Review of 2010

A full report of the activities of the Game & Wildlife Conservation Trust

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Review of 2010

Issue 42

A full report of the activities of the Game & Wildlife Conservation Trust (Registered Charity No. 1112023) during the year

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GAME & WILDLIFE CONSERVATION TRUST OBJECTS

- To promote for the public benefit the conservation of game and its associated flora and fauna;
- To conduct research into game and wildlife management (including the use of game animals as a natural resource) and the effects of farming and other land management practices on the environment, and to publish the useful results of such research;
- To advance the education of the public and those managing the countryside in the effects of farming and management of land which is sympathetic to game and other wildlife.
- To conserve game and wildlife for the public benefit including: where it is for the protection of the environment, the conservation or promotion of biological diversity through the provision, conservation, restoration or enhancement of a natural habitat; or the maintenance or recovery of a species in its natural habitat on land or in water and in particular where the natural habitat is situated in the vicinity of a landfill site.

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Game & Wildlife CONSERVATION TRUST

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as at 1 January 2011

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Chairman's report

by Ian Coghill

The Trust is a wonderful organisation. It has the best scientists, the finest and most generous membership and is unsurpassed in finding practical solutions to conservation problems. We spend a far greater proportion of our income on research, solving the problems that face game and wildlife in today's countryside, than any similar organisation. Without the Trust and the people who support it, the British countryside would be poorer and have less biodiversity.

Sometimes what we find may not be what everyone wants to hear. There is a wish in some quarters that everything can be put right by 'protection' and habitat improvement. Increasingly, the evidence grows that habitat adjustment will not necessarily succeed without targeted predator control. What is the point of attracting large numbers of breeding birds if all the eggs and chicks are eaten by crows and foxes?

To help people understand these points, it is essential that the Trust gets better at driving home its key messages. The best science deserves to have the greatest impact. I want to build on the very successful work of my predecessor, Mark Hudson. He led the Trust's Policy and Profile Programme, which culminated in the policy successes highlighted in the policy report on page 7.

One way to increase our influence is to work in partnership with other conservation organisations. Government agencies, nature trusts, the Farming & Wildlife Advisory Group, Linking Environment & Farming, the Salmon & Trout Association, the Woodland Trust and even huge, rich bodies like the National Trust and the RSPB, will all encounter problems that our science and expertise can help them surmount. It is essential for the greater good of Britain's game and wildlife that we work together when we can. We already know that some of our key messages may not be comfortable for some potential partners, but we owe it to the wildlife we seek to conserve to take those very messages to where they are needed most.

All that we have achieved and all that must be done to ensure the continuance of all that we value in the British countryside is thanks to our members. The funds generated by generous individuals, county groups and countless member-based activities are our life blood. No organisation has better members; what we need is more of them. If every one of us got just one of our friends to enrol this year, we would be the fastest growing conservation organisation in the land. That would send a clear message.

Chief Executive's report

by Teresa Dent

In 2010 we asked if Environmental Stewardship schemes had done enough for conservation.
© Peter Thompson/GWCT

Big Society

I hesitate to say this, but I think there may be something in this Big Society idea – at least for conservation. Centrally-governed conservation has not worked well enough. It has not failed, as I am sure we would be in an even worse position were it not for our 24-year history of Environmental Stewardship schemes, but has it done enough? We have had the Environmentally Sensitive Areas Scheme (ESAs) since 1987, Countryside Stewardship since 1991, and the Entry Level and Higher Level Stewardship schemes since 2005. A lot of money has gone and continues to go into them (£399 million in 2010), targets have been hit in terms of participation (70% of England's agricultural area is now in a scheme) and we know the wildlife prescriptions work. After all they are based on proven research carried out by ourselves, among many others. But despite all this, farmland bird numbers continue to decline, as do woodland birds. Rare arable weeds remain just that, and many of our streams and rivers will struggle to meet the requirements of the Water Framework Directive.

It behoves us all to think afresh. Of course conservation needs funding; so it would be mad to throw out the schemes we have. But the schemes have failed to get farmers to 'look up' and focus on the desired outcome – more wildlife. Instead, it's heads down, wading through handbooks, filling in forms and working out which options pay the most money for the least effort.

Perhaps we start with the wrong question. Farmers are asked to join a scheme. They are not asked: "What wildlife would you like on your farm?" Centralist thinkers immediately worry: "But what if the wildlife they choose does not fit with our national and regional conservation targets?" Why should it matter if one farmer wants skylarks, the other grey partridge and another more wild brown trout in his stream? Farmers have long links with their land and the mental image they have of more wildlife is the farm of their childhood.

Big Society is about doing 'more than the bare civic minimum' and we need that in wildlife restoration. It is also about personal motivation and that is why farms and estates that run shoots, or love wild grey partridges, undertake conservation and deliver more songbirds as a result. We know it works – see the report on page 18. It is about taking responsibility for one's own locality – we need farmers to take responsibility for the husbandry of their wildlife, just as they care for their crops and livestock.

Teresa Dent, chief executive of the Trust.
© Hugh Nutt

The shooting fraternity is a Big Society that already delivers a lot for conservation, but could do more. Farmers and landowners manage 75% of our land area; to imagine we can put our wildlife right without the commitment of that Big Society is simply unrealistic.

Our Partridge Count Scheme is a great example of successful Big Society conservation. So is the black grouse conservation on grouse moors in the North Pennines. We have handed the River Monnow restoration to locals – wild brown trout and water voles are now being conserved by the local fishing club. At the Allerton Project in Leicestershire, all the villages in the river catchment have just completed a three-year project to reconnect the local community with their farms, wildlife and food production.

Year of 2010

Adam Smith became our Scottish director at the beginning of the year (replacing the retired Ian McCall). Previously our Scottish head of policy, it was a timely moment to step into the top job as our policy work increased significantly due to the consultation on the Rural Land Use Strategy and the passage of the Wildlife and Natural Environment Bill.

Stephen Tapper, our director of policy and public affairs, retired at the end of 2010 after 37 years with the Trust. It is hard to sum up in a few words the contribution he has made. He was involved in the start of the Sussex Project, ran the Salisbury Plain Predation Experiment, supervised the research department and, more recently, took responsibility for communications and turning our science into policy. He earned the respect of all the conservation NGOs, the Government, civil servants, as well as his colleagues and our members. In fact the Government has not let him retire and he is still involved with the Farm Regulation Task Force and the Minister's Advisory Group on the Natural Environment White Paper.

In December, the first meeting of our new All-Party Parliamentary Game and Wildlife Conservation Group, chaired by Nicholas Soames MP, discussed 'Common sense conservation: managing wildlife better'. Key note speaker, Richard Benyon Minister for Natural Environment & Fisheries, emphasised that Defra was committed to the countryside and to reversing the decline in biodiversity. Reassuringly, he asserted that science needs to be at the heart of policy making on the environment.

It is a great pleasure to welcome Ian Coghill as our new chairman. Ian's involvement with the Trust goes back a long time – he first became a member in June 1992 and a trustee (his first stint of four!) in 1998.

This *Review* summarises a year of very hard work from staff, amazing fundraising efforts by our volunteer county groups, solid support from sponsors, and great generosity from members and donors. 2010 marked 80 years of research, advice and policy supported, funded and put into practice by our own Big Society. I think we should be very proud of what we have achieved.

(L-R) Stephen Tapper, our director of policy and public affairs, who retired in 2010, explaining our research to Caroline Spelman, Secretary of State for Defra. © Morag Walker/GWCT

Our policies

by Adam Smith and Alastair Leake

Restoring the balance

At the end of 2009 we published *Restoring the balance*, a discussion document which focused on the fact that conservation in the UK is not working well enough. We wanted to initiate a debate about how it could be done better and discuss ideas relying less on 'prescription' and 'protection' and more on wildlife management, thereby allowing agri-environment schemes to reward conservation success, clarifying wildlife management regulation and incorporating game conservation skills into mainstream conservation. That debate continued through the year as we focused on these themes with policy makers in England and Scotland.

Scotland

2010 saw two major pieces of policy work taking place, namely The Scottish Government's consultations on its Rural Land Use Strategy and the Wildlife and Natural Environment (Scotland) Bill. Both consultations have occupied a considerable amount of policy effort, and we also arranged field visits for MSPs so that they could experience practical game conservation on the ground. The visit by the Scottish Parliament's Rural Affairs Committee to the Langholm Moor Demonstration Project in September, made snares, traps and heather muirburn a reality for many of them for the first time. In December, MSPs visited a Perthshire estate so that the conservation benefits of pheasant and partridge releasing could be illustrated better.

In addition we undertook work with a wide range of other Scottish bodies. Just one we engaged with was the Police Wildlife Officers and Procurators Fiscal. We provided training to their staff with the aim of minimising interference in legal

Policy and profile in action: Adam Smith, director Scotland and Alasdair Laing, Scottish chairman, speak to the nation on BBC, ITN and Sky following the launch of our Economic Review of Scottish Grouse Moors. *This event generated a great deal of positive media coverage.*
© Katrina Candy/GWCT

Our Scottish Game Fair attracted 60,000 visitors and is the largest public showcase of conservation benefits of wildlife management in Scotland. © GWCT

game management. By working with organisations like this we help others understand the science and our conservation 'philosophy', and help ensure that effective wildlife management becomes part of mainstream thinking in the future.

Our *Economic Review of Scottish Grouse Moors* was launched at the GWCT Scottish Game Fair in July. With results from 90 estates, it provides hard evidence of the socio-economic benefits of grouse moor management; £27 million a year to Gross Domestic Product and over 100 full-time-equivalent jobs. Our Scottish Game Fair is the largest public showcase of conservation benefits of wildlife management in Scotland, and attracts 60,000 visitors. However, this rural landscape is always changing and 2010 also saw us begin to address the next generation of issues; land reform, carbon-based economies and 're-wilding' of upland landscapes.

England

South of the border we had a new Government in Westminster and with it, a new ministerial team at Defra. The Secretary of State wasted little time in setting out the administration's plans by publishing the Natural Environment White Paper discussion document, *The Nature of England*, in July. Billed as the most significant piece of legislation affecting the countryside for 20 years, the Government states that its aim is to be 'the greenest Government ever' and sets a broad scope to the consultation, addressing policies on biodiversity and habitats, the marine environment, water quality and availability, air quality, soils, trees, woodlands, forests, landscapes and recreation.

The Earl of Wessex being shown around our Scottish Game Fair by Hugo Straker, Fair Director. © Angus Forbes/GWCT

Subsequently, the Government Office for Science published its report entitled *The Future of Food and Farming*, recognising the importance of farming in the face of an increased world population and increasingly scarce resources. The new Government also honoured its pledge to reduce regulatory burdens by setting up a 'Better Regulation Taskforce' to improve agricultural efficiency.

We have been at the heart of these discussions as our director of policy and public affairs, Stephen Tapper, sits on both the White Paper Ministerial Advisory Panel and the Regulation Taskforce. These are key positions and Stephen's appointment is recognition of his substantial knowledge and the value of our wealth of scientific research to inform the discussions. Clearly with tight budgets, preserving Environmental Stewardship and pressing for better outcomes will be important, particularly as the European Commission publishes its options for the reform of the Common Agricultural Policy (CAP). The Commission recognises, as do we, the importance of rewarding land managers for delivering public goods, but how this is achieved with a reduced budget, an enlarged EU and demands for greater support for marginal areas certainly represents a challenge.

Securing adequate finance for agri-environment schemes and rural development will be important for game and wildlife management in the post 2013 CAP programme. Without the funds it may become difficult, for instance, to keep Entry Level Stewardship (ELS) open to all qualifying applicants as the existing arrangements

Alastair Leake addressing the members of the Pesticide Forum at the Allerton Project. © Peter Thompson/GWCT

are able to do. But maintaining this pot of money can only be one of a number of objectives we need to seek. We also need to refine the stewardship schemes so that they deliver real improvements to biodiversity and the environment. It is all very well that the ELS scheme is sufficiently rewarding, inspiring and easy to enter into, and that 70% of the land area is now covered, but so long as species fail to recover, then this success can, at best, be considered partial. We need to work with our partners and other stakeholders, including Natural England and Defra, to make Environmental Stewardship more outcome-focused and successful.

There are three ways we can tackle this. Firstly we need farmers and landowners to focus their choice on options which are more complementary and perhaps more species or outcome-orientated. For this, they may need additional help and guidance. Secondly, we need to present 'packages' of options together and to look at adding new elements into those 'packages' that will greatly increase the chances of a desired outcome. This may include a re-appraisal of the points value given to each option. Thirdly, we need a means to encourage farmers to work more closely together within a district, parish, catchment or landscape to co-ordinate their efforts on a broader front.

Securing sufficient agri-environment funding and then improving its effectiveness by inspiring and rewarding those who ultimately will be responsible for their management, is a challenge worthy of our efforts.

Defra employees visiting the Arundel Estate to see Stewardship options on the ground for grey partridges. © Peter Thompson/GWCT

Turning words into birds

by Ian Lindsay

Our research is delivered through our advisory team.
© Peter Thompson/GWCT

As early as the 1960s the phrase "turning words into birds" was used to describe our practical focus on species recovery. The primary focus 50 years ago was on game species, but today it includes a much wider range of declining bird species where the targeted delivery of researched management options is central to their recovery.

2010 saw two new initiatives aimed at strengthening this approach. Early in the year we launched Grouse Technical Services, aimed at bringing a range of management options to the grouse moor. Delivered as a partnership between our research and advisory staff and focusing on disease control and population management, it offers the grouse manager accelerated delivery of a range of techniques, that were, until recently, the preserve of scientists. Almost without precedent, the year saw a second successive highly productive grouse season, owing on many moors to the increased use of medicated grit developed as a result of new research. Still in the uplands, we built on the strong case made by the Upland Predation Experiment at Otterburn. The benefits to upland waders of predator control, are now being shown to a range of conservation bodies concerned with continuing declines in these species.

In the lowlands, the launch of the Rotherfield Demonstration Project (see page 22) seeks to apply the success gained by the Grey Partridge Recovery Project to a mixed-farm environment where soil type, topography and land use are typical of large parts of the UK. Using the basic game management options which delivered successful results within the Allerton Project and at Royston, the project aims to demonstrate the recovery of wild game, woodland and farmland bird populations – the 'art of the possible'.

Generalist wildlife conservation advice is now freely available to farmers and landowners, and unprecedented levels of agri-environment uptake have been achieved. As yet, this has failed to reverse the decline of many species. In contrast, the small number of successful recovery projects (grey partridges, black grouse and others) have been achieved where specific management options have been applied and where sufficient research has been undertaken to identify the factors limiting the productivity of the species. It is here that our unique partnership and expertise within our research and advisory staff, supported by our demonstration projects, can provide successful species recovery. "Words into birds" still seems apt, even 50 years on.

Membership and marketing

by Andrew Gilruth

We are fortunate that, in the economic downturn, our members and supporters remained committed to the organisation's vision and scientific research.

At a time when many charitable organisations are concerned about the future, we held steady with a minimal 2% decline in members, with 21,347 members continuing to fund our important research projects.

Evidence of our members' generosity and interest was apparent right from the beginning of the year, when we received a considerable response to our funding appeal to support our wader research in the Avon Valley. This early success placed us in a powerful position of influence, both inside and outside the game management community.

Later on in the year, our corporate partnerships received a further boost. In addition to valuable support from existing partners: Hiscox, Oval, Mitsubishi and Musto, three new partners lent their support to membership and fundraising. Foxdenton Sloe Gin, Promatic Traps and GunsOnPegs are now supporting our work, bringing benefits to our members and funding for our research. In particular, comprehensive shooting liability insurance provided by GunsOnPegs is highly appreciated by many members.

Although we hope that members will continue recommending the Trust to their friends, other methods of membership recruitment remained strong during the year. This is thanks, in large part, to our recruiters whose hard work and enthusiasm at shows and events is highly effective. Jamie Daniell remains our top recruiter and has been training new recruiters to follow his excellent example. Sheila Roads and Dave Hayward also deserve a special mention for making a particulary strong start in 2010.

Last year also saw the launch of a new legacy campaign. It was an encouraging success, putting us in contact with over 240 potential legacy supporters willing to help secure a sound future for our research.

As well as our concerns for the current financial climate, we also have an eye on the future. Elly Woolston, a highly respected and experienced marketeer, kindly agreed to chair our membership and marketing committee, and to lend her expertise to our new phase of membership recruitment and income growth.

We are extremely grateful for the continued support of our members. © Peter Thompson/GWCT

Report by the Director of Research

by Nick Sotherton

(Above and below) All our scientists have worked extremely hard in the last year.
© Morag Walker/GWCT

This year's *Review* is the usual mixture of reporting on projects nearing completion and those about to get underway.

We report on our new project on wild grey partridges in the uplands of northern England that inhabit the inbye land on the edges of grouse moors. These populations can do very well, especially if the weather encourages good breeding seasons. As the lead partner for the grey partridge Biodiversity Action Plan, we need also to consider these upland populations. Funding from external sources has allowed us to start this work, which is featured on page 42.

We also report on recycling work at the Allerton Project (see page 60). Although not the usual wildlife study featured in our *Reviews*, this work has allowed us to help solve an environmental problem regarding pollution and the safe disposal of waste, avoiding the use of landfill sites. Such very practical, problem-solving research is the hallmark of our output and will be of great benefit to the farming community.

Our monitoring work at the Allerton Project has taken place each year since 1992; 18 years that we have counted game and wildlife, and measured its response to the management changes we have made. In 2011, we aim to reinstate a shoot with feeding and predator control beginning again after a gap of nine years. When game management was withdrawn, wild pheasants did very badly and numbers crashed back down to the levels we found when we first arrived (see page 52). As for songbirds, having increased dramatically in response to game management, numbers declined by 21% during the five years without predator control and by a further 20% in the next four years when winter feeding was also withdrawn.

We also completed our most recent studies on capercaillie. It has long been held that weather was the most important factor influencing breeding success and hence population levels of capercaillie. In poor weather, breeding success was poor, few chicks were reared and few juveniles were recruited into the adult population to make up for adult losses. The impact of predation was never really considered until now. Research by David Baines and his team has shown that the incidence of predator signs has increased in capercaillie woods, particularly for fox and pine marten, but not crows

Our recycling work at the Allerton Project has provided a practical solution for the farming community. © Peter Thompson/GWCT

or raptors (see page 36). Weather will always remain an issue, but is one we can do little about. Foxes, however, can be controlled, and habitat improvements continued in the remaining capercaillie strongholds.

Our annual *Reviews* also allow us to report periodically on our latest analyses of many of our long-term databases. In this *Review* we comment on trends in the five species of corvids (crows and magpies, etc) reported by our members submitting returns to our National Gamebag Census. We look at increases in magpies and crows, and recent recoveries in numbers of rooks, jackdaws and jays (see page 28). It is easy to ignore the fact that some of these generalist, abundant and ubiquitous predators are doing very well, particularly at a time when some of their prey species are not.

Finally, our research team again published over 50 scientific papers this year, including the publication and defence of three PhD theses from research students working in collaboration with us and supervised by our scientists.

Our upland researchers catching and tagging red grouse. © Mel Brown/GWCT

Winter behaviour of woodcock

We caught, ringed, then radio-tracked 42 woodcock. © Andy Gosler

KEY FINDINGS

- Individual woodcock differ in their behaviour, with resident birds typically ranging further than migrants.
- Prolonged frosts caused birds to shift their daytime locations closer to the River Test (movements of less than one kilometre).
- Snow prompted birds to move over 100 kilometres, but a high proportion returned to their previous locations once it thawed.

Andrew Hoodless
Adele Powell

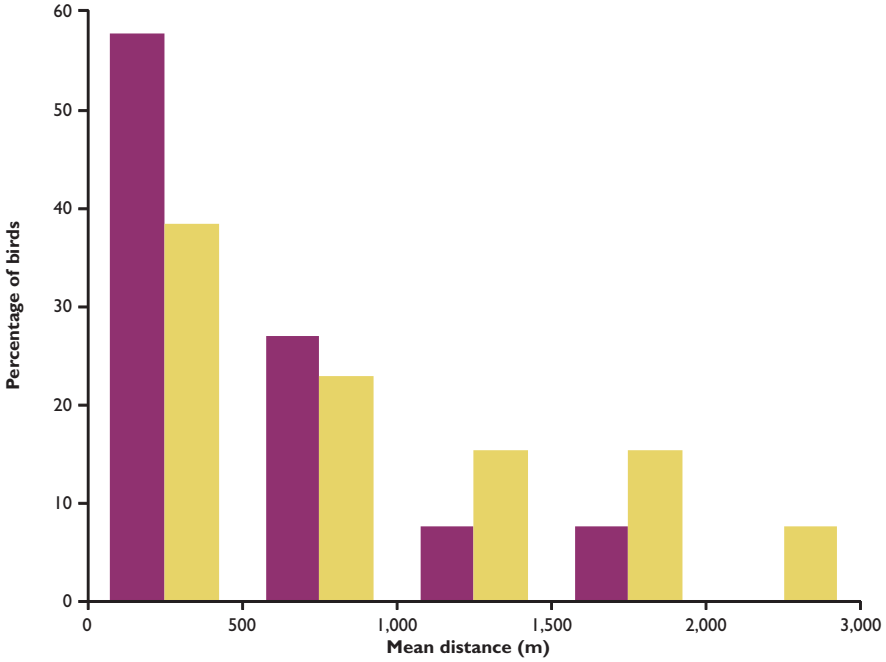
During the recent cold winters, many responsible shooters have been asking for better information about how woodcock respond to freezing conditions and snow, so that they can make informed decisions about shooting policies. A detailed understanding of their foraging behaviour and habitat use under different weather conditions is also essential in assessing the effects of future changes in habitat and climate.

We began a three-year radio-tracking study in autumn 2008, to compare the behaviour of woodcock in relation to their resident/migrant status and age. The study area in north-west Hampshire has resident, breeding woodcock and a range of lowland habitats including mature oak woodland, conifer plantations, shrubby willow-alder copses, winter cereals, stubbles and pastures. Woodcock density is typically about 10-12 birds per 100 hectares in mid-winter.

During 2008/09 and 2009/10, we radio-tracked 42 woodcock, which we determined as residents or migrants using stable-isotope analysis of feather samples. Most birds provided at least 40 radio-locations and we tracked several birds for over four months. All of the birds used several sites by day and night with, on average, four daytime woodland sites and three nocturnal fields in a month. Over the course of the winter,

Figure 1

Distances flown between woodland and fields by radio-tagged resident and migrant woodcock at dawn and dusk



most birds have been more faithful to their nocturnal rather than their daytime sites, but some have not flown to fields every night. Typically, 12% of bird-nights have been spent in woodland, with a few individuals remaining in woodland on a third of nights.

Individual woodcock differ in their behaviour. Our preliminary results suggest that these differences are related to whether the bird is a resident or migrant rather than to the bird's age. Hence, many of the migrant birds restricted their activity to the same woodland stand during the day and the same field at night for many consecutive days, whereas the majority of residents ranged over a relatively large area, visiting several different day and night sites over the same period. Of the flights to fields at dusk, 73% of the average distances travelled by migrants were less than 600 metres, compared with 46% of average distances for residents (see Figure 1). Most of the woodcock sought out pastures, particularly those recently grazed by cattle, but a few regularly frequented stubbles.

We now understand more about woodcock behaviour in cold weather. In mild weather all birds fed for short periods in woodland during the day, but were most active on fields at night and fed intensively for about 40 minutes after arriving on fields at dusk and again for a similar time before departing at dawn. In frosty conditions, woodcock still flew to fields at night, even though on most occasions the ground was frozen too hard to allow them to probe the soil with their bills. Daytime feeding increased and some birds shifted their daytime locations up to a few hundred metres, typically moving closer to the River Test, where there was a greater chance of finding unfrozen ground. After snow, the birds ceased flying to fields at night and after six days, about 80% of the radio-tagged birds in both years had left the study area. All of the birds that left in January 2009 returned within 10 days of the thaw, whereas in 2010 only about 50% returned. One bird travelled 100 kilometres south-west, and was reported shot near the Dorset coast.

Radio-tracking more woodcock during winter 2010/11 should further improve our understanding of their wintering strategies.

ACKNOWLEDGEMENTS

We are grateful to the Countryside Alliance Foundation, *Shooting Times* Woodcock Club, NERC and contributors to the Woodcock Migration Appeal for funding our woodcock studies.

Most woodcock were faithful to their nocturnal rather than their daytime sites. © Chris Heward/GWCT

Do agri-environment schemes help lowland lapwings?

Lapwings are generally regarded as a barometer of the ecological health of farmland.
© Andrew Hoodless/GWCT

KEY FINDINGS

- In many situations, lapwing productivity is too low to maintain stable breeding populations.
- On wet grassland in the Avon Valley, habitat improvements have not yet been able to reverse lapwing declines.
- Preliminary work suggests that there is scope for improving lapwing breeding success on fallow plots. Further information is required to determine the situations and management that deliver sufficient fledged young.

Andrew Hoodless

In the UK Biodiversity Action Plan, the Government aims to reverse the decline of farmland birds in England by 2020. One of these birds is the lapwing, a bird generally regarded as a ecological barometer of the health of farmland. Lapwing numbers have declined by 45% since 1970, resulting in the species being 'red-listed' as a bird of conservation concern. The main mechanism for improving farmland bird populations is the agri-environment schemes. For lapwings this should provide habitat for both nesting and foraging through the Environmental Stewardship (ES) options HK9, HK11 and HK13 on wet grassland and fallow plots under the EF13, HF17 and ES13 options on arable land.

With the lapwing, we know that the cause of the decline is poor breeding success, but the majority of lowland research has been on grassland nature reserves so we know little about lapwing breeding success in the wider countryside. In spite of habitat improvements, it is possible that lapwing numbers are held down on many farms by high predation rates or low food availability for chicks. Fallow plots provide nesting sites but may not provide sufficient food for chicks. They are also among the most expensive 'per hectare payment' arable options within Higher Level Stewardship (eg. HF13 carries a payment of £360 per hectare). If we are to reverse the decline of this bird, it is crucial to know whether the ES options are good enough to produce sufficient fledged young.

During 2010, we ran two research projects looking at lapwing breeding success on farms with ES agreements. The first was the fourth year of a study in the Avon Valley, on wet meadow land (see *Review of 2009*, page 20). Nest survival was higher in 2010 than in previous years at 43% (based on a sample of 77 nests), and average breeding success was 0.72 fledged young per pair. Fledging at least 0.70 young per pair is needed to maintain a stable population and 2010 was the first year during our monitoring that this was achieved in the Avon Valley. There was no statistical difference in lapwing breeding success between fields in ES and those not. We need to examine further the relationship between habitat and predation, partly because

habitat quality seems to vary depending on the length of time fields have been in ES. Currently, the Avon Valley does not support a stable lapwing population because of high rates of predation on nests and young. We estimate that without improved breeding success or immigration of lapwings from elsewhere, the Avon Valley population will decline by 50% in the next five years. We want to try some experiments to help resolve this difficult issue.

The second project looked at lapwing breeding success on arable fallow plots. This pilot study showed that 54% out of 26 plots across Hampshire and Dorset supported at least one pair of breeding lapwings. This compares with a previous national estimate of 40%. However, nest and brood survival rates were very variable. Overall nest survival was 48% (from a sample of 53 nests) and brood survival 38%, resulting, on average, in only 0.49 young fledging per pair. We believe that poor chick survival owing to starvation may be as important a limiting factor as nest predation in this situation. The fallow plots and surrounding arable crops may simply not have enough food in the form of beetles and insect larvae. We hope to work on this for a further two years, investigating the relative importance of food and predation.

ACKNOWLEDGEMENTS

This work was part-funded by Natural England, the Manydown Trust, the Hampshire & IOW Wildlife Trust, the Dorset Wildlife Trust and contributors to the Breeding Waders Appeal. We are grateful to all the landowners and farmers who provided access for these studies.

A lapwing nest on an arable fallow plot.
© Andrew Hoodless/GWCT

Grey partridge management and farmland birds

Grey partridge numbers on farms that contribute to our Partridge Count Scheme are increasing.
© Laurie Campbell

KEY FINDINGS

- Farmland bird numbers were 24% higher on Partridge Count Scheme (PCS) farms compared with farms not in the PCS.
- On average five more bird species per farm were recorded on PCS farms compared with other farms.
- PCS farms were more likely to undertake predator control, supplementary feeding and provide key habitats like wild bird cover and beetle banks than other farms.

