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Research Paper

The effects of a motorway on movement behaviour and gene flow in a forest carnivore: Joint evidence from road mortality, radio tracking and genetics

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ABSTRACT

Roads represent barriers to animal movement due to physical obstruction, mortality, or behavioural avoidance. The population-level consequences of such constraints remain poorly understood, because successful crossings may be sufficient to counteract negative effects of fragmentation and isolation. Here we examine the individual- and population-level barrier effects of a motorway on the common genet *Genetta genetta*, by combining long-term road mortality, radio tracking and population genetics data. We found 84 genets killed at roads, of which 68% were subadults, with a peak mortality during the dispersal period. The home ranges of resident adults often bordered the motorway, and their sizes were similar close to (314 ha, n = 9) and far from (258 ha, n = 10) the motorway. The crossing rate was much higher for dispersing subadults (4.1 crossings/100 nights, n = 3) than for resident adults living near the motorway (0.2 crossings/100 nights, n = 9), though the number of tracked subadults crossing the motorway was low. Genetic kinship analysis revealed seven crossings based on father-offspring and half-sibling relationships. There was no significant genetic differentiation related to the motorway. The movement of residents were strongly constrained by the motorway, though gene flow mediated by successful crossings, particularly by subadults, likely prevented genetic differentiation. Genet movements across the motorway were probably facilitated by low traffic flow and the presence of crossing structures. Our study implies that evaluating mitigation strategies to reduce the barrier effects of roads would benefit from the integration of mortality, animal behaviour, and population genetics data, to increase effectiveness and avoid wasting scarce conservation resources.

1. Introduction

The successful movement of animals across heterogeneous landscapes is an important driver of ecological, demographic, and evolutionary processes, and is critical for the long-term persistence of species (Baguette, Blanchet, Legrand, Stevens, & Turlure, 2013; Clobert, Baguette, Benton, & Bullock, 2012). This type of movement is particularly relevant in human-dominated landscapes, where anthropogenic activities lead to the fragmentation of habitat and reductions in connectivity among habitat fragments (Crooks, Burdett, Theobald, Rondinini, & Boitani, 2011; Fischer & Lindenmayer, 2007). In this context, linear elements of transportation infrastructure, such as roads, may compromise the persistence of animal populations, because they can significantly impair the movement of individuals due to physical obstruction, road mortality (Jackson & Fahrig, 2011; van Langevelde & Jaarsma, 2004), or behavioural avoidance (Beyer, Ung, Murray, & Fortin, 2013; Riley et al., 2006). Given the worldwide expansion of road networks (Ceia-Hasse, Borda-de-Água, Grilo, & Pereira, 2017), it is

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