Eur J Wildl Res (2010) 56:651–662
DOI 10.1007/s10344-009-0360-6

ORIGINAL PAPER

Spatial segregation of two vole species (*Arvicola sapidus* and *Microtus cabrerae*) within habitat patches in a highly fragmented farmland landscape

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Received: 15 July 2009 / Revised: 2 November 2009 / Accepted: 15 December 2009 / Published online: 19 January 2010

Abstract Spatial segregation is one of the common mechanisms allowing the co-existence of similar interacting species in heterogeneous environments. Analysing spatial segregation requires information on individual home-range sizes and their degree of spatial overlap. In this study, we used radio-tracking to report for the first time the home-range and core-area sizes of sympatric Cabrera and water voles and to analyse intra- and inter-specific space sharing within habitat patches in a highly fragmented landscape. Results indicated that both species exhibited strong fine-scale site fidelity and reduced variation in range size across sexes and seasons. Monogamous mating system seemed to prevail for both species, although water voles may also exhibit polygynous breeding strategies. Mean home-range and core-area sizes of water voles (946.3 and 156.6 m^2) were about twice that of Cabrera voles (418.2 and 55.1 m^2). Within habitat patches, individuals of both species often overlapped their home ranges, particularly during the dry season (May–September), though intra-specific home-range overlap was generally higher than inter-specific overlap. Inter-specific space sharing was restricted to areas outside the centre of activity of animals, as no core-area overlap was ever recorded between Cabrera and water voles. Taken together, results support the view that co-existence of Cabrera and water voles in Mediterranean patchy habitats may in part result from spatial segregation among individuals, which may reflect competitive displacement or small-scale habitat partitioning. Results highlight the need to account for species interactions when designing conservation management strategies for sympatric Cabrera and water voles in fragmented landscapes.

Keywords Competition · Fragmentation · Spatial ecology · Species co-existence · Mediterranean farmland

Communicated by H. Kierdorf

Electronic supplementary material The online version of this article (doi:10.1007/s10344-009-0360-6) contains supplementary material, which is available to authorized users.

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Introduction

Understanding the mechanisms determining the co-existence of closely related species and their organising dynamics in spatially structured environments has received increasing attention in recent years (Amarasekare 2003; Dammhahn and Kappeler 2008). In particular, co-existence of similar interacting species in patchy habitats has often challenged researchers to meet the predictions from the competitive exclusion principle, especially when niche dimensions at which species differentiate are still to be identified, or life-history trade-offs remain unclear (Hoopes et al. 2005). In this context, spatial segregation is often referred to as an