Bird Study

ISSN: 0006-3657 (Print) 1944-6705 (Online) Journal homepage: https://www.tandfonline.com/loi/tbis20

The introduction of subsidies for grassland conservation in the Italian Alps coincided with population decline in a threatened grassland species, the Corncrake *Crex crex*

Mattia Brambilla & Paolo Pedrini

To cite this article: Mattia Brambilla & Paolo Pedrini (2013) The introduction of subsidies for grassland conservation in the Italian Alps coincided with population decline in a threatened grassland species, the Corncrake *Crex crex* , Bird Study, 60:3, 404-408, DOI: 10.1080/00063657.2013.811464

To link to this article: https://doi.org/10.1080/00063657.2013.811464

Bird Study (2013) **60**, 404–408
http://dx.doi.org/10.1080/00063657.2013.811464

SHORT REPORT

The introduction of subsidies for grassland conservation in the Italian Alps coincided with population decline in a threatened grassland species, the Corncrake *Crex crex*

MATTIA BRAMBILLA* and PAOLO PEDRINI
Museo delle Scienze, Sezione Zoologia dei Vertebrati, Via Calepina 14, Trento, I-38122, Italy

Capsule We analysed Corncrake population trends between 1997 and 2012 and evaluated changes before and after the introduction of subsidies for grassland conservation in 2000, which indirectly promoted unfavourable mowing practices over most grasslands in Trento province. According to both early and late season counts, the species has significantly declined in the study area since the early 2000s. Agri-environmental subsidies that are not adapted to the ecological requirements of the species may fail to achieve conservation objectives.

Agri-environmental schemes are likely to be the most important strategy to conserve biodiversity in farmed areas. Frequently they provide benefits to wild species (Davey *et al.* 2010b), but often the design of such schemes has not been based on their potential effects on biodiversity, which may result in only partial benefits, or even negative effects on many species (Kleijn & Sutherland 2003, Birrer *et al.* 2007, Davey *et al.* 2010a), including some of conservation concern (Kleijn *et al.* 2006). Agri-environmental schemes may not be sufficiently tuned to the ecological requirements of species (Kleijn *et al.* 2004), and often fail to enhance population trends (O'Brien & Wilson 2011, Princé *et al.* 2012). Reasons for lack of effects include a focus on small spatial scales, a lack of coordination among farmers at the landscape scale and restricted temporal scales (Siriwardena 2010).

In western Europe, permanent grassland represents one of the most biologically rich agricultural habitats. Grasslands are vanishing in many areas because they have become financially less attractive; in particular, low-intensity farmed grassland is becoming increasingly rare (Ostermann 1998, Debussche *et al.* 1999, Donald *et al.* 2001, Vickery *et al.* 2001, Donald *et al.* 2002, Romero-Calcerrada & Perry 2004, Brambilla *et al.* 2010, Nikolov 2010). To counteract the decline, subsidies for grassland maintenance have been made available to farmers in the Rural Development Programme of many European countries and regions. In many cases, subsidies just focus on maintaining grazing or mowing of grasslands, whereas they do not take into account the ecological needs of the species relying on grasslands and details on management at different temporal and spatial scales are lacking.

Here, we focus on the population trend of Corncrakes *Crex crex*, and on its relationship with the introduction of subsidies for grassland conservation in Trento province in the Italian Alps. The Corncrake is a threatened species tied to grasslands, and especially to tall swards and to low-intensity management regimes (Berg & Gustafson 2007). We assessed the effect of a non-targeted subsidy for grassland conservation on the population of this priority species.

We separately considered early and late counts because of within-season habitat and distribution (from low to high elevation) shifts (Brambilla & Rubolini 2009, Gilroy *et al.* 2010, Brambilla & Pedrini 2011, Brambilla *et al.* 2012), which can affect the estimation of population trends (Pedrini *et al.* 2012). We expected an almost immediate effect of changes in mowing practices introduced by subsidies on the population trend for late season data, and a weaker or delayed effect for early season data. This is because grassland mowing takes place in the middle of the breeding season, and so

*Correspondence author. Email: brambilla.mattia@gmail.com

Corncrake abundance in the late season will be affected by changed mowing regimes in the first year, whereas effects on early season abundance will not be seen until at least the following year.

