Europe appointed a consortium of 3 scientists from the fields of bioethics and animal welfare with the purpose of having the consortium reflect on the subject of ethics in fur production. A first scientific publication, framing the ethical debate around animal use and fur farming in particular, is due to be released in the course of 2015.

- Responding to this first paper, the future scope of the Ethical Committee is to analyse the ethics in the European fur farming sector. Considering areas like animal welfare, sustainability, the value of animals and various moral views, the Ethical Committee can point out ethical gaps in fur production. Ultimately, the European fur sector will introduce an Ethical Charter in order to assure the public that consistent ethical consideration is integrated with European fur production.

- Further analysis of public attitudes towards animal use and fur production were undertaken with a second public survey in December 2012 (again by independent market research company Ipsos) in Denmark, France, The Netherlands, Poland, Spain and the UK. The outcome of this survey will be used to further articulate the WelFur implementation plan in member countries.

Future developments

WelFur is a dynamic programme and the welfare assessment protocols for mink and foxes should be considered a first version. We will strive for a 5 year revision cycle, with a view to improving its scientific basis and providing more efficient tests. The revision will be based on the experiences gained from the implementation process and will include recommendations from external reviewers and ethical experts as well as new research.

Given that WelFur is a farm level certification programme with the objective of demonstrating transparency, the European Fur Breeders' Association will gather and publish annual reports with data from the assessments when the implementation is under way.

Conclusion

The European fur farmers associated with Fur Europe have the same objectives as the general public. The implementation of WelFur, the testing and the controls may well reveal room for some future changes. This is in accordance with the purpose of the programme as Fur Europe recognises the need and demand for constant improvement. WelFur is a scientifically valid and reliable programme that will further develop the welfare of our fur-farm animals and demonstrate transparency in the European fur-farming sector.

Table of content

Terms and definitions

Adult: Individual older than 7 months. In WelFur terms adult mink can be present in period 1, 2 and 3.

Animal-based measurement: Measurement that is taken directly from the animal.

Assessor: Person in charge of collecting data using the WelFur protocol on a farm in order to assess the welfare of animals.

Dam: Adult female mink selected for breeding.

Farm: In this protocol, "farm" is used to designate the animal unit, which means the whole or section of a farm that deals with mink.

Farm manager: Person responsible for the farm.

Fur-chewing: A behavioural disorder where mink chew their own fur or that of a cage mate.

Habituation: The weakening of responses due to repeated exposure to stimulus.

Juveniles: Young mink older than 10 weeks and less than 8 months. Thus juveniles are found on farms in the period between the time of separation and pelting or selection. In WelFur terms mink juveniles are present only in Period 3.

Kits: Young mink from birth until separation/10 weeks of age. In WelFur terms, mink kits are only present in Period 2. Kits become juveniles at separation typically before or at 10 weeks of age, also if they are continuously housed with the mother.

Management-based measurement: Measurement that refers to what the farm manager does on the farm and what management procedures are used or planned.

Overall assessment of welfare: Synthesis of welfare information, which will be used to allocate a farm to a welfare category.

Pelting: The killing of animals to harvest mature winter pelts. In the northern hemisphere this period would be early November to late December and defines the end of Period 3. Killing for harvesting fur can also take place in late March or early April after mating e.g. of males and unmated females.

Resource-based measurement: Measurement that is taken regarding the environment in which the animals are kept.

Section of cages: Battery type pens assembled as one unit, often 6 cages.

Separation: When the kits are put out in pairs or groups after weaning. One or more kits may be housed with the female mother with or without weaning.

Weaning: When the dam is removed from the litter or vice versa, terminating the lactation if it has not ceased already. Usually at 6-8 weeks after birth.

Welfare category: Final categorisation given to a farm that indicates the overall welfare of animals in that particular farm.

Welfare criterion: Represents a specific area of welfare concern that has to be addressed to satisfy good animal welfare.

Welfare measurement: Measurement taken on a farm that is used to assess a welfare criterion. A welfare measurement may be animal, resource or management-based.

Welfare principle: Collection of criteria associated with: feeding, housing, health and behaviour.

Welfare score: Score that indicates the welfare state under a criterion or principle.

WelFur protocol: Description of the measurements that will be used to calculate the overall assessment of welfare. The protocol also specifies how the data will be collected.

Photo : © Kopenhagen fur

1 Scope

This protocol deals with measurements related to the on-farm welfare assessment of mink. The interpretation of these in terms of mink welfare and their aggregation to produce an overall judgment on the level of welfare on a given farm was performed by experts and calculations deriving from their opinions.

A similar objective of producing an overall score of animal welfare at farm level was dealt with for cattle, pigs and poultry within a European project called Welfare Quality®[1]. In WelFur, even if the general construction procedure is the same as in Welfare Quality®, several characteristics, listed below, have to be taken into consideration in the model construction for farmed fur animals.

Contrary to many other farm animal production systems, the whole production cycle (including breeding, lactation, weaning, growing and finally killing for pelting) occurs on the same farm in fur production. As a consequence, it is necessary to take into account, all types of animals (adult males, adult females, kits and juveniles). Consequently, when appropriate, the construction of each criterion needed to be adjusted according to the different animal types so that their differences can be taken into account for the interpretation of the related measurement in terms of welfare.

Moreover, to have an overall view of the whole fur farm, the entire production cycle has to be evaluated. As a consequence, three periods (from pelting to mating / from mating to separation / from separation to pelting time) were defined and have to be assessed. Depending on the period, the number and types of animals (adult males, adult females, kits and juveniles) and the resources used differ (see Figure 1). This has a direct impact on the frequency of visits and on the construction of the criteria. Moreover, at criterion level the data collected at several periods have to be integrated and this requires specific arrangements for the calculation of scores. Consequently, to build a model for the overall assessment of welfare on a fur farm, it is necessary to combine the results from the three periods.

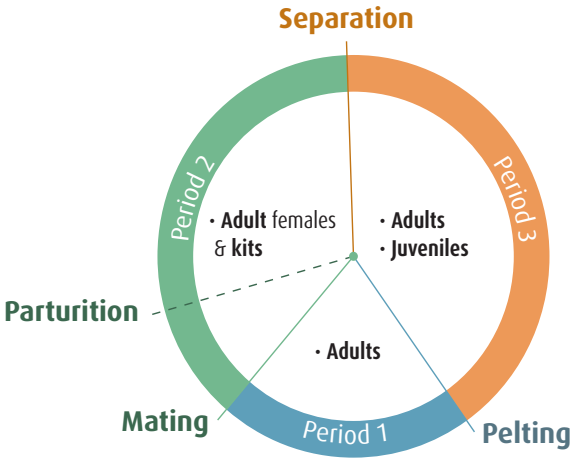


Figure 1 The three periods of the production cycle considered for mink

1 Welfare Quality® Assessment Protocol for Cattle, 2009, ISBN/EAN 978-90-78240-04-4, 180 pages.
Welfare Quality® Assessment Protocol for Poultry, 2009, ISBN/EAN 978-90-78240-06-8, 119 pages.
Welfare Quality® Assessment Protocol for Pigs, 2009, ISBN/EAN 978-90-78240-05-1, 119 pages.

Furthermore, the assessment system developed in WelFur should be applicable to all the production systems present in Europe, including variability in regulations (*e.g.* cage enrichments) and climatic conditions (from Finland to Greece).

Even if the general procedures presented here might be applicable to other farmed fur animals, such as Ferrets, this protocol cannot be used before a revision of the procedures, for other species than mink.

With regard to the implementation procedure, it is suggested by EFBA to not run the whole protocol each year but to follow this proposal: the first year a farm is assessed, three visits on the farm are required (one per period) ; then, one visit per year is necessary, with a different period assessed each year (Figure 2 Suggested implementation procedure over several consecutive years).

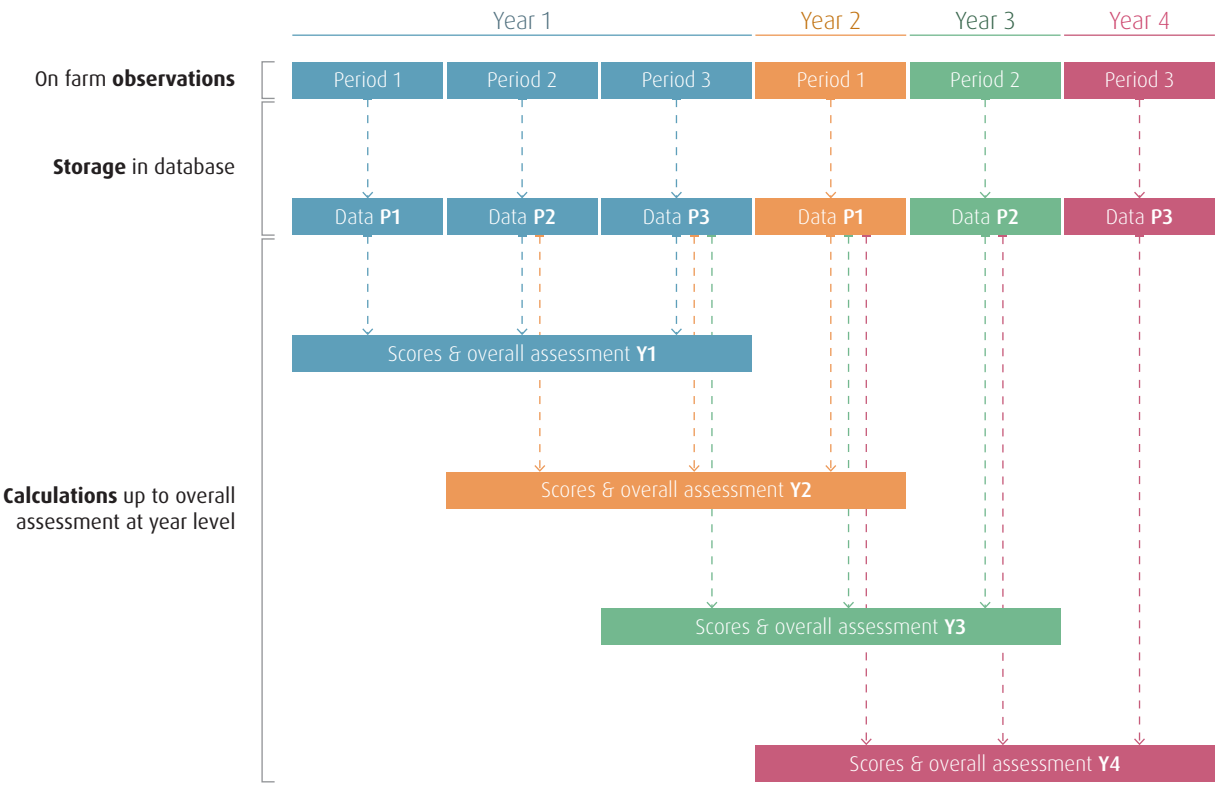


Figure 2 Suggested implementation procedure over several consecutive years (with P = period and Y = year)

Photo : © Kopenhagen fur

2 Background of WelFur protocols

2.1 Overall structure of the WelFur assessment

The objective of the WelFur project was to develop farm-level welfare assessment protocols for the three main fur animal species farmed in Europe (the mink, the blue fox and the silver fox). As in the Welfare Quality® project, the aim was to build an overall assessment of welfare. Therefore, the results obtained from measurements are synthesised to form such an overall assessment.

The welfare assessment related to a given farm is based on the calculation of welfare scores from the information collected on that farm (Figure 3). An advisor can use the welfare assessment to highlight points requiring the farm manager's attention. The information can also be used to inform consumers about the welfare status of the animals whose fur they buy.

This document contains the protocol for mink. It presents all the measurements relevant for the farm mink and an explanation of what data should be collected and in what way.

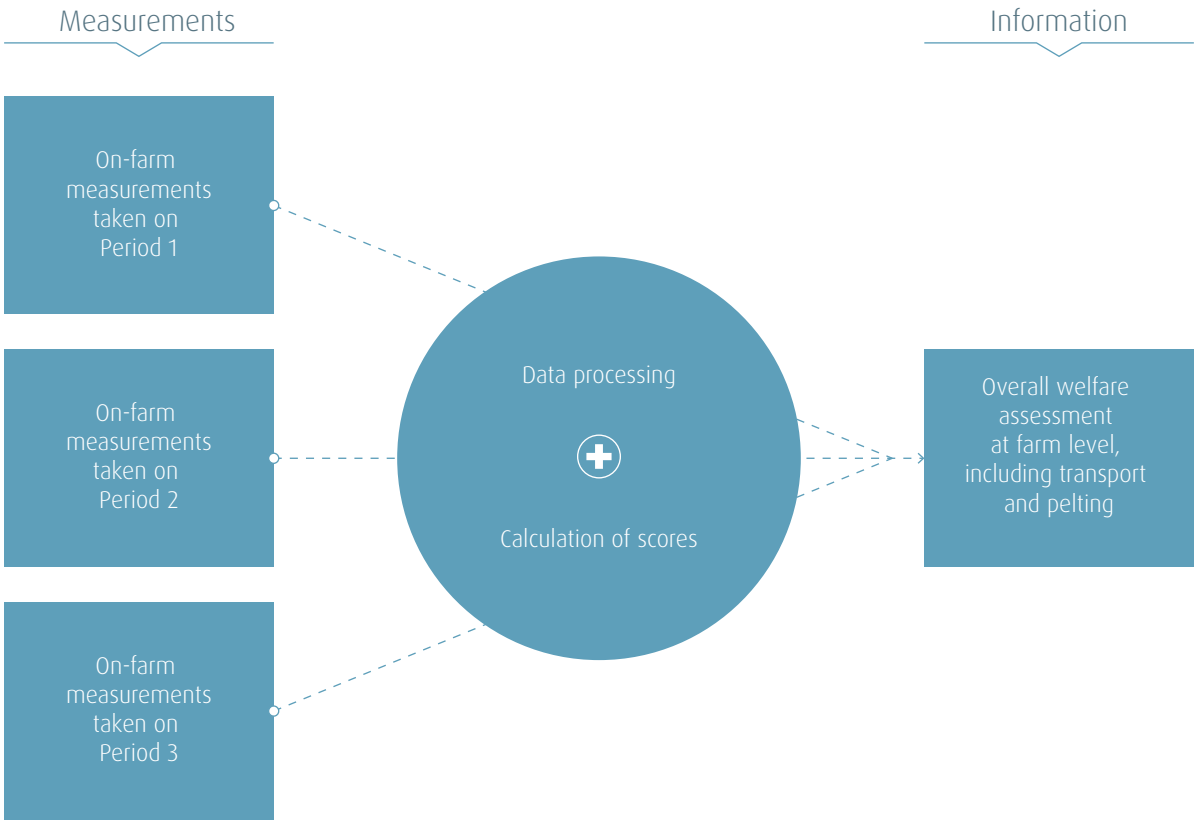


Figure 3 Structure of the WelFur assessment including the different sources of information.

2.2 Basic principles

2.2.1 Defining welfare principles and criteria

The WelFur project used the welfare principles and criteria defined in Welfare Quality® (Table 1).

Welfare principles	Criterion number	Welfare criteria
Good feeding	1	Absence of prolonged hunger
	2	Absence of prolonged thirst
Good housing	3	Comfort around resting
	4	Thermal comfort
	5	Ease of movement
Good health	6	Absence of injuries
	7	Absence of disease
	8	Absence of pain induced by management procedures
Appropriate behaviour	9	Expression of social behaviours
	10	Expression of other behaviours
	11	Good human-animal relationship
	12	Positive emotional state

Table 1 The principles and criteria that are the basis for Welfare Quality® and WelFur assessment protocols

The criteria are detailed as follows in the Welfare Quality® protocols:

1. Animals should not suffer from prolonged hunger, *i.e.* they should have a suitable and appropriate diet.
2. Animals should not suffer from prolonged thirst, *i.e.* they should have a sufficient and accessible water supply.
3. Animals should have comfort when they are resting.
4. Animals should have thermal comfort, *i.e.* they should neither be too hot nor too cold.
5. Animals should have enough space to be able to move around freely.
6. Animals should be free of injuries, e.g. skin damage and locomotory disorders.
7. Animals should be free from diseases, *i.e.* farm managers should maintain high standards of hygiene and care.
8. Animals should not suffer from pain induced by inappropriate management, handling, killing or surgical procedures (e.g. castration).
9. Animals should be able to express normal, non-harmful, social behaviours (e.g. grooming).
10. Animals should be able to express other normal behaviours, *i.e.* it should be possible to express species-specific natural behaviours such as observing surroundings.
11. Animals should be handled well in all situations, *i.e.* handlers should promote good human-animal relationships.
12. Negative emotions such as fear, distress, frustration or apathy should be avoided whereas positive emotions such as security or contentment should be promoted.

2.2.2 Calculation of scores and consultation process

As in Welfare Quality®, once all the measurements have been recorded on a farm, a bottom-up approach is followed to produce an overall assessment of animal welfare on that particular farm. First the data collected (*i.e.* the values obtained for the different measurements) on the farm are combined to calculate criterion-scores; then criterion-scores are combined to calculate principle-scores and finally the farm is assigned to one welfare category according to the principle-scores it attained (Figure 4). A mathematical model has been designed to obtain the criteria and principle scores.

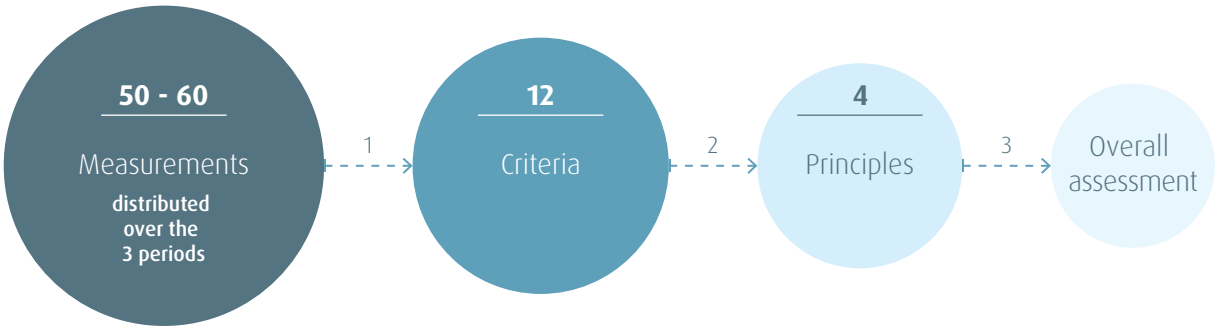


Figure 4 Approach defined in Welfare Quality® and therefore in WelFur, to produce an overall assessment of animal welfare

As in Welfare Quality®, animal scientists, including those who developed the measurements, were consulted to define formulae to compute data from measurements into criterion-scores (Step 1 in Figure 4).
In Welfare Quality®, these consultations helped to define principle-scores from criterion-scores and to decide of a procedure to synthesise principle-scores into an overall assessment (Steps 2 and 3 in Figure 4). Therefore, in WelFur, these two steps were extrapolated from Welfare Quality® with no further consultation.

Calculation of criterion-scores

The data produced by the measurements relevant to a given criterion are interpreted and synthesised to produce a criterion-score that reflects the compliance of the farm to this criterion. As in Welfare Quality® assessment protocols, this compliance is expressed on a 0 to 100 value scale, in which:

- '0' corresponds to the worst situation one can find on a farm (*i.e.* the situation below which it is considered there cannot be further decrements in welfare),
- '50' corresponds to a neutral situation, the level of welfare is not too bad but not good,
- '100' corresponds to the best situation one can find on a farm (*i.e.* the situation above which it is considered there cannot be further improvements in welfare on a farm).

As in Welfare Quality®, several methods were used to compute data from measurements into criterion-scores[2]:

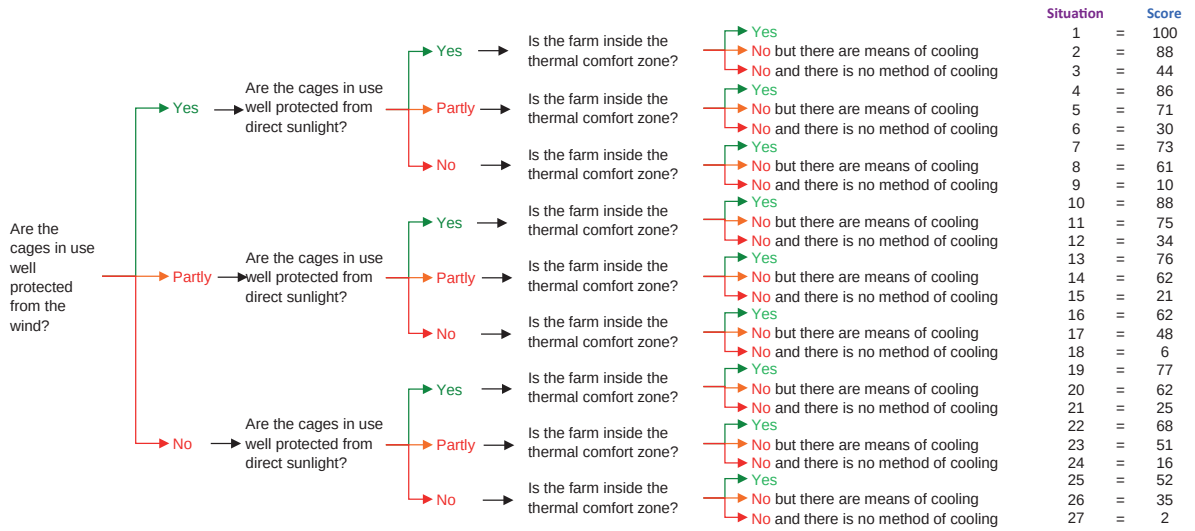
- When all measurements used to check a criterion are taken at farm level and are expressed in a limited number of categories or when there are more than 4 possible situations at animal level, a decision tree is produced. An example is provided in Explanation box 1.

- When a criterion is checked by only one measurement taken at individual level expressed on an ordinal scale (≤ 4 possible situations), this scale generally represents the severity of a problem and, at farm level, the proportion of animals observed in each possible situation can be calculated (e.g. percentage of mink with good nest box quality, percentage of mink with moderately good nest box quality, percentage of mink with moderately bad nest box quality and percentage of mink with bad nest box quality). In that case, a weighted sum is calculated, with weights increasing with the severity of the problem and a non-linear function is then applied. An example is provided in Explanation box 2.

Experts from animal sciences were consulted to interpret the raw data in terms of welfare. Then experts were asked to score virtual farms. In the situations where weighted sums were to be calculated, this consultation was used to define weights that produce the same ranking of farms as the one given by experts.
Experts do not in general follow a linear reasoning, I-spline functions were therefore chosen to produce criterion-score. I-spline functions allow calculation of portions of curves (expressed as cubic functions) so as to obtain a smooth increasing representative curve (see Explanation box 2).

Explanation box 1: Decision tree as applied to Measurement of *Protection from exceptional weather* conditions in Period 2, as part of the Criterion of *Thermal Comfort* in mink

To assess the Criterion of Thermal Comfort on a mink farm in Period 2 during which adults and kits are farmed, two measurements are to be considered: Measurements of Protection from exceptional weather conditions and of Nest box material and bedding/nesting material. To evaluate the Measurement of Protection from exceptional weather conditions on a farm, four questions based on the protection from wind, the protection from direct sunlight, whether the farm is within the thermal comfort zone, and if not, if means of cooling are used. These aspects can be considered hierarchically due to their respective dependence and importance. This led us to propose the following decision-tree:



2 The text below is derived from the Welfare Quality® protocols. The examples are from the WelFur project

Since there may be several types of cages on a given farm, several situations may be observed simultaneously on the farm. Then, the score to be assigned to the farm is the one corresponding to the worst situation observed on, for this measure, at least 10% of the animals.

Explanation box 2: Weighted sum and I-spline functions as applied to Measurement of *Resting quality of the nest box*/ resting area in Period 3, as part of the Criterion of *Comfort around resting* in mink

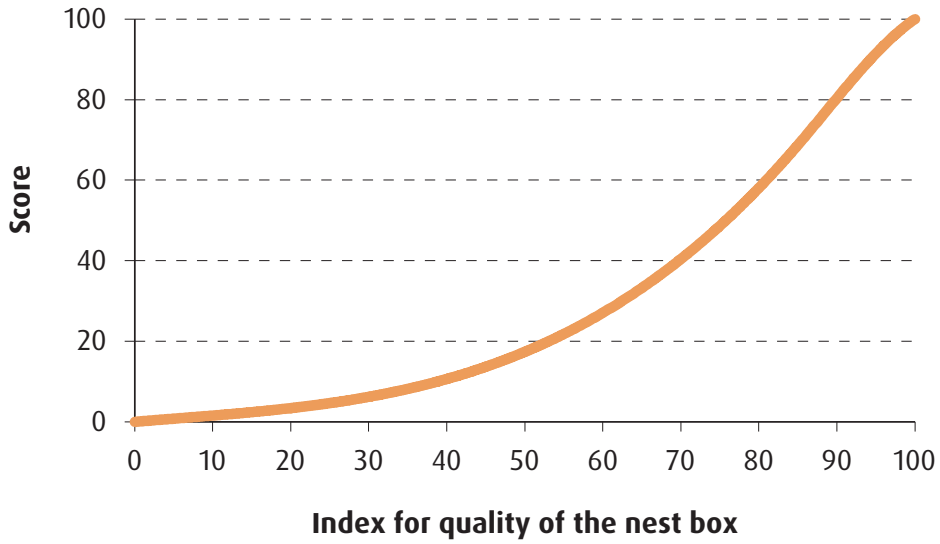
The % of mink with 4 categories of nest box quality are combined in a weighted sum, with a weight of 0 for the higher score, 1 for the moderately high score, 2 for the moderately low score and 3 for the lowest score of nest box quality. This sum is then transformed into an index (I) that varies from 0 to 100:

$$I = \left(100 - \frac{0(\%\ \text{high}) + 1(\%\ \text{moderately high}) + 2(\%\ \text{moderately low}) + 3(\%\ \text{low})}{3}\right)$$

This index is computed into a score using *I*-spline functions:

When $I \leq 40$
then Score = $(-0.00000000000009137342158053 \times I) + (0.013617157616759903090986 1 \times I^2) + (-0.000082293892766292675469 5 \times I^3)$

When $I \geq 40$
then Score = $-13.665871583481454365482932 2 + (1.024940368793673339808947 3 \times I) + (-0.012006351603693144261542 1 \times I^2) + (0.000131235350741006523466 3 \times I^3)$



When a criterion was composed of very different measurements which experts found difficult to consider together and/or when a given measurement is assessed at several periods of the production cycle and/or on several animal types (*e.g.* adults *vs*. juveniles), measurements, periods or animal types were aggregated using Choquet integrals (see Explanation box 3).

Calculation of principle-scores from criterion-scores
In the WelFur project, we averaged the parameters set in Welfare Quality® for the various species (cattle, pigs and poultry) to determine the parameters to be used for fur animals.

Explanation box 3: Use of the Choquet integral to aggregate sub-scores

Each time sub-scores are to be aggregated (*i.e.* when a measurement is observed during several periods or when several measurements are interpreted independently and need therefore to be aggregated to obtain a score at criterion level), we use the *Choquet integral*. In that explanation box, we will use Measurement of *Body condition score* of the Criterion of *Absence of prolonged hunger* as an illustrative example. In that example the three period sub-scores are to be aggregated. Choquet integral allows fine control of the importance attached to periods in the aggregation but also of the impact of low and high sub-scores on the aggregated one.

Formally, the Choquet integral to aggregate n elements (corresponding here to the sub-scores, noted Si) writes:

$$C(S_1,\ldots,S_n)=\sum_{i=1}^{n}\left[S_{(i)}-S_{(i-1)}\right]\times\mu\left(A_{(i)}\right)$$

With the convention $S_{(0)}=0\le S_{(1)}\le S_{(2)}\le\ldots\le S_{(n)}$ $\mathbf{X}_{(0)}=0\le\mathbf{X}_{(1)}\le\mathbf{X}_{(2)}\le\ldots\le\mathbf{X}_{(n)}$ (*i.e.* the brackets indicate a reordering of the elements, in that example the three periods, depending on the score they obtained, from the lowest to the highest) and $A_{(i)}=\{(i),\ldots,(n)\}$, $A_{(n+1)}=\varnothing$.

μ is a capacity function defined for any subset of periods entering in the composition of the measurement-score at year level. This capacity is a set function subject to the following constraints: $\mu(\varnothing)=0$, $\mu(\{1,\ldots,n\})=1$ and

To be somewhat more operational, here are the explanations on how to practically calculate the score for our example. The scores obtained by a farm for the 3 periods are sorted in increasing order. The difference between the lowest sub-score and the next sub-score is multiplied by the 'capacity' of the group comprising all periods except the one that has the lowest score. Then, the difference between the last but one sub-score and the next sub-score is multiplied by the 'capacity' of the group comprising all periods except the two that have the lowest sub-scores (here, since that there are only 3 elements to be aggregated, it is the capacity of the period that has the highest sub-score). Finally, the measure-score therefore corresponds to the sum of these three terms. This can be written as follows:

$$\text{Measure-score}=\begin{cases}S_1+(S_2-S_1)\mu_{23}+(S_3-S_2)\mu_3 & \text{if} \quad S_1\le S_2\le S_3\\ S_1+(S_3-S_1)\mu_{23}+(S_2-S_3)\mu_2 & \text{if} \quad S_1\le S_3\le S_2\\ S_2+(S_1-S_2)\mu_{13}+(S_3-S_1)\mu_3 & \text{if} \quad S_2\le S_1\le S_3\\ S_2+(S_3-S_2)\mu_{13}+(S_1-S_3)\mu_1 & \text{if} \quad S_2\le S_3\le S_1\\ S_3+(S_1-S_3)\mu_{12}+(S_2-S_1)\mu_2 & \text{if} \quad S_3\le S_1\le S_2\\ S_3+(S_2-S_3)\mu_{12}+(S_1-S_2)\mu_1 & \text{if} \quad S_3\le S_2\le S_1\end{cases}$$

Where S_1, S_2 and S_3 are the sub-scores assigned to Measurement of *Body condition score* in Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made of Periods 1 and 2 and so on...

The parameters of the Choquet integral used to calculate the Criterion of *Absence of prolonged Hunger*-score are:

μ_1	=	0.11	μ_{12}	=	0.11
μ_2	=	0.08	μ_{13}	=	0.34
μ_3	=	0.22	μ_{23}	=	0.51

Thus, with the μ listed above:

$$\text{Absence of prolonged hunger-score} = \begin{cases} S_1 + 0.51(S_2 - S_1) + 0.22(S_3 - S_2) & \text{if} \quad S_1 \le S_2 \le S_3 \\ S_1 + 0.51(S_3 - S_1) + 0.08(S_2 - S_3) & \text{if} \quad S_1 \le S_3 \le S_2 \\ S_2 + 0.34(S_1 - S_2) + 0.22(S_3 - S_1) & \text{if} \quad S_2 \le S_1 \le S_3 \\ S_2 + 0.34(S_3 - S_2) + 0.11(S_1 - S_3) & \text{if} \quad S_2 \le S_3 \le S_1 \\ S_3 + 0.11(S_1 - S_3) + 0.08(S_2 - S_1) & \text{if} \quad S_3 \le S_1 \le S_2 \\ S_3 + 0.11(S_2 - S_3) + 0.11(S_1 - S_2) & \text{if} \quad S_3 \le S_2 \le S_1 \end{cases}$$

with 1 = Period 1, 2 = Period 2 and 3 = Period 3.

The importance of each period is given by the so called *Shapley Value,* which, for this example, is:

Period 1 (1) = $\frac{1}{3} \times (1 + \mu_1 - \mu_{23}) + \frac{1}{6} \times (\mu_{12} - \mu_2 + \mu_{13} - \mu_3)$ = 0.225

Period 2 (2) = $\frac{1}{3} \times (1 + \mu_2 - \mu_{13}) + \frac{1}{6} \times (\mu_{12} - \mu_1 + \mu_{23} - \mu_3)$ = 0.295

Period 3 (3) = $\frac{1}{3} \times (1 + \mu_3 - \mu_{12}) + \frac{1}{6} \times (\mu_{13} - \mu_1 + \mu_{23} - \mu_2)$ = 0.48

The calculations are derived from the following general formula of the *Shapley Value*:

$$\Phi(i) = \sum_{A \subseteq N \setminus \{i\}} \frac{(n - a - 1)!\, a!}{n!} \times [\mu(A \cup \{i\}) - \mu(A)]$$

The interactions between the scores are given by the interaction indices. The higher the index, the more limited are the compensations (*i.e.* one low score is sufficient for the farm to be low):

I_{12} = $\frac{1}{2} \times (1 - \mu_{13} - \mu_{23} + \mu_3) + \frac{1}{2} \times (\mu_{12} - \mu_1 - \mu_2)$ = 0.145

I_{13} = $\frac{1}{2} \times (1 - \mu_{12} - \mu_{23} + \mu_2) + \frac{1}{2} \times (\mu_{13} - \mu_1 - \mu_3)$ = 0.235

I_{23} = $\frac{1}{2} \times (1 - \mu_{12} - \mu_{13} + \mu_1) + \frac{1}{2} \times (\mu_{23} - \mu_2 - \mu_3)$ = 0.35

I_{123} = $1 - \mu_{12} - \mu_{13} - \mu_{23} + \mu_1 + \mu_2 + \mu_3$ = 0.45

The calculations are derived from the following general formula of the *Interaction Index*:

$$I_{ij} = \sum_{A \subseteq N \setminus \{i,j\}} \frac{(n - a - 2)!\, a!}{(n - 1)!} \times [\mu(A \cup \{ij\}) - \mu(A \cup \{i\}) - \mu(A \cup \{j\}) + \mu(A)]$$

Assignment of farms to the welfare categories

We transposed the rules used in Welfare Quality® to produce an overall welfare assessment of farms.
However, contrary to Welfare Quality®, the names of the classes have been changed because we believe that an animal production can never be excellent and that the key reference point is the best current practice according to experts. Briefly, a farm is classified in one welfare category according to its principle-scores (Figure 5):

- A farm is considered to correspond to '**Best current practice**' if it scores more than 55 on all principles and more than 80 on two of them.
- A farm is considered to correspond to '**Good current practice**' if it scores more than 20 on all principles and more than 55 on two of them.
- A farm is considered to correspond to '**Acceptable current practice**' if it scores more than 20 on three principles and more than 10 on the remaining principle.
- Other farms are considered to correspond to '**Unacceptable practice**'.

In addition, an indifference threshold equal to 5 is applied: for instance, a score of 50 is not considered to be significantly different from one of 55. This means, as in Welfare Quality®, that 5 is added to each principle-score before assigning a category to a farm.

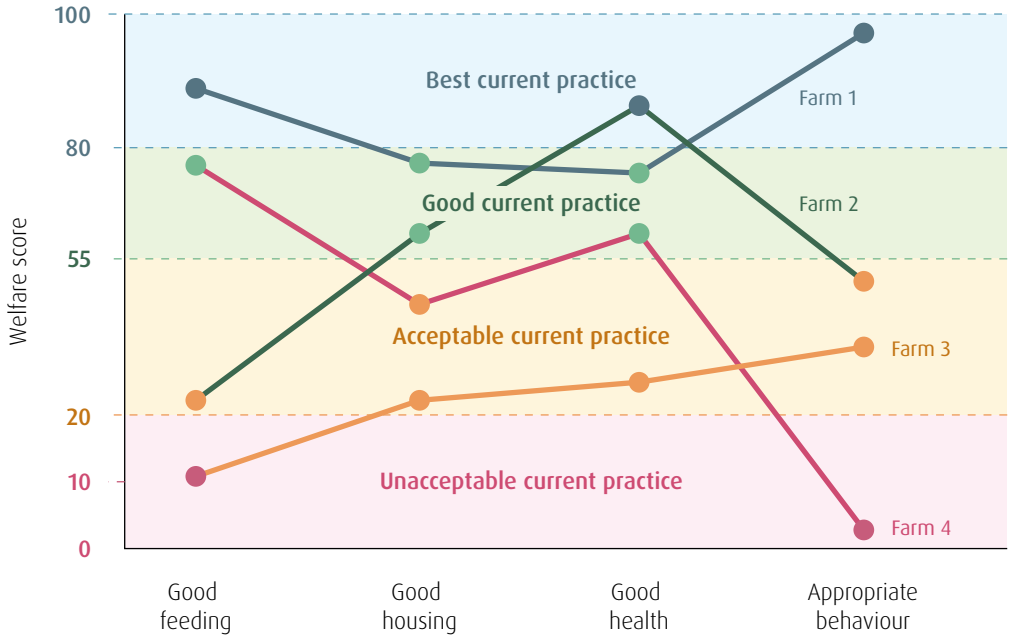


Figure 5 Examples of farms in the four welfare categories

Final comments

In this protocol the reader will find all the necessary information to understand what is done in WelFur to produce an overall welfare assessment of mink at farm level. However, for the data collection, specific training is required to ensure the relevance and the reliability of the observations. The development of the training material for the assessors started in parallel with the development of the protocol and training material (*e.g.* videos, pictures, farm visit, etc.) will be consolidated. A software package has been developed to calculate welfare scores and to produce the overall assessment of farms. For more information, contact the partners of the WelFur project, represented by the Fur Europe office.

The following chapters are specific to mink. They are structured to present firstly the measurements collected on farms and the sampling strategy to be adopted and secondly the calculation of scores needed for the overall assessment.

Photo : © Kopenhagen fur

3 Welfare assessment protocol for mink

The assessment of welfare should be a multi-disciplinary process since only the assessment of a variety of different parameters can provide the comprehensive assessment of an animal's welfare in any given system. To this end, the WelFur project utilizes physiological, health and behavioural aspects as well as the more traditional input based aspects of housing and management, to assess the welfare of mink on farms.

In this chapter, a description of each measurement for mink is given, followed by additional information about the sampling strategy to be adopted and the order in which the different measurements should be carried out during a farm visit.

Before commencing farm visits, assessors need to be fully trained in all the measurements that are to be assessed by using photographs, video clips and practical 'on farm' training. For some of the health measurements, this training will involve recognition of certain conditions/ diseases; however it is imperative that this document is not used as a diagnostic tool to identify individual health conditions but rather as a tool to highlight the presence of health problems affecting the welfare of animals. The assessor should not enter into discussions with the farm manager on the prevalence or severity of different diseases on the farm; this is a matter for the farm manager and the herd veterinarian. Additionally, in general, the role of the assessor is to assess and not to advise directly. The farm manager should, however, be advised if serious health problems are observed.

Trained assessors will use animal-based, management-based and resource-based measurements to achieve a representative assessment of mink's welfare on each farm. In this chapter, the same protocol describes the three periods of the production cycle considered for mink. However, how each measurement applies to each period is specified in the data collection descriptions while section 3.2.5 "Registration guidelines for use on farm visit" and Annex A "Recording sheets for mink" will have a set of descriptions for each period. Moreover, for the on-farm assessment, it is impossible to evaluate all the animals present on the farm according to the time needed to assess all the measurements. Therefore, a stratified sample of mink is defined at the beginning of the farm visit in order to have a representative number of the different types of animals for all measurements. The majority of the measurements are scored according to either a two-point scale (0/1) or a three-point scale (0/1/2).
The assessment scale has been selected so that, as a general rule, a score 0 is awarded where welfare is good and a score 1 (and 2 or 3 in case of a three- and four-point scales) is awarded where welfare is poor or unacceptable. In some cases, a cardinal scale (*e.g.* cm or m^2) is used.

3.1 Introduction to mink production

3.1.1 The mink

The mink (*Neovison vison*) is a carnivore that originates from North America where the first fur farms were established around 1865. The first farms in Europe were established in 1920. There is also a European mink (*Mustela lutreola*) which is not farmed.

In the wild, adult mink are solitary and territorial and their home range is maintained by scent-marking and aggression. The male territory may overlap several females while territory overlap does not occur between adult animals of the same sex. Adult males and females come together briefly at mating time. Juvenile mink disperse in search of vacant territories in the autumn at the age of 3 to 5 months. Mink retreat to a den for resting and the den is also important during the annual delivery of young in April-May. Mink kits are born altricial, *i.e.* small (8-11 g), hairless, without the ability to hear, see, or thermo regulatory capacity until the age of 21-30 days.

In nature, mink eat a wide range of prey, such as small mammals (rodents and lagomorphs), fish, amphibians, echinoderms, crustaceans and birds, dependent on local availability, season and competition. The size of a mink territory depends on the food resources, *i.e.* smaller in case of a rich habitat.

Mink have been farmed in basically the same housing conditions consisting of wire netting cages with a nest box for the last 100 years. This has enhanced the adaptation of the farmed mink to the housing environment resulting in common signs of domestication, such as reduced fear and smaller brains compared to wild mink. The reproductive ability (number of kits delivered) and body size of farm mink has increased, due to domestication/directional selection.

3.1.2 Welfare and the annual cycle of production

Mink production is characterised by a strict annual cycle of very different seasons which are synchronised within a few weeks for all mink in the northern hemisphere. Traditionally all annual seasons of production, *e.g.* conditioning, breeding, whelping, growing and pelting take place on the same farm. The number of mink therefore varies by a factor of 6 between the winter season and the growth season and some farmers have separate farm units for the growth season. As all mink are in the same phase of production the welfare measurements can be taken when the risk of welfare problems is at its highest, as illustrated by the observation period within each season in Figure 6.

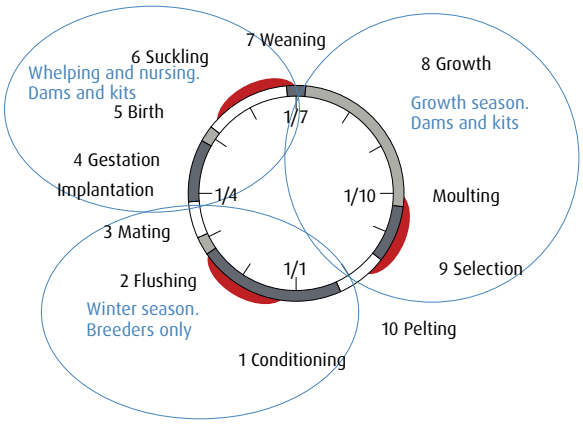


Figure 6 The three major seasons of the annual cycle of mink production to be covered by WelFur. The 10 major management tasks are marked by numbers while observation periods for assessment are marked in red within each season.

The main management principle in mink production is to follow the annual cycle and handle the shifts between them. The annual cycle is governed by the changes in day length and mink are therefore housed under natural light and day-length conditions. Mink are allowed natural mating behaviour and artificial insemination is not possible. All mink are housed with a nest box and bedding material usually allows for nest building in which the females are allowed unrestricted delivery and nursing of the kits. Mink kits are weaned when lactation ceases after the kits have started to eat and drink. Production does not restrict the time of weaning from what is found to be the best for the female and her kits. No physical mutilation is needed and the mink are left intact (no identification mark, trimming, clipping, castration, *etc.*). During their life span farm mink can be housed in accordance with their main social needs in all production phases. At the end of production mink are killed on-farm directly from the home-cage, without prior transportation. *Post mortem* inspection indicates that mink are generally pelted with few clinical problems or physical lesions. The general housing conditions allow for efficient inspection of health and behaviour.

A range of potential welfare problems often encountered in animal production is therefore not an issue in mink production (mutilations, early weaning, transportation for slaughter). This is only indirectly reflected in the WelFur mink protocol, as a relatively low number of measurements, because the protocol only includes valid measurements that vary between farms.

3.1.3 Building the mink WelFur assessment protocol

The goal for WelFur has been to build a protocol with which the welfare of the mink on a farm can be assessed during three one-day visits of 5-7 hours. WelFur is built on the available scientific literature and the knowledge within the project group on behaviour, health, management and housing conditions. The welfare assessment protocol is evaluating the actual welfare of the mink and not the compliance with legislation. This is partly because there is not necessarily a relation between scientific knowledge and legislation and partly because the actual legislation differs between European countries although the legal framework for mink production is based on the Council of Europe (CoE) recommendations.

By reviewing the literature, 54 potentially feasible welfare measurements for mink were identified. For each of the three periods, each measurement was evaluated according to their:

- Validity: whether the measurement reflects some aspect of the actual welfare of the mink relative to the criteria
- Reliability: acceptable inter- and intra-observer reliability and robustness to external factors *e.g.* time of day or weather condition
- Feasibility: whether the measurement is possible and practical to apply in practice with reasonable costs

The review for each of the 12 assessment criteria led to an assessment of the validity, reliability and feasibility of the measurements based on a three point scale:

1. High certainty: Solid and complete data available; strong evidence in multiple references with most authors coming to the same conclusion

2. Medium certainty: Some or only incomplete data available; evidence provided in small number of references; authors' conclusions vary from one to the other; solid and complete data available from other species which can be extrapolated to the species considered

3. Low certainty: Scarce or no data available; evidence provided in unpublished reports or based on personal observations or communications; authors' conclusions vary considerably between the reports

A total of 22 welfare measurements passed this evaluation and are included in one or more of the three periods. Some measurements were excluded due to lack of scientific knowledge on the validity or reliability or due to lack of feasibility. However, on-going scientific research may refine measurements so that the validity and feasibility will be high enough for inclusion in the protocol at a later state. As an example a measurement of prolonged stress includes activity of the Hypothalamic-Pituitary-Adrenal (HPA)-axis. In mink, the main stress hormone is cortisol. Prolonged or repeatedly high levels of cortisol have negative consequences, for example, suppression of digestion, growth, reproduction, immunity and the inflammatory response. Baseline levels of cortisol can be measured non-invasively as metabolites present in faeces of adult mink. This could be a relevant additional indicator in mink, if its feasibility increases.

Another aspect of WelFur-mink is that it should be applicable in all European countries, even though it has been developed and tested only in the Nordic countries and The Netherlands. Unforeseen situations may appear during application in other countries and therefore it is planned that the WelFur protocols will be updated in a number of years in the light of new knowledge gained.

3.1.4 Welfare of mink during the annual production cycle

In the farm situation, new female breeders are selected in November among often fat or obese young mink. The selected females are conditioned to an average or below average body condition in the period between selection and late February, in order to reproduce well and to respond to flushing. The mink are slimmed by reducing the energy allowance in order to mobilize their abundant deposits of body fat. Although the mink is somewhat adapted to body weight changes, this can have some consequences for animal welfare that can be observed with higher and higher certainty towards the end of the observation period. Low temperatures in this period increases the need for nest box insulation, bedding material and frost protected watering systems but also on feeding management. Welfare is therefore assessed using a combination of animal-based measurements of behaviour (stereotypy and fur chewing) and health (mortality, disease, body condition) and resource based measurements of housing conditions.

During mating and gestation mink are in a positive energy balance and health and welfare are generally good. After parturition mink kits develop rapidly from a female-male weight of 8-11 g at birth to 158-176 g at four weeks when they start to take solid food, 315-367 g at six weeks when they begin to drink water, and 805-1157 g at weaning in July. This development puts high demand on the females as well as her litter, and welfare measurements therefore, apply to the lactation period in mink.

Mink kits join the annual cycle of adults and are synchronised in terms of body weight and pelt moulting 3-4 months after birth. In September, the mink body is fully developed in terms of mineral content and body length. Weight gain from September is primarily via deposition of body fat. Due to selection, the average body weight of mink has increased by more than 2% a year over the last decade. Consequently, the farm mink of today have a large appetite resulting in high body condition at pelting time when the mink are 6–7 months old. Although obesity is not a welfare problem in itself, consequences for health, mortality or access to the nest box may develop during autumn. The vernal equinox is the signal for the change to a winter coat and it also seems to be a signal to secure the territory for the winter. The risk of aggression between mink in the cage increases and wounds may result. The juvenile mink also reach their adult level of temperament in the autumn. The latter part of the growth season is therefore optimal for assessment of all the animal-based measurements of behaviour (stereotypy, temperament and fur chewing) and health (injuries, mortality, disease, body condition) and resource based measurements of housing conditions.

3.2 Collection of data for mink

Specific considerations for each period are listed in each description, *i.e.* for Period:

- Adult breeders during the winter period: December 1st to February 28th. Data collection period for animal-based measurements: January 1st to February 20th. Data collection in Period 1 ends when generous flush-feeding before mating begins, if this is before February 20th.

- Adults and kits in the reproduction period: March 1st to July 15th. Data collection period for animal-based measurements: May 5th to July 1st. Data collection in Period 2 ends when weaning begins, if this is before July 1st.

- Adults and juveniles in the growth period: July 16th to November 30th. Data collection period for animal-based measurements: September 23rd to November 30th. Data collection in Period 3 ends when pelting begins, if this is before November 30th.

Sample size:
A representative sample of the mink on the farm are selected according to § 3.2.6. For all periods the sample should represent the farm and only mink included in the representative sample are considered.

The 22 welfare measurements for mink.

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

3.2.1 Good feeding

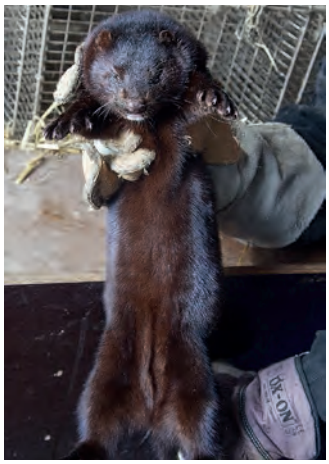
3.2.1.1 Absence of prolonged hunger

Title	**Body condition score**
Scope	Animal-based measurement: Periods 1, 2 and 3
Sample size	Mink in the sample defined in 3.2.6.
Method description	Make sure that all mink are outside the nest box – preferably standing on their hind legs. Walk slowly from cage to cage, potentially at the back end of the cages and try to get each mink standing on its hind legs, for example, using a tongue spatula or similar to make the mink interested/stand up. Observe the mink's neck, shoulders, hips and belly. Consider how hollow the stomach is and how visible the spine is. Assess the 5 grade Body Condition Score (BCS) of the mink according to the classification described below. This 5 grade score is also frequently used by farmers but for welfare assessment only grades 1 and 2 are of interest and therefore only mink in these two low grades need to be registered. **Specifically in Period 1:** Mink selected as breeders in November are usually in high BCS (4 or 5). Loss of more than 2 scores in BC per month is associated with prolonged hunger and the classification therefore varies with time of the evaluation. Prolonged hunger is expected BCS 2 in January and BCS 1 in February. Grade females first and then males – do not switch back and forth between females and males if possible. **Specifically in Period 2:** Only adults are scored. Mink dams will ideally increase their BCS from 2 in late February to 3 in late March, 4 in late gestation and 3-4 after birth. Mink dams in BCS 1 in late lactation is therefore associated with prolonged hunger. **Specifically in Period 3:** During growth mink will generally increase their BCS from 3 at weaning to 3 to 5 in November. Mink in BCS 2 is therefore associated with prolonged hunger. **Body condition scores:** Developed from scoring system by Kirsti Rouvinen-Watt and Dean Armstrong **1 = Very thin**: The mink has an emaciated appearance with decreased muscle mass, a thin neck and a narrow waistline. There is no body fat and the stomach is sunk in. Shoulder and hip bones can be seen. **2 = Thin**: The mink has a thin neck and a visible waistline. There is no subcutaneous body fat layer and only little in the neck. Body condition scores 3 to 5 can all be scored the same if the assessor wants to save time assigning a score: **3 = Ideal**: The mink has a slender neck and a straight body shape. There is a slight amount of subcutaneous body fat. **4 = Heavy**: The mink has a thicker neck and a pear-shaped body. The shoulder and hip bones are covered by a moderate fat layer. An abdominal fat pad is present. **5 = Obese**: The mink has a thick neck with a rounded chest and a full body shape. The shoulder and hip bones are covered by a moderate to thick fat layer. A fat pad is present in the abdomen and the tail. Fat deposits can be seen in the limbs and the face. **Individual level:** **0 –** Period 1: BCS > 2 in January and BCS > 1 in February. Period 2: BCS > 1. Period 3: BCS > 2. **1** – Period 1: BCS ≤ 2 in January and BCS ≤ 1 in February. Period 2: BCS ≤ 1. Period 3: BCS ≤ 2.

