Welfare Quality

Assessment protocol for laying hens

Version 2.0

Welfare Quality
Science and society improving animal welfare

Acknowledgement

"The present document originates from the Welfare Quality research project which was co-financed by the European Commission, within the 6th Framework Research, contract No. FOOD-CT-2004-506508.
The text represents the authors' views and does not necessarily represent a position of the Commission who will not be liable for the use made of such information".

Disclaimer
Restrictions on use of the integrated Welfare Quality system

This document presents the practical assessment protocols required to carry out a Welfare Quality assessment. The practical application and integrity of this system depends upon the following;

- **Training and validation** in the methods and protocols is **essential** (for further information or contact see http://www.welfarequalitynetwork.net).
- Ownership or possession of these assessment documents alone does not indicate capacity to carry out assessment without adequate approved training.
- No individual or organisation can be considered capable of applying these methods in a robust, repeatable, and valid way without attending harmonised training approved by the Welfare Quality Network.
- The strength of the integrated approach lies in the use of the entire assessment method. Use of isolated elements of the Welfare Quality system will not be considered as appropriate for assessing animal welfare.
- The application of the Welfare Quality logo, and reference to the Welfare Quality assessment system in promotional or other commercial material (including training material), is dependent upon agreed conditions of use, which must be negotiated with the Welfare Quality Network as represented by the coordinator. Non-promotional and non-commercial reference to the Welfare Quality system, for example in scientific literature or documentation describing welfare assessment in general, is encouraged.
- This publication may only be copied in part or in whole with clear reference to this document: *Welfare Quality Network (2019). Welfare Quality assessment protocol for laying hens Version 2.0. Welfare Quality Network*

This document presents version 2.0 of the assessment protocol for laying hens, updating version 1 of the assessment protocol for poultry.

December, 2019

Foreword

The European Welfare Quality project developed standardized ways of assessing animal welfare and a standardized way of integrating this information to enable farms and slaughterhouses to be assigned to one of four categories (from poor through to good animal welfare).
One of the innovations of the Welfare Quality animal welfare assessment system was that it focuses more on animal-based measures (e.g. directly related to animal body condition, health aspects, injuries, behaviour, etc.). Other approaches existing at that time largely concentrated on design or management-based characteristics (e.g. size of cage or pen, flooring specifications, handling etc.). Of course, this does not mean that resource-based or management-based factors are ignored in Welfare Quality; and many of these are important features of the system. A particular attraction of using animal-based measures is that they show the 'outcome' of the interaction between the animal and its environment (housing design and management) and this combined outcome is measured by the Welfare Quality assessment system.

Within the Welfare Quality project, these assessment protocols have been developed through the collaboration of a large number of research groups and institutes. A list of the contributors to Welfare Quality can be found in Annex C.

The Welfare Quality protocols reflect the present status of scientific research, but will undergo an ongoing process of updating and revision since they are considered 'living documents'. Indeed, the current updated protocol describes Version 2.0 of the Welfare Quality assessment procedure for laying hens. It was developed and edited by Thea van Niekerk (Wageningen-UR, Livestock Research, NL) and Henk Gunnink (Wageningen-UR, Livestock Research, NL), with Per Nielsen (University of Kopenhagen, DK) and Ute Knierim (University of Kassel, D) as advisors. Editing of the English language was done by Bryan Jones (ABWC, UK).

Prof Dr Harry J. Blokhuis (Coordinator Welfare Quality Network)
Uppsala, December 2019

Please use the following citation when referring to this document:
Welfare Quality Network (2019). Welfare Quality assessment protocol for laying hens, version 2.0. Welfare Quality Network.

Table of content

Introduction

Animal welfare is an important attribute of an overall 'food quality concept' and consumers expect their animal-related products, especially food, to be produced with respect for the welfare of the animals. Recent surveys carried out by the European Commission[1] as well as studies within the Welfare Quality project[2], confirm that animal welfare is an issue of considerable significance for European consumers and that European citizens show a strong commitment to animal welfare. In order to accommodate societal concerns about the welfare quality of animal food products as well as related market demands, e.g. welfare as a constituent aspect of product quality, there is a pressing need for reliable science based systems for assessing the animals' welfare status[3].

In January 2006 the European Commission adopted a Community Action Plan on the Protection and Welfare of Animals[4]. The Action Plan outlined the Commission's planned initiatives and measures to improve the protection and welfare of animals for the period 2006-2010. The Action Plan aimed to ensure that animal welfare is addressed in the most effective manner possible, in all EU sectors and through EU relations with Third Countries. Among other things the Action Plan foresaw a classification system for animal welfare practices, to differentiate between cases where minimum standards are applied and cases where even higher standards are used. It also foresaw the establishment of standardised indicators whereby production systems which apply higher animal welfare standards than the minimum standards get due recognition. The option of an EU label for animal welfare has also been put forward, to promote products obtained in line with certain animal welfare standards.

Consumers' concern and the apparent demand for information on animal welfare was the starting point of Welfare Quality, funded from the European Commission within the 6th EU programme. The project started in 2004 and became the largest piece of integrated research work yet carried out in animal welfare in Europe. The Welfare Quality project was a partnership of 40 institutions in Europe and, since 2006, four in Latin America. The partners were based in 13 European and four Latin American countries. The Welfare Quality Network succeeded the project and is a collaborative effort of a large group of former partners of the Welfare Quality project (see http://www.welfarequalitynetwork.net/network/44203/7/0/40). The Welfare Quality Network focuses on scientific exchange and activities to contribute to the further development of the Welfare Quality animal welfare assessment systems. The Welfare Quality Network also aims to provide relevant knowledge and services to support actors in animal production chains who would like to implement or use the Welfare Quality animal welfare assessment systems.
The activities focus on the following main areas:

- •Management of the system and support instruments (including training in their use by Network partners)
- •Maintenance of the system
- •Upgrading of the system
- •Promotion of stakeholder involvement
- •Prioritizing and facilitating research

The Welfare Quality Network relies on funding from the partner institutes for its existence.

---

[1] European Commission (2005). Attitudes of consumers towards the welfare of farmed animals. Eurobarometer, Brussels. 138 pp.
European Commission (2006). Communication from the Commission to the European Parliament and the Council on a Community Action Plan on the Protection and Welfare of Animals 2006-2010, COM (2006) 13 final, Brussels.
European Commission (2007). Attitudes of EU citizens towards Animal Welfare. Eurobarometer, Brussels. 82 pp.
[2] Kjaernes, U., Roe, E. & Bock, B. (2007). Societal concerns on farm animal welfare. In: I. Veissier, B. Forkman and B. Jones (Eds), Assuring animal welfare: from societal concerns to implementation (pp. 13-18). Second Welfare Quality stakeholder conference, 3-4 May 2007, Berlin, Germany.
[3] Blokhuis, H.J., Jones, R.B., Geers, R., Miele, M. & Veissier, I. (2003). Measuring and monitoring animal welfare: transparency in the food product quality chain. Animal Welfare, 12, 445-455.
[4] European Commission. (2006). Communication from the commission to the European Parliament and the Council on a community action plan on the protection and welfare of animals 2006e2010, COM (2006) 13 final, Brussels.

The Welfare Quality project set out to develop scientifically based tools to assess animal welfare. The acquired data provide feedback to animal unit managers about the welfare status of their animals, and is translated into accessible and understandable information on the welfare status of food producing animals for consumers and others. Welfare Quality also generated knowledge on practical strategies to improve animal welfare on farm and at slaughter.

In a truly integrated effort Welfare Quality combined analyses of consumer perceptions and attitudes with existing knowledge from animal welfare science and thereby identified 12 criteria that should be adequately covered in the assessment systems. To address these areas of concern, it was decided to concentrate on so-called animal-based measures that address aspects of the actual welfare state of the animals in terms of, for instance, their behaviour, fearfulness, health or physical condition. Such animal-based measures include the effects of variations in the way the farming system is managed (role of the farmer) as well as specific system-animal interactions. Of course it is clear that resource- and management-based measures can also contribute to a welfare assessment if they are closely correlated to animal-based measures. Moreover, resource- and management-based measures can be used to identify risks to animal welfare and to identify the causes of poor welfare so that improvement strategies can be implemented.

Following a common approach across animal species an integrated, standardized and, wherever possible, animal-based methodology for assessment of animal welfare was then developed. The chosen animal species, based on their economic and numeric importance, are pigs, poultry and cattle. In addition, the focus has been on the production period of the animals´ life (i.e. farm/transport/slaughter).

The present 2.0 protocol is an update of the first protocol and describes the procedures and requirements for the assessment of welfare in laying hens. Not all presented measures have been equally well validated. Where no validation was available or could not be made, an attempt was made to select the most promising measures. The document presents the collection of data for laying hens measured on farms. As yet there is no protocol for collection of data at slaughter and no calculation of welfare scores for laying hens.

Glossary

ADT	Avoidance distance test
Cm	Centimetre(s)
(C-) m^2	Square (centi-) metre
e.g.	*exempli gratia*: for example
h	Hour(s)
i.e.	*id est*: that is
Kg	Kilogram(s)
Min	Minute(s)
NO(T)	Novel object (test)
QBA	Qualitative behaviour assessment
RS	Recording sheet
s	Second(s)

1 Scope

In this laying hen protocol the descriptions are kept as short as possible (although for training purposes more detailed descriptions of the measures are recommended). The information gathered covers the production period on farm for laying hens from the moment they are placed in the hen house until depopulation, excluding transport and slaughter. This is only a part of the full life span as indicated in figure 1.

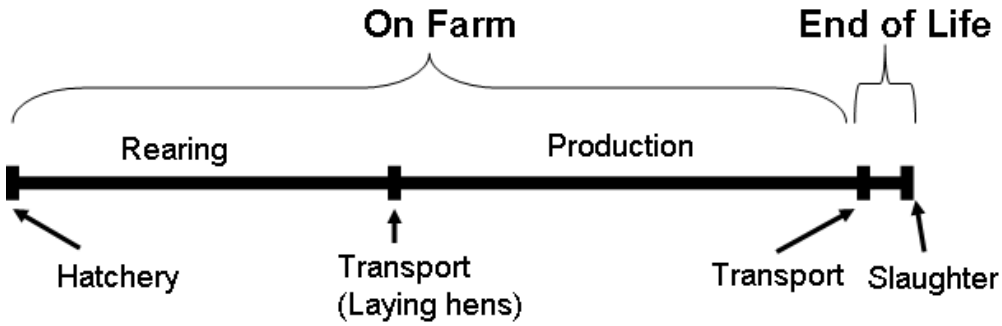


Figure 1 Schematic reproduction of the different periods in the life of production poultry.

At least four major periods can be distinguished for laying hens: the hatchery, the pullet rearing period (which runs from hatching to point of lay), the production period (egg production); and the end of life of the animal, where it will be transported and slaughtered (see Table 1).
Some specific periods are not yet included in the protocols for laying hens:

- In this protocol we do not consider the hatchery or the pullet rearing period. No data will be collected during the time the animals are transported and slaughtered. Neither do we consider parent or other poultry breeding stock;
- Transport between farms, as often occurs between rearing and production periods is not considered;

This is also shown in Table 1.

	Rearing	**Producing**	**End of life**
Laying hens			

Included in laying hen protocol Not included in laying hen protocol

Table 1 Periods in the life of laying hens which are considered in the Welfare Quality laying hen protocol.

The protocol described in this section applies only to laying hens (*Gallus gallus*). The protocol is applicable in a wide range of animal units, whether they are extensive or intensive. A separate protocol is available for broiler chickens. The protocol is not applicable to other avian species such as broiler breeders, ostriches, turkeys, geese, ducks, quail or guinea fowl.

When visiting a farm for professional assessment purposes, it may be appropriate to collect additional information. Such information may be useful for management support or advice for the farmer. This advisory support role must be separated from the inspection role because in general assessors must not involve themselves in giving prescriptive advice to clients. If additional

information is collected, this may contribute to improved efficiency in the long term, e.g. by reducing the total number of visits to particular farms. However since this document deals with the assessment system, only those issues necessary for the assessment process are included. It is proposed that any additional questions aimed at advisory support are best developed independently by the advisory or management support services in each country.

2 Legal aspects

The Welfare Quality protocols should only be applied to farming systems which operate within the applicable legal framework of the country. The Welfare Quality protocols do not replace or supersede any existing farm assurance or legal standards. They provide an additional tool for the assessment of animal welfare using predominantly animal-based measures and as such can add valuable additional information to existing inspection programs.

The individual animal unit manager has responsibility to operate within legal requirements. It is not considered feasible or desirable to list all legal statutes relevant to animal and farm operation in Europe within this document. For those reasons, a list of current normative legal texts is not provided for within the Welfare Quality protocols.

However, the current key legislative framework can be found at the webpage of EUR-lex, where the relevant treaties, legislation, case-law and legislative proposals can be consulted.[1] If the application or interpretation of any element of this standard conflicts with legislation, current acting legislation always has priority.

[1] http://eur-lex.europa.eu

3 Terms and definitions

Advisor
Person who uses the outcome of the Welfare Quality protocols and other information to advise the animal unit manager on how to improve welfare
NOTE This is distinct from the assessor

Animal unit
Section of a farm that deals with a certain type of animal

Animal unit manager
Person responsible for an animal unit

Animal-based measure
Measure that is taken directly from the animal
NOTE Animal-based measures can include, for instance, behavioural and clinical observations

Assessment protocol
An assessment protocol is a description of the procedures and requirements for the overall assessment of welfare

Assessor
Person in charge of collecting data using the Welfare Quality protocols on an animal unit in order that the welfare of animals is assessed

Flock cycle
A laying hen flock cycle starts when a young flock, about 17 weeks, is placed in the laying bird house and ends when the flock is transported to the slaughterhouse.