Trento province covers 6206 km^2 in the central-eastern part of northern Italy. Elevation ranges between 67 and 3769 m asl; 30% of the land is below 1000 m, and 50% between 1000 and 2000 m. The landscape is characterized by intensively cultivated and urbanized valley floors, mountainsides covered by woodlands interspersed with pastures, vineyards and secondary (anthropogenic) grasslands, and by alpine habitats at higher elevations (above 2000 m). Rainfall values range from 700 to 1500 mm/year (locally higher). Until some decades ago, grasslands were much more widespread, but underwent a drastic reduction (from 39 000 ha in 1982 to 29 000 ha in 2000; source: Trento province, Agriculture Department).

Subsidies for grassland conservation were introduced within the Rural Development Programme of the Trento province in 2000, and they were used to maintain 14 000 ha of grassland between 2000 and 2006; only 40 ha of grassland benefitted from agri-environmental schemes involving wildlife-friendly practices (low inputs, delayed mowing, unmown marginal strips) over the same period. In the subsequent Rural Development Programme (2007–2013), the subsidies continued to be the most adopted action in the province (over more than 20 000 ha), whereas the newly introduced measures for Corncrake conservation (delayed mowing and conservation of unmanaged patches) were applied only to 39 ha (Anonymous 2010).

Within the province, we identified six study areas (including all main occurrence sites for Corncrakes; Tesino, 479 ha, average elevation 975 m asl; Alta Val di Non, 807 ha, 975 m; Val di Gresta, 356 ha, 1175 m; Folgaria, 520 ha, 1175 m; Andalo, 203 ha, 957 m; Vezzena, 114 ha, 1401 m), all subjected to mowing promoted by the subsidies, although specific data on the extent of the mowing are not known. Each study area was divided into sectors that were simultaneously censused by different teams of observers. Calling males were counted by means of crepuscular/nocturnal surveys (22:30–03:00) in the six areas during 1997–2012, listening to spontaneous vocalizations every c. 300 m, and using playback (i.e. broadcast calls of males) if no male was singing (one minute of playback, three minutes of listening, repeated twice). The number of calling males is used as a population estimate for this (Schäffer 1995, Tyler & Green 1996, Schipper *et al.* 2011) and other elusive species (Poulin *et al.* 2005, Longoni *et al.* 2011). All areas were visited once in May to early June, before mowing (which in the study areas takes place around the 15th June, with inter-annual variations), and once in late June to July, after mowing. We avoided rainy and windy days. Field tests at the beginning of the research revealed how the number of males counted in consecutive field sessions before mowing was fairly constant, suggesting high vocal activity and detection rate (P. Pedrini *et al.* unpublished data), as found for other rallids (Brambilla & Jenkins 2009); previous analyses revealed weak effects of census date within the survey period (Brambilla & Pedrini 2011). Not all the areas were visited each year; out of 84 cases, early count data were available for 73 areas/years, and late count data for 60.

We used the program TRIM (TRends & Indices for Monitoring data) 3.54 to assess population trends by means of a generalized estimating equations approach which takes into account overdispersion and serial correlation (Pannekoek & Van Strien 2001, Soldaat *et al.* 2007, Ludwig *et al.* 2008). The proportion of missing data within our counts was relatively low (Pannekoek & Van Strien 2001). We built separate models for early and late counts due to within-season changes in abundance (see above). The value of the population index was set at 1 in 1997 (first year used as reference). We ran six models: no time effects (counts vary across sites and not across time points), time effects (effects for each site and time point), simple linear trend (constant increase or decrease), linear trend with step-wise selection of change points (switching trend model with slope parameter changing at some time points) using default *P*-values (0.15 for entry and 0.2 for removal), step-wise selection of change points using more stringent *P*-values (0.05 for entry and 0.1 for removal). Then, for each period we selected the most parsimonious model according to the relative AIC value as calculated by TRIM. Indices calculated according to the 'imputed' and 'model' trend (cf. Pannekoek & Van Strien 2001) were identical to the third decimal; the former ones were shown. Linear trend models with step-wise selection of change points using default *P*-values had by far the lowest AIC values for both periods ($\Delta AIC > 10$ for all other models in both periods).