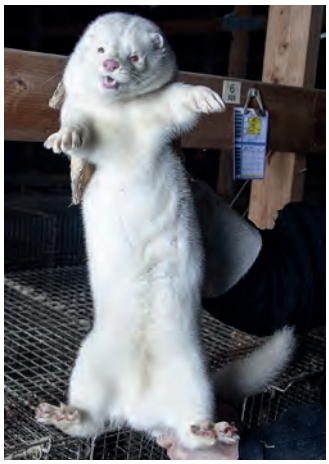
Classification

Farm level:
Percentage of animals that are too thin (1) at the time of inspection:

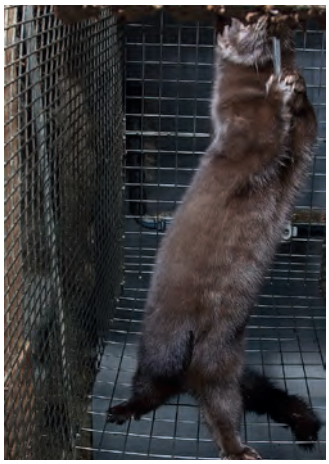
Adult in body condition 1



Adult in body condition 1



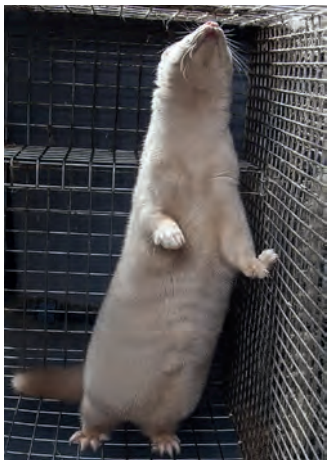
Adult in body condition 2



Adult in body condition 2

Adult in body condition 3

Adult in body condition 3



Adult in body condition 5

Adult in body condition 5

Photos : © Bente Krogh Hansen & Jesper Clausen.

3.2.1.2 Absence of prolonged thirst

Two sub-measurements are taken and combined to the measurement of *Continuous water availability* to assess the Criterion of *Absence of prolonged thirst*. Each sub-measurement leads to a classification. The classification at farm level results from the combination of these two sub-measurements and is described at the end of this section.

Sub-Title	**Type of watering system**
Scope	Resource-based measurement: Periods 1, 2 and 3
Sample size	The farm/sample defined in 3.2.6
Method description	Consult the farmer about the watering system(s) providing drinking water for the animals. Is it an automatic watering system that secures continuous access at all times – also in times of low temperatures that are common in the area during the period? If not, how many times per day is water provided? If various systems are used on the farm, these should be covered by the stratified sample. Unusual systems are assigned as they fit best: for example, automatic watering system providing water for example, 6 times a day is recorded as 1 or 2 for *Continuous water availability* and 0 for *Watering frequency*. If ice or snow is provided instead of water in sub-zero temperatures, this is recorded as 1 or 2 for *Continuous water availability* and 2 for *Watering frequency*. **Specifically in Periods 1 and 3:** In areas of sub-zero temperatures during winter, consider the functioning of the drinking water system and/or the practice of providing drinking water in periods of frost during winter (water circulation/defrosting mechanism or manual water supply). **Specifically in Period 2:** Additional equipment to help kits access to the water resource (e.g. extra equipment to ease the activation of the nipple or to secure that drops of water remains after activation, open water surface, drinking nipples close to the nest box, etc).

Farm/section level:
Watering system:
0 – Automatic watering system providing water at all times throughout the year. Frost protection, so the system does not freeze in sub-zero temperatures.
1 – Automatic watering system providing water at all times but that may freeze or is not working in sub-zero temperatures.
2 – Water is provided manually throughout the year.

If 1 or 2, watering frequency:
0 – Water is provided at least twice a day
1 – Water is provided once a day
2 – Water is provided less than once a day

Additional watering for kits (only in Period 2):
0 – There is additional watering system for kits
1 – There is no additional watering system for kits

Classification

Farm level:
Seven possible situations are resulting from the combination of watering system and watering frequency:
0 – 0
1 – 1 and 0
2 – 1 and 1
3 – 1 and 2
4 – 2 and 0
5 – 2 and 1
6 – 2 and 2

At farm level the evaluation is 0 or 1 regarding:
Additional watering for kits

Additional water for kits – Score 0 for Additional watering

Sub-Title	**Functioning and cleanliness of the water points**
Scope	Resource-based measurement: Periods 1, 2 and 3
Sample size	The sample defined in 3.2.6
Method description	Check the functioning of all the water points in the sample (by activating the watering system/ nipple with a long stick from the aisle or a bent nail from behind the cage). Check the cleanliness of all the water points (nipples/cups) in the sample. If various systems are used in the farm, these should be covered by the stratified sample.

Specifically in Periods 1: The functioning of watering systems is only tested in frost protected type 0 watering systems. If ice or snow is generally provided instead of water in sub-zero temperatures, functioning is not scored while cleanliness is classified as 0 if ice/snow is clean and as 1 if not.

Specifically in Period 2: The cleanliness of water points is only regarding the primary watering system, not additional equipment. For example, if a drinking nipple system is the primary source of water and additional water is supplied in a bowl, only the cleanliness of the nipple is assessed.

Specifically in Periods 3: The functioning of watering systems is only tested in automatic type 0 or 1 watering systems. If ice or snow is generally provided instead of water in sub-zero temperatures, functioning is not scored while cleanliness is classified as 0 if ice/snow is clean and as 1 if not.

Cage level:
Functioning of the water points:
0 – The drinkers/nipples work properly (water comes out when activated)
1 – The drinkers/nipples do not work (no water comes out when activated)

Cleanliness of the water points (drinkers/nipples):
0 – Clean
1 – Dirty

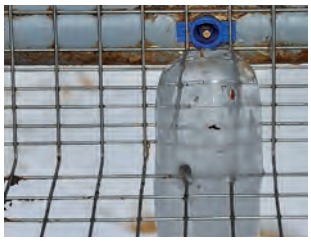
Classification

Cage level: For each cage the evaluation is 0 or 1 regarding:

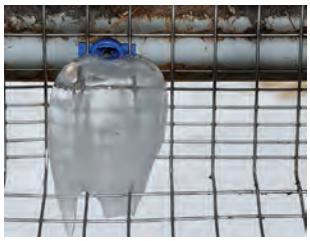
- Functioning of the water points
- Cleanliness of the water points

Additional information

Frozen water nipples
seen from outside



Clean and frozen nipple – still working
Score 0 for functioning



Frozen nipple – not working but acces to ice
Score 1 for functioning

Dirty nipple - Score 1 for cleanliness
Not functioning - Score 1 for functioning.

Photos : © Steen H. Møller & Jesper Clausen

Title	**Continuous water availability**

Classification

Farm level: Percentage of animals in each of the situations resulting from the combination of the two sub-measurements described above: *Type of watering system* and *Functioning and cleanliness of the water points*. The number of situations differ from one period to another:

Period 1: 16 different situations are relevant

Period 1	Type	Functioning	Cleanliness	% of animals
Situation 1	0	0	0	*P1*
Situation 2	0	0	1	*P2*
Situation 3	0	1	0	*P3*
Situation 4	0	1	1	*P4*
Situation 5	1		0	*P5*
Situation 8	2		1	*P8*
Situation 9	3		0	*P9*
Situation 10	3		1	*P10*
Situation 11	4		0	*P11*
Situation 12	4		1	*P12*
Situation 13	5		0	*P13*
Situation 14	5		1	*P14*
Situation 15	6		0	*P15*
Situation 16	6		1	*P16*

Period 2: 14 different situations are relevant

Period 2	Type	Kits	Functioning	Cleanliness	% of animals
Situation 1	0	0	0	0	*P1*
Situation 2	0	0	0	1	*P2*
Situation 3	0	0	1	0	*P3*
Situation 4	0	0	1	1	*P4*
Situation 5	0	1	0	0	*P5*
Situation 6	0	1	0	1	*P6*
Situation 7	0	1	1	0	*P7*
Situation 8	0	1	1	1	*P8*
Situation 9	4			0	*P9*
Situation 10	4			1	*P10*
Situation 11	5			0	*P11*
Situation 12	5			1	*P12*
Situation 13	6			0	*P13*
Situation 14	6			1	*P14*

Period 3: 22 different situations are relevant

Period 3	Type	Functioning	Cleanliness	% of animals
Situation 1	0	0	0	*P1*
Situation 2	0	0	1	*P2*
Situation 3	0	1	0	*P3*
Situation 4	0	1	1	*P4*
Situation 5	1	0	0	*P5*
Situation 6	1	0	1	*P6*
Situation 7	1	1	0	*P7*
Situation 8	1	1	1	*P8*
Situation 9	2	0	0	*P9*
Situation 10	2	0	1	*P10*
Situation 11	2	1	0	*P11*
Situation 12	2	1	1	*P12*
Situation 13	3	0	0	*P13*
Situation 14	3	0	1	*P14*
Situation 15	3	1	0	*P15*
Situation 16	3	1	1	*P16*
Situation 17	4		0	*P17*
Situation 18	4		1	*P18*
Situation 19	5		0	*P19*
Situation 20	5		1	*P20*
Situation 21	6		0	*P21*
Situation 22	6		1	*P22*

3.2.2 Good housing

3.2.2.1 Comfort around resting

Title	**Access to a nest box**
Scope	Resource-based measurement: Periods 1, 2 and 3
Sample size	The sample defined in 3.2.6.
Method description	A nest box is a compartment in -or attached to- the cage giving the mink physical and visual shelter. Only cages in use are considered. The size of the nest box must allow: nest building, birth, lactation and that all mink in the cage can be contained in the nest box. Observe if all mink have access to a nest box.

	Specifically in Period 3. All mink in the cage should have access to a nest box at the same time. In case of many animals sharing a nest box (*e.g.* 4 mink or more) it is evaluated on the basis of whether all the mink can stay in the nest box at the same time. Four female mink can normally share one nest box with the floor dimensions 23 x 28 cm with an inner height of 20 cm or larger while two males and two females need 28 x 28 cm. This rule of thumb can be overruled by subjective evaluation in case where males are extraordinarily large – hindering access via the nest box opening or resulting in the nest box being too small to accommodate all mink at the same time. Record the number of animals in the sample that **do not** have access to a nest box. This may be because the nest box access is blocked, because there are too many animals to fit into the nest box or because there is no nest box. **Cage level**: **0 -Yes**, all mink in the cage have access to a nest box **1, 2, 3, 4 or x – Number** of mink without access to a/the nest box
Classification	**Farm level:** **Percentage** of mink with access to a nest box

Title	**Resting quality of the nest box/resting area**
Scope	Resource/management-based measurement: Periods 1, 2 and 3
Sample size	The sample defined in 3.2.6
Method description	Inspect the nest boxes or, in case of no nest box, the resting area. Open the lid or remove bedding material in order to inspect the inside of the nest box and use a torch if needed. Assess whether the nesting material is dry or wet, whether the resting area is clean or dirty, undamaged or damaged and whether there are fleas in the nest box. **Specifically in Period 2:** In the last part of the lactation period, the litter may be fed from the top of the nest box. Therefore bedding material may be removed from the top of the nest box in that period. The entrance part of the nest box may be contaminated with feed but the nesting area should be clean. **Cage level**: Record for each cage in the sample if the nest box/resting area is: **0 – Dry** or **1 – Wet** **0 – Clean** or **1 – Dirty** **0 – Whole/undamaged** or **1 – Damaged** (*e.g.* sharp edges) **0 – Free from fleas** or **1 – Infested with fleas**
Classification	**Farm level:** **Percentage of animals** with a nest box / resting area of the following quality: 0 – Dry and clean and not damaged nest box without fleas 1 – Wet or dirty or damaged nest box / resting area or with fleas 2 – Nest box / resting area with 2 of the following: wet, dirty, damaged or fleas 3 – Nest box / resting area with 3 or all of the following: wet, dirty, damaged or fleas



Clean nest, Score 0 | Threshold for clean nest | Dirty nest, Score 1

Photos : © Steen H. Møller.

3.2.2.2 Thermal comfort

Title	**Protection from exceptional weather conditions**
Scope	Resource/management-based measurement: Periods 1, 2 and 3
Sample size	The sample defined in 3.2.6
Method description	The mink should be protected from direct sunlight, heat, cold wind and strong draughts while the cages should still be well ventilated. This protection from exceptional weather conditions depends on farm location, surroundings, more or less open sheds and cages/nest boxes design. Examine the type of environmental protection at cage section level, not at individual cage level. Assess the general protection for the mink in the part of the shed of the sampled section. Assess the general protection for the full length of the season, not only the actual day of assessment. This protection will often be the same for all cages in the sample or for all cages in each shed. **Specifically in Period 1**: Only climate protection from the wind is recorded. **Specifically in Periods 2 and 3**: Record climate protection from wind, direct sunlight and heat. The mink are at risk of heat exhaustion in ambient temperatures above 30 °C. **Wind**: General protection from the wind by landscape, fencing, stand of trees around the farm, closed sheds, neighbouring sheds, wind shields or similar. **Sun**: Protection from direct sun by shade in closed sheds, wide roof in two-row sheds or shade by other means. Are clear roofing plates covered/painted during summer **Heat**: Protection from heat exhaustion by means of cooling is needed in areas where temperatures above 30 °C can be expected, for example, by water vaporisers or sprinklers. **At cage section level**: **Protection from wind (all periods):** **0** – High, the cage sections are well protected from the wind, for example, in closed sheds, sheds with wind protection that can be closed or in open sheds that are well protected by landscape, fencing, neighbouring sheds and/or a stand of trees around the farm **1** – Medium, the cage sections are somewhat protected from the wind, for example, in open sheds, without wind protection but some protection by landscape, fencing, neighbouring sheds, and/or a stand of trees around the farm **2** – Low, the cage sections are exposed to the wind, for example, in open sheds, without wind protection, no protection by landscape, fencing, neighbouring sheds, or trees or bushes around the farm

Protection from direct sunlight (Periods 2 and 3):
0 – High, the cages in his part of the shed are well protected from direct sunlight by roof shade in closed or two-row sheds or shade by other means. Clear roofing plates are covered/painted during summer
1 – Medium, the cages in his part of the shed are somewhat protected from direct sunlight by roof shade in closed or two-row sheds or shade by other means. Clear roofing plates are not covered/painted during summer
2 – Low, the cages in this part of the shed are not well protected from direct sunlight because the roof does not shade the entire cage and clear roofing plates are not covered/painted during summer

Is the farm placed in a geographical region with low risk of temperatures above 30°C (See climate information on national or regional level in registration descriptions). (Periods 2 and 3):
0 – Yes. The farm is at low risk of temperatures above 30°C
1 – No. The farm is at risk of temperatures regularly above 30°C

Possibility for cooling in case of temperatures above 30°C (Periods 2 and 3):
0 – Means of cooling installed and turned on in ambient temperatures above 30°C
1 – No means of cooling are installed

Classification

Farm level:
In Period 1, *Protection from wind*: Percentage of animals with score 0, score 1 and score 2

In Periods 2 and 3: Percentage of animals in each of the 27 possible situations resulting from the combination of risk of temperatures above 30°C the 3 scores for *Protection from wind,* the 3 scores for *Protection from direct sunlight,* the 2 scores for *Risk of temperatures above 30°C* and the 2 scores for *Possibility for cooling*

Periods 2 & 3	Protection from wind	Protection from sunlight	Risk of temperatures above 30°C	Possibility for cooling	% of animals
Situation 1	0	0	0		*P1*
Situation 2	0	0	1	0	*P2*
Situation 3	0	0	1	1	*P3*
Situation 4	0	1	0		*P4*
Situation 5	0	1	1	0	*P5*
Situation 6	0	1	1	1	*P6*
Situation 7	0	2	0		*P7*
Situation 8	0	2	1	0	*P8*
Situation 9	0	2	1	1	*P9*
Situation 10	1	0	0		*P10*
Situation 11	1	0	1	0	*P11*
Situation 12	1	0	1	1	*P12*
Situation 13	1	1	0		*P13*
Situation 14	1	1	1	0	*P14*
Situation 15	1	1	1	1	*P15*
Situation 16	1	2	0		*P16*
Situation 17	1	2	1	0	*P17*
Situation 18	1	2	1	1	*P18*

Situation 19	2	0	0		*P19*
Situation 20	2	0	1	0	*P20*
Situation 21	2	0	1	1	*P21*
Situation 22	2	1	0		*P22*
Situation 23	2	1	1	0	*P23*
Situation 24	2	1	1	1	*P24*
Situation 25	2	2	0		*P25*
Situation 26	2	2	1	0	*P26*
Situation 27	2	2	1	1	*P27*

Title	**Nest box material and bedding/nesting material**
Scope	Resource-based measurement: Periods 1, 2 and 3
Sample size	The sample defined in 3.2.6
Method description	Nest boxes may be made of wood, plywood, chip-board, plastic or other material with different properties for insulation, moisture absorbance and diffusion. Bedding material may be hay, straw, flax or other straw-like material, shredded straw/paper, wood or other soft shavings, wool or similar, with different properties for insulation and as nest building material. Record the insulating capacity of the nest box material the mink get in contact with. Record if there is access to enough bedding material to build a closed nest in the box, to cover the floor, or less than that. Record whether the nest box is protected from draughts by a wind breaking device at the entrance or by being covered, for example, by a plate and/or bedding material. In areas with high risk of temperatures below -10°C for long periods (more than two weeks) the insulation capacity of the nest box is especially important. The presence and quality of a nest box and bedding material are important in each of the three periods. However, there may be a shift of the underlying reasons for this, as follows: **Specifically in Period 1:** This is a cold period, where mink require a thermal protective nest dependent on the outside climate and housing conditions. The nest box should be suitable to fit the adult male or female mink and/or supplied with enough bedding material to form a nest of the right size. **Specifically in Period 2:** The pregnant females have a behavioural need to prepare a nest for the young and the newborn kits need a warm nest, in particular for the first weeks of life. **Specifically in Period 3:** Assess whether bedding material is available for the mink to regulate the nesting quality in order to be protected against both heat and cold? Based on the observations of the previous measurement **Resting quality of the nest box/ resting area**, a general assessment of the nest box material and bedding is applied at section level, but not at individual nest box level. The assessment is based on the general insulating capacity, the general amount of bedding material and the general draughts protection, e.g. the presence of a wind breaking device in front of the nest box entrance or a covered nest:

A: Nest box in Periods 1 and 3 in areas with high risk of temperatures below -10°C for more than two weeks. (See climate information on national or regional level in registration descriptions):
0 – Especially high insulating capacity nest box (*e.g.* expanded polystyrene or netting insert with insulating material around)
1 – High insulating capacity nest box (*e.g.* wood plywood, chip/particle-board) with netting insert
2 – No nest box OR nest box without netting insert

A: Nest box in all periods in areas with low risk of temperatures below -10°C for more than two weeks:
0 – High insulating capacity nest box (*e.g.* wood, plywood, chip/particle-board,) with netting insert.
1 – Medium insulating capacity nest box (*e.g.* wood, plywood, chip/particle -board, without netting insert or plastic with netting insert).
2 – Low insulating capacity (e.g. plastic without netting insert or no nest box)

B: Bedding material at section level, based on the observations of resting quality of the nest box/resting area:
0 – Plenty: Access to enough bedding material to build a closed nest in the box/cover the mink
1 – Some: Access to enough bedding material to cover the floor of the box
2 – None: Not enough bedding material to cover the floor of the box

C: Protection against drafts by sheltered nest box opening, nest box filled with bedding or lid/nest covered with bedding or other material:
0 – Yes
1 – No

These combinations are condensed into 4 categories of thermal protection of the nest box (based on sum of the three scores A+B+C):

At cage-nest level:
0 – A+B+C ≤ 2.

1 – A+B+C = 3.

2 – A+B+C = 4.

3 – A+B+C > 4.

Classification

At farm level:
Percentage of mink in each category of nest box.

Additional information

A: Nest box, Score 0 (in low risk area)
B: Bedding material, Score 0
C: Nest covered, Score 0

A: Nest box, Score 0
B: Bedding material, Score 1
C: Nest covered, Score 1

A: Nest box, Score 0 (in low risk area)
B: Bedding material, Score 1

A: Nest box, Score 0
B: Bedding material, Score 2

Photos : © Steen H. Møller.

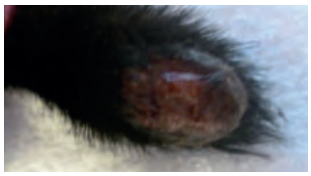
3.2.2.3 Ease of movement

Title	**Space available for moving (area and height)**
Scope	Resource-based measurement: Periods 1, 2 and 3
Sample size	The sample defined in 3.2.6
Method description	Measure the cage size (width, length and height) in cm (or count the wire-mesh in inches and multiply by 2.5). When two floor cages are used, the area and height in both sections is measured. Only the cage area with full height is included, however the area beneath cage enrichments (e.g. shelves) is not excluded, while the area beneath low parts of the roof (less than 40 cm or top nesters) is excluded. Calculate the floor area of the cage sizes encountered and the number of each. **At cage level:** **Floor area:** **0 –** ≥ 2550cm^2 **1 –** 1000 ≤ cage area <2550cm^2 **2 –** < 1000cm^2 **Cage height:** **0 –** ≥ 50cm **1 –** 40 ≤ cage height <50cm **2 –** < 40cm **Floor area above 2550cm^2 / mink more than two in Period 3 (see additional information):** **0 –** ≥ 850cm^2/ with minimum 40cm height **1 –** < 850cm^2/ with minimum 40cm height
Classification	**Farm level:** **Floor area:** **Percentage of animals** kept in cage sizes classified as: 0, 1 or 2. **Cage height:** **Percentage of animals** kept in cage sizes classified as: 0, 1 or 2. **Floor area/mink (only in Period 3):** **Percentage of animals** kept in cage sizes classified as: 0 or 1.

Additional information	The number of animals in each cage in the sample is known from the animal-based measurements and need not to be counted again.

3.2.3 Good health

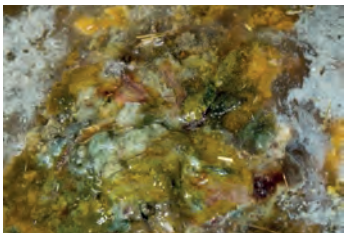
3.2.3.1 Absence of injuries

Title	**Skin lesions or injuries to the body**
Scope	Animal-based measurement: Periods 1, 2 and 3
Sample size	Mink in the sample defined in 3.2.6
Method description	Inspect the body of all mink in the sample, for example, after scoring temperament or body condition, where a full visual inspection of the body is possible. If two lesions or more are observed in the same mink, each lesion is scored and the added score is recorded. However, 3 is the maximum score recorded for a mink. For example, 1+1=2, 1+2=3, 1+3=3, 2+2=3... **Specifically in Period 1**: Inspect adults housed alone especially at the tail. **Specifically in Period 2**: In late lactation aggression/injuries in litter occurs especially in the throat/neck/head region after they begin to eat solid food at 4 weeks of age and until weaning, especially in hot and dry weather conditions. Inspect the females and the throat/neck/head region of kits. **Specifically in Period 3**: Inspect especially at the tip and base of the tail. Abscesses, ear and eye injuries may also occur. **Individual level:** **0 –** No injuries **1 –** Unhealed injuries with a diameter < 10mm OR minor healed lesions, for example, missing part of an ear or less than half the tail **2 –** Unhealed injuries with a diameter < 30mm OR major healed lesions, for example, missing more than half the tail **3 –** Unhealed injuries with a diameter > 30mm OR other major unhealed injury, for example, missing more than half the tail or bone exposed
Classification	**Farm level:** **Percentage of mink** with injuries in categories 1, 2 and 3
Additional information	 Unhealed injury, tail missing, score 3  Bite injury at tail, score 2  Bite injury at tail, score 3  Unhealed injury, score 1  Unhealed injury, score 2  Healed injury, score 1 **Photos** : © Steen H. Møller & Steffen W. Hansen

3.2.3.2 Absence of disease

Title	**Mortality**
Scope	Management-based measurement: Periods 1, 2 and 3
Sample size	The farm
Method description	Mortality is defined as unwanted/uncontrolled death of animals as well as humanely killed mink. This means that all mink that are humanely killed or found dead are included while mink that are killed for pelting during the normal pelting time (November/December as well as males and unmated females in March/April) are not included. Consult the farmer on the mortality records for the actual period and one year back. **Specifically in Period 1:** Record the mortality from December 1st to the day of visit. Use data from last year for the rest of the period. Check with the farmer if the number of animals has changed significantly (more than 10 %) since last year. **Specifically in Period 2:** Male and female dams since March 1st. Mink pelted after the mating season in April are not included. The farmers' records of loss of new born kits is very dependent on the farmers' practices in counting juveniles (*e.g.* at a few days or weeks after birth). Therefore kit mortality is not included in the measurement until May 15th. Mortality is recorded within the 3 following sub-periods, using actual or last years data: 2a. Adults from March 1st to May 14th (from the beginning of Period 2 to mid lactation). 2b. Adults and kits from May 15th to June 15th (from the time of expected valid mortality data to weaning). 2c. Adults and kits from June 16th to July 15th (from normal weaning time to the end of separation). Check with the farmer if the number of animals has changed significantly (more than 10 %) since last year. **Specifically in Period 3:** Record the mortality from July 16th to the day of visit and use data from last year for the rest of the period. Check with the farmer if the number of animals has changed significantly (more than 10 %) since last year. **Farm level:** Number of dead mink in each period (and sub-periods of Period 2)
Classification	**Farm level:** • Percentage of dead mink during the period (1 and 3) • Percentage of dead mink in each of the three sub-periods of Period 2

Title	**Diarrhoea**
Scope	Animal-based measurement: Periods 1, 2 and 3
Sample size	Mink in the sample defined in 3.2.6
Method description	Diarrhoea is defined as grey, yellow, green or red mucoid droppings which can best be observed in the slurry trough or under the cages while checking the drinking nipples. In some cases diarrhoea can be observed directly on the mink – especially in case of "sticky kits" in Period 2. Clear clinical signs of serious diarrhoea are noted.

	This includes very mucous, watery, fluent or bloody manure without form or texture. The manure is often not black and can include blood or parts of intestinal epithelium, e.g. in case of more serious disease (shrimp' like droppings are seen in case of mink virus enteritis). While observing the animals in each cage and especially while checking the functioning of each water nipple note the cages containing mink that are affected. **Specifically in Period 2:** 'Sticky kits' (an astro or calici viral infection causing exudation and diarrhoea, which gives the kits a 'sticky' appearance) is prevalent. **Specifically in Period 3:** Notifiable diseases (*e.g.* Mink virus enteritis) may also appear after weaning and separation of the juveniles. In the autumn fast growing male juveniles with high feed intake may be affected by unspecific health problems like diarrhoea. **Cage level:** **0** – No evidence of diarrhoea **1** – Evidence of diarrhoea (including 'Sticky kits' and later forms of enteritis in Period 2)
Classification	**Farm level:** **Percentage** of cages with evidence of diarrhoea
Additional information	   Two examples of diarrhoea, Score 1 — Sticky kits, Score 1 **Photos** : © Steen H. Møller & Nordvacc — **Photo** : © Tove N. Clausen

Title	**Lameness or impaired movement**
Scope	Animal-based measurement: Periods 1, 2 and 3
Sample size	Mink in the sample defined in 3.2.6
Method description	Lameness or impaired movement is defined as mink not moving normally, without any obvious reason such as injuries noted elsewhere in the protocol. All clinical signs of lameness, impaired movement or paralysis is noted, without discriminating between different levels of seriousness of the condition: While observing the animals in each cage, record the number of individual mink that are affected. **Individual level:** **0** – No evidence of lameness or impaired movement **1** – Evidence of lameness or impaired movement
Classification	**Farm level:** **Percentage** of mink with evidence of lameness or impaired movement

Title	**Obviously sick animals**
Scope	Animal-based measurement: Periods 1, 2 and 3
Sample size	Mink in the sample defined in 3.2.6
Method description	All clinical signs of obviously sick mink, apart from the two previous measurements (*i.e.* Diarrhoea and *Lameness or impaired movement*) are noted in this category, without discriminating between different symptoms or levels of seriousness of each condition. Notifiable diseases (Virus enteritis, Distemper, Aleutian Disease) may appear in all periods. In the autumn fast growing male juveniles with high feed intake may be affected by unspecific health problems. While observing the animals in each cage, record the number of individual mink that are affected with physical signs of poor health or disease other than diarrhoea, lameness or impaired movement. **Individual level:** **0** – No signs of poor health or disease **1** – Obvious signs of poor health or disease
Classification	**Farm level:** **Percentage of mink** with evidence of poor health or disease

3.2.3.3 Absence of pain induced by management procedures

Mink production does not involve any management procedures mutilating the animals such as castration, trimming, teeth or tail cutting, not even marking of the animals. Two management procedures that might be painful if applied incorrectly are vaccination and blood sampling for prevention or testing and stamping out diseases. Due to their purpose, however, these two management procedures are not considered under this criterion.

Title	Killing methods for pelting of mink
Scope	Management/resource-based measurement: Periods 1, 2 and 3
Sample size	The killing methods in use at the farm
Method description	Ask the farmer how mink are killed for pelting at the farm and how many methods/units (*e.g.* killing boxes) are in use on the farm at pelting time and inspect and evaluate all methods/units. If killing boxes are used there should be a gas hose for the gas used for killing or connection to a gas engine for carbon monoxide release into the box. The hose for transfer of the gas should not be broken, destroyed or worn out, as this could cause insufficient levels of gas in the box. If a gas engine is used, the gas must be cleaned and cooled before entering the box. Working procedures must secure sufficient concentration of gas before animals are put into the box. During an outbreak of disease the general procedure for killing mink at pelting may be needed. Therefore access within two days to functioning killing methods/boxes is necessary all year round. In November and early December a large part of the mink that were born in May are killed and pelted. Check/evaluate all killing methods/boxes that are in use for functionality. Are they in a functional state or can they be made functional? (*i.e.* is gas available within 2 days if needed?) Killing boxes should be solid and not destroyed in any parts. They should have an opening at the top for putting individual animals in the box and this should have a lid so that it can be closed. Correctly applied, such methods include: CO > 4% (pure or from engine), CO_2 > 80%, lethal injection, head-only electrical stunning and head-to-body electrical stunning.

	Killing box/method level: **0 –** Box with no broken, destroyed or worn out parts and well-functioning gas transfer to the box. Working procedures secure sufficient amount and quality (*i.e.* clean and cool*)* of gas before use. Enough gas is available within 2 days if needed. Other documented and efficient killing method meeting the requirements of Council Regulation (See additional information). **1 –** Boxes with minor defects but gas transfer to the box is working AND/OR uncertain if working procedures secure sufficient amount and quality of gas before use (*i.e.* clean and cool*)*. Enough gas is available within 2 days if needed. Other killing method that is efficient but not sufficiently documented or doubt about meeting the requirements of Council Regulation (See additional information). **2 –** Old or worn out box with several defects or broken hose for the gas transfer into the box AND/OR working procedures does not secure sufficient amount and quality of gas before use (*i.e.* clean and cool). Not enough gas available within 2 days if needed. Other killing method that is not sufficiently documented or efficient or does not meet the requirements of Council Regulation (See additional information).
Classification	**Percentage** of killing boxes/methods in category 0, 1 or 2
Additional information	A list of killing methods and their key parameters approved by the COUNCIL REGULATION (EC) No 1099/2009 of 24 September 2009, on the protection of animals at the time of killing can be found at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:303:0001:0030:EN:PDF
	See also Council of Europe, Recommendation concerning fur animals at: http://www.coe.int/t/e/legal_affairs/legal_co-operation/biological_safety_and_use_of_animals/farming/Rec%20fur%20animals%20E% 201999.asp

Title	**Killing methods for individual mink**
Scope	Management/resource-based measurement: Periods 1, 2 and 3
Sample size	The killing methods in use at the farm
Method description	When sick or injured individual animals are found it should be possible to kill them instantly if treatment is not possible or when the best option to reduce pain and suffering is humane killing. Efficient means of killing individual mink should be available at all times. Assess the functionality of the killing equipment/method that are used on the farm, that it is functioning and without defects and that the farmer knows how to operate it. Correctly applied, efficient means of killing individual mink include: CO > 4 % (pure or from engine), CO_2 > 80%, lethal injection, head-only electrical stunning, head-to-Body electrical stunning, percussive blow to the head, Penetrative captive bolt device and firearm with free projectile. **Killing method level:** **0 –** Access to well-functioning efficient means of killing individual mink meeting the requirements of Council Regulation (See additional information). **1 –** Access to not very well-functioning or efficient means of killing individual mink or no gas available at the visit or doubt about meeting the requirements of COUNCIL REGULATION (See additional information). **2 –** No functioning equipment on the farm for killing individual animals that meets the requirements of Council Regulation (See additional information).
Classification	**Farm level:** **Killing method** in category 0, 1 or 2.

3.2.4 Appropriate behaviour

3.2.4.1 Expression of social behaviours

Title	**Social housing**
Scope	Management-based measurement: Period 3
Sample size	The farm
Method description	Ask the farmer how the mink are housed in different social combinations at the farm (register in sheet 1.2 of Annex A). **Specifically in Period 3**: Social housing is relevant only in Period 3 (after separation). **Farm level (juveniles):** **0 –** Pair housing one male and one female **1 –** Pair housing two of the same sex or group housing, *i.e.* three or more mink in the same cage (including an adult female with two or more juveniles) **2 –** Single housing **Farm level (adult dams):** **0 –** Single housed **1 –** Housed together with one or two male juveniles **2 –** Family housed together with her litter **3 –** Housed together with other adult(s)
Classification	**Percentage of juveniles** housed according to 0, 1 or 2 **Percentage of adult dams** housed according to 0, 1, 2 or 3

Title	**Age and procedures at weaning**
Scope	Management-based measurement: Period 2
Sample size	The farm
Method description	Ask the farmer about the strategy for weaning focusing on the normal, planned procedure. Assess the weaning procedure according to the classification described below. **Farm level:** Age at weaning in weeks **0 –** ≤ 6 **1 –** 7 **2 –** 8 **3 –** 9 **4 –** ≥ 10 including no weaning **Distance between dams and weaned kits:** Is the distance between the dams and the kits > approximately 20 m after weaning? **0 –** Long distance between dams and weaned kits **1 –** Short distance between dams and weaned kits **Litters kept together:** Are litters kept together for ≥ 7 days after weaning? **0 –** Together ≥ 7 days **1 –** Together < 7 days

Classification	The farm combination of the 20 potential combinations of 5 ages of weaning, 2 distances between dams and weaned kits and 2 periods of keeping the litter together.

Period 2	Age at weaning	Distance between dams and weaned kits	Are litters kept together for ≥ 7 days after weaning	% of animals
Situation 1	0	1	0	*P1*
Situation 2	0	1	1	*P2*
Situation 3	0	0	0	*P3*
Situation 4	0	0	1	*P4*
Situation 5	1	1	0	*P5*
Situation 6	1	1	1	*P6*
Situation 7	1	0	0	*P7*
Situation 8	1	0	1	*P8*
Situation 9	2	1	0	*P9*
Situation 10	2	1	1	*P10*
Situation 11	2	0	0	*P11*
Situation 12	2	0	1	*P12*
Situation 13	3	1	0	*P13*
Situation 14	3	1	1	*P14*
Situation 15	3	0	0	*P15*
Situation 16	3	0	1	*P16*
Situation 17	4	1	0	*P17*
Situation 18	4	1	1	*P18*
Situation 19	4	0	0	*P19*
Situation 20	4	0	1	*P20*

3.2.4.2 Expression of other behaviours

Title	**Stereotypic behaviour**
Scope	Animal-based measurement: Periods 1, 2 and 3
Sample size	Mink in the sample defined in 3.2.6
Method description	Stereotypic behaviour is defined as repetitive, invariant motor acts without any obviously function or goal. A common form of stereotypy in mink is pacing along the side of the cage but stereotypies can take many different forms. Three repetitions of the behaviour are used as criteria for repeatability. **Specifically in Period 2:** Only the Dam is observed. During observation, the observer keeps a distance from the mink, for example, by observing the mink from the parallel row or a nearby shed to minimise the impact of the observer on the mink.

	Let the mink habituate until they do not pay attention to the presence of the observer, before starting the registration of stereotypic behaviour (usually a few seconds but one minute maximum) Observe the cage-section for 2 minutes and note the number of mink per cage that were active and the number of mink that performed stereotypic behaviour within the 2 minutes (3 or more repetitions). Depending on the layout of the shed, one or two sections of battery type pens typically of 6 cages each can be observed at the same time. Mink are primarily active at dawn and at dusk and before feeding, which makes it important to synchronise the observations in practise. In order to overcome the variation in stereotypies during the day due to daily rhythm in the minks´ activity or between periods due to the feeding strategy, the observation of stereotypies in all three periods is performed from 1 hour before the usual (expected) time of feeding. If the observations cannot be completed before the time of feeding, ask the farmer to postpone the feeding until the observation of stereotypic behaviour is completed as the mink should not be able to hear the feeding machine during the observation. **Individual level:** **0 –** Not active (lying in the cage or in the nest box with only minor changes in the lying position) **1 –** Stereotypic behaviour (three or more repetitions in a row of the same behavioural pattern)
Classification	**Farm level:** The **percentage** of mink observed performing stereotypic behaviour

Title	**Cage enrichments**
Scope	Resource-based measurement: Periods 1, 2 and 3
Sample size	The sample defined in 3.2.6
Method description	Check the availability of bedding material and of one or more occupational objects in the cage that may promote a more varied behavioural pattern. In order to cover all types of enrichments that may be used in practice and to include future enrichments, the occurrence of environmental enrichments is classified in three levels according to the documented effect. For example, to decrease abnormal behaviour such as stereotypy or fur chewing, to reduce baseline stress or to increase health. This classification is the same as that used for evaluation of the validity and reliability of measurements: **0 –** High certainty: Solid and complete data available; strong evidence in multiple references with most authors coming to the same conclusion **1 –** Medium certainty: Some or only incomplete data available; evidence provided in small number of references; authors' conclusions vary from one to the other; solid and complete data available from other species which can be extrapolated to the species considered **2 –** Low certainty: Scarce or no data available; evidence provided in unpublished reports or based on personal observations or communications; authors' conclusions vary considerably between the reports In this way new enrichments can be included as their effect is documented. If other enrichments that do not fit into the descriptions listed below with high or medium certainty are observed, these are registered under low certainty until the effects have been evaluated and documented.

In all periods:
Access to beneficial enrichments with:

0. High certainty:
    - Platforms (or attached tubes) at least 20cm above the cage floor, big enough to allowed the mink to rest on the platform or in the tube
    - Biting ropes
    - Soft plastic tubes (unfixed)
1. Medium certainty:
    - Straw, straw like material and straw briquettes
    - Hard plastic tubes, plastic chains, or balls
    - Running wheel
    - Swimming water
    - Other water-based enrichments
2. Low certainty:
    - Other objects not yet documented

More than two enrichments in a high category are added to the category below (*e.g.* three high certainty enrichments equal two high certainty enrichments and one medium certainty enrichment).

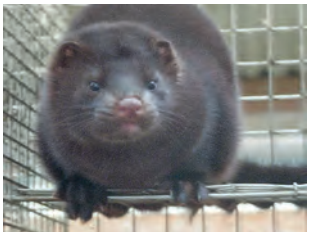
Classification

Calculate the **percentage** of mink in each of the situations resulting from the combination of the number of enrichments with certainty level 0, 1 or 2.

All periods	Number of high certainty enrichments	Number of medium certainty enrichments	Number of low certainty enrichments	% of animals
Situation 1	2	2	≥2	*P1*
Situation 2	2	2	1	*P2*
Situation 3	2	2	0	*P3*
Situation 4	2	1	≥2	*P4*
Situation 5	2	1	1	*P5*
Situation 6	2	1	0	*P6*
Situation 7	2	0	≥2	*P7*
Situation 8	2	0	1	*P8*
Situation 9	2	0	0	*P9*
Situation 10	1	2	≥2	*P10*
Situation 11	1	2	1	*P11*
Situation 12	1	2	0	*P12*
Situation 13	1	1	≥2	*P13*
Situation 14	1	1	1	*P14*
Situation 15	1	1	0	*P15*
Situation 16	1	0	≥2	*P16*
Situation 17	1	0	1	*P17*
Situation 18	1	0	0	*P18*
Situation 19	0	2	≥2	*P19*

Situation 20	0	2	1	*P20*
Situation 21	0	2	0	*P21*
Situation 22	0	1	≥2	*P22*
Situation 23	0	1	1	*P23*
Situation 24	0	1	0	*P24*
Situation 25	0	0	≥2	*P25*
Situation 26	0	0	1	*P26*
Situation 27	0	0	0	*P27*

Additional information



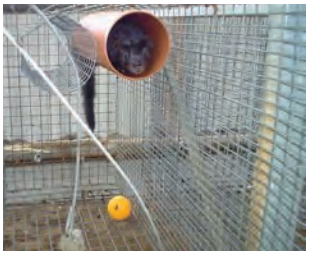
Platform enrichment (0)

Straw briquettes (1) and soft plastic tube (0)

Straw enrichment (1)

Hard plastic tube (1)

Biting rope (0)



Biting ropes (0), open and closed attached tubes (0) + ping pong ball (2)

Photos: © Steen H. Møller, Steffen W. Hansen & Bente K. Hansen

Title	**Fur chewing**
Scope	Animal-based measurement: Periods 1 and 3
Sample size	Mink in the sample defined in 3.2.6
Method description	Fur chewing is defined as mink chewing their own fur or that of a cage mate. Fur chewing is most often observed on the tip of the tail but larger area on the tail and body may be fur-chewed. Observe all mink in the cage and record fur chewing. If two or more areas of fur chewing are observed in the same mink, each is scored and the added score is recorded. However, 3 is the maximum score recorded, for example, 1+1=2, 1+2=3, 1+3=3, 2+2=3... **Individual level:** **0 – No/very little** fur chewing (The outer tip of the tail is not visible (not naked) and/or less than 0.5cm^2 of the tail or body has been chewed).

	1 – Moderate fur chewing (The outer tip of the tail is visible (naked) and/or fur chewing of less than 3cm of the tail or less than 3 x 3cm fur chewing of the body). **2 – Severe** fur chewing (> 3cm of the tail or > 3 x 3cm of the body has been chewed). **3 – Extensive** fur chewing (> 10cm of the tail or > 10 x 10cm of the body has been chewed).
Classification	**Percentage of mink** with fur chewing at level 0, 1, 2 or 3.
Additional information	 Fur chewing, Score 0  Fur chewing, Score 1  Fur chewing, Score 3 **Photos** : © Steen H. Møller & Steffen W. Hansen

3.2.4.3 Good human-animal relationship & Positive emotional state

Title	**Temperament test**
Scope	Animal-based measurement: Periods 1, 2 and 3
Sample size	Mink in the sample defined in 3.2.6
Method description	The aim is to categorize the temperament of the mink as being explorative, fearful, aggressive or undecided. The mink can be tested at any time except in the period from one hour before the usual time of feeding (because of the stereotypy observations) to 30 minutes after feeding. If the mink are in the nest box make sure that the mink are awake and aware of your presence, for example, by making noise drawing the wooden tongue spatula across the wire netting. In order to categorize fearful mink correctly the mink should be shut out from the nest box, but this would make the test unfeasible. An approach-avoidance assessment has therefore been included to handle this. The assessor stands still in the aisle in front of the mink cage and puts a wooden tongue spatula through the wire netting in the middle of the front of the mink cage, 3 - 4 inches from the top, which is usually the door, depending on cage design. The mink's first stable reaction (within 15 sec.) to the spatula is recorded according to the four categories (see photographic reference). **Specifically in Period 3:** Due to social interactions the testing of cages with more than 2 mink can be more complicated. The procedure is basically the same but in two-floor cages, two tongue spatulas (one in each floor) may be needed if the mink are present on both floors during testing or if one mink (often a female) is prevented from approaching the stick due to the presence of one or more other mink. **Individual level:** **Exploratory:** The mink approaches, makes contact with and explores the tongue spatula. Also mink that makes a rapid attack but quickly revert to exploration **Fearful:** The mink flee away from the tongue spatula and retreats into the cage or the nest box without having contact with the spatula. Mink that focus on (are aware of) the tongue spatula but do not leave the nest box enough to get closer than 15 cm from the tongue spatula. **Aggressive:** The mink makes an intense attack on the tongue spatula, bites it and maintains the bite (often combined with hissing sound and tail flick).

	Undecided: The mink does not reach a stable reaction but shifts between more than one, does not react according to one of the three above-mentioned ways, stays in the nest box or does not react within 15 seconds. Mink that focus on (are aware of) the tongue spatula and leaves the nest box enough to get closer than 15 cm from the tongue spatula but does not make exploratory contact within 15 seconds.
Classification	**Farm level:** **Percentage of mink** with each of three categories of temperament: **0: Exploratory** **1: Aggressive or Undecided** **2: Fearful**
Additional information	   Exploratory (0) Aggressive (1) Fearful (2) **Photos** : © Steen H. Møller & Steffen W. Hansen

Title	**Frequency and duration of handling and transportation**
Scope	Management-based measurement: Periods 1, 2 and 3
Sample size	The farm
Method description	Handling is defined by catching or trapping the mink and removing it from the cage or nest box. Mink may be caught and handled for a number of reasons, for example, vaccination, inspection (*e.g.* at grading), weighing, moving to another cage (*e.g.* at weaning or separation of juveniles), for mating, to another farm *etc*. Each time the animal is affected by the catching and by the duration of the time it is caught, handled or transported. Consult the farmer about pre-planned management routines involving handling for the full actual production period (not only the observation periods). **Specifically in Period 1:** The mink selected as next years' breeders are often moved from the cage where they grew up to another shed for the winter. This may be before or at the beginning of Period 1. In order to keep things simple, this moving is always recorded as part of period 1, while live animal grading is recorded exclusively as part of period 3. **Specifically in Period 2:** The mink are moved briefly for mating (usually the females) and often a number of times. Mated females are often moved before parturition and again at weaning. Juveniles are often separated (and sometimes moved to other farms) for the growing period. Counting or moving kits to other dams is not regarded as handling until the kits are 4 weeks of age - and can hear and see. **Specifically in Period 3:** The juveniles are often handled for vaccination, weighing and sorting of breeders before pelting time. In order to keep things simple, live animal grading is recorded exclusively as part of period 3, even if it may extend into period 1.

	Within the current farming practice: 1a: How often are mink caught, handled and/or moved for less than 1 minute? 1b: How many mink (or % of the population) are involved? 2a: How often are mink caught, handled and/or moved for more than 1 minute but less than an hour? 2b: How many mink (or % of the population) are involved? 3a: How often are mink caught, handled and/or moved for more than an hour? 3b: How many mink (or % of the population) are involved?
Classification	**Farm level:** Calculate the average number of times mink are caught and handled: **1 –** Average number of times mink are caught and handled for less than 1 minute **2 –** Average number of times mink are caught and handled for more than 1 minutes but less than an hour **3 –** Average number of times mink are caught and handled for more than an hour

3.2.5 Guidelines for a farm visit

3.2.5.1 Before the visit

Before the farm visit, the assessor needs to inform the farmer about the purpose of the visit, how it is conducted and what preventive measures are taken against spreading of disease. In order to be able to stratify the sampling to sections covering the minks' age, social grouping, colour types and housing facilities, the assessor needs to get the background information needed. This includes number and distribution of colour types of mink in the sheds, social grouping in Period 3, and the general farm layout (number and type of sheds, cage types, and watering systems) (registration sheet 1 of Annex A). Ask for the usual time of feeding and make an agreement with the farmer to be able to observe stereotypic behaviour before feeding.

3.2.5.2 Bio-security

Adhere to the individual farms' own bio-security requirements and take care to shower, change clothing and clean and disinfect boots and other non-disposable items (*e.g.* clipboard, torch etc.) after each visit. Make sure to comply with national or regional bio-security regulations for mink farms.
The assessor should park his/her vehicle outside the farm area.

3.2.5.3 Equipment required

- Tablet with the WelFur Mobile Application for data collection and registration sheets, description and board for backup
- Cards with section and cage number to mark the cage sections in the sample
- Torch to observe the nest box and animals for injuries and fur chewing
- Tongue spatulas for temperament tests
- Equipment to test the functioning of water nipples
- Folding ruler or measuring tape for measuring cage size
- Device for getting the mink out of the nest box
- Measures for disinfection of equipment (the torch, the folding ruler)
- Clean clothes and boots/shoe covers

3.2.5.4 The farm visit

Check and confirm the previously agreed information at the beginning of the actual visit and fill in further information that might be needed in order to define a representative sample as described in section 3.2.6. Discuss and record the management-based measurements with the farmer or agree on a more appropriate time to do so. Repeat your brief

explanation of what is about to be done during the course of the visit, since the person hosting the visit may not be familiar with the assessment. Explain to the farmer that there will be an assessment of animal-based and resource-based measurements and how long these will approximately take to complete. Ask the farmer to show you the location of the mink selected as your representative sample and make a brief sketch or note of the buildings for personal records, for example, on a farm print from Google maps or similar. Show the farmer the labelling of the selected cage sections – and explain that these will be left in order to make the observation results transparent to the farmer after the visit – and may then be removed by the farmer.

Thank the farmer for their time and help during the visit. Inform the farmer about observations that may be of special interest, for example, sick or injured mink. Explain how data are treated and how and when the outcome can be expected.

