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Present agri-environment measures in Europe are not sufficient for the conservation of a highly sensitive bird species, the Corncrake *Crex crex*

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ABSTRACT

The Corncrake *Crex crex* breeds mainly in managed grasslands in Europe. Agri-environment schemes (AES) were introduced in many European countries to protect broods from earlier and more frequent mowing. In order to assess the efficacy of these AES on the scale of regional populations, we obtained information on current AES options for Corncrakes in 33 countries and administrative regions within the European Union (EU) and European free Trade Association (EFTA) using a questionnaire. Options suitable for Corncrake conservation were available in 18 regions, but coverage of the regional Corncrake populations was highly variable. Coverage with AES was high in selected western regions, but low throughout eastern Europe where most Corncrakes breed. The various suitable options together covered only 6.2% of the total Corncrake population inside the EU and EFTA. While AES were effective at restoring Corncrake populations in Scotland, no evidence was found for effects on populations in other EU regions.Limited coverage of Corncrake populations in countries holding the largest populations, as well as its low breeding-site fidelity suggest that the Corncrake's future is not secured by the current extent of AES. If current farming practices in eastern European countries become more intensive as expected, the species' future may be at risk. Besides developing AES which are more attractive to farmers and better targeting the requirement of Corncrakes, conservation of farmland birds in Europe should pay more attention to continent-wide changes of breeding conditions in order to be successful.

1. Introduction

Declines in farmland bird communities is commonly regarded as one of the most pronounced expressions of biodiversity losses among European breeding birds (Donald et al., 2006). It is associated with an ongoing intensification of agricultural practices, mostly as a result of the European Common Agricultural Policy (CAP). Since 1992, agri-environment schemes (AES) have been established to halt biodiversity loss on farmland, however, they have only met with moderate or mixed success (e.g. Kleijn and Sutherland, 2003; Kleijn et al., 2006; Breeuwer et al., 2009; Whittingham, 2011). One reason may be that many AES insufficiently address the factors causing declines (Breeuwer et al., 2009). Breeding birds are important target species in many AES, but existing reviews did not find clear benefits of existing AES for common farmland birds across the EU (Donald et al., 2006; Gamero et al., 2017). The contribution of AES to the conservation of target species has, however, rarely been evaluated at the scale of biogeographic populations (Whittingham, 2011).

Here we examine the extent to which AES have been implemented for a main target species and assess whether they have made a positive contribution to conservation efforts within Europe. The Corncrake *Crex crex* is a medium-sized, ground-breeding rail inhabiting tall herbaceous meadows, usually agriculturally managed and mown at least once a year or recently abandoned (Green et al., 1997a; Berg and Gustafson, 2007; Grishchenko and Prins, 2016). Being a short-lived species, its breeding numbers are highly sensitive to changes in annual reproduction (Green et al., 1997b; Green, 1999, 2008). Due to their habitat requirements and a late breeding season that runs from May through August, Corncrakes are especially susceptible to changes in grassland management practices. In addition to losses of suitable meadows through conversion to crops or succession, earlier and more frequent mowing was found to be the main threat causing Corncrake populations to decline, especially in western Europe (Green et al., 1997a; Koffijberg and Schäffer, 2006). Due to these declines, the species was previously listed as globally threatened (Collar et al., 1994) and became a target for conservation activities, notably in France (Broyer, 1995, 1996) and in Scotland (O'Brien et al., 2006). In eastern Europe the Corncrake remained a common species probably due to less intensive farming

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Table 1
Agricultural practices that promote Corncrake breeding success (BirdLife International Corncrake Conservation Team, 2016).

Agricultural practices supporting Corncrake breeding success
mowing (or grazing) after 15 August
mowing (or grazing) after 31 July in combination with CFM or if mowing progress is slow
mowing (or grazing) after 15 July with CFM – supporting early/first broods
Corncrake-friendly mowing techniques (CFM) after young are > 2 weeks old (1 July or later, depending on timing of breeding)
mowing centre-out as CFM if performed from the beginning, and if adjacent uncut vegetation remains as a refuge
leaving ≥10 m wide refuge strips as CFM
grazing after young are > 2 weeks old (1 July or later) and if adjacent uncut/ungrazed vegetation remains as a refuge
cutting 30–50% of the area before Corncrakes arrive and leave a large enough area until 1–15 August

methods and large extent of suitable habitat (Green and Rayment, 1996; BirdLife International, 2015).