In both periods, there was an initial increase, until 2000, followed by a sudden decrease in the number of calling males (Fig. 1). As expected, the decline in the first years after the introduction of subsidies was

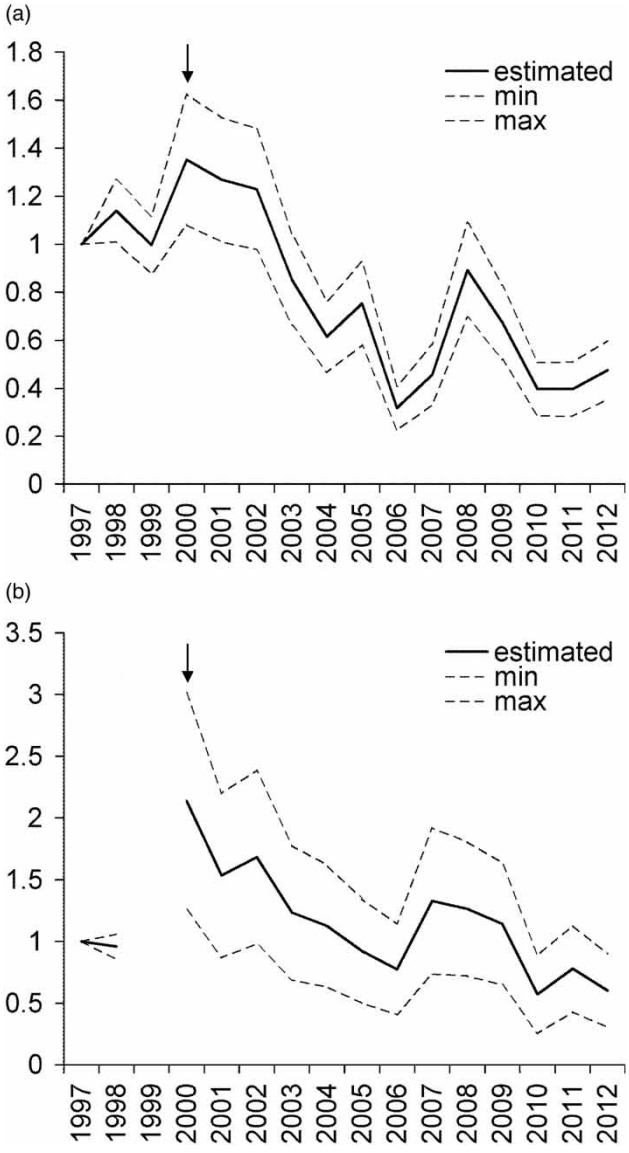

Figure 1. Corncrake trend according to early count data (A; May to early June) and according to late count data (B; late June to July; no data available for 1999), respectively. The date of the introduction of subsidies for grassland conservation (year 2000) is also shown by the arrow.

steeper in the late than in the early part of the breeding season. In the early season, the number of calling males (imputed value ± se) was 50 ± 8 in 1997 and 24 ± 5 in 2012 (−52%; −65% from 2000 to 2012). The model for the early period included as change points the following years: 1999, 2000, 2002, 2004, 2005, 2006, 2008, and 2010 (all $P < 0.183$). The overall trend (±se) was equal to 0.93 ± 0.01 and was classified as 'Steep decline ($P < 0.05$)'. In the late season, the number of calling males (imputed value ± se) was 33 ± 12 in 1997 and 20 ± 7 in 2012 (−39%; −72% from 2000 to 2012). The model for the late period included as change points the following years: 1998, 2000, 2006, and 2007 (all $P < 0.065$). The overall trend (±se) was equal to 0.95 ± 0.02 and was classified as 'Moderate decline ($P < 0.05$)'.

Spatial and temporal scales are a key issue for agri-environmental schemes (Siriwardena 2010), as well as the management of locally significant habitat types (MacMahon *et al.* 2013). For Corncrakes, spatial and temporal features of grass mowing are crucial: survival of adults, chicks and nests depend on methods and extent of mowing (Green *et al.* 1997a, 1997b). Subsidies for grassland conservation in the Trento province, by encouraging mowing without consideration for when and where to cut the grass in relation to the ecology of target species, might have negative effects on Corncrakes. Indeed, with the introduction of the subsidies the Corncrake population started a marked decline in the province.