Roger Draycott
Helen Connor

Grey partridge numbers on farms that contribute to our Partridge Count Scheme (PCS) are increasing thanks to the management on these farms. This contrasts with the national picture where numbers of partridges and many other farmland birds such as skylarks, yellowhammers and lapwings continue to decline. Here we investigate whether these species are doing any better on farms in our PCS where there may be better habitat, extra food and predator control.

Between 2007 and 2009 we studied 48 farms across Hertfordshire, Bedfordshire, Cambridgeshire and Suffolk. Of these, 24 were in our PCS and each farm was paired with a neighbouring 'control' farm, which was not in the scheme but was otherwise similar. We used line transects to survey birds, based on the BTO Breeding Bird Survey. The transects were two kilometres long and covered ground that was representative of the study site. We surveyed the farms twice between April and June, early in the morning. We also noted habitat features and whether supplementary feeding or predator control was carried out.

We found, on average, 24% more birds on farms in the PCS than on control farms (see Figure 1). This was not just more gamebirds and pigeons; all birds seemed to benefit. Species diversity was higher on PCS farms, with an average of 35 species recorded per farm compared with 30 species per farm on control farms. For declining species (those on the red and amber list), 17% more individuals were recorded on

Figure 1

Bird abundance for all birds, excluding wood pigeon (WP) and rook (RO), and also excluding pheasant, red-legged partridge and grey partridge

PCS farms (n=24)

Control farms (n=24)

*Significance: **P<0.01 ***P<0.001*

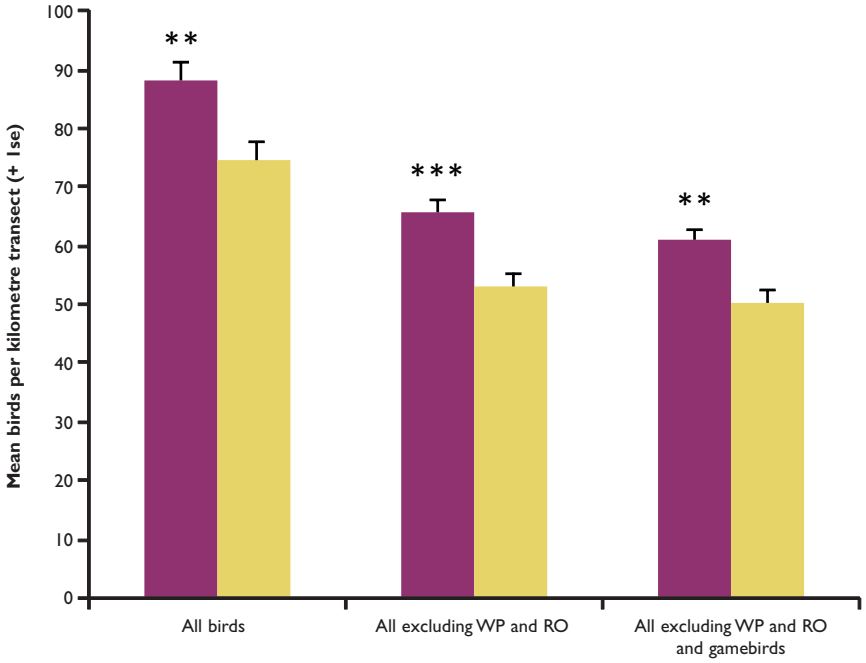


TABLE 1

Percentage of farms within each group (PCS or control) where each habitat type was provided or type of management was undertaken

Habitat/ management feature	PCS farms (n=24) (%)	Control farms (n=24) (%)	Significance value
Fox control	100	33	**
Corvid control	92	21	**
Winter feeding	92	13	**
Spring feeding	88	8	**
Wild bird cover	71	21	**
Winter game cover	100	25	**
Brood-rearing cover	54	17	*
Beetle banks	33	4	**
Tussocky grass margins	100	75	*
Skylark plots	8	4	NS
Over-winter stubble	50	21	NS

** = P<0.05, ** = P<0.01, NS = no significant difference.*

PCS farms, with on average, two more species recorded per farm on PCS farms, than on control farms.

Conservation options designed to help farmland birds are available to all farmers through Environmental Stewardship. These include wild bird cover, grassy nesting strips, beetle banks and insect-rich foraging cover. All these options were more common on farms in the PCS than on neighbouring farms (see Table 1). Farms in the PCS are encouraged to provide extra habitat in winter, spring and summer, as well as supplementary food and predator control to reduce nest predation. Feeding and predator control were also more common on PCS farms. This study has shown that habitat management, supplementary feeding and predator control undertaken to conserve grey partridges, also improves numbers of declining farmland birds.

Conservation options designed to help farmland birds, such as wild bird cover, were more common on farms from the PCS than neighbouring farms. © Roger Draycott/GWCT

Partridge Count Scheme

2010 was a good year for chick production.
© Peter Thompson/GWCT

KEY FINDINGS

- 2010 saw a 39% increase in spring pair density on long-term sites and 11% on recent sites.
- The average young-to-old ratio improved slightly with 2.7 young birds per old bird, compared with 2.5 in 2009.
- The average in all regions remained above the 1.6 ratio needed to ensure a stable population.

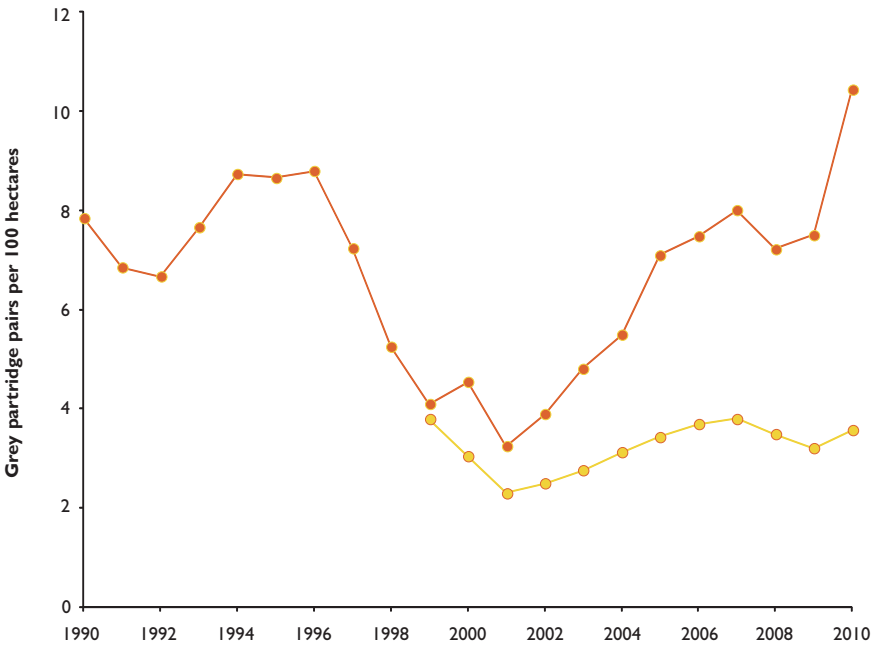
Neville Kingdon
Julie Ewald

The Partridge Count Scheme (PCS) began in 1933 and is our primary means for collecting information about grey partridge populations across the country and, in return, communicating the findings of our research on to land managers taking actions to conserve this species. The scheme is the foundation of our commitment to the grey partridge Biodiversity Action Plan and allows us to demonstrate the principle of "conservation through wise use" to policy makers. The results of this year's spring and autumn grey partridge counts from the PCS are summarised in Table 1.

As a result of difficult counting conditions in the cold spring of 2010, we received 746 counts (down from the 794 received in spring 2009) and 816 last autumn. However, good breeding success in 2009 meant that nearly 8,400 grey partridge pairs were counted over an area of 205,000 hectares (506,000 acres) in spring 2010. The average pair density over all PCS sites increased by 2.5% (see Table 1). Taking account of the sites that did not count partridges each year, our long-term members of the scheme saw an increase in spring pair density of 39%, whereas recent members saw an 11% increase since 2009 (see Figure 1). Compared with recent sites (those which joined the scheme since 1998), long-term contributors count over twice the area (633 versus 285 hectares), have one full-time gamekeeper (compared with a part-time

Figure 1

Trends in annual grey partridge pair density



keeper) and are more likely to implement conservation headlands, beetle banks and over-winter and brood-rearing game covers.

In autumn 2010, 764 counts were returned (down 6% from the 816 of autumn 2009), partly due to a delayed harvest (see Table 1). Most encouraging was the total number of grey partridges counted, up from 41,302 birds in 2009 to 47,324 in autumn 2010. This was an increase of 14.5% despite fewer counts being done. Nationally, autumn densities increased by 11.7% to 22 birds per 100 hectares (up from 19.7 in 2009), despite a 10% decrease in northern England.

The average young-to-old ratio (Y:O) improved slightly (from 2.5 to 2.7 young birds per old bird) on 2009 and this is evident across most regions except eastern England where Y:O fell and in northern and southern England where Y:O has remained stable. Importantly, all regions, except Wales, remained above the 1.6 young to every adult bird needed to ensure a stable population. This modest improvement in Y:O is reflected in the average brood sizes. The national brood size increased to 6.4 young per covey up from 6.1 in 2009, indicating that 2010 was a good year for chick production.

We would like to encourage more of our members and other readers to join this scheme. In particular, we would like more members in Cornwall, Oxfordshire, Warwickshire, Suffolk, Cheshire, Fife, Aberdeenshire and Wales. Every one counts! Please go to www.gwct.org.uk/partridge, or contact our Partridge Count Scheme Co-ordinator on 01425 651066 to learn more.

ACKNOWLEDGEMENTS

This work was kindly supported by a donation from Nicholas Lyle.

TABLE 1

Grey partridge counts

a. Densities of grey partridges pairs in spring 2009 and 2010, from contributors to our Partridge Count Scheme

	Number of sites		*Spring pair density (pairs per 100ha)*		
Region	*2009*	**2010**	*2009*	**2010**	**Change (%)**
South	*140*	113	*1.4*	2.1	33.3%
Eastern	*205*	203	*5.6*	5.4	-3.7%
Midlands	*159*	143	*3.2*	3.6	11.1%
Wales	*1*	1	*2.6*	-	-
Northern	*191*	195	*5.0*	4.4	-13.6%
Scotland	*98*	91	*2.6*	3.1	16.1%
Overall	*794*	**746**	*3.9*	**4.0**	**2.5%**

b. Densities and young-to-old ratios of grey partridges in autumn 2009 and 2010, from contributors to our Partridge Count Scheme

	Number of sites		*Young-to-old ratio*		*Autumn density (birds per 100ha)*		
Region	*2009*	**2010**	*2009*	**2010**	*2009*	**2010**	**Change (%)**
South	*140*	124	*2.3*	2.4	*8.3*	11.4	37.3%
Eastern	*218*	200	*2.8*	2.6	*24.5*	29.3	19.5%
Midlands	*162*	155	*2.4*	2.6	*14.6*	18.1	23.9%
Wales	*1*	1	*0.7*	-	*6.6*	-	-
Northern	*194*	190	*2.9*	2.9	*28.7*	25.7	-10.4%
Scotland	*101*	94	*2.6*	3.2	*16.6*	19.8	20.7%
Overall	*816*	**764**	*2.5*	**2.7**	*19.7*	**22.0**	**11.7%**

The number of sites includes all those who returned information, including zero counts. The young-to-old ratio is calculated from estates where at least one adult grey partridge was counted. The autumn density was calculated from estates that reported the area counted.

The Rotherfield Demonstration Project

Our new demonstration project at Rotherfield aims to increase numbers of wild game together with other wildlife. © Francis Buner/GWCT

KEY FINDINGS

- We describe our new wild game demonstration project in east Hampshire.
- We aim to develop a sustainable and integrated game shoot, in conjunction with grey partridge re-establishment and the recovery of other declining farmland and woodland species.
- Habitat creation and enhancements totalled 174 hectares in 2010 (17% of the total farmland area), with a target area of 219 hectares.

Francis Buner
Nicholas Aebischer
Malcolm Brockless

Our previous Grey Partridge Recovery Project at Royston targeted wild grey partridges at a site where they were still present in low numbers. Within five years we successfully increased the density of breeding pairs by five times. Our new Rotherfield Demonstration Project (2010-2014) aims to increase numbers of wild game in general, together with other wildlife. On the site, grey partridges have gone locally extinct and wild pheasant numbers currently allow only moderate shooting. The land is heavily wooded, and thus sub-optimal for grey partridges, but it is representative of large parts of the UK where wild game, once common, has dwindled away and where recovery will be challenging, but not impossible.

Background

Extending to around 3,600 acres (1,457 hectares), the Rotherfield demonstration area owned by the Scott family, is located in east Hampshire and is characterised by mixed farmland. The area has around 1,000 acres (405 hectares) of well managed ancient semi-natural woodland, 670 acres (271 hectares) of grassland and 1,600 acres (647 hectares) of arable on medium clay loam. The crops in 2010 were winter wheat (280 hectares), winter barley (94 hectares), winter oats (63 hectares), winter oilseed rape (74 hectares), maize (54 hectares), spring wheat (43 hectares) and spring rape (26 hectares). The grass is managed for cattle (389 dairy cows, 148 dairy replacement cows, five bulls and 52 beef cattle). Additionally, around 320 acres (129 hectares) are conservation areas (excluding over-wintered stubbles) managed under Environmental

All grey partridges released on the Rotherfield demonstration area are ringed for monitoring purposes. © Markus Jenny/GWCT

TABLE 1

Existing and minimum target arable habitat enhancements at Rotherfield relevant to wild gamebird recovery (HLS option codes provided in brackets)

Habitat	Total 2010 Existing (hectares)	2012-2014 Minimum target (hectares)
Beetle banks (HF7)	2.3	1.6
Enhanced wild bird seed mix margins (HF12)	9.9	24.1
Conservation headlands with no fertilisers (HF14)	5.0	0
Cultivated arable margins for rare arable weeds (HF20)	2.1	2.8
Pollen and nectar mix (HF4)	1.0	3.3
Total high quality nesting, brood-rearing and escape cover	**20.3**	**31.8**
Grass margins (HE1-3)	25.4	14.5
Floristically-enhanced grass strips (HE10)	0.6	8.6
Total grass margins	**26.0**	**23.1**
Restoration of species-rich semi-natural grassland (HK7)	2.1	2.1
Creation of species-rich semi-natural grassland (HK8)	0.5	8.0
Restoration of grassland for target features (HK16)	0.0	6.9
Creation of grassland for target species (HK17)	0.0	6.1
Maintenance of species rich grassland (HK15)	0.0	2.1
Total species rich grassland	**2.6**	**25.2**
Over-wintered stubbles (HF6)	65.0	70.0
Extended over-wintered stubbles (left until August, HF22)	28.0	30.0
Total stubbles	**93.0**	**100.0**
Uncropped cultivated areas (lapwing plots, HF13)	2.0	2.0
Field corner management (HF1)	24.3	32.8
Arable reversion (HD7)	6.1	4.6
Total	**174.3**	**219.5**

Stewardship, the old Countryside Stewardship Scheme and the Campaign for the Farmed Environment. Table 1 gives an overview of the most important habitat enhancements in 2010, including stubbles beneficial for game and other wildlife in winter and spring.

The estate's game books date back to the 1840s and give a fascinating insight into the history of game shooting in that part of the world (see Table 2 overleaf). In summary, these show how numerous grey partridges were up to the 1900s and how they steadily declined until their extinction in the 1990s. Once extinct, the estate briefly switched to the release of red-legged partridges. At the same time, pheasants were released to increase the shooting bag. However, in 2004 the estate decided to stop releasing altogether and to convert to a wild bird shoot, based on four to six days per season. This abrupt change resulted in much reduced bags owing to low stock, low breeding success, difficulty in driving and, indeed, shooting the few wild birds. Since 2004, grey partridges have been restocked, which has resulted in only moderate breeding success until now (see Table 3 on page 25).

Habitat improvements

To increase the amount and quality of the habitat we submitted a Higher Level Stewardship (HLS) application with an agreement expected in April 2012. Until then we will increase the quality of habitat according to the possibilities within the current Entry Level Stewardship scheme agreement. Table 1 shows the most beneficial habitat improvements for gamebird recovery that are already in place, in comparison with the targets planned for the next five years. Particular emphasis has been put on high-quality nesting, brood-rearing and escape cover, which we aim to increase from 20.3 hectares to 31.8 hectares (78.6 acres), and species-rich grassland from 2.6 hectares

We aim to increase high-quality nesting, brood-rearing and escape cover. © Francis Buner/GWCT

to 25.2 hectares (62.3 acres). The woodland, which is already well managed, will have additional woodland edge features and wider rides. Furthermore, from 2011 the farm will reduce block cropping.

Game recovery strategy

The project area is split into two halves with the Trust side managed by our gamekeeper, Malcolm Brockless, and the Rotherfield side managed by the estate's gamekeeper, Peter Rose. On the Trust side, all of our game management recommendations are being implemented, whereas on the Rotherfield side, the management decisions are being made by the estate.

Keepers who rear gamebirds for shooting often find the timing of focused predator control from March to July difficult. Apart from good habitat, predator control is essential to recover and sustain wild game such as pheasants at shootable numbers. Also when trying to re-establish a stock of grey partridges, red-legged partridges should not be released as some greys may be accidentally shot on red-legged drives. In the short-term this will typically result in low bag numbers. At Rotherfield we aim to demonstrate a possible way out of what seems a difficult situation for most.

At Rotherfield we aim to recover wild pheasants by habitat and predator management only, whereas grey partridge recovery will be based on our *Guidelines for re-establishing grey partridges through releasing*. We anticipate it will take three to five years for game to start thriving, during which time we will be having as many shoot days as the stock will stand and bag numbers as high as we can make them. To help maintain shooting interest during the critical transition period we aim to release a

TABLE 2

Overview of historic game bags at Rotherfield

Decade	Years	Pheasants shot (average/year)	Pheasants reared (average/year)	Grey partridges shot (average/year)	Red-legged partridges shot (average/year)	Red-legged partridges reared (average/year)
1840s	8	140	0	286	0	0
1870s	10	812	no data available	456	0	0
1900s	7	1,609	1,971	167	0	0
1930s	8	1,849	2,987	65	0	0
1950s	10	259	no data available	11	0	0
1980s	10	959	no data available	2	0	0
1990s	6	1,361	4,558	0	279	1,367
2000s	6	60	0	0	0	0

TABLE 3

Grey partridge recovery (all birds were released in either late summer or autumn of the year given)

Year	Birds released	Spring pairs	Autumn adults	Wild broods	Wild young
2003	0	0	0	0	0
2004	77	0	0	0	0
2005	75	8	12	0	0
2006	69	8	7	0	0
2007	75	10	11	0	0
2008	124	4	9	3	4
2009	227	15	16	3	20
2010	113	24	24	2	19

moderate number of around 600 reared cock pheasant poults during late July/early August on the Trust side. This will be done annually until good bag numbers can be achieved with wild game only. We hope that this strategy will appeal to a wide number of practitioners and make partridge recovery from no stock a real possibility.

Monitoring

In 2010 we began a monitoring programme for gamebirds, woodcock, lapwings and songbirds. In spring we found 184 cock and 264 hen pheasants on the whole project area. The autumn counts are difficult owing to the large amount of woodland, but we believe that the 40 wild broods counted, comprising 144 chicks, do not reflect the true breeding success. We hope to find a better method to record breeding success in future years.

There were 24 grey partridge pairs in the spring, all of which were derived from released stock. Breeding success was low with only two broods seen. We recorded 35 pairs of red-legged partridges and 14 broods in autumn.

For woodcock, we surveyed four different woods in May and June, of which two had 20 to 30 sightings of roding males. This equates to five or six individual males per wood, although the extent of overlap between the woods is unknown. No roding was recorded in the other two woods.

We recorded 10 pairs of lapwings, of which nine clutches hatched and five produced one to three fledglings. Along transects measuring 30 kilometres in length in total, we recorded 58 bird species during the breeding season, of which 10 were UK red-listed species: cuckoo, skylark, tree pipit, song thrush, spotted flycatcher, marsh tit, starling, house sparrow, linnet and yellowhammer.

Wild pheasant recovery will be achieved by habitat and predator management only. © Peter Thompson/GWCT

(L-R) Francis Buner is leading the monitoring and Malcolm Brockless, our gamekeeper, is managing the Trust side at Rotherfield. © Markus Jenny

Generic chick food index

Sweet clover alongside a conservation headland will provide lots of insects for farmland bird chicks. © Peter Thompson/GWCT

KEY FINDINGS

- We devised a generic chick-food index for three declining farmland birds: grey partridge, skylark and yellowhammer.
- On our Sussex Study area this index has shown a slight increase in recent years.

Julie Ewald
John Holland
Barbara Smith

The chicks of most farmland birds must eat invertebrates during the first few weeks after hatching to survive. Invertebrate food supplies within crops can be affected by pesticide applications, and this can influence chick survival, rates, recruitment and population size. To help monitor changes in insect food supply for some farmland bird chicks, and working with the Food and Environment Research Agency (FERA), we devised a generic indicator that would include information on grey partridge, skylark and yellowhammer chick diet. Such work then allows others to monitor the effects of pesticides on our farmland wildlife. The impetus behind this project was interest by the Pesticides Forum in designing an indicator of food resources for a range of farmland bird chicks whose declines are related to pesticide use. The Pesticides Forum is a group that brings together independent stakeholders to advise the Government and industry on responsible pesticide use and we are founder members. Our members will be familiar with the concept of the grey partridge Chick Food Index (CFI), which measures the availability of insect food for grey partridge chicks in crops. Similar indices have been constructed for other declining farmland birds, namely corn bunting, skylark and yellowhammer. Declines in the abundance of the invertebrates that make up these various indices have been linked to declines in the abundance of grey partridges particularly, but also corn buntings and yellowhammers. From a regulatory and advisory point of view, it would be helpful to combine these various chick-food indicators into one, more simple, measure of food abundance – helping to gauge resources available for all species of farmland birds where research

Skylark chicks are fed on insects for their first seven to 10 days of life. © David Mason

Yellowhammer, a declining farmland bird with insect-eating chicks.
© Peter Thompson/GWCT

indicates that pesticide use, through indirect effects on food resources, is contributing to population declines.

We compared the published data on diets of these chicks and selected invertebrate groups that represented more than 10% of the chick diet in the published studies. This resulted in the selection of 10 groups of invertebrates grouped by size, morphology and availability to foraging chicks or parents that would need to be monitored to report reliably on the availability of chick food for these species and could be used to calculate a Generic Farmland Bird Chick Food Index (see Table 1). We converted the numbers of these invertebrates to their biomass, using published data on how much each weighed.

We compared this new generic index to past trends in indices for grey partridge, skylark, yellowhammer and corn bunting using data from our Sussex Study. We found that our new generic index correlated significantly with the indices for grey partridge, skylark and yellowhammer, but not with the index for corn bunting. For Sussex, the indications are that chick-food insect levels are increasing in winter wheat for these birds (see Figure 1). This work allows us to expand the applicability of our invertebrate sampling to farmland birds other than grey partridges.

TABLE 1

Invertebrate groups selected to form the basis of a proposed Generic Farmland Bird Chick Food Index

Spiders and harvestmen
Aphids*
Ground and click beetle adults*
Leaf beetle and weevil adults*
Rove and sap beetle adults
Caterpillars of sawflies, butterflies, moths and lacewings*
Ants
Cranefly adults
Cranefly and beetle larvae
March flies

** Groups in the Grey Partridge CFI.*

ACKNOWLEDGEMENTS

This work was funded by the Chemicals Regulation Directorate on behalf of Defra.

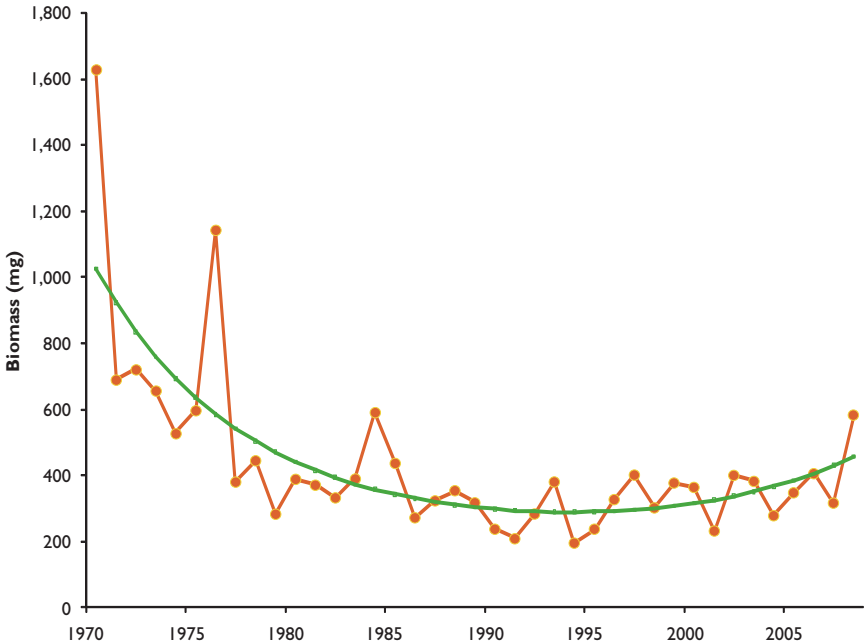
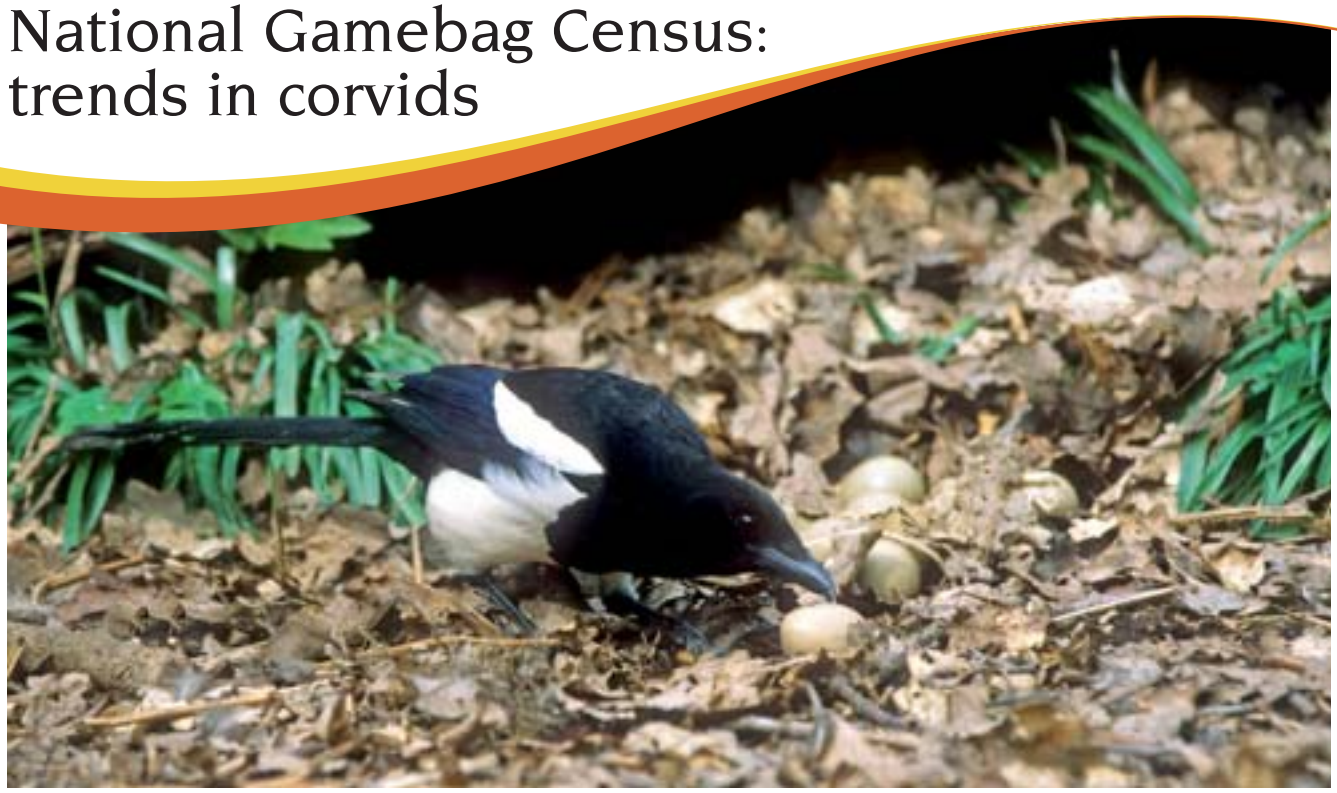


Figure 1

Generic Farmland Bird Index

Catastrophic decline of the chick food index followed by a small recent increase

National Gamebag Census: trends in corvids



Magpies tend to forage for insects in pasture, but will take bird eggs and nestlings too. © David Mason

KEY FINDINGS

- Since 1961, bags of crow and magpie have doubled and tripled respectively, with a stabilisation after 1990 that matches the introduction of the Larsen trap.
- Bags of rook and jackdaw halved during the first 20 years before climbing back to their original levels by 2009.
- Bags of jays fluctuated around the same level for 30 years before declining by a third.
- The patterns observed in the bags are similar to those from the national population monitoring scheme run by the British Trust for Ornithology.

