The grey partridge in the UK: population status, research, policy and prospects

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Abstract

The grey partridge in the UK: population status, research, policy and prospects.— Numbers of grey partridges (*Perdix perdix*) have declined catastrophically over the last 50 years in the UK. By contrast, the Partridge Count Scheme of the Game & Wildlife Conservation Trust (GWCT) shows an 81% increase on participating UK sites since 2000. We explore the background and reasons for this conflicting picture. GWCT research has led to scientifically proven recommendations for improving the UK partridge environment, ranging from habitat requirements to predator density. The research has influenced UK government policy, which now includes one of the most conservation–oriented and flexible agri–environment schemes in Europe, allowing land managers to recover much of the cost of grey partridge habitat creation. Culling common predators is not covered by agri–environment schemes, so it is primarily shooting estates with private gamekeepers that have implemented the full package of management measures. The future fate of the grey partridge in the UK rests on the balance between the economics of agricultural production, agri–environment measures and shooting.

Key words: Grey partridge, *Perdix perdix*, Causes of decline, Management for recovery, Agri–environment measures.

Resumen

La perdiz pardilla en el Reino Unido: estado de la población, investigación, gestión y perspectivas.— Durante los últimos cincuenta años, los efectivos de la perdiz pardilla (*Perdix perdix*) han descendido catastróficamente en el Reino Unido. Por el contrario, el Programa de Recuento de la Perdiz de la GWCT (Fundación para la Conservación de la Caza y la Fauna Salvaje) presenta un 81% de aumento desde el año 2000 en los lugares del Reino Unido en que interviene. En este estudio exploramos los antecedentes y las razones de estos resultados tan contradictorios. Las investigaciones de la GWCT han tenido como consecuencias recomendaciones científicamente demostradas para la mejora del medio ambiente de la perdiz en el Reino Unido, desde los requerimientos del hábitat hasta la densidad de depredadores. Dichas investigaciones han influido en la política gubernamental del Reino Unido, que ahora incluye uno de los proyectos de Europa más orientadas hacia la conservación y más flexible en cuanto a hábitat y agricultura, lo que permite a los gestores del territorio recuperar gran parte del hábitat costero de la perdiz pardilla. Actualmente, los proyectos sobre agricultura y medio ambiente no abarcan la selección de los depredadores más comunes, de manera que son principalmente los cotos de caza con guardabosques privados los que han aplicado todas las medidas de gestión. El futuro de la perdiz pardilla en el Reino Unido reside en el equilibrio entre la economía de la producción agrícola, las medidas agro–medioambientales, y la caza.

Palabras clave: Perdiz pardilla, *Perdix perdix*, Causas de disminución, Gestión para la recuperación, Medidas agro–medioambientales.

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Introduction

The grey partridge *Perdix perdix* is a traditional gamebird species across the whole of Europe. In the UK, the grey partridge was the most important driven game bird on lowland estates up to the Second World War, as evidenced by records of numbers shot (Tapper, 1992). From then onwards, the numbers shot dropped rapidly. The British Trust for Ornithology (BTO) publishes a national breeding population index starting in 1966, which shows that the fall in numbers shot was matched by a prolonged drop in the number of breeding pairs, down 86% by 2000 (Crick et al., 2004). Since 2000, the BTO population index has dropped by a further 40% by 2010 (Aebischer & Ewald, 2010 updated).

In parallel, the Game and Wildlife Conservation Trust (GWCT) has been monitoring the abundance and breeding success of grey partridges across the UK through its Partridge Count Scheme (PCS) (Ewald et al., 2009). This too generates an index of the grey partridge breeding population (fig. 1). Between 1966 and 2000, this index shows a similar decline to the BTO index. However, there is a dramatic difference thereafter, because the PCS index increases by 81% between 2000 and 2010.

This paper explores the reasons for this conflicting picture. It reviews the research that has been carried out to understand the causes of the grey partridge decline and to counteract them, the policy background against which the grey partridge story unfolds, and the efforts that have been put in place to restore numbers of the grey partridge in the UK.

Research

Concerns generated by the decline in grey partridge bags prompted a long–term research programme by GWCT starting in the late 1960s (Potts, 1986). Three main causes of decline were identified, linked to agricultural intensification: (1) destruction of nesting habitat, resulting in poor holding capacity; (2) pesticide–induced reduction in chick–food insects in crops, leading to poor chick survival; and (3) increased predation pressure on remaining habitat, leading to adult and nest losses. We present below the evidence linking these factors to the decline, the experimental work that confirmed their importance, and the research carried out to find solutions.