Our study covers a period regarded as favourable for Corncrakes at the Eurasian level. Most populations monitored during that time showed stability or increase, especially (but not exclusively, see Keišs 2003, 2004) where dedicated conservation measures were implemented (O'Brien *et al.* 2006). During the past 15–20 years, despite fluctuations typical for Corncrake populations (Cramp 1985), which also occurred within our area (Pedrini *et al.* 2012, Fig. 1), the species was stable or increasing in most countries for which data are available: in most western European states, a partial recovery has occurred since 1997 (with fluctuations), and the largest world population of the species (the Russian one) has been stable or increasing since 2002 (BirdLife International 2013). Therefore, the post-2000 decline in Trento province is very unlikely to be due to general/global factors, such as conditions during wintering or migration. The decline (2000–2012) followed an initial increase (1997–2000), and its onset was coincident with the introduction of the subsidies for grassland conservation, with a stronger effect on late count data in the first two years, as expected.

Subsidies changed the mowing system in the grasslands of the province. Grasslands were once mown by single owners, in a mosaic fashion: each owner mowed their own land, and mowing was spread over several days or weeks, allowing birds to thrive in unmown patches. Small plots with other cultivations, small wetland patches and other marginal elements

were also interspersed within the largest grasslands. With the subsidies, this system collapsed: adjacent fields belonging to different owners are now mown simultaneously by the same farmer, and marginal elements are removed to maximize the extent eligible for subsidies. This results in mowing within a short space of time over wide areas, and thus produces a homogeneous vegetation structure over large areas. Although there is no direct evidence that the introduction of subsidies caused the species' decline, it is very likely that the resulting mowing, with large extents cut simultaneously and without unmown patches, caused the disappearance of suitable habitat conditions (Berg & Gustafson 2007) and high mortality (Green *et al*. 1997b, Tyler *et al*. 1998).

Agri-environmental subsidies not adapted to the ecological requirements of the species may fail to promote species conservation. In this case, the lack of management recommendations in the subsidies for grassland conservation is the most likely cause of the negative trend of the Corncrake population, a species highly sensitive to farming practices. The extent of grassland that benefitted from agri-environmental schemes promoting a species-friendly management were too small (c. 0.1% of the total grassland extent that received subsidies) to compensate for the impact due to unfavourable mowing. The new Rural Development Programme will be launched in 2014, and to conserve Corncrakes, this should include a revision and correction of measures to address problems caused by the unsustainable mowing favoured by subsidies that are not adapted to the species' requirements. The identification of the most suitable sites for Corncrakes (Tattoni *et al*. 2012) is a priority. These sites will need targeted subsidies to promote appropriate methods for mowing (Green *et al*. 1997b) and its timing (Brambilla & Pedrini 2011), and the conservation of unmown patches with tall vegetation, especially in wetter areas (Berg & Gustafson 2007, Berg & Hiron 2012). Such measures have the potential to greatly enhance the value of the agri-environmental schemes for grassland conservation for Corncrakes (Pedrini *et al*. 2012) and other wild species.

ACKNOWLEDGEMENTS

The study was partially financed by Project Biodiversità (2001–2005) and by Trento province (Agricultural and RN2000 departments) ans MuSE. We are grateful to colleagues and volunteers for help with fieldwork, to I. Farronato and C. Tattoni for collaboration, to F. Dellagiacoma, V. Fin, A. Agostini, L. Sottovia, Ufficio RN2000TN for support, to two anonymous reviewers and the Editor, W. Cresswell, for helpful comments on a first draft of the paper. D. Chamberlain kindly revised the English text.

REFERENCES

Anonymous. 2010. Servizio di Valutazione indipendente del Programma di Sviluppo Rurale per il periodo 2007–2013 della Provincia Autonoma di Trento. Available at http://ec.europa.eu/agriculture/rurdev/countries/it/mte-rep-it-trento_it.pdf (accessed 12 February 2013).

Berg, Å. & Gustafson, T. 2007. Meadow management and occurrence of corncrake *Crex crex*. *Agric., Ecosyst. Environ.* **120:** 139–144.

Berg, Å. & Hiron, M. 2012. Occurrence of Corncrakes *Crex crex* in mosaic farmland landscapes in south-central Sweden – effects of habitat and landscape structure. *Bird Conserv. Int.* **22:** 234–245.

BirdLife International. 2013. Species factsheet: *Crex crex*. Available at http://www.birdlife.org (accessed 6 February 2013).

Birrer, S., Spiess, M., Herzog, F., Jenny, M., Kohli, L. & Lugrin, B. 2007. The Swiss agri-environment scheme promotes farmland birds: But only moderately. *J. Ornithol.* **148:** 295–303.

Brambilla, M. & Jenkins, R.K.B. 2009. Cost-effective estimates of water rail *Rallus aquaticus* breeding population size. *Ardeola* **56:** 95–102.