Nicholas Aebischer
Peter Davey

The common British members of the crow family are generalist predators of farmland and woodland. They may be shot and trapped year round by landowners, occupiers and other authorised persons to conserve fauna and flora under an annual general licence, issued under the *Wildlife & Countryside Act (1981)*. We collect information on the numbers culled by mailing questionnaires to some 900 contributors to the National Gamebag Census (NGC) at the end of each season. Participation in the NGC is voluntary, and we are most grateful to all the owners and keepers who send in their returns each year. We have calculated the trends in numbers of magpie, crow, jackdaw, rook and jay culled per unit area since 1961. For each species, analysis is based on sites that have returned bag records for two or more years. The analysis summarises the year-to-year change within sites as an index of change relative to the start year 1961. In the graphs, this means that the first point is always set to a height of 1. A height of 2 indicates a doubling and a height of 0.5, a halving of numbers since 1961.

Magpie (Figure 1)

The magpie is an omnivorous species that is encountered frequently on lowland farmland. It tends to forage for insects in pasture, but will take bird eggs and nestlings too. There was a spectacular five-fold increase in the bag index up to the early 1990s. Since then the index has stabilised, but at a level far in excess of that recorded during the 1960s. The stabilisation may at least in part be due to the deployment of Larsen traps by gamekeepers from 1990 onwards. The explosion in numbers during the 1970s and 1980s parallels the trend in fox bags. Both species have increased significantly in urban and suburban environments, and both species take advantage of the availability of household refuse and bird table offerings. The national population trend estimated by the British Trust for Ornithology also identifies a significant increase in abundance up to 1990 and stabilisation thereafter.

Crow (Figure 2)

The hooded crow and carrion crow are treated here as a single species. The crow is omnivorous and occurs across all habitats. It is a major predator of ground-nesting birds, consuming both eggs and chicks. The crow bag index has increased overall, with a doubling between 1983 and 1995. The national trend estimated by the British Trust for Ornithology also identifies a significant increase in abundance between 1966 and 2004. Crows and magpies are the two main species targeted by Larsen trap users, so it is perhaps no coincidence that the crow index has stabilised in the same way as the magpie index in recent years.

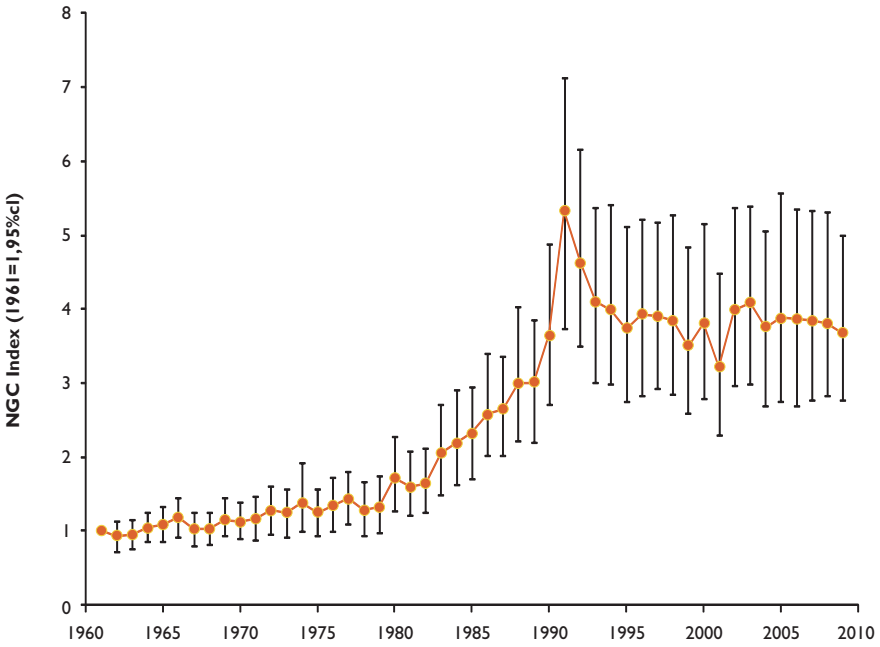


Figure 1

Magpie (1961-2009)

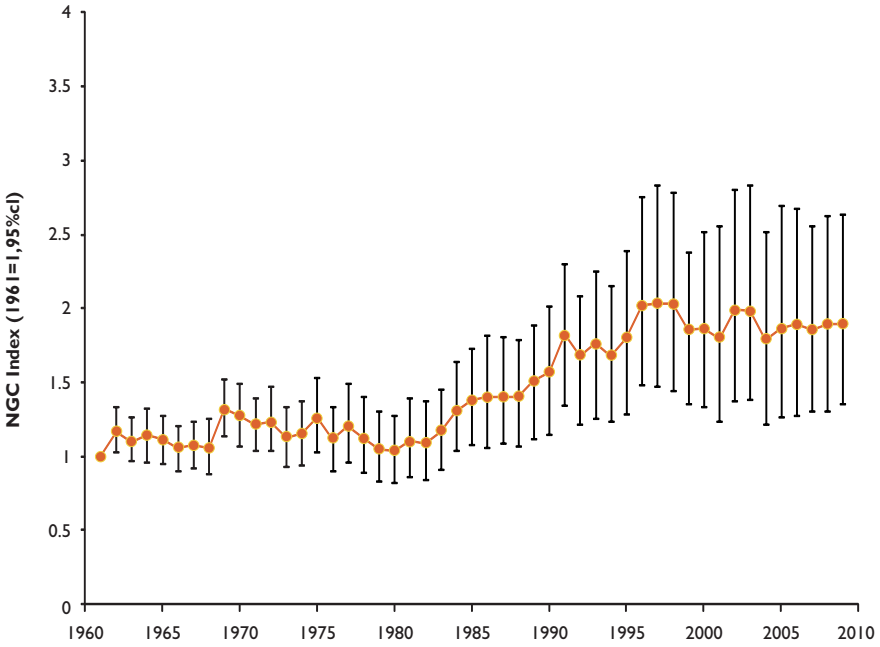


Figure 2

Crow (1961-2009)

Carrion crow plumage is black, but can take on an iridescent blue sheen depending on the light.
© Peter Thompson/GWCT

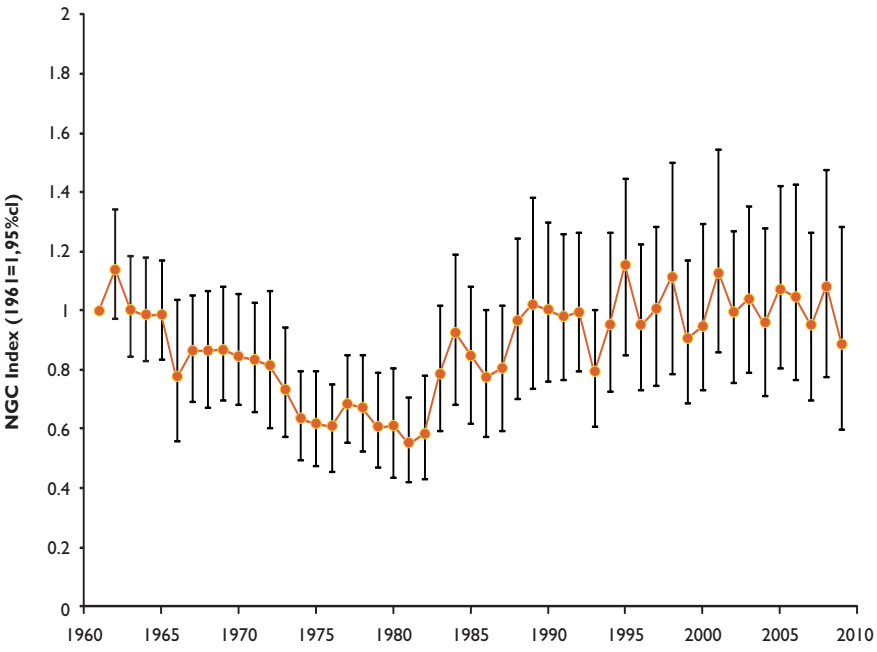
The rook is our most gregarious corvid.
© David Mason

NATIONAL GAMEBAG CENSUS PARTICIPANTS

We are always seeking new participants in our National Gamebag Census. If you manage a shoot and do not already contribute to our scheme, please contact Gillian Gooderham, the National Gamebag Census Co-ordinator, by telephone (01425 651019) or email (ggooderham@gwct.org.uk).

Figure 3

Rook (1961-2009)



The jackdaw is also gregarious and tends to forage in flocks, most frequently in arable situations.
© Peter Thompson/GWCT

Rook (Figure 3)

The rook is our most gregarious corvid, being particularly numerous in arable situations across lowland Britain. It is mainly insectivorous and an efficient destroyer of leatherjackets in grassland, but when foraging in numbers among ripe crops can do considerable damage. The rook will also eat the eggs of ground-nesting birds when it finds them. Rook bag index declined by 45% up to the early 1980s, recovered to its initial level by the mid-1990s, and has remained relatively stable since then. The national trend estimated by the British Trust for Ornithology identifies a 40% increase in abundance between 1976 and 1996. The trend probably reflects changes in food availability, first a reduction through the decline of mixed farming and grass leys to the mid-1980s, followed by an increase owing to set-aside, landfill sites and road casualties.

Jackdaw (Figure 4)

The jackdaw is, like the rook, gregarious and tends to forage in flocks, most frequently in arable situations. The species is mainly insectivorous, but it will take bird eggs too. Following a halving of bag numbers during the 1970s and the 1980s, numbers have

picked up to levels similar to those recorded during the 1960s. The national trend estimated by the British Trust for Ornithology identifies a doubling of abundance between 1975 and 2009. As for the rook, the changes can be explained through loss of food resources from grassland initially, subsequently compensated by alternative sources of food foraged from set-aside, landfill, roadsides and bird tables.

Jay (Figure 5)

The jay is found throughout the UK, but is associated primarily with deciduous woodland, occurring most often within oak-rich forest. During the breeding season, songbird eggs and chicks are well represented in its diet, and it occasionally also takes those of gamebirds. Between 1960 and the late 1980s, the bag index remained fairly stable. It nearly halved over the next 15 years before showing a slight recovery since 2000. The national population trend estimated by the British Trust for Ornithology indicates a fluctuating abundance between 1966 and 2004, with a dip during the 1990s similar to the one observed in the bag. Many jays are shot in winter and may be continental visitors. Winter acorn availability drives the dispersal of continental jays and may influence the numbers resident in the UK as well.

Winter acorn availability drives the dispersal of continental jays, and may influence the numbers resident in the UK. © Laurie Campbell

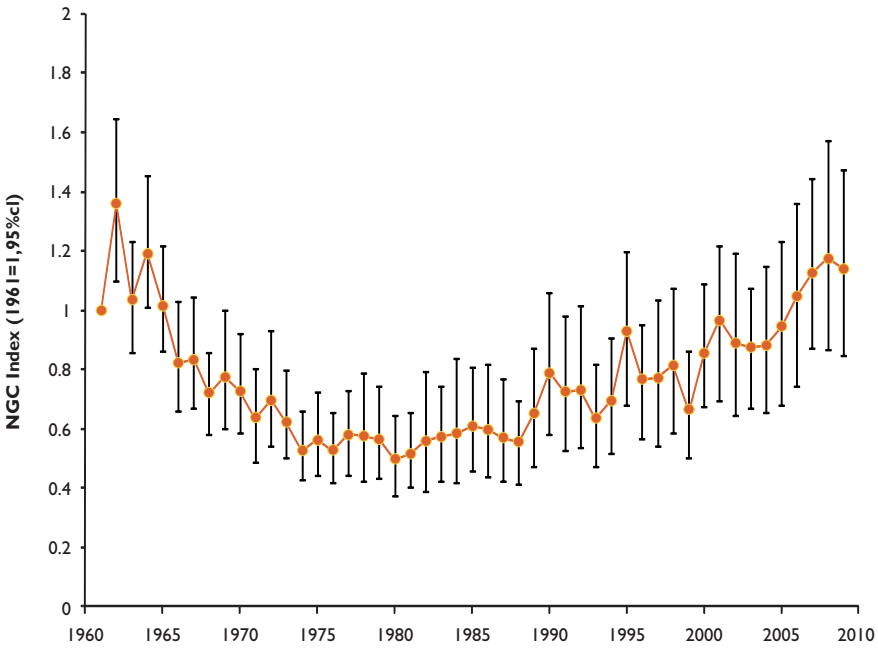


Figure 4

Jackdaw (1961-2009)

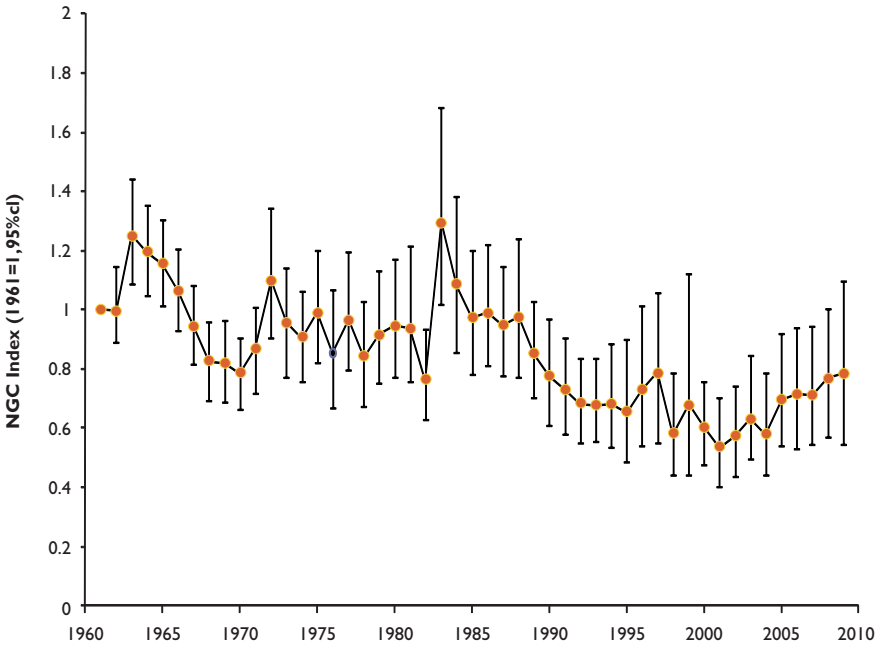


Figure 5

Jay (1961-2009)

Uplands monitoring in 2010

Good breeding success of red grouse was associated with low parasite burdens. © Laurie Campbell

KEY FINDINGS

- Red grouse, black grouse and capercaillie all bred well in 2010.
- High breeding success of red grouse was associated with low parasite burdens as most moors now use new medicated grit.
- Black grouse and capercaillie bred well owing to good post-hatch weather in June. This was much needed by black grouse in northern England, where numbers had dropped alarmingly following the cold, snowy winter.
- We are conducting a questionnaire survey of the fourth grouse species, ptarmigan, to determine current status, recent trends in abundance and distribution.

David Baines
Dave Newborn
David Howarth

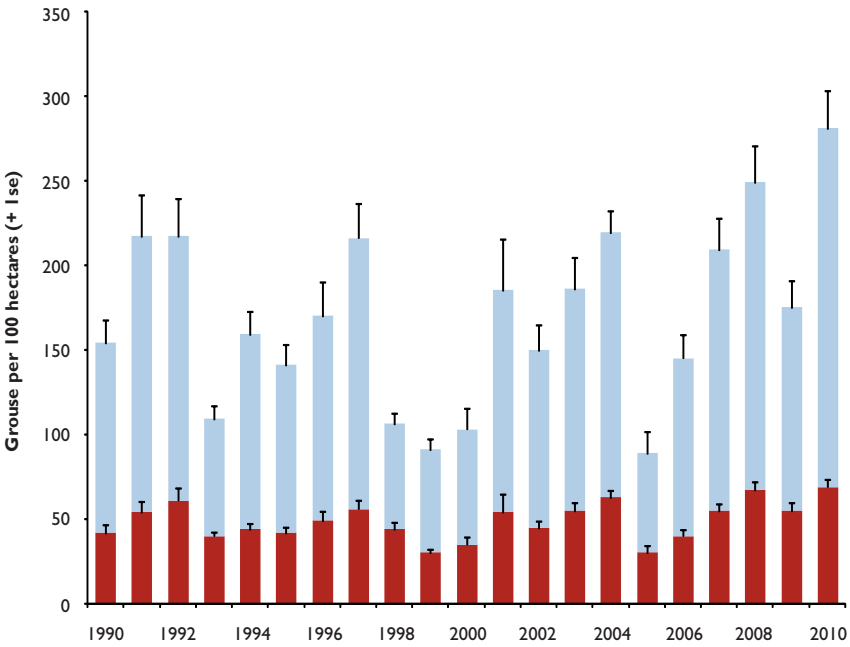
Red grouse in northern England and Scotland

We count red grouse using pointing dogs in late March to mid-April before breeding, and again in July or early August after breeding. The same block of heather moorland, usually of about 100 hectares in total, is counted each time. Overall, we count 45 blocks spread across Britain; 25 in northern England and 20 in Scotland.

Medicated grit was used on three-quarters of our count areas in northern England, compared with fewer than half in both 2007 and 2008. Consequently, we had a very rapid grouse recovery on moors that had previously not used it and had suffered a crash in spring 2009 caused by parasites. Spring densities in 2010 averaged 86 birds per 100 hectares in northern England, an increase of 18% since spring 2009, and 48 per 100 hectares in Scotland, an increase of 60%. These increases were helped by good over-winter survival of red grouse, despite one of the coldest and snowiest winters in recent years, with many birds vacating the moors for several weeks at a time in mid-winter. The high spring densities, coupled with a good breeding season, resulted in the highest mean July grouse density we have ever recorded in England, a grand 281 grouse per 100 hectares (see Figure 1). In Scotland, densities rose by 50% from levels in July 2009 to 129 grouse per 100 hectares (see Figure 2). This represents

Figure 1

Average density of young and adult red grouse in July from sites* across northern England, 1990-2010



** 1990-2000 = 18 sites*
2001 = 8 sites;
2002-2003 = 18 sites;
2004-2010 = 25 sites

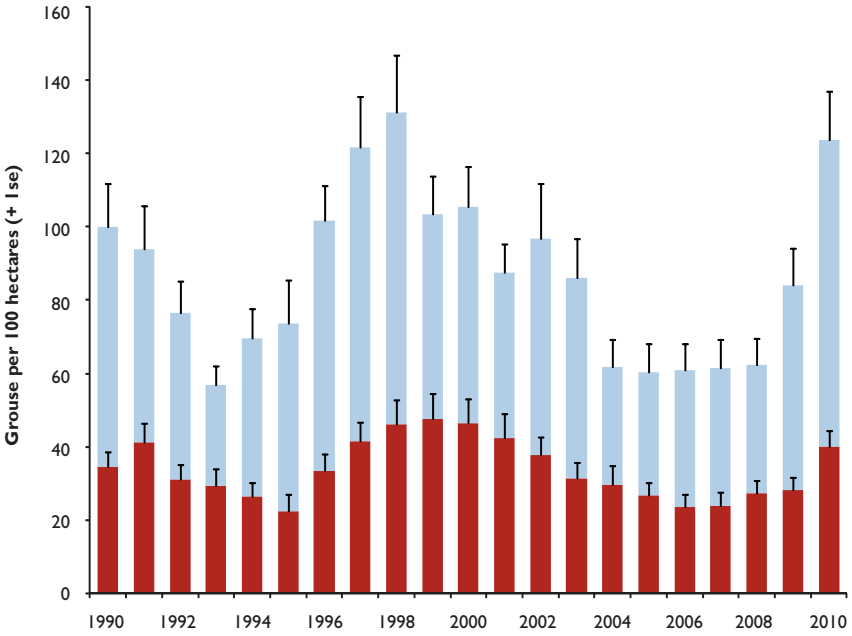


Figure 2

Average density of young and adult red grouse in July from 20 Scottish moors, 1990-2010

Young grouse

Adult grouse

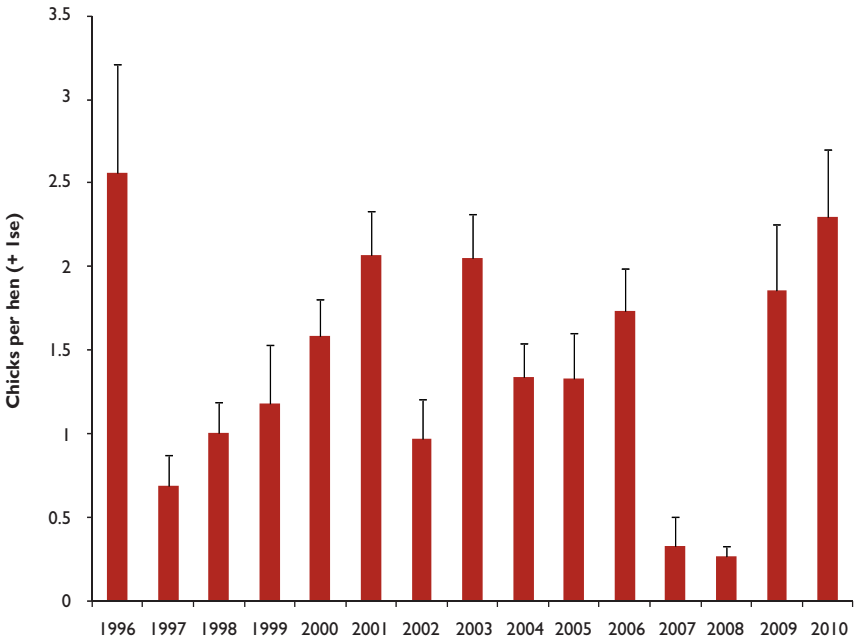
a doubling on 2008 densities and values returning to levels last seen in 1998. Following a 40% increase in breeding success on moors using medicated grit, we had almost double the density of birds on these moors compared with moors where medicated grit was not used.

With continued use of medicated grit across most of our study moors, we predict that we will see a dampening in the four- to five-year cycle in grouse numbers that has typified moors in northern England. We hope that grouse production will be more consistent and shooting bags more readily predictable. Medicated grit has quickly become one of the most important tools available to the grouse manager. However, it must be used sensibly. Legally it must be withdrawn a month before shooting starts and over-zealous use could contribute towards the strongyle worm becoming resistant to the drug. In comparative livestock systems, this can occur within as few as five to 10 years. We need to work alongside disease experts to evaluate collectively how best to reduce the risk of this happening in grouse.

Medicated grit must be used sensibly and, legally, must be withdrawn a month before shooting starts. © Henrietta Appleton/GWCT

Figure 3

Black grouse breeding success in northern England between 1996 and 2010



Black grouse

In northern England, between 1996 and 2007, black grouse numbers recovered from 773 males to 1,207, but since then they have declined to their lowest recorded level, just 495 males in spring 2010. This was caused by two poor breeding years in 2007 and 2008 (see Figure 3) with only 0.33 and 0.26 chicks per hen following a wet June. In the 2009/2010 winter, four months of prolonged snow covered most of the heather, and black grouse numbers dropped by 35%, with the largest lek going from 35 to just three males. This poor over-winter survival is in part caused by the lack of woodland in northern England. Willow and birch can provide a crucial food source in adverse conditions. In Scotland, where woodland is generally more accessible to black grouse, they survived better with increases in numbers in the Scottish Highlands (+25%) and Angus Glens (+13%).

The 2010 summer breeding surveys in the North Pennines found 29 greyhens, 20 with broods and a total of 68 chicks; an average of 2.3 chicks per hen, the best breeding year since 1996 (see Figure 3). This above-average breeding success should lead a recovery. Similar good breeding success was recorded in the Scottish Highlands where 40 greyhens were found, 30 with broods and a total of 98 chicks, giving an average of 2.5 chicks per hen.

Poor over-winter survival of black grouse is in part caused by the lack of woodland which can provide crucial food in adverse conditions. © Laurie Campbell

Capercaillie production in 2010 was at its highest since 1991 and was high for the second year in succession. © Laurie Cambpell

Capercaillie

This is our 20th consecutive year of capercaillie counts, this year funded by Scottish Natural Heritage, and we recorded good breeding success with an average of 1.4 chicks per hen. This was not only the best since 1991 (see Figure 4), but also high for the second year in succession. This was based on sightings of 47 hens, 60% of which had broods. However, owing to declining numbers of birds across many forests, particularly those towards the edge of the range, sampling was restricted to 10 forests where densities were good. Consequently, these breeding data comprised primarily five sites in Strathspey, the core area for capercaillie, and contained 94% of all hens encountered. Outside Strathspey, there were insufficient sightings to generate regional breeding figures. The low densities of hens in these other regions could cause range contraction in some areas, which will decrease the resilience of the species to environmental change. Significant forest habitat improvements have been made throughout much of the range. Although this is helpful, improved breeding success in both 2009 and 2010 was linked to favourable weather conditions in June when chicks hatch.

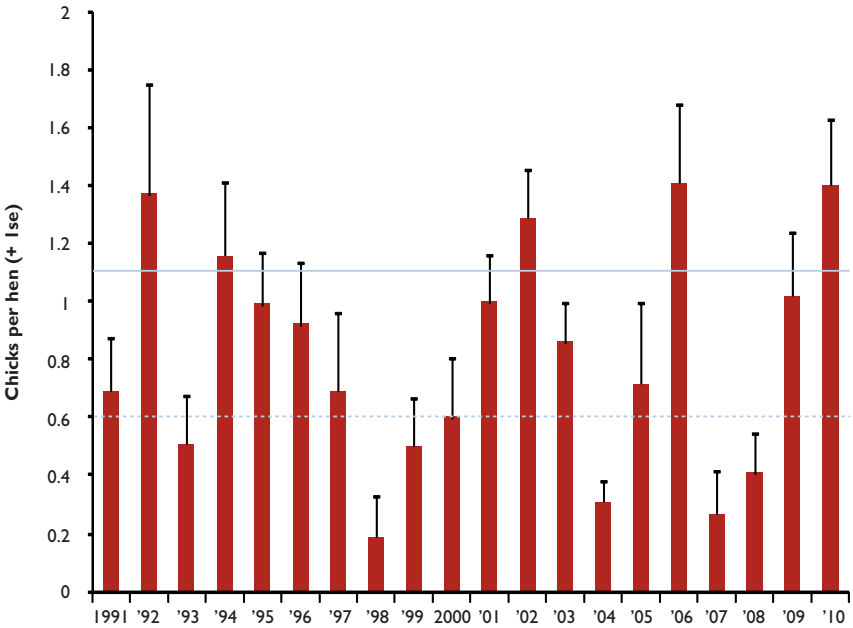


Figure 4

Capercaillie breeding success between 1991 and 2010* sampled from 14-20 forests per year in the Scottish Highlands

Lines indicate levels of productivity required to maintain a stable population under different scenarios (taken from Moss et al. 2000): blue solid line – with fence collision mortality; blue dashed line – without fence collision mortality.

