



Ultrasonic device effectiveness in keeping rodents off the road

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Abstract

Finding achievable ways to reduce roads' impacts on wildlife is a conservation priority. Road verges may be important refuges for small fauna, making them good hunting sites for predators. These make both prey and predators vulnerable to vehicle collisions. Thus, actions aiming to dissuade these animals from approaching roads are needed. Here we tested the effectiveness of ultrasonic devices to keep rodents away from the road verges. We hypothesised that exposing rodents to ultrasounds will cause them to stay away from the device and, consequently, from the road. We sampled rodents before and after the devices were switched on. Our results showed a reduction in animal activity after 10 days with the devices on. The next step is to analyse if this behaviour translates in a reduction of wildlife-vehicle collisions of rodents and their predators.

Keywords Wildlife-vehicle collision · Ultrasounds · Mice · Mortality · Mitigation

Introduction

Roads are a major mortality source for many species (Le Gouar et al. 2011). Reducing the amount of casualties is a conservation priority without a universal solution. Sometimes, particularly when roads cross inhospitable landscapes (e.g. intensive agricultural areas), animals get attracted to road verges using them as refuges, corridors or feeding areas (Ruiz-Capillas et al. 2013). The high prey availability on road verges attracts predators like owls, increasing their road-kill risk (Grilo et al. 2014). Indeed, the abundance of rodents on verges can be higher than in

surrounding landscapes (Sabino-Marques and Mira 2011; Ruiz-Capillas et al. 2013). Thus, reducing rodents' activity in the vicinity of roads may prevent vehicle collisions of rodents and their predators (Grilo et al. 2014).

Wildlife-vehicle collisions can be mitigated with the construction of wildlife passages, exclusion fencing or by promoting animal avoidance of roads (e.g. Martinig and McLaren 2019). Measures promoting animal avoidance of roads such as reflectors are employed (D'Angelo and van der Ree 2015), but they are not effective with all taxonomic groups, namely rodents. Another alternative is to use sonic devices for repelling animals (Fox et al. 2018). These devices are commercially available, although their effectiveness in preventing wildlife-vehicle collisions may be little (Valitzski et al. 2009). Animals communicate using specific patterns of frequency, amplitude and duration (Bomford and O'Brien 1990). In particular, rodents reproduce sounds with frequencies between 0 and 110 kHz (which includes ultrasounds: non-audible sounds with frequencies higher than 20 kHz; Sprock et al. 1967), depending on species, age and social situation (Portfors 2007).

Ultrasonic devices have been tested in laboratory and field conditions with inconclusive results about their effectiveness (Bomford and O'Brien 1990; Shumake 1997; Georgiev et al. 2018). Here we tested the effectiveness of ultrasonic devices (hereafter, referred as devices) in dissuading rodents to approach roads. The devices reproduce high-intensity ultrasounds with intermittent output and changing frequencies, which seem to be more aversive than lower-intensity, pure tones (Bomford and O'Brien 1990; Shumake 1997). Due to

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