Brambilla, M. & Pedrini, P. 2011. Intra-seasonal changes in local pattern of corncrake *Crex crex* occurrence require adaptive conservation strategies in Alpine meadows. *Bird Conserv. Int* **21:** 388–393.

Brambilla, M. & Rubolini, D. 2009. Intra-seasonal changes in distribution and habitat associations of a multi-brooded bird species: Implications for conservation planning. *Anim. Conserv.* **12:** 71–77.

Brambilla, M., Casale, F., Bergero, V., Bogliani, G., Crovetto, G.M., Falco, R., Roati, M. & Negri, I. 2010. Glorious past, uncertain present, bad future? Assessing effects of land-use changes on habitat suitability for a threatened farmland bird species. *Biol. Conserv* **143:** 2770–2778.

Brambilla, M., Falco, R. & Negri, I. 2012. A spatially explicit assessment of within-season changes in environmental suitability for farmland birds along an altitudinal gradient. *Anim. Conserv.* **15:** 638–647.

Cramp, S. 1985. *The Birds of the Western Palearctic, Volume IV.* Oxford University Press, Oxford.

Davey, C.M., Vickery, J.A., Boatman, N.D., Chamberlain, D.E., Parry, H.R. & Siriwardena, G.M. 2010a. Assessing the impact of entry level stewardship on lowland farmland birds in England. *Ibis* **152:** 459–474.

Davey, C.M., Vickery, J.A., Boatman, N.D., Chamberlain, D.E. & Siriwardena, G.M. 2010b. Entry level stewardship may enhance bird numbers in boundary habitats. *Bird Study* **57:** 415–420.

Debussche, M., Lepart, J. & Dervieux, A. 1999. Mediterranean landscape changes: Evidence from old postcards. *Glob. Ecol. Biogeogr* **8:** 3–15.

Donald, P.F., Green, R.E. & Heath, M.F. 2001. Agricultural intensification and the collapse of Europe's farmland bird populations. *Proc. R. Soc. B: Biol. Sci.* **268:** 25–29.

Donald, P.F., Pisano, G., Rayment, M.D. & Pain, D.J. 2002. The common agricultural policy, EU enlargement and the conservation of Europe's farmland birds. *Agric., Ecosyst. Environ.* **89:** 167–182.

Gilroy, J.J., Anderson, G.Q.A., Grice, P.V., Vickery, J.A. & Sutherland, W.J. 2010. Mid-season shifts in the habitat associations of yellow wagtails *Motacilla flava* breeding in arable farmland. *Ibis* **152:** 90–104.

Green, R.E., Rocamora, G. & Schäffer, N. 1997a. Populations, ecology and threats to the Corncrake *Crex crex* in Europe. *Vogelwelt* **118:** 117–134.

Green, R.E., Tyler, G.A., Stowe, T.J. & Newton, A.V. 1997b. A simulation model of the effect of mowing of agricultural grassland on the breeding success of the corncrake (*Crex crex*). *J. Zool.* **243:** 81–115.

Keišs, O. 2003. Recent increases in numbers and the future of Corncrake *Crex crex* in Latvia. *Ornis Hungarica* **12–13:** 151–156.

Keišs, O. 2004. Results of a survey of Corncrake *Crex crex* in Latvia, 1989–1995. *Bird Census News* **13:** 73–76.

Kleijn, D. & Sutherland, W.J. 2003. How effective are European agri-environment schemes in conserving and promoting biodiversity? *J. Appl. Ecol* **40:** 947–969.

Kleijn, D., Berendse, F., Smit, R., Gilissen, N., Smit, J., Brak, B. & Groeneveld, R. 2004. Ecological effectiveness of agri-environment schemes in different agricultural landscapes in The Netherlands. *Conserv. Biol.* **18:** 775–786.

Kleijn, D., Baquero, R.A., Clough, Y., Díaz, M., De Esteban, J., Fernãndez, F., Gabriel, D., Herzog, F., Holzschuh, A., Jöhl, R., Knop, E., Kruess, A., Marshall, E.J.P., Steffan-Dewenter, I., Tscharntke, T., Verhulst, J., West, T.M. & Yela, J.L. 2006. Mixed biodiversity benefits of agri-environment schemes in five European countries. *Ecol. Lett.* **9:** 243–254.

