Review of 2012

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

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Review of 2012

Issue 44

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 of 1 January 2013

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Chairman and Chief Executive's report

by Ian Coghill, Chairman and Teresa Dent, Chief Executive

Our Diamond Jubilee community orchard, planted as part of the celebration of the 20th Anniversary of our Allerton Project. © Tim Scrivener

Our Allerton Project demonstration farm celebrated its 20th Anniversary in 2012; a quarter of a century since Lord and Lady Allerton gifted their family farm to the Trust. Their decision was a profound compliment to the Trust and showed a far-sighted approach. This was the first time that a farm had been left to a conservation charity where the recovery of many of our much loved farmland birds would be both researched and demonstrated in practice. Even today, this detailed work has only been undertaken at the Allerton Project, and in the last 10 years, on the RSPB's farm in Cambridgeshire.

Since then this ordinary farm has repaid the Allertons' generosity by showing thousands of farmers, gamekeepers and policy makers how to combine commercial farming with wildlife conservation successfully; how much game management contributes to the conservation of other wildlife on the farm; how to manage soil to prevent erosion and the pollution of waterways; how controlling predation can help farmland birds; and now how to try and create a shoot that combines released birds and wild

Jim Paice, MP, guest speaker at our joint Allerton and LEAF open day. © Tim Scrivener

(L-R) Minister Richard Benyon, MP, at the launch of the Marlborough Downs Nature Improvement Area, Teresa Dent, chief executive, Poul Christensen, chair Natural England and Chris Musgrave, one of the farmers involved in the project.
© Morag Walker/GWCT

production. It still has much to teach us, not least how to intensify, but sustainably, our food production, while doing the same for our wildlife husbandry.

The thousands of visitors who annually visit the GWCT Scottish Game Fair were thwarted last year when wet weather forced us to cancel the event after the first day. We have had wet shows before, but never one where we have had to admit defeat by the elements. As it turned out, of course, we were merely one of many. It was a huge disappointment to us, our loyal trade stands, and our visitors and, although we were insured against the worst of the loss, it has had an impact on the Trust's finances.

Our broad range of research projects is again highlighted in this review, alongside our policy, advisory and educational work. We want this research to be shared, and available to anyone who can benefit from it. To that end, we hosted a new kind of research conference in 2012 to which we invited all the conservation organisations and agencies we know and work with. It was a stimulating and influential day. During 2012, we published our 1,700th science article, one of a list that goes back to 1929, the vast majority of which are published in peer-reviewed scientific journals.

Our science and expertise continues to inform policy and meet the challenges facing the shooting world. We have been very involved in the Lead Ammunition Group and the review of wildlife law being undertaken by the Law Commission.

None of this would be possible without the generous and unstinting support of our members, donors and sponsors. To them we extend our warmest thanks. The collective expertise, energy, enthusiasm and sheer hard work of our staff is impressive and we thank them all. The leadership and direction provided without reward by our committed trustees is another great strength.

Our science and expertise demonstrated at our research conference last year continues to inform policy. (L-R) Ian Coghill, chairman, Minister Richard Benyon MP and Teresa Dent, chief executive.
© Andrew Gilruth/GWCT

Our policies

by Alastair Leake, Director of Policy and Adam Smith, Director Scotland

We are continuing to get the results of our research embedded in policy and implemented in the countryside. (Inset L-R) Alastair Leake our director of policy and Sir Jim Paice MP. © Peter Thompson/GWCT and Tim Scrivener

There has been a steady divergence of land management policies across the UK, as the devolved administrations establish their own agendas and respond to the particular political circumstances they face. Our core messages on conservation management, however, have remained consistent.