Nesting habitat

Grey partridges nest in rank grassy cover that conceals the nest from predators. Radio–tracking found that two–thirds of females hide their nest in linear boundary features such as the base of hedgerows, grassy banks or uncut field margins, the rest being mainly in autumn–sown cereals (Aebischer et al., 1994). Since the Second World War, the drive for greater agricultural efficiency has led to field enlargement through the removal of field boundaries. One consequence has been a reduction in the length of hedgerows by 40% over the last 60 years (Brown, 1992; Anon., 2009), with a consequent reduction in nesting cover; Potts (1980) estimated that 24% of post–war nesting cover had been lost by 1978. In addition, annual mowing or treatment with herbicides to prevent crop invasion by weeds (Boatman, 1992) further reduced nesting cover quality. Both Potts (1980) and Rands (1986) demonstrated a correlative link between the availability of suitable nesting cover and spring density of grey partridges.

Restoring nesting habitat requires re–establishing areas of rank tussocky grass and other concealing vegetation, most simply as strips around field margins. Large fields can be subdivided by using non–permanent grass strips ('Beetle Banks'; Thomas et al., 1991) sown with tussock–forming grasses, which do not impede agricultural operations. Cutting management must ensure that tall dead grass is always present early in the season to provide nest cover (Aebischer, 1997).

Chick–food availability

Grey partridge chick survival is a key determinant of population change (Aebischer & Ewald, 2004). Its importance is demonstrated by figure 2, whereby average annual chick survival (from the PCS) explains over two–thirds of variation in the year–on–year change in the BTO population index. Accordingly, much research effort has been expended in understanding this crucial phase of the grey partridge life cycle.

Grey partridge parents lead their chicks away from the nest after hatching. The chicks feed themselves and during the first two weeks their diet is made up overwhelmingly of insects (Ford et al., 1938; Potts, 1980, 1986). Nutrition experiments in 1964–65 showed that the high protein intake from insects was crucial for feather development and survival (Southwood & Cross, 2002). In the field, radio–tracking of females with broods showed that the chicks spent 97% of their time in cereal crops (Green, 1984), which must therefore have been their primary source of food. In corroboration, there was a strong relationship between chick survival and chick–food abundance in cereals at the farm scale (fig. 3).

The abundance and availability of chick–food insects in cereal crops has changed dramatically with the advent of pesticides. Herbicides were first, introduced in the 1950s to combat weeds in crops, and by 1965 nearly all cereal fields were treated with them (Potts, 1980). This greatly reduced the abundance of arable weeds that acted as host plants for insects, and the abundance of chick–food insects halved as a result (table 1). Then, during the 1970s, insecticide use became widespread. Vickerman & Sunderland (1977) showed that insecticide applied in summer could reduce chick–food insects by over 90%. At the farm level, grey partridge chick survival was a third lower on areas of extensive insecticide use than on areas with little or no insecticide use (Aebischer & Potts, 1998).

How then to restore insect abundance in cereals in a way compatible with modern farming? One answer was 'Conservation Headlands', whereby the outer six metres of the cereal crop ('headland') were treated selectively to encourage a weedy understorey accessible to partridge chicks while eliminating agriculturally damaging