3.2.6 Sampling and practical information

3.2.6.1 Sample size

A representative sample of the mink on the farm is selected according to social housing, sex, age and colour type for each of the three observation periods. Thereafter shed type, cage system and watering systems are included in the selection of the sample. Each sample consists of 120 cages equal to 20 cage sections of 6 cages. In case of other types of cage systems stick to the sample size of 120 cages, for example, in case of 5, 7 or 8 cages per section, mark 20 sections of 6 cages by the pre-printed cards with section and cage number. The smallest unit in the sampling is a section of 6 cages and therefore typically 5 % of the total sample.

In Period 1 the breeders are normally kept singly in the cages and the sample of 120 cages is primarily selected according to sex, colour type and housing. In Period 2 a sample of 120 litter/females is taken, including barren females which occur in the selected sections. If litters are housed in every second cage 40 sections are sampled. In Period 3 a key parameter is social housing of mink (which may well be confounded with, for example, colour type and shed). Sampling in Period 3 is therefore more complicated and as each cage holds more mink, the sample size is reduced to 15 sections and 90 cages:

1. Calculate the proportion of dams housed singly, paired with a juvenile or with more than one juvenile in Sheet 1.2 Table 2 (Annex A).

2. Calculate the proportion of juvenile mink housed singly, pair-wise or in groups (more than 1 mink of each sex) in Sheet 1.2, Table 3 (Annex A). For example, 1 male + 1 female, 1 male + 2 females, 2, 3 or 4 females and so on.

3. In Sheet 1.2, Table 4 (Annex A), calculate the number of mink in total and divide by the number of sections to be sampled (*e.g.* 15). This is the reference number of mink that roughly should justify a section of cages to be sampled. (For example, if the number of adult males is way below this number, no males are sampled.) If the number of pair-housed juveniles is roughly 4 times this number, four sections are sampled. Distribute the number of cage sections according to 1 and 2 using Table 4 in Sheet 1.2 (Annex A).

4. Calculate roughly the proportion of colour types involved in the different social group housing combinations and distribute the number of sections of cage sections.

3.2.6.2 Practical information

Mark/label the sections selected by the cards with section and cage number that is easy to observe also from outside or from some distance (for example for observation of stereotypy). Plan to take the animal based measurements in the order defined in Sheet 3 (Annex A), so that most measurements can be taken as part of the same observation. Make sure that you are able to observe stereotypic behaviour from one hour before the usual time of feeding. If needed, agree with the farmer that you can finish the observation before feeding. If the mink are fed several times a day, stereotypy is observed before the main feeding during the farm visit.

For all observation periods only mink included in the representative sample are considered for collection of the resource- and animal-based measurements given in the table below. The management-based measurements include all mink affected on the farm: For example, "mortality" is measured as percentage of total number of animals in each period,

which is specially important when kits are included in period 2.
An overview of the order in which the information and the measurements can be collected and how much time the recordings may take, is given in Table 2.

Information collected	Specification	Time & sheet(s) required
Practical information	Specifying a representative sample	**60 minutes Sheets 1 and 2**
Type of watering system	Management-based measurement: Periods 1, 2 and 3	
Social housing	Management-based measurement: Period 3	
Mortality	Animal-based measurement: Periods 1, 2 and 3	
Killing methods	Management-based measurement: Periods 1, 2 and 3	
Age and procedure at weaning	Management-based measurement: Periods 1, 2 and 3	
Frequency and duration of handling and transportation	Management-based measurement: Periods 1, 2 and 3	
Function and cleanliness of the water points	Resource-based measurement: Periods 1, 2 and 3	**15 minutes Sheet 3**
Diarrhoea	Animal-based measurement: Periods 1, 2 and 3	
Temperament test	Animal-based measurement: Periods 1, 2 and 3	**60 minutes Sheet 3**
Body condition score	Animal-based measurement: Periods 1, 2 and 3	**90 minutes Sheet 3** While these measurements are taken, the rest of the below measurements in sheet 3 can also be observed
Fur chewing	Animal-based measurement: Periods 1 and 3	
Skin lesions or injuries to the body	Animal-based measurement: Periods 1, 2 and 3	
Lameness or impaired movement	Animal-based measurement: Periods 1, 2 and 3	
Obviously sick animals	Animal-based measurement: Periods 1, 2 and 3	
Access to a nest box	Resource-based measurement: Periods 1, 2 and 3	**30 minutes Sheet 3**
Resting quality of the nest box/resting area	Resource-based measurement: Periods 1, 2 and 3	
Cage enrichments	Resource-based measurement: Periods 1, 2 and 3	
Stereotypic behaviour	Animal-based measurement: Periods 1, 2 and 3	**60 minutes Sheet 3**
Space available for movement	Resource-based measurement: Periods 1, 2 and 3	**15 minutes Sheet 4**
Nest box material and bedding/nesting material	Resource-based measurement: Periods 1, 2 and 3	
Protection from exceptional weather conditions	Resource-based measurement: Periods 1, 2 and 3	

Table 2 Order of information collected, type of measurement and time required. For the resource based measurements and the animal based measurements a representative sample of 90-120 cages is selected.

The number of males and females in each cage is recorded in the registration sheet. For each of the measurements of Temperament test, Body Condition Score, Fur chewing, Skin lesions or injuries to the body, Lameness or impaired movement, Obviously sick animals and Stereotypic behaviour, the number of animals in each category is recorded.

During the nursing period the number of kits in each cage is recorded in the registration sheet. For each of the measurements of Obviously sick animals and of Skin lesions or injuries to the body the number of kits affected is recorded.

For the clinical measurements it is important that a good visual inspection of the body is possible. Therefore, mink hiding in the nest box have to be chased out in the cage if careful inspection in the nest box is not sufficient. As the same is the case for the body condition score (BSC) clinical measurements may most efficiently be recorded as part of or immediately after the scoring of body condition. During these procedures the other measurements in sheet 3 (except for stereotypy and functioning of water points) can also be recorded.

In general, empty cells are taken as a 0 and do not, therefore, have to be recorded. Binary measurements are, therefore, taken as 1 = "yes, there is a problem". Missing information must be marked with a horizontal line, for example, in the case of an empty cage in a sampled section.

Photo : © Kopenhagen fur

3.3 Calculation of scores for mink

3.3.1 Criterion-scores

From measurements to criterion-scores, up to 3 steps can be necessary. They are briefly presented in Figure 7.

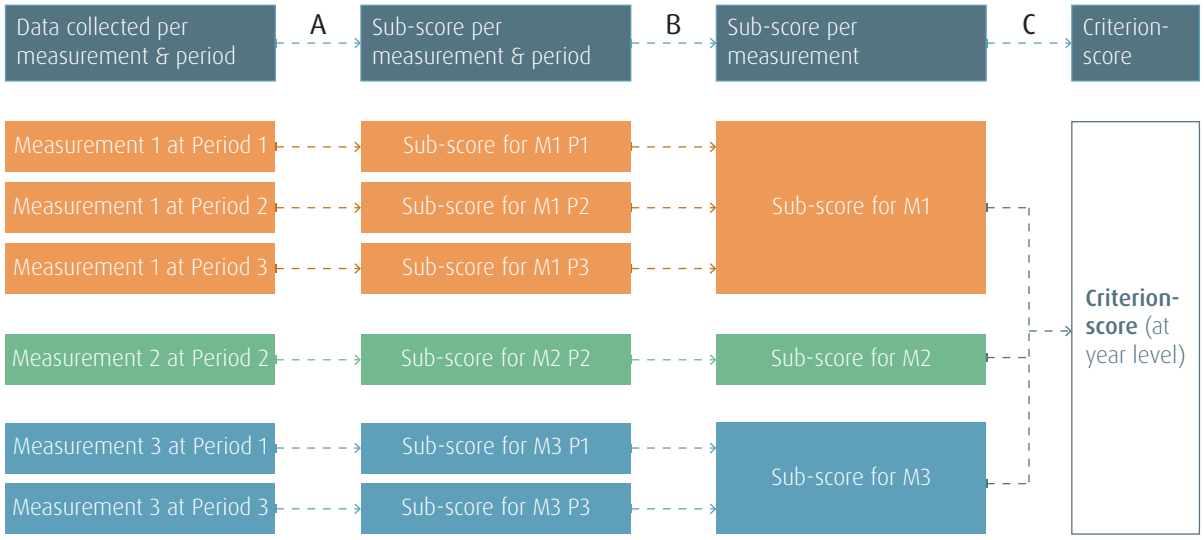


Figure 7 Up to 3 steps (called A, B and C) are necessary to go from raw data collected on farms to criterion-score, here presented as a virtual example: **A-** Interpretation in terms of welfare of data collected for a given measurement at a given period, **B-** Aggregation of sub-scores obtained for a given measurement at different periods and **C-** Aggregation of sub-scores obtained on the different measurements.

To perform those steps, different aggregation tools are used. These are summarised in Table 3.

Spline	% of animals in an impaired welfare state (*e.g.* % of lean mink) transformed into a score using least-squares spline curve fitting
Decision-tree	Construction of a decision-tree leading to X possible situations, scores directly assigned to each of these X situations
Decision-tree & % Rule	Construction of a decision-tree leading to X possible situations (including protection against freezing), scores directly assigned to each of these X situations + The worst situation observed on at least Y% of the animals is considered
Index & Spline	Calculation of an index based on a linear combination of the % of animals in the different categories (*e.g.* % of mink presented cages with an area above / at / below the recommendation), transformed into a score using least-squares spline curve fitting
Choquet	The sub-scores (*e.g.* one per period or one per measure) are synthesised thanks to a Choquet integral

Table 3 The different types of construction used to assess welfare on mink farms

More particularly, Table 4 presents the twelve criteria used to assess welfare of mink with, for each, the measurements used, the type of measurement (*i.e.* animal- or resource-based or taken from farm records), the period(s) concerned and the aggregation tools used.

Criterion number	Measurement	Type of measurement*	Period	No. of measurements	A-Construction at measurement level		B-Aggregation of periods per measurement	C-Aggregation of measurements
C1	Body condition score	A	P1, P2 & P3	1, 1, 1	Spline (% of too lean mink)		Choquet	no
C2	Continuous water availability	R	P1, P2 & P3	6, 6, 4	Decision-tree (16, 14, 16 situations, for P1, P2, P3 respectively) + 4 % Rule		Choquet	no
C3	Access to a nest box	R	P1, P2 & P3	1, 1, 1	Spline (% of animals with access to a nest box)		Choquet	Choquet
	Resting quality of the nest box	R + M	P1, P2 & P3	1, 1, 1	Index (% of mink with no/ one/ two / three or four problems) & Spline		Choquet	
C4	Protection from exceptional weather conditions	R + M	P1	1	Index (% of mink in cages with high / medium / low protection from wind) & Spline		Choquet	Choquet
			P2 & P3	4, 4	Decision-tree (27 situations) +10 % Rule, different for P2 and P3			
	Nest box material and bedding / nesting material	R	P1, P2 & P3	1, 1, 1	Index (% of mink with high / moderate / low / bad protection) & Spline		Choquet	
C5	Floor area	R	P1, P2 & P3	1, 1, 1	Index (% of mink in cage with good / moderate / bad area) & Spline	P3: Choquet (to aggregate the two sub-measurements) T	Choquet	Choquet
	Floor area/extra mink more than 2	R	P3	1	Spline (% of mink in cage with bad area/ extra mink)			
	Cage height	R	P1, P2 & P3	1, 1, 1	Index (% of mink in cage with high / medium / low cages) & Spline		Choquet	
C6	Skin lesions or injuries to the body	A	P1, P2 & P3	1, 1, 1	Index (% of mink without injuries / with injuries of category 1 / with injuries of category 2 / with injuries of category 3) & Spline		Choquet	no

* *Type of measurement: observed on the farm may be animal-based (A), resource-based (R) or management-based (M)*

Table 4 Measurements and construction tools for each criterion
Table 4a Criteria 1 to 6

Criterion number	Measurement	Type of measurement*	Period	No. of measurements	A-Construction at measurement level		B-Aggregation of periods per measurement	C-Aggregation of measurements
C7	Mortality	A	P1	1	Spline (% of dead mink)		Choquet	Choquet
			P2 sub-P1	1	Spline (% of dead mink)	Choquet		
			P2 sub-P2	1	Spline (% of dead mink)			
			P2 sub-P3	1	Spline (% of dead mink)			
			P3	1	Spline (% of dead mink)			
	Diarrhoea	A	P1, P2 & P3	1, 1, 1	Spline (% of mink with evidence of diarrhoea), different for P1, P2 and P3		Choquet	
	Lameness or impaired movement	A	P1, P2 & P3	1, 1, 1	Spline (% of mink, including kits) with evidence of impaired movement), different for P1, P2 and P3		Choquet	
	Obviously sick animals	A	P1, P2 & P3	1, 1, 1	Spline (% of mink, including kits) with evidence of impaired movement), different for P1, P2 and P3		Choquet	
C8	Killing method for pelting of mink	R + M	P1, P2 & P3	1, 1, 1	Index (% of mink killed with good / acceptable / bad method of killing) & Spline, different for P1, P2 and P3		Choquet	Choquet
	Killing method for individual mink	R + M	P1, P2 & P3	1, 1, 1	Decision-tree (3 situations), different for P1, P2 and P3		Choquet	
C9	Social housing adult dams	M	P3	1	Index (% of dams housed with other adults / famely housed with her litter / housed with one or two male kits / singly housed) & Spline		no	Choquet
	Social housing juveniles	M	P3	1	Index (% of juvenile housed in groups of three or more mink in the same cage / housed in pair with the same sex cage mate or with the other sex cage mate / singly housed) & Spline		no	
	Age and procedures at weaning	M	P2	3	Decision-tree (20 situations) + 15 % Rule		no	
C10	Stereotypic behaviours	A	P1, P2 & P3	1, 1, 1	Spline (% of mink performing stereotypy), different for P1, P2 and P3		Choquet	Choquet
	Cage enrichments	R	P1, P2 & P3	1, 1, 1	Decision-tree (27 situations) + 6 % rule, different for P1, P2 and P3		Choquet	
	Fur chewing	A	P1 & P3	1, 1	Index (% of mink with no or very little / moderate / severe / extensive fur chewing) & Spline		Choquet	

C11 & C12	Temperament test	A	P1, P2 & P3	1, 1, 1	Index (% of exploratory / expressing other temperament (undecided or aggressive) / fearful mink) & Spline, different for P1, P2 and P3	Choquet	Choquet
	Frequency and duration of handling and transportation	M	P1, P2 & P3	1, 1, 1	Index (average number of handlings of mink < 1 min / 1 min ≤ Handling of mink < 1h / ≥ 1h) & Spline, different for P1, P2 and P3	Choquet	

* *Type of measurement: observed on the farm may be animal-based (A), resource-based (R) or management-based (M)*

Table 4b Criteria 7 to 12

3.3.1.1 Absence of prolonged hunger

The score of a farm with regard to the Criterion of *Absence of prolonged hunger* is calculated from the % of very lean mink for the three periods of the production cycle. So a the first step is to calculate one sub-score for each period, then to aggregate the three sub-scores obtained for each period in order to have the criterion-score covering the production cycle.

Sub-scores S_1, S_2 and S_3 for Periods 1, 2 and 3
The calculation of the sub-score is the same for each period:
The greater the % of very lean mink, the lower the criterion-score. As a consequence we first have to calculate an intermediate value, for each period, called *index*:

Let I_1 = 100 - % of very lean mink in Period 1
Let I_2 = 100 - % of very lean mink in Period 2
Let I_3 = 100 - % of very lean mink in Period 3

I_i is computed into a score using *I*-spline functions (Figure 8) as follows:

$$\textbf{Score} = a_x + b_x \times I_i + c_x \times I_i^2 + d_x \times I_i^3 \qquad i = 1, 2 \text{ or } 3$$

with $x = 1$ when $I_i < k$ and $x = 2$ when $I_i \geq k$

Criterion 1 - Periods 1, 2 and 3			
a_1	0	a_2	-30577.7933490208197326865047216
b_1	0.036580620948438544171033O	b_2	1042.46112689884694191277958 45
c_1	-0.000366403830266726635370 2	c_2	-11.84609744673154274607895 79
d_1	0.000022470504811338699706 1	d_2	0.04489265513391030998358 03
k	88		

with i = 1, 2 or 3 according to the period considered while assessing the farm.

Note: The coefficients are the same for the three periods since the interpretation in terms of welfare is the same whatever the period considered.

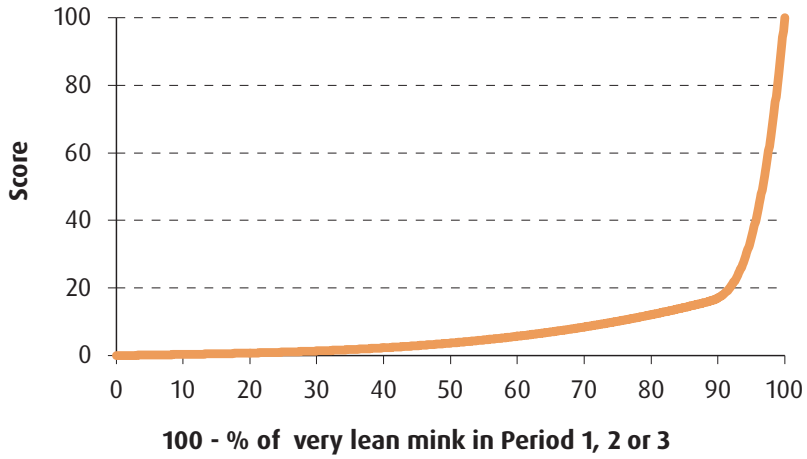


Figure 8 Calculation of the sub-score S_i for the Criterion of **Absence of prolonged** hunger according to the percentage of very lean mink in period i (with i= 1, 2 or 3)

Score for the Criterion of *Absence of prolonged hunger*

The three sub-scores are combined to form the global score for the Criter*ion of Absence of prolonged hunger* using a Choquet integral. Here is the formula:

Choquet integral:

$$C(a_1,\ldots,a_n)=\sum_{i=1}^{n}\left(a_{(i)}-a_{(i-1)}\right)\mu\left(\{(i),\ldots,(n)\}\right)$$

With the convention $a_{(0)}=0\le a_{(1)}\le\cdots\le a_{(n)}$ (*i.e.* a reordering of the periods (or measurements or criteria) depending on the score they obtained, from the worst period (or measurement or criterion to the best one).

$\mu(A)$ is a capacity function defined for any subset A of criteria entering in the composition of the principle. This capacity is subjected to the following constraints:

$$\begin{cases}\mu(\varnothing)=0\\ \mu(\{1,\cdots,n\})=1\\ A\subseteq B\Rightarrow\mu(A)\le\mu(B)\end{cases}$$

The parameters of the Choquet integral used to calculate the criterion 1-score are:

μ_1	=	0.11	μ_{12}	=	0.11
μ_2	=	0.08	μ_{13}	=	0.34
μ_3	=	0.22	μ_{23}	=	0.51

Reminder:

$$\text{Absence of prolonged hunger-score} = \begin{cases} S_1 + (S_2 - S_1)\mu_{23} + (S_3 - S_2)\mu_3 & \text{if} \quad S_1 \le S_2 \le S_3 \\ S_1 + (S_3 - S_1)\mu_{23} + (S_2 - S_3)\mu_2 & \text{if} \quad S_1 \le S_3 \le S_2 \\ S_2 + (S_1 - S_2)\mu_{13} + (S_3 - S_1)\mu_3 & \text{if} \quad S_2 \le S_1 \le S_3 \\ S_2 + (S_3 - S_2)\mu_{13} + (S_1 - S_3)\mu_1 & \text{if} \quad S_2 \le S_3 \le S_1 \\ S_3 + (S_1 - S_3)\mu_{12} + (S_2 - S_1)\mu_2 & \text{if} \quad S_3 \le S_1 \le S_2 \\ S_3 + (S_2 - S_3)\mu_{12} + (S_1 - S_2)\mu_1 & \text{if} \quad S_3 \le S_2 \le S_1 \end{cases}$$

Therefore, with the μ listed above:

$$\text{Absence of prolonged hunger-score} = \begin{cases} S_1 + 0.51(S_2 - S_1) + 0.22(S_3 - S_2) & \text{if} \quad S_1 \le S_2 \le S_3 \\ S_1 + 0.51(S_3 - S_1) + 0.08(S_2 - S_3) & \text{if} \quad S_1 \le S_3 \le S_2 \\ S_2 + 0.34(S_1 - S_2) + 0.22(S_3 - S_1) & \text{if} \quad S_2 \le S_1 \le S_3 \\ S_2 + 0.34(S_3 - S_2) + 0.11(S_1 - S_3) & \text{if} \quad S_2 \le S_3 \le S_1 \\ S_3 + 0.11(S_1 - S_3) + 0.08(S_2 - S_1) & \text{if} \quad S_3 \le S_1 \le S_2 \\ S_3 + 0.11(S_2 - S_3) + 0.11(S_1 - S_2) & \text{if} \quad S_3 \le S_2 \le S_1 \end{cases}$$

Where S_1, S_2 and S_3 are the scores obtained by a given farm during Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made of Periods 1 and 2 and so on...

3.3.1.2 Absence of prolonged thirst

We evaluate the daily water availability, the functioning and the cleanliness of the water points in different ways according to the period considered. These aspects are assessed in sheds containing animals, with no difference between all the types of animals and species.

For each cage the observer must answer the questions:

- *Is there continuous access to fresh water throughout Period i (including type of water supply, special arrangements for kits and functioning of the automatic watering system)?*
- *Is the watering system (nipple or cup) clean?*

Water availability is assessed in different ways for the three periods of the production cycle according to the type of climate during one period and the animals present on farm during each period (especially kits in Period 2). So the first, sub-scores are calculated at farm level for each of the three periods and, then, these three sub-scores are combined in order to obtain the Criterion-score covering the three periods of the production cycle.

Sub-scores S_1, S_2 and S_3 for Periods 1, 2 and 3
The score S_i (where i = 1, 2 or 3 according to the period considered) for the Criterion of *Absence of prolonged thirst* is assigned to the sample of mink according to the answers to the two questions (Figure 9, Figure 10 and Figure 11) as follows:

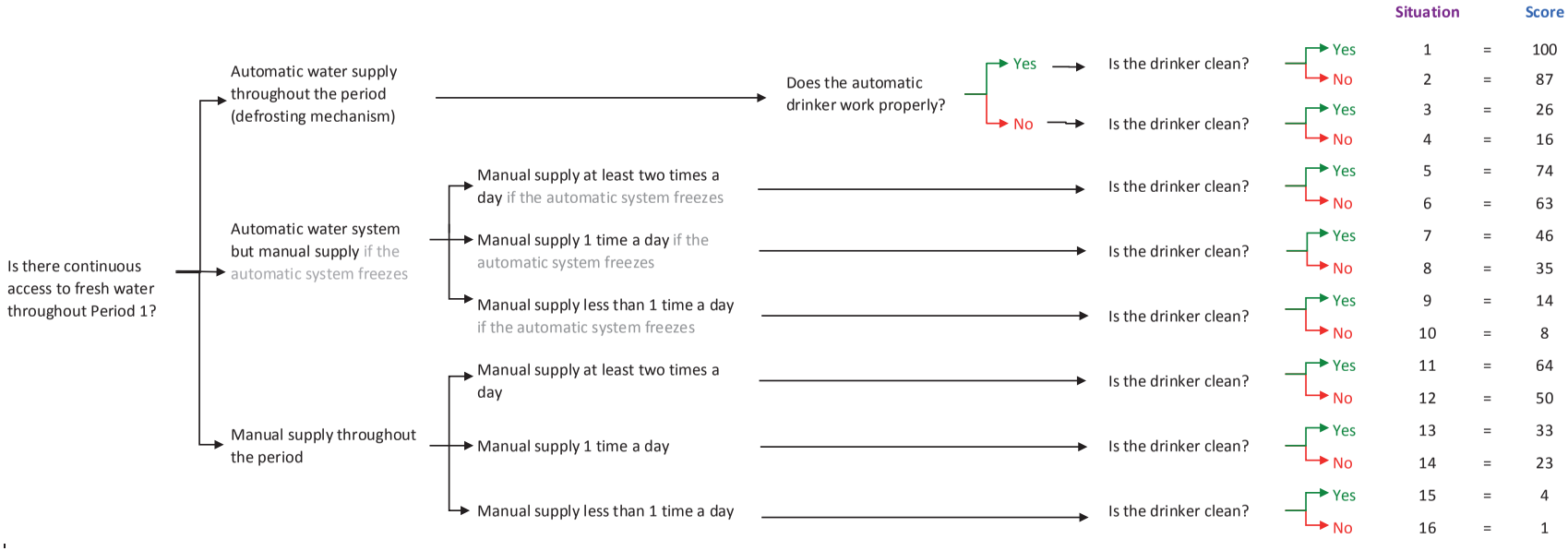


Figure 9 Sub-scores S_1 assigned to combinations of answers to questions on the Criterion of **Absence of prolonged thirst** in Period 1

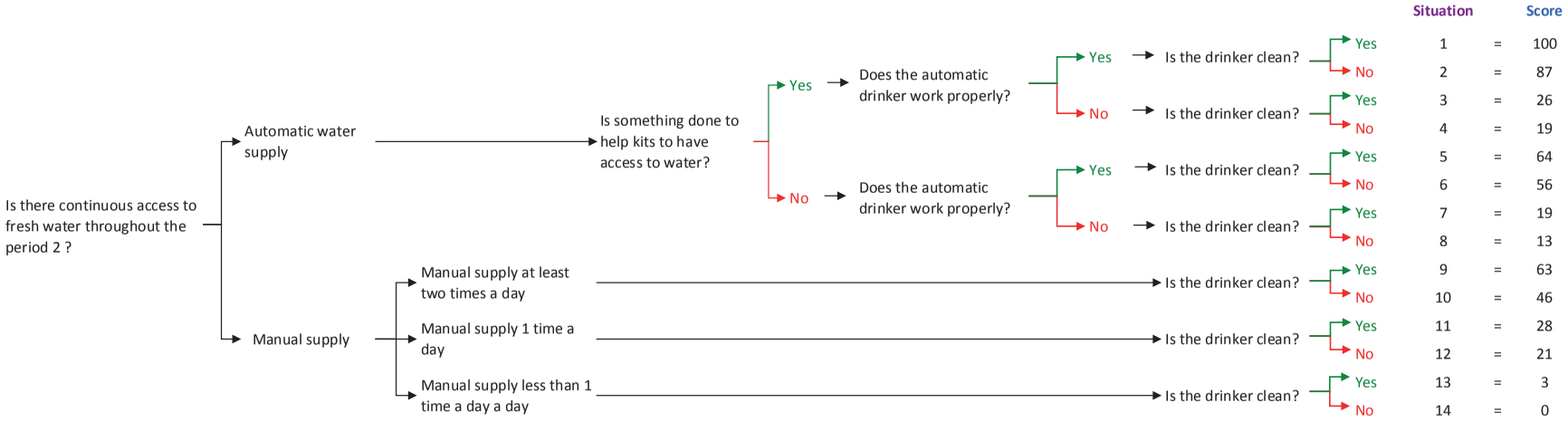


Figure 10 Sub-scores S_2 assigned to combinations of answers to questions on the Criterion **of Absence of prolonged thirst** in Period 2

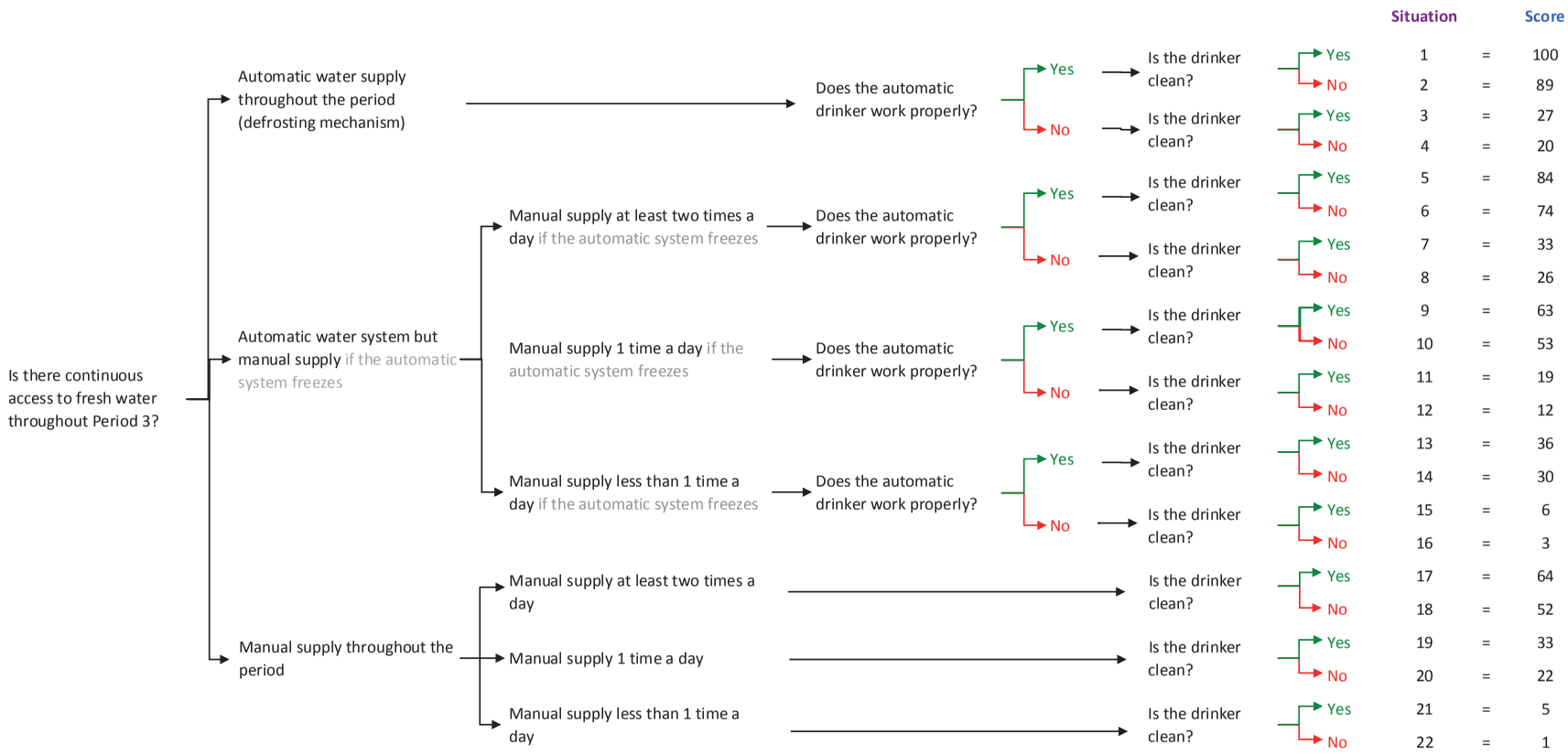


Figure 11 Sub-scores S_3 assigned to combinations of answers to questions on the Criterion of Absence of prolonged thirst in Period 3

Since animals may be housed with different water provision conditions, we consider the % of animals in each situation defined by the decision-tree and the final score to be assigned to the farm is the lowest score (= the one corresponding to the worst situation found on the farm) observed on at least 4 % of the animals.

Score for the Criter*ion of Absence of prolonged thirst*
The three sub-scores are combined to form the global score for the Criter*ion of Absence of prolonged thirst* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.00	μ_{12}	=	0.28
μ_2	=	0.28	μ_{13}	=	0.10
μ_3	=	0.04	μ_{23}	=	0.49

with 1 = Period 1, 2 = Period 2 and 3 = Period 3.

Reminder:

$$\text{Absence of prolonged thirst-score} = \begin{cases} S_1 + (S_2 - S_1)\mu_{23} + (S_3 - S_2)\mu_3 & \text{if} \quad S_1 \le S_2 \le S_3 \\ S_1 + (S_3 - S_1)\mu_{23} + (S_2 - S_3)\mu_2 & \text{if} \quad S_1 \le S_3 \le S_2 \\ S_2 + (S_1 - S_2)\mu_{13} + (S_3 - S_1)\mu_3 & \text{if} \quad S_2 \le S_1 \le S_3 \\ S_2 + (S_3 - S_2)\mu_{13} + (S_1 - S_3)\mu_1 & \text{if} \quad S_2 \le S_3 \le S_1 \\ S_3 + (S_1 - S_3)\mu_{12} + (S_2 - S_1)\mu_2 & \text{if} \quad S_3 \le S_1 \le S_2 \\ S_3 + (S_2 - S_3)\mu_{12} + (S_1 - S_2)\mu_1 & \text{if} \quad S_3 \le S_2 \le S_1 \end{cases}$$

Therefore, with the μ listed above:

$$\text{Absence of prolonged thirst-score} = \begin{cases} S_1 + 0.49(S_2 - S_1) + 0.04(S_3 - S_2) & \text{if} \quad S_1 \le S_2 \le S_3 \\ S_1 + 0.49(S_3 - S_1) + 0.28(S_2 - S_3) & \text{if} \quad S_1 \le S_3 \le S_2 \\ S_2 + 0.10(S_1 - S_2) + 0.04(S_3 - S_1) & \text{if} \quad S_2 \le S_1 \le S_3 \\ S_2 + 0.10(S_3 - S_2) + 0.00(S_1 - S_3) & \text{if} \quad S_2 \le S_3 \le S_1 \\ S_3 + 0.28(S_1 - S_3) + 0.28(S_2 - S_1) & \text{if} \quad S_3 \le S_1 \le S_2 \\ S_3 + 0.28(S_2 - S_3) + 0.00(S_1 - S_2) & \text{if} \quad S_3 \le S_2 \le S_1 \end{cases}$$

Where S_1, S_2 and S_3 are the scores obtained by a given farm for Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made of Periods 1 and 2 and so on...

3.3.1.3 Comfort around resting

Two partial scores are calculated, one for Measurement of *Access to a nest box* and one for Measurement of *Resting quality of the nest box/resting area*, before being combined into a criterion-score.
Moreover, these two measurements are assessed for the three periods of the production cycle. So the first step is to calculate the sub-score for each period, then to aggregate the three sub-scores obtained for each period in order to have the score covering the production cycle for each of these two measurements.

Sub-scores S_1^{nba}, S_3^{nba} and S_3^{nba} for Periods 1, 2 and 3 for Measurement of *Access to a nest box*

The score of a farm with regard to Measurement of *Access to a nest box* is calculated from the % of mink with access to a nest box, for the three periods of the production cycle.
The greater the percentage, the greater the measurement score.

The calculation of the sub-score is the same for each period:

In Period 1:
Let P_1 = % of mink with access to a nest box in Period 1

P_1 is computed into a score using *I*-spline functions (Figure 12) as follows:

Score = $a_x + b_x \times P_1 + c_x \times P_1^2 + d_x \times P_1^3$

with $x = 1$ when $P_1 < k$ and $x = 2$ when $P_1 \geq k$

Criterion 3 - Access to a nest box - Period 1			
a_1	0	a_2	-30414.758088391485216561704874 0
b_1	0.089099193168383744589888 8	b_2	1036.955800965983371497713960 7
c_1	-0.001012490832282802793659 6	c_2	-11.783588095970028319925404 5
d_1	0.000024092727352816118639 5	d_2	0.044655058953078384520463 1
k	88		

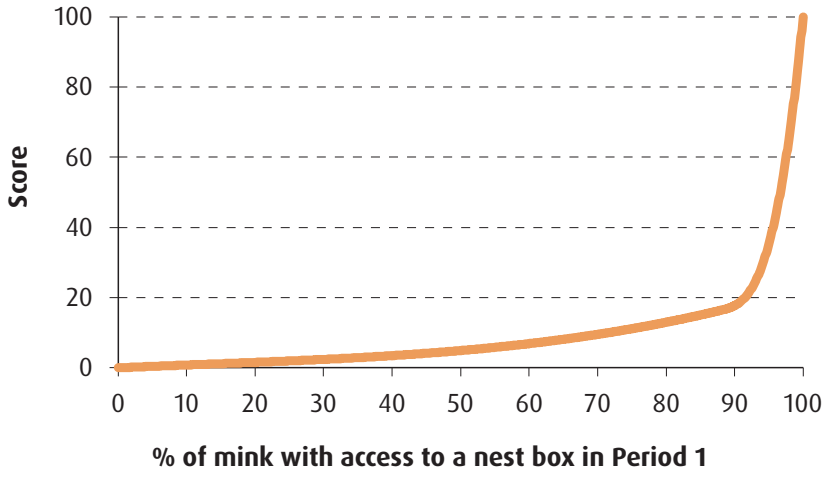


Figure 12 Calculation of the sub-score S_1^{nba} for Measurement of Access to a nest box according to the percentage of mink with access to a nest box in Period 1

In Period 2:
Let P_2 = % of mink with access to a nest box in Period 2

P_2 is computed into a score using *I*-spline functions (Figure 13) as follows:

Score = $a_x + b_x \times P_2 + c_x \times P_2^2 + d_x \times P_2^3$

with $x = 1$ when $P_2 < k$ and $x = 2$ when $P_2 \geq k$

Criterion 3 - Access to a nest box - Period 2			
a_1	0	a_2	-32802.564991341983841266483068 5
b_1	0.121582404802140789379372 2	b_2	1118.390788240672918618656694 9
c_1	-0.001268912299045598258279 1	c_2	-12.708872929742073054626416 7
d_1	0.000017353893435670675598 1	d_2	0.048152215466403941457329 6
k	88		

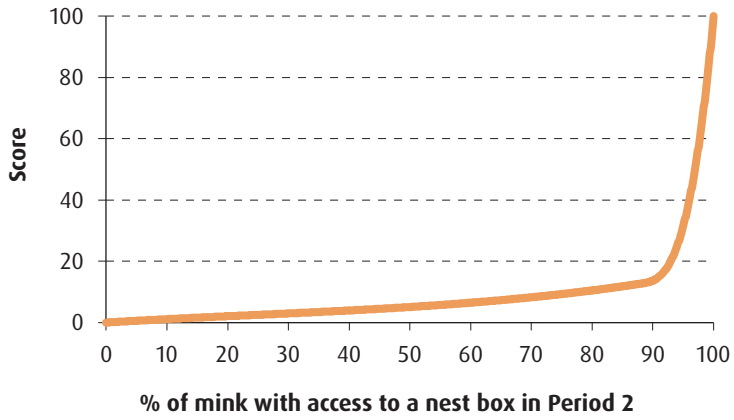


Figure 13 Calculation of the sub-score S_2^{nba} for Measurement of Access to a nest box according to the percentage of mink with access to a nest box in Period 2

In Period 3:
Let P_3 = % of mink with access to a nest box in Period 3

P_3 is computed into a score using *I*-spline functions (Figure 14) as follows:

Score = $a_x + b_x \times P_3 + c_x \times P_3^2 + d_x \times P_3^3$

with $x = 1$ when $P_3 < k$ and $x = 2$ when $P_3 \geq k$

Criterion 3 - Access to a nest box - Period 3			
a_1	0	a_2	-17020.509804360914131393656134 6
b_1	0.072727517954133166777630 5	b_2	593.811574664490535724326036 9
c_1	-0.000845668812950904884989 7	c_2	-6.904787203094159053762268 7
d_1	0.000027755782689466652120 7	d_2	0.026787224362589512338672 6
k	86		

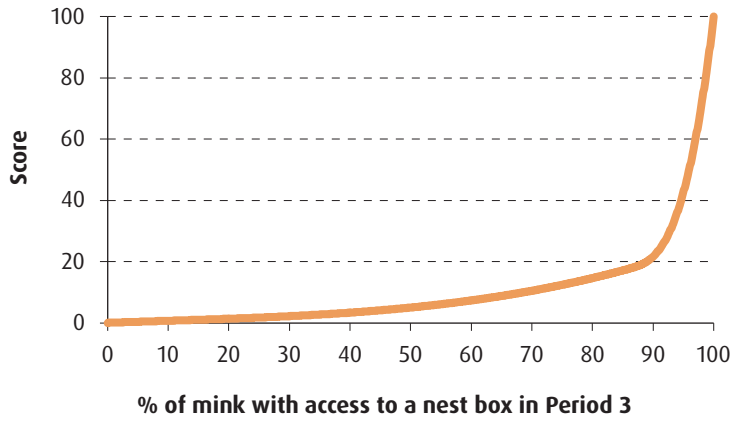


Figure 14 Calculation of the sub-score S_3^{nba} for Measurement of Access to a nest box according to the percentage of mink with access to a nest box in Period 3

Score S^{nba} for Measurement of *Access to a nest box*

The three sub-scores are combined to form the partial score S^{nba} for access to a nest box using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.05	μ_{12}	=	0.59
μ_2	=	0.21	μ_{13}	=	0.05
μ_3	=	0.00	μ_{23}	=	0.21

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^{nba}\text{-score} = \begin{cases} S_1^{nba} + \left(S_2^{nba} - S_1^{nba}\right)\mu_{23} + \left(S_3^{nba} - S_2^{nba}\right)\mu_3 & \text{if} \quad S_1^{nba} \le S_2^{nba} \le S_3^{nba} \\ S_1^{nba} + \left(S_3^{nba} - S_1^{nba}\right)\mu_{23} + \left(S_2^{nba} - S_3^{nba}\right)\mu_2 & \text{if} \quad S_1^{nba} \le S_3^{nba} \le S_2^{nba} \\ S_2^{nba} + \left(S_1^{nba} - S_2^{nba}\right)\mu_{13} + \left(S_3^{nba} - S_1^{nba}\right)\mu_3 & \text{if} \quad S_2^{nba} \le S_1^{nba} \le S_3^{nba} \\ S_2^{nba} + \left(S_3^{nba} - S_2^{nba}\right)\mu_{13} + \left(S_1^{nba} - S_3^{nba}\right)\mu_1 & \text{if} \quad S_2^{nba} \le S_3^{nba} \le S_1^{nba} \\ S_3^{nba} + \left(S_1^{nba} - S_3^{nba}\right)\mu_{12} + \left(S_2^{nba} - S_1^{nba}\right)\mu_2 & \text{if} \quad S_3^{nba} \le S_1^{nba} \le S_2^{nba} \\ S_3^{nba} + \left(S_2^{nba} - S_3^{nba}\right)\mu_{12} + \left(S_1^{nba} - S_2^{nba}\right)\mu_1 & \text{if} \quad S_3^{nba} \le S_2^{nba} \le S_1^{nba} \end{cases}$$

Therefore, with the μ listed above:

$$S^{nba}\text{-score} = \begin{cases} S_1^{nba} + 0.21\left(S_2^{nba} - S_1^{nba}\right) + 0.00\left(S_3^{nba} - S_2^{nba}\right) & \text{if} \quad S_1^{nba} \le S_2^{nba} \le S_3^{nl} \\ S_1^{nba} + 0.21\left(S_3^{nba} - S_1^{nba}\right) + 0.21\left(S_2^{nba} - S_3^{nba}\right) & \text{if} \quad S_1^{nba} \le S_3^{nba} \le S_2^{nl} \\ S_2^{nba} + 0.05\left(S_1^{nba} - S_2^{nba}\right) + 0.00\left(S_3^{nba} - S_1^{nba}\right) & \text{if} \quad S_2^{nba} \le S_1^{nba} \le S_3^{n} \\ S_2^{nba} + 0.05\left(S_3^{nba} - S_2^{nba}\right) + 0.05\left(S_1^{nba} - S_3^{nba}\right) & \text{if} \quad S_2^{nba} \le S_3^{nba} \le S_1^{n} \\ S_3^{nba} + 0.59\left(S_1^{nba} - S_3^{nba}\right) + 0.21\left(S_2^{nba} - S_1^{nba}\right) & \text{if} \quad S_3^{nba} \le S_1^{nba} \le S_2^{nl} \\ S_3^{nba} + 0.59\left(S_2^{nba} - S_3^{nba}\right) + 0.05\left(S_1^{nba} - S_2^{nba}\right) & \text{if} \quad S_3^{nba} \le S_2^{nba} \le S_1^{n} \end{cases}$$

Where $S^{nba}{}_1$, $S^{nba}{}_2$ and $S^{nba}{}_3$ are the scores obtained by a given farm for the partial score S^{nba} in Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made of Periods 1 and 2 and so on...

Sub-scores S_1^q, S_2^q and S_3^q for Periods 1, 2 and 3 for Measurement of *Resting quality of the nest box/resting area*
The score of a farm with regard to Measurement of *Resting quality of the nest box/resting area* is calculated from the % of mink in each category of quality of the nest box/resting area (4 levels here):

Level	**0**	**1**	**2**	**3**
% of mink	$p^q_{i,0}$	$p^q_{i,1}$	$p^q_{i,2}$	$p^q_{i,3}$
$\text{Let } I_i = \left(100 - \frac{\sum_{k=0}^{3} w^q_{i,j} \; p^q_{i,j}}{w^q_{i,3}} \right)$	with i = 1, 2 or 3 according to the period considered and j = 0, 1, 2 or 3 according to the level.			
Weights	$w^q_{i,0} = 0$	$w^q_{i,1} = 1$	$w^q_{i,2} = 2$	$w^q_{i,3} = 3$

I_i is computed into a score using *I*-spline functions (Figure 15) as follows:

Score = $a_x + b_x \times I_i + c_x \times I_i^2 + d_x \times I_i^3$ i = 1, 2 or 3

with x = 1 when $I_i < k$ and x = 2 when $I_i \geq k$

Criterion 3 - Quality of the nest box - Periods 1, 2 and 3			
a_1	0	a_2	-13.665871583481454365482932 2
b_1	-0.000000000000091373421580 53	b_2	1.024940368793673339808947 3
c_1	0.013617157616759903090986 1	c_2	-0.012006351603693144261542 1
d_1	-0.000082293892766292675469 5	d_2	0.000131235350741006523466 3
k	40		

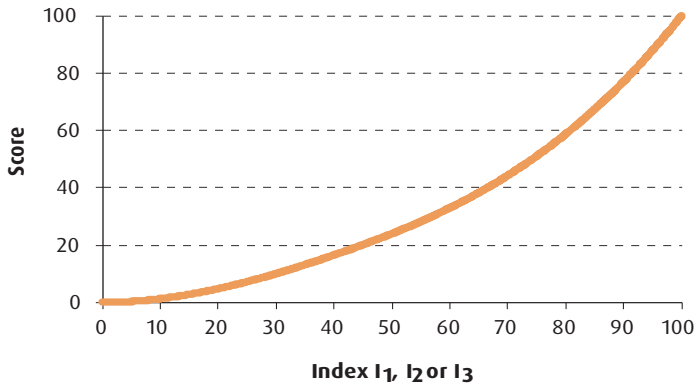


Figure 15 Calculation of the sub-score S_i^q for Measurement of ***Resting quality of the nest box/resting area*** according to the percentage of mink in each category of quality of the nest box/resting area (with i = 1, 2 or 3 according to the period considered)

Score S^q for Measurement of *Resting quality of the nest box/resting area*

The three sub-scores are combined to form the partial score S^q for Measurement of *Resting quality of the nest box/resting* area using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.11	μ_{12}	=	0.60
μ_2	=	0.28	μ_{13}	=	0.11
μ_3	=	0.00	μ_{23}	=	0.29

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

$$S^q\text{-score} = \begin{cases} S_1^q + \left(S_2^q - S_1^q\right)\mu_{23} + \left(S_3^q - S_2^q\right)\mu_3 & \text{if} \quad S_1^q \le S_2^q \le S_3^q \\ S_1^q + \left(S_3^q - S_1^q\right)\mu_{23} + \left(S_2^q - S_3^q\right)\mu_2 & \text{if} \quad S_1^q \le S_3^q \le S_2^q \\ S_2^q + \left(S_1^q - S_2^q\right)\mu_{13} + \left(S_3^q - S_1^q\right)\mu_3 & \text{if} \quad S_2^q \le S_1^q \le S_3^q \\ S_2^q + \left(S_3^q - S_2^q\right)\mu_{13} + \left(S_1^q - S_3^q\right)\mu_1 & \text{if} \quad S_2^q \le S_3^q \le S_1^q \\ S_3^q + \left(S_1^q - S_3^q\right)\mu_{12} + \left(S_2^q - S_1^q\right)\mu_2 & \text{if} \quad S_3^q \le S_1^q \le S_2^q \\ S_3^q + \left(S_2^q - S_3^q\right)\mu_{12} + \left(S_1^q - S_2^q\right)\mu_1 & \text{if} \quad S_3^q \le S_2^q \le S_1^q \end{cases}$$

Therefore, with the μ listed above:

$$S^q\text{-score} = \begin{cases} S_1^q + 0.29\left(S_2^q - S_1^q\right) + 0.00\left(S_3^q - S_2^q\right) & \text{if} \quad S_1^q \le S_2^q \le S_3^q \\ S_1^q + 0.29\left(S_3^q - S_1^q\right) + 0.28\left(S_2^q - S_3^q\right) & \text{if} \quad S_1^q \le S_3^q \le S_2^q \\ S_2^q + 0.11\left(S_1^q - S_2^q\right) + 0.00\left(S_3^q - S_1^q\right) & \text{if} \quad S_2^q \le S_1^q \le S_3^q \\ S_2^q + 0.11\left(S_3^q - S_2^q\right) + 0.11\left(S_1^q - S_3^q\right) & \text{if} \quad S_2^q \le S_3^q \le S_1^q \\ S_3^q + 0.60\left(S_1^q - S_3^q\right) + 0.28\left(S_2^q - S_1^q\right) & \text{if} \quad S_3^q \le S_1^q \le S_2^q \\ S_3^q + 0.60\left(S_2^q - S_3^q\right) + 0.11\left(S_1^q - S_2^q\right) & \text{if} \quad S_3^q \le S_2^q \le S_1^q \end{cases}$$

Where S^q_1, S^q_2 and S^q_3 are the sub-scores obtained by a given farm for Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made of Periods 1 and 2 and so on...

Score for the Criterion of *Comfort around resting*

The two partial scores are combined to form the global score for the Criterion of Comfort *around resting* using a Choquet integral. The parameters of the Choquet integral are:

μ_{nba}	=	0.49	μ_q	=	0.05

with nba, nest box access and q, quality of the nest box.

Reminder:

$$\text{Comfort around resting-score} = \begin{cases} S^{nba} + \left(S^{q} - S^{nba}\right)\mu_{q} & \text{if} \quad S^{nba} \le S^{q} \\ S^{q} + \left(S^{nba} - S^{q}\right)\mu_{nba} & \text{if} \quad S^{q} \le S^{nba} \end{cases}$$

Therefore, with the μ listed above:

$$\text{Comfort around resting-score} = \begin{cases} S^{nba} + 0.05\left(S^{q} - S^{nba}\right) & \text{if} \quad S^{nba} \le S^{q} \\ S^{q} + 0.49\left(S^{nba} - S^{q}\right) & \text{if} \quad S^{q} \le S^{nba} \end{cases}$$

Where S^{nba} and S^{q} are the partial scores obtained by a given farm for measurements of *Access to a nest box* and *Resting quality of the nest box/resting area* respectively.
μ_f and μ_p are the capacities of measurements of a*ccess to a nest box* and *Resting quality of the nest box/resting area* respectively.