** Please note that only the figures for 2003 to 2009 are directly comparable as capercaillie breeding success was derived from a different subset of forest areas each year before this, and in 2010 the number of forest areas was reduced.*

Ptarmigan

We have no history of work on ptarmigan, but in 2010 we started a new project trying to establish the bird's current status and trends in population abundance and distribution. Funded by the Cairngorms National Park Authority, we have circulated a questionnaire to montane land managers asking for information on ptarmigan sightings and any hunting bag data they may have. We are particularly interested in annual harvesting levels of this bird in relation to estimates of population size, and the possible effects of climate change on parasites, like strongyle worms.

Capercaillie, weather and predators

Capercaillie. © Laurie Campbell

KEY FINDINGS

- Capercaillie continue to decline in Scotland and the majority of birds are now confined to Strathspey.
- A re-survey of predator indices in 11 forests containing capercaillie and last surveyed in 1995 showed 2.7 and 3.7-fold increases respectively in the fox and pine marten abundance indices.
- Martens, a key predator of capercaillie clutches at Abernethy, and carrion crows were negatively correlated with capercaillie breeding success, whereas foxes were associated with declines in adult hens.
- Interactions between martens and weather may be influential in driving the continued decline.

David Baines

Capercaillie numbers have declined in Scotland since the mid-1970s, but a winter survey in 2003-04 suggested that, although capercaillie remain seriously threatened, the population size may have stabilised at about 2,000 birds. The most recent winter survey in 2009 has, however, shown that the decline is continuing, although probably not as steeply as before. Previous studies by us and the Centre for Ecology and Hydrology show that the rapid decline was linked to poor breeding success, which in turn was associated with weather and high numbers of generalist predators that take eggs, chicks and even full-grown birds.

Over the last few years, RSPB scientists have shown that at their Abernethy Forest Reserve pine martens have become more common since the mid-1990s and that of 20 capercaillie nests that they studied, martens predated 33-57% of clutches. It is likely that similar increases in marten abundance have occurred in other forests and this may, in part, account for the continued capercaillie declines. To attempt to determine whether this was the case, we were funded by SNH and RSPB to repeat the 1995 survey of predators within key capercaillie forests and to consider how any changes in predators and weather may have affected capercaillie numbers and breeding success between 1991-2009.

Of the forests surveyed in 1995 we revisited 11, plus a further five where we had surveyed capercaillie broods annually. In each forest, we surveyed 10 kilometres of tracks for mammal scats; with a clear-up round in the second half of April to remove all scats and then four further visits, two in May and two in June. All scats were assigned to marten, fox or other species. We sent approximately 30% of the almost 1,400 scats to Forest Research for DNA analysis to confirm the species identity. In all, 77% had been identified correctly by our two observers. However, of those incorrectly identified, there was a bias towards identifying marten scats as fox. DNA confirmation was used to calculate correction factors of x 0.49 for scats identified in the field as fox and x 1.30 for those identified as marten. No similar data were available for 1995. We surveyed crows and raptors four times in May and June over a five-kilometre length of the same tracks.

TABLE 1

Predator indices, (means ± 1se) from 11 forests used by breeding capercaillie surveyed in both 1995 and 2009. Mammal indices are scats per 10 km per day x 100 and exclude scats from the clear-up round. Bird indices are sightings per 10 km per visit

	1995		2009	
Predator	**Forests with sign**	**Abundance index**	**Forests with sign**	**Abundance index**
Red fox	11 (100%)	15.9 ± 5.2	11 (100%)	43.5 ± 12.2
Pine marten	8 (73%)	15.3 ± 5.5	9 (82%)	57.3 ± 21.8
Carrion crow	10 (91%)	2.7 ± 0.7	8 (73%)	2.9 ± 1.0
Raptors	9 (82%)	1.5 ± 0.7	5 (45%)	1.0 ± 0.4

Marten distribution has expanded relative to 1995 and the mean abundance index has increased 3.7-fold since 1995, whereas for fox there has been a 2.7-fold increase (see Table 1). Given the bias in scat misidentification in favour of martens, these results could be a little speculative, but the level of misidentification is likely to be similar between the two periods. Although this assumption cannot be tested, the increase in fox and marten was significant even if these correction factors were not applied. Correction factors have not been applied when considering relationships of fox and marten with capercaillie. Indices of carrion crow and raptors showed no change over time.

We analysed annual counts of hen capercaillie and their broods in 26 forests in relation to predator abundance from 19 forests (14 surveyed in 1995 and 16 in 2009), annual weather data from the vicinity of each forest, the type of forest (native pinewoods or commercial plantation, either Scots pine or mixed species) and the region.

The index of pine marten abundance has increased almost four-fold since 1995. © Laurie Campbell

Abernethy Forest in Strathspey – key habitat for capercaillie. © Laurie Campbell

Capercaillie breeding success and hen density declined between 1991 and 2009. Poor breeding success was associated with proportionally fewer hens rearing chicks as opposed to a reduction in brood size. Breeding success averaged 0.6 chicks per hen and did not differ between forest types. Birds bred less well in forests in Perthshire towards the southern edge of their current range, than they did in forests in Strathspey (see Table 2). Perthshire, together with Argyll and Moray, had the highest declines in hen density and only in Strathspey were densities considered stable (see Table 3). Breeding success (chicks per hen and broods per hen) was strongly influenced by the weather and was higher in years when there was a larger increase in temperature in April, when temperatures at chick hatch time were higher and when April on the whole was cooler.

When considering the effects of weather and predators simultaneously, we found that chicks per hen and broods per hen were lower when April was warmer and when both marten and crow indices of abundance were higher. Broods per hen were higher in years when the temperature rose more in April and when temperatures at chick hatching were higher, whereas brood size was lower when the weather at hatching time was wetter and in forests with more crows. Higher fox indices were associated with greater declines in hen density.

TABLE 2

Mean values of capercaillie breeding success (± 1se) across six Scottish regions between 1991 and 2009

Region	Forests	Chicks per hen	Brood size	Broods per hen
Strathspey	8	0.86 ± 0.14	2.34 ± 0.13	0.41 ± 0.06
Aberdeenshire	6	0.69 ± 0.18	1.88 ± 0.17	0.42 ± 0.09
Perthshire	6	0.37 ± 0.09	1.87 ± 0.18	0.21 ± 0.06
Moray	2	0.55 ± 0.21	2.59 ± 0.42	0.22 ± 0.11
Easter Ross	3	0.47 ± 0.18	1.94 ± 0.28	0.26 ± 0.12
Argyll	1	0.67 ± 0.36	1.92 ± 0.44	0.39 ± 0.20

TABLE 3

Mean indices of capercaillie density (hens per 100 hectares) and percentage decline rates of capercaillie (hens per 100 hectares per year, ± 1se) for each of six Scottish regions between 1991 and 2009

Region	Forests	Hen density	Change % ± se
Strathspey	8	1.9 ± 0.8	-1.3 ± 0.9
Aberdeenshire	6	1.6 ± 0.8	-13.0 ± 1.3
Perthshire	6	0.9 ± 0.5	-16.4 ± 2.0
Moray	2	0.8 ± 0.9	-16.2 ± 2.8
Easter Ross	3	0.7 ± 0.5	-8.8 ± 4.3
Argyll	1	3.2 ± 3.6	-23.0 ± 6.5

We conclude that increases in martens and foxes, along with changes in weather, provide an alternative explanation to climate change alone in explaining the reductions in capercaillie breeding success. It may be possible that the decline of capercaillie can be halted by continued improvements in habitat management and by restoration of predator control in remaining capercaillie strongholds. We need some predator removal experiments to demonstrate cause and effect of these correlations.

Foxs were associated with greater declines in numbers of adult capercaillie hens.
© Laurie Campbell

Black grouse in Scottish forestry

© Allan MacLeod/GWCT

Black grouse flying in forested habitats.

KEY FINDINGS

- We have radio-tagged 54 black grouse since the project began, with 30 still being tracked.
- 13 of the 17 deaths have been attributed to predation.
- 23% of radio-locations have been in coniferous woodland habitats, though forest use varies markedly throughout the year and between individual birds.

Patrick White

In Scotland, black grouse are most often associated with forests and forest edges, but surprisingly little is known about how they use them. Our study investigated the spatial and structural aspects of forests used by black grouse, in particular commercial plantations.

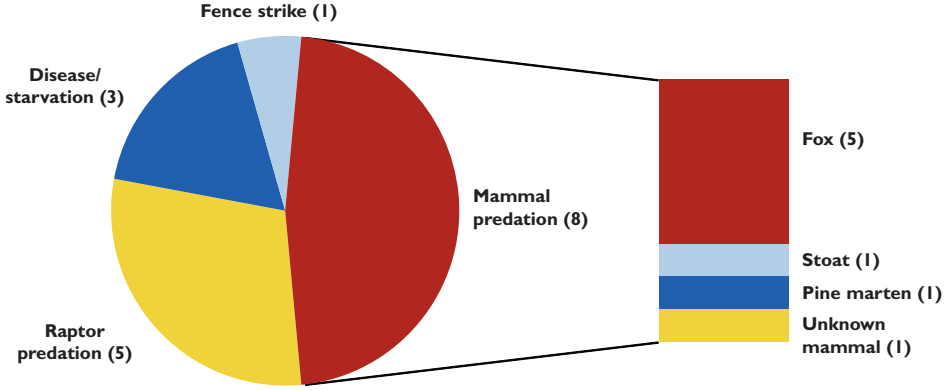
We caught and radio-tagged black grouse in the vicinity of large-scale commercial forests, and then observed how the grouse used them. We chose two areas in highland Perthshire (Tummel/Rannoch), where there are large plantations managed by Forestry Commission Scotland, surrounded by populations of black grouse large enough to sample and be readily caught. The Tummel study site contains part of the Cairngorms National Park, and 21 out of 54 (39%) tagged birds used habitat either in the Park or within one kilometre of its boundary.

So far, 54 birds have been tagged, 22 and 24 during August 2009 and 2010 respectively, when hens and broods were found with pointing dogs, and eight during October to November 2010 at night roosts. Catching with pointing dogs; which involves surveying chick-rearing habitat, also has the advantage of allowing estimation of various breeding success measures. We found that 75% of hens had broods and the average brood size was 3.3 poults, or 2.5 poults per hen.

Of the 54 birds, 30 birds remain alive, five are missing, two lost their tags and 17 died. Causes of the 17 deaths are given in Figure 1.

Figure 1

Causes of death for 17 radio-tagged birds found dead between August 2009 and November 2010, and suspected mammal species within the 'mammal predation' component



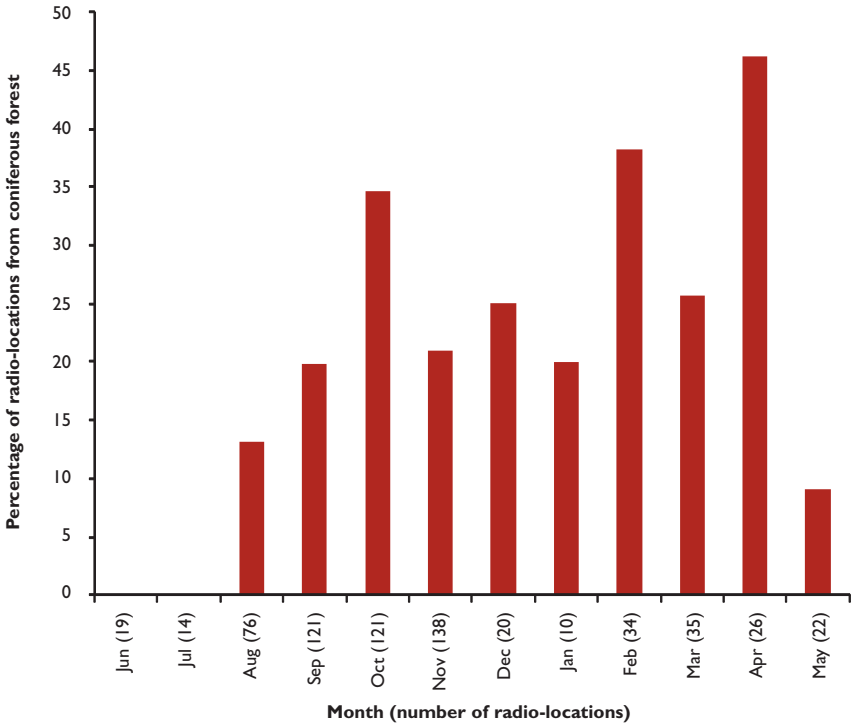


Figure 2

Proportion of radio-locations within coniferous forest by month

Monthly sample sizes are given in parentheses (low in December and January owing to heavy snow)

Once the birds were tagged, we located each one weekly, recording habitat data at its exact location ('flush-point'). Figure 2 shows the percentage of flush-points in coniferous forest per month, beginning with the main hatching period of June to July. Forest use was zero over this period, but increased from late summer throughout the winter, with some suggestion that it increased in late winter, before falling again in May when lekking begins.

Observations so far suggest large variation between birds in their use of forest, even between birds of the same age and sex that were tagged in similar habitat. For example, two males tagged as poults in August 2009 on moorland, both about half a kilometre from the edge of a large plantation, and still being tracked in late 2010, have behaved very differently. One has generally avoided the plantation (see Figure 3, red circles). The other (see Figure 3, blue squares) has spent most of the winter within it (October to March).

Our emphasis now is on gaining more information from tagged birds of different ages and sexes over a second annual cycle. Ultimately, we intend to provide forest owners with information to help them improve forests for black grouse.

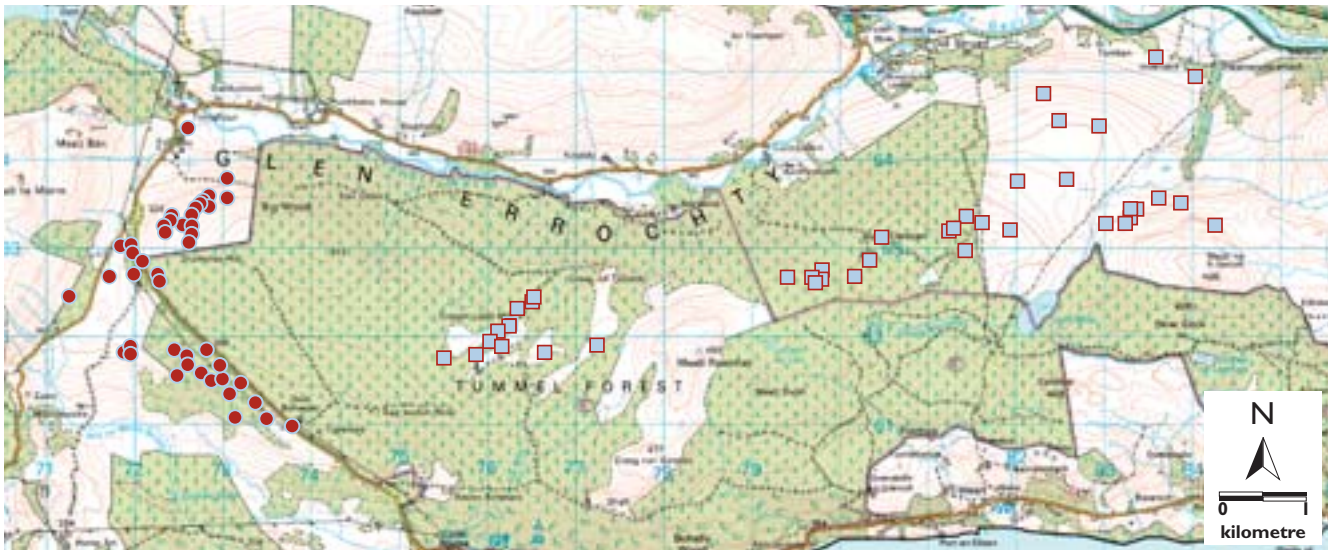
ACKNOWLEDGEMENTS

This project is funded by Scottish Natural Heritage, Cairngorms National Park Authority and Forestry Commission Scotland. We are also grateful for the support of our host estates in Perthshire for making this work possible.

Figure 3

Radio-locations of two males tagged as poults in August 2009 and still being tracked in late 2010, showing contrasting strategies in relation to forest use

- Black grouse male extensively using the plantation
- Black grouse male generally avoiding plantation



Grey partridges on upland farms

In the North Pennines grey partridges share many habitats with black grouse. © Laurie Campbell

KEY FINDINGS

- Grey partridge breeding success is positively correlated with that of black grouse in the same region.
- Sawfly larvae were the most important chick food, just as for black grouse.
- Over-winter survival is a critical limiting factor.

Phil Warren
Tom Hornby

Grey partridges are primarily recognised as a bird of lowland arable farming. However, good numbers persist in the upland fringes of the North Pennines. Here, they frequent enclosed hay meadows, rushy pastures and grass-dominated moorland, sharing many habitats with black grouse. Little is known of their population dynamics or habitat use. To fill these gaps, a three-year project, funded through The SITA Trust and The County Durham Environment Trust, was launched in spring 2010. The project aims to quantify numbers of birds in some of the Durham and Yorkshire Dales, establish local conservation targets and promote management to increase numbers.

To assess partridge distribution and abundance, we conducted a bird call survey based on listening to responses to a tape-recorded call. These were conducted in March and April along 61 four-kilometre transects through suitable marginal hill ground. In total, we found 51 calling cocks, or 0.7 pairs per 100 hectares, which suggests a total of 403 (323-504, 95%CL) pairs in our study area (see Figure 1). We found that partridges were almost entirely absent from habitats at high altitude (above 400 metres) and we put this down to high over-winter mortality during the prolonged snow in winter 2009/10. Along routes that were previously surveyed in 2007 in Upper Teesdale, County Durham (n=6) and Catterick, North Yorkshire (n=3), grey partridge numbers fell by 92% owing to two successive poor breeding years followed by a severe winter.

Grey partridges are often found during our summer black grouse brood surveys on moorland fringe habitats. These surveys (1991-2010) found on average 25 pairs per year (range seven to 95 pairs), with productivity 2.1 young-to-old on average (range 0.4-4.6). Annual breeding productivity was positively correlated with that of black grouse in our study area (see Figure 2). Both varied in relation to rainfall in June, with poor chick survival in wet years.

In March, 10 partridges (five cocks and five hens) were equipped with necklace radio transmitters on the Raby Estate in Upper Teesdale, and followed weekly to assess their habitat use, breeding success and survival. Three died before the breeding season (fox predation, road casualty and disease). Four hens nested, with an average first clutch size of 14 eggs (range nine to 17). Two nests were in rushes and one in bracken, with the other on a roadside verge. Two nests hatched successfully between 12 and 14 June. The other two abandoned, then subsequently re-laid (12 and seven eggs), one again in bracken and the other on a roadside verge. The latter hen was taken from her nest by a domestic cat, with the former hatching successfully on 12 July.

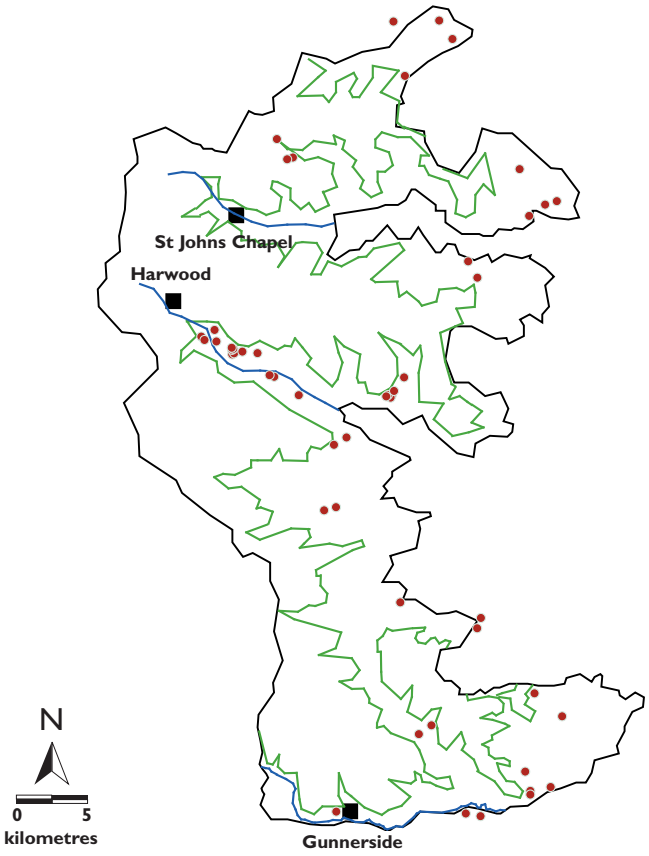


Figure 1

The study area in the Durham and Yorkshire Dales, which includes Teesdale, Weardale and Swaledale

- Grey partridge encounter spring 2010
- 400 metre altitude line

In the second week of August all hens were flushed to establish brood size, with the three hens having 11, six and two young respectively. One hen has since been eaten by a raptor in August.

To assess chick diet we located roosting tagged hens at night and marked their location without disturbing them. We then visited the site the following morning and collected the brood's faeces. We collected chick droppings from broods aged four days to 29 days from 19 roost sites. Initial findings from the first roost sites of two of the broods suggest that, as with black grouse, sawflies form almost three-quarters of all invertebrates in chick diet.

Further research to develop management practices that boost sawfly larvae abundance and improve over-winter survival are a priority for conservation of wild grey partridges in the uplands.

Grey partridge nest site in Upper Teesdale.
© Tom Hornby/GWCT

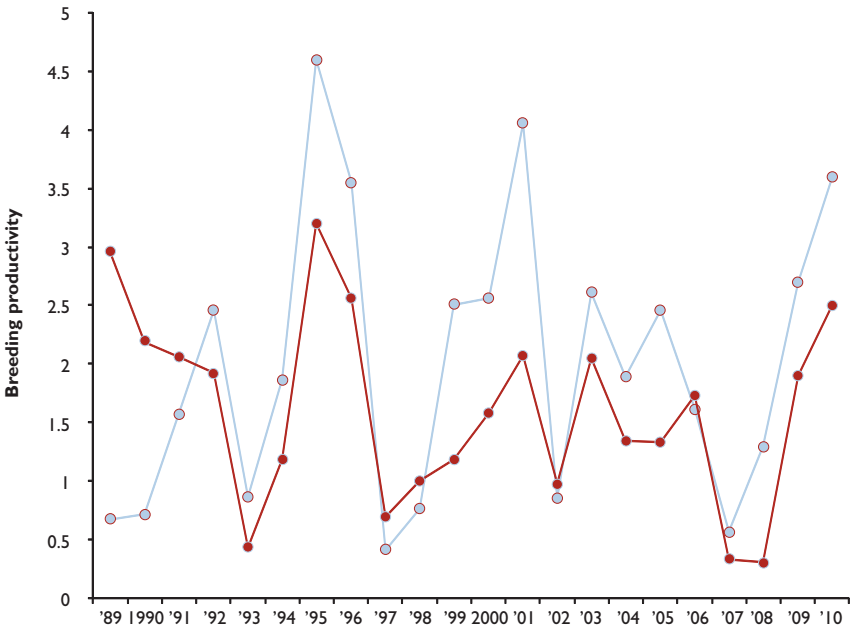


Figure 2

Grey partridge and black grouse breeding productivity in the North Pennines 1991-2010

- Grey partridge young-to-old
- Black grouse chicks per hen

Langholm Moor Demonstration Project: year three

Female harriers from all the nests have taken substantial quantities of diversionary food. © Laurie Campbell

The Langholm Moor Demonstration Project was launched in September 2007 and work started in early 2008. The 10-year project aims to reconcile grouse moor and raptor interests with the core objective of re-establishing Langholm Moor as a driven grouse moor while maintaining a viable population of hen harriers.

The project is based on Langholm Moor partly because it was the principal site for the Joint Raptor Study between 1992 and 1997. During that project hen harrier numbers increased, peaking at 20 breeding females in 1997 (see Figure 1). Red grouse showed a corresponding decline in numbers, and as a result of the reduction in grouse, the estate laid off or redeployed keepers, and management of the moor largely stopped.

Since early 2008, the project has employed a team of five keepers to manage the moor. In addition to predator control, heather burning and the provision of medicated grit to control strongyle worms, all harriers that nest on the moor are provided with diversionary food.

The numbers of harriers nesting at Langholm in the first three years of the project have been low, continuing the trend of recent years (see Figure 1). In 2010 three females nested (all with the same male). However, only one nest was successful with six young fledging. This pattern contrasts to that during the Joint Raptor Study when numbers increased from two pairs in the first year of the project to 11 pairs in year three.

We have provided all the nests with dead day-old cockerel chicks and rats as diversionary food, and the female harriers from all the nests have taken substantial quantities of this carrion. We have watched all the harrier nests to identify prey delivered to harrier chicks and have seen a total of 226 items at the four nests combined; of these most were passerines (54%) or diversionary food (33%). We have seen no grouse or grouse chicks being brought to the harrier nests.

Red grouse abundance has increased from the low density at the start of the project (see Figure 2). However, the increase from July 2009 to July 2010 was a modest 7%. This compares with a more than doubling in recorded numbers from July 2008 to July 2009. Poorer over-winter survival during winter 2009/2010 than in winter 2008/2009 and a fall in breeding success (2010 – 3.8 young per hen; 2009 – 4.6 young per hen) contributed to the modest increase observed in the last year.

KEY FINDINGS

- Three female hen harriers nested but only a single nest was successful with six young fledging.
- Diversionary food was taken by the female hen harrier and during nest watches no grouse or grouse chicks were recorded being brought to the nest.
- Red grouse numbers showed a small increase compared with 2009.

Damian Bubb

Figure 1

Number of breeding female hen harriers at Langholm from 1992 to 2010

ACKNOWLEDGEMENTS

The Langholm Moor Demonstration Project is a partnership between the Game & Wildlife Conservation Trust, Scottish Natural Heritage, Buccleuch Estates, RSPB and Natural England.

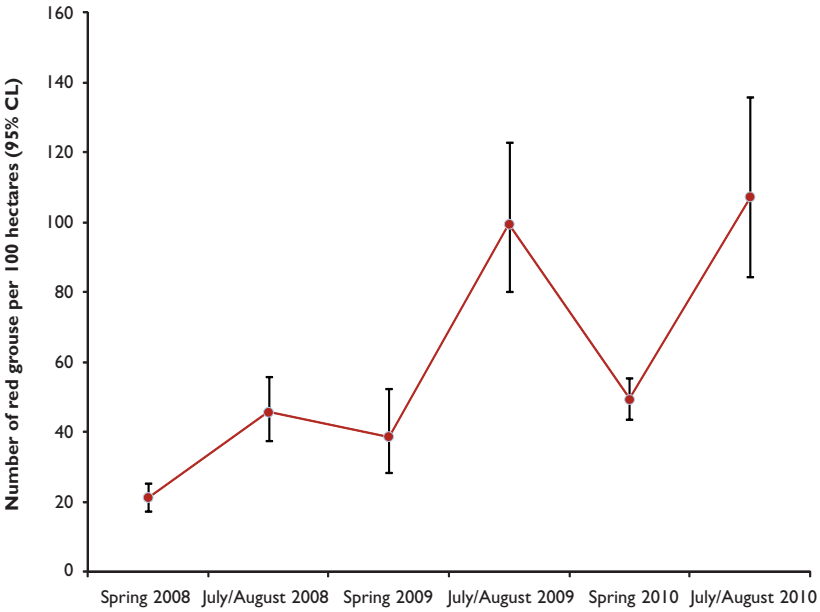


Figure 2

Density of red grouse at Langholm derived from distance sampling transects

Young hen harriers. © Laurie Campbell

The Farm4Bio project

Insect-rich cover and natural regeneration.
© Helen Martin/Rothamsted Research

KEY FINDINGS

- Farms where advice was provided and four key habitats were established supported more wild bees, hoverflies and insect food for farmland birds than where no advice was provided and where key habitats were not in place.
- The abundance of some declining farmland bird species and wild bees was directly related to the amount of uncropped land. A minimum of 5% uncropped land is recommended for birds but the more the better.
- How uncropped land is arranged on farm was less important, except for linnets which preferred wild bird seed mixtures in large blocks and butterflies that favoured their resources provided in strips.

