



General Enquiries on the form should be made to:
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Evidence Project Final Report

- Note**

In line with the Freedom of Information Act 2000, Defra aims to place the results of its completed research projects in the public domain wherever possible.

The Evidence Project Final Report is designed to capture the information on the results and outputs of Defra-funded research in a format that is easily publishable through the Defra website. An Evidence Project Final Report must be completed for all projects.

- This form is in Word format and the boxes may be expanded, as appropriate.

- ACCESS TO INFORMATION**

The information collected on this form will be stored electronically and may be sent to any part of Defra, or to individual researchers or organisations outside Defra for the purposes of reviewing the project. Defra may also disclose the information to any outside organisation acting as an agent authorised by Defra to process final research reports on its behalf. Defra intends to publish this form on its website, unless there are strong reasons not to, which fully comply with exemptions under the Environmental Information Regulations or the Freedom of Information Act 2000.

Defra may be required to release information, including personal data and commercial information, on request under the Environmental Information Regulations or the Freedom of Information Act 2000. However, Defra will not permit any unwarranted breach of confidentiality or act in contravention of its obligations under the Data Protection Act 1998. Defra or its appointed agents may use the name, address or other details on your form to contact you in connection with occasional customer research aimed at improving the processes through which Defra works with its contractors.

Project identification

- Defra Project code
- Project title
- Contractor organisation(s)
- Total Defra project costs (agreed fixed price)
- Project: start date
end date

6. It is Defra's intention to publish this form.

Please confirm your agreement to do so.....YES NO

(a) When preparing Evidence Project Final Reports contractors should bear in mind that Defra intends that they be made public. They should be written in a clear and concise manner and represent a full account of the research project which someone not closely associated with the project can follow.

Defra recognises that in a small minority of cases there may be information, such as intellectual property or commercially confidential data, used in or generated by the research project, which should not be disclosed. In these cases, such information should be detailed in a separate annex (not to be published) so that the Evidence Project Final Report can be placed in the public domain. Where it is impossible to complete the Final Report without including references to any sensitive or confidential data, the information should be included and section (b) completed. NB: only in exceptional circumstances will Defra expect contractors to give a "No" answer.

In all cases, reasons for withholding information must be fully in line with exemptions under the Environmental Information Regulations or the Freedom of Information Act 2000.

(b) If you have answered NO, please explain why the Final report should not be released into public domain

N/A

Executive Summary

7. The executive summary must not exceed 2 sides in total of A4 and should be understandable to the intelligent non-scientist. It should cover the main objectives, methods and findings of the research, together with any other significant events and options for new work.

Anthropogenic (man-made) noise increased across the globe in the 20th Century and is now recognised as a major environmental change in the 21st Century. As part of the EC Environmental Noise Directive, the UK has strived to reduce the impact of anthropogenic noise on humans. Policy has also extended to include impacts of noise on the marine environment. Defra commissioned this review to collate the literature on the impacts of anthropogenic noise on non-marine UK species, with a particular focus on UK Priority Species (UK PS) and Species of Principal Importance (SPI) for England, Northern Ireland, Scotland and Wales. The project had four key objectives:

Objective 1: Identify and review relevant literature. Collate information on the main sources of anthropogenic noise, the known impacts of such noise on UK species in general and UK PS and SPI in particular, the hearing abilities of UK PS and SPI, and the known impacts of noise (not specifically anthropogenic) on species that are similar phylogenetically and ecologically to UK PS and SPI.

Objective 2: Make an informed assessment of the strength of evidence. Consider the literature obtained from Objective 1 and independently assess the strength of conclusions that can be drawn about the potential impacts of anthropogenic noise.

Objective 3: Use indirect information to assess the likely impact of anthropogenic noise on priority species. Enhance the limited evidence base available from studies directly assessing the impact of anthropogenic noise on UK PS and SPI by: combining information about the hearing capabilities of UK PS and SPI with knowledge about major sources of ecologically relevant anthropogenic noise; drawing conclusions from studies examining the impact of non-anthropogenic noise; and extrapolating from research investigating the impact of anthropogenic noise on species that are phylogenetically and ecologically similar to UK PS and SPI.

