Agriculture, Ecosystems and Environment 138 (2010) 55–63

Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment

journal homepage: www.elsevier.com/locate/agee

The effect of agri-environment schemes on grey partridges at the farm level in England

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ARTICLE INFO

Article history:
Received 1 December 2009
Received in revised form 22 March 2010
Accepted 24 March 2010
Available online 20 April 2010

Keywords:
Farmland birds
Biodiversity Action Plan
Agri-ecology
Agricultural policy

ABSTRACT

In this study results from land managed by volunteer members of the Game and Wildlife Conservation Trust's Partridge Count Scheme (PCS) were used to determine how well Environmental Stewardship (ES) and its predecessor schemes have performed for one intensively studied farmland bird, the grey partridge (*Perdix perdix*) between 2005 and 2008. The individual agri-environmental scheme (AES) options that PCS members chose to implement were classified into groups based on the habitat that they provide for grey partridges at different stages of their life cycle. Three groups of options had consistently positive effects—beetle banks, conservation headlands and wild bird cover, all in-field options. Options with consistently negative effects were those including grass and scrub management. Unfortunately for grey partridges, beetle banks and conservation headlands currently have very little uptake within AES; of non-PCS agreements 1.9% include beetle banks and 2% conservation headlands. Non-PCS agreements have a slightly higher uptake of wild bird cover (12.9%).

1. Introduction

The use of agri-environmental schemes (AES) to address declines in farmland bird populations has met with limited success across EU Member States (Kleijn and Sutherland, 2003; Kleijn et al., 2006). The schemes that have been successful to date in the UK have been those that addressed the well-defined requirements of species that had limited geographical distributions (Aebischer et al., 2000; Peach et al., 2001). In each case, the population recovery of the rare species involved has depended upon the diagnosis of population decline, the testing of remedial measures and their targeted deployment at a scale large enough to affect the national populations (Evans and Green, 2007; Wilson et al., 2009). Achieving this for more extensively distributed, declining species is widely considered to be much more challenging. Nevertheless, the expansion of AES in England, brought about by the introduction of the Entry Level Scheme (ELS) and the Higher Level Scheme (HLS) in 2005, was broadly greeted by farmland bird conservationists as providing the necessary delivery mechanisms to address the conservation of both widespread and more localised declining farmland species (Evans and Green, 2007).

The number of grey partridges have declined by over 90% since the 1950s in Great Britain (Potts, 1986), and consequently the species appears on the list of priority species identified by the UK Biodiversity Action Plan (Anon., 1995) and on the Red list of *Birds of Conservation Concern in the UK* (Eaton et al., 2009). It is also one of the 19 species included in the Farmland Bird Indicator, used by the UK government to assess progress with its target that seeks to reverse the decline in farmland birds by 2020, and also as part of its biodiversity indicator for the natural environment (DEFRA, 2008). At a European level, the grey partridge forms part of the common farmland bird indicator included in the European wild bird indicators produced by Pan-European Common Bird Monitoring Scheme (PECBMS, Gregory et al., 2005).

Following four decades of research into the factors causing the decline of the grey partridge and the land management measures necessary to increase numbers at the farm level, there is good knowledge of the agri-environment 'recipe' needed to reverse the grey partridge decline (Aebischer, 1997; Aebischer et al., 2000; Potts, 1986). For instance, grey partridge brood sizes nearly doubled where conservation headlands (the outer 6–12 m of cereal fields selectively sprayed with pesticides) were used (Sotherton, 1991) and beetle banks provide appropriate mid-field nesting cover (Thomas et al., 2001). Evaluation of the Arable Stewardship Pilot Scheme (ASPS), which ran from 1998 to 2002, suggested that the grey partridge is capable of responding to the deployment of targeted agri-environment measures (Bradbury et al., 2004). This body of research on grey partridge ecology fed directly into the design of AES options: a number of partridge-friendly ASPS options were adopted into Countryside Stewardship (CSS) and selected Envi-

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doi:10.1016/j.agee.2010.03.018

ronmentally Sensitive Areas (ESAs) from 2002, and subsequently included within ELS and HLS from 2005.

The Game and Wildlife Conservation Trust (GWCT)'s Partridge Count Scheme (PCS) has, in recent years, counted grey partridge numbers at around 1000 farms covering over 250,000 ha of arable land, much of which is under AES agreement (Aebischer and Ewald, 2004; Ewald et al., 2009). In contrast to what has been found in recent British Trust for Ornithology (BTO) Breeding Bird Surveys (Risely et al., 2009), numbers of grey partridges on farms within the PCS have increased since the GWCT expanded the scheme in 1999 and initiated regional grey partridge groups to assist PCS members to undertake management for grey partridges (Aebischer and Ewald, 2004; Aebischer, 2009). The work reported here arose from an opportunity to combine data from the PCS with detailed AES uptake data from Natural England's Genesis system (an overarching scheme management and administration system for ES), allowing us to investigate how the suite of AES running in England (CSS, ESA, ELS and HLS) has contributed to these increases since 2005. Grey partridge demographic parameters, which have been used in the past to identify the causes of grey partridge population decline (Potts and Aebischer, 1995), were examined to see how they responded to the provision of AES options on PCS sites.