Laying hen *(Gallus gallus)*
Domesticated fowl of genotypes predominantly selected for laying eggs, and additionally sometimes used for meat production

Management-based measure
Measures which refer to what the animal unit manager does on the animal unit and what management processes are used
NOTE Management-based measures include, for instance, the procedures used to protect animals from disease, including for example maintaining good litter quality

Overall assessment of welfare
Synthesis of welfare information, which will then be used to allocate an animal unit to a particular welfare category
NOTE The overall assessment of welfare reflects the overall welfare state of the animals

Pullet (*Gallus gallus*)
Young laying birds before onset of egg laying

Resource-based measure
Measure that is taken regarding the environment in which the animals are kept
NOTE Resource-based measures contain for instance the number of drinkers

Welfare category
Final categorization given to an animal unit that indicates the overall welfare of animals in that particular unit
NOTE This is expressed on a 4 level scale: not classified, acceptable, enhanced, and excellent

Welfare criterion
Represents a specific area of welfare concern that has to be addressed to satisfy good animal welfare
NOTE An example of a welfare criterion is “absence of prolonged hunger”

Welfare measure
Measure taken on an animal unit that is used to assess a welfare criterion
NOTE A measure can be animal-based, resource-based or management-based

Welfare principle
Collection of criteria associated with one of the following four areas: feeding, housing, health and behaviour

Welfare Quality protocol
Description of the measures that will be used to calculate the overall assessment of welfare
NOTE The protocols also specify how the data will be collected

Welfare score
Score that indicates how well an animal unit fulfils a criterion or principle

4 Background to the Welfare Quality protocols

This chapter outlines the principles and overall structure of the Welfare Quality protocols and how they are to be used in the overall assessment of animal welfare.

4.1 Overall structure of the project

Welfare Quality has developed a system to enable overall assessment of welfare and the standardised conversion of welfare measures into summary information.

The welfare assessment related to a specific animal unit is based on the calculation of welfare scores from the information collected on that unit. An advisor can use the welfare assessment to highlight points requiring the animal unit manager's attention. The information can also be used to inform consumers and other stakeholders about the welfare status of animal products or the welfare quality of the supply chain.

The species protocols contain all the measures relevant for the species and an explanation of what data should be collected, and in what way.
The species protocols address animals at different stages of their lives and/or in various housing systems. It can cover the rearing, the production, or the end of life of the animal, which includes transport and slaughter (Figure 2). At the moment there are no measures in the Welfare Quality protocols that are carried out during the actual transport process, but the effects of transport on welfare can be determined by examining the animals on arrival at the slaughterhouse. Transport measures may be added in the future.

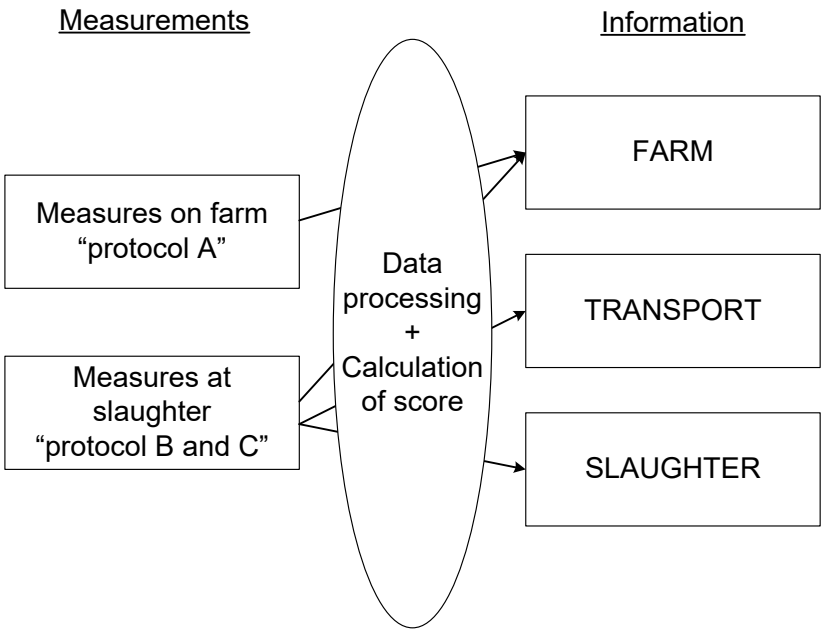


Figure 2 The different sources of information in Welfare Quality. It is outside the scope of this document, but potential use of the output generated includes information provided to consumers, advisors and retailers.

4.2 Basic principles

4.2.1 Introduction

Welfare is a multidimensional concept. It comprises both physical and mental health and includes several aspects such as physical comfort, absence of hunger and disease, possibilities to perform motivated behaviour, etc. The importance attributed to different aspects of animal welfare may vary between different people.

The different measurable aspects of welfare to be covered are translated into welfare criteria. The criteria reflect what is meaningful to animals as understood by animal welfare science. They also have to be agreed by stakeholders in order to ensure that wider ethical and societal issues have been dealt with, and furthermore to maximize the likelihood of successful translation into practice. In the case of Welfare Quality these have been systematically discussed with members of the general public and farmers, as well as with representatives of these and other stakeholder groups.

A top-down approach was used - four main welfare principles were identified and then split into twelve independent welfare criteria. Finally measures were selected to assess these welfare criteria. In general, the principles and criteria which have been chosen are relevant for different species and throughout an animal's entire lifespan. A bottom-up approach, i.e. stepwise integration of measures, leads ultimately to the overall assessment of welfare (see Figure 3).

Animals differ in their genetics, early experience and temperament and therefore may experience the same environment in different ways. Even apparently similar environments may be managed differently by the stockperson, further affecting animals' experience of a particular situation. Because welfare is a characteristic of the individual animal, Welfare Quality has based its welfare assessment essentially on animal-based measures (e.g. health and behaviour). Since resource-based measures (e.g. type of housing and stocking density) or management-based measures (e.g. breeding strategies and health plans) are a poor direct guarantee of good animal welfare in a particular situation, these measures generally receive less attention within the protocols. However, when no animal-based measure is available to check a criterion, or when such a measure is not sensitive or reliable enough, measures of the resources or the management are used to check as much as possible that a given welfare criterion is met.

There is no gold standard measure of overall animal welfare and no available information on the relative importance animals attribute to the various welfare aspects. Welfare Quality scientists are aware that the production of an overall assessment of animal welfare is by nature bound to ethical decisions, e.g. on whether we should consider the average state of animals vs. the worst ones, whether we should consider each welfare criterion separately vs. together in a more holistic approach, or whether a balance between societal aspirations for high welfare levels and the realistic achievements of such levels in practice should be achieved. Welfare Quality scientists did not decide upon these ethical issues themselves. They consulted numerous experts, including animal scientists, social scientists, and stakeholders, and the methodology for overall assessment was then adjusted according to their opinions; i.e. all of the parameters used in the scoring model were optimised so as to best match expert opinions.

4.2.2 Defining welfare principles and criteria

Each welfare principle is phrased in such a way that it communicates a key welfare question. Four main principles are identified: good feeding, good housing, good health, appropriate behaviour. They correspond to the questions:

- Are the animals properly fed and supplied with water?
- Are the animals properly housed?
- Are the animals healthy?
- Does the behaviour of the animals reflect optimized emotional states?

Each principle comprises two to four criteria. Criteria are independent of each other and form an exhaustive but minimal list. Welfare principles and criteria are summarized in Table 2.

Welfare principles	**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	Emotional state

Table 2 The principles and criteria that are the basis for the Welfare Quality assessment protocols.

More detailed definitions of welfare criteria are described below.

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 disease, i.e. animal unit managers should maintain high standards of hygiene and care.
8. Animals should not suffer pain induced by inappropriate management, handling, slaughter, or surgical procedures (e.g. castration, dehorning).
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 foraging.
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.

4.2.3 Measures developed to check criteria

Whenever possible, the final Welfare Quality assessment measures have been evaluated with respect to their validity (does the measure reflect some aspect of the actual welfare of animals), reliability (acceptable inter or intra observer repeatability and robustness to external factors e.g. time of day or weather conditions) and their feasibility. A further important aspect of this data collection is that value judgements are minimized, i.e. the assessor counts or classifies animals according to a simple series of categories illustrated by pictures or video clips. Hence measures in the protocols do not require veterinary diagnostic expertise or specialist animal behaviour knowledge to be accurately recorded. Some measures which were initially proposed did not meet these conditions and were dropped from the scheme early in the evaluation process, whereas other measures have been accepted in anticipation of further improvements and refinements. This latter concession was made because at least one measure per criterion is needed to assess overall animal welfare. For some criteria, it has been necessary to include resource- and/or

management-based measures because no animal-based measure was sufficiently sensitive or satisfactory in terms of validity, reliability, or feasibility.

NOTE It is important to remember that research is continuing to identify new and better measures and that Welfare Quality protocols will continue to be updated in the light of new knowledge.

4.2.4 Calculation of scores

Once all the measures have been performed on an animal unit, a bottom-up approach is followed to produce an overall assessment of animal welfare on that particular unit: first the data collected (i.e. values obtained for the different measures on the animal unit) are combined to calculate criterion-scores; then criterion-scores are combined to calculate principle-scores; and finally the animal unit is assigned to one welfare category according to the principle-scores it attained (Figure 3). A mathematical model has been designed to produce the overall assessment.

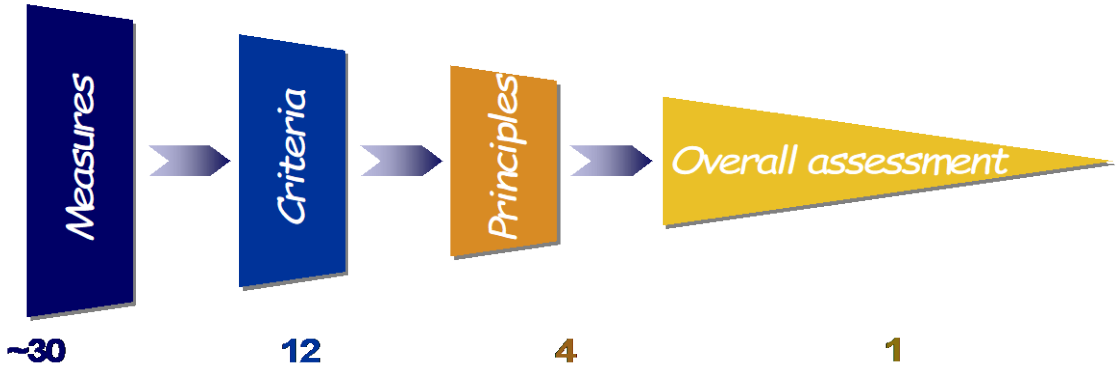


Figure 3 Bottom-up approach for integrating the data on the different measures to an overall assessment of the animal unit.

Calculation of criterion-scores

Although this is not generally the case, some measures may be related to several criteria (e.g. low body condition score can originate from hunger or disease, or both). In order to avoid double counting measures have been allocated to only one criterion, except in very few cases where we could distinguish the way they were interpreted (e.g. access of cattle to pasture is used to check the Ease of movement criterion, especially for animals which are tethered in winter, and the Expression of other behaviour).

The data produced by the measures relevant to a given criterion are interpreted and synthesized to produce a criterion-score that reflects the compliance of the animal unit to this criterion. This compliance is expressed on a '0' to '100' value scale, in which:

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

Because the total number of measures, the scale on which they are expressed, and the relative importance of measures varies between and within criteria and also between animal types, the calculation of scores varies accordingly. In the poultry protocol there are two main types of calculation:

- When all measures used to check a criterion are taken at farm level and are expressed in a limited number of categories, a score table is used.
- When a criterion is checked by only one measure taken at individual level, this scale generally represents the severity of a problem and the proportion of animals observed can be calculated (e.g. percentage animals walking normally, percentage moderately lame animals, percentage severely lame animals). In that case a weighted sum is

calculated, with weights increasing with severity. An example is provided in Explanation box 1.

Experts from animal sciences were consulted to interpret the raw data in terms of welfare. When necessary, alarm thresholds were defined by consultation with them. 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.
This exercise showed that experts do not in general follow a linear reasoning, e.g. for a given disorder a 10 % increase does not yield the same decrement in expert scores at the bottom of the [0,100] scale (where most animals get this disorder) than at the top of the scale (when most animals are normal). It is therefore necessary to resort to non-linear functions to produce criterion-scores, in this case I-spline functions. Briefly, I-spline functions allow calculation of portions of curves so as to obtain a smooth representative curve. They are expressed in the form of cubic functions (Explanation box 1).

When a criterion was composed of very different measures which experts found difficult to consider together, blocks of measures were aggregated using Choquet integrals (Explanation box 2).