To promote Corncrake conservation mainly through increased breeding success, AES options were introduced in several European countries at national or regional levels (Koffijberg and Schäffer, 2006). AES in the European Union (EU) typically consist of a set of separate options, targeting various species or habitats and differing in the level of restrictions and payments, from which farmers may chose. The most important practices included in options for Corncrakes are (1) postponed mowing, with first dates for mowing and grazing not earlier than 1 August (Koffijberg and Schäffer, 2006), and (2) Corncrake-friendly mowing (CFM, Tyler et al., 1998) methods. CFM is performed either by mowing from the centre of the field to the outside (inside-out mowing, Broyer, 1996; Green et al., 1997b; Tyler et al., 1998), or less frequently by leaving unmown refuges in the centre (Broyer, 2003; Arbeiter et al., 2017). Regionally, AES might also include provision of early and late cover (ELC, Corbett and Hudson, 2010). Table 1 lists agricultural practices which are considered suitable under the conditions outlined above.

Corncrakes have a short lifespan and can raise two large broods per year (Green et al., 1997b). Therefore populations should respond to a good breeding season or effective protection in the next year. We studied the potential of present AES to conserve of Corncrakes across Europe using a questionnaire and recent data on population size and trends. Specifically we sought answers to three questions.

1. How well are Corncrake populations in Europe covered by AES options that effectively increase breeding success?
2. Which factors (e.g. payment levels, flexibility of prescriptions) are associated with a high coverage of the national or regional population?
3. Is there an association between coverage with AES and trends in numbers within a country or region?

2. Methods

2.1. Agri-environment schemes

We used a questionnaire (Table B.1) to collect information on the prescriptions, payments and coverage of AES options available for Corncrake habitats across Europe. The questionnaire was sent to national or regional Corncrake experts in 26 countries where Corncrakes are regular breeders, and which are either members of the EU (24 countries) or the European Free Trade Association (EFTA, Norway and Switzerland). In France, Germany, Italy and Belgium separate AES exist for each administrative region. In these countries information on AES was collected and analysed at the regional level.

In the EU, AES are linked to the seven-year financial periods. We asked for details of AES available in the current financial period 2014–2020, but also for the availability of similar AES in the previous period 2007–2013. Some regions offer various options, either for farmers to choose or separated by area (e.g. inside and outside protected areas). In these cases, we chose the option most suitable for Corncrake conservation for analysis.

We converted payments into EUR using exchange rates from 31 December 2014. Data on gross domestic product per inhabitant (GDP) in 2013, when the current AES were prepared, were obtained from databases of the statistical authorities in Europe (Eurostat, http://ec.europa.eu/eurostat/tgm) and Germany (Arbeitskreis Volkswirtschaftliche Gesamtrechnungen der Länder VGRdL, http://www.vgrdl.de/VGRdL/tbls/home.asp).

In each country or region, we asked the respondents to estimate the proportion of the Corncrake population (< 25%, 25–50%, or > 50%) that inhabited fields under the respective AES option.

2.2. Corncrake populations

Corncrake breeding population sizes and trend assessments during 2000–2012 for all countries covered were available from BirdLife International (2015). We used trend assessments as a three-level factor with the levels increasing, decreasing, and stable/fluctuating. For German regions (federal states), population size was taken from Gedeon et al. (2014) and trends from Grüneberg et al. (2017). Total population sizes were calculated as the geometric mean of the minimum and maximum numbers in the sources and log-transformed for statistical analysis. For five regions the original trend asessments did not correspond with population growth rates and were changed for further analysis (see Table B.2).

For 20 regions we were able to calculate population growth rates based on indices or population estimates from monitoring data. Estimates were taken from Koffijberg et al. (2016) and other recent sources shown in Table B.2. Growth rates were calculated for two periods, 2000–2014 and 2008–2014 to match the financial period for which AES information was available.

2.3. Statistical analysis

The influence of GDP and basic characteristics of AES on log-transformed payments was analysed with a linear model. We used a proportional odds mixed effects model to explore if the coverage with AES options could be predicted from Corncrake density, flexibility of the option and residual payment from the linear model. The model included AES coverage as a three-level (no suitable option available, < 25% or uncertain coverage, > 25% coverage) as response, and country as a random factor.

We then tested if trend estimates could be explained by longitude and AES coverage, using a proportional odds model for the 2000–2012 trend assessments from 30 regions and linear models for the population growth rates in 20 regions. AES coverage as a three-level factor (see above) was based on information if AES options similar to those since 2014 were already available during 2007–2013.

To assess the importance of the predictors in all models we started with a full model containing all predictors and compared this to a set of reduced models using Akaike's Information Criterion adjusted for small samples, AICc. Relative importance was assessed via cumulative Akaike weights for each predictor. Statistical tests were performed in R 3.3.1 (R Core Team, 2016) with the packages MuMIn 1.15.6 (Bartoń, 2016) and ordinal (Christensen, 2015).

3. Results

3.1. Availability and coverage of AES options

We obtained information about AES in the current period