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ARTICLE

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Use of space and habitat selection by roe deer *Capreolus capreolus* in a Mediterranean coastal area: how does woods landscape affect home range?

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Abstract The home-range dynamics and habitat selection of nine roe deer were studied from March 1994 to August 1994 in the Maremma Natural Park along the Tyrrhenian coast of Italy. The habitat was highly fragmented, with open agricultural fields prevailing in the study area (57%); the climate was Mediterranean. Data on spatial behaviour were collected by radio-tracking techniques. Habitat selection and structure were investigated by compositional and landscape analysis, both within the study area and within the home ranges. Animals of our sample showed spatial-use patterns varying from stationary to roaming. Stationary individuals used small home ranges while roaming ones moved, especially during the reproductive period in July and August. The percentage and structure of woodlands influenced the size of home ranges and the behaviour of males: stationary males used large amounts of woodlands within their home ranges and showed a territorial behaviour whereas males that used a high percentage of fields showed wider home ranges even during the territorial period. Females seemed to be less influenced by the presence and patch-structure of woodland within their home range. Landscape structure and habitat composition seemed to be important factors influencing the spatial behaviour of this roe deer population.

Key words Roe deer · *Capreolus capreolus* · Habitat selection · Home range · Mediterranean habitat · Spatial behaviour

Introduction

Roe deer *Capreolus capreolus* is the most widespread ungulate species in Europe where it has colonised many different habitats (Linnell et al. 1998) showing a high level of flexibility and success. The species has adapted to a wide variety of environments and habitats, and it is now assumed that these aspects influence the social structure and spatial behaviour of a roe deer population (Hewison et al. 1998). Therefore, roe deer has become one of the most investigated ungulate species, with much information being available regarding its ecology and behaviour. Adult males are commonly thought of as territorial animals before and during the reproductive period (Owen-Smith 1977; Hewison et al. 1998; Liberg et al. 1998; Linnell and Andersen 1998; Rossi et al. 2003), even in populations living in open areas (Zejda and Bauerova 1985; Maublanc et al. 1987) where they generally form groups to feed during winter (Kurt 1968; Zejda 1978; Maublanc et al. 1987; Cibien et al. 1989; Hewison et al. 1998). In most territorial ungulate species, only part of the adult male population is territorial – usually 1/3 or 2/3 (Owen-Smith 1977) – and it is now assumed that some prime-age males may adopt non-territorial strategies even if these were previously thought to be rare in roe deer (Johansson and Liberg 1996). In Hewison et al. (1998) and Liberg et al. (1998), all the hypotheses and theories about the roe deer mating system and territoriality are well reviewed, but even if those authors stated that alternative forms of social organisation may be adopted in a recently colonised habitat such as the Mediterranean and agricultural zones, to date, no data have been presented.

Females are not territorial (Bramley 1970; Chapman et al. 1993), but they usually show high site fidelity during the birth and reproductive periods (Wahlström and Liberg 1995; Danilkin 1996; Nilsen et al. 2004). They may range over the territories of several males, and the sizes of their home range are defined by food and cover availability (Tufto et al. 1996).

In winter, especially in mountainous habitat, all roe deer show great variation in spatial behaviour in relation to resource availability and snow cover (Cederlund 1983; Mysterud 1999; Lamberti et al. 2001; 2004). In agricultural landscapes, roe deer show variability in social and spatial behaviour in relation with human activity and woodland fragmentation. The only key factor that remains constant in

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