Explanation box 1: Weighted sum and I-spline functions as applied to lameness in dairy cows

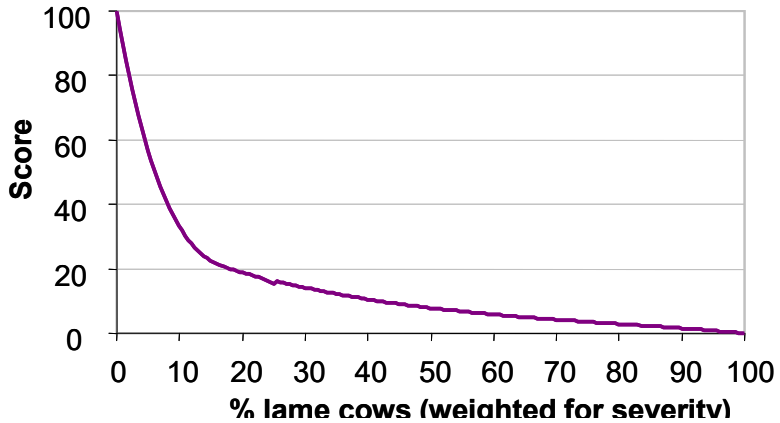
The % of animals moderately lame and the % of animals severely lame are combined in a weighted sum, with a weight of 2 for mild lameness and 7 for severe lameness. This sum is then transformed into an index that varies from 0 to 100:

Index for lameness $\mathbf{I} = \left(100 - \frac{2(\%mild) + 7(\%severe)}{7}\right)$

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

When $\mathbf{I} \leq 65$ then Score = $(0.0988 \times \mathbf{I}) - (0.000955 \times \mathbf{I}^2) - (5.34 \times 10^{-5} \times \mathbf{I}^3)$

When $\mathbf{I} \geq 65$ then Score = $29.9 - (0.944 \times \mathbf{I}) - (0.0145 \times \mathbf{I}^2) + (1.92 \times 10^{-5} \times \mathbf{I}^3)$



Calculation of principle-scores from criterion-scores

Criterion-scores are synthesized to calculate principle-scores. For instance, the scores obtained by an animal unit for absence of injuries, absence of disease, and absence of pain due to management procedures are combined to reflect compliance of this unit with the principle 'good health'. Animal and social scientists were consulted, and considered some criteria to be more important than others (e.g. in most animal types, 'Absence of disease' is considered to be more important than 'Absence of injuries' which in turn is more important than 'Absence of pain induced by management procedures'). Nevertheless, synthesis does not really allow compensation

between scores (e.g. absence of disease does not compensate for injuries and vice versa). A specific mathematical operator (Choquet integral) was used to take into account these two lines of reasoning. In short, the Choquet integral calculates the difference between the minimum score and the next minimum score and attributes a weight (called 'capacity') to that difference. This process is repeated until the highest score is reached. In the species-specific sections, only the 'capacities' are given (μ_x for the capacity of a criterion x, μ_{xy} for the capacity of a group made of 2 criteria x and y, etc.). An example of the calculation of principle-scores is provided in Explanation box 2.

Explanation box 2: Use of a Choquet integral to calculate the principle-scores for 'Good health'.

'Good health' integrates 3 criteria; 'Absence of injuries', 'Absence of disease', and 'Absence of pain induced by management procedures'. First the scores obtained by a farm for the 3 criteria are sorted in increasing order. The first criterion-score is considered, and then the difference between that score and the next criterion-score is multiplied by the 'capacity' (see explanation below) of the group made of all criteria except the one that brings the lowest score. Following this, the difference between the last but one score and the next score is multiplied by the 'capacity' of the group made by the combined criteria except those that bring the two lowest scores. This can be written as follows:

$$\text{Principle-score} = \begin{cases} S_6 + (S_7 - S_6)\mu_{78} + (S_8 - S_7)\mu_8 & \text{if } S_6 \le S_7 \le S_8 \\ S_6 + (S_8 - S_6)\mu_{78} + (S_7 - S_8)\mu_7 & \text{if } S_6 \le S_8 \le S_7 \\ S_7 + (S_6 - S_7)\mu_{68} + (S_8 - S_6)\mu_8 & \text{if } S_7 \le S_6 \le S_8 \\ S_7 + (S_8 - S_7)\mu_{68} + (S_6 - S_8)\mu_6 & \text{if } S_7 \le S_8 \le S_6 \\ S_8 + (S_6 - S_8)\mu_{67} + (S_7 - S_6)\mu_7 & \text{if } S_8 \le S_6 \le S_7 \\ S_8 + (S_7 - s_8)\mu_{67} + (S_6 - s_7)\mu_6 & \textit{if } (S_8 \le S_7 \le S_6) \end{cases}$$

Where S_6, S_7, and S_8 are the scores obtained by a given farm for Criterion 6 (Absence of injuries), 7 (Absence of disease), and 8 (Absence of pain due to procedures)

μ_6 μ_7 μ_8 are the capacities of Criterion 6, 7 and 8

μ_{67} is the capacity of the group made of criteria 6 and 7, etc.

Assignment of animal units to the welfare categories

The scores obtained by an animal unit on all of the welfare principles are used to assign that farm to a welfare category. At this stage, animal scientists, social scientists, and stakeholders, were consulted. The stakeholders were members of the Advisory committee of Welfare Quality.
Four welfare categories were distinguished to meet stakeholders' requirements:

Excellent: the welfare of the animals is of the highest level.

Enhanced: the welfare of animals is good.

Acceptable: the welfare of animals is above or meets minimal requirements.

Not classified: the welfare of animals is low 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 excellence threshold is set at 80, the one for enhanced at 55 and that for acceptability at 20. But, just as criteria do not compensate 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

excellent, enhanced etc. but also what can realistically be achieved in practice. Therefore, a farm is considered 'excellent' if it scores more than 55 on all principles and more than 80 on two of them while it is considered 'enhanced' if it scores more than 20 on all principles and more than 55 on two of them. Farms with 'acceptable' levels of animal welfare score more than 10 on all principles and more than 20 on three of them. Farms that do not reach these minimum standards are not classified (Figure 4). An indifference threshold equal to 5 is applied to cover for uncertainty. For instance, 50 is not considered significantly lower than 55.

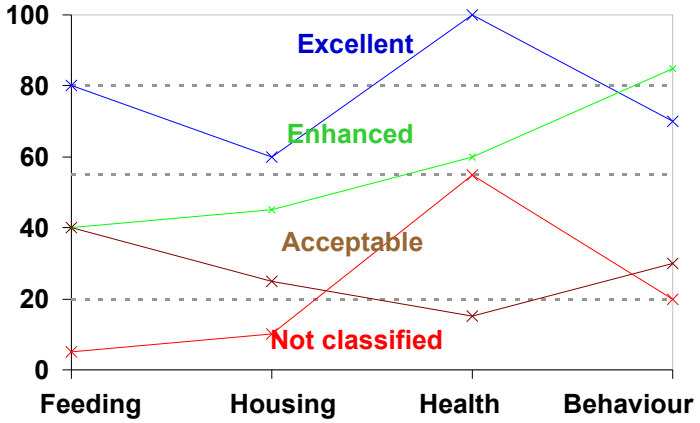


Figure 4 Examples of farms in the four welfare categories.

Software has been developed to calculate welfare scores and to produce the overall assessment of animal units. For more information, contact the Welfare Quality Network, represented by its coordinator (see www.welfarequalitynetwork.net).

Missing data

There can be various reasons why data are missing: the data are not available, the data can't be collected in a reliable way or measurements are mistakenly forgotten. The problem with missing data is, that the calculation of the scores can't be carried out. This aspect will be taken into consideration in future updates of the protocol. For the time being the best possible solution is to use a 'most probable' score:

1. an average score, preferably from that country or that type of housing/management
2. if not available, an average that the assessors feel is a best possible approach

Final comments

The following sections are specific to the animal species covered in this document. They are structured to present firstly the measures collected on farms, secondly the measures collected at slaughter that apply to welfare assessment on-farm, thirdly the calculation of scores needed for overall assessment, and finally the measures collected at slaughter that apply to assessment of the welfare of the animals during transport and slaughter.

It should be emphasised that scientific research will continue to refine measures and that the Welfare Quality protocols will be updated in the light of new knowledge. **Training and validation** in the methods and protocols **is essential** and no individual or organisation can be considered capable of applying these methods in a robust, repeatable, and valid way without attending harmonised training approved by the Welfare Quality Network.

The Welfare Quality protocol for laying hens takes about 6-7 hours to carry out, depending on the ease of catching birds. The exact time requirements per measurement is mentioned in table 10 (§ 5.1.5).

5 Welfare Quality applied to laying hens

The assessment of welfare is a multi–disciplinary process and measuring a variety of different parameters can provide a more comprehensive assessment of an animal's welfare in any given system. To this end, the Welfare Quality utilizes physiological, health and behavioural adaptations to assess the welfare of laying hens on farm.

In this chapter, a description of each measure for laying hens is given, followed by additional information about the sample size and the order in which the different measures have to be carried out.

Before commencing farm visits, assessors will have been fully trained in all the measures that are to be assessed with the aid of photographs, video clips and practical 'on farm' training (there is an agreed training procedure approved by the Welfare Quality Network and details and qualifications can be found http://www.welfarequalitynetwork.net/network/45848/7/0/40). For some of the health measures, this involves being able to recognize symptoms of certain conditions/diseases; but 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 animal unit manager on the prevalence or severity of different diseases on their farm; this is a matter for the animal unit manager and the herd veterinarian.

Trained assessors will use either animal–based, management-based or resource–based measures to achieve a representative assessment of laying hen welfare of each farm. Many different measures are assessed, and many are scored according to a three–point scale ranging from 0 – 2. The assessment scales have been selected so that a score 0 is awarded where welfare is good, a score 1 is awarded (where applicable) where there has been some compromise on welfare, and a score 2 is awarded where welfare could be jeopardized. In some cases a binary (0/2, i.e. Yes/No) or a continuous scale (e.g. cm) is used.

The assessor should prepare for and start the visit according to the description provided in Annex A ('Guidelines for visit to the animal unit'). Data can be recorded with aid of Annex B ('Recording Sheets').

5.1 Collection of data for laying hens on farm

	Welfare Criteria		Measures
Good feeding	1	Absence of prolonged hunger	Keel bone prominence
	2	Absence of prolonged thirst	Availability of water
Good housing	3	Comfort around resting	Shape and total length of available perches, evidence of red mites, dust sheet test
	4	Thermal comfort	Panting or huddling
	5	Ease of movement	Stocking density, horizontal movement, vertical movement, perforated floors
Good health	6	Absence of injuries	Keel bone damage, skin lesions, foot pad lesions, toe damage, beak damage/abnormalities
	7	Absence of disease	On farm mortality and culls, enlarged crops, eye pathologies, respiratory infections, enteritis, parasites, comb abnormalities
	8	Absence of pain induced by management procedures	Beak treatment
Appropriate behaviour	9	Expression of social behaviours	Plumage damage at the back of head, comb pecking wounds
	10	Expression of other behaviours	Plumage damage (back, tail, vent), nest space, suitability of litter, enrichment measures, free range, cover on the range, covered veranda, enrichment use, comfort behaviour and foraging
	11	Good human-animal relationship	Avoidance distance test (ADT)
	12	Emotional state	Novel object test (NOT), qualitative behaviour assessment (QBA)

5.1.1 Good feeding

5.1.1.1 Absence of prolonged hunger

Title	**Keel bone prominence**
Scope	Animal-based measure: Laying hens
Sample size	Sample size: 100 birds (see § 5.1.5)
Method description	Absence of prolonged hunger can be measured on birds by assessing their body condition. Prolonged hunger will result in emaciated birds, which can be assessed by estimating keel bone prominence. Laying hens are a lean type of bird, meaning that some keel bone prominence is normal. A bird with normal body condition will have some breast muscles present. Emaciated birds hardly have any breast muscle tissue left and have a very edged and prominent keel bone. Examine the breast of the hen by looking at it (in the case of a featherless breast) and by running fingers alongside and over the keel bone. Compare to the photographic reference and assess according to the following: **Photographic examples:** 0 = normal (smooth to moderate breath muscle contour with keel) 1 = slightly to moderate prominent keel, but does not feel sharp, flat breast muscle 2 = severely prominent keel, depressed contour to breast muscle **Scoring category:** Number of emaciated birds (score 2) out of the 100 birds scored.
Classification	**Flock level** % of emaciated birds (score 2)

Brown hens

Score: 0 1 1 2

White hens

Score: 0 1 2

© brown hens: Bristol University; white hens: van Niekerk, WUR

5.1.1.2 Absence of prolonged thirst

Title	**Availability of water**
Scope	Resource- and animal-based measure: Laying hens
Sample size	Animal unit
Method description	A purely animal-based measure is currently not available for laying hens and therefore the assessor will check the availability of clean water alongside with any indication of dehydrated birds. Examine the water lines in the house for: - Water in water reservoir - Water in the end part of the waterline Check at random several drinkers for their water supply. Choose various levels and check in the front, the back, the centre and the sides of the house. A maximum of 3 non-functional drinkers is acceptable, provided there are at least 2 functional drinkers within 50 cm of each non-functional drinker and there is no more than one non-functional drinker in a cage. Check for any indications of dehydrated birds (e.g. blue combs) **Scoring category:** **0** = access to water **2** = any indication of non-permanent availability of water
Classification	**Flock level** Worst score found in the house

Blue area may indicate dehydration

© van Niekerk, WUR

5.1.2 Good housing

5.1.2.1 Comfort around resting

Title	**Shape and total length of available perches**
Scope	Resource-based measure: Laying hens
Sample size	Animal unit
Method description	Perches are defined as such if they are raised above a surface that is usable for the birds (e.g. slatted floor, litter floor; perches may be attached directly on top of the floors). First examine the perches for shape. Record if any of the perches have sharp edges (e.g. wooden, rectangular perches are considered to have sharp edges, but not if the edges are rounded; round or mushroom-shaped perches are considered to have no sharp edges). Then examine if more than 50% of the perches are positioned in a specific resting zone. A resting zone can be created with A-frames with perches or a perch area on top of a multi-level system (the resting zone may contain water lines, but is without feeders).

