DISTURBANCE OF MEADOW BIRDS BY RAILWAY NOISE IN THE NETHERLANDS

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Introduction The construction of new railroads and increased usage of existing railroads may lead to disturbance of local animal populations. A comparison between noise level and density of territories is presented. It is shown that densities of meadow birds close to railroads are reduced in comparison to undisturbed areas. A method for application of results is included.

Methods Study areas were selected with a density of at least 16 pairs black-tailed godwit (see figure) per km^2. This is a common meadow bird in the Netherlands, although its numbers are decreasing. The selected areas did not possess disturbing factors apart from a railroad. 15 study areas were selected, 111 ha on average, from which seven were situated in the north and eight in the west of the Netherlands. Within these areas the presence of meadow birds was estimated based on seven visits to the areas. The following species were included in this study: black-tailed godwit *Limosa limosa*, lapwing *Vanellus vanellus*, oystercatcher *Haematopus ostralegus*, redshank *Tringa totanus*, common snipe *Gallinago gallinago*, curlew *Numenius arquata*, northern shoveler *Anas clypeata*, garganey *Anas querquedula*, yellow wagtail *Motacilla flava*, meadow pipit *Anthus pratensis* and skylark *Alauda arvensis*.

The selected areas were divided into zones parallel to the railroad. Within these zones, the average noise immission was calculated using the standard Dutch noise calculation scheme. Calculation height was 1 m above ground level. The noise level used was the equivalent noise level throughout a full day-night period, the $L_{Aeq,24h}$. The noise levels were calculated with a standardized method [1] based on standardized weather patterns. These calculations take into account the use of the railway, in terms of the number, length and types of trains, as well as the type of track. For the analysis of bird density versus noise level a complementary log-log model was used [2].

Results Bird densities in the study areas did not show any regional trend: high densities occurred both along the more quiet railroads in the north and along the busier railroads in the west of the country. Noise immission, however had a significantly negative effect on the density of garganey, black-tailed godwit and skylark, as well as on all meadow birds together and all waders together. In the other species a negative trend was present, which showed most clearly in shoveler, oystercatcher and lapwing. However, the samples of these birds were very small. The threshold noise level from which densities were affected varied little between species: black-tailed godwit 45 dB(A), skylark 42 dB(A) and garganey 49 dB(A). The uncertainty of these threshold levels are large, for black-tailed godwit 30-57 dB(A). In figure 1 the relation between relative density and immission levels is shown for the black-tailed godwit, skylark and all meadowbirds combined, as well as the confidence intervals.

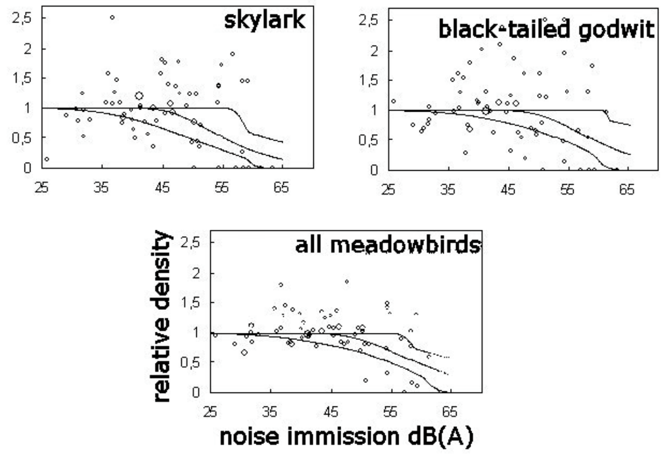

Figure 1 Relative density of birds in relation to noise load for two species and all meadowbirds together. Relations are based on regression. The symbol size reflects their importance in regression The middle line indicates the regression; the outer lines 90% confidence limits

Discussion For calculating the noise load the $L_{Aeq,24h}$ was used. The density of birds was correlated with several other noise measures, such as the peak noise level, and the time the train passage noise is audible, but the correlation did not improve. We feel the use of the $L_{Aeq,24h}$ gives a good approximation for bird disturbance. However, the mechanism through which birds might be disturbed by passing trains is not known. It could be a combination of sound, vision and other factors such as the presence of a small dike on which the track is laid. Very few studies have looked into behavioural or physical responses to different causes of disturbance. The equivalent noise level is seen as a representative dose for all combined disturbance effects of a railway line, which especially takes into account the intensity of use of the railroad.

Application The relation found will be applied in noise effect studies for new railway lines in the Netherlands. The calculation scheme is as follows:

1. Calculate the $L_{Aeq,24h}$ contours 1 m above ground level in steps of 1 or 2 dB(A).
2. Import these noise contours into a GIS system, with a map of the area of interest.
3. Calculate the surface area between any pair of noise contours.
4. Determine the percentage of birds which will disappear between each pair of contours using the noise data [3] belonging to the middle line of figure 1.
5. Calculate the effective loss of area for the birds (percentage times surface area). If information about the actual territoria is available, the expected loss of territoria can be calculated.
6. Repeat this for each pair of contours.
7. Sum the total effective area loss.

The result of this calculation may be used for nature compensation elsewhere. Example calculations on a typically quiet and a busy Dutch railroad have been performed. The areal loss for the black-tailed godwit lies between 16 and 23% of the total area within the 45 dB(A) noise contour. For the busy railroad the 45 dB(A) contour is farther away, but in addition the noise disturbance within the area is higher. Noisy railroads thus have a much larger impact than quiet railroads.

Keywords: meadow birds, railroad, noise, disturbance

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References

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