Longoni, V., Rubolini, D., Ambrosini, R. & Bogliani, G. 2011. Habitat preferences of Eurasian bitterns *Botaurus stellaris* booming in ricefields: Implications for management. *Ibis* **153:** 695–706.

Ludwig, T., Storch, I. & Wübbenhorst, J. 2008. How the black grouse was lost: Historic reconstruction of its status and distribution in Lower Saxony (Germany). *J. Ornithol.* **149:** 587–596.

MacMahon, B.J., Carnus, T. & Whelan, J. 2013. A comparison of winter bird communities in agricultural grassland and cereal habitats in Ireland: Implications for common agricultural policy reform. *Bird Study* **60:** 176–184.

Nikolov, S.C. 2010. Effects of land abandonment and changing habitat structure on avian assemblages in upland pastures of Bulgaria. *Bird Conserv. Int.* **20:** 200–213.

O'Brien, M. & Wilson, J.D. 2011. Population changes of breeding waders on farmland in relation to agri-environment management. *Bird Study* **58:** 399–408.

O'Brien, M., Green, R.E. & Wilson, J. 2006. Partial recovery of the population of Corncrakes *Crex crex* in Britain, 1993–2004. *Bird Study* **53:** 213–224.

Ostermann, O.P. 1998. The need for management of nature conservation sites designated under natura 2000. *J. Appl. Ecol* **35:** 968–973.

Pannekoek, J. & Van Strien, A.J. 2001. *TRIM (Trends and Indices for Monitoring Data)*. Statistics Netherlands, Voorburg.

Pedrini, P., Rizzolli, F., Rossi, F. & Brambilla, M. 2012. Population trend and breeding density of corncrake *Crex crex* (Aves: Rallidae) in the Alps: Monitoring and conservation implications of a 15-years survey in Trentino, Italy. *Ital. J. Zool.* **79:** 377–384.

Poulin, B., Lefebvre, G. & Mathevet, R. 2005. Habitat selection by booming bitterns *Botaurus stellaris* in French mediterranean reed-beds. *Oryx* **39:** 265–274.

Princé, K., Moussus, J.-P. & Jiguet, F. 2012. Mixed effectiveness of French agri-environment schemes for nationwide farmland bird conservation. *Agric., Ecosyst. Environ.* **149:** 74–79.

Romero-Calcerrada, R. & Perry, G.L.W. 2004. The role of land abandonment in landscape dynamics in the SPA 'Encinares del rÃo Alberche y Cofio, Central Spain, 1984–1999. *Landsc. Urban Plann.* **66:** 217–232.

Schäffer, N. 1995. Rufverhalten und Funktion des Rufens beim Wachtelkönig *Crex crex*. *Vogelwelt* **116:** 141–151.

Schipper, A.M., Koffijberg, K., van Weperen, M., Atsma, G., Ragas, A.M.J., Hendriks, A.J. & Leuven, R.S.E.W. 2011. The distribution of a threatened migratory bird species in a patchy landscape: A multi-scale analysis. *Landsc. Ecol.* **26:** 397–410.

Siriwardena, G.M. 2010. The importance of spatial and temporal scale for agri-environment scheme delivery. *Ibis* **152:** 515–529.

Soldaat, L., Visser, H., Roomen, M. & Strien, A. 2007. Smoothing and trend detection in waterbird monitoring data using structural time-series analysis and the Kalman filter. *J. Ornithol.* **148:** S351–S357.

Tattoni, C., Rizzolli, F. & Pedrini, P. 2012. Can LiDAR data improve bird habitat suitability models? *Ecol. Model* **245:** 103–110.

Tyler, G.A. & Green, R.E. 1996. The incidence of nocturnal song by male Corncrakes *Crex crex* is reduced during pairing. *Bird Study* **43:** 214–219.

Tyler, G.A., Green, R.E. & Casey, C. 1998. Survival and behaviour of Corncrake *Crex crex* chicks during the mowing of agricultural grassland. *Bird Study* **45:** 35–50.

Vickery, J.A., Tallowin, J.R., Feber, R.E., Asteraki, E.J., Atkinson, P.W., Fuller, R.J. & Brown, V.K. 2001. The management of lowland neutral grasslands in Britain: Effects of agricultural practices on birds and their food resources. *J. Appl. Ecol.* **38:** 647–664.

(MS received 13 February 2013; revised MS accepted 30 May 2013)