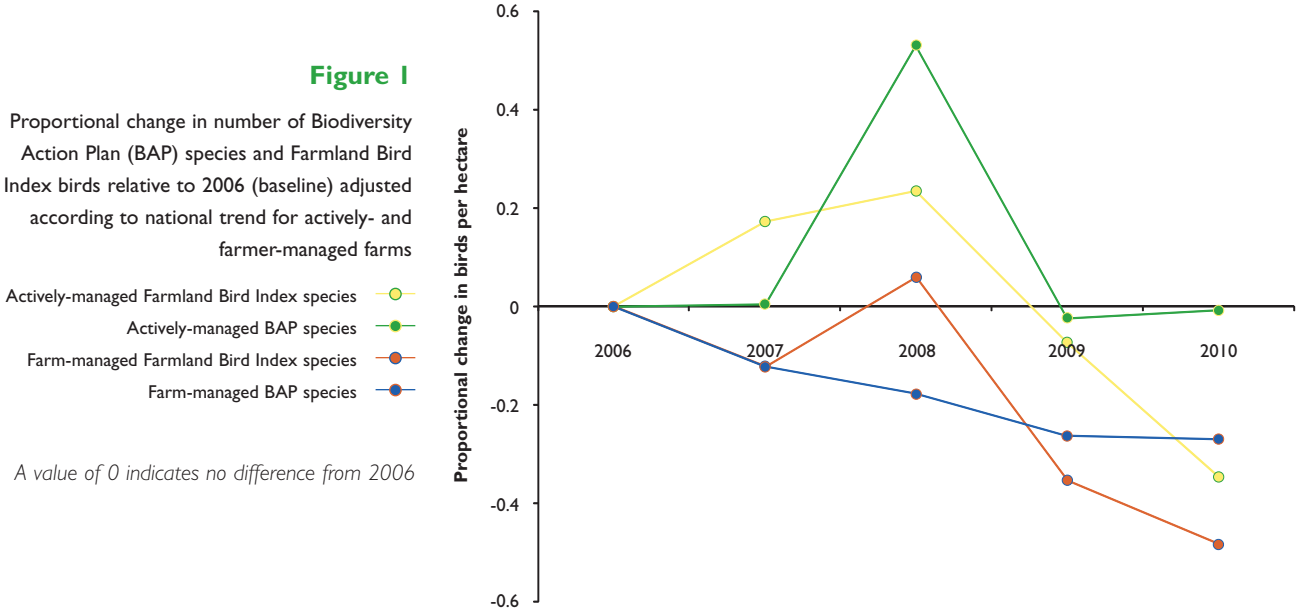
John Holland
Tom Birkett
John Simper

The widespread adoption of agri-environment schemes is seen as the best way to improve farmland biodiversity. Yet if this approach is to be applied efficiently and successfully we first need to know whether active, more focused management (comparable with the Higher Level Stewardship approach with advisory back-up) compared with the farm management (Entry Level Stewardship (ELS) approach without advice) leads to higher levels of biodiversity. Are there relationships between the proportion of uncropped land and levels of biodiversity and can thresholds be identified? How should this land be arranged in the landscape?

The Farm4bio project aims to answer these questions. We compared seven approaches that include farms with and without advice, with 1.5 or six hectares of uncropped land in the 100-hectare study area, and uncropped land arranged in either several strips or one to two large blocks, giving the following treatments: 1. Six hectares in strips actively-managed; 2. 1.5 hectares in strips actively-managed; 3. Six hectares in blocks actively-managed; 4. 1.5 hectares in blocks actively-managed; 5. Six hectares farm-managed; 6. 1.5 hectares farm-managed; 7. Organic. We trialled each treatment on four farms across southern England and East Anglia.

Figure 1

Proportional change in number of Biodiversity Action Plan (BAP) species and Farmland Bird Index birds relative to 2006 (baseline) adjusted according to national trend for actively- and farmer-managed farms



A value of 0 indicates no difference from 2006

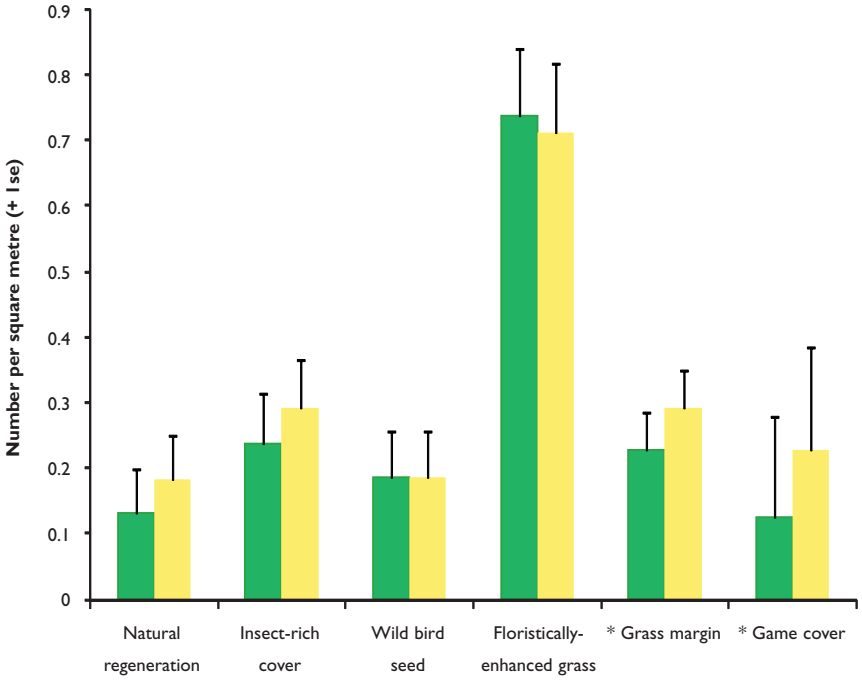


Figure 2

Number of wild bees and wild bee species in four habitats on actively-managed farms and the two* most common farm-managed habitats in June

Number

Species richness

On the actively-managed farms, four essential types of habitats were established adjacent to each other: wild bird seed mixtures; insect-rich cover for foraging birds; floristically-enhanced grass to provide nectar and pollen; natural regeneration to encourage annual arable plants. On the farm-managed sites, the majority of uncropped land was managed as grass margins, which is the most popular habitat created under ELS. On all the plots we measured the abundance and diversity of plants, insects and birds.

The actively-managed habitats encouraged beetles, whereas spiders increased on farmer-managed farms in the grass margins. More linnets were found on actively-managed farms. Compared with the national trend, the number of birds on the Farmland Bird Index and Biodiversity Action Plan species were maintained on the actively-managed farms, but declined on the farmer-managed farms (see Figure 1). Weed diversity, hares and skylarks were greater or more numerous on organic farms.

Having more uncropped land had positive effects on a broad range of organisms including plants in field margins, butterfly diversity, wild bee abundance and diversity, and 16 farmland bird species (significant for three declining species). How the uncropped land was arranged had less impact, although linnets preferred large blocks, and skylarks and butterflies favoured strips (possibly reflecting the territorial distribution of the larks relative to the more gregarious linnets, as opposed to the arrangement of the habitat itself). We would still advise that insect-rich habitats are spread across farms in strips close to nesting sites to maximise the number of bird territories that have access to the habitat and reduce the distance over which birds must forage. The actively-managed habitats supported almost three times as many chick-food insects.

A closer look at the invertebrates in each habitat type revealed that floristically-enhanced grass (FEG) supported over three times as many wild bees (bumble bees and solitary bees) compared with the other habitats in June (see Figure 2) and August. Hoverflies (whose larvae eat aphid pests) were twice as abundant in the FEG and grass margins compared with the other actively-managed habitats and game cover.

The weight of key chick-food invertebrates was twice as high and there were up to 50% more parasitic wasps in actively-managed habitats compared with grass margins. The grey partridge chick-food index exceeded the level required to maintain a grey partridge population only in the wild bird seed mixture. However, this habitat is suitable only if the vegetation at ground level is sufficiently open for foraging chicks. We believe that it is the high weed levels within this habitat that is supporting the insects rather than the sown plants.

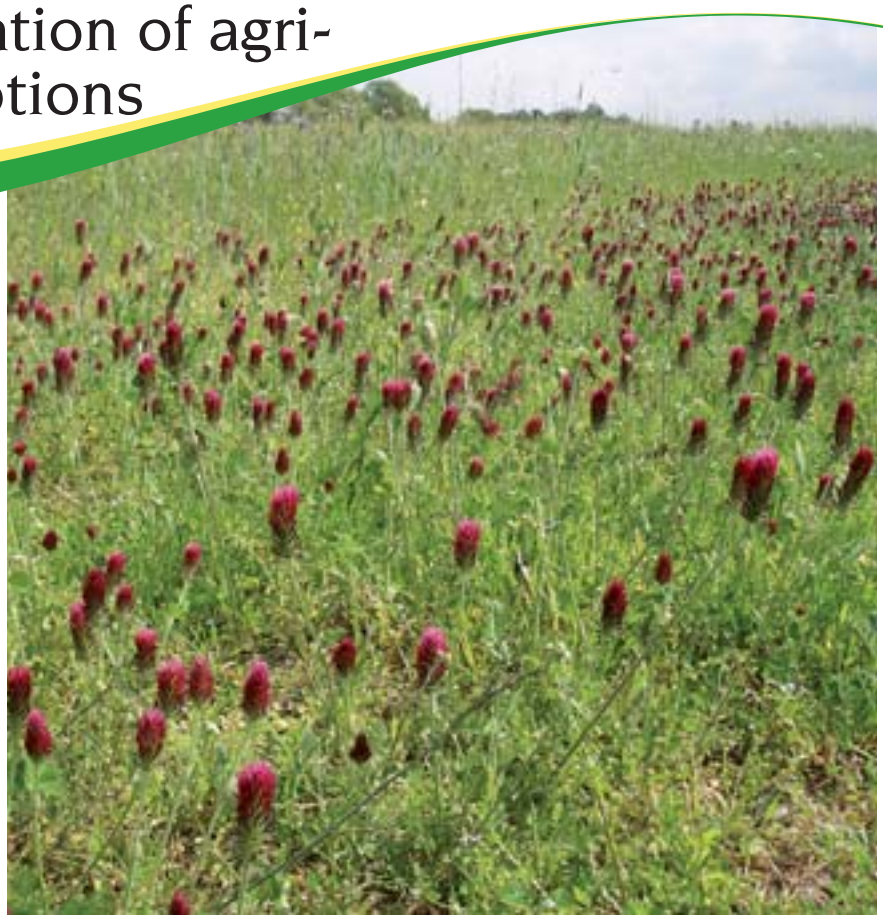
Our recommendation is that the current levels of uncropped land could support significantly more biodiversity if it were more positively managed, although for birds at least, the area of uncropped land should ideally be beyond five percent. Every farm should aim to provide flowers in summer and seeds in winter and the more the better.

Bees did well in the flower-rich grassy habitats. © Tom Birkett/GWCT

ACKNOWLEDGEMENTS

The Farm4Bio project is funded through the Sustainable Arable LINK programme. The other research partners are Rothamsted Research, The British Trust for Ornithology and The NIAB TAG Group. The project is sponsored by Bayer CropScience, BASF, Cotswold Seeds, Defra, Dow AgroSciences, DuPont, HGCA, PGRO and Syngenta. We would also like to thank all the farmers, funders and fellow researchers.

The next generation of agri-environment options



Clover ley in its first year.
© Brin Hughes/Conservation Grade producers Ltd

KEY FINDINGS

- Wild bird seed mixtures containing only broadleaved plants, perennial flowers and grasses or grass and legumes provided the most invertebrates and chick food.
- Sowing broadleaved plants in cereal wild bird seed mixtures or conservation headlands increases their chick-food value.

John Holland
Barbara Smith
Matt Wainhouse

The uptake of many of the most valuable options in UK agri-environment schemes (AES) has been relatively poor and, at a national scale, farmland birds have failed to recover. If new wildlife-friendly habitats are designed to be multifunctional, this may increase their attractiveness to farmers. Also, as a consequence, less land would be taken out of production, an important issue with food security moving up the agenda and productive land producing wheat at £150 per tonne. Our research has shown the importance of insects for farmland bird chicks yet insect-rich habitats are still the missing component on many farms, as are flower-rich areas. Nectar and pollen supplies are essential for bees and the natural enemies of insect pests. To some extent, wild bird seed mixes may also provide both of these key resources. In addition, we also have to consider the time and skill required to establish and manage these habitats alongside their reliability of establishment, as this can strongly influence their uptake. Perennial habitats, once established, are on the whole less labour-intensive and more reliable. Finally, if the habitats are to be used by birds then they must have a sufficiently open vegetation structure that allows access to foraging chicks.

This year we started a project with Conservation Grade Producers Ltd, as we had both identified the need to improve the provision of chick-food insects, wild bird seed (WBS) and pollen and nectar on farmland. This is being achieved through testing new seed mixtures and the development of a wildlife crop rotation that aims to provide agronomic benefits while also encouraging farmers to grow some of the less popular, but most important AES options. The rotation consists of a grass-legume ley for two years to generate soil nitrogen and provide flower-rich habitat followed by a two-year kale-based WBS mixture. In addition, we are developing more appropriate perennial seed mixes for field margins and comparing chick-food levels in autumn-sown wild bird seed mixtures consisting of either only cereal (wheat, barley and triticale) or broadleaves (brown mustard, oilseed rape, fodder radish, phacelia, linseed) or both (triticale, barley, linseed, fodder beet, perennial chicory, brown mustard, oilseed rape and phacelia). We sampled the three WBS mixtures and the grass legume leys in 2010 at the same time as a three-year-old flower-and-grass mix supplied by Oakbank and winter wheat. In June, we collected insects using a Dvac suction sampler and measured plant diversity and vegetation structure.

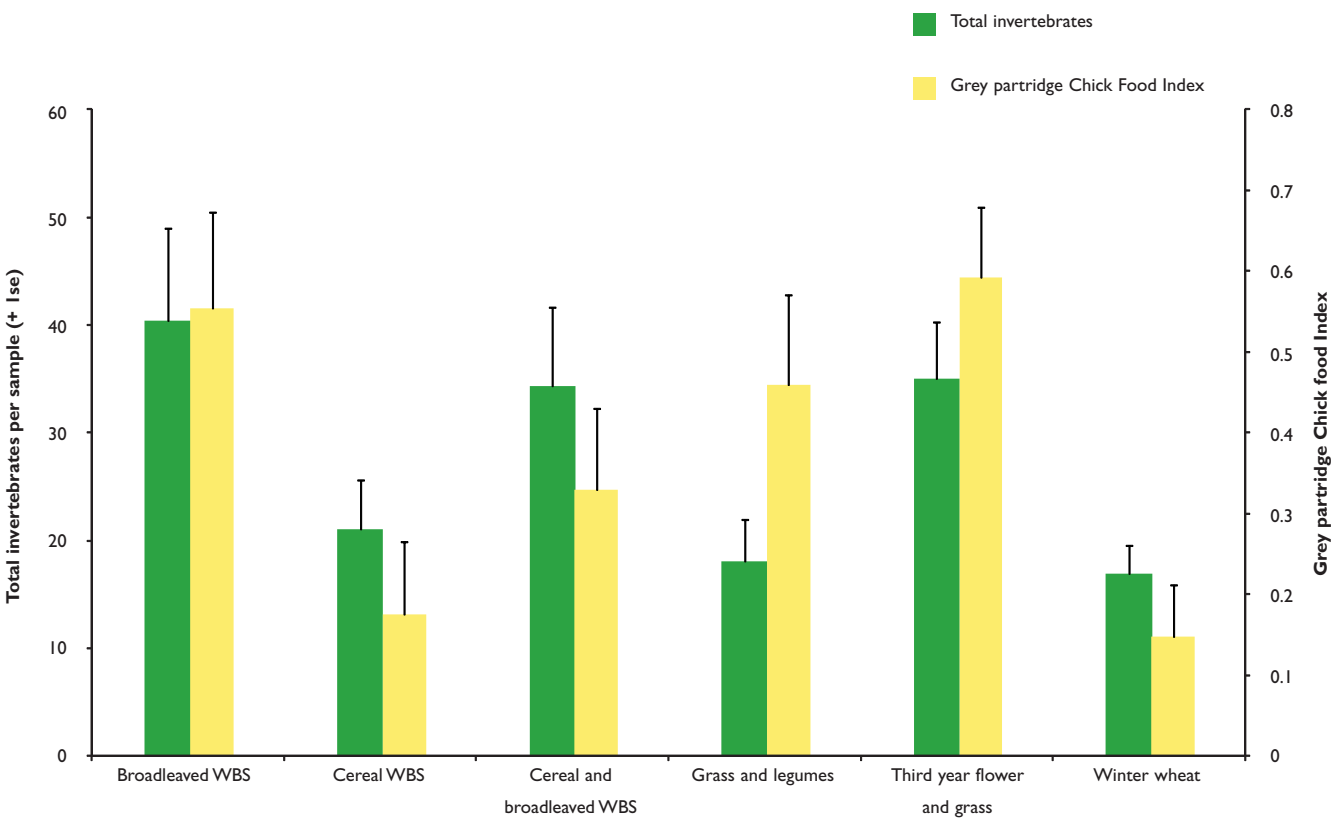
The total number of invertebrates and the grey partridge Chick Food Index (CFI) was highest in the broadleaf WBS, legumes and three-year-old grass and flower mix, and lowest in winter wheat and the cereal-only WBS (see Figure 1). Overall,

ACKNOWLEDGEMENTS

We would like to thank Conservation Grade Producers Ltd, Oakbank Game & Conservation Ltd and the farmers for funding, support and access to study sites.

Figure 1

Total number of invertebrates and grey partridge Chick Food Index for each habitat



the mean CFI values for all habitats were below our target CFI of 0.7, which is the level required to maintain grey partridge numbers. There was, however, considerable variation between farms and fields: the 0.7 level was exceeded in three of the broadleaved WBS, two grass-legume leys and three of the flower-and-grass strips. Further analysis of the insect and vegetation data indicated that the abundance of invertebrates including chick-food could be raised by increasing the plant diversity in the cereal-only WBS and grass-legume mixes. The cereal-only WBS was effectively a conservation headland and these findings suggest that unless a rich under-storey of weeds that support invertebrates develops in the conservation headland, as occurs on light soils, then it would be better to establish a broadleaved brood-rearing cover or add some broadleaved plants to the cereal. In the broadleaved, cereal and grass-and-legume mixes the invertebrates increased as the vegetation became more dense, but this may reduce access for birds and especially chicks.

Flower-rich field margin. © John Holland/GWCT

The value of sainfoin

Sainfoin © Peter Thompson/GWCT

KEY FINDINGS

- Sainfoin is a leguminous species suited to calcareous soils and recommended by Defra for inclusion in stewardship seed mixes, but it is often over-looked by farmers.
- Sainfoin supported rare and scarce species of insect as well as many common ones including pollinators, species that are efficient predators of insect pests and insects that are food for farmland birds. Sainfoin fields supported a high number of insects when compared with other habitats.
- Sainfoin would be a valuable addition to stewardship mixes.

Barbara Smith
Tarryn Castle

Uncropped land on farmland is very important for insects because of the range of weeds and sown plants that encourage insect diversity. Although there have been studies assessing the effect of different habitats on farmland wildlife, there have been few studies investigating the value of individual plant species that also benefit farmland conservation. Our study investigated the value of sainfoin for farmland insects on the Cholderton Estate in Hampshire.

Historic use of sainfoin dates back to the 17th century, when it was cultivated widely as a forage crop. This forage variety originated from central and southern parts of Europe and temperate regions of Asia. One advantage of sainfoin as a fodder crop is that it is metabolised more readily by cattle, sheep and horses than other crops, such as soya. This not only results in healthy animals but also leads to fewer greenhouse gas emissions (because less methane is produced). Since the 19th century, cultivation in the UK has declined coinciding with the introduction of fertilisers. Current use of sainfoin is low, despite being recommended by stewardship schemes for inclusion in pollen and nectar mixtures. This may be due to the lack of knowledge regarding the biodiversity and conservation benefits that sainfoin has to offer farmland environments.

Previous studies of insects associated with sainfoin have largely focused on pests. The aim of this study was to identify the insects associated with sainfoin at Cholderton, where the Hampshire common cultivar has been grown for many years, and to evaluate its potential for increasing farmland biodiversity. Fields of sainfoin were compared with clover leys of mixed *Trifolium* species and regenerated chalk grassland fields. As regenerated chalk grassland is typically species-rich, it is a useful yardstick by which to measure the diversity of other fields. Cholderton Estate is a mixed farm located on the Hampshire/Wiltshire border and covers 1,000 hectares. The chalk downland was converted to farmland in the early 19th century. The soils are thin and low in natural organic matter and manure is added to most areas to boost fertility. We collected invertebrates from fields using both sweep net and Vortis suction sampler. We collected samples from at least 30 metres in from the edge of the field to prevent edge effects.

There were numerous similarities between the regenerated grassland and sainfoin fields, including a number of bugs, flies, beetles, wasps, bees and ants, but of the three

Sainfoin is often over-looked by farmers, but is very beneficial for wildlife. © Peter Thompson/GWCT

field types, sainfoin supported the greatest number of insects. There was a clear difference between sainfoin and clover leys; our results show that sanfoin is more attractive to insects. We found nationally rare and scarce species in sainfoin and the regenerated grassland fields including plant bugs, weevils and ragwort flea beetle. We also found a rare plume moth, *Merrifieldia tridactyla*, in sainfoin fields. Sainfoin has an extended growth period and flowering time making it highly attractive for groups of invertebrates such as pollinators and other insects which depend on floral resources during part of their life-cycle. It adds structural diversity to the sward as it has numerous erect stems and can reach over a metre in height. This is likely to aid the build-up of natural enemies of pest species, especially spiders, as they are known to increase with structural diversity. Many of the insect species living in the sainfoin fields are also known to be part of farmland bird diet, so not only do insects associated with sainfoin benefit overall biodiversity, they also aid a healthy farmland environment.

Recent research has emphasised the value of sainfoin as fodder and our study demonstrates that using sainfoin in place of grass silage would greatly boost farm biodiversity. Adding sainfoin to farmland flower margins and uncropped land is also useful as it can lead to an increase in the number of pollinators and natural enemies of pests. Where the soil conditions are suitable, sainfoin can be promoted for use in agricultural environments to increase biodiversity on farmland.

ACKNOWLEDGEMENTS

This work has been generously supported by Henry Edmunds of Cholderton Estate.

Common blue butterflies feed on sainfoin. © Tom Birkett/GWCT

Allerton Project game and songbirds

Linnet numbers declined when predator control stopped. © Peter Thompson/GWCT

KEY FINDINGS

- Wild pheasant numbers increased in response to game management and declined when it was withdrawn.
- Songbird numbers declined by 21% during the five years without predator control and by a further 20% in the subsequent four years when winter feeding was also withdrawn.
- The relative contribution of habitat creation, predator control and winter feeding is likely to vary between farms, depending on existing habitat and predator abundance.
- This work now enters another phase with the development of our new shoot.

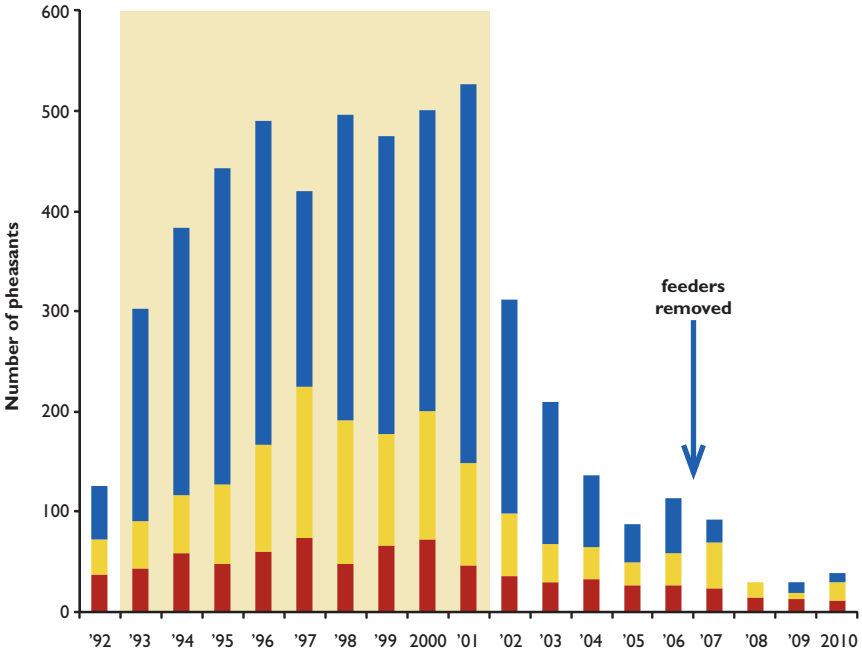
Chris Stoate
John Szczur
Patrick White

Following a baseline year in 1992, in which there was no change to the farm management at the Allerton Project, a game management system was introduced in the period up to 2001, during which time there was a five-fold increase in wild pheasant numbers (see Figure 1). Predator control was stopped in 2001, to investigate the effect on game and non-game birds, and winter feeding was stopped for the same reason in 2006, while the new habitats were maintained. Pheasant numbers dropped dramatically after 2001 when predator control stopped and no further shoot days could be held.

Songbird species responded in different ways to the changes in management, with a large increase in overall numbers during the initial game management phase of the project. Some continued to increase when predator control stopped, whereas others, including the Biodiversity Action Plan species song thrush, spotted flycatcher, linnet and bullfinch declined. Our annual transect data showed that songbird numbers declined by 21% during the five years without predator control and by a further 20% in the subsequent four years when winter feeding was also withdrawn (see Figure 2).

Figure 1

Autumn wild pheasant numbers from 1992 to 2010



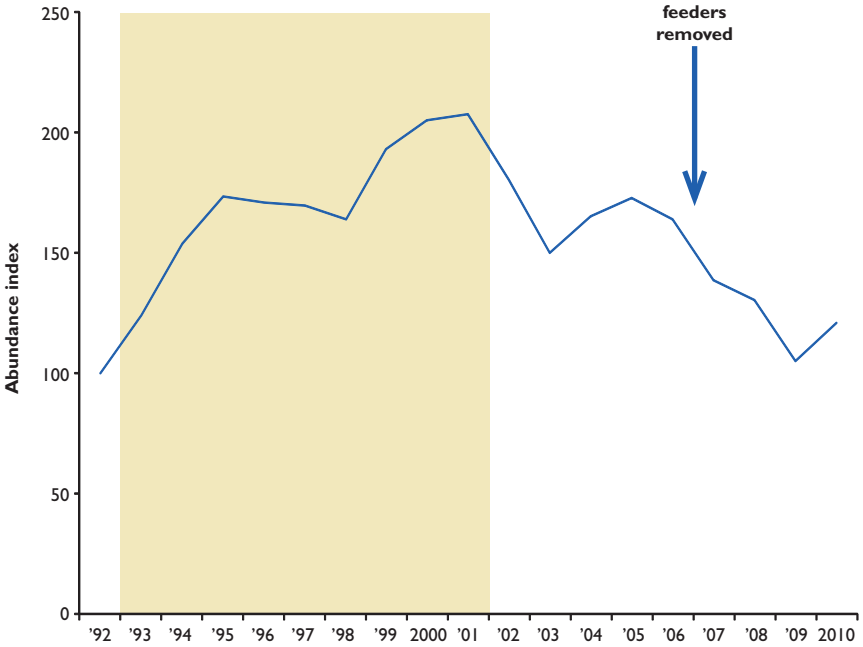


Figure 2

Songbird abundance relative to the start of the project

Keepered period

Together with research into nesting success of individual species, these results suggest that predator control, carried out as part of a game management system for shooting, can have a positive impact on the abundance of at least some songbird species at the farm scale. Recent population modelling by PhD student, Patrick White, suggests that for blackbird, chaffinch and yellowhammer, predator control had sufficient effect on nesting success to influence subsequent breeding population size. The modelling suggested that these species would need to make twice as many nesting attempts to maintain a stable population in the absence of predator control as they would when there was predator control.

