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The effects of anthropogenic noise on animals: a meta-analysis

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Abstract

Anthropogenic noise has become a major global pollutant and studies have shown that noise can affect animals. However, such single studies cannot provide holistic quantitative assessments on the potential effects of noise across species. Using a multi-level phylogenetically controlled meta-analysis, we provide the first holistic quantitative analysis on the effects of anthropogenic noise. We found that noise affects many species of amphibians, arthropods, birds, fish mammals, molluscs and reptilians. Interestingly, phylogeny contributes only little to the variation in response to noise. Thus, the effects of anthropogenic noise can be explained by the majority of species responding to noise rather than a few species being particularly sensitive to noise. Consequently, anthropogenic noise must be considered as a serious form of environmental change and pollution as it affects both aquatic and terrestrial species. Our analyses provide the quantitative evidence necessary for legislative bodies to regulate this environmental stressor more effectively.

It is important to note that our analysis quantifies whether there is an effect of noise, but it does not imply that all changes caused by anthropogenic noise have to be biologically negative *per se*. Whether an effect may be negative or positive in a biological sense may depend on the species or a given context, and such complexities cannot be unravelled in such a large scale analysis. For example, anthropogenic noise decreases the hunting efficiency of bats [20]. Thus, increasing noise levels affect the predator negatively, which in turn may be associated with a reduced predation pressure on potential prey, i.e. potential prey may benefit indirectly from anthropogenic noise. Therefore, to quantify the direction of effects more data from standardized noise exposure experiments measuring the same response variables are needed. This will allow a more fine-scaled analysis of the potential effects of noise between species.