	Calculate the total length of available and accessible perches in the house to be examined (both in resting zones and other zones). **A-frames with perches:** Calculate the number of perches per A-frame, multiply by length of A-frame and number of A-frames to calculate total perch length in the house. **Multi-level systems:** Measure the length of one perch per floor, multiply by number of perches present on all floors to assess total perch length**.** **Cages:** Measure the total perch length in one cage and multiply by number of cages present in the house**.** **Perch length per bird** Divide the total perch length by the total number of hens housed to calculate the perch length per bird (cm per animal). **Availability of official reports:** If official reports of local authorities are available use the figures shown in these reports, provided they are in compliance with the WQ-protocol.
Classification	**Flock level** **0** = No sharp edges on perch **2** = Presence of sharp edges on perch and **0** = More than 50% of the perch length is positioned in a resting zone **2** = From 0 to 50% of the perch length is positioned in a resting zone and Perch space per bird housed in **cm** per bird

Title	**Evidence of Red Mites**
Scope	Animal- and resource-based measure: Laying hens
Sample size	Animal unit, 100 birds (see § 5.1.5)
Method description	Examine both the equipment in the house and actual birds for red mites (*Dermanyssus gallinae*). Common mite infestation sites are under perches and in cracks and crevices. See photographic reference. Red mites can often be found by scraping in cracks and crevices with a sharp implement. Another way to find mites is to hold a piece of white paper underneath the wire floor or perch and knock the perch, any red mites will then fall onto the paper and can be seen. Severe infestations can be seen clearly as ‘clumps’ of mites bunched together. Severe infestations can also be seen as blood spotting on eggs. Check some standard places: underneath perches both in the front and the back of the house, manure belts, the inside of nestboxes and egg belts Furthermore inspect the birds for presence of red mites by checking the comb, legs and breast skin- and check dead birds if they are present (this can be combined with the individual scoring of the 100 birds). Combine all of the findings of the inspection of the birds and the house into one score.

Classification	**Flock level** **0** = No red mites detectable on birds and in the house **1** = Red mites found in the house, but not in large numbers and not clearly visible (e.g. no or few mites found on hens, and mites found in the house are hidden in cracks and crevices but not in many places and not in large quantities) **2** = Red mites found on birds or large quantities of red mites found in the house (e.g. large numbers of mites are evident)

Red mite (*Dermanyssus Gallinae*)

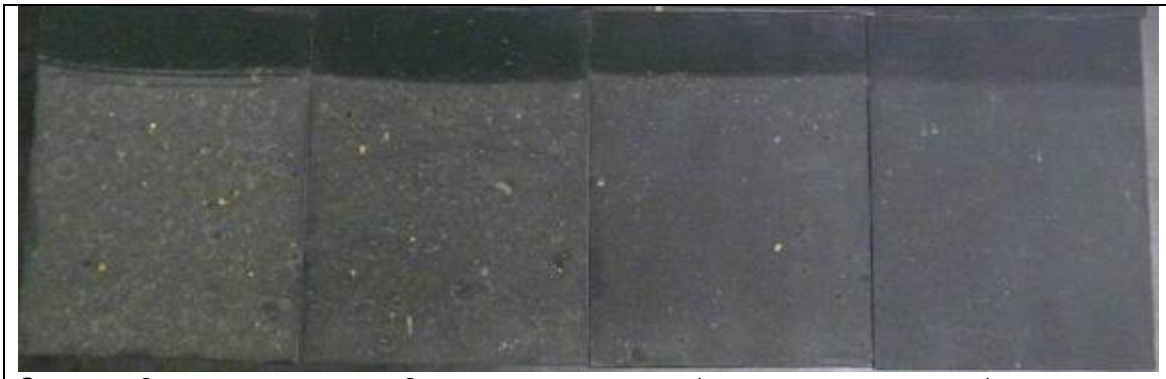
Severe infestation of red mites, clearly visible clutches of mites

© Mul, WUR

Clearly visible mites

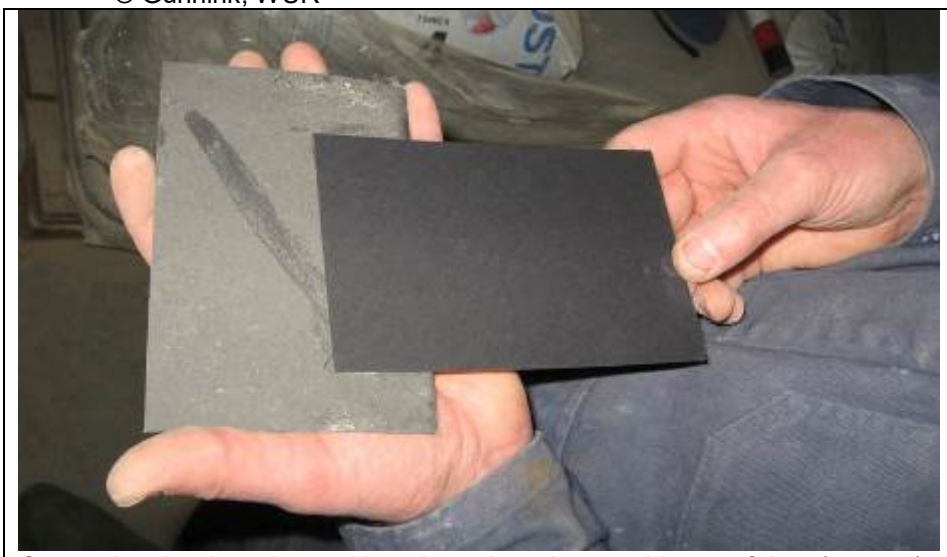
© Gunnink, WUR

Title	**Dust sheet test**
Scope	Management-based measure: Laying hens
Sample size	Animal unit
Method description	The dust sheet test is conducted using 4 black A5 or A6 size papers. Choose 4 locations in the area the birds live in, but not too close to feed hoppers or other equipment that causes dust. The paper should also be out of reach of the birds. Position the black paper when you first enter the house – and then remove it after 3 hours. Write with a finger on the paper to get an impression of the amount of dust on the paper. Compare the sheet with a clean sheet. Classify the dust level found on the paper as follows: **0 =** No or minimal evidence of dust (sheet has same colour as clean sheet) **1 =** Isolated specks or a thin layer of dust on sheet is detectable (without comparing with a clean sheet, the test sheet still appears black but there is a slight colour difference between the 2 sheets) **2 =** Dust covers the sheet, even without comparing with a clean sheet it is clear that the test sheet is no longer black. i.e. (there is a clear difference in colour between clean and test sheets)
Classification	**Flock level** Rounded average of all four sheets



Scores: 2 2 1 1

© Gunnink, WUR



Comparing the dust sheet with a clean dust sheet: evidence of dust (score 2)

© van Niekerk, WUR

5.1.2.2 Thermal comfort

Title	**Panting or huddling**
Scope	Animal-based measure: Laying hens
Sample size	Animal unit (see § 5.1.5)
Method description	Both panting and huddling can be natural responses to unfavourable temperatures – however, long, maintained or persistent panting or huddling indicates that the thermal environment is not being kept at a temperature which is comfortable for the birds in the long term. As temperature may change during the visit, it is important to make the thermal measurements both at the beginning and the end of the visit. Panting is defined as breathing rapidly and in short gasps. Not just open mouth breathing. When a bird pants it increases its respiratory rate to allow rapid exchange of air to prevent overheating. The visible signs of panting are that the birds often sit upright, open their beak and often make visible respiratory movements. When birds are cool or cold, they will often group together into tight groups, sitting closely alongside each other, often in 'clumps' with areas of empty space in between. This huddling is usually distinct from the normal 'loose grouping' that birds will show when resting. Huddling is less common than panting, as birds are usually kept adequately warm due to their stocking density and their production of metabolic heat. In free range unheated housing huddling may be more commonly seen. It is however possible for birds to get cold in cold weather or if the house temperature falls due to high ventilation rates. Only count birds that huddle due to thermal reasons (e.g. in a cold environment or an environment with cold draft). Do not count birds that pile up for unknown reasons (smothering). Estimate the percentage of animals of the total flock that perform panting or huddling behaviour, based on inspection during flock walks through the whole hen house at the start of the protocol, halfway through the measurements and at the end of the assessments, recording the percentage of animals panting or huddling after each walk.
Classification	**Flock level:** From the 3 measures, use the worst percentage of birds showing panting or huddling

5.1.2.3 Ease of movement

Title	**Stocking density**
Scope	Resource-based measure: Laying hens
Sample size	Animal unit
Method description	Examine both litter and slatted floor areas in the house, i.e. the total space in the house that is permanently accessible for the birds. This is assessed according to available reported information or it is directly calculated through observing the available litter and slatted floor areas. Slatted floors are only counted as available space if manure is prevented from falling on the lower level. Platforms are calculated as available space if they are at least 30 cm wide. Space taken by "furniture" (feeders, drinkers, perches) is not subtracted from the total available space. Nest space is not calculated as available space.

	Availability of official reports: Use the available space indicated in official reports of local authorities if they are in compliance the WQ protocol. **Litter space and systems with slatted floors:** Measure the total available litter space and total available slatted area (length x width in m^2). Only count space that is permanently available to the birds, thus free range area is not taken into account, but a covered veranda area can be included in the calculation if this area is permanently available. **Cage houses and systems with slatted floors:** It may be possible to measure a cage or section and multiply this by the number of cages / sections present.. Divide the total available space by the total number of hens housed in the house examined (cm^2 per hen).
Classification	**cm^2** / hen housed

Title	**Horizontal movement**
Scope	resource and animal-based measure: Laying hens
Sample size	Animal unit
Method description	Examine the way birds move horizontally in the available space in the system (left to right and back and forth), for instance if you walk the flock. How easily can birds escape your approach? Is the aisle wide, so they can pass you easily? Is it easy for the birds to hop on floors or walk underneath and thus escape to the sides? Can birds easily round the corners at the end of the system? Look at dead ends where birds can't escape. Determine if feeders or perches are obstacles. Although space in cages is limited, horizontal movement can be assessed within the cage. Look at the ease to pass the feed trough, especially if perches are positioned on top of it. Can birds easily move under or over the feeder to the other side? How easily can birds go to nests and litter areas? If no elements are installed in the cages, score should be 0, even in case of high stocking densities. Can birds move freely back and forth in the system? Can birds move freely from left to right in the system? 0 = no clear obstacles 1 = obstacles, but birds can negotiate them fairly easy 2 = obstacles prevent birds from moving freely
Classification	**score for the system**

Title	**Vertical movement**
Scope	resource and animal-based measure: Laying hens
Sample size	Animal unit
Method description	Examine the way birds move vertically in the available space in the system (up and down), for instance if you walk the flock. Look at the way birds are able to overcome vertical distances. Look at availability of stairs/steps, sloping ramps and other devices to facilitate vertical movement. Look at the lay-out of the system: are there stepwise positioned floors or perches to enabling birds to move vertically? Are the vertical distances birds have to negotiate reasonable? (a precise distance is difficult to provide, as the ease

	to negotiate this will depend on more factors, e.g. width of the aisle, light intensity, experience of the birds) Vertical movement is possible in cages if there are elevated elements at least 20 cm above the floor (dustbathing area, perch). If there is no such facility enable vertical movement in the cage, then vertical movement is impossible and should be scored as a 2. Can birds move freely up and down the system? 0 = birds to go up and down easily 1 = obstacles, but birds can negotiate them fairly easy 2 = birds are obstructed from going up and down
Classification	**score for the system**

Title	**Perforated floors (% of available space)**
Scope	Resource-based measure: Laying hens
Sample size	Animal unit
Method description	Examine the amount of all perforated floor area (wooden or plastic slatted area or areas of netting) in relation to total available space. Perforated floors must be so arranged as to prevent droppings falling on the levels below **Availability of official reports:** Use records of available perforated floor areas in the official reports of local authorities if they are in compliance with the WQ protocol. Calculate the percentage of perforated floor by dividing the total area of perforated floor by the total available space (slatted and litter floor).
Classification	**Percentage** of slatted floor of total available space

5.1.3 Good health

5.1.3.1 Absence of injuries

Title	**Keel bone damage**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	Keel bones are normally straight without dips, bulbs, deviation or other palpable abnormality. Abnormalities can be fresh or healed fractures or deformations. A keel bone deformation is any abnormality from the normal straight shape of the keel. The majority of keel bone deformations are caused by fractures and thus represent a major welfare issue. Healed fractures usually have thickened sections due to extra calcification, but often they also go along with deformations. Minor deviations are often not caused by breaks, but originate from decalcification and pressure of perches on the keel bone. They may represent a welfare risk, but are of a lesser order than actual broken keel bones. However, outward examination of the breast only cannot reliably differentiate between breaks and deformations. Therefore, keel bone damage in general is assessed. Examine the breast of the hen by looking at it (in case of a featherless breast) and by running your fingers alongside and over the keel bone. Make sure to check the keel ends for deviations.

