Sensitivity study for the extrinsic incubation period and C. obsoletus models

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Sensitivity study for the extrinsic incubation period

In this study the extrinsic incubation period is expressed by its reciprocal, the virus reproduction rate $\gamma_M(T)$. Available functional relationships are depicted in Figure S1. The sensitivity of the basic reproduction number $R_0$ concerning the application of different temperature dependent functions $\gamma_M(T)$ is depicted in Figure S2. The sensitivity of the Bluetongue risk assessment regarding alternative extrinsic incubation periods is low.

**Figure S1:** Temperature dependent virus reproduction rates $\gamma_M(T)$. In red after [1], in black after [2], in blue after [3], and in green after [4].

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Sensitivity study for *C. obsoletus* models

Alternatively, two linear regression models were applied to simulate *C. obsoletus* densities in unsampled regions. The first, a Poisson regression model, gives an accurate estimate of the mean but underestimates the variance. The second, a Negative Binomial regression model, avoids overdispersion but overestimates the mean (Table S1). In this study we prefer the first one. A comparison of Figures 5 and S3 demonstrates the minor impact, i.e. the low sensitivity, of the *C. obsoletus* model on the Bluetongue risk assessment. The verification of the Poisson model results in a sensitivity of 0.81 and a specificity of 0.53. Applying the Negative Binomial model leads to a slightly higher sensitivity of 0.89, but a lower specificity of 0.43.

The formula for the Negative Binomial model reads as follows

\[ \log_e(n_i + 1) = -1.4991 + 0.0986 T_{i,i} + 0.1296 T_{i-37,i} + 1.1658 T_{i-100,i-16} , \]  

(1)

with the daily temperature \( T \), the mean temperature \( T \), and the mean logarithmic precipitation \( T \) (all coefficients significant with \( p < 0.001 \)).
<table>
<thead>
<tr>
<th></th>
<th>mean</th>
<th>variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>observed midges</td>
<td>14.92</td>
<td>959.91</td>
</tr>
<tr>
<td>simulated midges - Poisson regression</td>
<td>14.92</td>
<td>438.88</td>
</tr>
<tr>
<td>simulated midges - Negative Binominal regression</td>
<td>19.38</td>
<td>830.17</td>
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</tbody>
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**Table S1:** Mean and variance estimated by the Poisson and the Negative Binominal regression model.

**References**