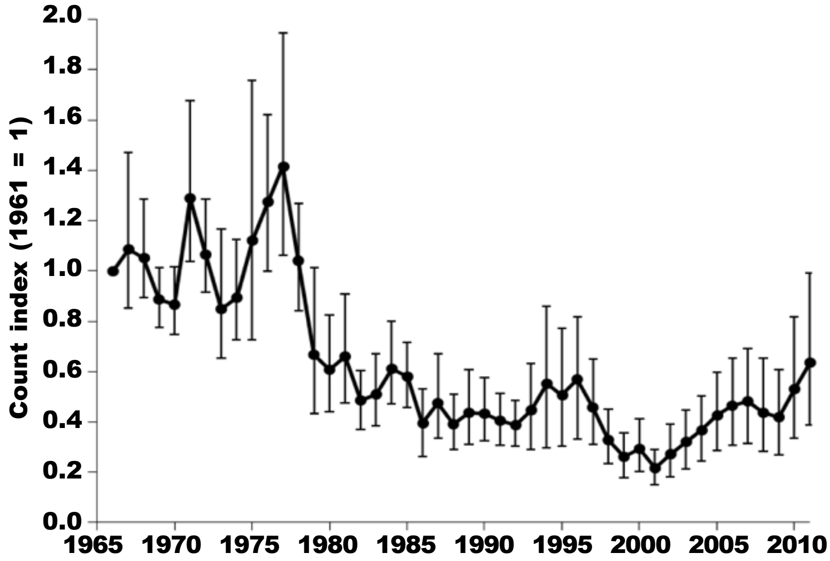

Fig. 1. Annual index (with 95% confidence limits) of grey partridge pairs recorded on sites contributing to the GWCT's Partridge Count Scheme 1961–2011, relative to the start year (1961 = 1). Updated from Aebischer & Ewald (2010).

Fig. 1. Índice anual (con límites de confianza del 95%) de las parejas de perdiz pardilla registradas en lugares que contribuyeron al Programa de Recuento de la Perdiz del GWCT de 1961 a 2011, en relación con el año de inicio (1961 = 1). Actualizado de Aebischer & Ewald (2010)

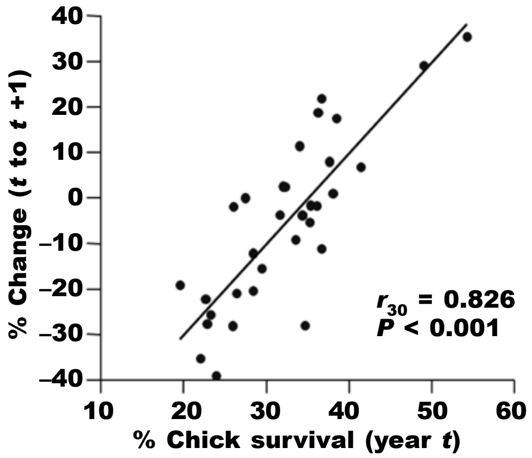

Fig. 2. Annual changes in the BTO national index of grey partridge abundance correlate closely with annual chick survival rates from the GWCT's Partridge Count Scheme (Aebischer & Ewald, 2004).

Fig. 2. Cambios anuales en el índice nacional BTO de abundancia de perdiz pardilla, que está estrechamente correlacionada con las tasas anuales de supervivencia de crías del Programa de Recuento de la Perdiz del GWCT (Aebischer & Ewald, 2004).

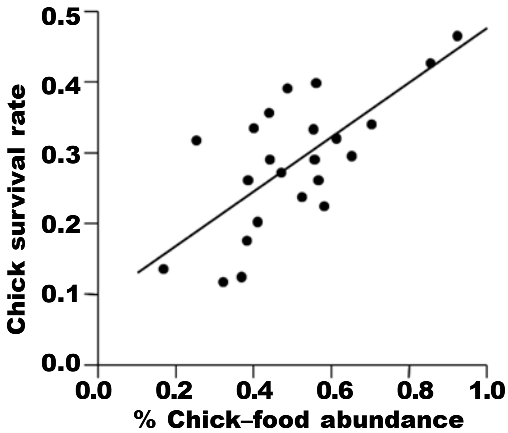

Fig. 3. Annual grey partridge chick survival per farm is closely related to the average density of chick–food insects sampled in cereal crops on the same farm, for five farms in Sussex at the farm scale 1970–1992 (Aebischer, 1997).

Fig. 3. La supervivencia anual de crías de perdiz pardilla por granja está estrechamente relacionada con la densidad promedio de insectos del alimento para crías provinente de los cultivos de cereales de la misma granja, para cinco granjas en Sussex a escala de la granja 1970–1992 (Aebischer, 1997).

Table 1. Reduction in the abundance of grey partridge chick–food insects in cereal crops wrought by herbicide use (adapted from Potts, 1986): R. Reduction; CMPP+S. CMPP + Simazine; (1) Some MCPB; (2) Listed in Ewald & Aebischer (2000).

Tabla 1. Reducción de la cantidad de insectos en el alimento para las crías de perdiz, debido al uso de herbicidas en las cosechas de grano (adaptado de Potts, 1986): R. Reducción; CMPP+S. CMPP + Simazine; (1) Algunos MCPB; (2) Citado en Ewald & Aebischer (2000).