England

Getting the results of our research embedded in policy, and better still implemented in the countryside, is our ultimate objective. We hope to achieve the favourable conservation status of species through habitat improvement and through a more directly targeted interventionist strategy. Over the decades, our scientists have developed beetle banks, conservation headlands, wildlife seed mixes and pollen and nectar mixes. Each concept was thought out, put into practice, measured, refined and then costed. Since the advent of Entry Level Stewardship in 2005, it has been pleasing to see large numbers of farmers entering into agreements and carrying out environmental work on their farms.

However, despite the widespread uptake of agri-environment schemes, we have not seen the dramatic improvements in species numbers we had hoped for. This has encouraged us to look further at the structure of the schemes and indeed the options within them. It has become clear that, faced with over 60 option choices, farmers will often choose those which suit them and their farms best rather than focusing on the needs of species found on their farms. This is not surprising; after all they are first and foremost food producers rather than ecologists, so we need to devise a means to make their participation more effective. One of the approaches we have sought is the segmentation of options; so called 'bundles' of measures. These should enable farmers to target their objectives, with packages designed to help improve soil health, water quality, bird populations and wildlife generally. They are set out in the new agri-environment scheme handbook for farmers.

We have also sought to have new options introduced, in particular supplementary feeding during the so-called 'hungry gap', between January and April. When this was first considered for inclusion as an option, our scientific evidence was less robust than for other options, although we were well aware of the benefits to game species. But work carried out over the last decade has produced the evidence we needed to convince policy makers, other stakeholders, and ultimately the European Commission that this option should be made available and funded for the benefit of farmland birds.

Other aspects of our policy work have focused on maintaining the tools that landowners, farmers, keepers and conservationists all need to manage wildlife. We have responded to the Law Commission consultation on the review of wildlife law and continue our involvement with the deliberations of the Lead Ammunition Group, and both the agri-environment and buzzard stakeholder groups.

UK policy

Some issues remain common to the whole of the UK. The removal of the herbicide Asulam (the only selective chemical available until now to control bracken) from a list of EU approved substances has required us to work closely with other stakeholders in the Bracken Control Group. We have actively sought alternatives or the re-instatement of this important means of control. We have also contributed to the many discussions on reform of the Common Agricultural Policy (CAP). This in particular could be decisive in determining the way wildlife conservation and rural development may be funded in the future.

Alastair Leake, our director of policy, talking to delegates who attended the Association of Applied Biologist Conference at the University of Leicester on Environmental Stewardship schemes. © GWCT

Scotland

Agricultural support and the public goods that farmers are expected to produce were a subject of intense scrutiny in Scotland where 70% of farmed land is classified as a Less Favoured Area. But this was only one of the many conservation issues addressed: land use, biodiversity and land reform strategies and recently introduced legislation were all on the agenda.

Demonstrating that the public's interest in healthy habitats and wildlife is well served by the responsible application of game management principles was our key aim. We sought to make it clear that managed conservation is needed to sustain wildlife alongside Scotland's policy concentrated on 'tractors, timber and turbines'. Though curtailed by the weather, our 2012 Scottish Game Fair demonstrated to the public, practitioner and policy maker alike how the combined and co-ordinated management approach of game conservation – where habitat, predators and disease are all of concern – has a great deal to be said for it.

In 2013 a real world demonstration of the interaction of weather and management was our work with Whitburgh Farms on the Scottish Grey Partridge Project. The monitoring work at this Mid-Lothian based farm strongly suggested that grey partridges may only have survived 2012 in any numbers on the best managed

(Central group L-R) Adam Smith, GWCT director Scotland, Hugh Dignon, Head of Wildlife Management Scottish Government, Stewart Stevenson, Minister for Environment & Climate Change, and Dave Parish, GWCT senior scientist at our Scottish Game Fair. © GWCT

Langholm is an important venue for a wide range of parties who want to see contemporary moorland issues researched. © Adam Smith/GWCT

sporting properties in Scotland, thanks to the combination of predator and habitat management. Protecting and enhancing a bundled conservation approach within the greening of the CAP and next generation of agri-environment schemes will be vital for practical conservation. We stressed the need for this when the Environment Minister, Stewart Stevenson, visited our projects including the Langholm Moor Demonstration Project, where the partners are developing new approaches to wildlife management.