3.3.1.4 Thermal comfort

Two partial scores are calculated, one for Measurement of Protection from exceptional weather conditions and one for Measurement of Nest box material and bedding/nesting material, before being combined into a criterion-score.
Moreover, these two measurements are assessed for the three periods of the production cycle. So the first step is to calculate the sub-score for each period, then to aggregate the three sub-scores obtained for each period in order to have the score covering the production cycle for each of these two measurements.

Sub-scores S_2^t, S_2^t and S_3^t for Periods 1, 2 and 3 for Measurement of *Protection from exceptional weather conditions*

Since climate changes between periods, Measurement of Protection from exceptional weather conditions is evaluated differently according to the needs of the mink to be protected against wind, draft or overheating. In Period 1, only protection from the wind is considered. In Periods 2 and 3, all these elements are taken into account and therefore the construction has to be done differently by combining them into a finite number of possible combinations.

In Period 1:

The score of a farm with regard to Measurement of *Protection from exceptional weather conditions* is calculated from the % of mink within each level of the scale used to assess protection from the wind (3 levels here):

Level	**0**	**1**	**2**
% of mink	p_0^t	p_1^t	p_2^t
$\text{Let } I_1 = \left(100 - \frac{\sum_{j=0}^{2} w_j^t \; p_j^t}{w_2^t}\right)$	with j = 0, 1 or 2 according to the level considered		
Weights	$w_0^t = 0$	$w_1^t = 1$	$w_2^t = 5$

I_1 is computed into a score using *I*-spline functions (Figure 16) as follows:

$$Score = a_x + b_x \times I_1 + c_x \times I_1^2 + d_x \times I_1^3$$

with $x = 1$ when $I_1 < k$ and $x = 2$ when $I_1 \geq k$

Criterion 4 - Protection from exceptional weather conditions - Period 1			
a_1	0	a_2	4.2769408581759496001950538
b_1	1.0139631146150960283591758	b_2	0.58626902881206910400635 48
c_1	-0.0157682180025724150151945	c_2	-0.0015117484760839175559483
d_1	0.0002106188579806710830036	d_2	0.0000522136410214378175396
k	30		

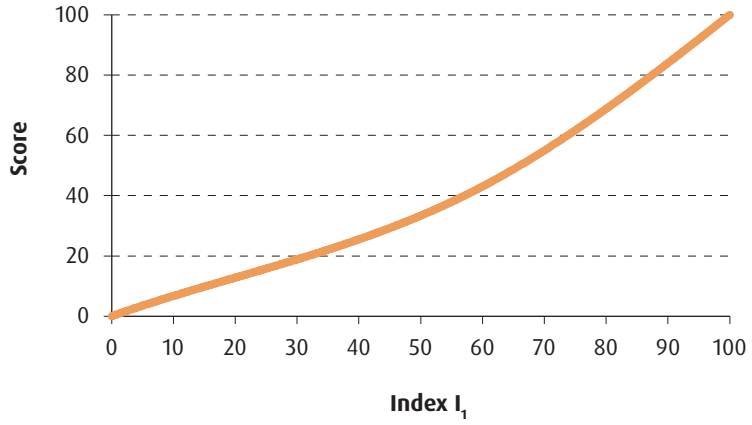


Figure 16 Calculation of the sub-score S_1^t for Measurement of **Protection from exceptional weather** conditions according to the percentage of mink in each category of protection from the wind in Period 1

In Periods 2 and 3:
One score is assigned to Measurement of Protection from exceptional weather conditions according to a decision tree combining the protection from wind, the protection from direct sunlight, the protection from thermal discomfort (is the farm inside or at risk of exceeding the thermal comfort zone) and the presence of means of cooling (Figure 17 and Figure 18). Since the interpretation in terms of welfare is different between the periods considered, the two periods are scored separately. Since animals may be housed with different environmental protection conditions, we consider the % of animals in each situation defined by the decision-tree and the final score to be assigned to the farm is the worst score (= the one corresponding to the worst situation found on the farm) observed on at least 10 % of the animals.

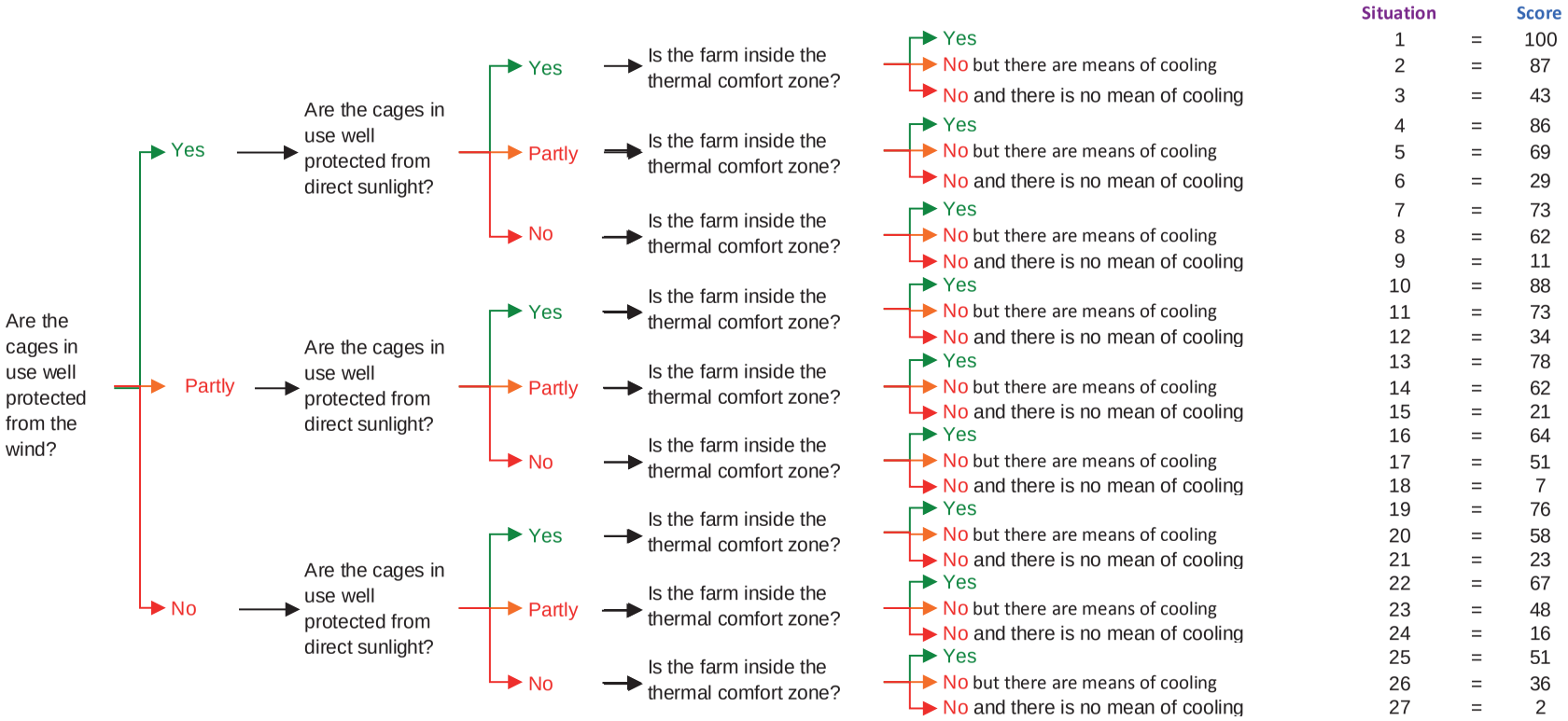


Figure 17 Sub-scores S_2^t assigned to combinations of answers to questions on **Measurement of Protection** from exceptional weather conditions in Period 2

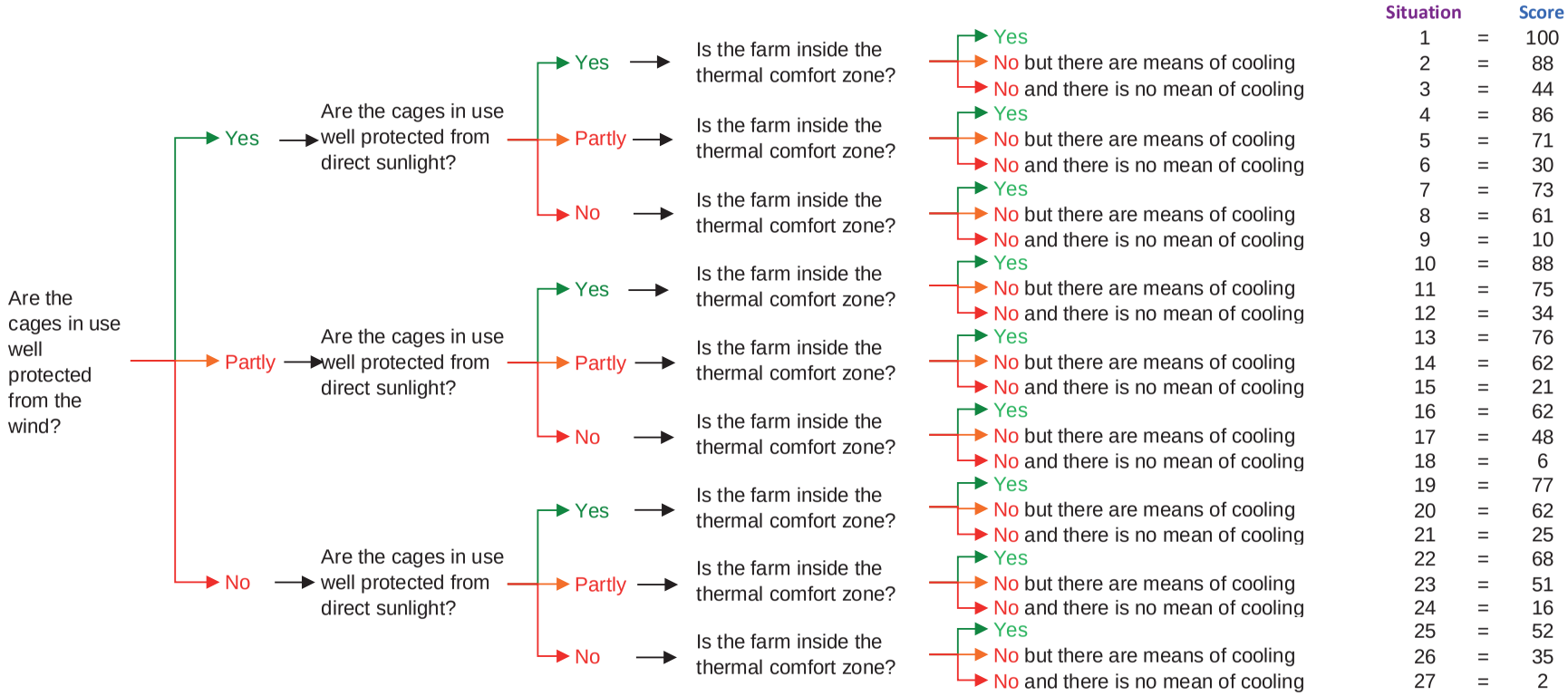


Figure 18 Sub-scores S_3^t assigned to combinations of answers to questions on Measurement of Protection from exceptional weather conditions in Period 3

Score S^p for Measurement of *Protection from exceptional weather conditions*

The three sub-scores are combined to form the partial score S^p for Measurement of *Protection from exceptional weather conditions* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.21	μ_{12}	=	0.59
μ_2	=	0.07	μ_{13}	=	0.21
μ_3	=	0.00	μ_{23}	=	0.10

with 1 = Period 1, 2 = Period 2 and 3 = Period 3.

Reminder:

$$S^p\text{-score} = \begin{cases} S_1^p + \left(S_2^p - S_1^p\right)\mu_{23} + \left(S_3^p - S_2^p\right)\mu_3 & \text{if} \quad S_1^p \le S_2^p \le S_3^p \\ S_1^p + \left(S_3^p - S_1^p\right)\mu_{23} + \left(S_2^p - S_3^p\right)\mu_2 & \text{if} \quad S_1^p \le S_3^p \le S_2^p \\ S_2^p + \left(S_1^p - S_2^p\right)\mu_{13} + \left(S_3^p - S_1^p\right)\mu_3 & \text{if} \quad S_2^p \le S_1^p \le S_3^p \\ S_2^p + \left(S_3^p - S_2^p\right)\mu_{13} + \left(S_1^p - S_3^p\right)\mu_1 & \text{if} \quad S_2^p \le S_3^p \le S_1^p \\ S_3^p + \left(S_1^p - S_3^p\right)\mu_{12} + \left(S_2^p - S_1^p\right)\mu_2 & \text{if} \quad S_3^p \le S_1^p \le S_2^p \\ S_3^p + \left(S_2^p - S_3^p\right)\mu_{12} + \left(S_1^p - S_2^p\right)\mu_1 & \text{if} \quad S_3^p \le S_2^p \le S_1^p \end{cases}$$

Therefore, with the μ listed above:

$$S^p\text{-score} = \begin{cases} S_1^p + 0.10\left(S_2^p - S_1^p\right) + 0.00\left(S_3^p - S_2^p\right) & \textit{if} \quad S_1^p \le S_2^p \le S_3^p \\ S_1^p + 0.10\left(S_3^p - S_1^p\right) + 0.07\left(S_2^p - S_3^p\right) & \textit{if} \quad S_1^p \le S_3^p \le S_2^p \\ S_2^p + 0.21\left(S_1^p - S_2^p\right) + 0.00\left(S_3^p - S_1^p\right) & \textit{if} \quad S_2^p \le S_1^p \le S_3^p \\ S_2^p + 0.21\left(S_3^p - S_2^p\right) + 0.21\left(S_1^p - S_3^p\right) & \textit{if} \quad S_2^p \le S_3^p \le S_1^p \\ S_3^p + 0.59\left(S_1^p - S_3^p\right) + 0.07\left(S_2^p - S_1^p\right) & \textit{if} \quad S_3^p \le S_1^p \le S_2^p \\ S_3^p + 0.59\left(S_2^p - S_3^p\right) + 0.21\left(S_1^p - S_2^p\right) & \textit{if} \quad S_3^p \le S_2^p \le S_1^p \end{cases}$$

Where S^p_1, S^p_2 and S^p_3 are the sub-scores obtained by a given farm for Periods 1, 2 and 3.
μ_1, μ_2 and μ_3 are the capacities of Periods 1, 2 and 3.
μ_{12} is the capacity of the group made of Periods 1 and 2 and so on...

Sub-scores S_1^n, S_2^n and S_3^n for Periods 1, 2 and 3 for Measurement of *Nest box material and bedding/nesting material*

The score of a farm with regard to Measurement of *Nest box material and bedding/nesting material* is calculated from the % of mink within each level of the scale used to assess nest box material and bedding/nesting material (4 levels here):

Level	0	1	2	3
% of mink	P_0^m	P_1^m	P_2^m	P_3^m

The calculation is the same for the three periods but as the interpretation is different in terms of welfare between periods, the measurement is interpreted separately for these periods and therefore the coefficients of the curve are different.

In Period 1:

$$\text{Let } I_1 = \left(100 - \frac{\sum_{j=0}^{3} w_j^m \; p_j^m}{w_3^m} \right)$$

with j = 0, 1, 2 or 3 according to the level considered.

Weights	$w_0^m = 0$	$w_1^m = 1$	$w_2^m = 5$	$w_3^m = 10$

I_1 is computed into a score using I-spline functions (Figure 19) as follows:

Score = $a_x + b_x \times I_1 + c_x \times I_1^2 + d_x \times I_1^3$

with $x = 1$ when $I_1 < k$ and $x = 2$ when $I_1 \geq k$

Criterion 4 - Nest box and bedding/nesting material - Period 1			
a_1	0	a_2	-820.32635236856719984643859 79
b_1	0.20283529505328692921217 74	b_2	32.16360201656143402715315 46
c_1	0.00039327827358334076701 33	c_2	-0.41468161127119057551837 50
d_1	0.00005392128107593093661 04	d_2	0.00185078226345985357749 47
k	77		

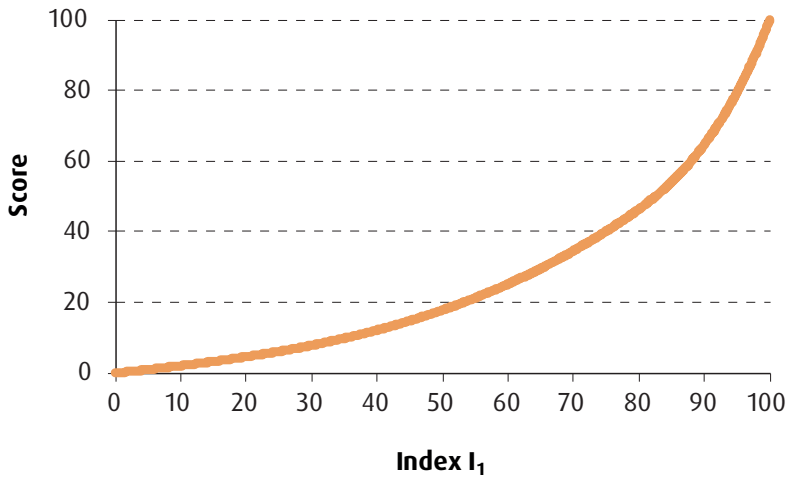


Figure 19 Calculation of the sub-score S_1^n for Measurement of **Nest box material and bedding/nesting material** according to the percentage of mink in each category of nest box material and bedding/nesting material in Period 1

In Period 2:

$$\text{Let } I_2 = \left(100 - \frac{\sum_{j=0}^{3} w_j^m \; p_j^m}{w_3^m} \right)$$

with j = 0, 1, 2 or 3 according to the level considered.

Weights	w_0^m = 0	w_1^m = 2	w_2^m = 8	w_3^m = 19

I_2 is computed into a score using I-spline functions (Figure 20) as follows:

Score = $a_x + b_x \times I_2 + c_x \times I_2^2 + d_x \times I_2^3$

with x = 1 when $I_2 < k$ and x = 2 when $I_2 \geq k$

Criterion 4 - Nest box and bedding/nesting material - Period 2			
a_1	0	a_2	-1293.52002814419711285154335 20
b_1	0.18708867116647115436123 27	b_2	50.58397369924055908541049 58
c_1	-0.00242972300220813770474 38	c_2	-0.65693473281511760575313 02
d_1	0.00007111492904862336229 21	d_2	0.00290446998625199567095 61
k	77		

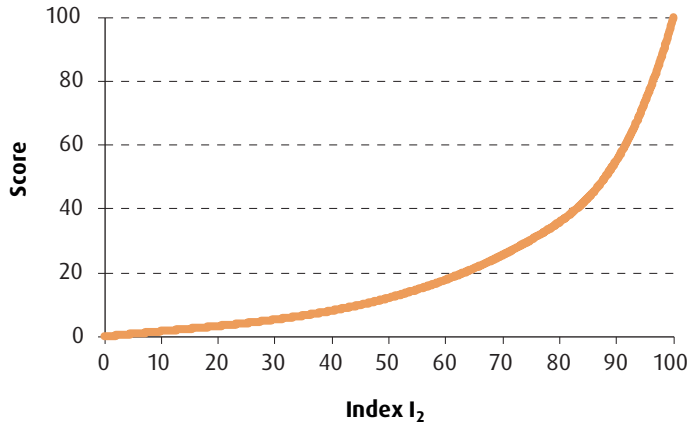


Figure 20 Calculation of the sub-score S_2^n for Measurement of **Nest box material and bedding/nesting material** according to the percentage of mink in each category of nest box material and bedding/nesting material in Period 2

In Period 3:

$$\text{Let } I_3 = \left(100 - \frac{\sum_{j=0}^{3} w_j^m \; p_j^m}{w_3^m} \right)$$

with j = 0, 1, 2 or 3 according to the level considered.

Weights	w_0^m = 0	w_1^m = 1	w_2^m = 5	w_3^m = 12

I_3 is computed into a score using I-spline functions (Figure 21) as follows:

Score = $a_x + b_x \times I_3 + c_x \times I_3^2 + d_x \times I_3^3$

with x = 1 when $I_3 < k$ and x = 2 when $I_3 \geq k$

Criterion 4 - Nest box and bedding/nesting material - Period 3			
a_1	0	a_2	-985.92454651902380646788515 15
b_1	0.37427682871571482658978 88	b_2	38.78692195642178575099023 87
c_1	-0.00486073803521130335530 96	c_2	-0.50372626448826940404046 58
d_1	0.00008490395162870244445 43	d_2	0.00224449499569211088217 95
k	77		

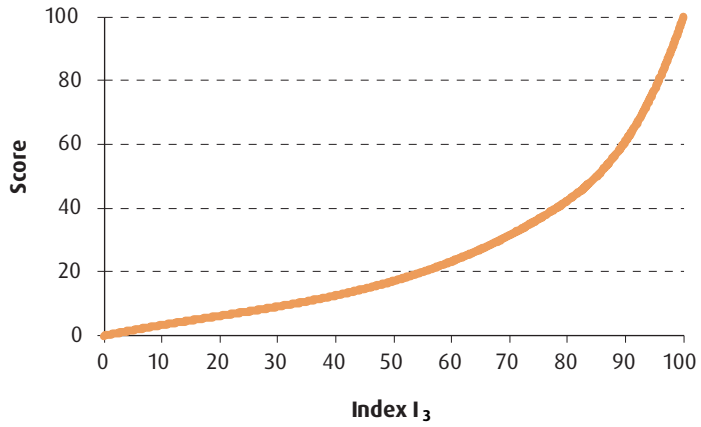


Figure 21 Calculation of the sub-score S_3^n for Measurement of **Nest box material and bedding/nesting material** according to the percentage of mink in each category of nest box material and bedding/nesting material in Period 3

Score S^n for Measurement *Nest box material and bedding/nesting material*

The three sub-scores are combined to form the score S^n for Measurement of *Nest box material and bedding/nesting material* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.00	μ_{12}	=	0.78
μ_2	=	0.20	μ_{13}	=	0.09
μ_3	=	0.00	μ_{23}	=	0.20

with 1 = Period 1, 2 = Period 2 and 3 = Period 3.

Reminder:

$$S^n\text{-score} = \begin{cases} S_1^n + \left(S_2^n - S_1^n\right)\mu_{23} + \left(S_3^n - S_2^n\right)\mu_3 & \text{if} \quad S_1^n \le S_2^n \le S_3^n \\ S_1^n + \left(S_3^n - S_1^n\right)\mu_{23} + \left(S_2^n - S_3^n\right)\mu_2 & \text{if} \quad S_1^n \le S_3^n \le S_2^n \\ S_2^n + \left(S_1^n - S_2^n\right)\mu_{13} + \left(S_3^n - S_1^n\right)\mu_3 & \text{if} \quad S_2^n \le S_1^n \le S_3^n \\ S_2^n + \left(S_3^n - S_2^n\right)\mu_{13} + \left(S_1^n - S_3^n\right)\mu_1 & \text{if} \quad S_2^n \le S_3^n \le S_1^n \\ S_3^n + \left(S_1^n - S_3^n\right)\mu_{12} + \left(S_2^n - S_1^n\right)\mu_2 & \text{if} \quad S_3^n \le S_1^n \le S_2^n \\ S_3^n + \left(S_2^n - S_3^n\right)\mu_{12} + \left(S_1^n - S_2^n\right)\mu_1 & \text{if} \quad S_3^n \le S_2^n \le S_1^n \end{cases}$$

Therefore, with the μ listed above:

$$S^n\text{-score} = \begin{cases} S_1^n + 0.20\left(S_2^n - S_1^n\right) + 0.00\left(S_3^n - S_2^n\right) & \text{if} \quad S_1^n \le S_2^n \le S_3^n \\ S_1^n + 0.20\left(S_3^n - S_1^n\right) + 0.20\left(S_2^n - S_3^n\right) & \text{if} \quad S_1^n \le S_3^n \le S_2^n \\ S_2^n + 0.09\left(S_1^n - S_2^n\right) + 0.00\left(S_3^n - S_1^n\right) & \text{if} \quad S_2^n \le S_1^n \le S_3^n \\ S_2^n + 0.09\left(S_3^n - S_2^n\right) + 0.00\left(S_1^n - S_3^n\right) & \text{if} \quad S_2^n \le S_3^n \le S_1^n \\ S_3^n + 0.78\left(S_1^n - S_3^n\right) + 0.20\left(S_2^n - S_1^n\right) & \text{if} \quad S_3^n \le S_1^n \le S_2^n \\ S_3^n + 0.78\left(S_2^n - S_3^n\right) + 0.00\left(S_1^n - S_2^n\right) & \text{if} \quad S_3^n \le S_2^n \le S_1^n \end{cases}$$

Where S^n_1, S^n_2 and S^n_3 are the sub-scores obtained by a given farm for Measurement of *Nest box material and bedding/nesting material* in Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities Measurement of *Nest box material and bedding/nesting material* in Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in Periods 1 and 2 and so on...

Score for the Criterion of *Thermal comfort*

The two partial scores are combined to form the global score for the Criterion of *Thermal comfort* using a Choquet integral. The parameters of the Choquet integral are:

μ_p	=	0.68	μ_n	=	0.10

with p, protection from exceptional weather conditions and n, nest box material and bedding/nesting material.

Reminder:

$$\text{Thermal comfort-score} = \begin{cases} S^p + \left(S^n - S^p\right)\mu_n & \text{if} \quad S^p \le S^n \\ S^n + \left(S^p - S^n\right)\mu_p & \text{if} \quad S^n \le S^p \end{cases}$$

Thus, with the μ listed above:

$$\text{Thermal comfort-score-score} = \begin{cases} S^p + 0.68\left(S^n - S^p\right) & \text{if} \quad S^p \le S^n \\ S^n + 0.10\left(S^p - S^n\right) & \text{if} \quad S^n \le S^p \end{cases}$$

Where S^p and S^n are the partial scores obtained by a given farm for Measures *Protection from exceptional weather conditions* and *Nest box material and bedding/nesting material* respectively.
μ_p and μ_n are the capacities of Measures *Protection from exceptional weather conditions* and *Nest box material and bedding/nesting material* respectively.

Where S^p and S^n are the partial scores obtained by a given farm for Measures *Protection from exceptional weather conditions* and *Nest box material and bedding/nesting material* respectively.
μ_p and μ_n are the capacities of Measures *Protection from exceptional weather conditions* and *Nest box material and bedding/nesting material* respectively.

3.3.1.5 Ease of movement

The Criterion of *Ease of movement* is assessed via Measurement of *Space available for moving*. For this measure, two partial scores are calculated, one for Sub-measurement *Area available* and one for Sub-measurement *Cage height*, before being combined into a criterion-score.
Moreover, these two sub-measurements are assessed for the three periods of the production cycle. So the first step is to calculate the sub-score for each period, then to aggregate the three sub-scores obtained for each period in order to have the score covering the production cycle for each of these two measurements.

The European recommendation for cage size fully meets the requirements of adequate welfare with respect to ease of movement and freedom to display most normal patterns of behaviour. Recommended cage size is 2550cm² x 45cm high for one single adult mink or a pair of juveniles or one adult female with her litter. If more than two (young) mink are housed together the floor area must be expanded by 850cm² per extra mink.

Sub-scores S_1^{aa}, S_2^{aa} and S_3^{aa} for Periods 1, 2 and 3 for Sub-measurement of *Area available*
To assess Sub-measurement of *Area available*, two sub-measurements are to be considered, Sub-measurement of *Floor area* (in cm²) in Periods 1, 2 and 3 and Sub-measurement of *Floor area/mink* (in cm²) only in Period 3, with no difference between the types of animals.
In Periods 1 and 2, Sub-measurement of *Area available* is considered thanks to the score for Sub-measurement of *Floor area*. In Period 3, Sub-measurement of *Area available* is considered thanks to the aggregation of the score for Sub-measurement of *Floor area* and the score for Sub-measurement of *Floor area/mink*.

a) Sub-scores S_1^{aa}, S_2^{aa} and S_{3a}^{aa} for Periods 1, 2 and 3 for Sub-measurement of *Floor area* (*i.e.* sub-scores S_1 and S_2 for Sub-measurement of *Area available* in Periods 1 and 2)
The score of a farm with regard to Sub-measurement of *Floor area* is calculated from the % of mink within each level of the scale used to assess floor area (3 levels here):

Level	0	1	2
% of mink	P_0^a	P_1^a	P_2^a

$$\text{Let } I_1 = \left(100 - \frac{\sum_{k=0}^{2} w_{i,j}^a \; p_{i,j}^a}{w_{i,2}^a}\right) \quad I_2 = \left(100 - \frac{\sum_{k=0}^{2} w_{i,j}^a \; p_{i,j}^a}{w_{i,2}^a}\right) \quad \text{and} \quad I_{3a} = \left(100 - \frac{\sum_{k=0}^{2} w_{i,j}^a \; p_{i,j}^a}{w_{i,2}^a}\right)$$

with i = 1, 2 or 3 according to the Period and j = 0, 1 or 2 according to the level.

Weights	$w_{i,0}^m = 0$	$w_{i,1}^m = 4$	$w_{i,2}^m = 15$

I_i is computed into a score using *I*-spline functions (Figure 22) as follows (with i = 1, 2 or 3a according to the period considered):

$$\textit{Score} = a_x + b_x \times I_i + c_x \times I_i^2 + d_x \times I_i^3 \qquad i = 1, 2 \text{ or } 3_a$$

with $x = 1$ when $I_i < k$ and $x = 2$ when $I_i \geq k$

Criterion 5 - Floor area - Periods 1, 2 and 3			
a_1	0	a_2	-4343.4758040737160627031698823
b_1	0.15302218085316668383377 70	b_2	153.45218509196024569973815 23
c_1	-0.00180026095139448395233 97	c_2	-1.80532001009056575213662 65
d_1	0.00007883024973381884566 42	d_2	0.00715145739489753476392 23
k	85		

Note: The coefficients are the same for the three periods since the interpretation in terms of welfare is the same whatever the period considered.

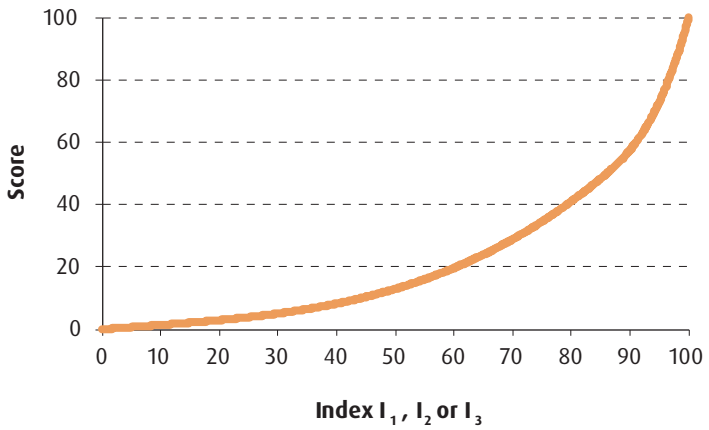


Figure 22 Calculation of the sub-score S_i^{aa} for Sub-measurement of Floor area according to the percentage of mink in each category of floor area (with i= 1, 2 or 3a according to the period considered)

b) Sub-score S_{3b}^{aa} for Period 3 for Sub-measurement of *Floor area/mink*

The score of a farm with regard to Sub-measurement of *Floor area/mink* is calculated from the % of mink in cage with bad area/mink in Period 3:

Let I_{3b} = 100 - % of mink in cage with bad area/mink in Period 3

I_{3b} is computed into a score using *I*-spline functions (Figure 23) as follows:

$$Score = a_x + b_x \times I_{3b} + c_x \times I_{3b}^2 + d_x \times I_{3b}^3 \qquad i = 1, 2 \text{ or } 3_a$$

with $x = 1$ when $I_{3b} < k$ and $x = 2$ when $I_{3b} \geq k$

Criterion 5 - Floor area/mink - Period 3			
a_1	0	a_2	-42.890943758310413613799028 1
b_1	0.16543027808489135788150 29	b_2	3.089812807188327514751335 9
c_1	-0.00375977904737820334268 86	c_2	-0.07022301834717181723277 69
d_1	0.00003263045786636644150 56	d_2	0.00053613984651108435775 05
k	44		

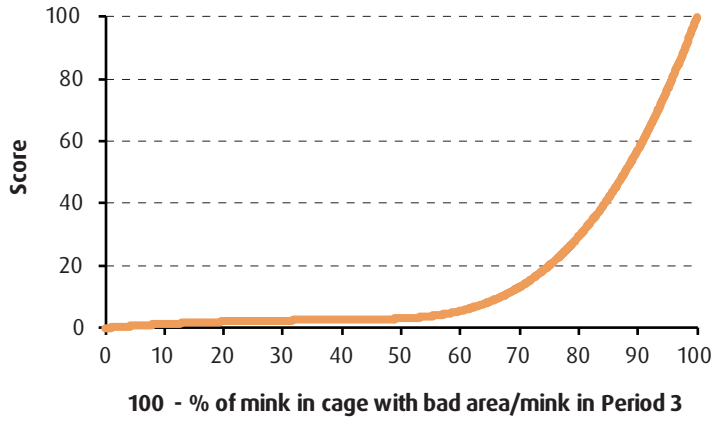


Figure 23 Calculation of the sub-score S_{3b}^{aa} for Sub-measurement of Floor area/mink according to the percentage of mink in cage with bad area/mink in Period 3

c) Sub-scores S_3 for Period 3 for Sub-measurement *of Area available*

The two partial scores S_{3a} and S_{3b} are combined to form the sub-score S_3^{aa} for Sub-measurement of *Area available* in Period 3 using a Choquet integral. The parameters of the Choquet integral are:

μ_n = 0.33 μ_p = 0.11

with 3a, floor area in Period 3 and 3b, floor area/mink in Period 3.

Reminder:

$$S_3^{aa} = \begin{cases} S_3^a + \left(S_3^b - S_3^a\right)\mu_{3b} & \text{if} \quad S_3^a \le S_3^b \\ S_3^b + \left(S_3^a - S_3^b\right)\mu_{3a} & \text{if} \quad S_3^b \le S_3^a \end{cases}$$

Therefore, with the μ listed above:

$$S_3^{aa} = \begin{cases} S_3^a + 0.11\left(S_3^b - S_3^a\right) & \text{if} \quad S_3^a \le S_3^b \\ S_3^b + 0.33\left(S_3^a - S_3^b\right) & \text{if} \quad S_3^b \le S_3^a \end{cases}$$

Where S_{3a} and S_{3b} are the partial scores obtained by a given farm for Sub-measurements *Floor area* and *Floor area/mink* respectively.
μ_f and μ_p are the capacities of Sub-measurements *Floor area* and *Floor area/mink* respectively.

Score S^{aa} for Sub-measurement of *Area available*

The three sub-scores are combined to form the partial score S^{aa} for Sub-measurement of *Area available* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.12	μ_{12}	=	0.12
μ_2	=	0.10	μ_{13}	=	0.45
μ_3	=	0.36	μ_{23}	=	0.59

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^{aa}\text{-score} = \begin{cases} S_1^{aa} + \left(S_2^{aa} - S_1^{aa}\right)\mu_{23} + \left(S_3^{aa} - S_2^{aa}\right)\mu_3 & \text{if} \quad S_1^{aa} \le S_2^{aa} \le S_3^{aa} \\ S_1^{aa} + \left(S_3^{aa} - S_1^{aa}\right)\mu_{23} + \left(S_2^{aa} - S_3^{aa}\right)\mu_2 & \text{if} \quad S_1^{aa} \le S_3^{aa} \le S_2^{aa} \\ S_2^{aa} + \left(S_1^{aa} - S_2^{aa}\right)\mu_{13} + \left(S_3^{aa} - S_1^{aa}\right)\mu_3 & \text{if} \quad S_2^{aa} \le S_1^{aa} \le S_3^{aa} \\ S_2^{aa} + \left(S_3^{aa} - S_2^{aa}\right)\mu_{13} + \left(S_1^{aa} - S_3^{aa}\right)\mu_1 & \text{if} \quad S_2^{aa} \le S_3^{aa} \le S_1^{aa} \\ S_3^{aa} + \left(S_1^{aa} - S_3^{aa}\right)\mu_{12} + \left(S_2^{aa} - S_1^{aa}\right)\mu_2 & \text{if} \quad S_3^{aa} \le S_1^{aa} \le S_2^{aa} \\ S_3^{aa} + \left(S_2^{aa} - S_3^{aa}\right)\mu_{12} + \left(S_1^{aa} - S_2^{aa}\right)\mu_1 & \text{if} \quad S_3^{aa} \le S_2^{aa} \le S_1^{aa} \end{cases}$$

Therefore, with the μ listed above:

$$S^{aa}\text{-score} = \begin{cases} S_1^{aa} + 0.59\left(S_2^{aa} - S_1^{aa}\right) + 0.36\left(S_3^{aa} - S_2^{aa}\right) & \text{if} \quad S_1^{aa} \le S_2^{aa} \le S_3^{aa} \\ S_1^{aa} + 0.59\left(S_3^{aa} - S_1^{aa}\right) + 0.10\left(S_2^{aa} - S_3^{aa}\right) & \text{if} \quad S_1^{aa} \le S_3^{aa} \le S_2^{aa} \\ S_2^{aa} + 0.45\left(S_1^{aa} - S_2^{aa}\right) + 0.36\left(S_3^{aa} - S_1^{aa}\right) & \text{if} \quad S_2^{aa} \le S_1^{aa} \le S_3^{aa} \\ S_2^{aa} + 0.45\left(S_3^{aa} - S_2^{aa}\right) + 0.12\left(S_1^{aa} - S_3^{aa}\right) & \text{if} \quad S_2^{aa} \le S_3^{aa} \le S_1^{aa} \\ S_3^{aa} + 0.12\left(S_1^{aa} - S_3^{aa}\right) + 0.10\left(S_2^{aa} - S_1^{aa}\right) & \text{if} \quad S_3^{aa} \le S_1^{aa} \le S_2^{aa} \\ S_3^{aa} + 0.12\left(S_2^{aa} - S_3^{aa}\right) + 0.12\left(S_1^{aa} - S_2^{aa}\right) & \text{if} \quad S_3^{aa} \le S_2^{aa} \le S_1^{aa} \end{cases}$$

Where S^{aa}_1, S^{aa}_2 and S^{aa}_3 are the sub-scores obtained by a given farm for Sub-measurement of A*rea available* in Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Sub-measurement of *Area available* in Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in period 1 and 2 and so on...

Sub-scores S_1^h, S_2^h and S_3^h for Periods 1, 2 and 3 for Sub-measurement of *Cage height*
The score of a farm with regard to Sub-measurement of *Cage height* is calculated from the % of mink within each level of the scale used to assess cage height (3 levels here):

Level	**0**	**1**	**2**
% of mink	$P^h_{i,0}$	$P^h_{i,1}$	$P^h_{i,2}$
Let $I_i = \left(100 - \frac{\sum_{k=0}^{2} w^h_{i,j} \; p^h_{i,j}}{w^h_{i,2}}\right)$	with i = 1, 2 or 3 according to the period and j = 0, 1 or 2 according to the level...		
Weights	$W^h_{i,0}$ = 0	$W^h_{i,1}$ = 1	$W^h_{i,2}$ = 5

I_i is computed into a score using *I*-spline functions (Figure 24) as follows:

$$\textbf{Score} = a_x + b_x \times I_i + c_x \times I_i^2 + d_x \times I_i^3 \qquad i = 1, 2 \text{ or } 3$$

with $x = 1$ when $I_i < k$ and $x = 2$ when $I_i \geq k$

Criterion 5 - Floor area/mink - Period 3			
a_1	0	a_2	-17.867569409543278879937 1338
b_1	0.424340806982242801925 7643	b_2	1.496394971489671377185 0045
c_1	-0.002251643053138740156 7378	c_2	-0.023692726342325918370 5571
d_1	0.000062214780427181224 0049	d_2	0.000205155335683893059 6701
k	50		

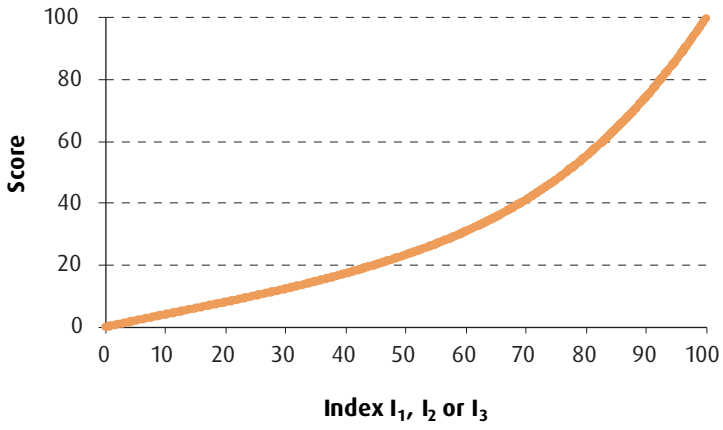


Figure 24 Calculation of the sub-score S_i^h for Sub-measurement of Cage height according to the percentage of mink in each category of cage height (with i= 1, 2 or 3 according to the period considered)

Score S^h for Sub-measurement of *Cage height*

The three sub-scores are combined to form the partial score S^h for Sub-measurement of *Cage height* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.12	μ_{12}	=	0.17
μ_2	=	0.14	μ_{13}	=	0.53
μ_3	=	0.50	μ_{23}	=	0.50

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^h\text{-score} = \begin{cases} S_1^h + \left(S_2^h - S_1^h\right)\mu_{23} + \left(S_3^h - S_2^h\right)\mu_3 & \text{if} \quad S_1^h \le S_2^h \le S_3^h \\ S_1^h + \left(S_3^h - S_1^h\right)\mu_{23} + \left(S_2^h - S_3^h\right)\mu_2 & \text{if} \quad S_1^h \le S_3^h \le S_2^h \\ S_2^h + \left(S_1^h - S_2^h\right)\mu_{13} + \left(S_3^h - S_1^h\right)\mu_3 & \text{if} \quad S_2^h \le S_1^h \le S_3^h \\ S_2^h + \left(S_3^h - S_2^h\right)\mu_{13} + \left(S_1^h - S_3^h\right)\mu_1 & \text{if} \quad S_2^h \le S_3^h \le S_1^h \\ S_3^h + \left(S_1^h - S_3^h\right)\mu_{12} + \left(S_2^h - S_1^h\right)\mu_2 & \text{if} \quad S_3^h \le S_1^h \le S_2^h \\ S_3^h + \left(S_2^h - S_3^h\right)\mu_{12} + \left(S_1^h - S_2^h\right)\mu_1 & \text{if} \quad S_3^h \le S_2^h \le S_1^h \end{cases}$$

Therefore, with the μ listed above:

$$S^h\text{-score} = \begin{cases} S_1^h + 0.50\left(S_2^h - S_1^h\right) + 0.50\left(S_3^h - S_2^h\right) & \text{if} \quad S_1^h \le S_2^h \le S_3^h \\ S_1^h + 0.50\left(S_3^h - S_1^h\right) + 0.14\left(S_2^h - S_3^h\right) & \text{if} \quad S_1^h \le S_3^h \le S_2^h \\ S_2^h + 0.53\left(S_1^h - S_2^h\right) + 0.50\left(S_3^h - S_1^h\right) & \text{if} \quad S_2^h \le S_1^h \le S_3^h \\ S_2^h + 0.53\left(S_3^h - S_2^h\right) + 0.12\left(S_1^h - S_3^h\right) & \text{if} \quad S_2^h \le S_3^h \le S_1^h \\ S_3^h + 0.17\left(S_1^h - S_3^h\right) + 0.14\left(S_2^h - S_1^h\right) & \text{if} \quad S_3^h \le S_1^h \le S_2^h \\ S_3^h + 0.17\left(S_2^h - S_3^h\right) + 0.12\left(S_1^h - S_2^h\right) & \text{if} \quad S_3^h \le S_2^h \le S_1^h \end{cases}$$

Where S^h_1, S^h_2 and S^h_3 are the sub-scores obtained by a given farm for Sub-measurement of *Cage height* in Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Sub-measurement of *Cage height* in Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in Periods 1 and 2 and so on...

Score for the Criterion of *Ease of movement*

The two partial scores are combined to form the overall score for the Criterion of *Ease of movement* using a Choquet integral. The parameters of the Choquet integral are:

μ_{aa}	=	0.51	μ_h	=	0.14

with aa, area available and h, cage height.

Reminder:

$$\text{Ease of movement-score} = \begin{cases} S^{aa} + \left(S^{h} - S^{aa}\right)\mu_{h} & \text{if} \quad S^{aa} \le S^{h} \\ S^{h} + \left(S^{aa} - S^{h}\right)\mu_{aa} & \text{if} \quad S^{h} \le S^{aa} \end{cases}$$

Therefore, with the μ listed above:

$$\text{Ease of movement-score} = \begin{cases} S^{aa} + 0.14\left(S^{h} - S^{aa}\right) & \text{if} \quad S^{aa} \le S^{h} \\ S^{h} + 0.51\left(S^{aa} - S^{h}\right) & \text{if} \quad S^{h} \le S^{aa} \end{cases}$$

Where S^{aa} and S^{b} are the partial scores obtained by a given farm for Sub-measurements of A*rea available* and *Cage height* respectively.
μ_a and μ_b are the capacities of Sub-measurements of A*rea available* and *Cage height* respectively.

3.3.1.6 Absence of injuries

The score of a farm with regard to the Criter*ion of Absence of injuries* is calculated from the % of mink within each of the four levels of the scale used to assess injuries, for the three periods of the production cycle. So the first step is to calculate one sub-score for each period, then to aggregate the three sub-scores obtained for each period in order to have the criterion-score covering the production cycle.

Sub-scores S_1, S_2 and S_3 for Periods 1, 2 and 3 for the Criter*ion of Absence of injuries*
The calculation of the sub-score is the same for each period.
The score of a farm with regard to the absence of injuries is calculated from the % of mink within each of the four level of the scale used to assess injuries (4 levels here):

Level	0	1	2	3
% of mink	$P_{i,0}\ (X)$	$P_{i,1}\ (X)$	$P_{i,2}\ (X)$	$P_{i,3}\ (X)$
The calculation is the same for the three periods but as the interpretation is different in terms of welfare between periods, the measurement is interpreted separately for these periods and therefore the coefficients of the curve are different.				

In Period 1:

$$\text{Let } I_i = \left(100 - \frac{\sum_{k=0}^{3} w_{i,j}\ p_{i,j}}{w_{i,3}} \right)$$

with i = 1, 2 or 3 according to the period considered and j = 0, 1, 2 or 3 according to the level..

Weights	$W_{i,0} = 0$	$W_{i,1} = 3$	$W_{i,2} = 6$	$W_{i,3} = 10$

I_i is computed into a score using *I*-spline functions (Figure 25) as follows:

$$\textbf{\textit{Score}} = a_x + b_x \times I_i + c_x \times I_i^2 + d_x \times I_i^3 \qquad i = 1, 2 \text{ or } 3$$

with $x = 1$ when $I_i < k$ and $x = 2$ when $I_i \ge k$

Criterion 6 - Absence of injuries - Periods 1, 2 and 3			
a_1	0	a_2	-1397.29447297039200748258735 98
b_1	0.00000000000043737706229 18	b_2	58.22060347480139341769245 22
c_1	-0.00000000000001806512426 09	c_2	-0.80861949793387299934011 03
d_1	0.00001782029716567465842 50	d_2	0.00376142910472982696865 05
k	72		

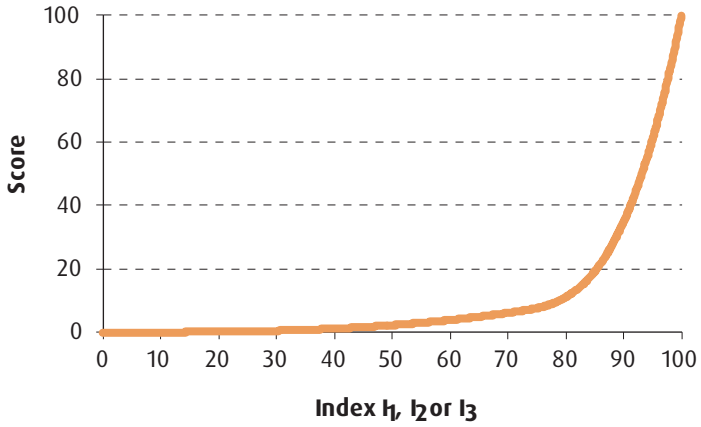


Figure 25 Calculation of the sub-score S_i for the Criterion of **Absence of injuries** according to the percentage of mink in each category of injuries (with i = 1, 2 or 3 according to the period considered)

Score for the Criterion *of Absence of injuries*

The three sub-scores are combined to form the overall score for the Criter*ion of Absence of injuries* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.00	μ_{12}	=	0.19
μ_2	=	0.19	μ_{13}	=	0.39
μ_3	=	0.14	μ_{23}	=	0.40

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$\text{Absence of injuries-score} = \begin{cases} S_1 + (S_2 - S_1)\mu_{23} + (S_3 - S_2)\mu_3 & \text{if} \quad S_1 \le S_2 \le S_3 \\ S_1 + (S_3 - S_1)\mu_{23} + (S_2 - S_3)\mu_2 & \text{if} \quad S_1 \le S_3 \le S_2 \\ S_2 + (S_1 - S_2)\mu_{13} + (S_3 - S_1)\mu_3 & \text{if} \quad S_2 \le S_1 \le S_3 \\ S_2 + (S_3 - S_2)\mu_{13} + (S_1 - S_3)\mu_1 & \text{if} \quad S_2 \le S_3 \le S_1 \\ S_3 + (S_1 - S_3)\mu_{12} + (S_2 - S_1)\mu_2 & \text{if} \quad S_3 \le S_1 \le S_2 \\ S_3 + (S_2 - S_3)\mu_{12} + (S_1 - S_2)\mu_1 & \text{if} \quad S_3 \le S_2 \le S_1 \end{cases}$$

Therefore, with the μ listed above:

$$\text{Absence of injuries-score} = \begin{cases} S_1 + 0.40(S_2 - S_1) + 0.14(S_3 - S_2) & \text{if} \quad S_1 \le S_2 \le S_3 \\ S_1 + 0.40(S_3 - S_1) + 0.19(S_2 - S_3) & \text{if} \quad S_1 \le S_3 \le S_2 \\ S_2 + 0.39(S_1 - S_2) + 0.14(S_3 - S_1) & \text{if} \quad S_2 \le S_1 \le S_3 \\ S_2 + 0.39(S_3 - S_2) + 0.00(S_1 - S_3) & \text{if} \quad S_2 \le S_3 \le S_1 \\ S_3 + 0.19(S_1 - S_3) + 0.19(S_2 - S_1) & \text{if} \quad S_3 \le S_1 \le S_2 \\ S_3 + 0.19(S_2 - S_3) + 0.00(S_1 - S_2) & \text{if} \quad S_3 \le S_2 \le S_1 \end{cases}$$

Where S_1, S_2 and S_3 are the scores obtained by a given farm for the Criter*ion of Absence of injuries* in Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made of Periods 1 and 2 and so on...