	Compare to the photographic reference and assess according to the following: 0 = No deviations, deformations or thickened sections, keel bone completely straight 1 = Deviations (flattening, s-shape, bending) or thickened sections present in very slight form 2 = Deviation or deformation of keel bone (including thickened sections)
Classification	**Flock level:** **Average keel bone score** **Percentage** of birds in the flock in category 2

Examples: Score 0 Score 1 Score 2

© Center: Staack, University of Kassel, © Left and right: van Niekerk, WUR

Title	**Skin lesions**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	Skin lesions are wounds that have not yet completely healed. Little wounds in a shape of punctiform pecks (holes) or scratches are only considered as lesions when there are 3 or more pecks and/or scratches. Examine the rear (rump, tail and belly) and legs of the individual hens for presence of skin lesions. Lift the feathers to examine the skin. Note the worst score for each hen according to the following: **0** = No lesions, only single (<3) pecks (punctiform damage <0.5 cm diameter) or scratches **1** = At least one lesion ≥0.5 cm <2 cm diameter at largest extent or ≥3 pecks or scratches **2** = At least one lesion ≥2 cm diameter at largest extent
Classification	**Flock level:** **Percentage** of birds in the flock in categories 0, 1, 2

	
Score 0: 1 punctiform wound	Score 0: no wounds, only broken feather shafts
	
Score 1: more than 3 punctiform wound <0.5 cm diameter	Score 1: one lesion of 0.5 cm diameter and more punctiform damage

Title	**Foot pad lesions**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	The feet of hens should have smooth skin without any wounds or abnormalities. Wire floors can cause hard patches or other proliferations (thickening) of the epithelium. Inflammation or skin damage can cause a swelling of the foot, called bumble foot. This starts with a minor swelling but can eventually result in very swollen balloon-shaped feet. Although this inflammation can heal during the flock cycle the lesions can cause distress to the bird. The cause of bumble foot is not completely clear, but perch design, hygiene and genotype may have an influence.

	Pick up a bird from within the penned group or from the litter or slatted floor. In cage systems take birds from different areas of the house and from different tier levels: Examine both feet of the hen and choose the foot with the worst condition to score according to the following: **0** = Feet intact, no or minimal proliferation of epithelium, no wounds **1** = Necrosis or proliferation of epithelium or chronic bumble foot with no or moderate swelling, not dorsally visible **2** = Swollen (dorsally visible)
Classification	**Flock level:** **Percentage** of the flock in each scoring category 0, 1, 2

Score 1: proliferation of epithelium

Score 2: bumble foot (dorsally visible)

© Keppler, University of Kassel

Title	**Toe damage**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	Toe damage is defined as wounds on one or more toes and/or missing (parts of) one or more toes. There are various causes of toe damage, e.g. poor equipment design (trapped, injured or torn off toes) or cannibalism. The final score is based on both the inspection of 100 birds and visual observations during other work in the hen house.The number of birds with toe damage is assessed. The classification reflects the number of birds with toe damage.
Classification	**Flock level:** **0** = No damaged toes **1** = Fewer than 3 birds with damaged toes **2** = 3 or more birds with damaged toes

Title	**Beak damage and abnormalities (not caused by trimming)**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	Due to poor equipment design beaks can be trapped and damaged. Apart from that, selection during rearing may not have been strict enough, leaving birds with misshaped beaks in the flock. The final score is based on the inspection of 100 birds and the number of birds with beak damage or abnormalities assessed. The classification reflects the number of birds with beak damage or abnormalities. Do not score abnormalities due to beak treatment, as these are scored separately (par. 5.1.3.3)
Classification	**Flock level:** **0** = No evidence of beak damage or abnormalities **1** = Fewer than 3 birds with beak damage or abnormalities **2** = 3 or more birds with beak damage or abnormalities

Normal untrimmed beak

Abnormality: Broken and twisted beak

Abnormality: Broken and cloven tip of beak

Abnormality: Broken tip of beak

© van Niekerk, WUR

5.1.3.2 Absence of disease

Title	**On farm mortality and culls**
Scope	Management-based measure: Laying hens
Sample size	Animal unit
Method description	Mortality is defined as the 'uncontrolled' death of animals (as distinct from culling/euthanasia). The animals may die from, for example, septicaemia, respiratory disease, acute infection or dehydration. Any animal which is 'found dead' in the house, or out on the field is considered a mortality. Culling is defined as birds which are actively killed by the animal unit manager for disease control purposes, lameness, sickness or disease. These birds are known as 'culls'. The animal unit manager is asked about mortality management on the farm based on data collected from farm records. Use house records of animal numbers placed, died and culled. Often no separate record is kept for culled birds, meaning that the numbers of hens recorded as dead may also including culls. • Number of animals placed in house (A) • Total number of animals which were found dead (but were not actively culled) during the flock cycle (M) (at time of visit) • Total number of animals culled during the flock cycle (C) (at time of visit) If no information is specifically available on culled birds, simply use the flock records on mortality (which will then reflect both deaths and culled). If information on culls is present, add these numbers to the mortality M to provide the total number of dead birds. Calculate the total percentage mortality (including culls) using the following equation: Percentage of mortality (incl. culls) = ((M+C)/A) x 100
Classification	**Percentage** of total mortality at the time of the visit

Title	**Enlarged crops**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	An enlarged crop is a condition in which the crop becomes distended with fluid and decomposing food. This abnormal development of the crop is usually visible as a pronounced swelling on the lower neck of the bird. The final score is based on the inspection of 100 birds. Classification reflects the number of birds with enlarged crops.
Classification	**Flock level:** **0** = No evidence of enlarged crops **1** = Fewer than 3 birds with enlarged crops **2** = 3 or more birds with enlarged crops

Title	**Eye pathologies**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	This measure assesses the flock in relation to eye pathologies; these include swelling of the eyelids and the skin around the eyes, closure of the eye/eyes and discharge from the eyes. The final score is based on the inspection of 100 birds. Classification reflects the number of birds with eye pathologies.
Classification	**Flock level:** **0** = No evidence of eye pathologies **1** = Fewer than 3 birds with eye pathologies **2** = 3 or more birds with eye pathologies

Title	**Respiratory infections**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	This measure assesses the flock in relation to respiratory infections. Respiratory infections cause increased or laboured respiratory effort, sneezing, and are often associated with audible breathing sounds. The final score is based on the inspection of the 100 birds. Classification reflects the number of birds with respiratory infections.
Classification	**Flock level:** **0** = No evidence of respiratory infections **1** = Fewer than 3 birds with respiratory infections **2** = 3 or more birds with respiratory infections

Title	**Enteritis**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	This measure assesses the flock in relation to enteritis. Enteritis includes gut infections or digestive metabolism abnormalities often resulting in altered faecal state – discoloured faeces or increased liquid content or diarrhoea. Scoring is based on whether soiled feathers or skin are visible. The final score is based on the inspection of the 100 birds.
Classification	**Flock level:** **0** = No evidence of enteritis **1** = Fewer than 3 birds with enteritis **2** = 3 or more birds with enteritis

Title	**Parasites (excluding red mites and worms)**
Scope	Animal- and management-based measure: Laying hens
Sample size	100 birds and animal unit (see § 5.1.5)
Method description	Poultry species are susceptible to several parasites, including lice, mites, ticks and intestinal worms. They can be harmful as they may transmit disease and stress or weaken the birds. Parasites can live on the birds (ectoparasites) and can be seen if the feather cover is inspected and moved aside by hand. Parasites can also live inside the hen (intestinal worms) and then mostly are not visible. Therefore, only ectoparasites are taken into

	account here. Although worms can be harmful if they transmit diseases or if the parasite load is too heavy, good measurements are lacking. Also the welfare relevance of low-moderate worm load is unknown. The final score is based on both the inspection of the 100 birds and the inspection of the house. Inspect the comb and the breast and legs by pushing the feathers aside to check for lice and mites. Examine the henhouse and housing system. Red mites are particularly hiding in cracks and crevices. Also check cross-sections of metal in the system, the attachment places of perches and, if possible, underneath slats.
Classification	**Flock level:** **0** = No evidence of ectoparasites **2** = Evidence of ectoparasites

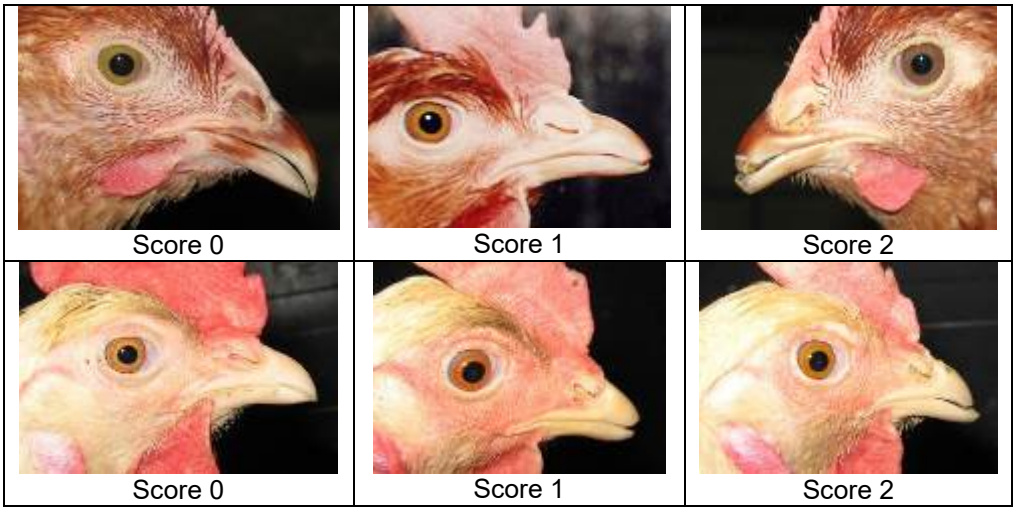
Title	**Comb abnormalities**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	A normal comb has an even red colour and no wounds or scratches. The final score is based on the inspection of the 100 birds. Apart from pecking wounds (these are scored separately) other comb abnormalities should be scored as well. Examples of comb abnormalities that are considered • blue or black spots or areas present (not reflecting dehydration) • very pale combs (hens at the peak of production may have a slightly paler comb, but are not considered abnormal) • wounds (not being punctiform pecking wounds) or missing parts
Classification	**Flock level:** **0** = No evidence of comb abnormalities **1** = Fewer than 3 birds with comb abnormalities **2** = 3 or more birds with comb abnormalities

© van Niekerk, WUR

5.1.3.3 Absence of pain induced by management procedures

Title	**Beak treatment**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	Beak trimming (with hot blade) and beak treatment (with IR) are both painful for the bird. Modern techniques use an Infrared beam to treat the beaks of day-old chicks. After 7-10 days the tip of the beak falls off or erodes away.

	Other methods are using a hot blade, trimming off part of the tip of the beak. This may lead to beak abnormalities and carries a higher risk for chronic pain, especially if the treatment is applied at a later age and/or a larger part of the beak is treated. Abnormally shaped beaks may impair birds' foraging, drinking and preening behaviour. Examine the beak on both sides. Only score effects/abnormalities that are the result of beak treatment. Other abnormalities should be scored under "Beak damage and abnormalities (not caused by trimming)" (par. 5.1.3.1). Score the beaks according to the following classification: **0** = Intact beak **1** = Moderate to light treatment with moderate to no abnormalities; lower beak should not be longer than upper beak **2** = Severe abnormalities or severe trimming, with clear abnormalities or lower beak is longer than upper beak
Classification	**Flock level:** **Percentage** of the flock in each scoring category 0, 1, 2

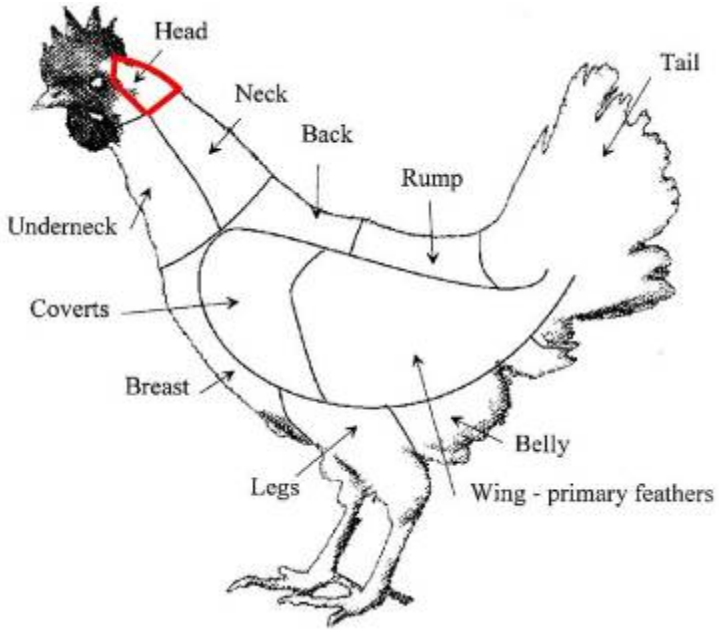


© White hens: Gunnink, WUR; © Brown hens: van Niekerk, WUR

5.1.4 Appropriate behaviour

5.1.4.1 Expression of social behaviours

Title	**Plumage damage on the back of head**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	The feathers of normal birds should be smooth with no signs of disturbance. All feather shafts then usually point in one direction resulting in a protective and insulating cover for the skin. Aggressive pecking is usually directed downwards to the head region. Plumage damage in this area is an indicator of aggressive behaviour. Birds are visually inspected individually. Score each animal according to the indicated body part marked with an orange line in the drawing.