In 2010, at the end of the period without predator control or winter feeding, overall numbers of birds at the Allerton Project were still 21% higher than they were in the 1992 baseline year when the project started. This demonstrates that habitat has had a direct conservation benefit. We know from our research on whitethroats, for example, that grass margins have a direct positive effect on the abundance of this species. On farms with lower numbers of nest predators, or where there is less suitable habitat, the benefits of providing habitat alone may be much greater than was the case at the Allerton Project.

The area of managed habitat on the farm has ranged from about 4% to 9% of the area, mainly within Stewardship agreements, but also on former set-aside. The project retained its set-aside land after the requirement for it was withdrawn to continue the research work into 2010. We have also provided habitats within the cropped area such as conservation headlands and 20 skylark plots in recent years.

We are currently developing a new shoot within the Allerton Project. This will take a slightly different form to the previous one which concentrated purely on wild gamebirds, and we will continue to monitor both game and non-game species to see how they respond to the new system.

An early pheasant nest. © Alex Butler/GWCT

We now have 20 skylark plots. © Alex Butler/GWCT

The farming year at the Allerton Project

The cropping structure has been revised from a fragmented to a parcelled layout.
© Alex Butler/GWCT

KEY RESULTS

- Many thousands visit the Allerton Project each year to see our latest innovations that help farming and the environment.
- Un-cropped and set-aside land was moved into funded agri-environment schemes or to the new shoot.
- A 21st-century grain storage facility has been built to meet demanding crop-quality standards.

Alastair Leake
Phil Jarvis

Last year saw the Allerton Project reach a turning point in the 18 years of research since Lord and Lady Allerton bequeathed the Estate to the Trust. This research has always been carried out against the back-drop of a modern commercial farm. Although this has been achieved, it is undeniable that some of the research we have carried out has affected the way that we have farmed.

The original objective was to integrate a wild gamebird management system across the 800 acres of farmland on the estate. This involved the three cornerstones of game management, namely habitat creation and management, provision of winter feed and predator control during the nesting season. The impact of the latter two on the farming is limited to an increased number of grassy tracks around the farm to allow the keeper access to traps and feeders and, as a consequence, there has been a

TABLE 1

Arable gross margins (£/hectare) at the Allerton Project 1995-2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Winter wheat	1,007	981	551	668	723	572	603	518	836	536	591	837	772	778	765	980
Winter barley	877	802	625	478	534	403	315	328	-	-	-	-	-	-	-	-
Winter oilseed rape	808	868	593	469	468	523	329	611	614	477	381	362	596	1,075	674	1,036
Spring oilseed rape	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Winter beans	626	574	616	507	553	573	331	452	491§	415§	541§	409§	694§	663§	427§	749§
Winter oats	-	-	-	-	-	-	-	462	759	545	516	692	634	643	651	1,045
Linseed	535	-	497	-	477	-	-	-	-	-	-	-	-	-	-	-
Set-aside	331	335	326	296	317	205	204	251	247	217	194	213	194	199	n/a	n/a

§ spring beans

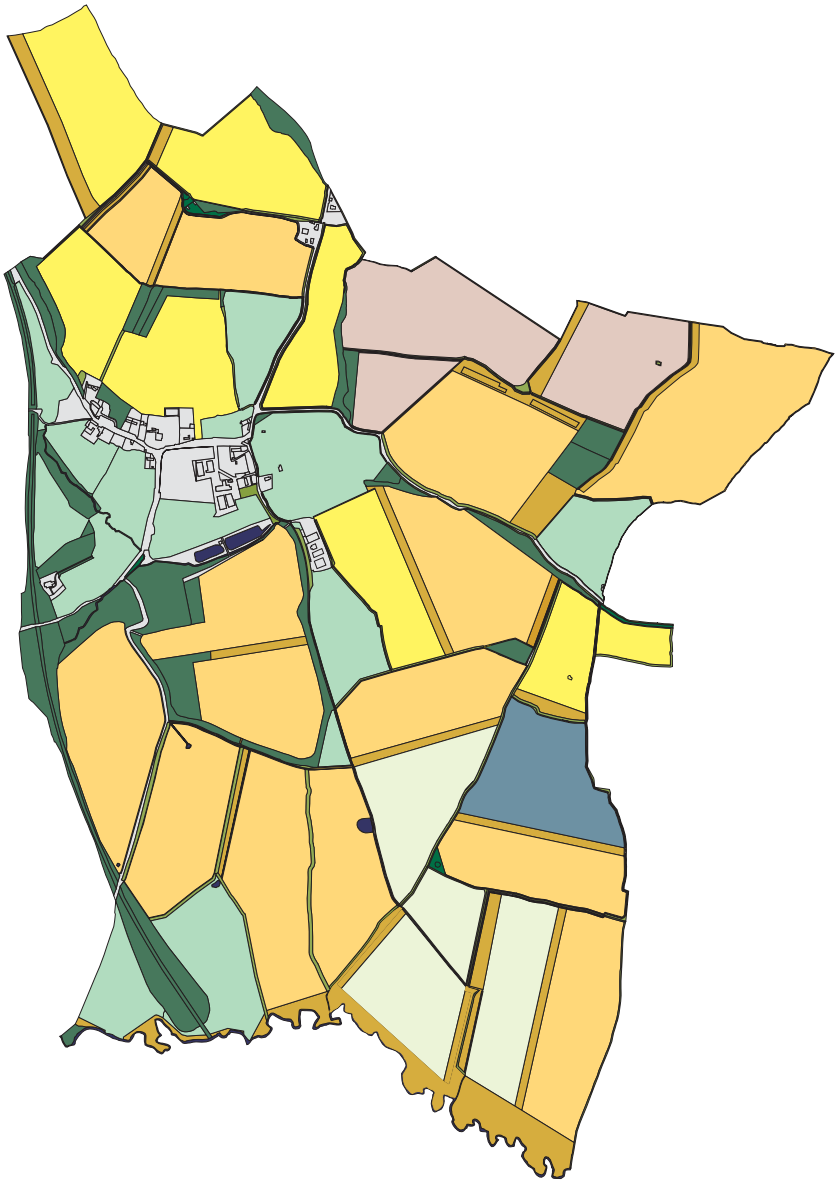


Figure 1

Allerton Project cropping 2009/10

- Woodland
- Permanent pasture
- Winter wheat
- Spring beans
- Winter oilseed rape
- Winter oats
- Hemp/flax
- Set-aside
- Hedgerow/verge

small reduction in the cropped area. However, two specific aspects of habitat creation and management have made a much greater impact, namely the removal of around 15% of the cropped area from production and the fragmentation of crop rotation patterns across the farm.

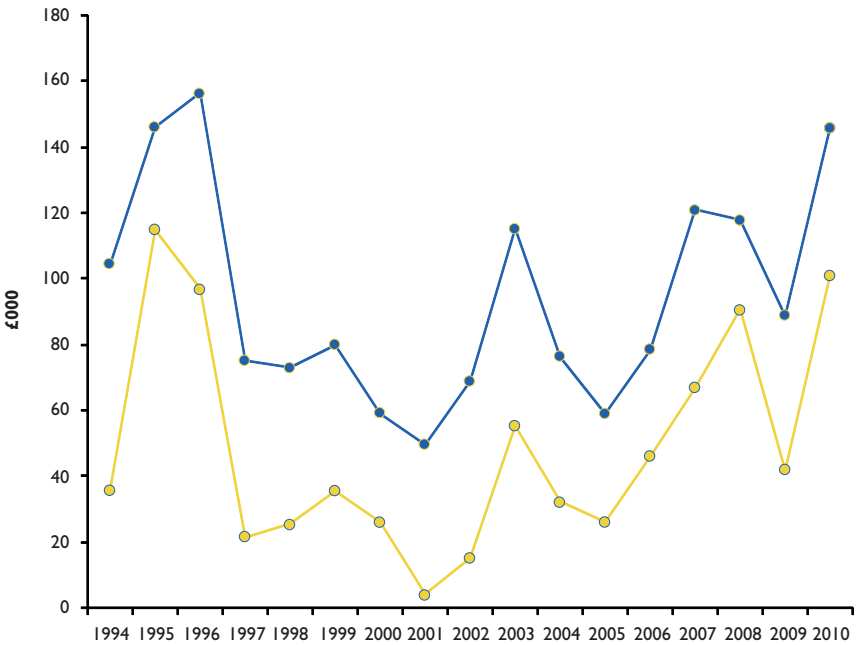


Figure 2

Gross profit and farm profit at the Allerton Project 1994-2010

- Gross profit
- Farm profit

TABLE 2

Farm conservation costs at the Allerton Project 2010 (£ total)

Set-aside (wild bird cover)[1]	
(i) Farm operations	500
(ii) Seed	408
(iii) Sprays and fertiliser	560
(iv) Extra set-aside	8,542
Total set-aside costs	**10,010**
Conservation headlands[2]	
(i) Extra cost of sprays	0
(ii) Farm operations	140
(iii) Estimated yield loss	1,249
Total conservation headland costs	**1,389**
Grain for pheasants	0
Grass strips	495
Stewardship (CSS & ELS)	13,698
Woodland	6,940
Total conservation costs	**32,532**
Stewardship income (CSS & ELS)	(14,500)
Total profit foregone	
- conservation	**18,032**
- research and education	**9,832**
	27,864

[1] Area of wild bird cover = 3.7 ha

[2] Area of conservation headlands = 4.0 ha

Further information on how these costs are calculated is available from the Game & Wildlife Conservation Trust

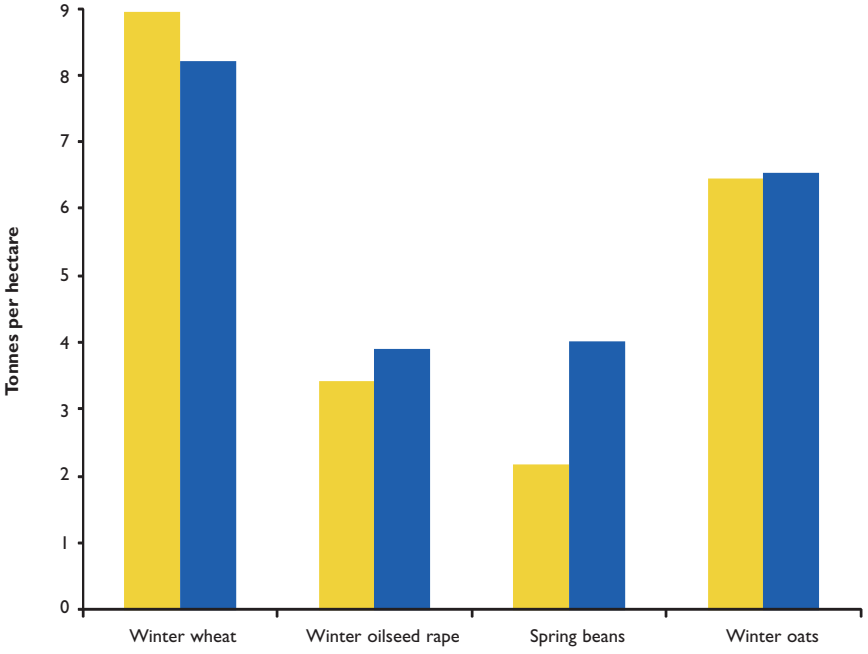
Taking land out of production in 1993, when the new game management system was first implemented, was entirely justified as this was EU policy at the time to reduce surplus crop production. Originally set at 15%, but varying over a 15-year period, most farmers considered their least productive land to satisfy this 'set-aside' policy. The initial requirement of 20-metre strips or parcels of at least 0.3 hectare meant, for ease of management, that most farmers opted to set entire fields aside. We took a different approach in an attempt to maximise the ecological benefit of such funded but un-cropped areas and placed much of our set-aside area in strips of the minimum width but up the middle of the fields. The crop yield maps produced today show that this is the most productive area of the field and the creation of two additional field edges causes additional yield loss. This measure therefore undoubtedly has affected the farm gross margin.

The effect of fragmented cropping is less easy to measure. There is unlikely to have been an effect on yields, but operational complexity brings with it additional demands on management, more travel and more time required to carry out all field operations.

The completion of our observations in 2010 of the effect of removing predator control and winter feeding, means that we can now re-appraise the structure of the farm to meet the challenges ahead. These include the re-establishment of a shoot

Figure 3

Crop yields at the Allerton Project in 2009 and 2010



Beetle banks are now being put across slopes to help reduce soil erosion. (Far left) Planting new woodland. © Alastair Leake/GWCT

with a part-time keeper, the removal of all set-aside land and the introduction of a new Entry Level Stewardship and Higher Level Stewardship scheme with a renewed emphasis on protecting water quality on the farm. Such a restructuring will see the relocation of most in-field strips to the lower yielding margins, re-orientation of some beetle banks across slopes to help reduce soil erosion and the consolidation of cropping. We believe that this approach to farming goes a long way towards demonstrating what farmers can do to meet future needs. These are to increase crop yields and efficiency of production, minimise the impact of this on biodiversity and wildlife by skilful, informed, and often intensive management of habitat, and protect watercourses and water quality using a variety of means. Couple this with our moves to increase carbon sequestration in our soils and woodland, and the re-introduction of the shoot, the Allerton Project farm is set to embrace the ecosystem services approach required for sustainable food production and land management advocated for the next century.

We have also invested substantially in new storage facilities for arable crops. Modern working practices and quality demands, along with increased yields, had left us with antiquated and inadequate grain storage facilities. Modern grain stores, while being purpose built to allow good air circulation, are essentially steel-framed buildings, which with a little adjustment, can be made multi-purpose. Traditional grain storage bins do not offer this flexibility. With strong grain prices and growing world demand, there is likely to be economic justification for increased yields. Having good storage provides us with greater flexibility to hold grain when prices are low and sell when prices are stronger.

Many thousands have visited the Allerton Project looking at our innovative farmland research. © Peter Thompson/GWCT

Dilemma of environmentally-friendly farming

A floristically enhanced margin is very beneficial for wildlife. © Alex Butler/GWCT

With public spending under scrutiny, farmers are concerned that agri-environment scheme payments may be cut and entry frozen. We are concerned that the restricted uptake of the options that we have strived to develop, like beetle banks, conservation headlands and wildlife seed mixes, could diminish the beneficial effects on wildlife. At present about 70% of agricultural land in England, covering over six million hectares, is funded by environmental agreements costing around £400 million each year.

Payments go towards funding the multitude of options within the Environmental Stewardship schemes. World Trade Agreement rules do not allow farmers to profit from environmental support payments, and so the option payments are carefully calculated to cover profit foregone and any additional costs in time and management. In 2006, we became one of the first farms to participate in the then new Entry Level Stewardship Scheme and this increased our 'environmental' income from £6k to £11k per year.

In 2010, with the co-operation of Natural England, we closed our original Countryside Stewardship agreement, which technically still had two years to run, and began a much larger Higher Level Stewardship scheme with a value to the project of £25k per year. This agreement requires a substantial amount of environmental work, but it provides a known and predictable annual income until 2020. This becomes increasingly important given the volatility of the grain markets in recent years.

Marketing some of our grain through Conservation Grade (CG) is helpful and allows us to achieve some premium over the market price. The CG brand is expanding, with Allinsons now offering 'wildlife-friendly' flour. Such niche markets provide some limited protection against volatile world markets.

Besides stewardship payments and crop sales we have another important income stream – the Single Farm Payment (SFP). Paid in Euros, the exact amount varies with the exchange rate. To qualify we have to be a farming business, with a holding number, although we are not actually required to do any farming to receive the payment. We do, however, have to observe the rules laid down in Cross Compliance, which includes all the EU Directives and certain Good Agricultural and Environmental Conditions. The future of the SFP is currently under discussion in Brussels as we run up to the 2013 Common Agricultural Policy reforms, but looking at the farm accounts for the Allerton Project, it is clear that the SFP is essential to us if we are to continue to farm profitably. A sustained increase in the price of the cereals and oilseeds we grow could allow us to farm profitably without the SFP, but price hikes are generally short-lived and much of the time we are selling crops below the cost of production (see Figure 1). If we were to stop farming and fallow the land we would need no farm staff; but we could not carry out the environmental work that we think is so important.

KEY FINDINGS

- Environmental Stewardship income has increased.
- There is greater volatility in crop prices.
- Single Farm Payment and Environmental Stewardship is important guaranteed income.

Alastair Leake

Figure 1

UK Feed Wheat prices (Source HGCA-Market Data Centre)

We need our farm staff to carry out the important environmental work. © Alex Butler/GWCT

Recycling farm waste

(Above and below) The EU Waste Directive requires all farms to dispose of pesticide containers through a professional waste disposal company.
© Peter Thompson/GWCT

Around five million hectares of arable crops are grown in the UK each year and if, on average, each hectare requires to be treated with two five-litre containers of pesticide, then there are 10 million plastic bottles to be disposed of. From 2007 the implementation of the EU Waste Directive requires farms in England not to burn containers on farms, but dispose of them through a professional waste disposal company. Farms produce different kinds of waste depending on the crops they grow or the animals they keep, but principally bulk seed and fertiliser bags, silage wrap, polypropylene string and pesticide containers make up most of the non-organic waste. Collecting waste from farms is costly because holdings are scattered. The waste is bulky and often soiled, which makes it more difficult to handle, and it has a low re-sale value. Consequently

KEY FINDINGS

- First-hand experience of recycling farm waste gives us a unique insight into the problems.
- An across-industry working group produces new guidelines.
- Global corporations adopt new practices based on our recommendations.

Alastair Leake
Phil Jarvis

many farmers find it simpler to consign their waste to landfill. Within the Allerton Project we wanted to see if we could find a way to recycle this farm waste. A grant from Leicestershire County Council enabled us to purchase a second-hand plastics baler and 15 local farmers began to arrive at our shed on the first Tuesday of every month to deliver their waste. Each farm pays a £200 annual membership fee and for that we will take in and process any quantity of waste, provided it is segregated and clean. Fertiliser bulk bags are made of a strong outer polypropylene fabric and inner sack of moisture resistant polyethylene; both can be recycled but only as their separate constituents.

Empty pesticide containers are hazardous unless fully rinsed and drained. A separate and more costly licence is required for operators handling hazardous waste and this was something we wanted to avoid. However, it soon became apparent that some containers are difficult to wash and drain because of their shape. Other aspects of container design are also problematic: paper labels glued to the containers legally have to be 'firmly affixed', but then they cannot be easily removed. They also clog up the extruders during the reprocessing operation. Foil seals which secure the contents from accidental spillage are difficult to remove intact from the container spouts. Many are awkward to rinse and create a waste product which can only be consigned to landfill.

We presented our case for improved container design to the Government's independent Advisory Committee on Pesticides, who acknowledged that the existing guidelines were nearly 20 years old. We were asked to set up an across-industry working group, to produce a new set of guidelines. In the meantime, several companies introduced improvements independently; self-sealing caps appeared and polyethylene labels shrunk onto rather than glued to the container. Eventually one container emerged which combined all the aspects the working group had recommended, including a wide, centrally-located aperture to reduce glugging, clearer plastic so that cleanliness can easily be checked, a removable and recyclable label and no foil seal. Remarkably the container uses 20% less plastic in its construction than its predecessor, making it easier to crush, transport and recycle. This design will be the standard for manufacturer BASF across Europe by 2012 and will help to make our recycling operation more efficient, something that is increasingly important since the initial 15 farmer members have been joined by over 60 others.

Our Allerton recycling centre is kindly sponsored by Mitsubishi. © Peter Thompson/GWCT

Over 70 farmers bring their farm waste to the Allerton Project to be recycled. © Peter Thompson/GWCT

Reducing soil erosion from arable fields

Switching to low-ground pressure tyres could help reduce soil erosion and water run-off. © Peter Thompson/GWCT

KEY FINDINGS

- Previous research shows that tramlines are a major contributor to soil erosion.
- Low-ground pressure vehicle tyres cut erosion by half.
- Drilling the tramlines had little effect on sediment run-off.

Alastair Leake

Much of our recent work within the Allerton Project has focused on soil management and water quality. Our farm lends itself well to this research, with steeply sloping fields growing arable crops on a heavy soil type, with an above-average 660 millimetres of rainfall each year. Several of the tributaries to the Eye Brook, the principal watercourse in the catchment, have their sources within the land we farm, which means that we can monitor the impact of our experiments on headwaters of this watercourse without the influence of confounding factors (such as septic tank discharges and point source inputs). One trial involved differing cultivation systems; ploughing versus lighter surface cultivations with the tractor cultivating either up and down the slope or along the contour. Although we recorded differences, what we did notice particularly was that around 80% of phosphorus and sediment associated with run-off and soil erosion reaching the edge of field came from the tractor tramlines. As all arable farmers use wheeled vehicles to carry out cultivations and harvesting operations, any sloping land with combinable crops is therefore at risk of diffuse pollution associated with such bare, compacted wheelings.

In 2009 the Allerton Project and ADAS secured funding, through Defra's Sustainable Arable LINK Programme (which brings together research expertise with industry sponsors), to conduct three years of trials, at four sites in different regions, on farms with different soil types. In the first year we aimed to test two ideas. The first was to see if sowing the tramlines helped to reduce erosion, through the leaves of the plants lessening the impact of heavy rainfall on the soil and the roots helping to bind

Run-off from the tramlines was collected in these tanks and measured. © Alastair Leake/GWCT

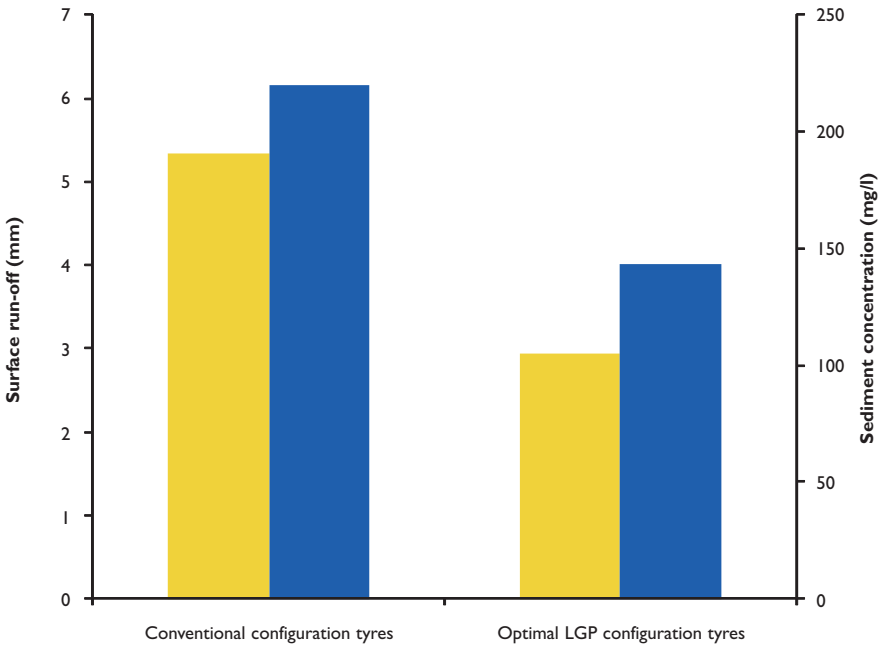


Figure 1

Surface run-off and sediment concentration using conventional tyres and low-ground pressure (LGP) tyres

Surface run-off (mm)

Sediment concentration (mg/l)

the soil in the tramline. This technique can only be used by farmers who have Global Positioning Systems fitted to their tractors because tramlines are no longer visible within the crop. The second idea was to see if compaction (and hence soil run-off) within the tramline could be reduced by using ultra-low ground pressure tyres. These tyres are manufactured with a reinforced side wall which allows the inflation pressure to be reduced. Most farmers will need to apply a herbicide to the crop in the autumn and our previous research at the Allerton Project and elsewhere has shown that it is this operation (which happens when soils are moist and ground cover is negligible) that can cause compaction. This compaction reduces the rate that water infiltrates into the soil, promoting run-off, and increasing erosion and the risk of diffuse pollution. For this treatment, low-ground-pressure (LGP) tyres were fitted to the tractor and the sprayer, and the results compared with those from normal tyres. Winter rainfall was less than usual, but results showed that losses in run-off and erosion in the drilled tramlines were no different from conventional tramlines. So we can conclude that the low ground cover in the vulnerable winter months means that drilling tramlines will not help to reduce erosion over-winter. However, run-off, erosion and diffuse pollution losses were halved using low-ground-pressure tyres compared with conventional configurations (see Figure 1). This is encouraging because switching tyre type is a relatively easy change for farmers to adopt, and has the potential to be linked to policy mechanisms such as Environmental Stewardship.

ACKNOWLEDGEMENTS

We would like to thank Martyn Silgram from ADAS for contributing to the study.

Muddy water run-off.
© Peter Thompson/GWCT

Stocking trout fry

Hatchery boxes.
© Dylan Roberts/GWCT

KEY FINDINGS

- The site retention rate of two-gram fry stocked from the hatchery in April was 0.5% and provides the most beneficial stocking strategy for juvenile triploids.
- The survival rate of fry stocked from wild brood stock was 1.4% where there was good habitat and little spawning by wild fish. This emphasises the importance of this stocking strategy to sites with good habitat and poor natural spawning.

Dominic Stubbing

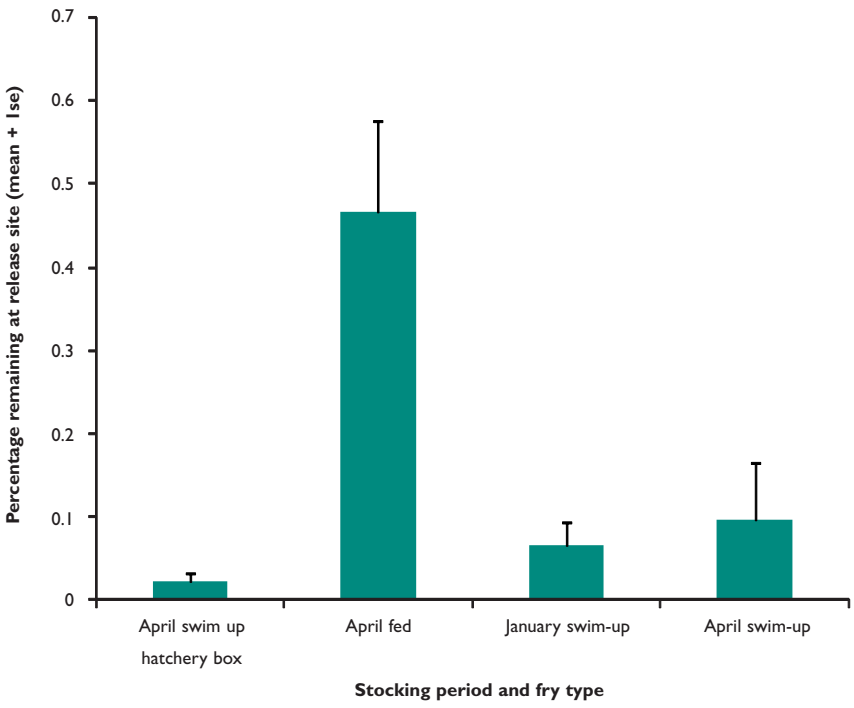
The Environment Agency's *National Trout and Grayling Fisheries Strategy* includes the phasing out of stocking with fertile diploid brown trout by 2015. Only triploid or native-strain brown trout reared under a suitable rearing regime will then be permitted.

There is little information available on survival and effects on wild trout from stocking juvenile triploid brown trout. We also need to understand better how incubator boxes perform as a stocking tool.

Also, little is known about the survival rates of native-strain trout stocked as swim-up fry hatched from incubator boxes. Given the recent policy announcements, understanding the factors determining the survival rates of native-strain eggs in incubator boxes, and also their survival to spawning age, is crucial for management. Therefore we set up a separate study to undertake an assessment of these survival rates.