3.3.1.7 Absence of disease

Four partial scores are calculated, one for Measurement of *Mortality*, one for Measurement of *Diarrhoea*, one for Measurement of *Lameness or impaired movement* and one for Measurement of *Obviously sick animals*, before being combined into a criterion-score.
Moreover, these four measurements are assessed for the three periods of the production cycle. So the first step is to calculate the sub-score for each period, then to aggregate the three sub-scores obtained for each period in order to have the score covering the production cycle for each of these four measurements.

Sub-scores S_1^m , S_2^m and S_3^m for Periods 1, 2 and 3 for Measurement of *Mortality*
In Period 1:
We focus on the male and female mink selected as breeders from December 1st or the end of pelting. Pelted mink are not included.
The score of a farm with regard to Measurement of *Mortality* in Period 1 is calculated from the % of dead mink.

Let I_1 = 100 - % of dead mink in Period 1

$$\text{Let } J_1 = \frac{I_1 - 70}{100 - 70} \times 100 \quad \text{if } I_1 \ge 70$$
$$J_1 = 0 \quad \text{if } I_1 < 70$$

J_1 is computed into a score using *I*-spline functions (Figure 26) as follows:

$$\textit{Score} = a_x + b_x \times J_1 + c_x \times J_1^2 + d_x \times J_1^3$$

with $x = 1$ when $J_1 < k$ and $x = 2$ when $J_1 \ge k$

Criterion 7 - Mortality - Period 1			
a_1	0	a_2	-704.79820238143588539969641 72
b_1	0.13415671199724577000722 55	b_2	30.77755676561564612825350 20
c_1	-0.00194430017367993928853 46	c_2	-0.44605154671301244784231 70
d_1	0.00004211236000606488204 43	d_2	0.00218755799296307647597 29
k	69		

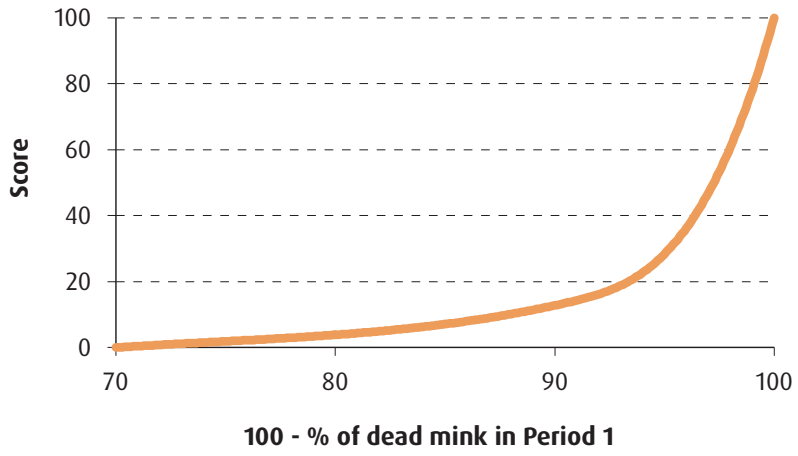


Figure 26 Calculation of the sub-score S_1^m for Measurement of **Mortality** according to the percentage of dead mink in Period 1

In Period 2:
We focus on the male and female breeders since March 1st, just before mating. The mortality in Period 2 is evaluated on the farm in the following 3 sub-periods:

2a. March 1st to May 14th (from the start of mating to mid lactation)
- Here we add to Period 2 the mortality related to mating, gestation and delivery.

2b. May 15th to June 15th (from the time all kits are born and dead kits can be reliably counted to weaning).

2c. June 16th to July 15th (from normal weaning time to separation).

Mortality data is registered by sub-period for the welfare evaluation in Period 2.
Therefore, the first step is to calculate the three sub-scores for each sub-period of Period 2 for mortality, then to aggregate the three sub-scores obtained for each sub-period 2a, 2b and 2c in order to have the sub-score for Measurement of *Mortality* in Period 2.

a) Sub-partial scores S_{2a}, S_{2b} and S_{2c} for *Measurement of Mortality* in Period 2

The score of a farm with regard to Measurement of *Mortality* in Sub-periods 2a, 2b and 2c is calculated from the % of dead mink.

Sub-period 2a:

Let I_{2a} = 100 - % of dead mink in Sub-period 2a

$$\text{Let } J_{2a} = \frac{I_{2a} - 70}{100 - 70} \times 100 \quad \text{if } I_{2a} \geq 70$$
$$J_{2a} = 0 \quad \text{if } I_{2a} < 70$$

J_{2a} is computed into a score using *I*-spline functions (Figure 27) as follows:

$$\textit{Score} = a_x + b_x \times J_{2a} + c_x \times J_{2a}^2 + d_x \times J_{2a}^3$$

with x = 1 when $J_{2a} < k$ and x = 2 when $J_{2a} \geq k$

Criterion 7 - Mortality - Sub-period 2a			
a_1	0	a_2	-797.11646705905616272502811 63
b_1	0.10104162367652073033326 4	b_2	34.26317583677125355734460 75
c_1	-0.00144345176684061845748 25	c_2	-0.48947393943202133215208 96
d_1	0.00004158357897494789807 72	d_2	0.00236553827777243829164893
k	70		

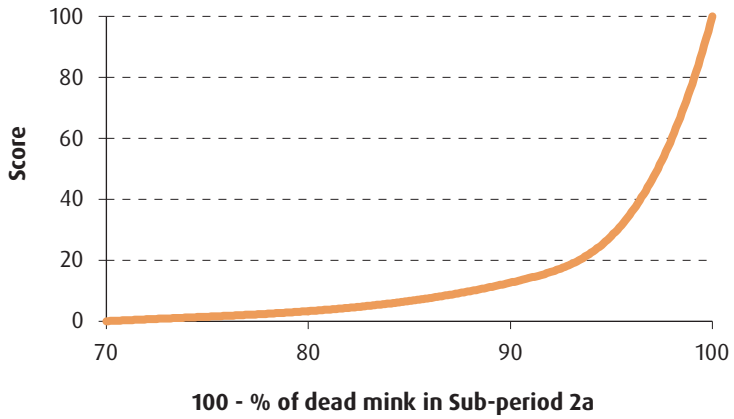


Figure 27 Calculation of the sub-score S_{2a}^{m} for Measurement **of Mortality** according to the percentage of dead mink in Sub-period 2a

Sub-period 2b:

Let I_{2b} = 100 - % of dead mink in Sub-period 2b

$$\text{Let } J_{2b} = \frac{I_{2b} - 60}{100 - 60} \times 100 \quad \text{if } I_{2b} \geq 60$$

$$J_{2b} = 0 \quad \text{if } I_{2b} < 60$$

J_{2b} is computed into a score using *I*-spline functions (Figure 28) as follows:

$$\textbf{\textit{Score}} = a_x + b_x \times J_{2b} + c_x \times J_{2b}^{\,2} + d_x \times J_{2b}^{\,3}$$

with x = 1 when $J_{2b} < k$ and x = 2 when $J_{2b} \geq k$

Criterion 7 - Mortality - Sub-period 2b			
a_1	0	a_2	-85.27649279059912146294664 13
b_1	0.10678060730226687780053 40	b_2	4.75822566842015959309719 62
c_1	-0.00194146558730933231802 51	c_2	-0.08651319396865954358677 44
d_1	0.00006202993606317846531 69	d_2	0.00057458586563529040567 44
k	55		

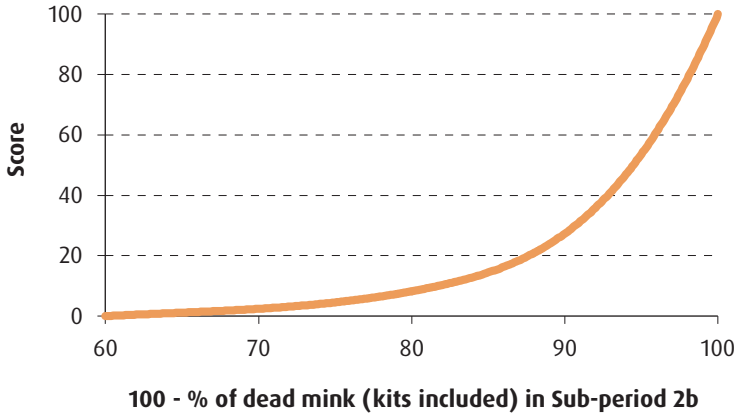


Figure 28 Calculation of the sub-score S_{2b}^{m} for Measurement of Mortality according to the percentage of dead mink (kits included) in Sub-period 2b

Sub-period 2c:
Let I_{2c} = 100 - % of dead mink in Sub-period 2c

$$\text{Let } J_{2c} = \frac{I_{2c} - 60}{100 - 60} \times 100 \quad \text{if } I_{2c} \geq 60$$
$$J_{2c} = 0 \quad \text{if } I_{2c} < 60$$

J_{2c} is computed into a score using *I*-spline functions (Figure 29) as follows:

$$\textbf{\textit{Score}} = a_x + b_x \times J_{2c} + c_x \times J_{2c}^{2} + d_x \times J_{2c}^{3}$$

with $x = 1$ when $J_{2c} < k$ and $x = 2$ when $J_{2c} \geq k$

Criterion 7 - Mortality - Sub-period 2c			
a_1	0	a_2	-118.69545733251510455374955 20
b_1	0.17696371760715351451054 29	b_2	6.65126139017907203054846 83
c_1	-0.00321752213831084498546 49	c_2	-0.12093202527442922789013 83
d_1	0.00004946833993807012603 29	d_2	0.00076288957105897050366 83
k	55		

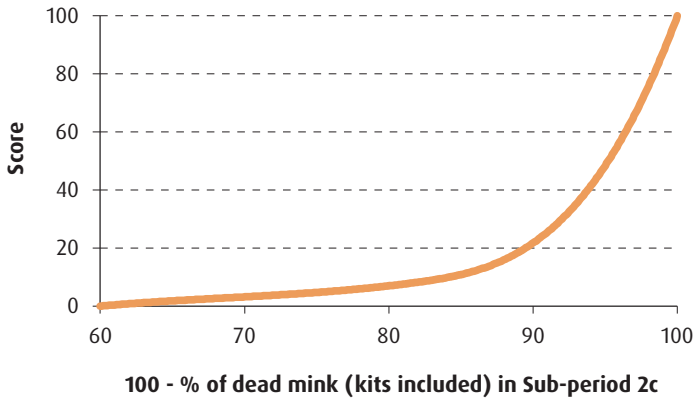


Figure 29 Calculation of the sub-score S_{2c}^{m} for Measurement of **Mortality** according to the percentage of dead mink (kits included) in Sub-period 2c

b) Sub-score S_2^m for *Measurement of Mortality in Period 2*

The three sub-partial-scores are combined to form Sub-score S_2^m for Measurement of Mortality in Period 2 using a Choquet integral. The parameters of the Choquet integral are:

μ_{2a}	=	0.32	μ_{2a2b}	=	0.35
μ_{2b}	=	0.15	μ_{2a2c}	=	0.48
μ_{2c}	=	0.15	μ_{2b2c}	=	0.15

with 2a = Sub-period 2a, 2b = Sub-period 2b and 2c = Sub-period 2c

Reminder:

$$S_2^m\text{-score} = \begin{cases} S_{2a}^m + \left(S_{2b}^m - S_{2a}^m\right)\mu_{2b2c} + \left(S_{2c}^m - S_{2b}^m\right)\mu_{2c} & \text{if} \quad S_{2a}^m \le S_{2b}^m \le S_{2c}^m \\ S_{2a}^m + \left(S_{2c}^m - S_{2a}^m\right)\mu_{2b2c} + \left(S_{2b}^m - S_{2c}^m\right)\mu_{2b} & \text{if} \quad S_{2a}^m \le S_{2c}^m \le S_{2b}^m \\ S_{2b}^m + \left(S_{2a}^m - S_{2b}^m\right)\mu_{2a2c} + \left(S_{2c}^m - S_{2a}^m\right)\mu_{2c} & \text{if} \quad S_{2b}^m \le S_{2a}^m \le S_{2c}^m \\ S_{2b}^m + \left(S_{2c}^m - S_{2b}^m\right)\mu_{2a2c} + \left(S_{2a}^m - S_{2c}^m\right)\mu_{2a} & \text{if} \quad S_{2b}^m \le S_{2c}^m \le S_{2a}^m \\ S_{2c}^m + \left(S_{2a}^m - S_{2c}^m\right)\mu_{2a2b} + \left(S_{2b}^m - S_{2a}^m\right)\mu_{2b} & \text{if} \quad S_{2c}^m \le S_{2a}^m \le S_{2b}^m \\ S_{2c}^m + \left(S_{2b}^m - S_{2c}^m\right)\mu_{2a2b} + \left(S_{2a}^m - S_{2b}^m\right)\mu_{2a} & \text{if} \quad S_{2c}^m \le S_{2b}^m \le S_{2a}^m \end{cases}$$

Therefore, with the μ listed above:

$$S_2^m\text{-score} = \begin{cases} S_{2a}^m + 0.15\left(S_{2b}^m - S_{2a}^m\right) + 0.15\left(S_{2c}^m - S_{2b}^m\right) & \text{if} \quad S_{2a}^m \le S_{2b}^m \le S_{2c}^m \\ S_{2a}^m + 0.15\left(S_{2c}^m - S_{2a}^m\right) + 0.15\left(S_{2b}^m - S_{2c}^m\right) & \text{if} \quad S_{2a}^m \le S_{2c}^m \le S_{2b}^m \\ S_{2b}^m + 0.48\left(S_{2a}^m - S_{2b}^m\right) + 0.15\left(S_{2c}^m - S_{2a}^m\right) & \text{if} \quad S_{2b}^m \le S_{2a}^m \le S_{2c}^m \\ S_{2b}^m + 0.48\left(S_{2c}^m - S_{2b}^m\right) + 0.32\left(S_{2a}^m - S_{2c}^m\right) & \text{if} \quad S_{2b}^m \le S_{2c}^m \le S_{2a}^m \\ S_{2c}^m + 0.35\left(S_{2a}^m - S_{2c}^m\right) + 0.15\left(S_{2b}^m - S_{2a}^m\right) & \text{if} \quad S_{2c}^m \le S_{2a}^m \le S_{2b}^m \\ S_{2c}^m + 0.35\left(S_{2b}^m - S_{2c}^m\right) + 0.32\left(S_{2a}^m - S_{2b}^m\right) & \text{if} \quad S_{2c}^m \le S_{2b}^m \le S_{2a}^m \end{cases}$$

Where S^m_{2a}, S^m_{2b} and S^m_{2c} are the scores obtained by a given farm for the partial score S^m_2 in Sub-periods 2a, 2b and 2c respectively.
μ_{2a}, μ_{2b} and μ_{2c} are the capacities of Sub-periods 2a, 2b and 2c respectively.
μ_{2a2b} is the capacity of the group made of Sub-periods 2a and 2b and so on...

In Period 3:

This period is defined for the evaluation of mortality in dams and juveniles after separation /beginning of growth period from July 16th.
I_3 = 100 - % of dead mink in Period 3

$$\text{Let } J_3 = \frac{I_3 - 70}{100 - 70} \times 100 \quad \text{if } I_3 \ge 70$$
$$J_3 = 0 \quad \text{if } I_3 < 70$$

J_3 is computed into a score using *I*-spline functions (Figure 30) as follows:

$$Score = a_x + b_x \times J_3 + c_x \times J_3^2 + d_x \times J_3^3$$

with $x = 1$ when $J_3 < k$ and $x = 2$ when $J_3 \geq k$

Criterion 7 - Mortality - Period 3			
a_1	0	a_2	-8243.2611889141007850412279367
b_1	0.050315927801916189576747 5	b_2	297.99952278192353105623624 29
c_1	0.005124110161328954832216 1	c_2	-3.5846254510464459208662902
d_1	0.000027101784731916278797 9	d_2	0.014389563420687910902384 7
k	83		

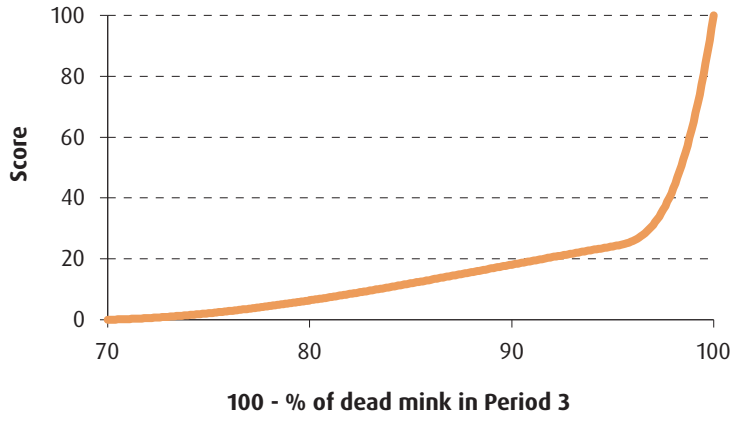


Figure 30 Calculation of the sub-score S_3^m for Measurement of **Mortality** according to the percentage of dead mink in Period 3

Score S^m for Measurement of Mortality

The three sub-scores are combined to form the partial score S^m for Measurement of *Mortality* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.27	μ_{12}	=	0.28
μ_2	=	0.18	μ_{13}	=	0.51
μ_3	=	0.22	μ_{23}	=	0.22

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^m\text{-score} = \begin{cases} S_1^m + \left(S_2^m - S_1^m\right)\mu_{23} + \left(S_3^m - S_2^m\right)\mu_3 & \text{if} \quad S_1^m \leq S_2^m \leq S_3^m \\ S_1^m + \left(S_3^m - S_1^m\right)\mu_{23} + \left(S_2^m - S_3^m\right)\mu_2 & \text{if} \quad S_1^m \leq S_3^m \leq S_2^m \\ S_2^m + \left(S_1^m - S_2^m\right)\mu_{13} + \left(S_3^m - S_1^m\right)\mu_3 & \text{if} \quad S_2^m \leq S_1^m \leq S_3^m \\ S_2^m + \left(S_3^m - S_2^m\right)\mu_{13} + \left(S_1^m - S_3^m\right)\mu_1 & \text{if} \quad S_2^m \leq S_3^m \leq S_1^m \\ S_3^m + \left(S_1^m - S_3^m\right)\mu_{12} + \left(S_2^m - S_1^m\right)\mu_2 & \text{if} \quad S_3^m \leq S_1^m \leq S_2^m \\ S_3^m + \left(S_2^m - S_3^m\right)\mu_{12} + \left(S_1^m - S_2^m\right)\mu_1 & \text{if} \quad S_3^m \leq S_2^m \leq S_1^m \end{cases}$$

Therefore, with the μ listed above:

$$S^m\text{-score} = \begin{cases} S_1^m + 0.22\left(S_2^m - S_1^m\right) + 0.22\left(S_3^m - S_2^m\right) & \text{if} \quad S_1^m \le S_2^m \le S_3^m \\ S_1^m + 0.22\left(S_3^m - S_1^m\right) + 0.18\left(S_2^m - S_3^m\right) & \text{if} \quad S_1^m \le S_3^m \le S_2^m \\ S_2^m + 0.51\left(S_1^m - S_2^m\right) + 0.22\left(S_3^m - S_1^m\right) & \text{if} \quad S_2^m \le S_1^m \le S_3^m \\ S_2^m + 0.51\left(S_3^m - S_2^m\right) + 0.27\left(S_1^m - S_3^m\right) & \text{if} \quad S_2^m \le S_3^m \le S_1^m \\ S_3^m + 0.28\left(S_1^m - S_3^m\right) + 0.18\left(S_2^m - S_1^m\right) & \text{if} \quad S_3^m \le S_1^m \le S_2^m \\ S_3^m + 0.28\left(S_2^m - S_3^m\right) + 0.27\left(S_1^m - S_2^m\right) & \text{if} \quad S_3^m \le S_2^m \le S_1^m \end{cases}$$

Where S^m_1, S^m_2 and S^m_3 are the scores obtained by a given farm for the partial score S^m in Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made of Periods 1 and 2 and so on...

Sub-scores S_1^d, S_2^d and S_3^d for Periods 1, 2 and 3 for Measurement of *Diarrhoea*

The score of a farm with regard to Measurement of *Diarrhoea* is calculated from the % of mink in cages with evidence of diarrhoea.
The calculation of the sub-score is the same for each period:

In Period 1:

Let I_1 = 100 - % of mink in cages with evidence of diarrhoea in Period 1

I_1 is computed into a score using *I*-spline functions (Figure 31) as follows:

$$\textit{Score} = a_x + b_x \times I_1 + c_x \times I_1^2 + d_x \times I_1^3$$

with $x = 1$ when $I_1 < k$ and $x = 2$ when $I_1 \ge k$

Criterion 3 - Diarrhoea - Period 1			
a_1	0	a_2	-28939.449918379388691391795873 6
b_1	0.000000000061532898653357 4	b_2	986.57177669545990283950231 97
c_1	0.005564513522767038089522 6	c_2	-11.20547432084563510557018 16
d_1	-0.000029026102273206931737 2	d_2	0.04243701546870053825655 23
k	88		

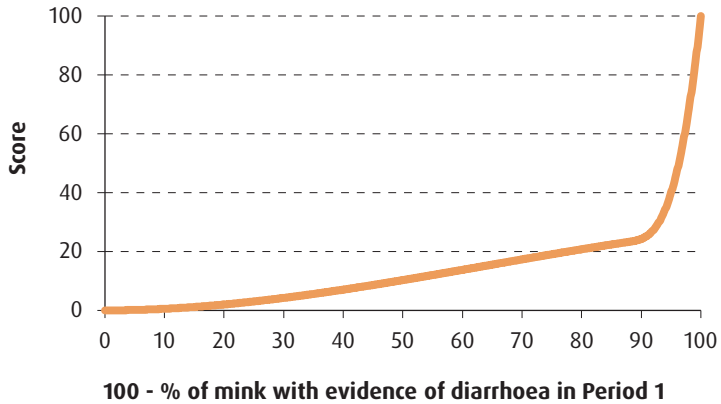


Figure 31 Calculation of the sub-score S_1^d for Measurement of **Diarrhoea** according to the percentage of mink in cages with evidence of diarrhoea in Period 1

In Period 2:
Let I_2 = 100 - % of mink in cages with evidence of diarrhoea in Period 2

I_2 is computed into a score using *I*-spline functions (Figure 32) as follows:

$$Score = a_x + b_x \times I_2 + c_x \times I_2^2 + d_x \times I_2^3$$

with $x = 1$ when $I_2 < k$ and $x = 2$ when $I_2 \geq k$

Criterion 7 - Diarrhoea - Period 2			
a_1	0	a_2	-19219.152286422580800717696547 5
b_1	0.267051062516677706337731 0	b_2	655.465171930920860177138820 3
c_1	0.001480353074026861471060 3	c_2	-7.443950122702075233860341 5
d_1	0.000009757887755467262275 4	d_2	0.028212136327942088920295 3
k	88		

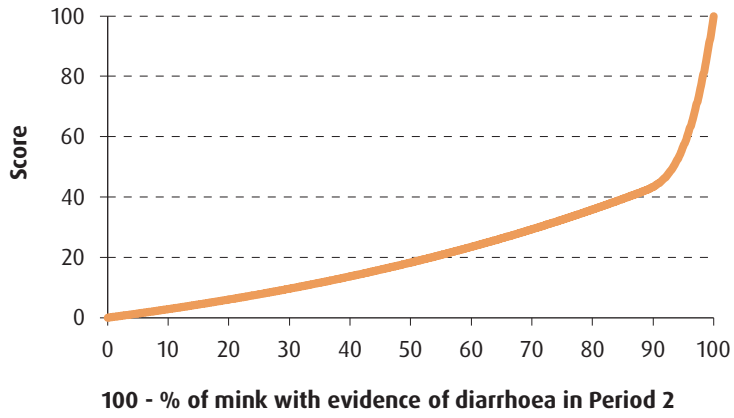


Figure 32 Calculation of the sub-score S_2^d for Measurement of **Diarrhoea** according to the percentage of mink in cages with evidence of diarrhoea in Period 2

In Period 3:
Let I_3 = 100 - % of mink in cages with evidence of diarrhoea in Period 3

I_3 is computed into a score using *I*-spline functions (Figure 33) as follows:

$$Score = a_x + b_x \times I_3 + c_x \times I_3^2 + d_x \times I_3^3$$

with $x = 1$ when $I_3 < k$ and $x = 2$ when $I_3 \geq k$

Criterion 7 - Diarrhoea - Period 3			
a_1	0	a_2	-26536.810176636467076605185866 4
b_1	0.067384476262052614425890 3	b_2	904.731019397095906242611818 0
c_1	0.001748137378524118818248 8	c_2	-10.278516694613225368470921 2
d_1	0.000008491519362063417006 5	d_2	0.038948875193530844984746 2
k	88		

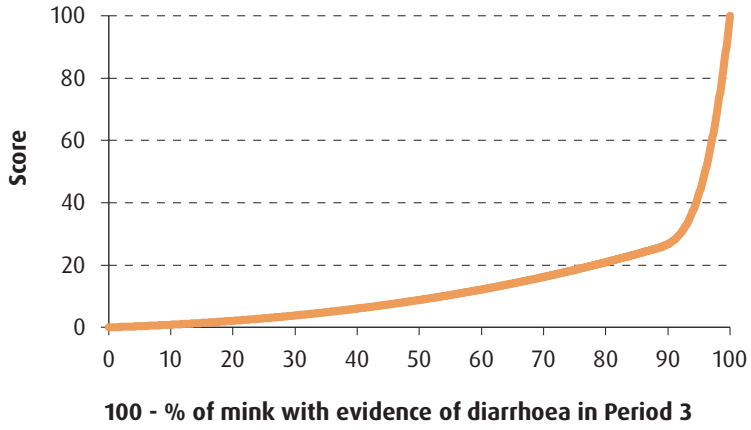


Figure 33 Calculation of the sub-score S_3^d for Measurement of **Diarrhoea** according to the percentage of mink in cages with evidence of diarrhoea in Period 3

Score S^d for Measurement of *Diarrhoea*

The three sub-scores are combined to form the partial score S^d for Measurement of *Diarrhoea* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.28	μ_{12}	=	0.28
μ_2	=	0.22	μ_{13}	=	0.35
μ_3	=	0.23	μ_{23}	=	0.31

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^d\text{-score} = \begin{cases} S_1^d + \left(S_2^d - S_1^d\right)\mu_{23} + \left(S_3^d - S_2^d\right)\mu_3 & \text{if} \quad S_1^d \le S_2^d \le S_3^d \\ S_1^d + \left(S_3^d - S_1^d\right)\mu_{23} + \left(S_2^d - S_3^d\right)\mu_2 & \text{if} \quad S_1^d \le S_3^d \le S_2^d \\ S_2^d + \left(S_1^d - S_2^d\right)\mu_{13} + \left(S_3^d - S_1^d\right)\mu_3 & \text{if} \quad S_2^d \le S_1^d \le S_3^d \\ S_2^d + \left(S_3^d - S_2^d\right)\mu_{13} + \left(S_1^d - S_3^d\right)\mu_1 & \text{if} \quad S_2^d \le S_3^d \le S_1^d \\ S_3^d + \left(S_1^d - S_3^d\right)\mu_{12} + \left(S_2^d - S_1^d\right)\mu_2 & \text{if} \quad S_3^d \le S_1^d \le S_2^d \\ S_3^d + \left(S_2^d - S_3^d\right)\mu_{12} + \left(S_1^d - S_2^d\right)\mu_1 & \text{if} \quad S_3^d \le S_2^d \le S_1^d \end{cases}$$

Therefore, with the μ listed above:

$$S^d\text{-score} = \begin{cases} S_1^d + 0.31\left(S_2^d - S_1^d\right) + 0.23\left(S_3^d - S_2^d\right) & \text{if} \quad S_1^d \le S_2^d \le S_3^d \\ S_1^d + 0.31\left(S_3^d - S_1^d\right) + 0.22\left(S_2^d - S_3^d\right) & \text{if} \quad S_1^d \le S_3^d \le S_2^d \\ S_2^d + 0.35\left(S_1^d - S_2^d\right) + 0.23\left(S_3^d - S_1^d\right) & \text{if} \quad S_2^d \le S_1^d \le S_3^d \\ S_2^d + 0.35\left(S_3^d - S_2^d\right) + 0.28\left(S_1^d - S_3^d\right) & \text{if} \quad S_2^d \le S_3^d \le S_1^d \\ S_3^d + 0.28\left(S_1^d - S_3^d\right) + 0.22\left(S_2^d - S_1^d\right) & \text{if} \quad S_3^d \le S_1^d \le S_2^d \\ S_3^d + 0.28\left(S_2^d - S_3^d\right) + 0.28\left(S_1^d - S_2^d\right) & \text{if} \quad S_3^d \le S_2^d \le S_1^d \end{cases}$$

Where S^d_1, S^d_2 and S^d_3 are the scores obtained by a given farm for the partial score S^d in Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made of Periods 1 and 2 and so on...

Sub-scores S^I_1, S^I_2 and S^I_3 for Periods 1, 2 and 3 for Measurement of *Lameness or impaired movement*
The score of a farm with regard to Measurement of *Lameness or impaired movement* is calculated from the % of mink with evidence of lameness.
The calculation of the sub-score is the same for each period:

In Period 1:
Let I_1 = 100 -% of mink with evidence of lameness in Period 1

$$\text{Let } J_1 = \frac{I_1 - 70}{100 - 70} \times 100 \quad \text{if } I_1 \geq 70$$
$$J_1 = 0 \quad \text{if } I_1 < 70$$

J_1 is computed into a score using *I*-spline functions (Figure 34) as follows:

$$\textit{Score} = a_x + b_x \times J_1 + c_x \times J_1^2 + d_x \times J_1^3$$

with $x = 1$ when $J_1 < k$ and $x = 2$ when $J_1 \geq k$

Criterion 7 - Lameness - Period 1			
a_1	0	a_2	-1972.097818620003636169712990 5
b_1	0.077193011078648107736732 7	b_2	78.961106636321844121084723 2
c_1	-0.001029240147914005538976 0	c_2	-1.052814765520313500246629 7
d_1	0.000029532434560700017190 1	d_2	0.004704134810037045692776 6
k	75		

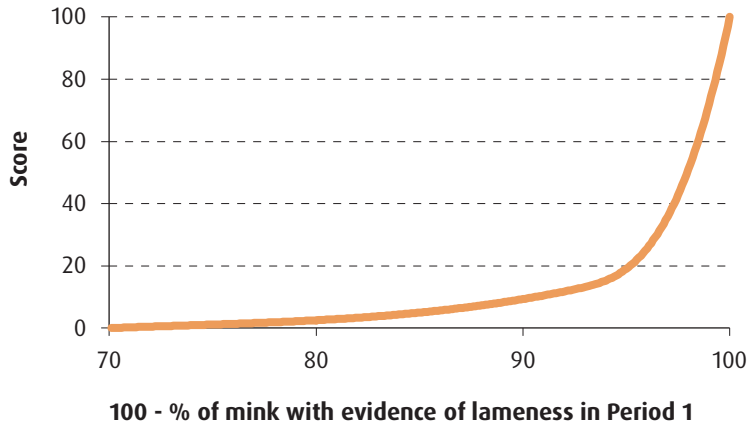


Figure 34 Calculation of the sub-score S^I_1 for Measurement of Lameness or impaired movement according to the percentage of mink with evidence of lameness in Period 1

In Period 2:
Let I_2 = 100 -% of mink with evidence of lameness in Period 2

$$\text{Let } J_2 = \frac{I_1 - 70}{100 - 70} \times 100 \quad \text{if } I_2 \geq 70$$
$$J_2 = 0 \quad \text{if } I_2 < 70$$

J_2 is computed into a score using *I*-spline functions (Figure 35) as follows:

$$\textbf{\textit{Score}} = a_x + b_x \times J_2 + c_x \times J_2^2 + d_x \times J_2^3$$

with $x = 1$ when $J_2 < k$ and $x = 2$ when $J_2 \geq k$

Criterion 7 - Lameness - Period 2			
a_1	0	a_2	-1949.00616376557650255563203 25
b_1	0.07636307682019120857130 90	b_2	78.03661050030687817979924 15
c_1	-0.00070271638823430151738 62	c_2	-1.04017269231463349576927 16
d_1	0.00002720543691625107422 13	d_2	0.00464707203672863264354 30
k	75		

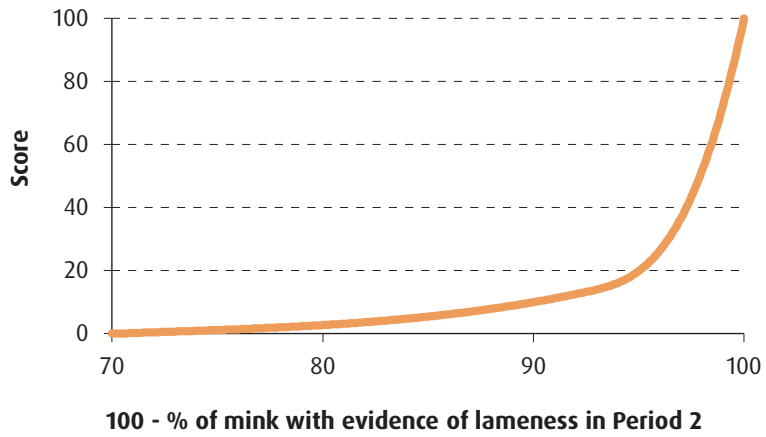


Figure 35 Calculation of the sub-score S_2^I for Measurement of **Lameness or impaired movement** according to the percentage of mink with evidence of lameness in Period 2

In Period 3:
Let I_3 = 100 -% of mink with evidence of lameness in Period 3

$$\text{Let } J_3 = \frac{I_3 - 70}{100 - 70} \times 100 \quad \text{if } I_3 \geq 70$$
$$J_3 = 0 \quad \text{if } I_3 < 70$$

J_3 is computed into a score using *I*-spline functions (Figure 36) as follows:

$$\textbf{\textit{Score}} = a_x + b_x \times J_3 + c_x \times J_3^2 + d_x \times J_3^3$$

with $x = 1$ when $J_3 < k$ and $x = 2$ when $J_3 \geq k$

Criterion 7 - Lameness - Period 3			
a_1	0	a_2	-1972.097818620003636169712990 5
b_1	0.077193011078648107736732 7	b_2	78.961106636321844121084723 2
c_1	-0.001029240147914005538976 0	c_2	-1.052814765520313500246629 7
d_1	0.000029532434560700017190 1	d_2	0.004704134810037045692776 6
k	75		

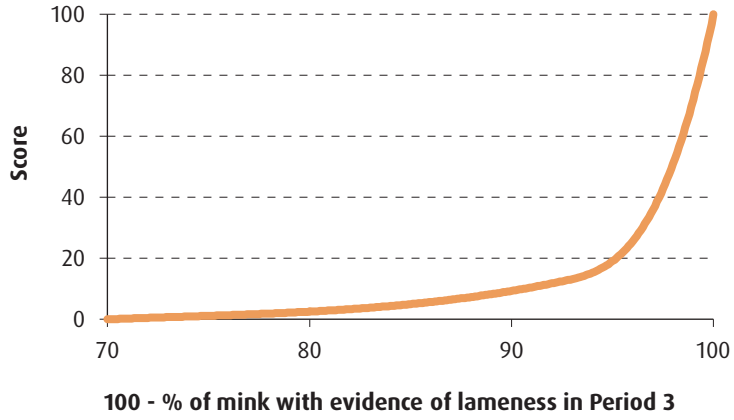


Figure 36 Calculation of the sub-score S_3^I for Measurement of Lameness or impaired movement according to the percentage of mink with evidence of lameness in Period 3

Score S^I for Measurement of *Lameness or impaired movement*

The three sub-scores are combined to form the partial score S^I for Measurement of *Lameness or impaired movement* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.28	μ_{12}	=	0.28
μ_2	=	0.22	μ_{13}	=	0.36
μ_3	=	0.22	μ_{23}	=	0.25

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^I\text{-score} = \begin{cases} S_1^I + (S_2^I - S_1^I)\mu_{23} + (S_3^I - S_2^I)\mu_3 & \text{if} \quad S_1^I \le S_2^I \le S_3^I \\ S_1^I + (S_3^I - S_1^I)\mu_{23} + (S_2^I - S_3^I)\mu_2 & \text{if} \quad S_1^I \le S_3^I \le S_2^I \\ S_2^I + (S_1^I - S_2^I)\mu_{13} + (S_3^I - S_1^I)\mu_3 & \text{if} \quad S_2^I \le S_1^I \le S_3^I \\ S_2^I + (S_3^I - S_2^I)\mu_{13} + (S_1^I - S_3^I)\mu_1 & \text{if} \quad S_2^I \le S_3^I \le S_1^I \\ S_3^I + (S_1^I - S_3^I)\mu_{12} + (S_2^I - S_1^I)\mu_2 & \text{if} \quad S_3^I \le S_1^I \le S_2^I \\ S_3^I + (S_2^I - S_3^I)\mu_{12} + (S_1^I - S_2^I)\mu_1 & \text{if} \quad S_3^I \le S_2^I \le S_1^I \end{cases}$$

Therefore, with the μ listed above:

$$S^I\text{-score} = \begin{cases} S_1^I + 0.25\left(S_2^I - S_1^I\right) + 0.22\left(S_3^I - S_2^I\right) & \text{if} \quad S_1^I \le S_2^I \le S_3^I \\ S_1^I + 0.25\left(S_3^I - S_1^I\right) + 0.22\left(S_2^I - S_3^I\right) & \text{if} \quad S_1^I \le S_3^I \le S_2^I \\ S_2^I + 0.36\left(S_1^I - S_2^I\right) + 0.22\left(S_3^I - S_1^I\right) & \text{if} \quad S_2^I \le S_1^I \le S_3^I \\ S_2^I + 0.36\left(S_3^I - S_2^I\right) + 0.28\left(S_1^I - S_3^I\right) & \text{if} \quad S_2^I \le S_3^I \le S_1^I \\ S_3^I + 0.28\left(S_1^I - S_3^I\right) + 0.22\left(S_2^I - S_1^I\right) & \text{if} \quad S_3^I \le S_1^I \le S_2^I \\ S_3^I + 0.28\left(S_2^I - S_3^I\right) + 0.28\left(S_1^I - S_2^I\right) & \text{if} \quad S_3^I \le S_2^I \le S_1^I \end{cases}$$

Where S^I_1, S^I_2 and S^I_3 are the sub-scores obtained by a given farm for Measurement of *Lameness or impaired movement* in Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Measurement of *Lameness or impaired movement* in Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in period 1 and 2 and so on...

Sub-scores S_1^s, S_2^s and S_3^s for Periods 1, 2 and 3 for Measurement *Obviously sick animals*

The score of a farm with regard to Measurement of *Obviously sick animals* is calculated from the % of mink with evidence of disease (other than diarrhoea or lameness).
The calculation of the sub-score is the same for each period.

In Period 1:
Let I_1 = 100 -% of mink with evidence of disease in Period 1

$$\text{Let } J_1 = \frac{I_1 - 50}{100 - 50} \times 100 \quad \text{if } I_1 \ge 50$$
$$J_1 = 0 \quad \text{if } I_1 < 50$$

J_1 is computed into a score using *I*-spline functions (Figure 37) as follows:

***Score* = $a_x + b_x \times J_1 + c_x \times J_1^2 + d_x \times J_1^3$**

with x = 1 when $J_1 < k$ and x = 2 when $J_1 \ge k$

Criterion 7 - Obviously sick animals - Period 1			
a_1	0	a_2	-5313.59599071883530996274203 06
b_1	-0.00000000000088359856755270	b_2	199.25984444110218873902340 42
c_1	0.00108325745050998586542749	c_2	-2.48966473856307146661492 88
d_1	0.00000614250846566909139 62	d_2	0.01038425893283559039992 35
k	80		

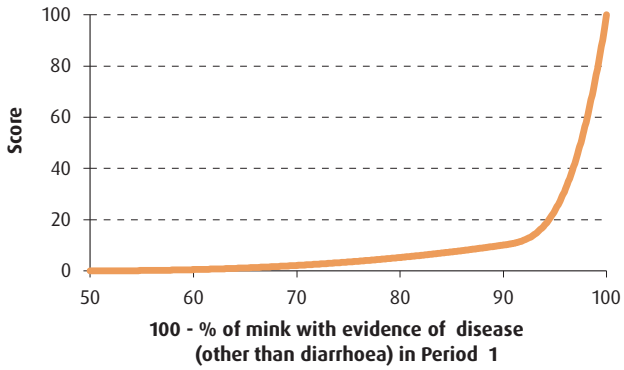


Figure 37 Calculation of the sub-score S_1^s for Measurement **of Obviously sick animals** according to the percentage of mink with evidence of disease in Period 1

In Period 2:

Let I_2 = 100 -% of mink with evidence of disease (other than diarrhoea), juveniles included, in Period 2

$$\text{Let } J_2 = \frac{I_2 - 50}{100 - 50} \times 100 \quad \text{if } I_2 \geq 50$$

$$J_2 = 0 \quad \text{if } I_2 < 50$$

J_2 is computed into a score using *I*-spline functions (Figure 38) as follows:

$$Score = a_x + b_x \times J_2 + c_x \times J_2^2 + d_x \times J_2^3$$

with x = 1 when $J_2 < k$ and x = 2 when $J_2 \geq k$

Criterion 7 - Obviously sick animals - Period 2			
a_1	0	a_2	-3331.9748704838020785246044397
b_1	-0.00000000001452498518177 90	b_2	126.53069015504581784625770 52
c_1	0.00006046321097480381658 59	c_2	-1.60159382960763729819575 47
d_1	0.00003680920964951346760 14	d_2	0.00679484415118582381343 25
k	79		

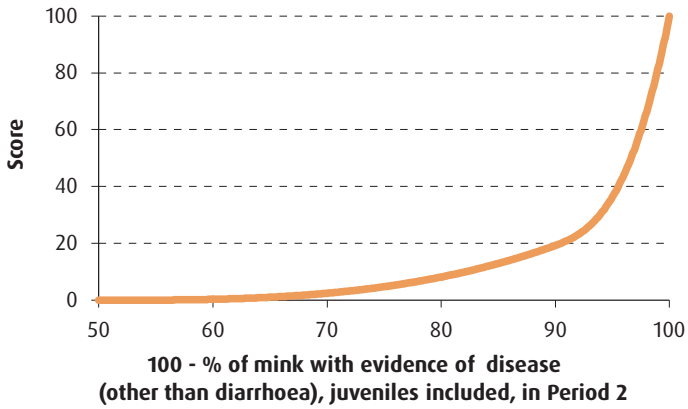


Figure 38 Calculation of the sub-score S_2^s for Measurement of **Obviously sick animals** according to the percentage of mink with evidence of disease other than diarrhoea (juveniles included) in Period 2

In Period 3:

Let I_3 = 100 -% of mink with evidence of disease (other than diarrhoea) in Period 3.

$$\text{Let } J_3 = \frac{I_3 - 50}{100 - 50} \times 100 \quad \text{if } I_3 \geq 50$$

$$J_3 = 0 \quad \text{if } I_3 < 50$$

J_3 is computed into a score using *I*-spline functions (Figure 39) as follows:

$$\textit{Score} = a_x + b_x \times J_3 + c_x \times J_3^2 + d_x \times J_3^3$$

with $x = 1$ when $J_3 < k$ and $x = 2$ when $J_3 \geq k$

Criterion 7 - Obviously sick animals - Period 3			
a_1	0	a_2	-4580.958543860506324563175439 8
b_1	-0.00000000001996269947089 93	b_2	173.960449473822450272564310 6
c_1	0.00176189554964385937385 62	c_2	-2.20026909258173919425871 65
d_1	-0.00000366540163499564136 79	d_2	0.00928760452247541501424 88
k	79		

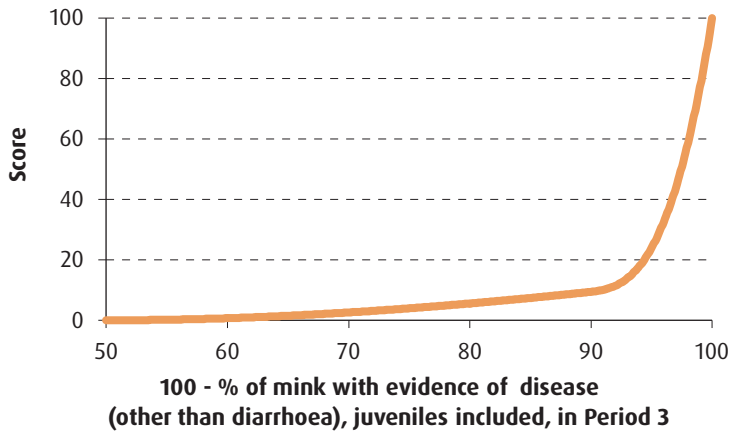


Figure 39 Calculation of the sub-score S_3^s for Measurement of **Obviously sick** animals according to the percentage of mink with evidence of disease in Period 3

Score S^s for Measurement of *Obviously sick animals*

The three sub-scores are combined to form the partial score S^s for Measurement *of Obviously sick animals* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.25	μ_{12}	=	0.31
μ_2	=	0.14	μ_{13}	=	0.41
μ_3	=	0.21	μ_{23}	=	0.21

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^s\text{-score} = \begin{cases} S_1^s + \left(S_2^s - S_1^s\right)\mu_{23} + \left(S_3^s - S_2^s\right)\mu_3 & \text{if} \quad S_1^s \le S_2^s \le S_3^s \\ S_1^s + \left(S_3^s - S_1^s\right)\mu_{23} + \left(S_2^s - S_3^s\right)\mu_2 & \text{if} \quad S_1^s \le S_3^s \le S_2^s \\ S_2^s + \left(S_1^s - S_2^s\right)\mu_{13} + \left(S_3^s - S_1^s\right)\mu_3 & \text{if} \quad S_2^s \le S_1^s \le S_3^s \\ S_2^s + \left(S_3^s - S_2^s\right)\mu_{13} + \left(S_1^s - S_3^s\right)\mu_1 & \text{if} \quad S_2^s \le S_3^s \le S_1^s \\ S_3^s + \left(S_1^s - S_3^s\right)\mu_{12} + \left(S_2^s - S_1^s\right)\mu_2 & \text{if} \quad S_3^s \le S_1^s \le S_2^s \\ S_3^s + \left(S_2^s - S_3^s\right)\mu_{12} + \left(S_1^s - S_2^s\right)\mu_1 & \text{if} \quad S_3^s \le S_2^s \le S_1^s \end{cases}$$

Therefore, with the μ listed above:

$$S^s\text{-score} = \begin{cases} S_1^s + 0.21\left(S_2^s - S_1^s\right) + 0.21\left(S_3^s - S_2^s\right) & \text{if} \quad S_1^s \le S_2^s \le S_3^s \\ S_1^s + 0.21\left(S_3^s - S_1^s\right) + 0.14\left(S_2^s - S_3^s\right) & \text{if} \quad S_1^s \le S_3^s \le S_2^s \\ S_2^s + 0.41\left(S_1^s - S_2^s\right) + 0.21\left(S_3^s - S_1^s\right) & \text{if} \quad S_2^s \le S_1^s \le S_3^s \\ S_2^s + 0.41\left(S_3^s - S_2^s\right) + 0.25\left(S_1^s - S_3^s\right) & \text{if} \quad S_2^s \le S_3^s \le S_1^s \\ S_3^s + 0.31\left(S_1^s - S_3^s\right) + 0.14\left(S_2^s - S_1^s\right) & \text{if} \quad S_3^s \le S_1^s \le S_2^s \\ S_3^s + 0.31\left(S_2^s - S_3^s\right) + 0.25\left(S_1^s - S_2^s\right) & \text{if} \quad S_3^s \le S_2^s \le S_1^s \end{cases}$$

Where S^s_1, S^s_2 and S^s_3 are the sub-scores obtained by a given farm for Measurement *of Obviously sick animals* in Period 1, in Period 2 and in Period 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Measurement *of Obviously sick animals* in Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in Periods 1 and 2 and so on...

Score for Measurement *of Absence of disease*

The four partial scores are combined to form the overall score for the Criter*ion of Absence of disease* using a Choquet integral. The parameters of the Choquet integral are:

μ_m	=	0.29	μ_{dl}	=	0.15
μ_d	=	0.15	μ_{ds}	=	0.15
μ_l	=	0.00	μ_{ls}	=	0.15
μ_s	=	0.15	μ_{mdl}	=	0.42
μ_{md}	=	0.29	μ_{mds}	=	0.59
μ_{ml}	=	0.29	μ_{mls}	=	0.65
μ_{ms}	=	0.44	μ_{dls}	=	0.31

with m, mortality; d, diarrhoea; l, lameness and s, obviously sick animals.