	For each bird a score is given on a 3-point scale: **0** = no or slight wear, (nearly) complete feathering (only single feathers lacking); **1** = moderate wear, i.e. damaged feathers (worn, deformed) or one or more featherless areas < 2.5 cm in diameter at the largest extent; **2** = at least one featherless area ≥ 2.5 cm in diameter at the largest extent  © Bilcik, B. & L.J. Keeling, 1999
Classification	**Flock level:** **Percentage** of the flock in each scoring category 0, 1, 2

		
Score 0	Score 1	Score 2

© Van Niekerk, WUR

Title	**Comb pecking wounds**
Scope	Animal-based measure: Laying hens
Sample size	100 birds (see § 5.1.5)
Method description	Examine the comb on both sides and look for pecking wounds. Score using the photographic reference. Do not score healed lesions (scars). **Individual level:** **0** = No evidence of pecking wounds **1** = Less than 3 pecking wounds **2** = Starting from 3 pecking wounds and more
Classification	**Flock level:** **Percentage** of the flock in each scoring category 0, 1, 2

Score 1

Score 1

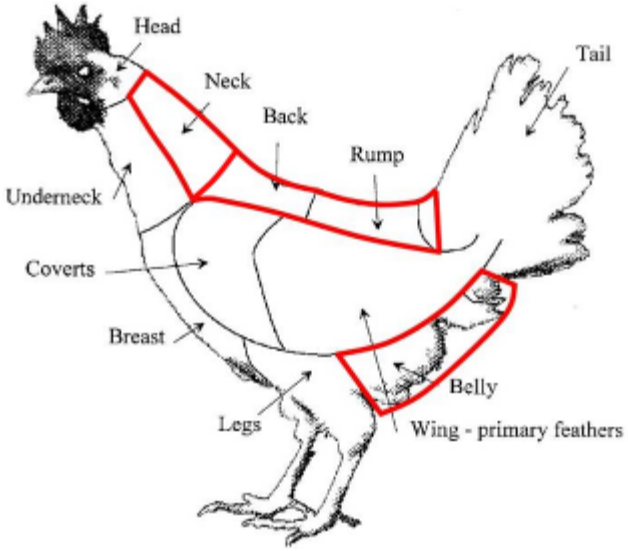
Score 2

Score 2

© Van Niekerk, WUR

5.1.4.2 Expression of other behaviours

Title	**Plumage damage**
Scope	Animal-based measure: Laying hens
Sample size	Sample size according to § 5.1.5
Method description	The feathers of normal birds should be smooth with no signs of disturbance. All feather shafts then usually point in one direction resulting in a protective

	and insulating cover to the skin. Due to abrasion against wire, feather shafts can be broken. Pecking behaviour feathers can result in disturbed, broken feathers or feather loss. Areas where feather damage usually starts are the tail, neck and cloacal region. Feather damage at the back of the head indicates aggressive behaviour and is recorded separately (see par. 5.1.4.1). Birds are visually inspected individually. Score each animal according to three individual body parts (see photographic reference). For each bird 3 scores are given (i.e. 1 for each body part): being the back and rump together, around the cloaca (belly) and the neck. The 3 body parts are chosen to provide information regarding the cause of feather damage: damage to feathers of the back and rump usually indicate feather pecking, damage to the feathers of the neck can be caused by abrasion, and feather loss to the belly can be seen in highly productive animals. However, the latter can also be caused by vent pecking. For each bird and body part a score is given on a 3-point scale: **0** = no or slight wear, (nearly) complete feathering (only single feathers lacking); **1** = moderate wear, i.e. damaged feathers (worn, deformed) or one or more featherless areas < 5 cm in diameter at the largest extent; **2** = at least one featherless area ≥ 5 cm in diameter at the largest extent  © Bilcik, B. & L.J. Keeling, 1999
Classification	**Flock level:** **Percentage** of the flock in each scoring category 0, 1, 2

Title	**Nest space**
Scope	Resource-based measure: Laying hens
Sample size	Animal unit
Method description	Estimate the nest space per bird: • For single nest boxes: count the number of nest boxes and divide the number of hens housed by the number of nest boxes. The outcome is the number of hens per nest box. • For group nest boxes: measure the nest surface and multiply this by the number of nest boxes. Then divide this total nest space by the

	number of hens housed. The outcome is the nest space per bird (in cm^2) **Availability of official reports:** Use the available figures shown in official reports of local authorities if these comply with the WQ protocol.
Classification	**Nest space per bird:** - single nest boxes: hens/nest - group nest boxes: cm^2/hen nest space

Title	**Suitability of litter**
Scope	Resource-based measure: Laying hens
Sample size	Animal unit
Method description	Dust bathing and scratching behaviours are important for laying hens. There should be enough space for the hens to perform dust bathing in groups as this is a social behaviour that birds tend to perform together. Scratching and manipulating litter can only be performed if the litter is of suitable quality. Asses the litter at 6-8 places, depending on the design of the house. Do not asses the litter within 1 meter distance from added enrichment resources such as bales of hay. For furnished cages make sure to distribute the assessments evenly over tiers, cage rows and the length of the house. Score the following issues; - litter quality (dryness and friability) - presence of original or added litter material (yes/no) Material from enrichment resources (at some distance from this enrichment) is seen as added litter, provided it is in quantities that do influence the suitability of the litter (e.g. make it more attractive, friable or dryer).
Classification	**Flock level:** **Litter quality:** 0 = dry and friable 1 = some compacted litter, less than 1/3 of surface 2 = more than 1/3 of litter compacted crust **Presence of original or added litter material:** 0 = yes 2 = no

Title	**Enrichment measures**
Scope	Resource-based measure: Laying hens
Sample size	Animal unit
Method description	Check the area inside and around the henhouse for enrichment. Enrichments may be: extra materials to manipulate (e.g. ropes hanging down to peck at, bales of roughage) or structures to make the environment less barren (e.g. dust bathing areas, pecking stones). Enrichments may also be additional natural daylight (especially if it contains UV). Enrichments containing feeding components stimulate birds to use them continually (e.g. grain dispensers, alfalfa). Enrichments in cages could be hanging ropes, bushes of ropes, or pecking stones (broken in smaller pieces).

	Record if there is any enrichment of the area. Amount of enrichments refers to how many different types of enrichments are present (10 bales of straw is 1 enrichment, 10 grain dispensers is also 1 enrichment). Litter, nestboxes, perches or claw shorteners are not considered enrichments, but basic equipment. Ramps, stairs or platforms in aviary systems are also not considered enrichments (their presence is represented in the score for vertical movement). One bale of hay for 1000 hens may be little but could be sufficient, depending on its position in the house and the type of housing system. For this reason WQ does not (yet) estimate the number of hens per enrichments. However, any enrichment that is taken into account should be accessible for all hens. If for instance one bale of hay is placed in one section of 3000 hens, but not in the other 3 sections of 3000 hens, this type of enrichment should not be counted. If in another house each section of 6000 hens does contain one bale of hay, it should be counted.
Classification	**Feeding components:** 0 = enrichments with feeding components 2 = no enrichment with feeding components **Amount of enrichments:** 0 = 3 or more types of enrichments 1 = less than 3 types of enrichments 2 = no enrichments

Title	**Free range**
Scope	Resource-based measure: Laying hens
Sample size	Animal unit
Method description	Note that this measure is applicable to free range or extensive systems only. If no free range is present, the worst score (score 2) should be given. This measure is an indicator of both the birds' ability to choose the environment in which it ranges and the suitability of the environment for birds. Check the area around the henhouse and the walls of the house. Record if there is any range area present. Check indirectly if the range is used by assessing the condition of the free range: look at hen droppings, destruction of plant cover and evidence of dust-bathing sites.
Classification	**Flock level:** **0** = obvious effect on the range (=hen droppings, destruction of plant cover found around the house and more than 7 m away from entrances to the free range, natural dust-baths are present) **1** = minor effect on the free range or limited to the vicinity of the house (=hen droppings, destruction of plant cover around the hen house up to 7 m away from entrances to the free range) **2** = No access to range or no visual effect on the range (= no hen droppings and plant cover destruction)

Title	**Cover on the range**
Scope	Resource-based measure : Laying hens
Sample size	Animal unit
Method description	Note that this measure is applicable to free range or extensive systems only. If no free range area is present this issue is not applicable. This issue must then be recorded as 0%. Cover on the range can be vegetation which the birds can use for cover (e.g. deep grass, trees, maize) or man-made shelters (e.g. tents, roofs, elevated camouflage nets, but not 'closed poultry houses'). Cover offers environmental variation to the birds and protection from aerial threats and predators which are considered to restrict the birds' use of range in some outdoor systems. Furthermore, examine the free range area and estimate the percentage of the area that is covered by trees, bushes, or artificial shelters.
Classification	**Flock level:** Estimated **percentage** of the range covered

Title	**Covered veranda**
Scope	Resource- and animal-based measure: Laying hens
Sample size	Animal unit
Method description	Check the covered veranda, if present, before starting the assessment of 100 individual birds Record if there is a covered veranda and if it is accessible for the birds. If the openings to the covered veranda are closed, check if they will be opened later. Check if the covered veranda is used by the birds by estimating the number of hens in the covered veranda. - Estimate the total available area of covered veranda - Estimate the percentage of covered veranda occupied by birds and multiply the available total area covered veranda with this percentage - Then calculate the used area covered veranda per bird
Classification	**Flock level:** Estimated cm used area covered veranda per bird present

Title	**Enrichment use, comfort behaviour and foraging**
Scope	Animal-based measure: Laying hens
Sample size	Animal unit
Method description	Checks for the occurrence (yes/no) of four types of behaviour: - Interaction with enrichment: this includes a wide range of behaviours performed using a wide range of enrichment devices. For instance (but not limited to) sitting on a straw bale, platform or perch, sitting near a bush or panel in the outdoor area, pecking at a pecking device. If birds are not actively using the enrichment, but clear evidence of its use can be observed (for instance signs of recent trampling of the vegetation or recent and excessive accumulation of faeces near or on the enrichment), score enrichment interaction as if it was observed. - Dust bathing (a sequence of behaviours in which a lying bird shows vertical wing shaking, head rubbing, bill-raking and scratching with one leg) - Preening (moving the beak over the plumage) - Foraging (pecking or scratching the litter whilst standing) Although any observation of these behaviours during the entire visit is

	included, specific attention is paid at the time that panting or huddling are assessed (i.e., 3 times during the visit). **0 =** more than 10% birds observed performing one or more of these behaviours **1 =** up to 10% of the birds observed performing one or more of these behaviours **2 =** more than 10, but less than 25 birds observed performing one or more of these behaviours **3 =** max 10 birds observed performing one or more of these behaviours **4 =** none of these behaviours observed
Classification	**Flock level:** The average of the scores (0-4 scale) of 3 scoring moments during the visit

5.1.4.3 Good human–animal relationship

Title	**Avoidance Distance Test (ADT)**
Scope	Animal-based measure: Laying hens
Sample size	21 hens (see § 5.1.5)
Method description	Choose 3 different litter areas or aisles alongside an elevated slatted floor or rows of cages and test hens based on the two different housing systems (see below). Ideally these 3 areas or aisles reflect the various areas in the house (e.g. middle aisle, outside aisle). **Non-cage systems:** Walk slowly parallel to the slatted floor through the litter area at a distance of 1.5 meter from the edge of the slatted area. The assessor holds his/her hand in a fixed position in front of the abdomen, directly above and in line with the birds feet. When a hen is sitting on the edge of the slatted area, turn 90 degrees and stand facing the hen. Then walk with a pace of one step per second towards the hen, looking at its toes. When the hen turns away or retreats (both feet step aside or away), the distance is measured from the hand of the assessor to the earlier position of the feet of the hen. If a distance of 1.5 meter cannot be achieved, e.g. due to narrow aisles), the 1.5 meter can be taken diagonally: walk the largest possible distance (e.g. alongside a slatted floor) and start walking towards a hen when the diagonal distance is 1.5 meter. **Cage systems:** The test is performed in the tier level which is visible by the assessor (which usually corresponds with tier level 2 or 3 depending on the cage design). The assessor walks down the corridor with small steps and at maximum distance from the body to the cage front. While walking, any bird with its head out (including the comb) of the front wire-mesh of the cage is selected. The assessor then stands at a diagonal distance of 1.5 meter from the hand to the front of the cage). The assessor's hand is held in front of the abdomen. The assessor then turns towards the hen and approaches it at a speed of 1 step/sec until the bird withdraws into the cage. At that point the distance from the assessor's hand to the front of the wire-mesh cage is measured. The ADT in non-cage and cage systems is somewhat incomparable. This is a known problem for which no solution is (yet) available. **In general:** Results are rounded to the nearest 5 cm. If a hen retreats due to other reasons than your approach, the test is stopped and another hen is chosen

	to perform the test. The average of all individual outcomes for the avoidance distance test is calculated.
Classification	**Flock level:** Average distance (in cm) between hand of the tester and the place where the hen's feet were before the test approach began.