Figure 1

Site retention of triploid trout fry stocked using different sizes and times of the year



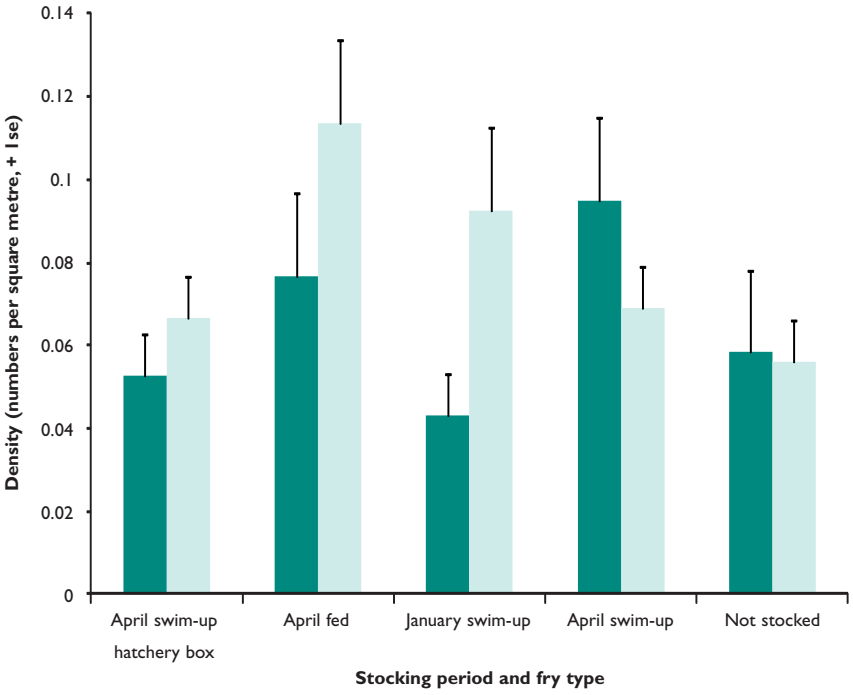


Figure 2

Density of wild trout in sites stocked with triploid trout fry using different sizes and times of the year

Wild trout parr

Adult wild trout

The two studies had similar methods. Firstly we incubated eggs in incubator boxes, which have clean cool water coming in the bottom, flowing up through the gravel and eggs and then through a fry collection chamber. Once eggs hatched and fry emerged, we extracted the fry from the collection chamber and marked them using calcein, which involves an immersion into salt and then calcein solutions so that the fry take up a fluorescent colour visible on the head and fins. This technique was first described in the *Review of 2005*. The fry were then allowed to recover and were stocked into the river.

In the first project on stocking triploid fry, some sites were stocked in January with eyed eggs in hatchery boxes and some in April with newly hatched fry. These April stockings also included some sites that were stocked with well-fed fry weighing around two grams. These treatments were all replicated six times and control sites that were unstocked were included in the experiment. These different sizes of fry represent what is commonly available from hatcheries. They were stocked into the rivers Piddle and Allen in Dorset, which have good habitat and are important trout fisheries.

In late July and August, we went back and electro-fished the stocked areas to recover surviving marked fish and also to assess wild trout numbers. Marked fish, now parr, were given a more permanent elastomer mark for future identification. This was all repeated in a second year.

Results showed that site retention (percentage of stocked fish found in the site) was very poor (see Figure 1). Retention of fed fish weighing about two grams was about 10 times better than for other treatments, so there were more parr in these sites stocked with bigger fry. Despite this, none of the stocking strategies we trialled had a negative effect on wild trout numbers when compared with control (unstocked) sites (see Figure 2). Survival of the eyed eggs in the hatchery boxes was not good at 34%, but then neither was that of the control groups kept in the hatchery at 56%. So far we think that two-gram fry stocked from the hatchery in April would provide the most beneficial stocking strategy for juvenile triploids.

Our second project took place at 13 sites on Candover Brook, Hampshire. The emphasis of this study was to capture wild trout at spawning time and to spawn them by hand. We collected brood-stock with sensitive electro-fishing around the Christmas period. We laid down the eggs straight away in hatchery boxes and these hatched in April. We then released the fry after marking them, then we electro-fished the sites in August to recapture stocked trout and wild trout.

Survival rates of eggs in the boxes were very good, averaging 73%. Survival rates of fry varied across the sites owing to differences in habitat quality and presence of wild trout spawning. Survival rates averaged 1.4% and were highest in areas where there was good habitat and less spawning by wild trout.

Daily cleaning of hatchery box screens.
© Dylan Roberts/GWCT

ACKNOWLEDGEMENTS

We would like to thank Kimbridge on the Test, The Vitacress Conservation Trust, Environment Agency, The Grange, Dorchester Fly Fishing Club, Wessex Chalkstreams, Howard Mason, St Giles Farms, Sparsholt students and Watergates Fish Farm.

River Frome salmon population

River Frome salmon migrate to feed off the coast of Greenland. © Phil Davison/Cefas

KEY FINDINGS

- An increased adult salmon run in 2008 and the opening of the upper Frome with a fish pass at Louds Mill, Dorchester, led to a 50% increase in salmon parr production in 2009.
- We now have evidence that River Frome salmon migrate to feed off the coast of Greenland.
- The 2008 smolt run suffered exceptionally high rates of loss.

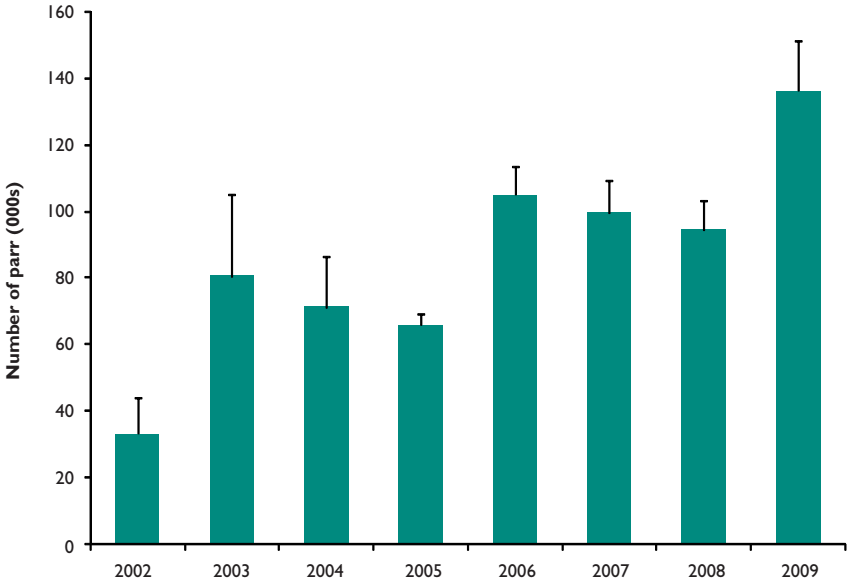
Anton Ibbotson

Estimated from the annual tagging programme and subsequent detection in the smolt counter the following spring, our annual counts of salmon parr and smolt production from the 2009 spawning showed increases over the previous year. Estimated numbers of salmon parr in the River Frome catchment in September 2009 increased by more than 50%. The opening of the upper Frome catchment by installation of the Louds Mill fish pass at Dorchester may have played some part in this increase, although we suspect that there were other factors that favoured parr production in 2009 including an increased adult run during 2008. Our first estimates of the smolt run in the spring of 2010 also showed an increase over 2009, albeit lower than the increase in parr numbers (see Figures 1 and 2). However, we cannot make final estimates of the smolt run until all the tagged smolts return as adults. These returns allow us to estimate the proportion of smolts that we failed to detect when leaving the river. This will not be achieved until 2013.

In September 2010, we tagged over 10,000 parr throughout the Frome catchment for the sixth year running. This work was completed in collaboration with the Centre

Figure 1

Number of salmon parr in the River Frome each September



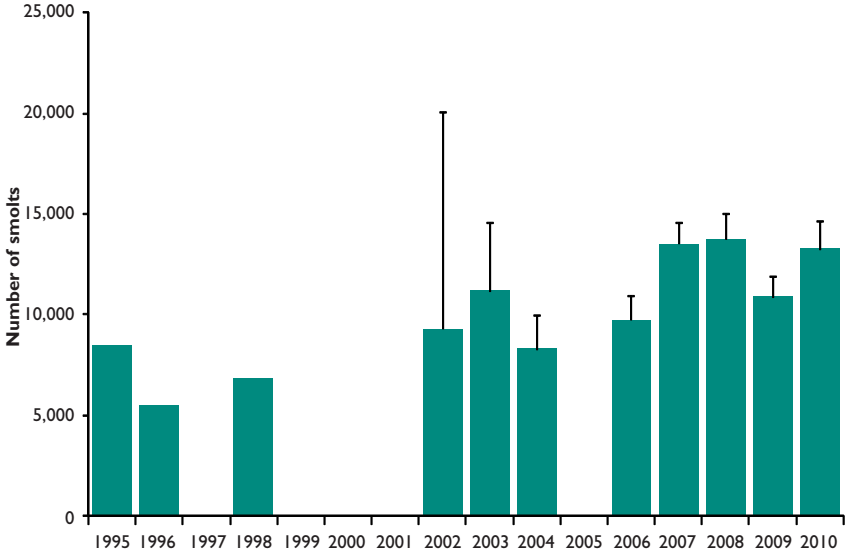


Figure 2

Spring smolt population estimate 1995-2010

for Environment, Fisheries & Aquaculture Science (Cefas) and data on both adults and smolts from the Frome are reported in national and international fisheries monitoring programmes. Adult tag returns from the 2006 and 2007 smolt runs were reasonable, at around 40 each year, but tag returns from the 2008 smolt run have been abysmal (only seven), as was the adult salmon count for 2009, indicating very poor survival at sea from that juvenile emigration. Although that will have a negative effect on the river population, it will be interesting to see how parr production in 2010, and hence smolt production in 2011, responds to the lower adult contribution. Adult tag returns from the 2009 smolt run were similar to those from 2006 and 2007 and the adult count for 2010 is the best we have had since 1998.

Our tagging and counting programmes will, over time, allow us to learn a great deal about the factors that drive salmon numbers up and down. We now have a record of a Frome salmon captured in the northern Atlantic off the coast of Greenland. During a routine sampling of fish markets in Greenland, organised by the North Atlantic Salmon Conservation Organisation, one of our salmon was found for sale in Sisimuit. At the time it was 67.9 centimetres in length and weighed 4.2 kilogrammes (over 9lbs). Since we knew that it had emigrated downstream past our smolt counter at East Stoke, Dorset on the night of 24 April 2008, we know it was destined to become a multi-sea-winter salmon rather than a grilse had it successfully made the return journey back to the stream where it was spawned in Dorset. We also know that it had spent a year in the river before beginning its migration and left the river at 14.9 centimetres long, which is the typical size of River Frome smolts. By the time it was caught in Greenland it had grown over 50 centimetres in length during the 500-plus days it had spent at sea. The distance between Wareham (UK) and Sisimuit is 2,070 miles or 3,332 kilometres. This is the first evidence that fish from the River Frome feed off the coast of Greenland.

One of our River Frome salmon was found for sale in Sisimuit, Greenland. © Phil Davison/Cefas

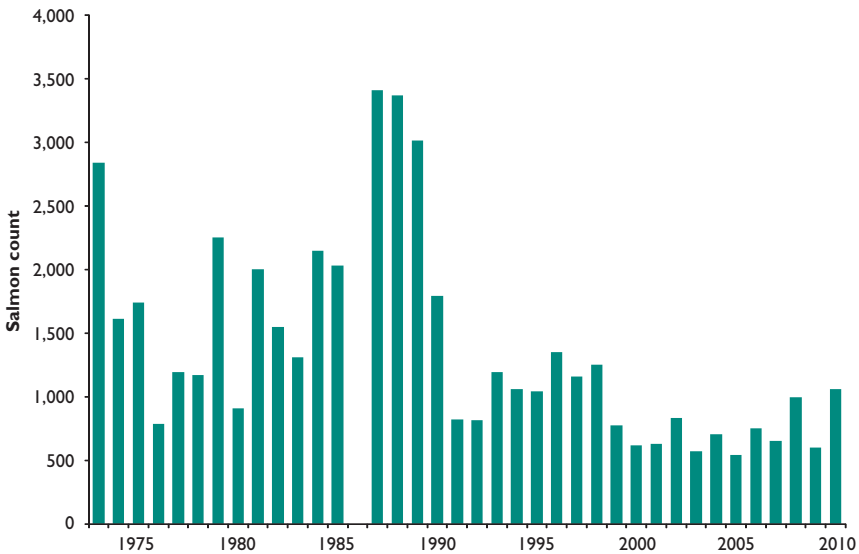


Figure 3

Numbers of returning adult salmon 1973-2010

Research projects

by the Game & Wildlife Conservation Trust in 2010

WILDLIFE DISEASE AND EPIDEMIOLOGY RESEARCH IN 2010

Project title	Description	Staff	Funding source	Date
Gamebird health	*Disease prevention and control in game and wildlife*	*Chris Davis*	*Core funds*	*1998- on-going*
Rearing field	*Provision of the research facility for the grey partridge rearing programme*	*Chris Davis, Matt Ford*	*Core funds*	*2000-2010*
PhD: Maternal immunity	*To investigate the extent of any immunity in pheasant chicks acquired from their mothers*	*Matthew Ellis Supervisors: Chris Davis, Dr Emma Cunningham/University of Edinburgh*	*BBSRC/CASE studentship*	*2006-2010*

LOWLAND GAME RESEARCH IN 2010

Project title	Description	Staff	Funding source	Date
Pheasant population studies	*Long-term monitoring of breeding pheasant populations on releasing and wild bird estates*	*Roger Draycott, Maureen Woodburn, Rufus Sage*	*Core funds*	*1996- on-going*
Monitoring of East Lothian LBAP	*Monitoring the effects of LBAP measures on bird populations in East Lothian*	*Dave Parish, Hugo Straker*	*Core funds*	*2003- on-going*
Grey squirrels and woodland birds	*Does grey squirrel control increase productivity in woodland birds?*	*Rufus Sage*	*European Squirrel Initiative*	*2007-2011*
The management of grass-lands for wildlife and game	*Monitoring the impact of introduced game crops in grassland areas of south-west Scotland*	*Dave Parish, collaboration with SAC*	*SAC, SGRPID*	*2008-2011*
Wild game cropping	*Productivity in wild game in East Anglia compared with cropping patterns*	*Roger Draycott*	*Felix Cobbold Trust, Chadacre Trust*	*2008-2011*
Released red-legged partridges	*Fate and dispersal in released red-legged partridges*	*Rufus Sage, Andrew Hoodless, Roger Draycott*	*Core funds*	*2008-2011*
Game marking scheme	*Study of factors affecting return rates of pheasant release pens*	*Rufus Sage, Maureen Woodburn, Roger Draycott*	*Core funds*	*2008- on-going*
Impacts of releasing	*Recovery of ground flora in pheasant release pens*	*Andrew Hoodless, Rufus Sage*	*Core funds*	*2007-2012*
Arable farming and birds	*Monitoring the response of birds to changes in farmland habitat and management*	*Roger Draycott*	*Sandringham Estate*	*2009- on-going*
Rewilding release shoots	*Factors affecting breeding in free-living reared pheasants*	*Rufus Sage*	*Core funds*	*2010-2013*
Woodcock monitoring	*Examination of annual variation in breeding woodcock abundance*	*Andrew Hoodless*	*Shooting Times Woodcock Club*	*2003- on-going*
Woodcock migration routes	*Trial of geolocators to record stopovers and journey times of woodcock on migration*	*Andrew Hoodless Collaboration with ONCFS*	*Woodcock Club*	*2010-2015*
Avon Valley waders	*Monitoring lapwing breeding success in relation to the Higher Level Scheme*	*Andrew Hoodless*	*Core funds, Natural England*	*2007-2012*
Floodplain grazing project	*Assessment of the biodiversity implications of cessation of weed cutting on the river Avon*	*Andrew Hoodless*	*Natural England*	*2010*
Lapwings on fallow plots (see page 16)	*Assessment of lapwing breeding success on AES fallow plots*	*Andrew Hoodless*	*Manydown Trust, Hampshire & Isle of Wight Wildlife Trust,*	*2010-2012*
PhD: Imprinting gamebird chicks	*Human imprinting gamebird chicks to release and recover as a tool for sampling chick-food invertebrates in crops*	*Gwendolen Hitchcock Supervisors: Rufus Sage, Dr Simon Leather/Imperial College, London*	*BBSRC/CASE studentship*	*2006-2010*
PhD: Trade-offs during pheasant growth and development	*Examination of the effects of carotenoid supplementation and parasite infection in early life on adult phenotype*	*Josephine Orledge Supervisors: Andrew Hoodless, Dr Nick Royle/University of Exeter*	*NERC/CASE studentship*	*2007-2011*
PhD: The management of grasslands for wildlife and game	*Autecological studies of granivorous birds in intensive agricultural grasslands of south-west Scotland*	*Dawn Thomson Supervisors: Dave Parish, Dr Davy McCracken/SAC, Prof Neil Metcalfe/ University of Glasgow, Dr Jane MacKintosh/SNH*	*Core funds, SNH, SAC*	*2006-2012*
DPhil: Origins of over-winter woodcock (see page 14)	*The use of stable isotopes to study woodcock migration and winter movements*	*Adele Powell Supervisors: Andrew Hoodless, Dr Andrew Gosler/Edward Grey Institute/University of Oxford*	*The Countryside Alliance Foundation*	*2008-2011*
PhD: Landscape-scale effects of game management	*Evaluation of relative importance of landscape and local management influences on species distribution and abundance*	*Jessica Newman Supervisors: Andrew Hoodless, Dr Graham Holloway – Reading University*	*Core funds, Private funds, Forestry Commission*	*2010-2013*

PARTRIDGE AND BIOMETRICS RESEARCH IN 2010

Project title	Description	Staff	Funding source	Date
Partridge count scheme (see page 20)	*Nationwide monitoring of grey and red-legged partridge abundance and breeding success*	*Neville Kingdon, Nicholas Aebischer, Julie Ewald, Dave Parish*	*Core funds*	*1933- on-going*
National Gamebag Census (see page 28)	*Monitoring game and predator numbers with annual bag records*	*Nicholas Aebischer, Gillian Gooderham, Peter Davey*	*Core funds*	*1961- on-going*
Sussex study	*Long-term monitoring of partridges, weeds, invertebrates, pesticides and land use on the South Downs in Sussex*	*Julie Ewald, Nicholas Aebischer, Steve Moreby, Dick Potts (consultant)*	*Core funds*	*1968- on-going*
Partridge over-winter losses	*Identifying reasons for high over-winter losses of grey partridges in the UK*	*Francis Buner, Nicholas Aebischer*	*Core funds, Payne-Gallwey Charitable Trust*	*2007-2012*
Mammal population trends	*Analysis of mammalian bag and cull data from the National Gamebag Census under the Tracking Mammals Partnership*	*Nicholas Aebischer, Jonathan Reynolds Peter Davey*	*JNCC*	*2003-2011*
Transactional Environmental Support Systems (TESS)	*Designing an environmental support system across Europe*	*Julie Ewald*	*EU*	*2009-2012*
Generic chick-food index (see page 26)	*Development of a new chick-food index for farmland birds*	*John Holland, Julie Ewald, Nicholas Aebischer*	*Chemicals Regulation Directorate*	*2010*
Wildlife monitoring at Rotherfield Park (see page 22)	*Monitoring of land use, game and songbirds for the Rotherfield Demonstration Project*	*Francis Buner, Malcolm Brockless, Julie Ewald, John Simper, Peter Thompson*	*Core funds*	*2010-2014*
DPhil: Oxfordshire partridges	*To quantify the fate of released grey partridges in Oxfordshire*	*Elina Rantanen Supervisors: Francis Buner, Prof David McDonald & Dr Phil Riordan/ University of Oxford*	*Private individual donor, Core funds, Various charitable trusts*	*2006-2010*

UPLANDS RESEARCH IN 2010

Project title	Description	Staff	Funding source	Date
Strongylosis research	*Development of strongylosis control techniques*	*David Newborn, David Baines, Mike Richardson*	*Core funds*	*2006-2011*
Grouse monitoring (see page 32)	*Annual long-term counts and parasite monitoring*	*David Newborn, David Baines, Mike Richardson, Kathy Fletcher, David Howarth*	*Core funds, Gunnerside Estate*	*1980- on-going*
Black grouse research	*Ecology and management of black grouse*	*Philip Warren*	*Core funds*	*1989- on-going*
Black grouse range extension	*Black grouse range restoration*	*Philip Warren, Frances Atterton*	*Natural England SITA Trust*	*1996-2011*
Otterburn Demonstration Moor	*Predator and habitat management for conservation benefits*	*David Baines, Craig Jones, Philip Chapman*	*Landmarc/Defence Estates*	*2008-2010*
Tick control	*Tick control in a multi-host system*	*Kathy Fletcher, David Howarth*	*Various Trusts*	*2000-2011*
Woodland grouse - Scotland	*Ecology and management of capercaillie*	*David Baines, Graeme Neish*	*SNH*	*1991-2011*
Grouse ecology in the Angus Glens	*Roles of parasites, predators and habitat in determining grouse abundance in the Angus Glens*	*Kathy Fletcher, Laura Taylor*	*Core funds*	*2006-2012*
Monitoring Langholm Moor Demonstration Project (see page 44)	*Research data for moorland restoration to-achieve economically-viable driven grouse shooting and sustainable numbers of hen harriers*	*David Baines, Damian Bubb Paula Keane/RSPB, Aly McCluskie/RSPB*	*Core funds, Buccleuch Estates SNH, RSPB, NE*	*2008-2018*
Mountain hares	*Developing a reliable method for estimating mountain hare numbers*	*Scott Newey/MLURI Rob Raynor/SNH, David Baines*	*SNH, MLURI*	*2008-2011*
Spatial habitat use by black grouse in commercial plantation forests in Scotland (see page 40)	*Radio-tracking study of black grouse habitat use in and around plantations in Perthshire to derive forest-based management prescriptions*	*David Baines, Patrick White*	*SNH, Cairngorms National Park Authority, Forest Enterprise Scotland*	*2009-2012*
Capercaillie and pine martens (see page 36)	*Assessment of changes in abundance indices of pine martens and other predator indices in Scottish forests used by breeding capercaillie*	*David Baines, Allan MacLeod*	*SNH, RSPB*	*2009-2010*
Conservation of grey partridges in the upland fringes (see page 42)	*Survey of the status, recent trends and habitat use by grey partridges in the upland fringes of northern England*	*Philip Warren, Tom Hornby*	*SITA Trust, Co Durham Environment Trust*	*2009-2012*

FARMLAND RESEARCH IN 2010

Project title	Description	Staff	Funding source	Date
Sawfly ecology	*Investigating the ecology of over-wintering sawflies*	*Steve Moreby, Tom Birkett*	*Core funds*	*2000-2010*
Farm4Bio (see page 46)	*Comparing different ways of managing uncropped land for farmland wildlife and to identify the proportion of land needed*	*John Holland & Rothamsted Research, BTO, The Arable Group, Tom Birkett, John Simper*	*Defra, HGCA, Bayer CropScience Ltd, BASF Ltd, Cotswolds Seeds, Dow AgroSciences Ltd, Du Pont, PGRO, Syngenta Ltd*	*2006-2011*

FARMLAND RESEARCH IN 2010 (continued)

Project title	Description	Staff	Funding source	Date
Perennial brood-rearing habitat	*Developing perennial brood-rearing habitat for grey partridges*	*Barbara Smith*	*Core funds*	*2007-2012*
Conservation Grade (see page 48)	*To develop sustainable, multi-purpose, farmland wildlife crops*	*John Holland, Matthew Wainhouse, Rouhan Marsh*	*Conservation Grade Ltd*	*2010-2015*
Invertebrates on arable weeds	*A meta-analysis of arable weeds and their associated invertebrate fauna*	*Barbara Smith, Caitlin Potter*	*Esmée Fairbairn Foundation*	*2010-2011*
Oakbank project	*Evaluating wildlife crops for chick-food insects*	*Barbara Smith, Matthew Wainhouse, Rouhan Marsh*	*Oakbank Game & Conservation Ltd*	*2010*
New Forest heather management	*To investigate rate of recolonisation of sites managed by burning*	*Barbara Smith, Sam Cruickshank*	*New Forest National Park*	*2010-2011*
Sainfoin (see page 50)	*To investigate the invertebrate ecology of sainfoin*	*Barbara Smith, Tarryn Castle*	*Core funds, Henry Edmunds*	*2010*
PhD: Invertebrate aerial dispersal	*Examining the dispersal of beneficial invertebrates within arable farmland*	*Heather Oaten Supervisors: John Holland, Barbara Smith Dr S Leather/Imperial College, London*	*RELU*	*2005-2011*
PhD: Bumblebee nesting ecology	*Enhancing bumblebee nest site availability in arable landscapes*	*Gillian Lye Supervisors: John Holland, Prof Dave Goulson/University of Stirling, Dr Juliet Osborne/Rothamsted Research*	*NERC/CASE studentship*	*2005-2010*
PhD: The population genetics of sawflies	*The impact of population dynamics on genetics and the implications for habitat management*	*Nicola Cook Supervisors: Dave Parish, Dr Steve Hubbard/University of Dundee, Dr Joanne Russell & Dr Alison Karley/ Scottish Crop Research Institute*	*BBSRC/CASE studentship, Scottish Crop Research Institute*	*2007-2011*
PhD: Beetle ecology	*Molecular analysis of intra-guild predation and invertebrate community structure*	*Jeff Davey Supervisors: John Holland, Prof Bill Symondson/University of Cardiff*	*BBSRC/CASE studentship*	*2006-2011*

ALLERTON PROJECT RESEARCH IN 2010

Project title	Description	Staff	Funding source	Date
Effect of game management at Loddington	*Effect of ceasing predator control and winter feeding on nesting success and breeding numbers of songbirds. Use of feed hoppers.*	*Chris Stoate, Alastair Leake, John Szczur*	*Allerton Project funds*	*2001- on-going*
Monitoring wildlife at Loddington (see page 52)	*Annual monitoring of game species, songbirds, invertebrates, plants and habitat*	*Chris Stoate, John Szczur, Alastair Leake, Steve Moreby, Barbara Smith*	*Allerton Project funds*	*1992- on-going*
Wetting up farmland for biodiversity	*Assessment of bird conservation potential of small wet features on farmland*	*Chris Stoate, John Szczur*	*Defra*	*2004-2010*
Soil and Waste Management	*Training for farmers in the understanding of Soil Management Plans and the EU Waste Directive*	*Alastair Leake, Phil Jarvis*	*Course fees, Defra, Environment Agency*	*2005- on-going*
Eye Brook community heritage project	*Community-based research into natural and cultural heritage of catchment as foundation for future management*	*Chris Stoate*	*Heritage Lottery Fund*	*2006-2010*
ClimateWater	*Climate change impacts on water as a resource and ecosystem*	*Chris Stoate*	*EU*	*2008-2011*
MOPS2: Mitigation options for phosphorus and sediment	*Development of constructed wetlands to reduce diffuse pollution*	*Chris Stoate, John Szczur*	*Defra*	*2009-2013*
Reducing risks associated with autumn wheeling of combinable crops (see page 62)	*Replicated field treatments looking at reducing compaction and increasing soil cover in tramline crop wheelings*	*Alastair Leake, Martyn Silgram (ADAS), John Quinton (University of Lancaster), Julian Hasler (HGCA/NFU)*	*ADAS, Chafer Machinery, Michelin, Simba*	*2009-2013*
Albrecht Soil Survey Technique	*Field-scale testing of the Albrecht Soil Survey Technique of nutrient management compared with conventional crop nutrition*	*Alastair Leake, Phil Jarvis*	*Royal Agricultural Society of England, the Glenside Group*	*2009-2012*
Water Friendly Farming	*Baseline data collection for diffuse pollution control project in headwater catchments*	*Chris Stoate, Jeremy Briggs, Penny Williams (Pond Conservation)*	*Environment Agency*	*2010*
Eye Brook parish food footprint	*Land area needed to provide locally sourced food*	*Chris Stoate, Rebecca Granatstein*	*Allerton project core funds/HLF*	*2010*
Welland Sediment Project	*Assessing sediment impacts in the upper river Welland and advocating mitigation*	*Chris Stoate, Kathryn Carr*	*Environment Agency*	*2009-2010*
Slug control	*Field evaluation trials on new active ingredient for slug control*	*Alastair Leake, Phil Jarvis, Anthony Thevenot*	*Omex*	*2009-2010*
Soil conditioner	*The feasibility of anaerobic digestate as a soil conditioner*	*Alastair Leake, ADAS*	*Biffa, Leicester City Council*	*2009-2011*