Herbicide	R	Authority
DNOC	25%	Johnson et al., 1955
2,4–D	36%	Ubrizy, 1968
MCPA(1)	47%	Southwood & Cross, 1969
Various	49%	Vickerman & O'Bryan, 1979
CMPP+S	58%	Vickerman, 1974
Various	55%	Sotherton et al., 1985
Various(2)	63%	Potts, 1986
Mean	48%	

weeds (Sotherton, 1991). Overall, chick food was more than twice as abundant in Conservation Headlands than in conventionally treated headlands (table 2). An eight–year experiment, which divided farms in two and randomly allocated Conservation Headlands to one half and conventional management to the other, found that in all years grey partridge chick survival was higher with than without Conservation Headlands (Sotherton et al., 1993). With Conservation Headlands, in five of the eight years it exceeded the 35% level above which, from figure 2, population change would be positive *i.e.* the population would grow. Without them it barely reached that level in even one year (Aebischer, 1997). Hence the linkage between insect restoration and partridge recovery was established.

Another method of providing chick food is by deliberately growing insect–rich brood–rearing crop mixtures (Aebischer, 1997). This option is attractive to farmers and landowners interested in shooting, as it also has benefits for other game birds. Refinements of this approach have led to growing parallel strips of cover that satisfy the year–round requirements of grey partridges, for instance by placing, a cereal mixture (brood–rearing) with first–year kale (winter cover) and quinoa (winter food), or with first–year kale and second–year kale (winter food) next to nesting cover.

Predation pressure

Because they nest on the ground, incubating female grey partridges and their eggs are vulnerable to mammalian and avian predators. Traditionally, one of the roles of the private gamekeepers employed by UK shooting estates was to kill predators as part of gamebird husbandry. Since the Second World War, the number of gamekeepers involved in active predation control has fallen and the number now is merely a fifth of what is used to be (Tapper, 1992). Conversely, the BTO population indices for crows *Corvus corone* and magpies *Pica pica* have more than doubled over the last 40 years (Baillie et al., 2010), and a tripling of the national fox *Vulpes vulpes* bag (Aebischer et al., 2011) indicates a similar increase in fox numbers. The predation pressure on grey partridges is therefore greater now than it was in the past.

The main issue is whether predation plays a role in population regulation rather than just removing a 'doomed surplus' sensu Errington (1956). A seven–year cross–over experiment conducted on two sites by GWCT showed conclusively that legal control of foxes, mustelids *Mustela* spp., brown rats *Rattus norvegicus*, crows and magpies not only increased the production of young grey partridges but also their spring pair density relative to no control (Tapper et al., 1996). Over three years, the effect resulted in a 3.5–fold difference in post–breeding numbers, and in a 2.6–fold difference in spring pair density. It is clear that high predation pressure had a considerable impact on grey partridge breeding density.

At the same time, the study demonstrates that it was not necessary to remove all predators throughout the year, but that the selective removal of common predators specifically during the nesting period was enough for the partridge population to respond. This perhaps makes it more acceptable and feasible as a management tool.

Policy

The research described above did not take place in isolation, but against the background of major changes in both agricultural and environmental policy. To put the research in context, we review below how policy has changed in these two areas.

Arable agriculture

Since the UK joined the European Economic Community (EEC) in 1973, its agricultural policy has been closely linked to that of the EEC and to that of its successor, the European Union (EU). The main events affecting agricultural policy are detailed in table 3. At the EU level, the biggest changes are the implementation of production controls, which in the case of arable agriculture took the form of first voluntary then mandatory set–aside, the greening of the Common Agricultural Policy via Environmentally Sensitive Areas then agri–environment measures, the decoupling of production from agricultural subsidies, and latterly the abolition of mandatory set–aside quotas.