5.1.4.4 Emotional state

Title	**Novel Object Test (NOT)**
Scope	Animal-based measure: Laying hens
Sample size	Sample size according to § 5.1.5
Method description	Select 4 locations in the caged henhouse to represent the distribution of the flock. In non-cage houses the locations of the novel object (NO) will be on the litter floor. The NO used in this test is a 50 cm long and 2.5 cm diameter stick with a series of coloured bands (see photographic reference). Choose 4 locations in the litter area in the house. Wait for 5 minutes after entering the house (to let the birds settle) and then place the NO in the litter and step back 1.5 m. Starting immediately, record the number of hens at a distance of less than 1 birds length of the NO (=30 cm). This measure is repeated every 10 seconds for a 2 minute period. Thus, there will be 12 counts per location. If 16 or more birds are within 30 cm of the NO, it would be difficult to count more in the 10 sec period so just note 16 birds. In cage houses the Novel Object (NO) is positioned in/on the feed trough of the cage that is at the same level as that of the assessor's chest (see picture) and the number of hens in the front half of the cage is counted. The maximum number of hens counted depends on cage size and thus the number of hens in the cage. Differences in positioning of the NO and the maximum number of recordable hens make it difficult to compare results from non-cage and cage systems. This is a known problem for which no solution is (yet) available.
Classification	**Flock level:** Average number of hens within 30 cm (=hen length) of the stick

Novel Object in litter

Novel Object position for cages

© Left photo: Graml, University of Veterinary Medicine Vienna, Austria;
© right photo: Gunnink, WUR

<table>
<tr><td>Title</td><td>Qualitative Behaviour Assessment (QBA)</td></tr>
<tr><td>Scope</td><td>Animal-based measure: Laying hens</td></tr>
<tr><td>Sample size</td><td>Animal unit (depending on number of observation points, see method description)</td></tr>
<tr><td>Method description</td><td>
Qualitative Behaviour Assessment (QBA) considers the expressive quality of how animals behave and interact with each other and the environment i.e. their ‘body language’.
Select between one and eight observation points (depending on the size and structure of the henhouse) that together represent the different areas of the poultry house. Decide the order in which to visit these observation points, wait a few minutes to allow the animals to return to undisturbed behaviour. Watch the animals that can be seen well from that point and observe the expressive quality of their activity at group level. It is likely that the animals will initially be disturbed, but their response to this can be included in the assessment. Total observation time should not exceed 20 minutes, and so the time taken at each observation point depends on the number of points selected for a farm:
<table>
<tr><td>Number of observation points</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Duration of observation per observation point in minutes</td><td>20</td><td>10</td><td>6.5</td><td>5</td><td>4</td><td>3.5</td><td>3</td><td>2.5</td></tr>
</table>
When observation at all selected points has been completed, find a quiet spot and score the 20 descriptors using the visual analogue scale (VAS). Please note that scoring is not carried out during observation, and that only one integrative assessment is made per farm.
Each VAS is defined by its left ‘minimum’ and right ‘maximum’ point. ‘Minimum’ means that at this point, the expressive quality indicated by the term is entirely absent in any of the animals you have seen. ‘Maximum’ means that at this point this expressive quality is dominant across all observed animals. Note that it is possible to give more than one term a maximum score; animals could for example be both entirely calm and content.
To score each term, draw a line across the 125 mm scale at the appropriate point. The measure for that term is the distance in millimetres from the minimum point to the point where the line crosses the scale. Do not skip any term.
Please be aware that are 10 positive and 10 negative terms. When scoring the negative terms (marked below in italics) there is an inverse relationship between score and so-called positive states, i.e. higher scores mean more negative states.

The terms used for the QBA laying hens assessment are:
<table>
<tr><td>• Active</td><td>• Confident</td><td>• Unsure</td><td>• Positively occupied</td></tr>
<tr><td>• Relaxed</td><td>• Depressed</td><td>• Energetic</td><td>• Scared</td></tr>
<tr><td>• Comfortable</td><td>• Calm</td><td>• Frustrated</td><td>• Nervous</td></tr>
<tr><td>• Fearful</td><td>• Content</td><td>• Bored</td><td>• Happy</td></tr>
<tr><td>• Agitated</td><td>• Tense</td><td>• Friendly</td><td>• Distressed</td></tr>
</table>
The QBA in cage systems is more difficult to assess than in non-cage systems. Also for unknown reasons the QBA for white genotypes is often
</td></tr>
</table>

	lower than for brown genotypes. These are known issues for which there is not (yet) a solution.
Classification	**Flock level:** **Continuous scales** for all body language parameters from minimum to maximum

5.1.5 Sampling and practical information

Table 3 Order for carrying out measures, sample size and time required for assessing laying hens on farm.

Measure	**Sample method or number of birds to sample**	**Time required (min)**
On farm mortality and culls	Farm records - Establish number of dead birds and number of birds actively culled in relation to total number placed.	10
Dust sheet test	Place dust test sheet at the start of the observation period and then assess at the end	5
Qualitative behaviour assessment (QBA)	Observations made at 2-8 points [X]	30 [X]
Novel object Test (NOT)	Object placed at 4 sites in the house, each site taking 5 min waiting + 2 min to assess +, 1 min to move to the next position(movement time) + 3 min preparation.	35
Avoidance Distance Test (ADT)	21 hens are assessed from 7 different areas, 10 seconds approaching at each site + 20 seconds recording + 30 seconds moving between sites.	30
Huddling	Flock observations, carried out while doing other work in the house, combined with some occasional observations if needed. Observation time therefore is minimal and almost as little as the time needed to fill in the forms.	5
Panting		
Enrichment use, comfort behaviour and foraging		
Horizontal movement		
Vertical movement		
Plumage damage back of head	100 birds picked - 10 birds from 10 locations	180-240 -[Y]
Plumage damage		
Keel bone deformation		
Keel bone prominence		
Comb abnormalities		
Comb pecking wounds		
Skin lesions		
Foot pad lesions		
Beak treatment		
Toe damage	Based on the same 100 birds – 10 birds from different locations	5
Beak damage/abnormalities		
Enlarged crops		
Eye pathologies		
Respiratory infections		
Enteritis		
Evidence of red mites or other parasites	Check the birds' environment. Check flock in general and more precisely check 100 birds for parasites. If possible also check dead birds.	5
Shape and total length of available perches	Establish the total perch length and divide it by the number of hens housed.	5 [-Z]
Availability of water	Inspect drinking lines, drinkers and water containers.	5 [-Z]

Perforated floor	Establish the total slatted floor area available, the type and the state of repair.	5 [-Z]
Suitability of litter	Asses the litter quality and presence of original or added litter material at 6-8 places	15
Free range	Check free range area and make calculation.	5
Cover on the range		
Enrichment measures	Check free range area, covered veranda and area inside the house	
Covered veranda		
Stocking density	Establish the total number of birds housed and divide by the available area.	15 [-Z]
Nest space	Calculate the nest space per bird.	5[Z]
	Total	**360-420 minutes** (6-7 hours) [-Y]

[X] Qualitative assessment: observation time per spot, 5 minutes in case of 4 spots and 10 minutes in case of 2 spots
[Y] Variation mainly due to variation in scoring 100 birds. Not included are the calculations afterwards that need to be carried out
[Z] Not included are the calculations afterwards that need to be carried out to get the totals

Selecting laying hens for assessment

- The same 100 selected hens can be used for the various clinical assessments; these are keel bone deformation, keel bone prominence, skin lesions, comb abnormalities, comb pecking wounds, foot pad lesions, beak trimming, plumage damage at the back of the head and plumage damage.
- Additionally, for these measures the following selection method should be used: 100 birds per flock should be selected from various points in the house. Ideally the selection should reflect the various areas in the house (perches, nest boxes, litter, perforated floor, tiers, covered veranda, free range). A selection can be made by either penning (corralling) birds or by picking up individual birds in several areas of the henhouse. The latter is preferred as it gives the least disturbance of the flock. Avoid double scoring of birds by marking them (e.g. with black marker on leg). The number of places to collect hens is dependent on the housing system and the number of compartments.
- In general, for the various observations and measurements the person carrying out the protocol can observe birds in various parts of the henhouse.
- The measures use of litter, evidence of red mites and other ectoparasites are carried out while doing other work in the house, so time indication in Table 10 reflects only the time required to write the outcomes down.
- In cage systems take the birds from different areas of the house and from different tier levels.

5.2 Calculation of scores for laying hens on farm

Not included in the protocol at the moment

5.3 Collection of data for laying hens at slaughterhouse

Not included in the protocol at the moment.

5.4 Calculation of scores for laying hens at slaughterhouse

Not included in the protocol at the moment.

Annex A: Guidelines for visit to the animal unit

Laying hens

To obtain meaningful results, flocks should be at least 50 weeks of age at the time of assessment. Moulted flocks should only be assessed at least 10 weeks after moulting.

List of equipment needed

Equipment	Remark
Clean appropriate clothing and footwear	Preferably use farm clothing and footwear, ensure your own clothing is clean and disinfected (if farm clothing and footwear is not available)
Clean scoring sheets	New set for each farm
Clip board	For scoring sheets
Pen/pencils	Pencil must continue to write in a dusty environment
Black permanent marker	To mark birds on left leg after clinical scoring; in this way no bird will be scored twice
Clinical scoring chart	This chart presents the scoring categories and is used as a check during scoring
Measuring tape (2m)	For ADT-test and for measuring farm equipment
Catching pen	Optional, to catch birds
Novel object	50 cm long and 2.5 cm diameter stick with coloured bands (see photographic reference)
Stop watch	For timing NOT
A 10 meter rule and a rigid meter or a laser rangefinder	For measuring sizes in the henhouse
5 A6 sheets of black paper or black metal plates	For measuring dust levels; 5 sheets are needed; 4 to be used in the poultry house and 1 clean sheet for subsequent comparison
Camera/smartphone	To photograph record sheets, which is a fast way of collecting the data (only with farmer permission).

<u>Communication with the farmer</u>
At the first contact with the farmer the following issues should be addressed:

- Introduction of the assessor: from what organisation, what authority
- Brief explanation of the aim of the visit and the protocol
- Estimation of time needed for the farm visit
- Ask the age of the birds and make sure they are in the desired age range
- Agreement that assessor can work in the hen house and is allowed to catch birds
- State that unnecessary disturbance will be avoided
- Agreement to bring equipment to the farm
- Reassure the farmer that the equipment will be clean and disinfected
- Discuss any specific bio security and ‘bird free days’ arrangements which the farmer may request
- Check working hours of farmer: when can the visit start?
- How much time is required from the farmer? When will he or she be available?
- Agree on a date and starting time for the visit

- Ask farmer to bring farm records and if available official reports of available space and resources in the laying hen house

Bio-security measures

When communicating with the farmer it is advisable to identify any requirements with regards to intervals between farm visits (e.g. is there a time requirement for the assessor to have avoided contact with poultry).

Make sure all equipment taken to the farm has been thoroughly cleaned and disinfected. It is advisable to transport all equipment in a closed box (to minimize any contamination of the car).

Sequence of recording

The sequence and timing of the assessment is partly dependant on when the farmer is available. Also, in layer units it is inadvisable to disturb the birds in the morning when eggs are laid. The checklist in Annex B lists the measures in the preferred order, but the assessor may carry them out in any order he finds practical depending on farm arrangements.

Annex B: Recording sheets

B3. Recording Sheets laying hens on farm

Name assessor	
Date	
Farm name	
Start time	
House number	
Number of birds on site (at the time of the visit)	
Date placed	
Age at placing	
Age at day of inspection	
Name of person interviewed	
Number of hens on site **Number of males on site**	
Genotype	
Type of house: furnished/aviary/floor system /other	
Free range: yes/no	
Veranda: yes/no	
Number of sections in the house **Sections divided by: wire/closed**	
Ventilation; mechanical/natural/other	
Other	
Is there a written report of previous credible inspection which has measured available space?	Available: No / Yes, type/authority: …….. Is it used for the WQ-assessment? Yes / No
Weather: bright sunlight/dim light/cloudy	
Outside temperature: °C/F	
Rain/snow/wind/other	

1. Mortality

From the farm records, calculate the percentage mortality (including culled birds):

Number of birds placed in the layer house (A)	Total number of birds which died and were culled during the flock cycle (B).	Percent Mortality (B/A) x 100

2. Dust sheet test in Henhouse

Place the black paper sheets above bird height near the entrance

3. Panting or huddling

Estimate the percentage of birds panting or huddling

(1st assessment: impression at start of work in henhouse, average of complete house)

Estimated % of birds panting or huddling (1st assessment) (only count birds that huddle for thermal reasons)	

4. Enrichment use, comfort behaviour and foraging

	0 = more than 10% birds observed performing one or more of these behaviours	**1 =** up to 10% of the birds observed performing one or more of these behaviours	**2 =** more than 10, but less than 25 birds observed performing one or more of these behaviours	**3 =** max 10 birds observed performing one or more of these behaviours	**4 =** none of these behaviours observed
Scoring 1					

5. Covered veranda

Percentage of covered veranda occupied by birds (1st assessment)	

6. Horizontal and vertical movement

Examine the way birds move horizontally in the available space in the system (left to right and back and forth).

Examine the way birds move vertically in the available space in the system (from litter to the various stacked floors and/or perch levels and vice-versa).