Objective 4: Identify patterns and gaps in the findings. Tabulate key information, identify patterns and discuss knowledge gaps relating to the potential impact of anthropogenic noise.

Comprehensive searches were made of the peer-reviewed literature and supplemented by web searches of publication lists from 25 UK wildlife organisations. Peer-reviewed papers and unpublished reports directly addressing the potential impacts of anthropogenic noise on UK PS and SPI were assessed for their strength of evidence and assigned one of three categories. Since impacts on

individual fitness are of most relevance and importance for population viability, studies were also assigned to one of three categories depending on what conclusions could potentially be drawn in this regard. Available audiograms of UK PS and SPI were compared with noise spectra for each ecologically relevant noise source, with overlaps in auditory frequency responses of the species and dominant frequency of the noise source indicating potential vulnerability. Potential impacts of anthropogenic noise on UK PS and SPI were extrapolated from known responses of these species to non-anthropogenic noise sources and from the effect of anthropogenic noise on phylogenetically and ecologically similar species from the UK and around the world.

In total, 86 publications directly addressing the impact of anthropogenic noise on non-marine species were identified, of which 16 focused on UK PS and SPI. Overall patterns were generally similar whether considering studies on species throughout the world, on all UK species or on UK PS and SPI only: the literature is currently dominated by studies on road traffic noise, on birds and on behavioural impacts. Inclusion of extrapolatory evidence from the combination of audiograms and noise spectra, from non-anthropogenic noise data and from studies on phylogenetically and ecologically similar species allowed consideration of the potential impact of noise for a total of 79 UK PS and SPI.

The major finding is that a strong evidence base does not exist regarding the potential impact of anthropogenic noise on non-marine UK PS and SPI. Definite conclusions could be made only about the reed bunting (*Emberiza schoeniclus*), which exhibits shifts in song frequency in response to road traffic noise. It is also likely that foraging in brown long-eared bats (*Plecotus auritus*), singing in European robins (*Erithacus rubecula*), house sparrows (*Passer domesticus*), starlings (*Sturnus vulgaris*) and bullfinches (*Pyrrhula pyrrhula*), and the behaviour of common toads (*Bufo bufo*) are affected by road traffic noise to some degree. Common issues preventing strong conclusions for other species include a lack of sufficient controls to rule out potential confounding factors (e.g. changes in the behaviour of animals near roads may be the consequence of differences in lighting, disturbance or habitat differences, rather than noise) and the use of acoustic measurements that are more relevant to humans than the auditory capabilities of the study species. In addition, hardly any studies directly considered how anthropogenic noise might impact individual fitness; while several more studies provided good proxies for fitness, definite conclusions in this regard would also be premature.

To make a fair assessment of how much anthropogenic noise affects non-marine wildlife in general, and UK PS and SPI in particular, will therefore require further empirical work. Such work should ideally address the current taxonomic bias towards studies on birds, include carefully designed experimental studies (while bearing in mind that such research on species of conservation priority raises some ethical issues), quantify the noise sources of relevance in a way that relates to the hearing capabilities of the study organism, look beyond short-term studies to consider chronic and repeated exposure, focus on response indicators that can inform models of population viability, and investigate impacts at community and ecosystem levels as well as how individuals are affected.

Project Report to Defra

8. As a guide this report should be no longer than 20 sides of A4. This report is to provide Defra with details of the outputs of the research project for internal purposes; to meet the terms of the contract; and to allow Defra to publish details of the outputs to meet Environmental Information Regulation or Freedom of Information obligations. This short report to Defra does not preclude contractors from also seeking to publish a full, formal scientific report/paper in an appropriate scientific or other journal/publication. Indeed, Defra actively encourages such publications as part of the contract terms. The report to Defra should include:
- the objectives as set out in the contract;
 - the extent to which the objectives set out in the contract have been met;
 - details of methods used and the results obtained, including statistical analysis (if appropriate);
 - a discussion of the results and their reliability;
 - the main implications of the findings;
 - possible future work; and
 - any action resulting from the research (e.g. IP, Knowledge Exchange).

See associated documents (one for main report and one for appendices).

References to published material

9. This section should be used to record links (hypertext links where possible) or references to other published material generated by, or relating to this project.

See associated document containing main report.