Reminder:

$$\text{Absence of disease-score} = \begin{cases}
S_m + (S_d - S_m)\,\mu_{dls} + (S_l - S_d)\,\mu_{sl} + (S_s - S_l)\,\mu_s & \text{if} \quad S_m \le S_d \le S_l \le S_s \\
S_m + (S_d - S_m)\,\mu_{dls} + (S_s - S_d)\,\mu_{ls} + (S_l - S_s)\,\mu_l & \text{if} \quad S_m \le S_d \le S_s \le S_l \\
S_m + (S_l - S_m)\,\mu_{dls} + (S_d - S_l)\,\mu_{ds} + (S_s - S_d)\,\mu_s & \text{if} \quad S_m \le S_l \le S_d \le S_s \\
S_m + (S_l - S_m)\,\mu_{dls} + (S_s - S_l)\,\mu_{ds} + (S_d - S_s)\,\mu_d & \text{if} \quad S_m \le S_l \le S_s \le S_d \\
S_m + (S_s - S_m)\,\mu_{dls} + (S_d - S_s)\,\mu_{dl} + (S_l - S_d)\,\mu_l & \text{if} \quad S_m \le S_s \le S_d \le S_l \\
S_m + (S_s - S_m)\,\mu_{dls} + (S_l - S_s)\,\mu_{dl} + (S_d - S_l)\,\mu_d & \text{if} \quad S_m \le S_s \le S_l \le S_d \\
S_d + (S_m - S_d)\,\mu_{mls} + (S_l - S_m)\,\mu_{ls} + (S_s - S_l)\,\mu_s & \text{if} \quad S_d \le S_m \le S_l \le S_s \\
S_d + (S_m - S_d)\,\mu_{mls} + (S_s - S_m)\,\mu_{ls} + (S_l - S_s)\,\mu_l & \text{if} \quad S_d \le S_m \le S_s \le S_l \\
S_d + (S_l - S_d)\,\mu_{mls} + (S_m - S_l)\,\mu_{ms} + (S_s - S_m)\,\mu_s & \text{if} \quad S_d \le S_l \le S_m \le S_s \\
S_d + (S_l - S_d)\,\mu_{mls} + (S_s - S_l)\,\mu_{ms} + (S_m - S_s)\,\mu_m & \text{if} \quad S_d \le S_l \le S_s \le S_m \\
S_d + (S_s - S_d)\,\mu_{mls} + (S_l - S_s)\,\mu_{ml} + (S_m - S_l)\,\mu_m & \text{if} \quad S_d \le S_s \le S_l \le S_m \\
S_d + (S_s - S_d)\,\mu_{mls} + (S_m - S_s)\,\mu_{ml} + (S_l - S_m)\,\mu_l & \text{if} \quad S_d \le S_s \le S_m \le S_l \\
S_l + (S_d - S_l)\,\mu_{mds} + (S_m - S_d)\,\mu_{ms} + (S_s - S_m)\,\mu_s & \text{if} \quad S_l \le S_d \le S_m \le S_s \\
S_l + (S_d - S_l)\,\mu_{mds} + (S_s - S_d)\,\mu_{ms} + (S_m - S_s)\,\mu_m & \text{if} \quad S_l \le S_d \le S_s \le S_m \\
S_l + (S_s - S_l)\,\mu_{mds} + (S_d - S_s)\,\mu_{md} + (S_m - S_d)\,\mu_m & \text{if} \quad S_l \le S_s \le S_d \le S_m \\
S_l + (S_s - S_l)\,\mu_{mds} + (S_m - S_s)\,\mu_{md} + (S_d - S_m)\,\mu_d & \text{if} \quad S_l \le S_s \le S_m \le S_d \\
S_l + (S_m - S_l)\,\mu_{mds} + (S_s - S_m)\,\mu_{ds} + (S_d - S_s)\,\mu_d & \text{if} \quad S_l \le S_m \le S_s \le S_d \\
S_l + (S_m - S_l)\,\mu_{mds} + (S_d - S_m)\,\mu_{ds} + (S_s - S_d)\,\mu_s & \text{if} \quad S_l \le S_m \le S_d \le S_s \\
S_s + (S_m - S_s)\,\mu_{mdl} + (S_d - S_m)\,\mu_{dl} + (S_l - S_d)\,\mu_l & \text{if} \quad S_s \le S_m \le S_d \le S_l \\
S_s + (S_m - S_s)\,\mu_{mdl} + (S_l - S_m)\,\mu_{dl} + (S_d - S_l)\,\mu_d & \text{if} \quad S_s \le S_m \le S_l \le S_d \\
S_s + (S_d - S_s)\,\mu_{mdl} + (S_l - S_d)\,\mu_{ml} + (S_m - S_l)\,\mu_m & \text{if} \quad S_s \le S_d \le S_l \le S_m \\
S_s + (S_d - S_s)\,\mu_{mdl} + (S_m - S_d)\,\mu_{ml} + (S_l - S_m)\,\mu_l & \text{if} \quad S_s \le S_d \le S_m \le S_l \\
S_s + (S_l - S_s)\,\mu_{mdl} + (S_m - S_l)\,\mu_{md} + (S_d - S_m)\,\mu_d & \text{if} \quad S_s \le S_l \le S_m \le S_d \\
S_s + (S_l - S_s)\,\mu_{mdl} + (S_d - S_l)\,\mu_{md} + (S_m - S_d)\,\mu_m & \text{if} \quad S_s \le S_l \le S_d \le S_m
\end{cases}$$

Therefore, with the μ listed above:

$$\text{Absence of disease-score} = \begin{cases}
S_m + 0.31(S_d - S_m) + 0.15(S_l - S_d) + 0.15(S_s - S_l) & \text{if} \quad S_m \le S_d \le S_l \le S_s \\
S_m + 0.31(S_d - S_m) + 0.15(S_s - S_d) + 0.00(S_l - S_s) & \text{if} \quad S_m \le S_d \le S_s \le S_l \\
S_m + 0.31(S_l - S_m) + 0.15(S_d - S_l) + 0.15(S_s - S_d) & \text{if} \quad S_m \le S_l \le S_d \le S_s \\
S_m + 0.31(S_l - S_m) + 0.15(S_s - S_l) + 0.15(S_d - S_s) & \text{if} \quad S_m \le S_l \le S_s \le S_d \\
S_m + 0.31(S_s - S_m) + 0.15(S_d - S_s) + 0.00(S_l - S_d) & \text{if} \quad S_m \le S_s \le S_d \le S_l \\
S_m + 0.31(S_s - S_m) + 0.15(S_l - S_s) + 0.15(S_d - S_l) & \text{if} \quad S_m \le S_s \le S_l \le S_d \\
S_d + 0.65(S_m - S_d) + 0.15(S_l - S_m) + 0.15(S_s - S_l) & \text{if} \quad S_d \le S_m \le S_l \le S_s \\
S_d + 0.65(S_m - S_d) + 0.15(S_s - S_m) + 0.00(S_l - S_s) & \text{if} \quad S_d \le S_m \le S_s \le S_l \\
S_d + 0.65(S_l - S_d) + 0.44(S_m - S_l) + 0.15(S_s - S_m) & \text{if} \quad S_d \le S_l \le S_m \le S_s \\
S_d + 0.65(S_l - S_d) + 0.44(S_s - S_l) + 0.29(S_m - S_s) & \text{if} \quad S_d \le S_l \le S_s \le S_m \\
S_d + 0.65(S_s - S_d) + 0.29(S_l - S_s) + 0.29(S_m - S_l) & \text{if} \quad S_d \le S_s \le S_l \le S_m \\
S_d + 0.65(S_s - S_d) + 0.29(S_m - S_s) + 0.00(S_l - S_m) & \text{if} \quad S_d \le S_s \le S_m \le S_l \\
S_l + 0.59(S_d - S_l) + 0.44(S_m - S_d) + 0.15(S_s - S_m) & \text{if} \quad S_l \le S_d \le S_m \le S_s \\
S_l + 0.59(S_d - S_l) + 0.44(S_s - S_d) + 0.29(S_m - S_s) & \text{if} \quad S_l \le S_d \le S_s \le S_m \\
S_l + 0.59(S_s - S_l) + 0.29(S_d - S_s) + 0.29(S_m - S_d) & \text{if} \quad S_l \le S_s \le S_d \le S_m \\
S_l + 0.59(S_s - S_l) + 0.29(S_m - S_s) + 0.15(S_d - S_m) & \text{if} \quad S_l \le S_s \le S_m \le S_d \\
S_l + 0.59(S_m - S_l) + 0.15(S_s - S_m) + 0.15(S_d - S_s) & \text{if} \quad S_l \le S_m \le S_s \le S_d \\
S_l + 0.59(S_m - S_l) + 0.15(S_d - S_m) + 0.15(S_s - S_d) & \text{if} \quad S_l \le S_m \le S_d \le S_s \\
S_s + 0.42(S_m - S_s) + 0.15(S_d - S_m) + 0.00(S_l - S_d) & \text{if} \quad S_s \le S_m \le S_d \le S_l \\
S_s + 0.42(S_m - S_s) + 0.15(S_l - S_m) + 0.15(S_d - S_l) & \text{if} \quad S_s \le S_m \le S_l \le S_d \\
S_s + 0.42(S_d - S_s) + 0.29(S_l - S_d) + 0.29(S_m - S_l) & \text{if} \quad S_s \le S_d \le S_l \le S_m \\
S_s + 0.42(S_d - S_s) + 0.29(S_m - S_d) + 0.00(S_l - S_m) & \text{if} \quad S_s \le S_d \le S_m \le S_l \\
S_s + 0.42(S_l - S_s) + 0.29(S_m - S_l) + 0.15(S_d - S_m) & \text{if} \quad S_s \le S_l \le S_m \le S_d \\
S_s + 0.42(S_l - S_s) + 0.29(S_d - S_l) + 0.29(S_m - S_d) & \text{if} \quad S_s \le S_l \le S_d \le S_m
\end{cases}$$

Where S_m, S_d, S_l and S_s are the scores obtained by a given farm for Measurement *of Mortality*, *Diarrhoea*, *Lameness or impaired movement* and Measurement *of Obviously sick animals* respectively.
μ_m, μ_d, μ_l and μ_s are the capacities of Measurements of *Mortality*, *Diarrhoea*, *Lameness or impaired movement* and of *Obviously sick animals* respectively.
μ_{md} is the capacity of the group made of Measurements from *Mortality* and *Diarrhoea* and so on...

3.3.1.8 Absence of pain induced by management procedures

Two partial scores are calculated, one for Measurement *of Killing methods for pelting of mink* (groups) and one for Measurement *of Killing methods for individual mink*, before being combined into a criterion-score.
Moreover, these two measurements are assessed for the three periods of the production cycle. So a first stage is to calculate the sub-score for each period, then to aggregate the three sub-scores obtained for each period in order to have the score covering the production cycle for each of these two measurements.

Sub-scores S_1^P, S_2^P and S_3^P for Periods 1, 2 and 3 for Measurement *of Killing methods for pelting of mink*

The score of a farm with regard to Measurement *of Killing methods for pelting of mink* is calculated from the percentages of boxes within each level of the scale used to assess box quality (3 levels here):

Level	**0**	**1**	**2**
% of boxes	P_0	P_1	P_2
The calculation of the sub-score is the same for each period:			
In Period 1:			
Let $I_1 = \left(100 - \frac{\sum_{j=0}^{2} w_j \; p_j}{w_2}\right)$ with j = 0, 1 or 2 according to the level considered.			
Weights	W_0 = 0	W_1 = 2	W_2 = 5

I_1 is computed into a score using *I*-spline functions (Figure 40) as follows;

***Score* = $a_x + b_x \times I_1 + c_x \times I_1^2 + d_x \times I_1^3$**

with x = 1 when $I_1 < k$ and x = 2 when $I_1 \geq k$

Criterion 8 - Killing methods for pelting - Period 1			
a_1	0	a_2	-3034.22649048524317549890838 56
b_1	0.29424874566494368943736 50	b_2	-101.98305645438196620489179 62
c_1	-0.00330616568163132800231 56	c_2	1.14587712201618363572208 64
d_1	0.00010936548909344080378 94	d_2	-0.00419469206499277404848 19
k	89		

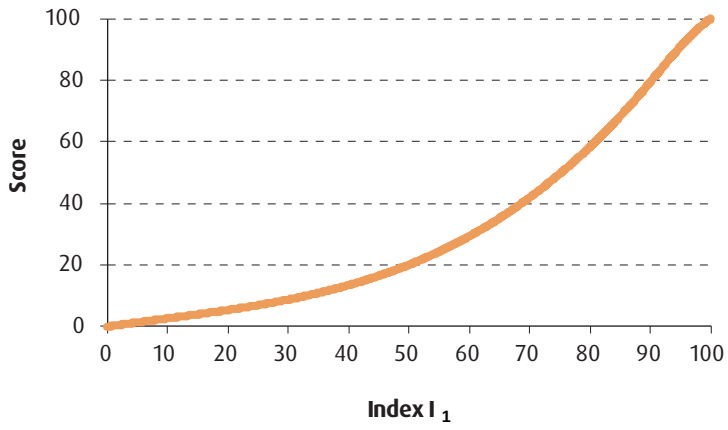


Figure 40 Calculation of the sub-score S_1^P for Measurement **of Killing methods for pelting of mink** according to the percentage of boxes within each level of the scale used to assess box quality in Period 1

In Period 2:

$$\text{Let } I_2 = \left(100 - \frac{\sum_{j=0}^{2} w_j \; p_j}{w_2} \right)$$

with j = 0, 1 or 2 according to the level considered.

Weights	W_0 = 0	W_1 = 2	W_2 = 5

I_2 is computed into a score using I-spline functions (Figure 41) as follows:

$$\textit{Score} = a_x + b_x \times I_2 + c_x \times I_2^2 + d_x \times I_2^3$$

with x = 1 when $I_2 < k$ and x = 2 when $I_2 \geq k$

Criterion 8 - Killing methods for pelting - Period 2			
a_1	0	a_2	2274.77022664980177069082856 18
b_1	0.27336898823381117200727625	b_2	-76.40428451442970469997817 42
c_1	-0.00307156166555000780968632	c_2	0.85847516488888453434693702
d_1	0.00010767354902417296410 28	d_2	-0.00311909342394400476705 66
k	89		

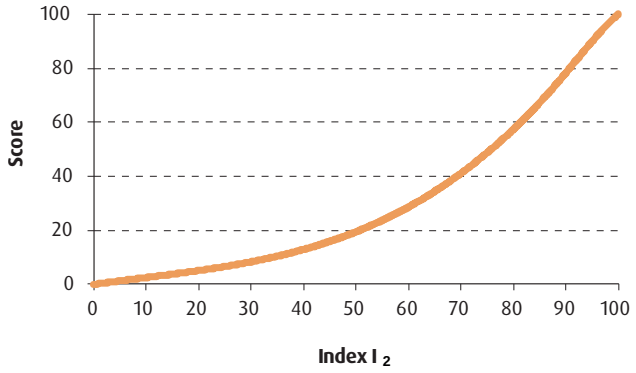


Figure 41 Calculation of the sub-score S_2^p for Measurement **of Killing methods for pelting of mink** according to the percentage of boxes within each level of the scale used to assess box quality in Period 2

In Period 3:

$$\text{Let } I_3 = \left(100 - \frac{\sum_{j=0}^{2} w_j \; p_j}{w_2} \right)$$

with j = 0, 1 or 2 according to the level considered.

Weights	W_0 = 0	W_1 = 6	W_2 = 13

I_3 is computed into a score using *I*-spline functions (Figure 42) as follows:

$$Score = a_x + b_x \times I_3 + c_x \times I_3^2 + d_x \times I_3^3$$

with $x = 1$ when $I_3 < k$ and $x = 2$ when $I_3 \geq k$

Criterion 8 - Killing methods for pelting - Period 3			
a_1	0	a_2	2.767553531792231069630361 2
b_1	0.458421148070639938865156 2	b_2	0.181665794868212909785043 5
c_1	-0.013791995355986094370925 9	c_2	-0.004566816915514766879458 1
d_1	0.000227236018809899592172 9	d_2	0.000124734036136566600865 7
k	30		

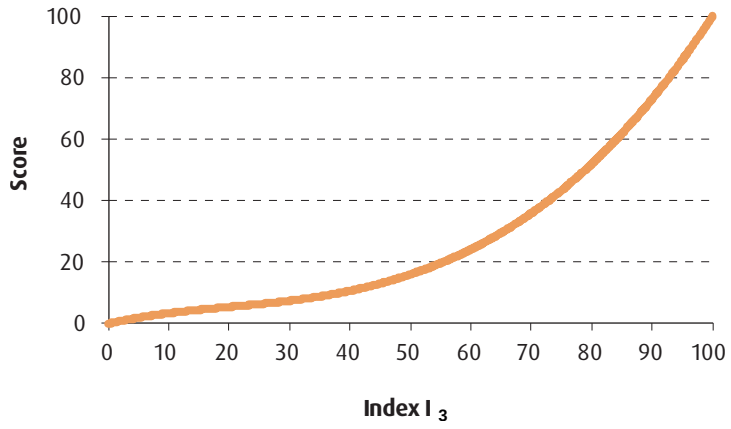


Figure 42 Calculation of the sub-score S_3^P for Measurement of Killing methods for pelting of mink according to the percentage of boxes within each level of the scale used to assess box quality in Period 3

Score S^P for Measurement *of Killing methods for pelting of mink*

The three sub-scores are combined to form the partial score S^P for Measurement *of Killing methods for pelting of mink* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.03	μ_{12}	=	0.07
μ_2	=	0.07	μ_{13}	=	0.57
μ_3	=	0.54	μ_{23}	=	0.61

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^p\text{-score} = \begin{cases} S_1^p + \left(S_2^p - S_1^p\right)\mu_{23} + \left(S_3^p - S_2^p\right)\mu_3 & \text{if} \quad S_1^p \le S_2^p \le S_3^p \\ S_1^p + \left(S_3^p - S_1^p\right)\mu_{23} + \left(S_2^p - S_3^p\right)\mu_2 & \text{if} \quad S_1^p \le S_3^p \le S_2^p \\ S_2^p + \left(S_1^p - S_2^p\right)\mu_{13} + \left(S_3^p - S_1^p\right)\mu_3 & \text{if} \quad S_2^p \le S_1^p \le S_3^p \\ S_2^p + \left(S_3^p - S_2^p\right)\mu_{13} + \left(S_1^p - S_3^p\right)\mu_1 & \text{if} \quad S_2^p \le S_3^p \le S_1^p \\ S_3^p + \left(S_1^p - S_3^p\right)\mu_{12} + \left(S_2^p - S_1^p\right)\mu_2 & \text{if} \quad S_3^p \le S_1^p \le S_2^p \\ S_3^p + \left(S_2^p - S_3^p\right)\mu_{12} + \left(S_1^p - S_2^p\right)\mu_1 & \text{if} \quad S_3^p \le S_2^p \le S_1^p \end{cases}$$

Therefore with the μ listed above:

$$S^p\text{-score} = \begin{cases} S_1^p + 0.61\left(S_2^p - S_1^p\right) + 0.54\left(S_3^p - S_2^p\right) & \textit{if} \quad S_1^p \le S_2^p \le S_3^p \\ S_1^p + 0.61\left(S_3^p - S_1^p\right) + 0.07\left(S_2^p - S_3^p\right) & \textit{if} \quad S_1^p \le S_3^p \le S_2^p \\ S_2^p + 0.57\left(S_1^p - S_2^p\right) + 0.54\left(S_3^p - S_1^p\right) & \textit{if} \quad S_2^p \le S_1^p \le S_3^p \\ S_2^p + 0.57\left(S_3^p - S_2^p\right) + 0.03\left(S_1^p - S_3^p\right) & \textit{if} \quad S_2^p \le S_3^p \le S_1^p \\ S_3^p + 0.07\left(S_1^p - S_3^p\right) + 0.07\left(S_2^p - S_1^p\right) & \textit{if} \quad S_3^p \le S_1^p \le S_2^p \\ S_3^p + 0.07\left(S_2^p - S_3^p\right) + 0.03\left(S_1^p - S_2^p\right) & \textit{if} \quad S_3^p \le S_2^p \le S_1^p \end{cases}$$

Where $S^p{}_1$, $S^p{}_2$ and $S^p{}_3$ are the partial scores obtained by a given farm for Periods 1, 2 and 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made of Periods 1 and 2 and so on...

Sub-scores S_1^p, S_2^k and S_3^k for Periods 1, 2 and 3 for Measurement *of Killing methods for individual mink*

One score is assigned to Measurement *of Killing methods for individual mink* according to a decision tree based on the functioning of the killing equipment in three categories, taking into account the different type of animals and species according to the period considered (Figure 43, Figure 44 and Figure 45).

Period 1

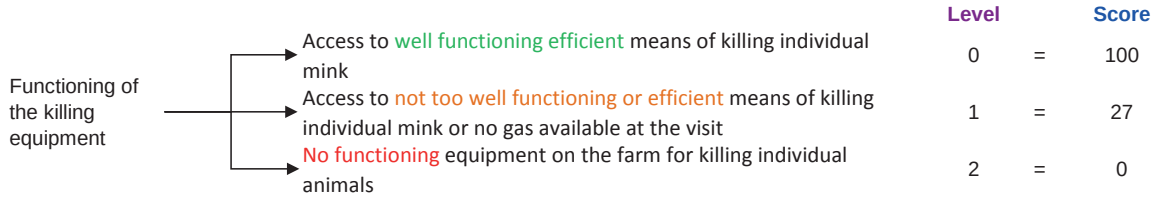


Figure 43 Sub-scores S_1^k assigned to the different types of killing equipments and their functioning in Period 1

Period 2

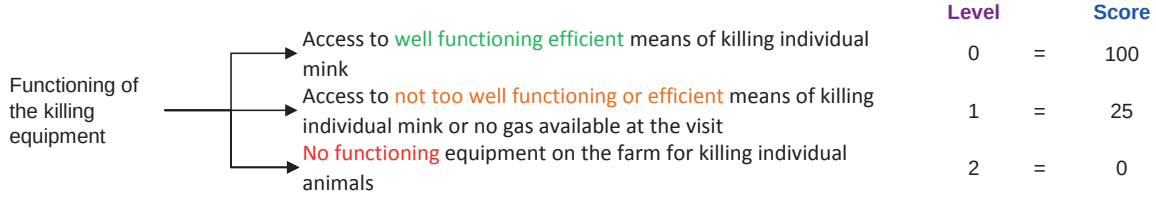


Figure 44 Sub-scores S_2^k assigned to the different types of killing equipments and their functioning in Period 2

Period 3

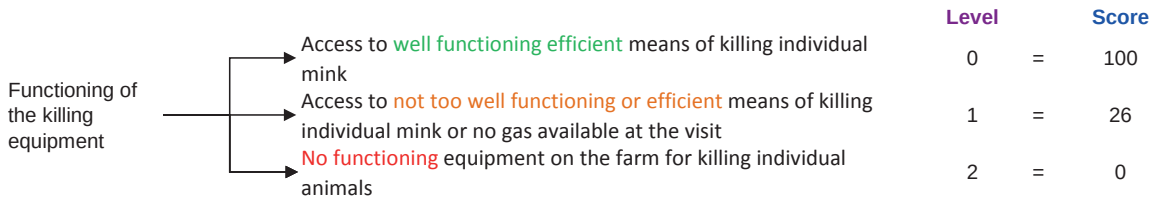


Figure 45 Sub-scores S_3^k assigned to the different types of killing equipments and their functioning in Period 3

Since different killing methods may be in use on the farm, we consider the killing device in the worst situation defined by the decision-tree and the final score to be assigned to the farm is the worst score observed (= the one corresponding to the worst killing device used on the farm within each period).

Score S^k for Measurement *of Killing methods for individual mink*

The three sub-scores are combined to form the partial score S^k for Measurement *of Killing methods for individual mink* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.21	μ_{12}	=	0.21
μ_2	=	0.11	μ_{13}	=	0.26
μ_3	=	0.19	μ_{23}	=	0.25

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^k\text{-score} = \begin{cases} S_1^k + \left(S_2^k - S_1^k\right)\mu_{23} + \left(S_3^k - S_2^k\right)\mu_3 & \text{if} \quad S_1^k \le S_2^k \le S_3^k \\ S_1^k + \left(S_3^k - S_1^k\right)\mu_{23} + \left(S_2^k - S_3^k\right)\mu_2 & \text{if} \quad S_1^k \le S_3^k \le S_2^k \\ S_2^k + \left(S_1^k - S_2^k\right)\mu_{13} + \left(S_3^k - S_1^k\right)\mu_3 & \text{if} \quad S_2^k \le S_1^k \le S_3^k \\ S_2^k + \left(S_3^k - S_2^k\right)\mu_{13} + \left(S_1^k - S_3^k\right)\mu_1 & \text{if} \quad S_2^k \le S_3^k \le S_1^k \\ S_3^k + \left(S_1^k - S_3^k\right)\mu_{12} + \left(S_2^k - S_1^k\right)\mu_2 & \text{if} \quad S_3^k \le S_1^k \le S_2^k \\ S_3^k + \left(S_2^k - S_3^k\right)\mu_{12} + \left(S_1^k - S_2^k\right)\mu_1 & \text{if} \quad S_3^k \le S_2^k \le S_1^k \end{cases}$$

Therefore, with the μ listed above:

$$S^k\text{-score} = \begin{cases} S_1^k + 0.25\left(S_2^k - S_1^k\right) + 0.19\left(S_3^k - S_2^k\right) & \text{if} \quad S_1^k \le S_2^k \le S_3^k \\ S_1^k + 0.25\left(S_3^k - S_1^k\right) + 0.11\left(S_2^k - S_3^k\right) & \text{if} \quad S_1^k \le S_3^k \le S_2^k \\ S_2^k + 0.26\left(S_1^k - S_2^k\right) + 0.19\left(S_3^k - S_1^k\right) & \text{if} \quad S_2^k \le S_1^k \le S_3^k \\ S_2^k + 0.26\left(S_3^k - S_2^k\right) + 0.21\left(S_1^k - S_3^k\right) & \text{if} \quad S_2^k \le S_3^k \le S_1^k \\ S_3^k + 0.21\left(S_1^k - S_3^k\right) + 0.11\left(S_2^k - S_1^k\right) & \text{if} \quad S_3^k \le S_1^k \le S_2^k \\ S_3^k + 0.21\left(S_2^k - S_3^k\right) + 0.21\left(S_1^k - S_2^k\right) & \text{if} \quad S_3^k \le S_2^k \le S_1^k \end{cases}$$

Where S^k_1, S^k_2 and S^k_3 are the sub-scores obtained by a given farm for Measurement *of Killing methods for individual mink* in Periods 1, 2 and 3 respectively.

μ_1, μ_2 and μ_3 are the capacities of Measurement *of Killing methods for individual mink* in Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in Periods 1 and 2 and so on...

Score for the Criterion *of Absence of pain induced by management procedures*
The two partial scores are combined to form the overall score for the Criterion *of Absence of pain induced by management procedures* using a Choquet integral. The parameters of the Choquet integral are:

$$\mu_p = 0.34 \qquad \mu_k = 0.05$$

with p, killing method for pelting and k, killing method for individual mink.

Reminder:

$$\text{Absence of pain induced by management procedures-score} = \begin{cases} S^p + \left(S^k - S^p\right)\mu_k & \text{if} \quad S^p \le S^k \\ S^k + \left(S^p - S^k\right)\mu_p & \text{if} \quad S^k \le S^p \end{cases}$$

Therefore, with the μ listed above:

$$\text{Absence of pain induced by management procedures-score} = \begin{cases} S^p + 0.05\left(S^k - S^p\right) & \text{if} \quad S^p \le S^k \\ S^k + 0.34\left(S^p - S^k\right) & \text{if} \quad S^k \le S^p \end{cases}$$

Where S^p and S^k are the partial scores obtained by a given farm for Measurement *of Killing methods for pelting of mink* and Measurement *of Killing methods for individual mink* respectively.
μ_n and μ_k are the capacities of Measurements *of Killing methods for pelting of mink* and *Killing methods for individual mink* respectively.

3.3.1.9 Expression of social behaviours

Two partial scores are calculated, one for Measurement *of Social housing* of adult females and juveniles and one for Measurement *of Age and procedures at weaning* , before being combined into a criterion-score. Social housing of adult females and juveniles is assessed separately only during the period 3 of the production cycle and weaning management is assessed in late Period 2-early Period 3 (considered as one period).
So the first step is to calculate sub-scores for Measurement *of Social housing* of adult females and juveniles separately for Period 3, then to aggregate the two sub-scores obtained for the 2 sub-measurements into Measurement *Social housing* sub-score in one part and calculate the sub-score for Measurement *of Age and procedures at weaning* in late Period 2-early Period 3 in the other part.

Sub-scores S_3^d and S_3^j for Period 3 for Measurement *of Social housing*
Measurement of Social housing of adult females:
The score of a farm with regard to Measurement *of Social housing* of adult females in Period 3 is calculated from the percentages of females within each level of the scale used to assess social housing (4 levels here):

Level	**0**	**1**	**2**	**3**
% of adult females	P_0^d	P_1^d	P_2^d	P_3^d
$\text{Let } I_3 = \left(100 - \frac{\sum_{j=0}^{3} w_j^d \; p_j^d}{w_3^d}\right)$	with j = 0, 1, 2 or 3 according to the level considered.			
Weights	$W_0^d = 0$	$W_1^d = 1$	$W_2^d = 2$	$W_3^d = 17$

I_3 is computed into a score using *I*-spline functions (Figure 46) as follows:

$$Score = a_x + b_x \times I_3 + c_x \times I_3^2 + d_x \times I_3^3$$

with $x = 1$ when $I_3 < k$ and $x = 2$ when $I_3 \geq k$

Criterion 9 - Females' social housing - Period 3			
a_1	0	a_2	-2156.606315800074298749677836 9
b_1	0.020196793414197385801989 2	b_2	87.450182675922235375765012 6
c_1	0.020196793414197385801989 2	c_2	-1.179310180400371166342665 7
d_1	-0.000017320510281900173188 3	d_2	0.005304689841461313407067 2
k	74		

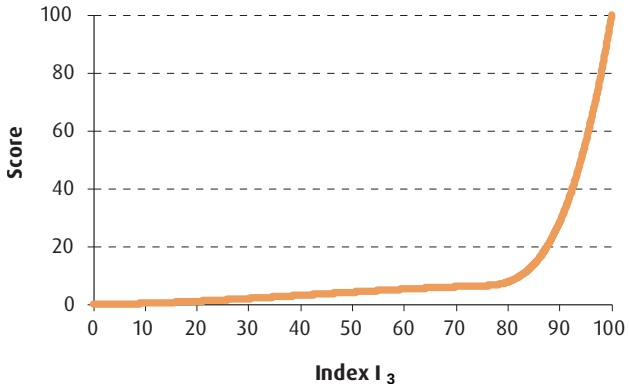


Figure 46 Calculation of the sub-score S_3^f for Measurement of Social housing according to the percentages of adult females within each level of the scale used to assess social housing in Period 3

Measurement of Social housing of juveniles:
The score of a farm with regard to Measurement of Social housing of juveniles in Period 3 is calculated from the percentages of juveniles within each level of the scale used to assess social housing (3 levels here):

Level	**0**	**1**	**2**
% of juveniles	P_0^{jv}	P_1^{jv}	P_2^{jv}
In Period 1:			
$\text{Let } I_1 = \left(100 - \frac{\sum_{j=0}^{2} w_j \; p_j}{w_2} \right)$	with j = 0, 1 or 2 according to the level considered.		
Weights	$W_0^{jv} = 0$	$W_1^{jv} = 4$	$W_2^{jv} = 9$

I_3 is computed into a score using *I*-spline functions (Figure 46) as follows:

$$Score = a_x + b_x \times I_3 + c_x \times I_3^2 + d_x \times I_3^3$$

with $x = 1$ when $I_3 < k$ and $x = 2$ when $I_3 \geq k$

Criterion 9 - Juveniles' social housing - Period 3			
a_1	0	a_2	-797.49582789417377171048428 86
b_1	0.32970400043590869509912 98	b_2	30.23579827113992024578692 51
c_1	0.00718580029244841357594 09	c_2	-0.36664038633653606158446 79
d_1	-0.00001728927805351876078 57	d_2	0.00154031986407048644867 33
k	80		

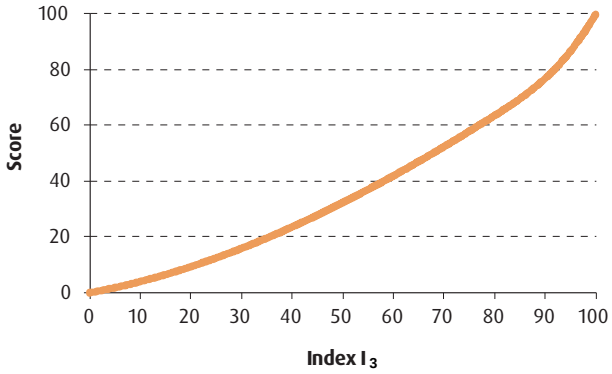


Figure 47 Calculation of the sub-score S_3^{jv} for Measurement of **Social housing** according to the percentages of juveniles within each level of the scale used to assess social housing in Period 3

Score S^h for Measurement of *Social housing*

The two partial scores are combined to form the sub-score S^h for Measurement *of Social housing* using a Choquet integral. The parameters of the Choquet integral are:

μ_f = 0.25 μ_{jv} = 0.36

with f, females' social housing and jv, juveniles' social housing.

Reminder:

$$S^h = \begin{cases} S^f + \left(S^{jv} - S^f\right)\mu_{jv} & \text{if} \quad S^f \leq S^{jv} \\ S^{jv} + \left(S^f - S^{jv}\right)\mu_f & \text{if} \quad S^{jv} \leq S^f \end{cases}$$

Therefore, with the μ listed above:

$$S^h = \begin{cases} S^f + 0.36\left(S^{jv} - S^f\right) & \text{if} \quad S^f \leq S^{jv} \\ S^{jv} + 0.25\left(S^f - S^{jv}\right) & \text{if} \quad S^{jv} \leq S^f \end{cases}$$

Where S^f and S^{jv} are the partial scores obtained by a given farm for Measurement *of Social housing* in adult females and in juveniles respectively.
μ_f and μ_{jv} are the capacities of Measurement *of Social housing* in adult females and in juveniles respectively.

Score S^w for Measurement *of Age and procedures at weaning*

One score is assigned to Measurement *of Age and procedures at weaning* according to a decision-tree combining the age at weaning and the types of weaning and post-weaning managements (Figure 48). If there are various types of weaning management used on a farm, the final score which would be assigned to the farm will be the worst situation (= the one corresponding to the worst score assigned to the different situations found on the farm) observed in at least 15% of the animals.

Figure 48 Scores S^w assigned to combinations of answers to questions on Measurement of **Age and procedures at weaning**

Score for the Criterion of *Expression of social behaviours*

The two partial scores are combined to form the sub-score for the Criterion of *Expression of social behaviours* using a Choquet integral. The parameters of the Choquet integral are:

μ_h = 0.14 μ_w = 0.32

with h, social housing and w, weaning management.

Reminder:

$$\text{Expression of social behaviours-score} = \begin{cases} S^h + \left(S^w - S^h\right)\mu_w & \text{if} \quad S^h \le S^w \\ S^w + \left(S^h - S^w\right)\mu_h & \text{if} \quad S^w \le S^h \end{cases}$$

Therefore, with the μ listed above:

$$\text{Expression of social behaviours-score} = \begin{cases} S^h + 0.32\left(S^w - S^h\right) & \text{if} \quad S^h \le S^w \\ S^w + 0.14\left(S^h - S^w\right) & \text{if} \quad S^w \le S^h \end{cases}$$

Where S^h and S^w are the partial scores obtained by a given farm for Measurements *of Social housing* and *Age and procedures at weaning* respectively.
μ_a and μ_b are the capacities of Measurements *of Social housing* and *Age and procedures at weaning* respectively.

3.3.1.10 Expression of other behaviours

Three partial scores are calculated: one for Measurement of *Stereotypic behaviours,* one for Measurement of *Cage enrichments,* and one for Measurement *Fur chewing*, before being combined into a criterion-score.
Moreover, except for Measurement *of Fur chewing* which is assessed only in Periods 1 and 3, these three measurements are assessed at different levels for the three periods of the production cycle. So the first step is to calculate the sub-score for each period considered, then to aggregate the sub-scores obtained in order to have the score covering the production cycle for each of these three measurements.

Sub-scores S_1^p, S_2^s and S_3^s for Periods 1, 2 and 3 for Measurement of *Stereotypic behaviours*

The score of a farm with regard to Measurement of *Stereotypic behaviours* is calculated from the % of mink performing stereotypies.
The calculation of the sub-score is the same for each period:

In Period 1:

Let I_1 = 100 - % of mink performing stereotypic behaviors in Period 1

I_1 is computed into a score using *I*-spline functions (Figure 49) as follows:

$$\textit{Score} = a_x + b_x \times I_1 + c_x \times I_1^2 + d_x \times I_1^3$$

with $x = 1$ when $I_1 < k$ and $x = 2$ when $I_1 \ge k$

Criterion 10 - Stereotypic behaviour - Period 1			
a_1	0	a_2	-729.38631568825098838715348 39
b_1	0.21475195068564956191181 64	b_2	27.56673911132362420062236 20
c_1	-0.00057685660589834814385 16	c_2	-0.34247669979982353627434 58
d_1	0.00007289670854202861215 43	d_2	0.00149747940251680712250 85
k	80		

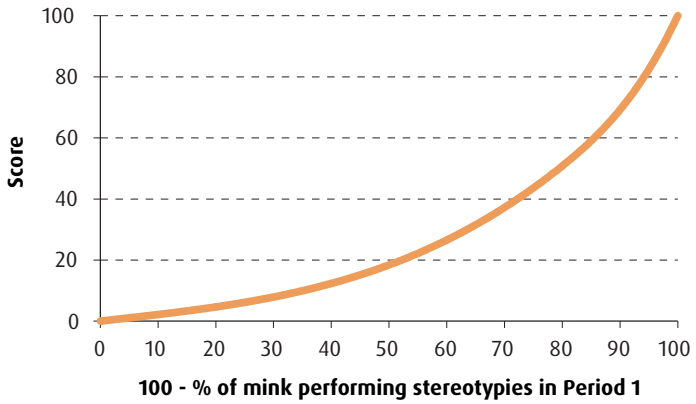


Figure 49 Calculation of the sub-score S_1^s for Measurement of Stereotypic behaviour according to the percentage of mink performing stereotypies in Period 1

In Period 2:
Let I_2 = 100 - % of mink performing stereotypic behaviours in Period 2

$$\text{Let } J_2 = \frac{I_2 - 40}{100 - 40} \times 100 \quad \text{if } I_2 \geq 40$$
$$J_2 = 0 \quad \text{if } I_2 < 40$$

J_2 is computed into a score using *I*-spline functions (Figure 50) as follows:

$$Score = a_x + b_x \times J_2 + c_x \times J_2^2 + d_x \times J_2^3$$

with $x = 1$ when $J_1 < k$ and $x = 2$ when $J_1 \geq k$

Criterion 10 - Stereotypic behaviour - Period 2			
a_1	0	a_2	-5823.71257267746659636031836 27
b_1	-0.00000000000018020975561149	b_2	210.49563932867513926794345 02
c_1	0.00000000000000668880705263	c_2	-2.53609208667170404893909 11
d_1	0.00004996055153933754637 39	d_2	0.01023506950618512101325 31
k	83		

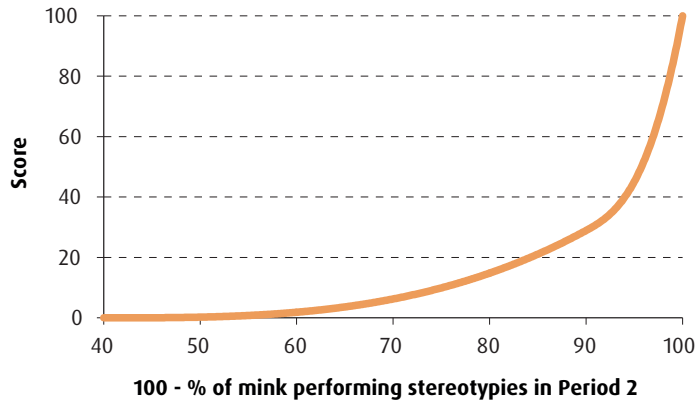


Figure 50 Calculation of the sub-score S_2^s for Measurement of Stereotypic behaviour according to the percentage of mink performing stereotypies in Period 2

In Period 3:

Let I_3 = 100 - % of mink performing stereotypic behaviours in Period 3

$$\text{Let } J_3 = \frac{I_3 - 40}{100 - 40} \times 100 \quad \text{if } I_3 \geq 40$$

$$J_3 = 0 \quad \text{if } I_3 < 40$$

J_3 is computed into a score using *I*-spline functions (Figure 51) as follows:

$$Score = a_x + b_x \times J_3 + c_x \times J_3^2 + d_x \times J_3^3$$

with $x = 1$ when $J_3 < k$ and $x = 2$ when $J_3 \geq k$

Criterion 10 - Stereotypic behaviour - Period 3			
a_1	0	a_2	-7056.81103017348868888802826 40
b_1	0.03886005370577124556907 83	b_2	249.10281124213855719062848 95
c_1	-0.00045717710254799859325 23	c_2	-2.93062166524450429250236 99
d_1	0.00006190412430614009736 42	d_2	0.01155274655652323463617 13
k	85		

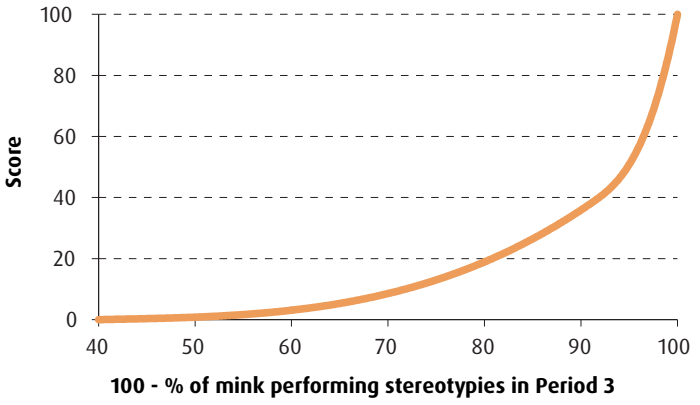


Figure 51 Calculation of the sub-score S_3^s for Measurement of Stereotypic behaviour according to the percentage of mink performing stereotypies in Period 3

Score S^s for Measurement of *Stereotypic behaviour*

The three sub-scores are combined to form the partial score S^s for Measurement of *Stereotypic behaviour* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.26	μ_{12}	=	0.26
μ_2	=	0.15	μ_{13}	=	0.27
μ_3	=	0.19	μ_{23}	=	0.33

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^s\text{-score} = \begin{cases} S_1^s + \left(S_2^s - S_1^s\right)\mu_{23} + \left(S_3^s - S_2^s\right)\mu_3 & \text{if} \quad S_1^s \le S_2^s \le S_3^s \\ S_1^s + \left(S_3^s - S_1^s\right)\mu_{23} + \left(S_2^s - S_3^s\right)\mu_2 & \text{if} \quad S_1^s \le S_3^s \le S_2^s \\ S_2^s + \left(S_1^s - S_2^s\right)\mu_{13} + \left(S_3^s - S_1^s\right)\mu_3 & \text{if} \quad S_2^s \le S_1^s \le S_3^s \\ S_2^s + \left(S_3^s - S_2^s\right)\mu_{13} + \left(S_1^s - S_3^s\right)\mu_1 & \text{if} \quad S_2^s \le S_3^s \le S_1^s \\ S_3^s + \left(S_1^s - S_3^s\right)\mu_{12} + \left(S_2^s - S_1^s\right)\mu_2 & \text{if} \quad S_3^s \le S_1^s \le S_2^s \\ S_3^s + \left(S_2^s - S_3^s\right)\mu_{12} + \left(S_1^s - S_2^s\right)\mu_1 & \text{if} \quad S_3^s \le S_2^s \le S_1^s \end{cases}$$

Therefore, with the μ listed above:

$$S^s\text{-score} = \begin{cases} S_1^s + 0.33\left(S_2^s - S_1^s\right) + 0.19\left(S_3^s - S_2^s\right) & \text{if} \quad S_1^s \le S_2^s \le S_3^s \\ S_1^s + 0.33\left(S_3^s - S_1^s\right) + 0.15\left(S_2^s - S_3^s\right) & \text{if} \quad S_1^s \le S_3^s \le S_2^s \\ S_2^s + 0.27\left(S_1^s - S_2^s\right) + 0.19\left(S_3^s - S_1^s\right) & \text{if} \quad S_2^s \le S_1^s \le S_3^s \\ S_2^s + 0.27\left(S_3^s - S_2^s\right) + 0.26\left(S_1^s - S_3^s\right) & \text{if} \quad S_2^s \le S_3^s \le S_1^s \\ S_3^s + 0.26\left(S_1^s - S_3^s\right) + 0.15\left(S_2^s - S_1^s\right) & \text{if} \quad S_3^s \le S_1^s \le S_2^s \\ S_3^s + 0.26\left(S_2^s - S_3^s\right) + 0.26\left(S_1^s - S_2^s\right) & \text{if} \quad S_3^s \le S_2^s \le S_1^s \end{cases}$$

Where S^s_1, S^s_2 and S^s_3 are the sub-scores obtained by a given farm for Measurement of *Stereotypic behaviour* in Period 1, in Period 2 and in Period 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Measurement of *Stereotypic behaviour* in Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in Periods 1 and 2 and so on...

Sub-scores S_1^e, S_2^e and S_3^e for Periods 1, 2 and 3 for Measurement of Cage enrichments

One score is assigned to Measurement of *Cage enrichments* according to a decision-tree based on different types and number of enrichments (Figure 52, Figure 53 and Figure 54).

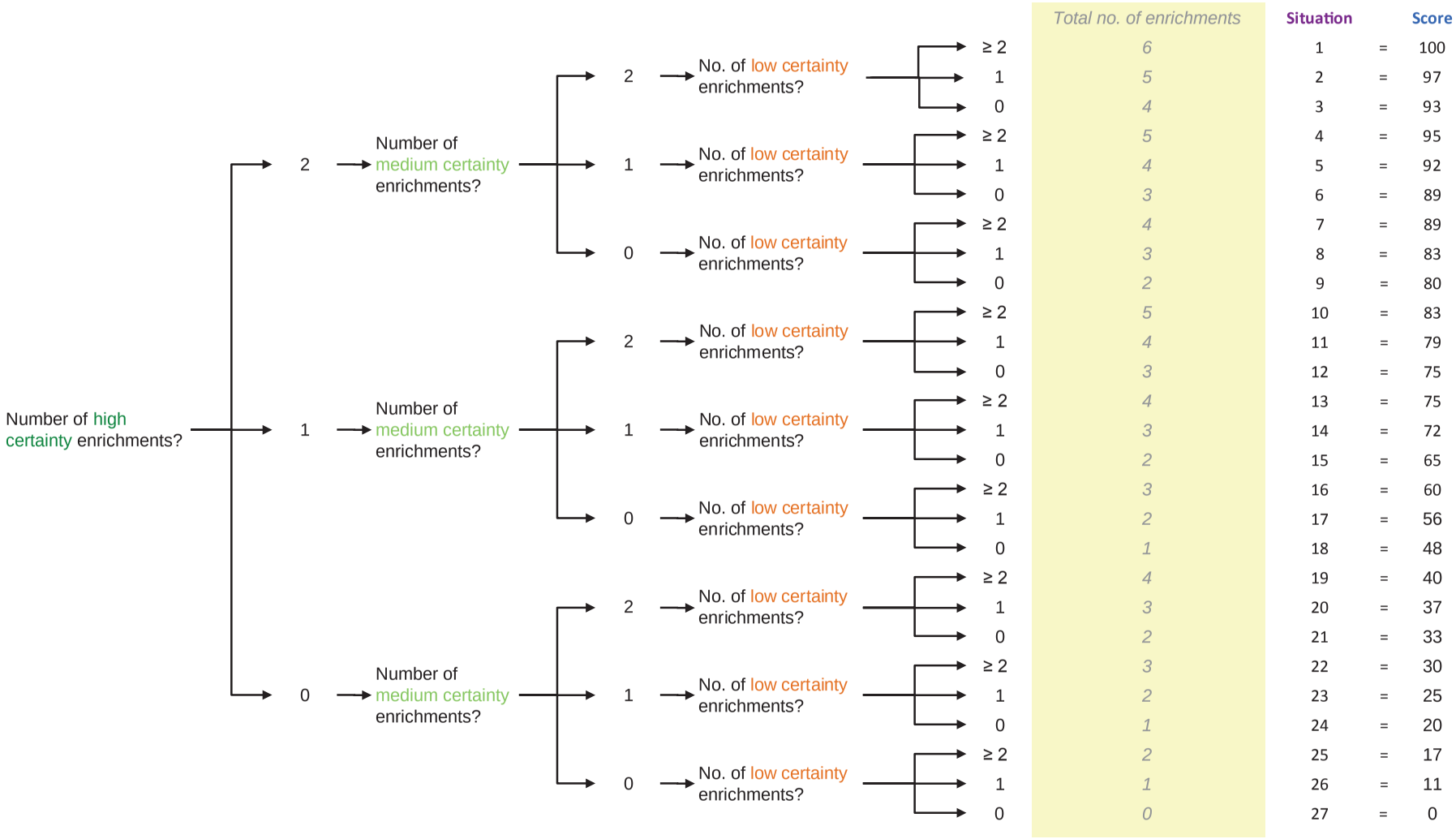


Figure 52 Sub-scores S_1^e assigned to combinations of answers to questions on Measurement of **Cage enrichments** in Period 1

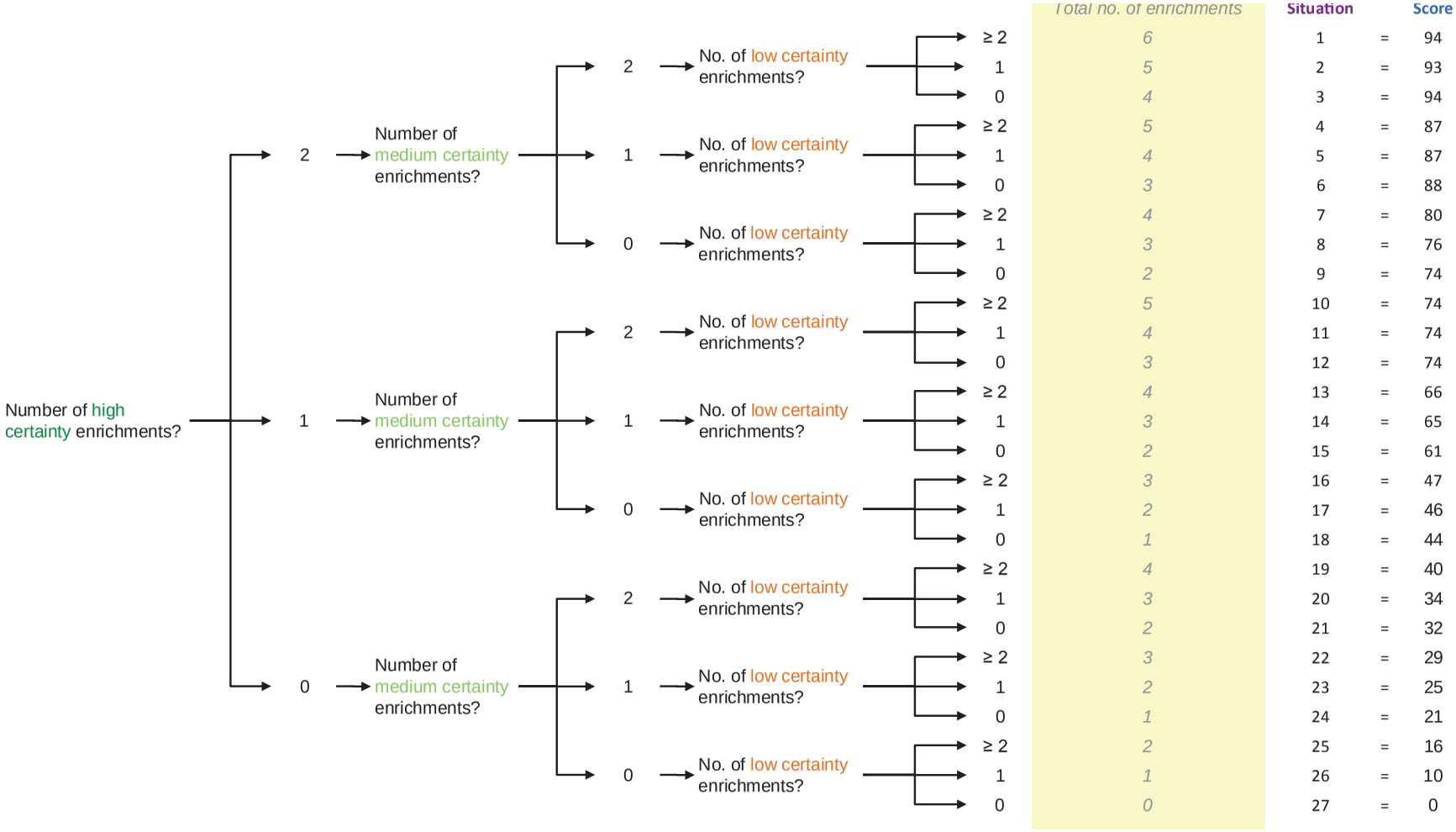


Figure 53 Sub-scores S_2^e assigned to combinations of answers to questions on Measurement of **Cage enrichments** in Period 2

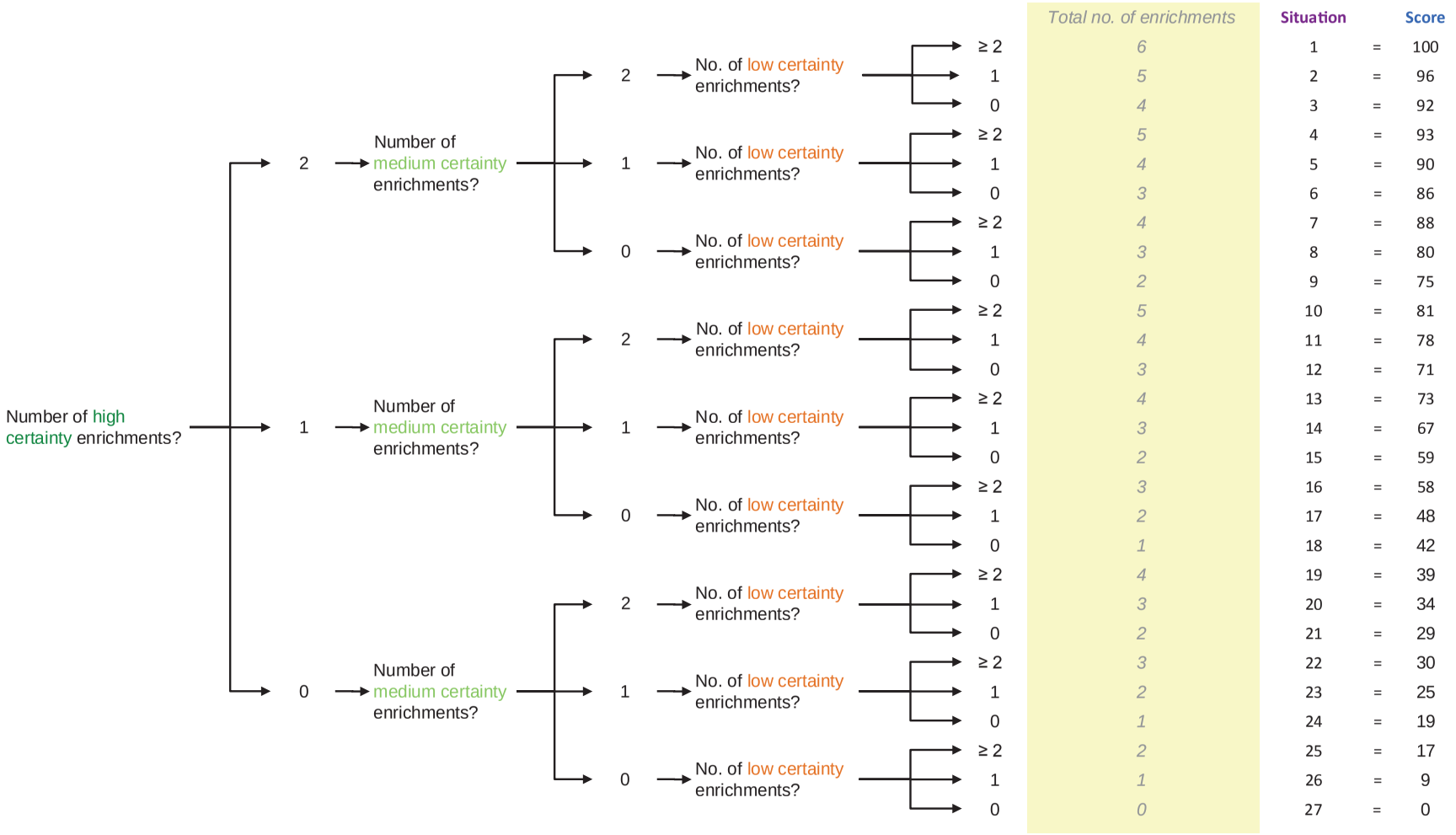


Figure 54 Sub-scores S_3^e assigned to combinations of answers to questions on Measurement of **Cage enrichments** in Period 3

Since animals may be housed with different types and numbers of enrichments, we consider the % of animals in each situation defined by the decision-tree and the final score to be assigned to the farm is the worst score (= the one corresponding to the worst situation found on the farm) observed on at least 6% of the animals.