ALLERTON PROJECT RESEARCH IN 2010 (continued)

PhD: Game as food	*Rural networks and processes associated with the use of game as food*	*Graham Riminton Supervisors: Chris Stoate, Dr Carol Morris & Dr Charles Watkins/University of Nottingham*	*ESRC/CASE studentship Supported by the BDS*	*2007-2011*
PhD: Environmental learning careers of farmers and delivery of environmental goods through agri-environment schemes	*An investigation into how farmers learn about effective environmental management through their active participation in agri-environment schemes*	*Susanne Jarratt Supervisors: Chris Stoate, Dr Carol Morris/ University of Nottingham*	*ESRC/NERC studentship*	*2009-2013*

PREDATION RESEARCH IN 2010

Project title	Description	Staff	Funding source	Date
Fox control methods	*Experimental field comparison of fox capture devices*	*Jonathan Reynolds, Mike Short*	*Core funds*	*2002- on-going*
River Monnow project	*Extension of mink control to the entire upper Monnow catchment, Herefordshire*	*Jonathan Reynolds, Ben Rodgers, Owain Rodgers*	*SITA Trust, John Ellerman Foundation, Core funds*	*2007-2010*
Tunnel traps	*Experimental field comparison of tunnel traps and methods of use*	*Jonathan Reynolds, Mike Short*	*Core funds*	*2008- on-going*
PhD: Pest control strategy	*Use of Bayesian modelling to improve control strategy for vertebrate pests*	*Tom Porteus Supervisors: Jonathan Reynolds, Prof Murdoch McAllister/University of British Columbia, Vancouver*	*Core funds, University of British Columbia*	*2006-2011*

FISHERIES RESEARCH IN 2010

Project title	Description	Staff	Funding source	Date
Fisheries research	*Develop wild trout fishery management methods including completion of write up/reports of all historic fishery activity*	*Dylan Roberts, Dominic Stubbing*	*Core funds*	*1997- on-going*
Monnow habitat improvement project	*Large-scale conservation project and scientific monitoring of 30 kilometres of river habitat on the River Monnow in Herefordshire*	*Dylan Roberts*	*Defra, Rural Enterprise Scheme, Monnow Improvement Partnership*	*2003- on-going*
Releasing trout fry (see page 64)	*Survival of domesticated triploid farmed trout fry stocked from incubator boxes in chalk streams and their impacts on wild trout*	*Dylan Roberts, Dominic Stubbing*	*Core funds*	*2008-2013*
Survival of native trout fry	*Survival of native trout fry stocked from incubator boxes on the Candover Brook*	*Dylan Roberts, Dominic Stubbing*	*Vitacress Conservation Trust, EA, Core funds*	*2008-2011*
Salmon life history strategies in freshwater (see page 66)	*Understanding the population declines in salmon*	*Anton Ibbotson, Dylan Roberts, William Beaumont, Luke Scott, Dominic Stubbing*	*Core funds, EA, CEFAS, Valentine Trust, Alice Ellen Cooper Dean Charitable Trust, AST, S&TA, Garfield Weston Foundation*	*2009- on-going*
Salmon smolt rotary screw trap assessment	*Calculating the effects of rotary screw traps on salmon smolts*	*Anton Ibbotson, Dylan Roberts, William Beaumont, Luke Scott, Dominic Stubbing*	*CEFAS*	*2009- on-going*
Avon demonstration test catchment project	*Impact of farm practice mitigation measures on fish*	*Dylan Roberts, Anton Ibbotson, Dominic Stubbing William Beaumont, Luke Scott*	*Defra*	*2010-2014*
PhD: Pike and weed management in lowland rivers	*Impact of pike removal and weed management on brown trout*	*Sui Phang Supervisors: Dylan Roberts, Anton Ibbotson, Dr R Gozlan & Dr R Britten/University of Bournemouth*	*Core funds, University of Bournemouth*	*2009-2013*
PhD: Water temperatures and salmonids	*Micro habitat use by salmonids in relation to temperature*	*Frances Mallion Supervisors: Dylan Roberts, Anton Ibbotson, Dr P Kemp/University of Southampton*	*University of Southampton, Core funds, EA, CEH*	*2009-2013*

Key to abbreviations:
AST = Atlantic Salmon Trust; AONB = Area of Outstanding Natural Beauty; BBSRC = Biotechnology and Biological Sciences Research Council; BDS = British Deer Society; CASE = Co-operative Awards in Science & Engineering; CEFAS = Centre for Environment, Fisheries & Aquaculture Science; CEH = Centre for Ecology and Hydrology; Defra = Department for Environment, Farming and Rural Affairs; EA = Environment Agency ESRC = Economic & Social Research Council; EU = European Union. Key to abbreviations: HGCA = Home-Grown Cereals Authority; JNCC = Joint Nature Conservation Committee; MoD = Ministry of Defence; MLURI = Macaulay Land Use Research Institute; NE = Natural England; NERC = Natural Environment Research Council; NWD AONB = North Wessex Downs Area of Outstanding Natural Beauty; RELU = Rural Economy & Land Use; RSPB = Royal Society for the Protection of Birds; S&TA = Salmon & Trout Association; SAC = Scottish Agricultural Colleges; SGRPID = Scottish Government Rural Payments and Inspections Directorate; SNH = Scottish Natural Heritage.

Scientific publications

by staff of the Game & Wildlife Conservation Trust in 2010

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Aebischer, NJ, Ewald, JA & Tapper, SC (2010) Driven grouse shooting in Britain: a form of upland management with wider conservation benefits. In: Allen, P (ed.) *The Ecologic and Economic Benefits of Hunting*: 186-201. World Forum on the Future of Sport Shooting Activities (WFSA), Rome, Italy.

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Black, J, Milner-Gulland, EJ, Sotherton, NW & Mourato, S (2010) Valuing complex environmental goods: landscape and biodiversity in the North Pennines. *Environmental Conservation,* 37: 136-146.

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Butler, DA & Davis, C (2010) Effects of plastic bits on the condition and behaviour of captive-reared pheasants. *Veterinary Record*, 166: 398-401.

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Ewald, JA, Aebischer, NJ, Richardson, SM, Grice, PV & Cooke, AI (2010) The effect of agri-environment schemes on grey partridges at the farm level in England. *Agriculture, Ecosystems and Environment,* 138: 55-63.

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Hitchcock, GE (2010) *Using human-imprinted pheasant* (Phasianus colchicus) *chicks to investigate farmland foraging potential.* Unpublished PhD thesis. Imperial College London.

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Tapper, SC (2010) *Waders on the Fringe. Why nationally scarce waders flourish on grouse moors*. Game & Wildlife Conservation Trust, Fordingbridge.

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Winspear, R, Grice, P, Peach, W, Phillips, J, Aebischer, NJ, Thompson, P, Egan, J & Nowakowski, M (2010) The development of Farmland Bird Packages for arable farmers in England. *Aspects of Applied Biology,* 100: 347-352.

Note: the publications listed as 2009 did not appear in print before the Review of 2009 went to press. For a complete record of the scientific publications by staff of the Game & Wildlife Conservation Trust, we therefore include them here.

Financial report
for 2010

KEY POINTS

- There was a small increase of £64,789 in the General Fund.
- Expenditure on research again exceeded £3 million.
- Restricted funds decreased by £162,560 as a result of spending grants received in earlier years.
- Overall funds were virtually unchanged.

The summary report and financial statement for the year ended 31 December 2010, set out below and on pages 76 to 77, consist of information extracted from the full statutory Trustees' report and consolidated accounts of the Game & Wildlife Conservation Trust and its wholly-owned subsidiaries Game & Wildlife Conservation Trading Limited and Game Conservancy Events Limited. They do not comprise the full statutory Trustees' report and accounts, which were approved by the Trustees on 20 April 2011 and which may be obtained from the Trust's Headquarters. The auditors have issued unqualified reports on the full annual accounts and on the consistency of the Trustees' report with those accounts, and their report on the full accounts contained no statement under sections 498(2) or 498(3) of the Companies Act 2006.

The Trust was aiming to break-even in 2010; the trustees consider that the General Fund deficit of £87,523 (around 1% of total income) is reasonable given the financial climate. Public sector funding is now particularly hard to secure and we are very grateful to the individual supporters and charitable trusts who have helped fill the void. One result of this public sector decrease is a substantial reduction in grants received in advance; this produces a deficit on restricted funds in the Statement of Financial Activities when previous years' grants are spent.

Investments performed well in the year. Realised and unrealised gains were 9% of the value of the investments as at the start of the year.

The trustees continue to keep the Trust's financial position under close review and to take action to protect the Trust against the inevitable uncertainty in fundraising in the current financial climate. They continue to be satisfied that the Trust's overall financial position is sound. In particular the Trust is continuing to meet its reserves target, which is that unrestricted cash and investments should exceed £1.5 million.

Plans for future periods

The Trust continues to work to the aims set out in its five-year business plan, which are as follows:

1. To focus on three areas of work: species recovery, game and wildlife management and wildlife-friendly farming.
2. To strengthen our ability to deliver the results and implications of that science to our three audience groups – the public, policy makers and practitioners.
3. To maintain the financial security of the Trust.
4. To improve the profile of the Trust and to make us a more relevant organisation to a broader range of stakeholders.

The Trust's strategy of promulgating practical conservation methods based on sound scientific research will continue to make our work even more relevant in the future.

I Coghill
Chairman of the Trustees

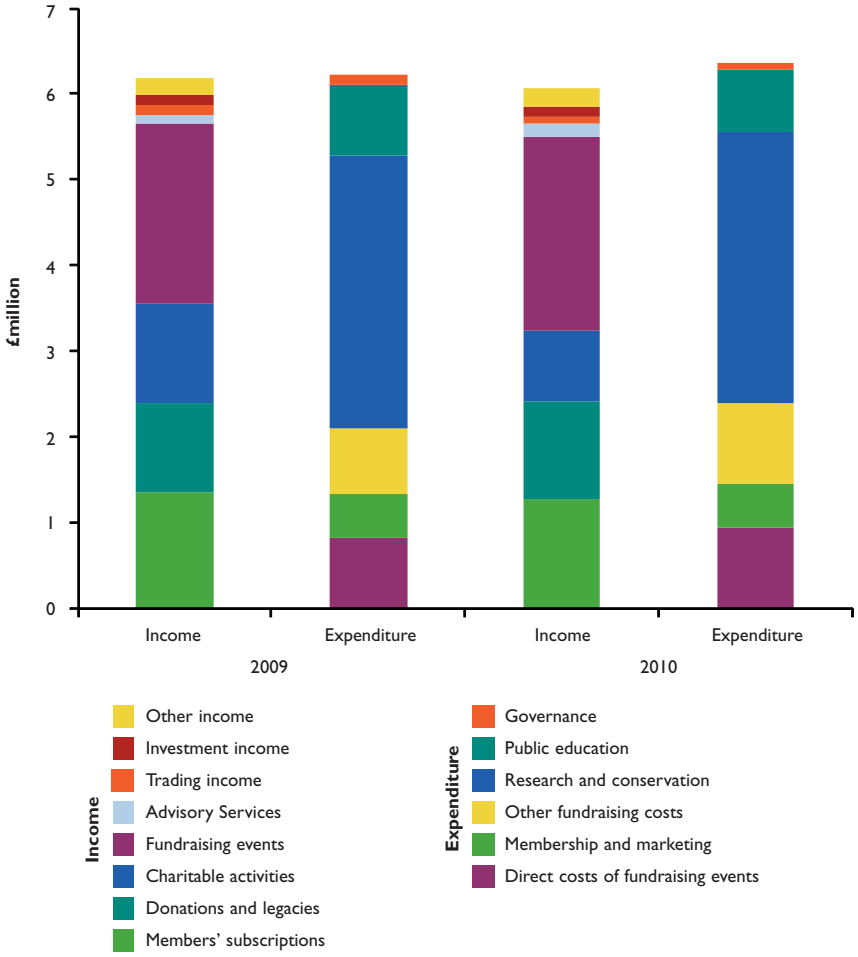

Figure 1

Total incoming and outgoing resources in 2010 (and 2009) showing the relative income and costs for different activities

Independent auditors' statement

to the Trustees and Members of the Game & Wildlife Conservation Trust (limited by guarantee)

We have examined the summary financial statement for the year ended 31 December 2010 which is set out on pages 76 and 77.

Respective responsibilities of Trustees and Auditors

The trustees are responsible for preparing the summarised Financial Report in accordance with applicable United Kingdom law. Our responsibility is to report to you our opinion of the consistency of the summary financial statement with the full annual financial statements and the Trustees' Report, and its compliance with the relevant requirements of section 427 of the Companies Act 2006 and the regulations made thereunder.

We also read the other information contained in the summarised Financial Report and consider the implications for our report if we become aware of any apparent misstatements or inconsistencies with the summary financial statement. The other information comprises only the Review of Financial Performance.

We conducted our work in accordance with Bulletin 2008/3 issued by the Auditing Practices Board. Our report on the Trust's full annual financial statements describes the basis of our opinion on those financial statements.

Opinion

In our opinion the summary financial statement is consistent with the full annual financial statements of the Game & Wildlife Conservation Trust for the year ended 31 December 2010 and complies with the applicable requirements of Section 427 of the Companies Act 2006 and the regulations made thereunder.

FLETCHER & PARTNERS
Chartered Accountants and Statutory Auditors
Salisbury, 28 April 2011

Consolidated

Statement of financial activities

	General Fund £	Designated Funds £	Restricted Funds £	Endowed Funds £	**Total 2010 £**	Total 2009 £
INCOME AND EXPENDITURE						
INCOMING RESOURCES						
Incoming resources from generated funds						
Voluntary income						
Members' subscriptions	1,259,262	-	2,870	-	**1,262,132**	1,349,169
Donations and legacies	670,482	-	469,749	-	**1,140,231**	1,035,959
	1,929,744	-	472,619	-	**2,402,363**	2,385,128
Activities for generating funds						
Fundraising events	2,255,978	-	6,239	-	**2,262,217**	2,105,097
Advisory Service	164,453	-	-	-	**164,453**	109,984
Trading income	84,441	-	-	-	**84,441**	107,115
Investment income	18,826	-	101,654	-	**120,480**	120,914
Incoming resources from						
Charitable activities	333,479	-	491,476	-	**824,955**	1,157,729
Other incoming resources	186,877	-	21,339	-	**208,216**	197,553
TOTAL INCOMING RESOURCES	4,973,798	-	1,093,327	-	**6,067,125**	6,183,520
RESOURCES EXPENDED						
Costs of generating funds						
Direct costs of fundraising events	942,814	-	-	-	**942,814**	812,567
Membership and marketing	500,111	-	-	-	**500,111**	514,892
Other fundraising costs	905,682	32,889	-	-	**938,571**	760,050
	2,348,607	32,889	-	-	**2,381,496**	2,087,509
Activities in furtherance of the charity's objects						
Research and conservation - Lowlands	989,440	-	524,018	-	**1,513,458**	1,632,169
Research and conservation - Uplands	550,606	-	196,715	-	**747,321**	668,897
Research and conservation - Allerton Project	123,946	-	433,372	20,750	**578,068**	647,590
Research and conservation - Fisheries	272,796	-	53,865	-	**326,661**	252,879
	1,936,788	-	1,207,970	20,750	**3,165,508**	3,201,535
Public education	693,882	-	47,917	-	**741,799**	816,306
	2,630,670	-	1,255,887	20,750	**3,907,307**	4,017,841
Governance	82,044	-	-	-	**82,044**	109,908
TOTAL RESOURCES EXPENDED	5,061,321	32,889	1,255,887	20,750	**6,370,847**	6,215,258
NET INCOMING/(OUTGOING) RESOURCES	(87,523)	(32,889)	(162,560)	(20,750)	**(303,722)**	(31,738)
OTHER RECOGNISED GAINS AND LOSSES						
Realised gains/(losses) on investments	(1,210)	-	-	-	**(1,210)**	38,986
Unrealised gains/(losses) on investments	153,522	-	-	143,842	**297,364**	214,149
NET MOVEMENT IN FUNDS	64,789	(32,889)	(162,560)	123,092	**(7,568)**	221,397
BALANCES AT 1 JANUARY 2010	2,343,785	190,524	541,363	4,243,215	**7,318,887**	7,097,490
BALANCES AT 31 DECEMBER 2010	£2,408,574	£157,635	£378,803	£4,366,307	**£7,311,319**	£7,318,887

Consolidated

Balance sheet

as at 31 December 2010

	2010		2009	
	£	£	£	£
FIXED ASSETS				
Tangible assets		3,124,179		3,088,213
Investments		3,380,949		3,155,041
		6,505,128		6,243,254
CURRENT ASSETS				
Stock	228,963		150,778	
Debtors	915,380		1,188,221	
Cash at bank and in hand	702,426		531,691	
	1,846,769		1,870,690	
CREDITORS:				
Amounts falling due within one year	636,994		541,603	
NET CURRENT ASSETS		1,209,775		1,329,087
TOTAL ASSETS LESS CURRENT LIABILITIES		7,714,903		7,572,341
CREDITORS:				
Amounts falling due after more than one year		403,584		253,454
NET ASSETS		£7,311,319		£7,318,887
Representing:				
CAPITAL FUNDS				
Endowment funds		4,366,307		4,243,215
INCOME FUNDS				
Restricted funds		378,803		541,363
Unrestricted funds:				
Designated funds	157,635		190,524	
Revaluation reserve	469,835		392,591	
General fund	1,889,105		1,921,664	
Non-charitable trading fund	49,634		29,530	
		2,566,209		2,534,309
TOTAL FUNDS		£7,311,319		£7,318,887

Approved by the Trustees on 20 April 2011 and signed on their behalf

I COGHILL

Chairman of the Trustees

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of the Game & Wildlife Conservation Trust
in 2010

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Head of Fisheries Research	Dylan Roberts BSc
Fisheries Biologist	Dominic Stubbing HND, MIFM, PhD, Ch. Env
Placement Student *(University of Hull)*	Niall Freemen *(March-April)*
Placement Student *(Sparsholt College)*	Martin Smith *(July-August)*
Head of Salmon & Trout Research Centre	Anton Ibbotson BSc, PhD
Senior Fisheries Scientist Salmon & Trout Research Centre	Bill Beaumont MIFM
Research Assistant Salmon & Trout Research Centre	Luke Scott
Placement Student *(University of Hull)*	Joe Kitanosono *(April)*
Placement Student *(Sparsholt College)*	Martin Smith *(April-May)*
Placement Student *(University of Hull)*	Niall Freeman *(August-October)*
Head of Lowland Gamebird Research	Rufus Sage BSc, MSc, PhD
Ecologist - Pheasants, Wildlife (p/t)	Maureen Woodburn BSc, MSc, PhD
Senior Ecologist - Partridges, Pheasants	Roger Draycott HND, MSc, PhD
Visiting PhD Student (University of León) - Partridges, Pheasants	José Ángel Armenteros Santos *(November-December)*
Bird Surveyor	Chris Le Clare *(March-August)*
Bird surveyor	Sue Wilson BA *(April-July)*
Bird Surveyor	Tony Powell *(April-August)*
PhD Student *(Imperial College, London)* - pheasant chick foraging	Gwen Hitchcock BSc *(until July)*
Placement Student *(University of Cardiff)*	Mark Hillsley *(until August)*
Placement Student *(University of Cardiff)*	Nick Hesford *(from Aug)*
MSc student *(University of Exeter)* - Pheasant tracking	Maeve Maher-McWilliams BSc *(February-June)*
MSc student *(Edinburgh Napier University)* - Pheasant pens	Kayleigh Hogg BSc *(April-August)*
Head of Wetland Research	Andrew Hoodless BSc, PhD
Research Assistant	Chris Heward *(from November)*
PhD Student *(University of Exeter)* - pheasant growth and development	Josie Orledge BSc
DPhil Student *(University of Oxford)* - woodcock migration	Adele Powell BSc, MSc
PhD Student *(University of Reading)* - game landscapes	Jessica Neumann BSc *(from October)*
MSc Student *(Imperial College, London)* - lapwings on grassland	Alison Nicholls BSc
MSc Student *(Imperial College, London)* - lapwings on grassland	Phil Churchill BSc
MSc Student *(University College, London)* - lapwings on fallow plots	Scott Hardy BSc
Placement Student *(Bath University)*	Amy Williams *(until July)*
Senior Scientist - Scottish Lowland Research	David Parish BSc, PhD
MSc Student *(University of Glasgow)* - yellowhammer ecology	Dawn Thomson BSc
MSc Student *(University of Dundee)* - population genetics of sawflies	Nicki Cook BSc
Head of Wildlife Disease & Epidemiology	Chris Davis BVM&S, MRCVS
Rearing Field Technician	Matt Ford *(until May)*
Head of Predation Control Studies	Jonathan Reynolds BSc, PhD
Research Assistant	Mike Short HND
Research Assistant	Thomas Porteus BSc, MSc
Research Assistant	Suzanne Richardson BSc, MSc
Research Assistant	Ben Rodgers BSc *(until June)*
Research Assistant	Owain Rodgers *(until June)*
Head of Farmland Ecology	John Holland BSc, MSc, PhD
Senior Ecologist	Barbara Smith BSc, PhD
Senior Entomologist	Steve Moreby BSc, MPhil
Entomologist	Sue Southway BA
Ecologist	Tom Birkett BSc, PgC
Ecologist	John Simper BSc, MSc
Research Assistant	Rouhann Marsh BSc *(June-August)*
PhD Student *(University of Stirling)* - bumblebees	Gillian Lye BSc
PhD Student *(University of Cardiff)* - predatory insects	Jeff Davey BSc
Placement Student *(University of Bath)*	Sam Cruikshank *(until September)*
Placement Student *(University of York)*	Caitlin Potter *(from September)*
Director of Upland Research	David Baines BSc, PhD
Office Manager, The Gillett	Julia Hopkins
Senior Scientist	Phil Warren BSc, PhD
Project Assistant - Black Grouse	Frances Atterton BSc, MSc

Research Assistant	Michael Richardson BSc
Research Assistant - Partridge	Tom Hornby *(from March)*
Research Ecologist Langholm	Damian Bubb BSc, PhD
Head Gamekeeper - Otterburn	Craig Jones *(until March)*
Beatkeeper - Otterburn	Phil Chapman *(until March)*
Placement Student *(University of Durham)*	Laura Kirk *(until August)*
Placement Student *(Harper Adams)*	Huw Lloyd *(until August)*
Placement Student *(University of York)*	Jemma Grant *(from August)*
Placement Student *(Harper Adams)*	Eleanor Healey *(from August)*
Senior Scientist - North of England Grouse Research	David Newborn HND
Senior Scientist - Scottish Upland Research	Kathy Fletcher BSc, MSc, PhD
Research Assistant - Scottish Upland Research	David Howarth
Research Assistant - Scottish Upland Research	Allan MacLeod BSc *(until June)*; Graeme Neish *(from July)*
Woodland Grouse Research Scientist	Patrick White BSc, PhD *(from January)*
Project Scientist - Angus Glens	Laura Taylor BSc
Placement Student *(Harper Adams)*	Melanie Brown *(until August)*
Placement Student *(University of York)*	Hannah Gooch *(until August)*
Placement Student *(University of York)*	Phoebe Morton *(from August)*
Placement Student *(University of Bath)*	Holly Stevens *(from September)*
DIRECTOR OF POLICY & THE ALLERTON PROJECT	Alastair Leake BSc (Hons), MBPR (Agric), PhD, FRAgS, MIAgM, CEnv *(from December)*
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Head of Research for the Allerton Project	Chris Stoate BA, PhD
Ecologist	John Szczur BSc
PhD Student *(University of Nottingham)* - game as food	Graham Riminton BSc
PhD Student *(University of Nottingham)* - farmers' environmental learning	Susanne Jarratt BSc *(from September)*
MSc Student *(University of Lancaster)* - game crops	Frances Davis BSc *(from May)*
BSc Student *(University of Ottowa)*	Rebecca Granatstien *(May-July)*
Placement Student *(Harper Adams)*	Claire Anderson *(until July)*
Placement Student *(Harper Adams)*	Matthew Sadler *(from August)*
Post-graduate Intern	Nicola Winning *(from November)*
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Farm Assistant	Michael Berg
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Assistant Biometrician	Peter Davey BSc *(until December)*
Senior Conservation Scientist	Francis Buner Dipl Biol, PhD
Visiting PhD Student *(University of León)* - partridge ecology	Carlos Sánchez Garcîa-Abad BVSc *(until February)*
Visiting PhD Student *(University of Rio Claro)* - partridge ecology	Christine Steiner Sao Bernardo *(May)*
Head of Geographical Information Systems	Julie Ewald BS, MS, PhD
Partridge Count Scheme Co-ordinator	Neville Kingdon BSc
Placement Student *(University of Cardiff)*	Penny Holgate *(until September)*
Placement Student *(University of York)*	Christopher Wheatley *(until September)*
Placement Student *(University of Reading)*	Katrina Beach *(from September)*
Placement Student *(Liverpool John Moores University)*	Laura Murdoch *(from September)*
DIRECTOR OF FUNDRAISING	Edward Hay
Personal Assistant	Charlotte Harmer BA *(until March)*; Matilda Harden BA *(from March)*
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London Events Assistant	Florence Mercer *(until January)*; Felicity Cranfield BA *(from January)*
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Southern Regional Fundraiser	Max Kendry
Eastern Regional Fundraiser	Lizzie Herring
North West Regional Organiser (p/t)	Rebecca Fifield *(from January)*
Regional Organiser (p/t)	Sally Read BSc *(from May)*
Fundraising Researcher	Jason Medlycott BA *(March-May)*; Natalie Palys BA *(June-July)*
Fundraiser - Scotland	Andrew Dingwall-Fordyce
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Head of Database	Corinne Duggins Lic ès Lettres
Database Assistant (p/t)	Beverley Mansbridge
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Head of Membership and Marketing	Sarah Felix-Rogers HND *(from October)*
Membership Assistant	Angela Hodge
Administrator (p/t)	Suzanne Fairbairn
Head of Telesales	Joanne Hilton
Corporate Partnership Manager	Philip Coley BSc *(until July)*
DIRECTOR SCOTLAND	Ian McCall BSc[1] *(until February)*; Adam Smith BSc, MSc, DPhil *(from February)*
Secretary - Scottish HQ (p/t)	Irene Johnston
Head of PR & Education - Scotland (p/t)	Katrina Candy HND
Head of Scottish Policy	Adam Smith BSc, MSc, DPhil *(until February)*
Senior Scottish Advisor & Scottish Game Fair Chairman	Hugo Straker NDA *(from February)*[2]
DIRECTOR OF ADVISORY & EDUCATION	Ian Lindsay BSc[3]
Co-ordinator Advisory Services (p/t)	Lynda Ferguson
Advisor/Development Officer	Alex Butler
Field Officer – Farmland Ecology	Peter Thompson DipCM, MRPPA (Agric)
Head of Education	Mike Swan BSc, PhD[4]
Regional Advisor - Central & Southern Scotland & Northern England	Hugo Straker NDA[2] *(until February)*
Regional Advisor - Eastern & Northern England (p/t)	Martin Tickler MRAC *(until September)*
Regional Advisor - North East	Henrietta Appleton BA, MSc
Advisor Grouse Technical Services	Craig Jones *(from March)*
Game Manager – Royston/Rotherfield	Malcolm Brockless

[1] Ian McCall was also Regional Advisor for Tayside, Fife, Northern Scotland & Ireland (until Feb) and consultant advisor to GWCT Scotland (from Feb);
[2] Hugo Straker was also Development Officer for Central and Southern Scotland (until Feb) and is now Regional Advisor for Scotland and Ireland;
[3] Ian Lindsay is also Regional Advisor - Wales, Midlands; [4] Mike Swan is also Regional Advisor for the South of England.

Notes

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