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# Exploring nest destruction and bird mortality in mown Mediterranean dry grasslands: an increasing threat to grassland bird conservation

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**Abstract** In recent years, haying has extended to Iberian Mediterranean dry grasslands potentially impacting on grassland bird ecology. We evaluated the impact of haying on a grassland bird community of South Portugal. Our main goals were: (1) to investigate the exposure of different species to haying, (2) to investigate potential removal of nests and dead birds from hayed fields by haying machinery using the ratio (REC) between the expected number of records and the number of records collected and (3) to link clutch destruction and bird mortality with haying management practices. Hayed fields were surveyed for signs of breeding and birds censused prior to mowing. Linear models were computed, linking the REC with haying machinery and sward properties. GLMs and model averaging were used to obtain models linking clutch destruction, bird mortality and haying management variables. Only 4 % of records evidenced successful nesting attempts ( $N=177$ ). REC evaluation suggested high nest or dead bird removal by the machinery, particularly in fields with lower vegetation biomass prior to cutting. Sickie bar mowers and one-rotor rotary rakes returned higher REC but lower

probability of found nests removed from the original nesting sites comparatively to discs mowers and wheel rakes. Higher probabilities of mortality events were found in fields mown earlier (but not in all years). On the other hand, lower mortality was found in fields raked with two-rotor rotary rakes. Delayed haying, silage production in temporary crops and the use haying machinery enabling simultaneously mowing and gathering hay in lines are discussed as management alternatives.

**Keywords** Clutch destruction · Hay · Haying machinery · Semi-natural grasslands · Mowing · Haying

## Introduction

The use of grasslands for hay production is a common and ancient agricultural practice in Europe. In recent years, haying has extended to Iberian Mediterranean dry grasslands. The abandonment of mixed cropping systems of cereal grain and sheep raising for beef–cattle production and the intensification of beef farms is associated in South Portugal (and other parts of south-western Iberia), with an increase in mown area in order to ensure the demands of plant biomass for cattle. There are no official statistics available on the area mown yearly, but in south Portugal (Alentejo and Algarve regions) between 1989 and 2013, bovine numbers experienced a 107 % increase (INE 2014). Also, the area of the main crops used for haying (forage oats, grass-legume crops or pure legume crops) increased 34 % between 1989 and 2009.

Iberian Mediterranean environments provide, under adequate soil and hydrological conditions, moderate to high primary production for hay or silage (Carpintero et al. 1991; Hernández et al. 1994; Rodríguez et al. 2006; San Miguel 2009). Here, mowing for hay occurs on average 1 month earlier than the harvesting of cereal crops for grain, which

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