Score S^e for Measurement of Cage enrichments

The three sub-scores are combined to form the partial score S^e for Measurement of *Cage enrichments* using a Choquet integral. The parameters of the Choquet integral are

μ_1	=	0.14	μ_{12}	=	0.31
μ_2	=	0.05	μ_{13}	=	0.69
μ_3	=	0.29	μ_{23}	=	0.29

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^e\text{-score} = \begin{cases} S_1^e + \left(S_2^e - S_1^e\right)\mu_{23} + \left(S_3^e - S_2^e\right)\mu_3 & \text{if} \quad S_1^e \le S_2^e \le S_3^e \\ S_1^e + \left(S_3^e - S_1^e\right)\mu_{23} + \left(S_2^e - S_3^e\right)\mu_2 & \text{if} \quad S_1^e \le S_3^e \le S_2^e \\ S_2^e + \left(S_1^e - S_2^e\right)\mu_{13} + \left(S_3^e - S_1^e\right)\mu_3 & \text{if} \quad S_2^e \le S_1^e \le S_3^e \\ S_2^e + \left(S_3^e - S_2^e\right)\mu_{13} + \left(S_1^e - S_3^e\right)\mu_1 & \text{if} \quad S_2^e \le S_3^e \le S_1^e \\ S_3^e + \left(S_1^e - S_3^e\right)\mu_{12} + \left(S_2^e - S_1^e\right)\mu_2 & \text{if} \quad S_3^e \le S_1^e \le S_2^e \\ S_3^e + \left(S_2^e - S_3^e\right)\mu_{12} + \left(S_1^e - S_2^e\right)\mu_1 & \text{if} \quad S_3^e \le S_2^e \le S_1^e \end{cases}$$

Thus, with the μ listed above:

$$S^e\text{-score} = \begin{cases} S_1^e + 0.29\left(S_2^e - S_1^e\right) + 0.29\left(S_3^e - S_2^e\right) & \text{if} \quad S_1^e \le S_2^e \le S_3^e \\ S_1^e + 0.29\left(S_3^e - S_1^e\right) + 0.05\left(S_2^e - S_3^e\right) & \text{if} \quad S_1^e \le S_3^e \le S_2^e \\ S_2^e + 0.69\left(S_1^e - S_2^e\right) + 0.29\left(S_3^e - S_1^e\right) & \text{if} \quad S_2^e \le S_1^e \le S_3^e \\ S_2^e + 0.69\left(S_3^e - S_2^e\right) + 0.14\left(S_1^e - S_3^e\right) & \text{if} \quad S_2^e \le S_3^e \le S_1^e \\ S_3^e + 0.31\left(S_1^e - S_3^e\right) + 0.05\left(S_2^e - S_1^e\right) & \text{if} \quad S_3^e \le S_1^e \le S_2^e \\ S_3^e + 0.31\left(S_2^e - S_3^e\right) + 0.14\left(S_1^e - S_2^e\right) & \text{if} \quad S_3^e \le S_2^e \le S_1^e \end{cases}$$

Where S^e_1, S^e_2 and S^e_3 are the sub-scores obtained by a given farm for Measurement of *Cage enrichments* in Period 1, in Period 2 and in Period 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Measurement of *Cage enrichments* in Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in Periods 1 and 2 and so on...

Sub-scores S_1^f and S_3^f for Periods 1 and 3 for *Measurement of Fur chewing*

Since in Period 2, adult females chew their fur in order to make a nest for their kits, the measurement is not considered in this period.

The score of a farm with regard to *Measurement of Fur chewing* is calculated from the percentages of mink within each level of the scale used to assess fur chewing (4 levels here):

Level	0	1	2	3
% of mink	$P^f_{i,0}$	$P^f_{i,1}$	$P^f_{i,2}$	$P^f_{i,3}$

The calculation is the same for each period:

$$\text{Let } I_i = \left(100 - \frac{\sum_{k=0}^{3} w^f_{i,j} \; p^f_{i,j}}{w^f_{i,3}} \right)$$

with i = 1 or 3 according to the period considered and j = 0, 1, 2 or 3 according to the level.

Weights	$W^f_{i,0} = 0$	$W^f_{i,1} = 9$	$W^f_{i,2} = 17$	$W^f_{i,3} = 25$

I_i is computed into a score using *I*-spline functions (Figure 55) as follows:

$$\textbf{Score} = a_x + b_x \times I_i + c_x \times I_i^2 + d_x \times I_i^3 \qquad i = 1 \text{ or } 3$$

with $x = 1$ when $I_i < k$ and $x = 2$ when $I_i \geq k$

Criterion 10 - Fur chewing - Periods 1 and 3			
a_1	0	a_2	2.7180080988894204097050533
b_1	0.52479555418609247219308l4	b_2	0.25299474431851165512341 59
c_1	-0.016469485935854143165979 5	c_2	-0.007409458940641505501900 6
d_1	0.000246744072395662132016 9	d_2	0.000146077105783886469683 0
k	30		

Note: The coefficients are the same for the two periods (Periods 1 and 3) since the interpretation in terms of welfare is the same whatever the period considered.

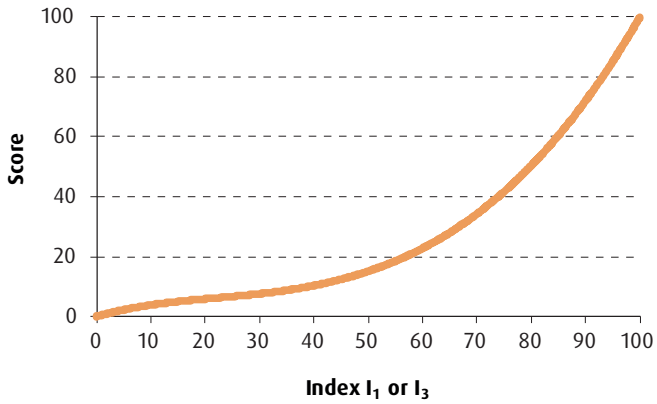


Figure 55 Calculation of the sub-score S_i^f for **Measurement of Fur chewing** according to the percentage of mink within each level of the scale used to assess fur chewing (with i = 1 or 3 according to the period considered)

Score S^f for Measurement of *Fur chewing*

The two sub-scores are combined to form the partial score S^f for Measurement *of Fur chewing* using a Choquet integral. The parameters of the Choquet integral are:

μ_1 = 0.14 μ_3 = 0.34

with 1, Period 1 and 3, Period 3

Reminder:

$$S^f\text{-score} = \begin{cases} S_1^f + \left(S_3^f - S_1^f\right)\mu_3 & \text{if} \quad S_1^f \le S_3^f \\ S_3^f + \left(S_1^f - S_3^f\right)\mu_1 & \text{if} \quad S_3^f \le S_1^f \end{cases}$$

Therefore, with the μ listed above:

$$S^f\text{-score} = \begin{cases} S_1^f + 0.34\left(S_3^f - S_1^f\right) & \text{if} \quad S_1^f \le S_3^f \\ S_3^f + 0.14\left(S_1^f - S_3^f\right) & \text{if} \quad S_3^f \le S_1^f \end{cases}$$

Where S^f_1 and S^f_3 are the scores obtained by a given farm for Measurement of *Fur chewing* in Period 1 and in Period 3 respectively.
μ_1 and μ_3 are the capacities of Measurement of *Fur chewing* in Periods 1 and 3 respectively.

Score for the Criterion of *Expression of other behaviours*

The three partial scores are combined to form the overall score for the Criterion of *Expression of other behaviours* using a Choquet integral. The parameters of the Choquet integral are:

μ_s	=	0.37	μ_{se}	=	0.52
μ_e	=	0.19	μ_{ef}	=	0.19
μ_f	=	0.18	μ_{sf}	=	0.55

with s, stereotypic behaviours; e, enrichments; and f, fur chewing.

Reminder:

$$\text{Expression of other behaviours-score} = \begin{cases} S^s + \left(S^e - S^s\right)\mu_{ef} + \left(S^f - S^e\right)\mu_f & \text{if} \quad S^s \le S^e \le S^f \\ S^s + \left(S^f - S^s\right)\mu_{ef} + \left(S^e - S^f\right)\mu_e & \text{if} \quad S^s \le S^f \le S^e \\ S^e + \left(S^s - S^e\right)\mu_{sf} + \left(S^f - S^s\right)\mu_f & \text{if} \quad S^e \le S^s \le S^f \\ S^e + \left(S^f - S^e\right)\mu_{sf} + \left(S^s - S^f\right)\mu_s & \text{if} \quad S^e \le S^f \le S^s \\ S^f + \left(S^s - S^f\right)\mu_{se} + \left(S^e - S^s\right)\mu_e & \text{if} \quad S^f \le S^s \le S^e \\ S^f + \left(S^e - S^f\right)\mu_{se} + \left(S^s - S^e\right)\mu_s & \text{if} \quad S^f \le S^e \le S^s \end{cases}$$

Thus, with the μ listed above:

$$\text{Expression of other behaviours-score} = \begin{cases} S^s + 0.19\left(S^e - S^s\right) + 0.18\left(S^f - S^e\right) & \text{if} \quad S^s \le S^e \le S^f \\ S^s + 0.19\left(S^f - S^e\right) + 0.19\left(S^e - S^f\right) & \text{if} \quad S^s \le S^f \le S^e \\ S^e + 0.55\left(S^s - S^e\right) + 0.18\left(S^f - S^s\right) & \text{if} \quad S^e \le S^s \le S^f \\ S^e + 0.55\left(S^f - S^e\right) + 0.37\left(S^s - S^f\right) & \text{if} \quad S^e \le S^f \le S^s \\ S^f + 0.52\left(S^s - S^f\right) + 0.19\left(S^e - S^s\right) & \text{if} \quad S^f \le S^s \le S^e \\ S^f + 0.52\left(S^e - S^f\right) + 0.37\left(S^s - S^e\right) & \text{if} \quad S^f \le S^e \le S^s \end{cases}$$

Where S^s, S^e and S^f are the sub-scores obtained by a given farm for Measurements of *Stereotypic behaviour, Cage enrichments* and *Fur chewing* in Period 1, in Period 2 and in Period 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Measurements of *Stereotypic behaviour, Cage enrichments* and *Fur chewing* in Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in Periods 1 and 2 and so on...

3.3.1.11 Good human-animal relationship & positive emotional state

As the "Temperament test" could be used to assess the Criteria of *Good human-animal relationship* and *positive emotional state*, we decided to regroup the two criteria into one.
Two partial scores are calculated, one for Measurement of *Temperament test* and one for Measurement of *Frequency and duration of handling and transportation*, before being combined into a criterion-score.
Moreover, these two measurements are assessed for the three periods of the production cycle. So the first stage is to calculate the sub-score for each period, then to aggregate the three sub-scores obtained for each period in order to have the score covering the production cycle for each of these two measurements.

Sub-scores S_1^t, S_2^t and S_3^t for Periods 1, 2 and 3 for Measurement of *Temperament test*
The score of a farm with regard to Measurement of *Temperament test* is calculated from the % of mink within each category used to temperament (3 levels here):

Level	0	1	2
% of mink	P_0^t	P_1^t	P_2^t

The calculation of the sub-score is the same for each period:

In Period 1:

$$\text{Let } I_i = \left(100 - \frac{\sum_{k=0}^{3} w_{i,j} \; p_{i,j}}{w_{i,3}} \right)$$

with j = 0, 1 or 2 according to the level.

Weights	$W_0^t = 0$	$W_1^t = 3$	$W_2^t = 8$

I_1 is computed into a score using *I*-spline functions (Figure 56) as follows:

$$\textbf{Score} = a_x + b_x \times I_1 + c_x \times I_1^2 + d_x \times I_1^3$$

with $x = 1$ when $I_1 < k$ and $x = 2$ when $I_1 \geq k$

Criterion 11&12 - Reaction of the mink to the temperament test - Period 1			
a_1	0	a_2	81.194410376894808223369 1821
b_1	1.041930950614809781029 6349	b_2	-3.386855067710309974415 8499
c_1	-0.018944199102116036220 7443	c_2	0.061579183018225173984 4723
d_1	0.000229719763769263113 0586	d_2	-0.000258300733789430304 3560
k	55		

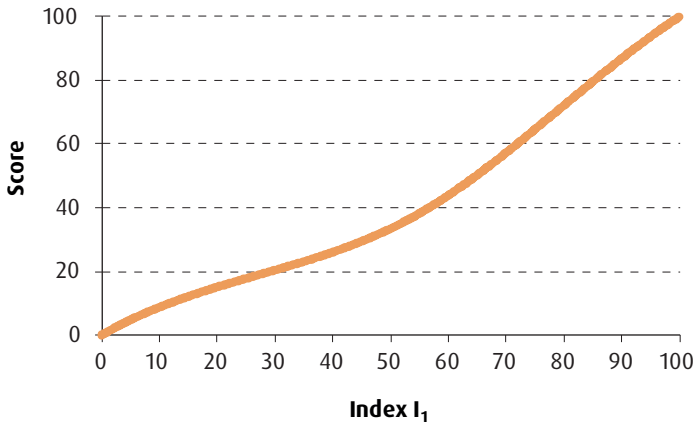


Figure 56 Calculation of the sub-score S_1^t for Measurement of **Temperament test** according to the percentage of mink within each category used to assess temperament in Period 1

In Period 2:

$$Let\ I_2 = \left(100 - \frac{\sum_{j=0}^{2} w_j^t \ p_j^t}{w_2^t} \right)$$

with j = 0, 1 or 2 according to the level.

Weights	W_0^t = 0	W_1^t = 2	W_2^t = 7

I_2 is computed into a score using *I*-spline functions (Figure 57) as follows:

$$Score = a_x + b_x \times I_2 + c_x \times I_2^2 + d_x \times I_2^3$$

with x = 1 when $I_2 < k$ and x = 2 when $I_2 \geq k$

Criterion 11&12 - Reaction of the mink to the temperament test - Period 2			
a_1	0	a_2	57.542373404902257050252956 1
b_1	0.893704370825321170457300 5	b_2	-1.983414300540053520904848 5
c_1	-0.011078268246396185195412 6	c_2	0.036873709624580836008433 9
d_1	0.000138461837529736333943 6	d_2	-0.000127938039596192122942 4
k	60		

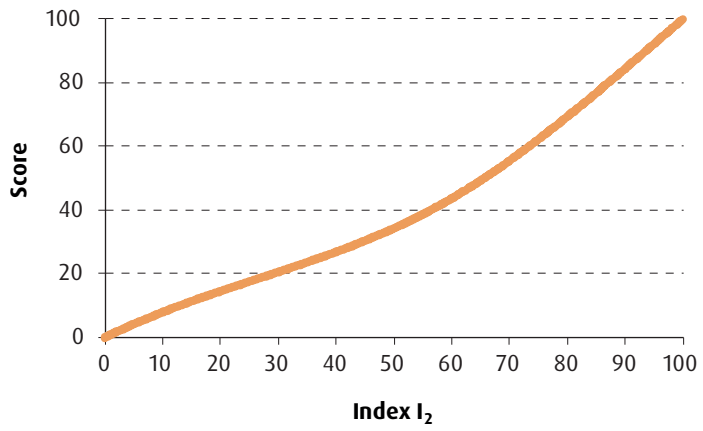


Figure 57 Calculation of the sub-score S_2^t for Measurement of **Temperament** according to the percentage of mink within each category used to assess temperament in Period 2

In Period 3:

$$Let\ I_3 = \left(100 - \frac{\sum_{j=0}^{2} w_j^t \ p_j^t}{w_2^t} \right)$$

with j = 0, 1 or 2 according to the level.

Weights	$W_0^t = 0$	$W_1^t = 3$	$W_2^t = 8$

I_3 is computed into a score using *I*-spline functions (Figure 58) as follows:

$$\textbf{Score} = a_x + b_x \times I_3 + c_x \times I_3^2 + d_x \times I_3^3$$

with $x = 1$ when $I_3 < k$ and $x = 2$ when $I_3 \geq k$

Criterion 11&12 - Reaction of the mink to the temperament test - Period 3			
a_1	0	a_2	72.270086970075297472249076 2
b_1	1.022096434512537621586147 9	b_2	-2.919908309479644525907815 5
c_1	-0.018583571536575929639134 6	c_2	0.053089241992897009958518 6
d_1	0.000223209013207922857269 2	d_2	-0.000211171674859962117546 2
k	55		

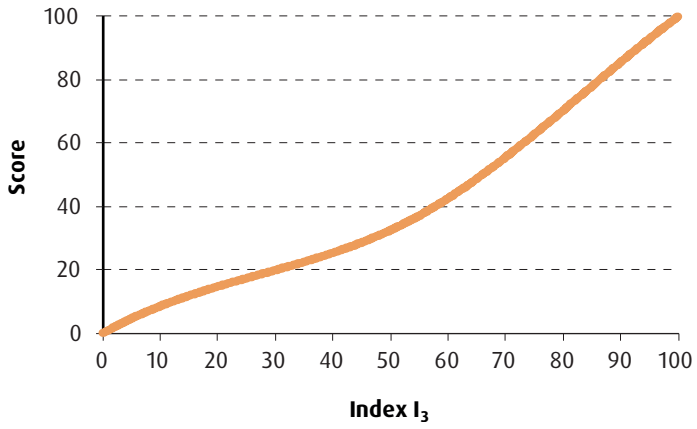


Figure 58 Calculation of the sub-score S_3^t for Measurement of Temperament according to the percentage of mink within each category used to assess temperament in Period 3

Score S^t for Measurement of *Temperament*

The three sub-scores are combined to form the partial score S^t for Measurement of *Temperament* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.12	μ_{12}	=	0.15
μ_2	=	0.15	μ_{13}	=	0.63
μ_3	=	0.50	μ_{23}	=	0.53

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

Reminder:

$$S^t\text{-score} = \begin{cases} S_1^t + \left(S_2^t - S_1^t\right)\mu_{23} + \left(S_3^t - S_2^t\right)\mu_3 & \text{if} \quad S_1^t \le S_2^t \le S_3^t \\ S_1^t + \left(S_3^t - S_1^t\right)\mu_{23} + \left(S_2^t - S_3^t\right)\mu_2 & \text{if} \quad S_1^t \le S_3^t \le S_2^t \\ S_2^t + \left(S_1^t - S_2^t\right)\mu_{13} + \left(S_3^t - S_1^t\right)\mu_3 & \text{if} \quad S_2^t \le S_1^t \le S_3^t \\ S_2^t + \left(S_3^t - S_2^t\right)\mu_{13} + \left(S_1^t - S_3^t\right)\mu_1 & \text{if} \quad S_2^t \le S_3^t \le S_1^t \\ S_3^t + \left(S_1^t - S_3^t\right)\mu_{12} + \left(S_2^t - S_1^t\right)\mu_2 & \text{if} \quad S_3^t \le S_1^t \le S_2^t \\ S_3^t + \left(S_2^t - S_3^t\right)\mu_{12} + \left(S_1^t - S_2^t\right)\mu_1 & \text{if} \quad S_3^t \le S_2^t \le S_1^t \end{cases}$$

Therefore, with the μ listed above:

$$S^t\text{-score} = \begin{cases} S_1^t + 0.53\left(S_2^t - S_1^t\right) + 0.50\left(S_3^t - S_2^t\right) & \text{if} \quad S_1^t \le S_2^t \le S_3^t \\ S_1^t + 0.53\left(S_3^t - S_1^t\right) + 0.15\left(S_2^t - S_3^t\right) & \text{if} \quad S_1^t \le S_3^t \le S_2^t \\ S_2^t + 0.63\left(S_1^t - S_2^t\right) + 0.50\left(S_3^t - S_1^t\right) & \text{if} \quad S_2^t \le S_1^t \le S_3^t \\ S_2^t + 0.63\left(S_3^t - S_2^t\right) + 0.12\left(S_1^t - S_3^t\right) & \text{if} \quad S_2^t \le S_3^t \le S_1^t \\ S_3^t + 0.15\left(S_1^t - S_3^t\right) + 0.15\left(S_2^t - S_1^t\right) & \text{if} \quad S_3^t \le S_1^t \le S_2^t \\ S_3^t + 0.15\left(S_2^t - S_3^t\right) + 0.12\left(S_1^t - S_2^t\right) & \text{if} \quad S_3^t \le S_2^t \le S_1^t \end{cases}$$

Where S^t_1, S^t_2 and S^t_3 are the sub-scores obtained by a given farm for Measurement of *Temperament* in Period 1, in Period 2 and in Period 3 respectively.
μ_1, μ_2 and μ_3 are the capacities of Measurement of *Temperament test* in Periods 1, 2 and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in Periods 1 and 2 and so on...

Sub-scores S^h_1, S^h_2 and S^h_3 for Periods 1, 2 and 3 for Measurement of *Frequency and duration of handling and transportation*

At farm level, we have to deal with 3 items of data: the average number of times mink are caught and handled for less than one minute, the average number of times mink are caught and handled for more than one minute but less than one hour and the average number of times mink are caught and handled for less than one minute.

A reference combination of average number of handlings/mink in categories 1, 2 and 3 representing the worst situation that might be found in production has been previously defined. This means that a score of 0 must be assigned to this situation.

The score of a farm with regard to handling procedures is calculated from the different combinations of average numbers of handlings/mink within each level of the scale used to assess handling procedures (3 levels here):

Level	1	2	3
Number of handlings/mink	n^h_1	n^h_2	n^h_3

The calculation of the sub-score is the same for each period:

In Period 1:

if $\sum_{j=0}^{2} w^h_j n^h_j > 15\times w^h_1 + 10\times w^h_2 + 5\times w^h_3$

then $I_1 = 0$

Else, $I_1 = \left(100 - \frac{\sum_{j=0}^{2} w^h_j \; n^h_j}{15\times w^h_1 + 10\times w^h_2 + 5\times w^h_3}\right)$

with j = 1, 2 or 3 according to the level.

Weights	$W^2_1 = 1$	$W^2_2 = 4$	$W^2_3 = 28$

I_1 is computed into a score using *I*-spline functions (Figure 59) as follows:

***Score* = $a_x + b_x \times I_3 + c_x \times I_3^2 + d_x \times I_3^3$**

with x = 1 when $I_3 < k$ and x = 2 when $I_3 \geq k$

Criterion 11&12 - Handling procedures - Period 1

a_1	0	a_2	-128.17934976785733169890590 94
b_1	1.05005968046473951993391 44	b_2	8.04166057867370831502285 00
c_1	-0.01909199419037573355883 99	c_2	-0.14621201054605509339623 38
d_1	0.00011570905570034921265 33	d_2	0.00088613339736018674128 17
k	55		

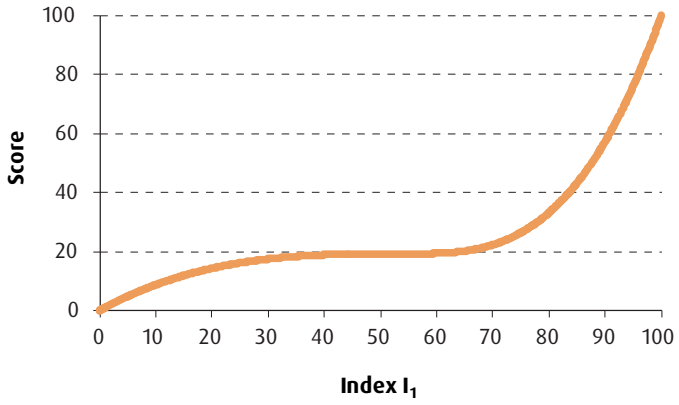


Figure 59 Calculation of the sub-score S_1^h for Measurement of **Frequency and duration of handling** and transportation according to the different combinations of average numbers of handlings/mink within each level of the scale used to assess handling procedures in Period 1

The calculation of the sub-score is the same for each period:

In Period 2:

$$\text{if} \quad \sum_{j=0}^{2} w_j^h \, n_j^h \quad > \quad 15 \times w_1^h + 10 \times w_2^h + 5 \times w_3^h$$

$$\text{then} \quad I_2 = 0$$

$$\text{Else,} \quad I_2 = \left(100 - \frac{\sum_{j=0}^{2} w_j^h \; n_j^h}{15 \times w_1^h + 10 \times w_2^h + 5 \times w_3^h} \right)$$

with j = 1, 2 or 3 according to the level.

Weights	$W_1^2 = 1$	$W_2^2 = 4$	$W_3^2 = 19$

I_2 is computed into a score using I-spline functions (Figure 60) as follows:

***Score* = $a_x + b_x \times I_2 + c_x \times I_2^2 + d_x \times I_2^3$**

with x = 1 when $I_2 < k$ and x = 2 when $I_2 \geq k$

Criterion 11&12 - Handling procedures - Period 2			
a_1	0	a_2	-1001.2818373521877219900488853
b_1	0.24651466176025604859489 70	b_2	37.7945841521371903581894003
c_1	-0.00308143327197292872868 25	c_2	-0.4724323086040081998149276
d_1	0.00009051783559415299388 90	d_2	0.00204614650812004169114 22
k	80		

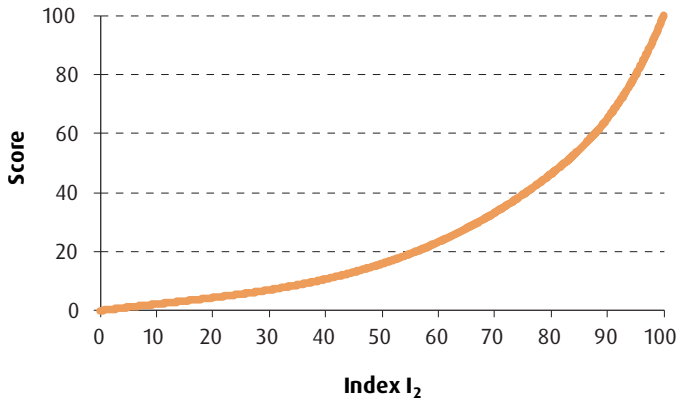


Figure 60 Calculation of the sub-score S_2^h for Measurement of **Frequency and duration of handling and transportation** according to the different combinations of average numbers of handlings/mink within each level of the scale used to assess handling procedures in Period 2

The calculation of the sub-score is the same for each period:

In Period 3:

if $\sum_{j=0}^{2} w_j^h n_j^h > 15 \times w_1^h + 10 \times w_2^h + 5 \times w_3^h$

then $I_3 = 0$

Else, $I_3 = \left(100 - \frac{\sum_{j=0}^{2} w_j^h \; n_j^h}{15 \times w_1^h + 10 \times w_2^h + 5 \times w_3^h} \right)$

with j = 1, 2 or 3 according to the level.

Weights	W_1^2 = 2	W_2^2 = 5	W_3^2 = 41

I_3 is computed into a score using *I*-spline functions (Figure 61) as follows:

***Score* = $a_x + b_x \times I_3 + c_x \times I_3^2 + d_x \times I_3^3$**

with x = 1 when $I_3 < k$ and x = 2 when $I_3 \geq k$

Criterion 11&12 - Handling procedures - Period 3			
a_1	0	a_2	-187.54150464589173452623072 08
b_1	0.90419786689507541943555 68	b_2	10.28127309261231481229970 09
c_1	-0.01506996444831121620411 27	c_2	-0.17135455145621564243541 00
d_1	0.00010471200472999963205 10	d_2	0.00097295970994937784354 78
k	60		

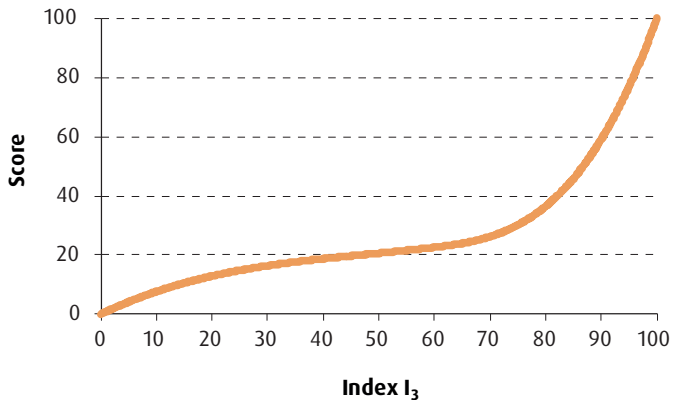


Figure 61 Calculation of the sub-score S_3^h for Measurement of **Frequency and duration of handling and transportation** according to the different combinations of average numbers of handlings/mink within each level of the scale used to assess handling procedures in Period 3

Score S^h for Measurement of *Frequency and duration of handling and transportation*

The three sub-scores are combined to form the partial score S^h for Measurement of *Frequency and duration of handling and transportation* using a Choquet integral. The parameters of the Choquet integral are:

μ_1	=	0.06	μ_{12}	=	0.29
μ_2	=	0.29	μ_{13}	=	0.37
μ_3	=	0.25	μ_{23}	=	0.35

with 1 = Period 1, 2 = Period 2 and 3 = Period 3

$$S^h\text{-score} = \begin{cases} S_1^h + \left(S_2^h - S_1^h\right)\mu_{23} + \left(S_3^h - S_2^h\right)\mu_3 & \text{if} \quad S_1^h \le S_2^h \le S_3^h \\ S_1^h + \left(S_3^h - S_1^h\right)\mu_{23} + \left(S_2^h - S_3^h\right)\mu_2 & \text{if} \quad S_1^h \le S_3^h \le S_2^h \\ S_2^h + \left(S_1^h - S_2^h\right)\mu_{13} + \left(S_3^h - S_1^h\right)\mu_3 & \text{if} \quad S_2^h \le S_1^h \le S_3^h \\ S_2^h + \left(S_3^h - S_2^h\right)\mu_{13} + \left(S_1^h - S_3^h\right)\mu_1 & \text{if} \quad S_2^h \le S_3^h \le S_1^h \\ S_3^h + \left(S_1^h - S_3^h\right)\mu_{12} + \left(S_2^h - S_1^h\right)\mu_2 & \text{if} \quad S_3^h \le S_1^h \le S_2^h \\ S_3^h + \left(S_2^h - S_3^h\right)\mu_{12} + \left(S_1^h - S_2^h\right)\mu_1 & \text{if} \quad S_3^h \le S_2^h \le S_1^h \end{cases}$$

Therefore, with the μ listed above:

$$S^h\text{-score} = \begin{cases} S_1^h + 0.35\left(S_2^h - S_1^h\right) + 0.25\left(S_3^h - S_2^h\right) & \text{if} \quad S_1^h \le S_2^h \le S_3^h \\ S_1^h + 0.35\left(S_3^h - S_1^h\right) + 0.29\left(S_2^h - S_3^h\right) & \text{if} \quad S_1^h \le S_3^h \le S_2^h \\ S_2^h + 0.37\left(S_1^h - S_2^h\right) + 0.25\left(S_3^h - S_1^h\right) & \text{if} \quad S_2^h \le S_1^h \le S_3^h \\ S_2^h + 0.37\left(S_3^h - S_2^h\right) + 0.06\left(S_1^h - S_3^h\right) & \text{if} \quad S_2^h \le S_3^h \le S_1^h \\ S_3^h + 0.29\left(S_1^h - S_3^h\right) + 0.29\left(S_2^h - S_1^h\right) & \text{if} \quad S_3^h \le S_1^h \le S_2^h \\ S_3^h + 0.29\left(S_2^h - S_3^h\right) + 0.06\left(S_1^h - S_2^h\right) & \text{if} \quad S_3^h \le S_2^h \le S_1^h \end{cases}$$

Where S^h_1, S^h_2 and S^h_3 are the sub-scores obtained by a given farm for Measurement of *Frequency and duration of handling and transportation* in Periods 1, 2 and 3 respectively.

μ_1, μ_2 and μ_3 are the capacities of Measurement of *Frequency and duration of handling and transportation* in Periods 1, 2

and 3 respectively.
μ_{12} is the capacity of the group made from the measurements in period 1 and 2 and so on...

Score for the Criterion of *Good human-animal relationship/Positive emotional state*
The two partial scores are combined to form the overall score for the Criterion of *Good human-animal relationship/positive emotional state* using a Choquet integral. The parameters of the Choquet integral are:

$\mu_t = 0.38$ $\mu_h = 0.19$

With t, temperament and h, handling procedures.

Reminder:

$$\text{Good H-A relationship/Positive emotional state-score} = \begin{cases} S^h + \left(S^t - S^h\right)\mu_t & \text{if} \quad S^h \le S^t \\ S^t + \left(S^h - S^t\right)\mu_h & \text{if} \quad S^t \le S^h \end{cases}$$

Therefore, with the μ listed above:

$$\text{Good H-A relationship/Positive emotional state-score} = \begin{cases} S^h + 0.38\left(S^t - S^h\right) & \text{if} \quad S^h \le S^t \\ S^t + 0.19\left(S^h - S^t\right) & \text{if} \quad S^t \le S^h \end{cases}$$

Where S^h and S^t are the partial scores obtained by a given farm for Measurement of *Frequency and duration of handling and transportation* and Measurement of *Temperament test* respectively.
μ_{tp} and μ_t are the capacities of Measures *Frequency and duration of handling and transportation* and *Temperament test* respectively.

3.3.2 Principle-scores

To calculate principles-score in WelFur, we decided to follow the same process as in Welfare Quality®. In Welfare Quality® parameters of the calculation (using Choquet integrals) to aggregate criterion-scores into principle-scores were defined for each animal type under study (*dairy cows, fattening bulls, veal calves, fattening pigs, sows and piglets, broilers and layers*).

An analysis of all of the experts' answers obtained in Welfare Quality® for the 8 types of animal cited above showed that there is no significant difference between the Principle-scores calculated for each type of animal. We therefore decided to calculate WelFur Principle-scores by gathering all animal types experts' answers into only one set of parameters, to be used in Welfare Quality® and in WelFur. We performed analytical work by testing and calculating several ways to combine the answers of the experts for all the animal types in order to achieve a common procedure for all livestock species.

Principle-scores are therefore calculated from the data collected on the eight animal types separately. Hence, we use Choquet integrals in order to form Mink Principle scores by using the mean of each animal type's principle-scores obtained by the combination of criterion-scores assigned by the Welfare Quality® experts.

The parameters of the integrals are given below for each principle.

Principle of Good feeding

$\mu_1 = 0.11$ $\mu_2 = 0.29$

with 1, Criterion *Absence of prolonged hunger* and 2, the Criterion of *Absence of prolonged thirst*.

Reminder:

$$\text{Good feeding-score} = \begin{cases} S_1 + (S_2 - S_1)\,\mu_2 & \text{if} \quad S_1 \le S_2 \\ S_2 + (S_1 - S_2)\,\mu_1 & \text{if} \quad S_2 \le S_1 \end{cases}$$

Therefore, with the μ listed above:

$$\text{Good feeding-score} = \begin{cases} S_1 + 0.29(S_2 - S_1) & \text{if} \quad S_1 \le S_2 \\ S_2 + 0.11(S_1 - S_2) & \text{if} \quad S_2 \le S_1 \end{cases}$$

Where S_1 and S_2 are the criterion-scores obtained by a given farm for the Criterion of *Absence of prolonged hunger* and the Criterion of *Absence of prolonged thirst* respectively.
μ_1 and μ_2 are the capacities of Criteria *Absence of prolonged hunger* and *Absence of prolonged thirst* respectively.

Principle of *Good housing*

μ_3	=	0.15	μ_{34}	=	0.34
μ_4	=	0.10	μ_{35}	=	0.45
μ_5	=	0.13	μ_{45}	=	0.36

with 3, the Criterion of *Comfort around resting*; 4, the Criterion of *Thermal comfort*; and 5, the Criterion of *Ease of movement*.

Reminder:

$$\text{Good housing-score} = \begin{cases} S_3 + (S_4 - S_3)\,\mu_{45} + (S_5 - S_4)\,\mu_5 & \text{if} \quad S_3 \le S_4 \le S_5 \\ S_3 + (S_5 - S_3)\,\mu_{45} + (S_4 - S_5)\,\mu_4 & \text{if} \quad S_3 \le S_5 \le S_4 \\ S_4 + (S_3 - S_4)\,\mu_{35} + (S_5 - S_3)\,\mu_5 & \text{if} \quad S_4 \le S_3 \le S_5 \\ S_4 + (S_5 - S_4)\,\mu_{35} + (S_3 - S_5)\,\mu_3 & \text{if} \quad S_4 \le S_5 \le S_3 \\ S_5 + (S_3 - S_5)\,\mu_{34} + (S_4 - S_3)\,\mu_4 & \text{if} \quad S_5 \le S_3 \le S_4 \\ S_5 + (S_4 - S_5)\,\mu_{34} + (S_3 - S_4)\,\mu_3 & \text{if} \quad S_5 \le S_4 \le S_3 \end{cases}$$

Therefore, with the μ listed above:

$$\text{Good housing-score} = \begin{cases} S_3 + 0.36(S_4 - S_3) + 0.13(S_5 - S_4) & \text{if} \quad S_3 \le S_4 \le S_5 \\ S_3 + 0.36(S_5 - S_3) + 0.10(S_4 - S_5) & \text{if} \quad S_3 \le S_5 \le S_4 \\ S_4 + 0.42(S_3 - S_4) + 0.13(S_5 - S_3) & \text{if} \quad S_4 \le S_3 \le S_5 \\ S_4 + 0.42(S_5 - S_4) + 0.15(S_3 - S_5) & \text{if} \quad S_4 \le S_5 \le S_3 \\ S_5 + 0.34(S_3 - S_5) + 0.10(S_4 - S_3) & \text{if} \quad S_5 \le S_3 \le S_4 \\ S_5 + 0.34(S_4 - S_5) + 0.15(S_3 - S_4) & \text{if} \quad S_5 \le S_4 \le S_3 \end{cases}$$

Where S_3, S_4 and S_5 are the criterion-scores obtained by a given farm for the Criterion of *Comfort around resting*, the Criterion of *Thermal comfort* and the Criterion of *Ease of movement* respectively.
μ_3, μ_4 and μ_5 are the capacities of Criteria *Comfort around resting*, *Thermal comfort* and *Ease of movement* respectively.
μ_{34} is the capacity of the group made from the Criteria of *Comfort around resting* and *Thermal comfort* and so on...

Principle of *Good health*

μ_6	=	0.08	μ_{67}	=	0.36
μ_7	=	0.22	μ_{68}	=	0.18
μ_8	=	0.12	μ_{78}	=	0.22

with 6, the Criterion of *Absence of injuries*; 7, the Criterion of *Absence of diseases*; and 8, the Criterion of *Absence of pain induced by management procedures*.

Reminder:

$$\text{Good health-score} = \begin{cases} S_6 + (S_7 - S_6)\mu_{78} + (S_8 - S_7)\mu_8 & \text{if} \quad S_6 \le S_7 \le S_8 \\ S_6 + (S_8 - S_6)\mu_{78} + (S_7 - S_8)\mu_7 & \text{if} \quad S_6 \le S_8 \le S_7 \\ S_7 + (S_6 - S_7)\mu_{68} + (S_8 - S_6)\mu_8 & \text{if} \quad S_7 \le S_6 \le S_8 \\ S_7 + (S_8 - S_7)\mu_{68} + (S_6 - S_8)\mu_6 & \text{if} \quad S_7 \le S_8 \le S_6 \\ S_8 + (S_6 - S_8)\mu_{67} + (S_7 - S_6)\mu_7 & \text{if} \quad S_8 \le S_6 \le S_7 \\ S_8 + (S_7 - S_8)\mu_{67} + (S_6 - S_7)\mu_6 & \text{if} \quad S_8 \le S_7 \le S_6 \end{cases}$$

Therefore, with the μ listed above:

$$\text{Good health-score} = \begin{cases} S_6 + 0.22(S_7 - S_6) + 0.12(S_8 - S_7) & \text{if} \quad S_6 \le S_7 \le S_8 \\ S_6 + 0.22(S_8 - S_6) + 0.22(S_7 - S_8) & \text{if} \quad S_6 \le S_8 \le S_7 \\ S_7 + 0.18(S_6 - S_7) + 0.12(S_8 - S_6) & \text{if} \quad S_7 \le S_6 \le S_8 \\ S_7 + 0.18(S_8 - S_7) + 0.08(S_6 - S_8) & \text{if} \quad S_7 \le S_8 \le S_6 \\ S_8 + 0.36(S_6 - S_8) + 0.22(S_7 - S_6) & \text{if} \quad S_8 \le S_6 \le S_7 \\ S_8 + 0.36(S_7 - S_8) + 0.08(S_6 - S_7) & \text{if} \quad S_8 \le S_7 \le S_6 \end{cases}$$

Where S_6, S_7 and S_8 are the scores obtained by a given farm for the Criterion of *Absence of injuries*, the Criterion of *Absence of diseases* and the Criterion of *Absence of pain induced by management procedures* respectively.
μ_6, μ_7 and μ_8 are the capacities of the Criteria of *Absence of injuries*, *Absence of diseases* and *Absence of pain induced by management procedures* respectively.
μ_{67} is the capacity of the group made from the Criteria of *Absence of injuries* and *Absence of diseases* and so on...

Principle of *Appropriate behaviour*

μ_9	=	0.14	μ_{1011}	=	0.16
μ_{10}	=	0.07	μ_{1012}	=	0.20
μ_{11}	=	0.09	μ_{1112}	=	0.27
μ_{12}	=	0.16	μ_{91011}	=	0.48
μ_{910}	=	0.16	μ_{91012}	=	0.56
μ_{911}	=	0.14	μ_{91112}	=	0.53
μ_{912}	=	0.23	μ_{101112}	=	0.51

with 9, the Criterion of *Expression of social behaviours*; 10, the Criterion of *Expression of other behaviours*; 11, the Criterion of *Good human-animal relationship*; 12, the Criterion of *Positive emotional state*.

NB: As Criteria 11 & 12 are considered as a single criterion for mink, the score has to be considered twice in the calculation of the Principle of *Appropriate behaviour*.