2. Materials and methods

2.1. Partridge Count Scheme (PCS)

As part of its Grey Partridge Recovery Programme, the GWCT expanded the membership of the PCS from 1998. The aim was to provide practical support and advice to farmers and landowners, who need to undertake the management necessary to reverse the bird's decline, and also to give some means of monitoring progress towards the BAP targets on farms and estates within the scheme. The GWCT organises regional Partridge Groups, open to all PCS contributors within the area. The meetings allow presentation and discussion of the latest research, management ideas and government agri-environment options relevant to grey partridges and also comprise field visits showing good management practice.

The PCS database contains records of autumn stubble counts of grey partridges across the UK from 1933 to 2008 and of spring pair counts from 1951 to 2008, undertaken by volunteers—usually the gamekeepers, farmers, managers or owners of the shoots, farms and estates that are registered with the PCS. Spring counts take place in March/April; autumn counts are undertaken post-harvest from late August to October. Counting takes place for 2 h at dawn and at dusk, using a four-wheel-drive vehicle as a mobile hide to drive around field edges in spring and autumn and across fields in autumn so that all partridge ground is examined. Around 200 ha of farmland can be covered at each counting session. Binoculars (10×40) are used to identify singles and pairs in spring and distinguish males, females and young in autumn. Counting in winds stronger than Beaufort Force 3 is not recommended. All counters are provided with detailed written instructions and given individual advice at the regular, regional Partridge Group meetings, to standardise counting practices as far as possible (Ewald et al., 2009; Potts, 1986). The area counted, its location, the site boundary, the number of gamekeepers, the number of grey partridges shot and the number released in the autumn are also recorded for most counts/sites. Site boundaries were digitally mapped in the Geographical Information System (GIS) MapInfo 9.0 (MapInfo Corp., Troy, USA) and the remaining data were computerised in Microsoft Access 2007 (Microsoft Corp., Redmond, USA). The data contained gaps where some sites did not return counts in some seasons or years, noting that all available data from 2004 to 2008 were included in the analysis. Many of the PCS sites (69%) reported at least a part-time gamekeeper, though no details were available for the intensity of predation management undertaken by these gamekeepers.

Grey partridge demographic variables were derived from the PCS count data, and comprised change in spring pair density, two measures of productivity (young-to-old ratio and mean brood size) and overwinter retention rate. These were defined and calculated as described below.

From the spring counts, the numbers of pairs of grey partridges recorded on each PCS site in each year was divided by the area counted in km^2 to give annual spring pair density from 2004 to 2008. The change in spring pair density was calculated for each pair of consecutive years of data at each site by taking the ratio of density in the second year to density in the first year, then subtracting 1. For those sites where no partridges were counted in one of the years being compared, numbers were adjusted by adding 0.5 before division to avoid problems with zero values. Sites with no partridges in either year were excluded.

For sites where grey partridges were recorded in the autumn, the young-to-old ratio (Y:O) was obtained as the number of young divided by the number of old birds. Mean brood size was calculated only for sites with at least one brood, as the number of young divided by the number of broods. Released birds were not included in these calculations.

Grey partridge overwinter retention rate (ORR) was calculated from densities in the autumn and following spring. It incorporated deaths, immigration, emigration and any differential detectability between seasons. The number of birds counted in the autumn was adjusted for shooting losses and releasing gains by subtracting the number of birds shot and adding the number released. Adjusted autumn counts and total spring counts were then transformed to densities by adding 0.5 and dividing by the respective areas counted. Overwinter retention rate was calculated as the ratio of spring to autumn density. No ORR was calculated for sites lacking one or other of the counts, or with no partridges in autumn and spring.

For purposes of presentation, the change in spring pair density and ORR were expressed as percentages. Means are accompanied by their 95% confidence intervals.

2.2. Agri-environment scheme (AES) data

Digitised locations of individual management options within CSS and ES agreements between 2005 and 2008 were supplied by Natural England as point objects defined by the x, y coordinates of their central position. The ESA options were supplied as polygons but were analysed using the centre point of each polygon. The data from each of the separate schemes were therefore available at similar scales. Only options that had not ended by September 2008 were used for analysis. These were imported into the MapInfo GIS.

Six months was considered to be the minimum period required for a management option to have become established and to have an effect on partridges. This meant that for options to have had an effect on changes in spring pair density, they had to have been in place 6 months before the first of April of the base year. For options to have had an effect on Y:O, mean brood size or ORR, they had to have been in place 6 months before the first of September. The start and end date of each agreement (from the data files supplied by Natural England) were used to calculate the duration of each agreement.

The boundaries of PCS sites that had counted grey partridges were overlaid with the locations of individual management options within the AES files. This resulted in a total of 917 PCS sites in an AES from 2004 to 2008 and 114 sites that were not in a scheme in 2004 and had not joined one by 2008. The sum of the areas of each option on a PCS site, divided by the area within the site boundary,