At the UK level, these changes translated directly into national policy – introduction of voluntary then mandatory set–aside, designation of Environmentally Sensitive Areas, introduction of Countryside Stewardship. But the UK government was also sensitive to the evidence of widespread declines in farmland birds (Fuller et al., 1995), and scarred by the huge cost of dealing with foot–and–mouth disease in 2001, when seven million animals were slaughtered. It therefore incorporated arable options into its agri–environment policies and commissioned a report to consider the future of farming and food (Curry, 2002). Its recommendations, combined with the opportunity offered under the EU Mid–term Review, led in 2005 to the almost total decoupling of subsidies from production with the Single Farm Payment scheme, tying subsidies instead to good agricultural practice and wildlife–friendly land management. At a stroke the economic incentive on UK farms changed completely. Defra statistics show that production subsidies dropped from £2,168 million in 2004 to £212 million in 2005, while uncoupled subsidies (Single Farm Payments) rose from £778 million to £2,819 million. Subsidies for set–aside, which had counted as production subsidies, were included with the Single Farm Payment under the new system.

Table 2. Increase in the abundance of grey partridge chick–food insects in cereals through the use of Conservation Headlands (Sotherton et al., 1993): Cvs. Conventional sprayed; Cnh. Conservation headland; Chn. Change (%).

Tabla 2. Aumento de insectos en el alimento a base de cereales para las crías de perdiz debido a la política de "Conservation Headlands" (Sotherton et al., 1993): Cvs. Rociado convencional; Cnh. Conservación Headlands; Chn. Cambio (%).

	Densities/0.5 m^2		
Chick food	Cvs	Cnh	Chn
Sawfly larvae & caterpillars	2.1	2.6	+24%
Leaf beetles	4.0	9.9	+148%
Plant bugs	10.4	36.0	+246%
All chick–food insects	29.9	68.6	+129%

Table 3. Chronological sequence of major policy decisions affecting agriculture at the level of the European Union (EU) and of the United Kingdom (UK) since 1962.

Tabla 3. Secuencia cronológica de las principales decisiones de gestión que afectan a la agricultura de toda la Unión Europea (EU) y del Reino Unido (UK) desde 1962.

EU	UK	Policy
1962		EEC introduces Common Agricultural Policy
	1973	UK joins EEC
1984		EU sets quota on dairy production
1985		EU introduces special aid for Environmentally Sensitive Areas (ESAs)
	1987	UK designates ESAs (first tranche)
1988		EU introduces voluntary set–aside
	1988	UK introduces voluntary set–aside
	1991	UK launches Countryside Stewardship
1992		EU MacSharry reforms: mandatory set–aside, agri–environment measures
	1992	UK introduces mandatory set–aside
	1993	UK designates ESAs (second tranche)
	1998	UK launches Arable Stewardship Pilot
1999		EU Agenda 2000: market subsidies reduced in favour of direct payments to farmers
	2002	UK adds arable options to Countryside Stewardship
2003		EU Mid–term Review: subsidies decoupled from production (single–farm payment)
	2005	UK launches Environmental Stewardship (Entry Level, Higher Level)
2008		EU CAP Health Check: set–aside abolished
	2008	UK abolishes set–aside
	2009	UK launches Campaign for the Farmed Environment

