



# Road effects on species abundance and population trend: a case study on tawny owl

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Received: 28 May 2019 / Revised: 22 August 2019 / Accepted: 21 September 2019  
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## Abstract

Urbanization and its inherent road network are one of the major movements that impulse landscape and biodiversity change, and its effects have yet to be fully understood. Few works focus on the effect of this urbanization on abundance and population trend of a certain species, as this study does, using the tawny owl (*Strix aluco*) as our case study. Although the tawny owl is not threatened at European or global scale, it is often found roadkilled. We studied the effects of different road types on tawny owl abundance in southern Portugal, from 2005 to 2016. In woodlands far from roads, we found high tawny owl abundance, a stable population trend, and low variation in site occupancy. On the contrary, main roads disrupted habitat quality for tawny owls—limiting their abundance and site occupancy and leading to a negative population trend due to disturbance and/or mortality. Secondary roads did not severely disrupt habitat quality, allowing initial occupation and relatively high densities, yet they may act as ecological traps, revealing instability in occupation along the breeding season and a negative population trend. Tawny owl individuals may settle near secondary roads while waiting for a vacant space in woodlands far from roads (the prime high-quality habitats). To avoid the negative effects of roads on tawny owl populations, mitigation efforts should be applied to both main and secondary roads.

**Keywords** Road impacts · Population dynamics · *Strix aluco* · Main roads · Secondary roads

## Introduction

The road network resulting from increasing urbanization impacts animal populations directly and indirectly. The most visible effect includes both wounding and mortality of a large number and diversity of animals (Coffin 2007; Karlson et al. 2014). Other negative effects of roads may include habitat

fragmentation that often generates edge and barrier effects (Ascensão and Mira 2006; Borda-de-Água et al. 2011; Lesbarrères and Fahrig 2012; Grilo et al. 2014); pollution, including chemicals, light, and noise (which may decrease breeding success; Reijnen and Foppen 2006); facilitated human access; and heightened invasion attempts by exotic species (Coffin 2007; Planillo et al. 2015).

Many studies conducted on roads demonstrate the impact they have on bird populations, which live near or somehow interact with these infrastructures (Rheindt 2003). These impacts are generally more noticeable around roads with a greater traffic volume, and many studies appoint noise pollution as the possible principal cause for a negative reaction from birds (Summers et al. 2011; McClure et al. 2013; Fröhlich and Ciach 2018). Due to the diminished capacity for receiving and interpreting conspecific calls, and reduced perception of potential predators, noise pollution seems a plausible hypothesis; nevertheless, there are many other factors that could potentially justify the aversion of some birds to roadside areas (Summers et al. 2011). Studies performed on the effects of roads on birds often focused on mortality rates and the location of mortality “hotspots” (Erritzoe et al. 2003). As

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This article is part of the Topical Collection on Road Ecology  
Guest Editor: Marcello D’Amico

**Electronic supplementary material** The online version of this article (<https://doi.org/10.1007/s10344-019-1325-z>) contains supplementary material, which is available to authorized users.

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