Horizontal movement		0 = no clear obstacles 1 = obstacles, but birds can negotiate them fairly easy 2 = obstacles prevent birds from moving freely	
Vertical movement		0 = birds go up and down easily 1 = obstacles, but birds can negotiate them fairly easy 2 = obstacles prevent vertical movement.	

7. Qualitative behaviour assessment (QBA)

Please observe the animals located in 2-4 places near the house entrance and in the centre of the house for 20 minutes in total. Then assess their behavioural expression ('body language') by scoring the following terms:

Active — Min. — Max.

Relaxed — Min. — Max.

Comfortable — Min. — Max.

Fearful — Min. — Max.

Agitated — Min. — Max.

Confident — Min. — Max.

Depressed — Min. — Max.

Calm — Min. — Max.

Content — Min. — Max.

Tense — Min. — Max.

Unsure — Min. — Max.

Energetic — Min. — Max.

Frustrated — Min. — Max.

Bored Min. Max.

Friendly Min. Max.

Positively Occupied Min. Max.

Scared Min. Max.

Nervous Min. Max.

Happy Min. Max.

Distressed Min. Max.

General comments and observations:

8. Novel Object test (NOT)

Wait 5 min at location before placing the novel object

Novel object test. Location a:

Time after placement (s)	10”	20''	30”	40''	50”	1’	1’10”	1’20''	1'30”	1’40''	1’50”	2’
Number of birds at a distance from the NO of less than a bird length												

Novel object test. Location b:

Time after placement (s)	10”	20''	30”	40''	50”	1’	1’10”	1’20''	1'30”	1’40''	1’50”	2’
Number of birds at a distance from the NO of less than a bird length												

Novel object test. Location c:

Time after placement (s)	10”	20''	30”	40''	50”	1’	1’10”	1’20''	1'30”	1’40''	1’50”	2’
Number of birds at a distance from the NO of less than a bird length												

Novel object test. Location d:

Time after placement (s)	10”	20''	30”	40''	50”	1’	1’10”	1’20''	1'30”	1’40''	1’50”	2’
Number of birds at a distance from the NO of less than a bird length												

Average outcome NOT = (sum of all NOT-scores) / 48	

9. Avoid distance Test (ADT)

Avoidance Distance Test. Location a:

Bird number	1	2	3	4	5	6	7
Avoidance distance (cm)							

Avoidance Distance Test. Location b:

Bird number	8	9	10	11	12	13	14
Avoidance distance (cm)							

Avoidance Distance Test. Location c:

Bird number	15	16	17	18	19	20	21
Avoidance distance (cm)							

Average outcome ADT = (sum of all ADT-scores) / 21	

10. Panting or huddling

Estimate the percentage of birds panting or huddling

(2nd assessment: before starting the clinical scoring; impression of complete house)

Estimated % of birds panting or huddling (2nd assessment) (only count birds that huddle for thermal reasons)	

11. Enrichment use, comfort behaviour and foraging

	0 = more than 10% of birds observed performing one or more of these behaviours	**1 =** up to 10% of birds observed performing one or more of these behaviours	**2 =** more than 10, but less than 25 birds observed performing one or more of these behaviours	**3 =** max 10 birds observed performing one or more of these behaviours	**4 =** none of these behaviours observed
Scoring 2					

12. Covered veranda

Percentage of covered veranda occupied by birds (2nd assessment)	

13. Clinical Scoring

	Back of head	**Plumage**	**Keel score**	**Keel bone promi-nence**	**Comb pecking wounds**	**Skin lesions**	**Foot pad lesions**	**Beak trimming**	**Remarks**
Bird number	0=good 1=no score 0 or 2; 2= ≥1 naked patch ≥2.5cm	0=good 1=no score 0 or 2; 2= ≥1 naked patch ≥5cm	0=no deviation; 1=slight deviation; 2=deformation	0=normal; 2=emacia-ted	0=none 1=<3 wounds 2=>3 wounds	0=<0.5 cm 1=<2cm or>3 wounds; 2=>2cm	0=intact 1=some problems 2=swollen dorsally visible	0=no trim, no abnor-mality; 1=light 2=severely abnormal	e.g. toe damage, beak abnormality, other clinical issue
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									

	Back of head	Plumage	Keel score	Keel bone promi-nence	Comb pecking wounds	Skin lesions	Foot pad lesions	Beak trimming	Remarks
Bird number	0=good 1=no score 0 or 2; 2= ≥1 naked patch ≥2.5cm	0=good 1=no score 0 or 2; 2= ≥1 naked patch ≥5cm	0=no deviation; 1=slight deviation; 2=deformation	0=normal; 2=emacia-ted	0=none 1=<3 wounds 2=>3 wounds	0=<0.5 cm 1=<2cm or>3 wounds; 2=>2cm	0=intact 1=some problems 2=swollen dorsally visible	0=no trim, no abnor-mality; 1=light 2=severely abnormal	e.g. toe damage, beak abnormality, other clinical issue
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									

	Back of head	Plumage	Keel score	Keel bone promi-nence	Comb pecking wounds	Skin lesions	Foot pad lesions	Beak trimming	Remarks
Bird number	0=good 1=no score 0 or 2; 2= ≥1 naked patch ≥2.5cm	0=good 1=no score 0 or 2; 2= ≥1 naked patch ≥5cm	0=no deviation; 1=slight deviation; 2=deformation	0=normal; 2=emacia-ted	0=none 1=<3 wounds 2=>3 wounds	0=<0.5 cm 1=<2cm or>3 wounds 2=>2cm	0=intact 1=some problems 2=swollen dorsally visible	0=no trim, no abnor-mality; 1=light 2=severely abnormal	e.g. toe damage, beak abnormality, other clinical issue
59									
60									
61									
62									
63									
64									
65									
66									
67									
68									
69									
70									
71									
72									
73									
74									
75									
76									
77									
78									
79									
80									
81									
82									
83									
84									
85									
86									
87									

	Back of head	**Plumage**	**Keel score**	**Keel bone promi-nence**	**Comb pecking wounds**	**Skin lesions**	**Foot pad lesions**	**Beak trimming**	**Remarks**
Bird number	0=good 1=no score 0 or 2; 2= ≥1 naked patch ≥2.5cm	0=good 1=no score 0 or 2; 2= ≥1 naked patch ≥5cm	0=no deviation; 1=slight deviation; 2=deformation	0=normal; 2=emacia-ted	0=none 1=<3 wounds 2=>3 wounds	0=<0.5 cm 1=<2cm or>3 wounds; 2=>2cm	0=intact 1=some problems 2=swollen dorsally visible	0=no trim, no abnor-mality; 1=light 2=severely abnormal	e.g. toe damage, beak abnormality, other clinical issue
88									
89									
90									
91									
92									
93									
94									
95									
96									
97									
98									
99									
100									
Mean score									

14. Other Questions/Observations

Water availability

Is there any sign of non-permanently available water supply?	0= No 2= Yes

15. Perches

Exclude (parts of) perches which the birds cannot access (including corners).

For A-frames:

Number of perches per A-frame	Number of A-frame	Length of A-frame	Total perch length	Number of birds placed	Perch length per bird (cm)

For multi-level systems:

Length of one perch	Number of perches	Total perch length	Number of birds placed	Perch length per bird (cm)

For cages:

Total perch length per cage	Number of cages	Total perch length	Number of birds placed	Perch length per bird (cm)

Shape and position of the perches:

Shape of perches	0 = No presence of sharp edges on perch 2 = Presence of sharp edges on perch	
Presence of a resting zone (with perches, but no feeders)	0 = more than 50% of the perch length is positioned in a resting zone 2 = 0-50% of the perch length is positioned in a resting zone	

16. Use of nest boxes

Single nest –calculate number of birds per nest.

Total number of nests (A)	Number of birds placed (N)	Bird: nest ratio (N / A)

Group nest – calculate available nest box area per bird.

Number of nests (A)	Nest area per nest (cm^2)	Number of birds placed (N)	Birds / cm^2 of nest area ((A x cm^2) / N)

17. Space: calculate the stocking density using data collected at the beginning of the audit

Cages

Usable area* / cage (cm^2) (A)	Number of hens / cage (N)	Stocking density: Usable area / bird (cm^2/hen) (A / N)

** = including litter area, excluding nest area*

Non-Cages

Overall litter floor area (m^2) (L)	Overall usable non-litter floor area (m^2) (W)	Total usable area (m^2) (L + W)=(U)	Number of birds placed (N)	Stocking density: Usable area / bird (cm2/hen) ((U / N)* 10,000)

18. Perforated floors

Indicate the % of total space covered with perforated floors and describe the type / style of perforated flooring material

Total % of usable area covered with perforated floor	
% of total perforated floor made of wire mesh	

19. Suitability of litter

Score the quality of the litter:

Place scored				
Litter quality: 0 = dry and friable 1=<30% of surface compacted litter 2= > 30 % of litter compacted crust				
Presence of original litter material: 0 = yes 2 = no				

Place scored				
Litter quality: 0 = dry and friable 1=<30% of surface compacted litter 2= > 30 % of litter compacted crust				
Presence of original litter material: 0 = yes 2 = no				

20. Enrichment measures

Feeding components	0 = enrichments with feeding components 2 = no feeding components	
Enrichments (e.g. hanging ropes, bales of hay, partitions, roofs in free range area)	0 = 3 or more enrichments 1 = less than 3 enrichments 2 = no enrichments	

21. Free range

Record if there is any range area present. Check indirectly if the range is used by assessing the condition of the free range and estimating the percentage of range covered:

0 = obvious evidence of range usage (=hen droppings, destruction of plant cover around the hen house and more than 7 m away from entrances to the free range, natural dust-baths present) **1** = minor evidence of free range use or only limited to the vicinity of the house (=hen droppings, destruction of plant cover found around the hen house up to 7 m away from entrances to the free range) **2** = No access to range or no visual effect of range usage (= no hen droppings and plant cover destruction)	
Estimated **percentage** of the range covered	

22. Clinical conditions

Estimate the proportion of birds with the following conditions:

	0 = no signs	1 = less than 3 birds	2 = 3 or more birds
enlarged crops			
eye pathologies			
respiratory infections			
enteritis			
toe damage			
comb abnormalities			
beak damage/abnormalities			

23. Evidence of Red mites

Estimate the infestation with red mites

0= No red mites detectable on birds or in the house 1= Red mites found on birds or in the house, but not in large quantities and not clearly visible 2= Large quantities of red mites found on birds and/or in the house	

24. Parasites (other than red mites)

Is there fly mesh on windows & doors?	0 = No 2 = Yes	
Is there any evidence of parasites? (beetles, lice, fleas, ticks)	0 = No 2 = Yes	

25. Panting or huddling
Estimate the percentage of birds panting or huddling
(3rd assessment: at the end of all measures in the house; impression of complete house)

Estimated % of birds panting or huddling (3rd assessment) (only count birds that huddle for thermal reasons)	
Worst score of the 3 assessments	

26. Enrichment use, comfort behaviour and foraging

	0 = more than 10% birds observed performing one or more of these behaviours	**1 =** up to 10% of the birds observed performing one or more of these behaviours	**2 =** more than 10, but less than 25 birds observed performing one or more of these behaviours	**3 =** max 10 birds observed performing one or more of these behaviours	**4 =** none of these behaviours observed
Scoring 3					
Average of the 3 scorings					

27. Covered veranda

Percentage of covered veranda occupied by birds (3rd assessment)	

Total available area covered veranda (m^2) (A)	Percentage of covered veranda occupied by birds:		Number of birds housed (N)	Used area covered veranda per bird (A x B) / N
	Assessment 1:	Average (B):		
	Assessment 2:			
	Assessment 3:			

28. Dust:

Inspect the black paper sheets which you placed near to the entrance door. Write something with your finger on the black paper:

Paper no.	0 = No or minimal evidence of dust (sheet has same colour as clean sheet)	1 = Isolated specks or thin layer of dust on sheet detectable; without comparing with clean sheet, the sheet still appears black (compared with clean sheet there is a slight colour difference)	2 = Dust covers the sheet, even without comparing with the clean sheet it is clear that the sheet colour is not black anymore (compared with a clean sheet there is a clear difference in colour)
1			
2			
3			
4			
Average			

B4. Recording Sheet laying hens at slaughterhouse

Not included in the protocol at the moment.

Annex C: Welfare Quality Network partners

Partner name	Country
Swedish University of Agricultural Sciences	Sweden
Cardiff University	United Kingdom
Wageningen UR Livestock Research	The Netherlands
INRA SFC	France
Institut de Recerca i Tecnologia Agroalimentàries	Spain
University of Natural Resources and Life Sciences	Austria
University of Copenhagen	Denmark
Universitat Autònoma de Barcelona	Spain
Veterinärmedizinische Universität	Austria
Vyzkumny ustav zivocisme vyroby	Czechia
Institute for Agriculture and Fisheries Research	Belgium
University of Reading	United Kingdom
University of Milan	Italy
Norwegian University of Life Sciences	Norway
Università degli Studi di Parma	Italy
SRUC	United Kingdom
Groupe ISA Lille	France
Università degli Studi di Padova-	Italy
Centro Ricerche Produzioni Animali	Italy
University of Bristol Veterinary School,	United Kingdom
University of Helsinki	Finland
Christian-Albrechts-University	Germany

Welfare Quality

ISBN number of version 1.0:
ISBN/EAN 978-90-78240-06-8
May 2019
Welfare Quality Network
www.welfarequalitynetwork.net