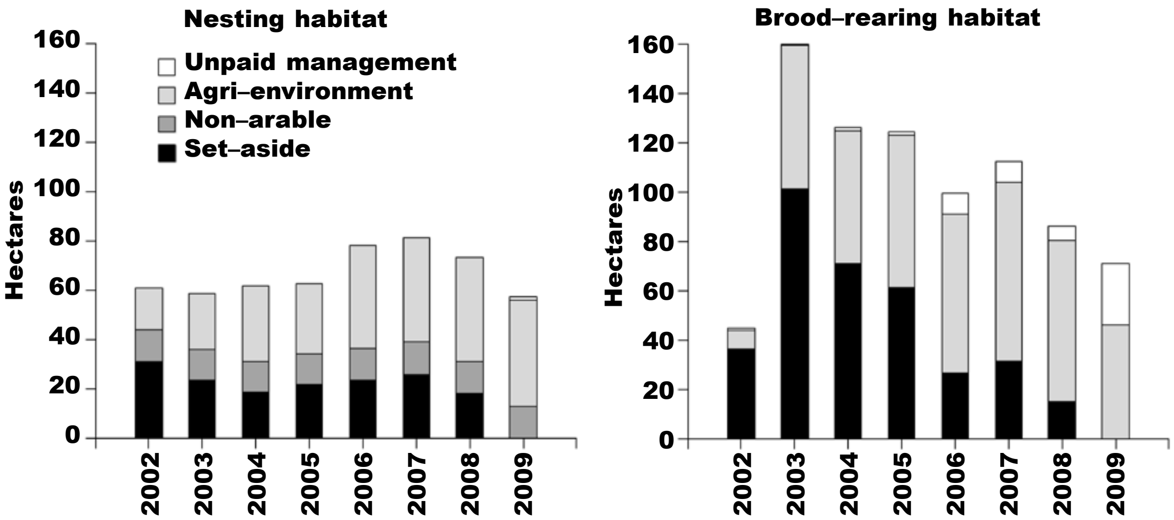

Fig. 4. Breakdown of the amounts of nesting and brood–rearing habitats on the demonstration areas of the GWCT's Grey Partridge Demonstration Project according to land–cover type, from 2002 to 2009.

Fig. 4. Desglose de la cantidad de hábitats de nidificación y de cría en las áreas de prueba del Proyecto de Demostración de la perdiz pardilla de la GWCT, según el tipo de cubierta del suelo, desde 2002 a 2009.

At the same time, the UK government introduced a new Environmental Stewardship Scheme, which replaced previous agri–environment schemes while incorporating and extending their wildlife–sympathetic elements (Anon., 2005). The scheme is in two parts, the Entry Level Scheme open to all farmers, and the competitive Higher Level Scheme that offers more intensive targeted habitat management. The Environmental Stewardship Scheme comprises 36 management options related to farmland (41 including archaeological ones). Of these, six are directly due to GWCT research and a further 23 have been influenced by it. In its current form, it is one of the most conservation–minded and flexible agri–environment schemes in Europe. With regard to grey partridge, it can defray the cost of creating, for example, nesting cover in the form of grass buffer strips and Beetle Banks, and insect–rich brood–rearing habitat in the form of unharvested cereal strips or Conservation Headlands.

Environment and biodiversity

In the UK, the grey partridge has been red–listed since 1990 (Batten et al., 1990) and has also been classified as a Species of Unfavourable Conservation Status by the EU (Tucker & Heath, 1994). Since signing the Biodiversity Convention at Rio de Janeiro in 1992, the UK Government has committed itself to addressing biodiversity issues through its Biodiversity Action Plan (Anon., 1995), under which the grey partridge is listed as a priority species. The GWCT was nominated as lead partner for the grey partridge in 1996, *i.e.* given the responsibility for taking forward the objectives in the government's species action plan: (1) halt the decline by 2005; (2) ensure the population is above 160,000 pairs by 2020; and (3) maintain, and where possible enhance, the current range. This set the scene for the recovery programme that is described in the next section.

Response

Being Lead Partner brought responsibility but no money. However, the generosity of private individuals and companies enabled the GWCT to launch a major programme for partridge recovery (Aebischer, 2009). Because almost all UK land is privately owned, and sympathetic land management is central to partridge recovery, the cornerstone of the programme was to motivate farmers, landowners and shoot managers to address the causes of decline. The programme was thus primarily education–oriented, and relied on two main strands: (1) encouraging by example through a Grey Partridge Demonstration Project, and (2) developing the PCS network to monitor, inform and advise.

Grey partridge demonstration project

The aim of the project was to establish a demonstration where visitors might see for themselves the management techniques needed for grey partridges, observe the increase in numbers of grey partridges that results from the management, learn about the pitfalls and costs, and be motivated to follow suit (Aebischer, 2009).

The project began in autumn 2001 and ended in spring 2010, on two areas of light arable farmland near Royston, Hertfordshire, some 65 km north of

