

Is habitat management an effective tool for wild rabbit (*Oryctolagus cuniculus*) population reinforcement?

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Abstract Wild rabbit scarcity in Spain is a serious problem due to its economic and ecological value; thus, management techniques to reinforce their populations are being implemented. Translocations are traditionally applied but high short-term mortality by predation makes them unsuccessful and increases their biological cost. An alternative to translocation would be to strengthen local reduced populations through habitat management (building artificial warrens and increasing food availability). Here, we test this method to determine its efficiency as an exportable protocol to recover wild rabbit populations. We compare two areas with and without artificial warrens and increased food availability and assess relative rabbit abundance by means of pellet counts. Results show that, during the 2 years following habitat management, rabbit numbers increased in the experimental plot in contrast to the not managed one, suggesting its effectiveness to reinforce low-density rabbit populations.

Keywords Rabbit abundance · Southern Spain · Management

Introduction

European rabbit (*Oryctolagus cuniculus* L.) is a native species in the Iberian Peninsula that has undergone a progressive decline in abundance in the past decades due to viral diseases (myxomatosis and rabbit hemorrhagic dis-

ease) and loss of suitable habitat (Moreno and Villafuerte 1995; Angulo 2003; Virgós et al. 2003; Calvete and Estrada 2004). Wild rabbit numbers have been reduced in most of their historical range (Villafuerte et al. 1995), even recording local extinctions. Since then some populations have recovered while others have not (Delibes-Mateos et al. 2007a; Williams et al. 2007). Rabbit scarcity in Spain constitutes a serious problem due to its economical and biological value. They are considered the primary small-game species in sport hunting (Calvete and Estrada 2004) and at the same time they are a keystone species in Iberian Mediterranean ecosystems (Delibes-Mateos et al. 2007b), being a staple prey for almost 30 predator species (Delibes and Hiraldo 1981; Jaksic and Soriguer 1981), such as the endangered Iberian Lynx (*Lynx pardinus*) or the Spanish Imperial Eagle (*Aquila adalberti*). Most recovery plans of endangered predators include therefore boosting the number of rabbits, usually by means of translocations (Moreno et al. 2004), predator control (Villafuerte et al. 1998; Calvete and Estrada 2004), habitat management (Moreno and Villafuerte 1995), or disease control (Calvete et al. 2004b; Calvete 2006).

Restocking is the most frequent management tool used to increase rabbit density in the short term mainly for hunting purposes (Calvete et al. 2004a), with thousands of rabbits being released every year in Spain (Delibes-Mateos et al. 2007a). However, this procedure has proven to be ineffective and very costly due to high mortality rates caused by stress and increased predation (Angulo 2003). Restocking may also involve an impact on resident rabbits still living in the release area, due to rabbits' complex social structure (Lockley 1961). An additional problem is that very little is known about the influence of translocations on the genetic structure of rabbit populations. The distribution of the two rabbit subspecies naturally occurring in the

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