**Supplementary Material S1**

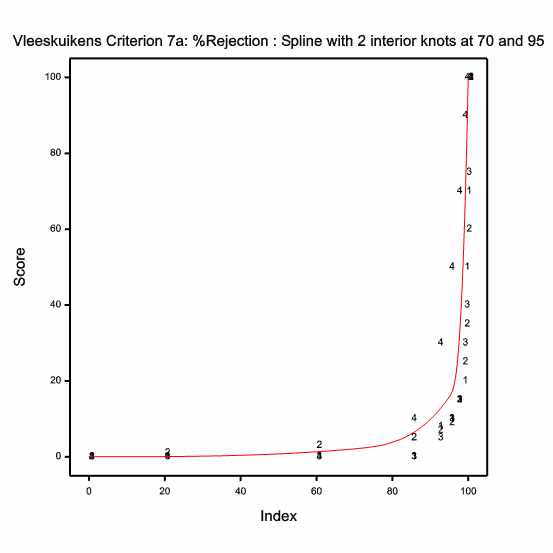
Here we present the modified calculation for criterion 7 (absence of disease) and for the measures of rejections and total mortality of a flock, to replace the calculations as presented in chapter 5.2.1.7 of Welfare Quality (2009).

An expert consultation was performed and spline functions were created for rejection figures and total mortality of a flock. Subsequently, a Choquet integral was calculated for criterion 7 according to [Botreau *et al.* (2009](#_ENREF_1)).

**Percentage total rejections**

***Table 1*** Results of expert consultation: scores of four experts for different values of imaginary % of rejections for a flock and the average score for all experts.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| % Rejections | Expert 1 score | Expert 2 score | Expert 3 score | Expert 4 score | Average  score |
| 0 | 100 | 100 | 100 | 100 | 100 |
| 0.5 | 70 | 60 | 75 | 100 | 76.25 |
| 1 | 50 | 35 | 41 | 100 | 56.25 |
| 1.5 | 20 | 25 | 30 | 90 | 41.25 |
| 3 | 15 | 15 | 15 | 70 | 28.75 |
| 5 | 10 | 9 | 10 | 50 | 19.75 |
| 8 | 8 | 7 | 5 | 30 | 12.5 |
| 15 | 0 | 5 | 0 | 10 | 3.75 |
| 40 | 0 | 3 | 0 | 0 | 0.75 |
| 80 | 0 | 1 | 0 | 0 | 0.25 |
| 100 | 0 | 0 | 0 | 0 | 0 |



**Figure 1** Spline function for criterion 7, measure % rejection, according to the expert consultation as presented in Table 1. Index = 100 - % rejections.

***Table 2*** Coefficients and values of spline function for criterion 7, measure % rejection, according to the expert consultation presented in Table 1.

|  |  |
| --- | --- |
| Coefficients | Value |
| a1 | 0.0000000000 |
| b1 | 0.0000000000 |
| c1 | 0.0000000000 |
| d1 | 0.0000061018 |
| a2 | -231.6675631157 |
| b2 | 9.9286098477 |
| c2 | -0.1418372835 |
| d2 | 0.0006815174 |
| a3 | -519197.8596370568 |
| b3 | 16398.3343341204 |
| c3 | -172.6513677013 |
| d3 | 0.6059781032 |

The index score for % rejections is transformed into a score with l-spline functions (Figure 2) as follows:

Index = I

When I≤70 then Score = 0.0000061018 x I3

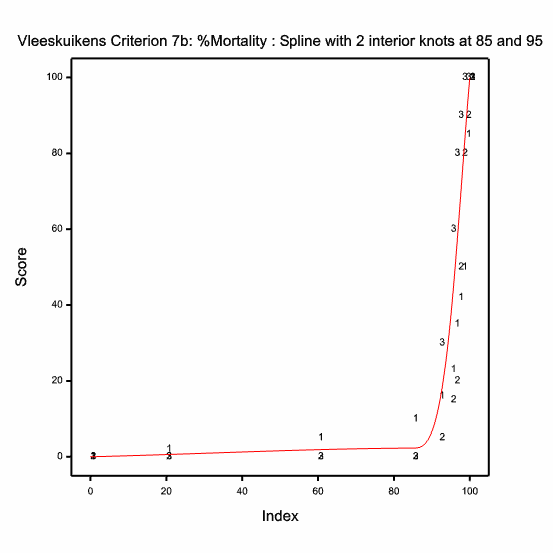
When I≥70 and I≤95 then Score = -231.668 + (9.9286 x I) – (0.14183728 x I2) + (0.0006815174 x I3)

When I≥95 then Score = -519197.86 + (16398.334 x I) – (172.651368 x I2) + (0.6059781032 x I3)

**Total flock mortality**

***Table 3***Result of expert consultation: scores of three experts for different values of imaginary % of mortality in a flock and the average expert score.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| % Mortality | Expert 1 score | Expert 2 score | Expert 3 score | Average score |
| 0 | 100 | 100 | 100 | 100 |
| 1 | 85 | 90 | 100 | 91.67 |
| 2 | 50 | 80 | 100 | 76.67 |
| 3 | 42 | 50 | 90 | 60.67 |
| 4 | 35 | 20 | 80 | 45 |
| 5 | 23 | 15 | 60 | 32.67 |
| 8 | 16 | 5 | 30 | 17 |
| 15 | 10 | 0 | 0 | 3.33 |
| 40 | 5 | 0 | 0 | 1.67 |
| 80 | 2 | 0 | 0 | 0.67 |
| 100 | 0 | 0 | 0 | 0 |



**Figure 2** Spline function for criterion 7, measure % mortality, according to the expert consultation as presented in Table 3. Index = 100 - % mortality.

***Table 4*** Coefficients and values of spline function for criterion 7, measure % rejection, according to the expert consultation presented in Table 3.

|  |  |
| --- | --- |
| Coefficients | Value |
| a1 | 0.0000000000 |
| b1 | 0.0241473135 |
| c1 | 0.0003195893 |
| d1 | -0.0000033715 |
| a2 | -21268.8183841396 |
| b2 | 750.6883257716 |
| c2 | -8.8310236888 |
| d2 | 0.0346293473 |
| a3 | 109906.7696641756 |
| b3 | -3391.6987003969 |
| c3 | 34.7730506336 |
| d3 | -0.1183674060 |

The index is transformed into a score with l-spline functions (Figure 2) as follows:

Index = I

When I≤85 then Score = (0.024147 x I) + (0.0003195893 x I2) - (0.0000033715 x I3)

When I≥85 and I≤95 then Score = -21268.82 + (750.6883 x I) – (8.83102368 x I2) + (0.0346293473 x I3)

When I≥95 then Score = 109906.77 - (3391.6987 x I) + (34.77305 x I2) - (0.1183674060 x I3)

**Criterion 7 score**

The modified calculation for the score of criterion 7 (absence of disease) as presented below replaces the score as presented in Welfare Quality (2009), chapter 5.2.1.7.

The two partial scores for rejections and total mortality are combined using a Choquet integral with the following parameters:

Rejections: µa = 0.12

Mortality: µb = 0.71

*Sum of capacities = 0.83*

**References**

Botreau R, Buist W, Butterworth A, Perny P and Veissier I 2009. Reports on the construction of welfare criteria for different livestock species. Part 3 – Subcriteria construction for Broilers on farm. Deliverable 2.8c, subtask 2.3.1.2, Welfare Quality® (EU Food-CT-2004-506508), Lelystad, The Netherlands.

Welfare Quality 2009. The Welfare Quality® assessment protocol for poultry (broilers, laying hens). The Welfare Quality® Consortium, Lelystad, The Netherlands.