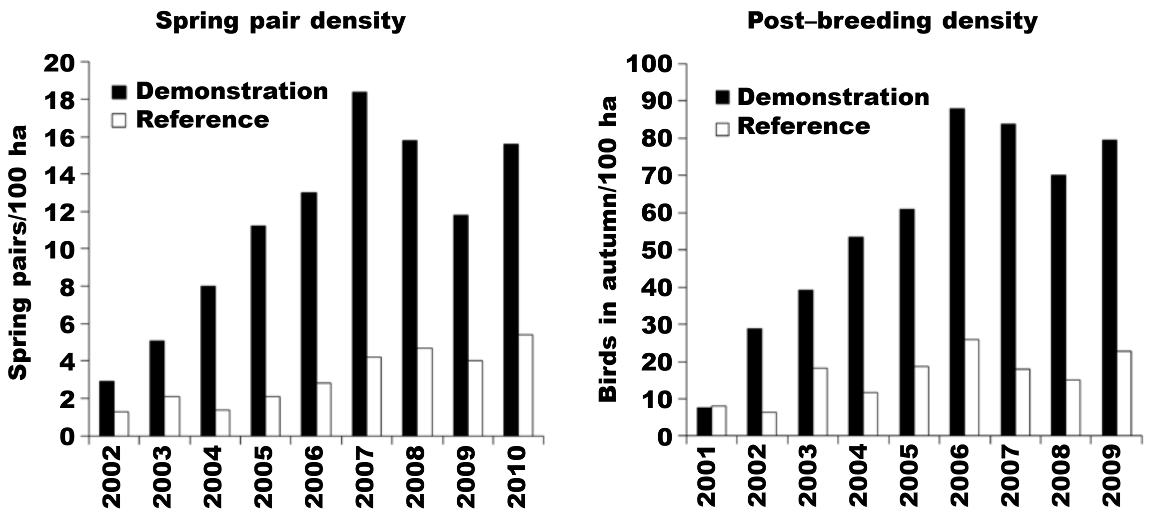

Fig. 5. Changes in grey partridge density in spring and after breeding on the demonstration and reference areas of the GWCT's Grey Partridge Demonstration Project, from autumn 2001 to spring 2010. Management began in 2002.

Fig. 5. Cambios en la densidad de perdiz pardilla en primavera, tras criar en las zonas de prueba y de referencia del Proyecto de Demostración de la perdiz pardilla de la GWC, desde el otoño de 2001 a la primavera de 2010. La gestión comenzó en el 2002.

London. One 996–ha area (six farm holdings) was the demonstration area, while a surrounding area of 1,311 ha (seven holdings) constituted a reference area for comparison. On the demonstration area, the GWCT employed a keeper to address the causes of decline in several ways.

In cooperation with the farmers, he created habitat for nesting and brood–rearing, as well as providing overwinter cover. This relied heavily on set–aside and agri–environment schemes to cover the costs of management (Aebischer & Ewald, 2010). In the first five years, a third of nesting cover was created on non–rotational set–aside strips (sown to grass and not cultivated again) and another third on agri–environment land (fig. 4). Brood–rearing cover was grown as mixed cereal crops half on rotational set–aside and half on agri–environment land. The availability of rotational set–aside fell after the decoupling of production subsidies in 2005, and all set–aside disappeared after the zero quota in 2008. The shortfall was made up by entering land into the new Environmental Stewardship Scheme, although some brood–rearing cover in 2009 was unpaid.

The keeper was also responsible for predator control, particularly during the partridge breeding season. He targeted foxes by night–shooting, small mustelids by tunnel–trapping, rats by poisoning, and corvids by shooting and Larsen–trapping. From September to March, he provided supplementary food in the form of wheat grain in hoppers placed along field margins and cover strips, to counteract any winter food shortage. He also counted and mapped grey partridges on the demonstration and reference areas in spring and autumn, allocating them to one or other area depending on location at the time of counting.

Initially, the density of grey partridge pairs was low, at under 3 pairs/km^2 (fig. 5). It increased during the next five years, then remained around 15 pairs/km^2, representing a sustainable 5–fold increase. The density of grey partridges in the autumn, after breeding, followed a similar pattern (fig. 5). It increased from 8 birds/km^2 before management to around 80 birds/km^2, a ten–fold increase. The ratio of spring to autumn bird numbers was 40–43% –a measure of combined overwinter survival and dispersal. It was lower than the usual value of around 50% (Potts, 1986), suggesting high emigration. Over the same period, increases on the surrounding reference area, from under 2 pairs/km^2 to over 5 pairs/km^2 in the absence of partridge–specific management, are consistent with high emigration from the demonstration area. Thus the data do not support the possibility that the increase observed on the demonstration area was reinforced by birds being attracted into it from the reference area.

The success of the demonstration project offered convincing evidence that the combined package of habitat management, predator control and supplementary feeding was effective.

Partridge count scheme (PCS)

The PCS began in 1933 as a means of monitoring annual density and breeding success of the grey partridge on some 90 'partridge manors'. As part of its national Recovery Programme, the GWCT relaunched the scheme in 1998 under the banner 'Every one counts'. The aim was to increase participation and, beyond monitoring, to use the contact with farmers, landowners and keepers to encourage more and better management (Ewald et al., 2009). In August 2011, there were 1597 sites registered with the PCS from across the UK.