Reminder:

$$\text{Appropr. behaviour-score} = \begin{cases}
S_9 + (S_{10} - S_9)\,\mu_{101112} + (S_{11} - S_{10})\,\mu_{1211} + (S_{12} - S_{11})\,\mu_{12} & \text{if} \quad S_9 \le S_{10} \le S_{11} \le S_{12} \\
S_9 + (S_{10} - S_9)\,\mu_{101112} + (S_{12} - S_{10})\,\mu_{1112} + (S_{11} - S_{12})\,\mu_{11} & \text{if} \quad S_9 \le S_{10} \le S_{12} \le S_{11} \\
S_9 + (S_{11} - S_9)\,\mu_{101112} + (S_{10} - S_{11})\,\mu_{1012} + (S_{12} - S_{10})\,\mu_{12} & \text{if} \quad S_9 \le S_{11} \le S_{10} \le S_{12} \\
S_9 + (S_{11} - S_9)\,\mu_{101112} + (S_{12} - S_{11})\,\mu_{1012} + (S_{10} - S_{12})\,\mu_{10} & \text{if} \quad S_9 \le S_{11} \le S_{12} \le S_{10} \\
S_9 + (S_{12} - S_9)\,\mu_{101112} + (S_{10} - S_{12})\,\mu_{1011} + (S_{11} - S_{10})\,\mu_{11} & \text{if} \quad S_9 \le S_{12} \le S_{10} \le S_{11} \\
S_9 + (S_{12} - S_9)\,\mu_{101112} + (S_{11} - S_{12})\,\mu_{1011} + (S_{10} - S_{11})\,\mu_{10} & \text{if} \quad S_9 \le S_{12} \le S_{11} \le S_{10} \\
S_{10} + (S_9 - S_{10})\,\mu_{91112} + (S_{11} - S_9)\,\mu_{1112} + (S_{12} - S_{11})\,\mu_{12} & \text{if} \quad S_{10} \le S_9 \le S_{11} \le S_{12} \\
S_{10} + (S_9 - S_{10})\,\mu_{91112} + (S_{12} - S_9)\,\mu_{1112} + (S_{11} - S_{12})\,\mu_{11} & \text{if} \quad S_{10} \le S_9 \le S_{12} \le S_{11} \\
S_{10} + (S_{11} - S_{10})\,\mu_{91112} + (S_9 - S_{11})\,\mu_{912} + (S_{12} - S_9)\,\mu_{12} & \text{if} \quad S_{10} \le S_{11} \le S_9 \le S_{12} \\
S_{10} + (S_{11} - S_{10})\,\mu_{91112} + (S_{12} - S_{11})\,\mu_{912} + (S_9 - S_{12})\,\mu_9 & \text{if} \quad S_{10} \le S_{11} \le S_{12} \le S_9 \\
S_{10} + (S_{12} - S_{10})\,\mu_{91112} + (S_{11} - S_{12})\,\mu_{911} + (S_9 - S_{11})\,\mu_9 & \text{if} \quad S_{10} \le S_{12} \le S_{11} \le S_9 \\
S_{10} + (S_{12} - S_{10})\,\mu_{91112} + (S_9 - S_{12})\,\mu_{911} + (S_{11} - S_9)\,\mu_{11} & \text{if} \quad S_{10} \le S_{12} \le S_9 \le S_{11} \\
S_{11} + (S_{10} - S_{11})\,\mu_{91012} + (S_9 - S_{10})\,\mu_{912} + (S_{12} - S_9)\,\mu_{12} & \text{if} \quad S_{11} \le S_{10} \le S_9 \le S_{12} \\
S_{11} + (S_{10} - S_{11})\,\mu_{91012} + (S_{12} - S_{10})\,\mu_{912} + (S_9 - S_{12})\,\mu_9 & \text{if} \quad S_{11} \le S_{10} \le S_{12} \le S_9 \\
S_{11} + (S_{12} - S_{11})\,\mu_{91012} + (S_{10} - S_{12})\,\mu_{910} + (S_9 - S_{10})\,\mu_9 & \text{if} \quad S_{11} \le S_{12} \le S_{10} \le S_9 \\
S_{11} + (S_{12} - S_{11})\,\mu_{91012} + (S_{10} - S_{12})\,\mu_{910} + (S_{10} - S_9)\,\mu_{10} & \text{if} \quad S_{11} \le S_{12} \le S_9 \le S_{10} \\
S_{11} + (S_9 - S_{11})\,\mu_{91012} + (S_{12} - S_9)\,\mu_{1012} + (S_{10} - S_{12})\,\mu_{10} & \text{if} \quad S_{11} \le S_9 \le S_{12} \le S_{10} \\
S_{11} + (S_9 - S_{11})\,\mu_{91012} + (S_{10} - S_9)\,\mu_{1012} + (S_{12} - S_{10})\,\mu_{12} & \text{if} \quad S_{11} \le S_9 \le S_{10} \le S_{12} \\
S_{12} + (S_9 - S_{12})\,\mu_{91011} + (S_{10} - S_9)\,\mu_{1011} + (S_{11} - S_{10})\,\mu_{11} & \text{if} \quad S_{12} \le S_9 \le S_{10} \le S_{11} \\
S_{12} + (S_9 - S_{12})\,\mu_{91011} + (S_{11} - S_9)\,\mu_{1011} + (S_{10} - S_{11})\,\mu_{10} & \text{if} \quad S_{12} \le S_9 \le S_{11} \le S_{10} \\
S_{12} + (S_{10} - S_{12})\,\mu_{91011} + (S_{11} - S_{10})\,\mu_{911} + (S_9 - S_{11})\,\mu_9 & \text{if} \quad S_{12} \le S_{10} \le S_{11} \le S_9 \\
S_{12} + (S_{10} - S_{12})\,\mu_{91011} + (S_9 - S_{10})\,\mu_{911} + (S_{11} - S_9)\,\mu_{11} & \text{if} \quad S_{12} \le S_{10} \le S_9 \le S_{11} \\
S_{12} + (S_{11} - S_{12})\,\mu_{91011} + (S_9 - S_{11})\,\mu_{910} + (S_{10} - S_9)\,\mu_{10} & \text{if} \quad S_{12} \le S_{11} \le S_9 \le S_{10} \\
S_{12} + (S_{11} - S_{12})\,\mu_{91011} + (S_{10} - S_{11})\,\mu_{910} + (S_9 - S_{10})\,\mu_9 & \text{if} \quad S_{12} \le S_{11} \le S_{10} \le S_9
\end{cases}$$

Therefore, with the μ listed above:

$$\begin{cases}
S_9 + 0.51(S_{10} - S_9) + 0.27(S_{11} - S_{10}) + 0.16(S_{12} - S_{11}) & \text{if} \quad S_9 \le S_{10} \le S_{11} \le S_{12} \\
S_9 + 0.51(S_{10} - S_9) + 0.27(S_{12} - S_{10}) + 0.09(S_{11} - S_{12}) & \text{if} \quad S_9 \le S_{10} \le S_{12} \le S_{11} \\
S_9 + 0.51(S_{11} - S_9) + 0.20(S_{10} - S_{11}) + 0.16(S_{12} - S_{10}) & \text{if} \quad S_9 \le S_{11} \le S_{10} \le S_{12} \\
S_9 + 0.51(S_{11} - S_9) + 0.20(S_{12} - S_{11}) + 0.07(S_{10} - S_{12}) & \text{if} \quad S_9 \le S_{11} \le S_{12} \le S_{10} \\
S_9 + 0.51(S_{12} - S_9) + 0.16(S_{10} - S_{12}) + 0.09(S_{11} - S_{10}) & \text{if} \quad S_9 \le S_{12} \le S_{10} \le S_{11} \\
S_9 + 0.51(S_{12} - S_9) + 0.16(S_{11} - S_{12}) + 0.07(S_{10} - S_{11}) & \text{if} \quad S_9 \le S_{12} \le S_{11} \le S_{10} \\
S_{10} + 0.53(S_9 - S_{10}) + 0.27(S_{11} - S_9) + 0.16(S_{12} - S_{11}) & \text{if} \quad S_{10} \le S_9 \le S_{11} \le S_{12} \\
S_{10} + 0.53(S_9 - S_{10}) + 0.27(S_{12} - S_9) + 0.09(S_{11} - S_{12}) & \text{if} \quad S_{10} \le S_9 \le S_{12} \le S_{11}
\end{cases}$$

$$\text{Appropr. behaviour-score} = \begin{cases} S_{10} + 0.53(S_{11} - S_{10}) + 0.23(S_9 - S_{11}) + 0.16(S_{12} - S_9) & \text{if} \quad S_{10} \le S_{11} \le S_9 \le S_{12} \\ S_{10} + 0.53(S_{11} - S_{10}) + 0.23(S_{12} - S_{11}) + 0.14(S_9 - S_{12}) & \text{if} \quad S_{10} \le S_{11} \le S_{12} \le S_9 \\ S_{10} + 0.53(S_{12} - S_{10}) + 0.14(S_{11} - S_{12}) + 0.14(S_9 - S_{11}) & \text{if} \quad S_{10} \le S_{12} \le S_{11} \le S_9 \\ S_{10} + 0.53(S_{12} - S_{10}) + 0.14(S_9 - S_{12}) + 0.09(S_{11} - S_9) & \text{if} \quad S_{10} \le S_{12} \le S_9 \le S_{11} \\ S_{11} + 0.56(S_{10} - S_{11}) + 0.23(S_9 - S_{10}) + 0.16(S_{12} - S_9) & \text{if} \quad S_{11} \le S_{10} \le S_9 \le S_{12} \\ S_{11} + 0.56(S_{10} - S_{11}) + 0.23(S_{12} - S_{10}) + 0.14(S_9 - S_{12}) & \text{if} \quad S_{11} \le S_{10} \le S_{12} \le S_9 \\ S_{11} + 0.56(S_{12} - S_{11}) + 0.16(S_{10} - S_{12}) + 0.14(S_9 - S_{10}) & \text{if} \quad S_{11} \le S_{12} \le S_{10} \le S_9 \\ S_{11} + 0.56(S_{12} - S_{11}) + 0.16(S_9 - S_{12}) + 0.07(S_{10} - S_9) & \text{if} \quad S_{11} \le S_{12} \le S_9 \le S_{10} \\ S_{11} + 0.56(S_9 - S_{11}) + 0.20(S_{12} - S_9) + 0.07(S_{10} - S_{12}) & \text{if} \quad S_{11} \le S_9 \le S_{12} \le S_{10} \\ S_{11} + 0.56(S_9 - S_{11}) + 0.20(S_{10} - S_9) + 0.16(S_{12} - S_{10}) & \text{if} \quad S_{11} \le S_9 \le S_{10} \le S_{12} \\ S_{12} + 0.48(S_9 - S_{12}) + 0.16(S_{10} - S_9) + 0.09(S_{11} - S_{10}) & \text{if} \quad S_{12} \le S_9 \le S_{10} \le S_{11} \\ S_{12} + 0.48(S_9 - S_{12}) + 0.16(S_{11} - S_9) + 0.07(S_{10} - S_{11}) & \text{if} \quad S_{12} \le S_9 \le S_{11} \le S_{10} \\ S_{12} + 0.48(S_{10} - S_{12}) + 0.14(S_{11} - S_{10}) + 0.14(S_9 - S_{11}) & \text{if} \quad S_{12} \le S_{10} \le S_{11} \le S_9 \\ S_{12} + 0.48(S_{10} - S_{12}) + 0.14(S_9 - S_{10}) + 0.09(S_{11} - S_9) & \text{if} \quad S_{12} \le S_{10} \le S_9 \le S_{11} \\ S_{12} + 0.48(S_{11} - S_{12}) + 0.16(S_9 - S_{11}) + 0.07(S_{10} - S_9) & \text{if} \quad S_{12} \le S_{11} \le S_9 \le S_{10} \\ S_{12} + 0.48(S_{11} - S_{12}) + 0.16(S_{10} - S_{11}) + 0.14(S_9 - S_{10}) & \text{if} \quad S_{12} \le S_{11} \le S_{10} \le S_9 \end{cases}$$

Where S_9, S_{10}, S_{11} and S_{12} are the scores obtained by a given farm for the Criterion of *Expression of social behaviours*, the Criterion of *Expression of other behaviours*, the Criterion of *Good human-animal relationship* and the Criterion of *Positive emotional state* respectively.
μ_9, μ_{10}, μ_{11} and μ_{12} are the capacities of Criteria *Expression of social behaviours*, *Expression of other behaviours*, *Good human-animal relationship* and *Positive emotional state* respectively.
μ_{910} is the capacity of the group made from the Criteria of *Expression of social behaviours* and *Expression of other behaviours* and so on...

Due to the positive values of the interactions between criterion-scores, the principle-scores are always intermediate between the lowest and the highest values obtained at criterion level and always closer to the minimum value.

Within each principle, some criteria are considered more important than others (and will contribute to a large extent to the principle-score):

- Within the Principle of *Good feeding*, the Criterion of *Absence of prolonged thirst* is considered more important than the Criterion of *Absence of prolonged hunger*.

- Within the Principle of *Good housing*, the Criterion of *Comfort around resting* is considered more important than the Criterion of *Ease of movement* which in turn is considered more important than the Criterion of *Thermal comfort*.

- Within the Principle of *Good health*, the Criterion of *Absence of diseases* is considered more important than the Criterion of *Absence of injuries* which in turn is considered more important than the Criterion of *Absence of pain induced by management procedures*.

- Within the Principle of *Appropriate behaviour*, the Criterion of *Positive emotional state* is considered more important than the Criterion of *Expression of social behaviours* which in turn is considered more important than the Criterion of *Good human-animal relationship* which in turn is considered more important than the Criterion of *Expression of other behaviours*.

Examples of principle-scores resulting from Criterion-scores are provided in Table 5, Table 6, Table 7 and Table 8.

Absence of prolonged hunger	Absence of prolonged thirst	Principle Good feeding
25	75	*39*
40	60	*46*
50	50	*50*
60	40	*42*
75	25	*30*

Table 5 Examples of scores for the Principle of Good feeding according to combinations of criterion-scores for the Criteria of **Absence of prolonged hunger** and **Absence of prolonged thirst**.

Comfort around resting	Thermal comfort	Ease of movement	Principle of Good housing
25	50	75	*37*
25	75	50	*37*
40	50	60	*45*
40	60	50	*45*
50	25	75	*39*
50	40	60	*46*
50	50	50	*50*
50	60	40	*44*
50	75	25	*36*
60	40	50	*46*
60	50	40	*45*
75	25	50	*39*
75	50	25	*37*

Table 6 Examples of scores for the Principle of **Good housing** according to combinations of criterion-scores for the Criteria of **Comfort around resting, Thermal comfort** and **Ease of movement**.

Absence of injuries	Absence of diseases	Absence of pain induced by management procedures	Principle of Good health
25	50	75	*34*
25	75	50	*36*
40	50	60	*43*
40	60	50	*44*
50	25	75	*33*

50	40	60	*43*
50	50	50	*50*
50	60	40	*46*
50	75	25	*40*
60	40	50	*43*
60	50	40	*44*
75	25	50	*32*
75	50	25	*36*

Table 7 Examples of scores for the Principle of **Good health** according to combinations of criterion-scores for the Criteria of **Absence of injuries, Absence of diseases** and **Absence of pain induced by management procedures**.

Social behaviours	Other behaviours	Good human-animal relationships	Positive emotional state	Principle of Appropriate behaviour
35	35	65	65	*43*
35	50	50	65	*45*
35	50	65	50	*44*
35	65	35	65	*41*
35	65	50	50	*44*
35	65	65	35	*40*
50	35	50	65	*45*
50	35	65	50	*44*
50	50	35	65	*46*
50	50	50	50	*50*
50	50	65	35	*44*
50	65	35	50	*44*
50	65	50	35	*43*
65	35	35	65	*42*
65	35	50	50	*45*
65	35	65	35	*39*
65	50	35	50	*45*
65	50	50	35	*44*
65	65	35	35	*40*

Table 8 Examples of scores for the Principle of **Appropriate behaviour** according to combinations of criterion-scores for the Criteria of **Expression of social behaviours, Expression of other behaviours, Good human-animal relationship** and **Positive emotional state.**

3.3.3 Overall assessment

The synthesis of the four principle-scores into an overall assessment is carried out in a similar way for all animal types in WelFur as well as in Welfare Quality®.
The scores obtained by a farm on all welfare principles are used to assign that farm to a welfare category. How many and what welfare categories are necessary depends on the purposes for which the welfare assessment will be used. According to the range of potential uses of the assessment, four welfare categories have been defined:

Best current practice: the welfare of the animals is of the best current level of practice.
Good current practice: the welfare of animals is of good current practice.
Acceptable current practice: the welfare of animals is at or above minimal requirements for current practice.
Unacceptable practice: the welfare of animals is below current practice and considered unacceptable.

'Aspiration values' are defined for each category. They represent the goal that the farm should try to achieve to be assigned to a given category. The 'best' threshold is set at 80, that for 'good' at 55 and that for acceptability at 20. However, just as criteria do not compensate for each other within a principle (see above), high scores in one principle do not offset low scores in another, so categories cannot be based on average scores. At the same time, it is important that the final classification reflects not only the theoretical acknowledgement of what can be considered as best, good, *etc*., but also what can realistically be achieved in practice.
A farm is considered of 'Best current practice' if it scores more than 55 on all principles and more than 80 on at least two while it is considered of 'Good current practice' if it scores more than 20 on all principles and more than 55 on at least two. Farms with 'Acceptable current practice' levels of animal welfare score more than 10 on all principles and more than 20 on at least three. Farms that do not reach these minimum standards are classified as of 'Unacceptable current practice' (Figure 62). Due to the variability of experts' answers during the different consultations, some uncertainty of the evaluation has to be taken into account. As a consequence, an indifference threshold equal to 5 is applied: for instance, 50 is not considered significantly lower than 55.

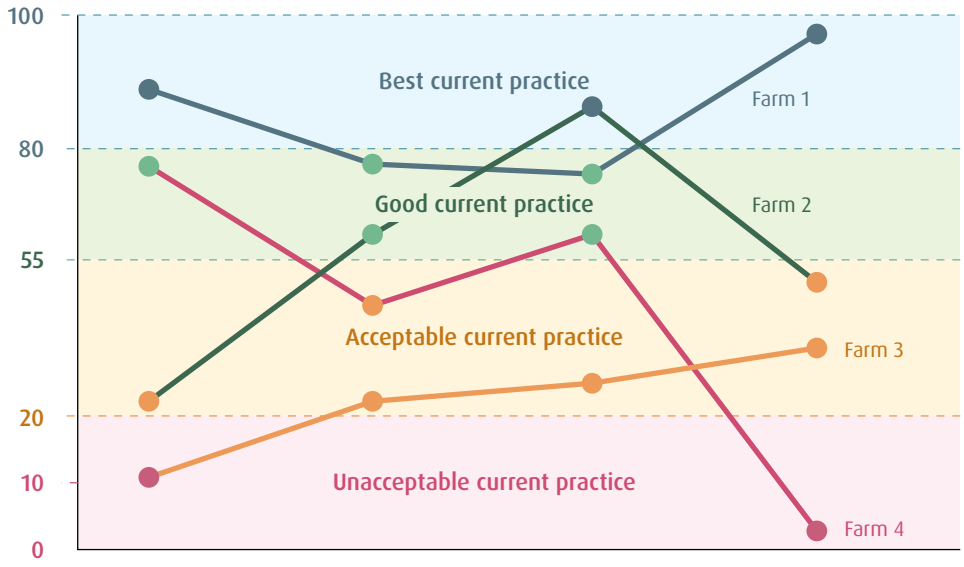


Figure 62 Examples of farms in the four welfare categories

3.4 Annex A: Recording sheets for mink

3.4.1 Blank recording sheets.

(The sheets are under continuous development and have been replaced by a tablet application for on-farm data collection.)

Farm id:	Phone number:	Period 1 Sheet 1
Date of visit:	Farm information	

* Information needed for the welfare assessment			Sampling and visit planning information				No. of sections in sample
ONLY for sheds holding animals			**Number of mink**		**Location/shed no.**		
ANIMALS	Breeders	Dams < 1 year old *					
		Dams > 1 year old *					
		Males *					
	Colour type by dams		Dams	(Males)	Dams	(Males)	
	Number of dams in each colour type	1 Brown (BRWN)					
		2 Mahogany (MAHG)					
		3 Standard Black (STD.)					
		4 Pearl (PERL)					
		5 White (WHIT)					
		6 Cross (CROS)					
		7 Silver blue (SILV)					
		8 Others (OTHR)					
SHEDS	Type	Two rows					
		Multi rows					
CAGES	Type	Single/pairs	Type 1				
			Type 2				
		Groups	Type 1				
			Type 2				
	Material (wall)	Wire-mesh					
		Solid					
		Other					
NEST BOXES	Presence	No. of cages without					
	Type	Normal					
		Top nesters					
	Material	Wood					
		Synthetic					
TYPE OF WATERING SYSTEM	Automatic	Frost protection *					
		No frost protection *		Water times a day *			
	Manual	No. of cages *					
FEEDING	Time of feeding						
HEALTH STATUS	Aleutian disease	No					
		Reagents found during eradication programme - to be pelted					
		Chronic - not to be pelted					
	Other notifiable or contagious diseases		No				
			Yes				
	Are sick and injured animals gathered in an 'infirmary' section		No				
			Yes		Where?		

Farm id		Farm management information_welfare
Date of visit:	**Observer**	**Period 1 Sheet 2**

	MORTALITY - NO OF DEAD MINK IN THE PERIOD FROM DECEMBER 1ST TO FEBRUARY 28TH					
	DAMS		***MALES***		***TOTAL***	
	Dead		Dead		Dead	
December						
January						
February						
Total						

HANDLING PROCEDURES FROM DECEMBER 1ST TO FEBRUARY 28TH						
Handling may include e.g.: Vaccination, Weighing, Grading, Moving, Selling	How many times are mink caught, handled and/or moved for less than 1 minute?	How many mink (or % of the population) are involved?	How many times are mink caught, handled and/or moved for more than 1 minute but less than an hour?	How many mink (or % of the population) are involved?	How many times are mink caught, handled and/or moved for more than an hour?	How many mink (or % of the population) are involved?
Total						

KILLING METHOD		**INSPECTION OF KILLING EQUIPMENT/MEANS OF KILLING**					
How are animals killed?	**No of killing boxes/ equipment**	**Pelting**			**Individual**		
		0: no broken or worn out parts, well functioning gas transfer	**1:** minor destruction, gas transfer is working and/or is insufficient	**2:** old, worn out parts, insufficient gas transfer	**0:** well functioning, efficient means of killing	**1:** not too well functioning	**2:** no functioning equipment

Farm id	Observer id	Date	Period 1 Sheet 3

Shed number/colour type	Cage/section number	Animal/cage id	Colour type	Number of males (M)	Number of dams (F)	Stereotypy		Temperament				BCS					Sickness		Injuries			Fur chewing			Enrichments		Water point			Nest box					Animal/cage id
																			Kits										Nest box					
																													Quality					
						Active	Stereotypic behaviour	Exploratory	Fearful	Aggressive	Undecided/in nest	1 Very thin	2 Thin	3 Ideal	4 Heavy	5 Obese	Obviously sick	Lameness	< 10mm 1	< 30mm 2	> 30mm 3	Moderate	Severe	Extensive	Type(s) 1-9	No bedding	Not clean	Not functional	Diarrhoea	No access	Wet	Dirty	Damaged	Fleas	
																								E.g.	0-no is not noted									
																								1, 3, 4	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	
		1																																1
		2																																2
		3																																3
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		23																																23
		24																																24
		25																																25

Period 1 Sheet 3

Date

Observer id

Farm id

Animal/cage id				26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Nest box	Quality	Fleas	0-no is not noted; 1- yes																									
Nest box	Quality	Damaged	1- yes																									
Nest box	Quality	Dirty	1- yes																									
Nest box	Quality	Wet	1- yes																									
Nest box		No access	1- yes																									
Water point		Diarrhoea	1- yes																									
Water point		Not functional	1- yes																									
Water point		Not clean	1- yes																									
Enrichments		No bedding	1- yes																									
Enrichments		Type(s) 1-9	E.g. 1, 3, 4																									
Fur chewing		Extensive																										
Fur chewing		Severe																										
Fur chewing		Moderate																										
Injuries	Kits	> 30mm	**3**																									
Injuries	Kits	< 30mm	**2**																									
Injuries	Kits	< 10mm	**1**																									
Sickness		Lameness																										
Sickness		Obviously sick																										
BCS		5 Obese																										
BCS		4 Heavy																										
BCS		3 Ideal																										
BCS		2 Thin																										
BCS		1 Very thin																										
Temperament		Undecided/in nest																										
Temperament		Aggressive																										
Temperament		Fearful																										
Temperament		Exploratory																										
Stereotypy		Stereotypic behaviour																										
Stereotypy		Active																										
Number of dams (F)																												
Number of males (M)																												
Colour type																												
Animal/cage id				26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Cage/section number																												
Shed number/colour type																												

Period 1 Sheet 3

Date

Observer id

Farm id

			Animal/cage id	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Nest box	Quality	Fleas	0-no is not noted; 1- yes																									
		Damaged	1- yes																									
		Dirty	1- yes																									
		Wet	1- yes																									
		No access	1- yes																									
Water point		Diarrhoea	1- yes																									
		Not functional	1- yes																									
		Not clean	1- yes																									
Enrichments		No bedding	1- yes																									
		Type(s) 1-9	E.g. 1, 3, 4																									
Fur chewing		Extensive																										
		Severe																										
		Moderate																										
Injuries	Kits	> 30mm	**3**																									
		< 30mm	**2**																									
		< 10mm	**1**																									
Sickness		Lameness																										
		Obviously sick																										
BCS		5 Obese																										
		4 Heavy																										
		3 Ideal																										
		2 Thin																										
		1 Very thin																										
Temperament		Undecided/in nest																										
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		Exploratory																										
Stereotypy		Stereotypic behaviour																										
		Active																										
			Number of dams (F)																									
			Number of males (M)																									
			Colour type																									
			Animal/cage id	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
			Cage/section number																									
			Shed number/colour type																									

Farm id

Observer id

Date

Period 1 Sheet 3

			Animal/cage id	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Nest box	Quality	Fleas	0-no is not noted; 1- yes																									
		Damaged	1- yes																									
		Dirty	1- yes																									
		Wet	1- yes																									
		No access	1- yes																									
Water point		Diarrhoea	1- yes																									
		Not functional	1- yes																									
		Not clean	1- yes																									
Enrichments		No bedding	1- yes																									
		Type(s) 1-9	E.g. 1, 3, 4																									
Fur chewing			Extensive																									
			Severe																									
			Moderate																									
Injuries	Kits	> 30mm	**3**																									
		< 30mm	**2**																									
		< 10mm	**1**																									
Sickness			Lameness																									
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			3 Ideal																									
			2 Thin																									
			1 Very thin																									
Temperament			Undecided/in nest																									
			Aggressive																									
			Fearful																									
			Exploratory																									
Stereotypy			Stereotypic behaviour																									
			Active																									
			Number of dams (F)																									
			Number of males (M)																									
			Colour type																									
			Animal/cage id	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
			Cage/section number																									
			Shed number/colour type																									

Farm id | Shed number/colour type | Cage/section number | Animal/cage id | Colour type | Number of dams (F) | Number of males (M)

Observer id | Date | Period 1 | Sheet 3

					Animal/cage id	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Nest box	Quality	Fleas	0-no is not noted	1-yes																										
		Damaged		1-yes																										
		Dirty		1-yes																										
		Wet		1-yes																										
		No access		1-yes																										
Water point		Diarrhoea		1-yes																										
		Not functional		1-yes																										
		Not clean		1-yes																										
Enrichments		No bedding		1-yes																										
		Type(s) 1-9	E.g.	1, 3, 4																										
Fur chewing		Extensive																												
		Severe																												
		Moderate																												
Injuries	Kits	> 30mm **3**																												
		< 30mm **2**																												
		< 10mm **1**																												
Sickness		Lameness																												
		Obviously sick																												
BCS		5 Obese																												
		4 Heavy																												
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		1 Very thin																												
Temperament		Undecided/in nest																												
		Aggressive																												
		Fearful																												
		Exploratory																												
Stereotypy		Stereotypic behaviour																												
		Active																												

Shed number/colour type	Cage/section number	Animal/cage id	Colour type	Number of males (M)	Number of dams (F)	Stereotypy		Temperament				BCS					Sickness		Injuries			Fur chewing			Enrichments		Water point			Nest box					Animal/cage id
																			Kits											Quality					
						Active	Stereotypic behaviour	Exploratory	Fearful	Aggressive	Undecided/in nest	1 Very thin	2 Thin	3 Ideal	4 Heavy	5 Obese	Obviously sick	Lameness	< 10mm **1**	< 30mm **2**	> 30mm **3**	Extensive	Severe	Moderate	Type(s) 1-9	No bedding	Diarrhoea	Not functional	Not clean	No access	Fleas	Damaged	Dirty	Wet	
																									E.g.	0-no is not noted								
																									1, 3, 4	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	
		126																																126
		127																																127
		128																																128
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		148																																148
		149																																149
		150																																150

Farm id | **Observer id** | **Date** | **Period 1** **Sheet 3**

Location	Nest box						Cage							
	Size			Thermal comfort			Bottom cage size			Top cage size- if in use			Thermal comfort	
				Insulation	Bed. Mat.	Wind device / covered nest							Protection from Wind	Within comfort zone
				0 - well	0 - sufficient								0 - high	
				1 - normal	1 - some	0 - yes							1 - medium	0 - yes
	W	L	H	2 - no	2 - none/little	1 - no	W	L	H	W	L	H	2 - low	1 - no
Farm														
Shed no.														
Section no.														

Farm id:	Phone number:	Period 2 Sheet 1
Date of visit:	Farm information	

* Information needed for the welfare assessment

ONLY for sheds holding animals			Sampling and visit planning information: Number of mink		Location/shed no.		No. of sections in sample
ANIMALS	Breeders	Dams < 1 year old *					
		Dams > 1 year old *					
		Males *					
	Colour type by dams		Dams	(Males)	Dams	(Males)	
	Number of dams in each colour type	1 Brown (BRWN)					
		2 Mahogany (MAHG)					
		3 Standard Black (STD.)					
		4 Pearl (PERL)					
		5 White (WHIT)					
		6 Cross (CROS)					
		7 Silver blue (SILV)					
		8 Others (OTHR)					
SHEDS	Type	Two rows					
		Multi rows					
	Cooling	Means of cooling? *					
CAGES	Type	Single/pairs	Type 1				
			Type 2				
		Groups	Type 1				
			Type 2				
	Material (wall)	Wire-mesh					
		Solid					
		Other					
NEST BOXES	Presence	No. of cages without					
	Type	Normal					
		Top nesters					
	Material	Wood					
		Synthetic					
TYPE OF WATERING SYSTEM	Automatic	Frost protection *					
		No frost protection *		Water times a day *			
	Manual	No. of cages *					
FEEDING	Time of feeding						
HEALTH STATUS	Aleutian disease	No					
		Reagents found during eradication programme - to be pelted					
		Chronic - not to be pelted					
	Other notifiable or contagious diseases		No				
			Yes				
	Are sick and injured animals gathered in an 'infirmary' section		No				
			Yes		Where?		

Farm id		Farm management information welfare
Date of visit:	**Observer**	**Period 2 Sheet 2**

	MORTALITY -NO OF DEAD MINK FROM MARCH 1ST TO JULY 15TH				**WEANING**		
	ADULTS (PELTED MALES ARE NOT INCLUDED)		**KITS**		**AGE AT WEANING**	**DISTANCE OF MOVED FEMALE**	**TRANSITION PERIOD**
	Dead		Dead		before or at 6 weeks, 7 weeks, 8 weeks, 9 weeks, 10 weeks or later	Female moved > 20m or housed close to weaned kits	More (≥) or less (<) than 7 days between weaning and final separation
March 1st - May 14th							
May 15th - July 15th							
June 15th - July 15th							
Total in period 2							

	HANDLING PROCEDURES FROM MARCH 1ST TO JULY 15TH					
	How many times are mink caught, handled and/or moved for less than 1 minute?	How many mink (or % of the population) are involved?	How many times are mink caught, handled and/or moved for more than 1 minute but less than an hour?	How many mink (or % of the population) are involved?	How many times are mink caught, handled and/or moved for more than an hour?	How many mink (or % of the population) are involved?
March 1st - April 14th						
April 15th - May 14th						
May 15th - July 15th						
Total in period 2						

KILLING METHOD		**INSPECTION OF KILLING EQUIPMENT/MEANS OF KILLING**					
How are animals killed?	**No of killing boxes/ equipment**	**Pelting**			**Individual**		
		0: no broken or worn out parts, well functioning gas transfer	**1:** minor defects, gas transfer is working and/or is insufficient	**2:** old, worn out parts, insufficient gas transfer	**0:** well functioning, efficient means of killing	**1:** not very well functioning	**2:** no functioning equipment

Farm id	Observer id	Date	Period 2 Sheet 3

Shed number/colour type	Cage/section number	Animal/cage id	Colour type	Number of kits in cage	Female missing	Stereotypy		BCS					Sickness			Injuries				Fur chewing			Enrichments		Water point			Nest box					Animal/cage id
						Adults								Adults+kits			Kits													Quality				
						Active	Stereotypy	1 Very thin	2 Thin	3 Ideal	4 Heavy	5 Obese	Sticky kits/diarrhoea	Disease	Lameness	Adults 1 - 3	< 10mm **1**	< 30mm **2**	> 30mm **3**	Moderate	Severe	Extensive	Type(s) 1-9	No bedding	Not clean	Not functional	Diarrhoea	No access	Wet	Dirty	Damaged	Fleas	
		E.g.																					1, 3, 4	0-no is not noted									
						1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	
		1																															1
		2																															2
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		24																															24
		25																															25

Period 2 Sheet 3

Date

Observer id

Farm id

Category	Subgroup	Item	Code	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Nest box	Quality	Fleas	0-no is not noted; 1- yes																									
Nest box	Quality	Damaged	1- yes																									
Nest box	Quality	Dirty	1- yes																									
Nest box	Quality	Wet	1- yes																									
Nest box		No access	1- yes																									
Water point		Diarrhoea	1- yes																									
Water point		Not functional	1- yes																									
Water point		Not clean	1- yes																									
Enrichments		No bedding	1- yes																									
Enrichments		Type(s) 1-9	E.g. 1, 3, 4																									
Fur chewing		Extensive																										
Fur chewing		Severe																										
Fur chewing		Moderate																										
Injuries	Kits	> 30mm	**3**																									
Injuries	Kits	< 30mm	**2**																									
Injuries	Kits	< 10mm	**1**																									
Injuries		Adults 1 - 3																										
Sickness	Adults+kits	Lameness																										
Sickness	Adults+kits	Disease																										
Sickness		Sticky kits/diarrhoea																										
BCS		5 Obese																										
BCS		4 Heavy																										
BCS		3 Ideal																										
BCS		2 Thin																										
BCS		1 Very thin																										
Stereotypy	Adults	Stereotypy																										
Stereotypy	Adults	Active																										
Female missing																												
Number of kits in cage																												
Colour type																												
Animal/cage id				26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Cage/section number																												
Shed number/colour type																												

Farm id	Observer id	Date	Period 2 Sheet 3

Shed number/colour type	Cage/section number	Animal/cage id	Colour type	Number of kits in cage	Female missing	Stereotypy		BCS					Sickness			Injuries				Fur chewing			Enrichments		Water point			Nest box					Animal/cage id
						Adults								Adults+kits			Kits												Quality					
						Active	Stereotypy	1 Very thin	2 Thin	3 Ideal	4 Heavy	5 Obese	Sticky kits/diarrhoea	Disease	Lameness	Adults 1 - 3	< 10mm **1**	< 30mm **2**	> 30mm **3**	Moderate	Severe	Extensive	Type(s) 1-9	No bedding	Not clean	Not functional	Diarrhoea	No access	Wet	Dirty	Damaged	Fleas	
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Period 2 Sheet 3

Date

Observer id

Farm id

Animal/cage id				76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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Nest box	Quality	Damaged	1- yes																									
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Nest box		No access	1- yes																									
Water point		Diarrhoea	1- yes																									
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Enrichments		Type(s) 1-9	E.g. 1, 3, 4																									
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Animal/cage id				76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Cage/section number																												
Shed number/colour type																												

Farm id	Observer id	Date	Period 2 Sheet 3

Shed number/colour type	Cage/section number	Animal/cage id	Colour type	Number of kits in cage	Female missing	Stereotypy		BCS					Sickness			Injuries				Fur chewing			Enrichments		Water point			Nest box					Animal/cage id
						Adults								Adults+kits			Kits													Quality				
						Active	Stereotypy	1 Very thin	2 Thin	3 Ideal	4 Heavy	5 Obese	Sticky kits/diarrhoea	Disease	Lameness	Adults 1 - 3	< 10mm **1**	< 30mm **2**	> 30mm **3**	Moderate	Severe	Extensive	Type(s) 1-9	No bedding	Not clean	Not functional	Diarrhoea	No access	Wet	Dirty	Damaged	Fleas	
																							E.g.	0-no is not noted									
																							1, 3, 4	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	1-yes	
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		102																															102
		103																															103
		104																															104
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		125																															125

Farm id | Date | Period 2 | Sheet 3

Observer id

Shed number/colour type	Cage/section number	Animal/cage id	Colour type	Number of kits in cage	Female missing	Stereotypy		BCS					Sickness			Injuries				Fur chewing			Enrichments		Water point				Nest box				
		Animal/cage id																																
						Adults	Stereotypy	5 Obese	4 Heavy	3 Ideal	2 Thin	1 Very thin	Adults+kits	Lameness	Disease	Kits	> 30mm **3**	< 30mm **2**	< 10mm **1**	Adults 1 - 3	Extensive	Severe	Moderate	Type(s) 1-9	No bedding	Not clean	Not functional	Diarrhoea	No access	Quality	Wet	Dirty	Damaged	Fleas
						Active							Sticky kits/diarrhoea											E.g.	1- yes	1- yes	1- yes	1- yes	1- yes	0-no is not noted	1- yes	1- yes	1- yes	1- yes
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Location	Nest box						Cage									
	Size			Thermal comfort			Bottom cage size			Top cage size			Thermal comfort			
				Insulation	Bed. Mat.	Wind device / covered nest							Protection from Wind	Protection from Sun	Means of Cooling	Within comfort zone
				0 - well	0 - sufficient								0 - high	0 - high		
				1 - normal	1 - some	0 - yes							1 - medium	1 - medium	0 - yes	0 - yes
	W	L	H	2 - no	2 - none/little	1 - no	W	L	H	W	L	H	2 - low	2 - low	1 - no	1 - no
Farm																
Shed no.																
Section no.																

Farm id:	Phone number:	Period 3 Sheet 1

Farm information

Date of visit:	First date of sorting:	First date of pelting:

* Information needed for the welfare assessment			Sampling and visit planning information			
ONLY for sheds holding animals			**Number of mink**		**Location/shed no.**	
ANIMALS	Breeders (> 1 year old)	Dams *				
		Males *				
	Juveniles	Juveniles *				
	Colour type by dams (female breeders)		Dams	Juveniles	Dams	Juveniles
	Number of dams (female breeders) in each colour type	1 Brown (BRWN)				
		2 Mahogany (MAHG)				
		3 Standard Black (STD.)				
		4 Pearl (PERL)				
		5 White (WHIT)				
		6 Cross (CROS)				
		7 Silver blue (SILV)				
		8 Others (OTHR)				
SHEDS	Type	Two rows				
		Multi rows				
	Cooling	Means of cooling? *				
CAGES	Type	Single/pairs	Type 1			
			Type 2			
		Groups	Type 1			
			Type 2			
	Material (wall)	Wire-mesh				
		Solid				
		Other				
NEST BOXES	Presence	No. of cages without				
	Type	Normal				
		Top nesters				
	Material	Wood				
		Synthetic				
WATERING SYSTEM	Automatic	Frost protection *				
		No frost protection *		Water times a day		
	Manual	No. of cages *				
FEEDING	Time of feeding					
HEALTH STATUS	Aleutian disease	No				
		Reagents found during eradication programme - to be pelted				
		Chronic - not to be pelted				
	Other notifiable or contagious diseases		No			
			Yes			
	Are sick and injured animals gathered in an 'infirmary' section		No			
			Yes		Where?	

Farm id		Housing and grouping information
Date of visit:	**Observer**	**Period 3 Sheet 1.2**

	HOUSING OF ADULT FEMALE DAMS					
	Alone	**With 1 male juvenile**	**With 2 male juveniles**	**With more juvenile kits (Family)**	**With other adult male**	**With other dam**
Number of female dams						
Colour type(s)						
Colour type(s)						
Colour type(s)						
Colour type(s)						
Colour type(s)						
In shed number(s)						

	HOUSING OF JUVENILES					
	Alone	**1 male and 1 female**	**2 juveniles of the same sex**	**3 juveniles**	**4 juveniles**	**5 or more juveniles**
Number of cage						
Colour type(s)						
Colour type(s)						
Colour type(s)						
Colour type(s)						
Colour type(s)						
In shed number(s)						
Preferred sex combination						

	FOR STRATIFICATION ON GROUPING OF MINK:				
In cage	**Mink**	**Cages**	**No. Mink**	**6 blocks**	**Sample no. of**
Alone	Female dams				
	Males				
	Juveniles				
Pairs	Dam + Male				
	Female + Male				
	Other				
Three	Dam + 2 M				
	3 females				
	Other				
Four	2 M + 2 F				
	4 Females				
	Other				
Five or more					
Total					
Divided by					
Reference number of mink per sample unit					

Thereafter distribute the number of cage blocks on colour types, houses and so on

Farm id			Farm management information_welfare
Date of visit:	**Observer**		**Period 3 Sheet 2**

	Mortality - No of dead mink in Period 3 (July 16th – November 30th)					
	ADULTS		**JUVENILES**		**TOTAL**	
	Dead		**Dead**		**Dead**	
July 16th - August 31st						
September 1st - November 30th						
Total in Period 3						

HANDLING PROCEDURES IN PERIOD 3 (JULY 16TH – NOVEMBER 30TH)						
Handling may include e.g.: Vaccination, Weighing, Grading, Moving, Selling	How many times are mink caught, handled and/or moved for less than 1 minute?	How many mink (or % of the population) are involved?	How many times are mink caught, handled and/or moved for more than 1 minute but less than an hour?	How many mink (or % of the population) are involved?	How many times are mink caught, handled and/or moved for more than an hour?	How many mink (or % of the population) are involved?
Total in Period 3						

KILLING METHOD		**INSPECTION OF KILLING EQUIPMENT/MEANS OF KILLING**					
How are animals killed?	**No of killing boxes/ equipment**	**Pelting**			**Individual**		
		0: no broken or worn out parts, well functioning gas transfer	**1:** minor defects, gas transfer is working and/or is insufficient	**2:** old, worn out parts, insufficient gas transfer	**0:** well functioning, efficient means of killing	**1:** not very well functioning	**2:** no functioning equipment

Animal/cage id																														
Nest box	Quality	Fleas	0-no is not noted	1 - yes																										
		Damaged																												
		Dirty																												
		Wet																												
	No access																													
Water point	Diarrhoea		0-no is not noted	1 - yes																										
	Not functional																													
	Not clean																													
Enrichments	No straw																													
	Type(s) 1-9																													
Fur chewing	Extensive																													
	Severe																													
	Moderate																													
Injuries	> 30mm																													
	< 30mm																													
	< 10mm																													
Sickness	Lameness																													
	Disease																													
BCS	Obese																													
	Heavy																													
	Ideal																													
	Thin																													
	Very thin																													
Temperament	Undecided/in nest																													
	Aggressive																													
	Fearful																													
	Exploratory																													
Stereotypy	Stereotypic behaviour																													
	Active																													
Number of females (F)																														
Number of males (M)																														
Colour type																														
Animal/cage id																														
Cage/section number																														
Shed number/colour type																														

Farm id **Observer id** **Date** **Period 3** **Sheet 3**

Farm id	Observer id	Date	Period 3 Sheet 3

Shed number/colour type	Cage/section number	Animal/cage id	Colour type	Number of males (M)	Number of females (F)	Stereotypy		Temperament				BCS					Sickness		Injuries			Fur chewing			Enrichments		Water point			Nest box					Animal/cage id
						Active	Stereotypic behaviour	Exploratory	Fearful	Aggressive	Undecided/in nest	Very thin	Thin	Ideal	Heavy	Obese	Disease	Lameness	< 10mm	< 30mm	> 30mm	Moderate	Severe	Extensive	Type(s) 1-9	No straw	Not clean	Not functional	Diarrhoea	No access	Quality				
																														Wet	Dirty	Damaged	Fleas	
																								0-no is not noted										
																								1 - yes					1 - yes					
		26																																26
		27																																27
		28																																28
		29																																29
		30																																30
		31																																31
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		48																																48
		49																																49
		50																																50

Animal/cage id					51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75		
Nest box	Quality	Fleas	0-no is not noted 1 - yes																												
		Damaged																													
		Dirty																													
		Wet																													
	No access																														
Water point	Diarrhoea		0-no is not noted 1 - yes																												
	Not functional																														
	Not clean																														
Enrichments	No straw																														
	Type(s) 1-9																														
Fur chewing	Extensive																														
	Severe																														
	Moderate																														
Injuries	> 30mm																														
	< 30mm																														
	< 10mm																														
Sickness	Lameness																														
	Disease																														
BCS	Obese																														
	Heavy																														
	Ideal																														
	Thin																														
	Very thin																														
Temperament	Undecided/in nest																														
	Aggressive																														
	Fearful																														
	Exploratory																														
Stereotypy	Stereotypic behaviour																														
	Active																														
Number of females (F)																															
Number of males (M)																															
Colour type																															
Animal/cage id					51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75		
Cage/section number																															
Shed number/colour type																															

Farm id **Observer id** **Date** **Period 3** **Sheet 3**

Farm id	Observer id	Date	Period 3 Sheet 3

Shed number/colour type	Cage/section number	Animal/cage id	Colour type	Number of males (M)	Number of females (F)	Stereotypy		Temperament				BCS					Sickness		Injuries			Fur chewing			Enrichments		Water point			Nest box					Animal/cage id
						Active	Stereotypic behaviour	Exploratory	Fearful	Aggressive	Undecided/in nest	Very thin	Thin	Ideal	Heavy	Obese	Disease	Lameness	< 10mm	< 30mm	> 30mm	Moderate	Severe	Extensive	Type(s) 1-9	No straw	Not clean	Not functional	Diarrhoea	No access	Quality: Wet	Quality: Dirty	Quality: Damaged	Quality: Fleas	
																								0-no is not noted										
																								1 - yes					1 - yes					
		76																																76
		77																																77
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		100																																100

Animal/cage id					101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Nest box	Quality	Fleas	0-no is not noted	1 - yes																									
		Damaged																											
		Dirty																											
		Wet																											
	No access																												
Water point	Diarrhoea		0-no is not noted	1 - yes																									
	Not functional																												
	Not clean																												
Enrichments	No straw																												
	Type(s) 1-9																												
Fur chewing	Extensive																												
	Severe																												
	Moderate																												
Injuries	> 30mm																												
	< 30mm																												
	< 10mm																												
Sickness	Lameness																												
	Disease																												
BCS	Obese																												
	Heavy																												
	Ideal																												
	Thin																												
	Very thin																												
Temperament	Undecided/in nest																												
	Aggressive																												
	Fearful																												
	Exploratory																												
Stereotypy	Stereotypic behaviour																												
	Active																												
Number of females (F)																													
Number of males (M)																													
Colour type																													
Animal/cage id					101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
Cage/section number																													
Shed number/colour type																													

Farm id **Observer id** **Date** **Period 3** **Sheet 3**

Farm id	Observer id	Date	Period 3 Sheet 3

Shed number/colour type	Cage/section number	Animal/cage id	Colour type	Number of males (M)	Number of females (F)	Stereotypy		Temperament				BCS					Sickness		Injuries			Fur chewing			Enrichments		Water point			Nest box					Animal/cage id
						Active	Stereotypic behaviour	Exploratory	Fearful	Aggressive	Undecided/in nest	Very thin	Thin	Ideal	Heavy	Obese	Disease	Lameness	< 10mm	< 30mm	> 30mm	Moderate	Severe	Extensive	Type(s) 1-9	No straw	Not clean	Not functional	Diarrhoea	No access	Quality: Wet	Quality: Dirty	Quality: Damaged	Quality: Fleas	
																								0-no is not noted										
																								1 - yes					1 - yes					
		126																																126
		127																																127
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Location	Nest box							Cage									
	Size			Thermal comfort				Bottom cage size			Top cage size			Thermal comfort			
	W	L	H	Insulation 0 - well 1 - normal 2 - no	Bed. Mat. 0 - sufficient 1 - some 2 - none/little	Wind device / covered nest 0 - yes 1 - no		W	L	H	W	L	H	Protection from Wind 0 - high 1 - medium 2 - low	Protection from Sun 0 - high 1 - medium 2 - low	Means of cooling 0 - yes 1 - no	Inside comfort zone 0 - yes 1 - no
Farm																	
Shed no.																	
Section no.																	

Farm id | Resource/management | Period 3 Sheet 4

3.4.2 Examples of sheets filled-in for sampling in Period 3

Farm id: *A.A.*	**Phone number:**	**Period 3** **Sheet 1**

Farm information

Date of visit: *20/10/2012*	**First date of sorting:** *31/10/2012*	**First date of pelting:** *15-11*

* Information needed for the welfare assessment			Sampling and visit planning information			
ONLY for sheds holding animals			**Number of mink**		**Location/shed no.**	
ANIMALS	Breeders (> 1 year old)	Dams *	*2000*		*1, 3, 13-14*	
		Males *	*50*		*3*	
	Juveniles	Juveniles *	*11500*		*2, 4, 5-12*	
	Colour type by dams		Dams	Juveniles	Dams	Juveniles
	Number of dams in each colour type	1 Brown (BRWN)	*1000*	*6000*	*1, 2, 3*	*2, 4,*
		2 Mahogany (MAHG)	*300*	*1800*	*13*	*5, 6,*
		3 Standard Black (STD.)	*300*	*1500*	*13*	*7, 8*
		4 Pearl (PERL)	*0*			
		5 White (WHIT)	*0*			
		6 Cross (CROS)	*300*	*1800*	*14*	*9, 10*
		7 Silver blue (SILV)	*0*			
		8 Others (OTHR)	*100*	*400*	*14*	*11*
SHEDS	Type	Two rows	*10*			*5 - 14*
		Multi rows	*4*			*1, 2, 3, 4,*
		Means of cooling	*Water misters*			*All sheds*
CAGES	Type	Single/pairs	Type 1			
			Type 2	*30*90cm*		*1, 3, 7 - 14*
		Groups	Type 1			
			Type 2	*30*90cm + 2nd floor*		*2, 4 - 6*
	Material (wall)	Wire-mesh	*All*			
		Solid				
		Other				
NEST BOXES	Presence	No. of cages without	*None*			
	Type	Normal	*30*24cm*			
		Top nesters	*None*			
	Material	Wood	*All*			
		Synthetic				
WATERING SYSTEM	Automatic	Frost protection *	*Circulation*			
		No frost protection *		Water times a day		
	Manual	No. of cages *				
FEEDING	Time of feeding		*10 - 12 am*			
HEALTH STATUS	Aleutian disease	No			*X*	
		Reagents found during eradication programme - to be pelted				
		Chronic - not to be pelted				
	Other notifiable or contagious diseases	No				
		Yes				
	Are sick and injured animals gathered in an 'infirmary' section	No				
		Yes	*X*		Where?	*11*

Farm id		Housing and grouping information
Date of visit:	**Observer**	**Period 3 Sheet 1.2**

	HOUSING OF DAMS					
	Alone	**With 1 male juvenile**	**With 2 male juveniles**	**With more juveniles kits (Family)**	**With other adult male**	**With other dam**
Number of female dams	*1200*	*300*	*500*			
Colour type(s)	*500 BRW 1*	*300 MGH 1*	*500 BRW 2*			
Colour type(s)	*300 BLK 1*					
Colour type(s)	*300 CRS*					
Colour type(s)	*100 OTH*					
Colour type(s)						
In shed number(s)	*1, 3, 13, 14*	*13*	*2*			

	HOUSING OF JUVENILES					
	Alone	**1 male and 1 female**	**2 juveniles of the same sex**	**3 juveniles**	**4 juveniles**	**5 or more juveniles**
Number of cage		*4450*			*325*	
Colour type(s)		*2000 BRW 5*			*250 BRW 1*	
Colour type(s)		*900 CRS 2*			*75 MGH 0*	
Colour type(s)		*750 BLK 2*				
Colour type(s)		*600 MGH 1*				
Colour type(s)		*200 OTH*				
In shed number(s)		*1, 3, 7 - 14*			*2, 4 - 6*	
Preferred sex combination					*4 F*	

	FOR STRATIFICATION ON GROUPING OF MINK:				
In cage	**Mink**	**Cages**	**No. Mink**	**6 blocks**	**Sample no. of**
Alone	Dams	*1200*	*1200*	*1*	
	Adult males	*50*	*50*		
	Juveniles	*0*	*0*		
Pairs	Dam + Male	*300*	*600*	*1*	
	Female + Male	*4450*	*8900*	*10*	
	Other	*0*	*0*		
Three	Dam + 2 M	*500*	*1500*	*2*	
	3 females	*0*	*0*		
	Other	*0*	*0*		
Four	2 M + 2 F	*0*	*0*		
	4 Females	*325*	*1300*	*1*	
	Other	*0*	*0*		
Five or more					
Total		*6825*	*13550*	*15*	
		Divided by	15		
Reference number of mink per sample unit			*903*		

*Thereafter distribute the number of cage blocks on colour types, houses and so on = marked in **red***

3.4.3 Annex B: Contributors to WelFur

WelFur partners	Country
European Fur Breeders' Association, Brussels	Belgium
INRA (National Institute of Agronomic Research), UMR1213 Herbivores, Clermont-Ferrand	France
University of Eastern Finland (UEF, Department of Biology)	Finland
MTT Agrifood Research Finland (MTT, Animal Production Research)	Finland
Aarhus University (AU, Department of Animal Science)	Denmark
Norwegian University of Life Sciences (UMB, Department of Animal and Aquacultural Sciences)	Norway
Swedish University of Agricultural Sciences (SLU, Department of Animal Environment and Health)	Sweden
University of Utrecht (UU, Faculty of Veterinary Medicine, Department of Animals in Science & Society)	The Netherlands
Experts from the original Welfare Quality® project	
Swedish University of Agricultural Sciences (SLU, Department of Animal Environment and Health)	Sweden
University of Guelph (Animal and Poultry Departement of Canada Science)	Canada
University of Birmingham (School of Biosciences)	United-Kingdom

The authors of the mink protocol:
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