Participants are asked to count the partridges on their land twice a year to enable the GWCT to monitor the number of breeding pairs and their productivity. To help contributors, the GWCT provides a guide to aging and sexing grey partridges in the spring and autumn. In addition, each contributor receives a spring and autumn newsletter, a pair density target based on landscape characteristics, and management feedback on how to achieve it. A series of fact sheets and leaflets address management issues in greater detail, covering the provision of nesting and brood–rearing habitat, methods of controlling predators, best use of agri–environmental subsidies and guidelines on shooting (all publicly available at http://www.gwct.org.uk/partridge).

The management message is reinforced through a network of 16 local Partridge Groups, which hold at least one meeting a year open to all contributors within the area. The meetings offer the opportunity to talk about research, management and agri–environment options in the context of grey partridges, and often involve field visits to demonstrate successful management. Friendly competition is encouraged within each Partridge Group by awarding an annual prize for the best conservation effort. The net result is that PCS contributors are more likely than non–contributors to use agri–environment options that benefit grey partridges, notably Beetle Banks and Conservation Headlands (Ewald et al., 2010).

Where we are now

The grey partridge decline is of such magnitude that it is clearly a conservation priority (Eaton et al., 2009). Extensive research means that the causes of the decline are well understood, counter–measures have been investigated and solutions found that are not only compatible with modern agriculture but also adopted into and funded by UK agri–environmental schemes. In addition, CAP reform has alleviated economic pressure on managing cropped land by decoupling subsidies from production. These factors suggest that the habitat requirements of grey partridges, which involve the cropped as much as the uncropped parts of a farm, are more acceptable to land managers now than in the past. The culling of common predators is not covered by agri–environment schemes, so it is primarily on shooting estates with private gamekeepers that the full package of management measures can be implemented most cost–effectively, thanks to the alternative revenue stream that shooting offers (PACEC, 2006).

How widely applicable are the solutions that have been deployed on the Grey Partridge Demonstration Project at Royston? In the Introduction, we highlighted the contrast between the PCS and the national picture given by the BTO population index, whereby since 2000 spring densities have almost doubled on land managed by PCS contributors, but nearly halved in the wider countryside. This success suggests a wide general applicability, but there are also broad landscape and climatic features that need to be taken into account. For instance, the GWCT's Allerton Project at Loddington Farm in Leicestershire has undertaken habitat management, predator control and supplementary feeding for game in much the same way as at Royston from 1992 to 2001 (Stoate & Leake, 2002). Pheasants *Phasianus colchicus*, hares *Lepus europaeus* and songbirds all increased but grey partridges remained at very low density. This was probably because the landscape was wooded rather than open and the soil was heavy and wet rather than light and well–drained. A mapping exercise based on landscape features found that the optimal areas for grey partridge in the UK were primarily in the east, with suitability declining from east to west (Aebischer, 2009).

Another factor that can prevent the recovery of grey partridges is intensive driven shooting of released red–legged partridges *Alectoris rufa*, because wild grey partridges are inadvertently shot during the drives. However, precautionary measures such as whistles to warn the guns when grey partridges are flushed over them are effective at reducing losses to a tolerable level (Watson et al., 2007). In the PCS, such precautions combined with sympathetic management result in grey partridge population growth even in the presence of high levels of red–legged partridge releasing and shooting (Aebischer & Ewald, 2010).

There is thus no doubt about the effectiveness of the PCS feedback procedures and the face–to–face education carried out through the local Partridge Groups to motivate farmers and landowners into instigating grey partridge conservation measures. Despite the increases on the land they manage, however, PCS participants are too few to make an impact on the national downward trend of the grey partridge. Looking into the future, therefore, the task ahead is clear: the PCS needs to expand and motivate many more land and shoot managers. This is where the GWCT's current efforts lie.

In conclusion, land and shoot managers are key to grey partridge recovery, and education is crucial for raising awareness and encouraging them into sympathetic management. The future fate of the grey partridge rests on the balance between the economics of agricultural production, agri–environment measures and shooting. We believe that the different strands of the GWCT recovery programme form a package that, coupled with the government's agricultural reforms, offers genuine hope for the recovery of the grey partridge in the UK.

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