Policy issues also affect practical management and we spent much time following up on legislative change. We were instrumental in ensuring that modern snaring was retained in Scotland in 2011. A key change is that for those wishing to snare foxes or rabbits, formal training – following our prescription – has become a legal requirement in Scotland. Trapping crow species for both wildlife conservation and sporting benefit was also under the spotlight, and we were pleased to help our partners, including Scottish Natural Heritage, bring in a pragmatic 2013 General Licence for Scotland.

Ensuring our viewpoint in this ever-changing political landscape is put across correctly to a variety of audiences is vital. Our public relations have never been more important, and through a cohesive policy and communications effort, we are delivering our message via the press including regular columns in national and regional papers, specialist farming and sporting magazines, letters to editors and strategically placed articles across the media.

(L-R) Kathy Fletcher, our senior Scottish scientist, Claire Baker MSP, Shadow Cabinet Secretary for Rural Affairs and the Environment and Gemma Davis, our policy officer Scotland, at our Scottish Game Fair. © GWCT

Training the trainers

by Ian Lindsay, Director of Advisory and Education

Our partnership with the new FWAG Association, launched at our Allerton Project last year, delivers our research directly to the farmers.
© Tim Scrivener

For over 80 years, the Trust and its forbears has been a presence on the ground, advising farmers and land managers on good practice. In an increasingly crowded market, we continue to lead the way in the present era of agri-environment schemes.

Over the past 10 years in particular, land and wildlife managers in the UK have seen an almost bewildering growth in the availability of on-farm advice. In the past this was largely the preserve of Government agencies, mainly ADAS, and was focused principally on improving farm productivity in the 1960s and 1970s, often at the expense of the environment. From modest beginnings in 1969, the Farming and Wildlife Advisory Group (FWAG) was the first independent 'farmer facing' organisation dedicated to the delivery of conservation advice on the farm. Since then, buoyed by developing agri-environment schemes, the conservation advice sector has grown significantly. Today, in England alone, there are probably over 800 advisors creating and administering conservation measures on behalf of farmer clients. There has also been an increasing breadth in the type of organisations offering farm advice beyond traditional bodies such as FWAG. A number of national wildlife protection and conservation organisations are now involved.

We have supported a small advisory team since the 1930s. This is a key component in the delivery of our researched management options, many of which, particularly those aimed at wild game, are now at the heart of our agri-environment schemes. Today, with a considerable increase in the delivery and uptake of agri-environment schemes and the organisations promoting them, a key challenge rests in making known the results of our research and putting together demonstration projects where it matters – at farm level. This is particularly important where, despite unprecedented levels of agri-environment uptake, we are still failing to deliver recovery from decline for some of our most familiar farmland and upland bird species.

Annually, our advisory team provides training events for a large number of public and private sector conservation organisations aimed at highlighting our management options for species recovery. In 2012, a key development in achieving this has been our partnership with the new FWAG Association; an association of independent regional FWAG groups reformed after the liquidation of the previous national organisation. This offers us the substantial prize of allowing our advisory team to provide a direct channel to a large national network of respected farmer-facing advisors, providing up-to-date researched options.


Letters to the Editor

THE TIMES ONE PENNY NEWSPAPER

Grey partridges

Sir, The RSPB has described the latest figures on turtledoves and grey partridges as a wildlife disaster (report Dec 7). However, our studies show that much effort is being implemented to save the "grey". In a recent study in *Animal Biodiversity and Conservation*, grey partridges had increased by 81 per cent on farms and shooting estates that are participating in the Game & Wildlife Conservation Trust's (GWCT) partridge count scheme.

The reason for this conflicting picture is that estates within the scheme are following the GWCT's recommendations for improving the environment for partridges. This research has influenced government policy, which now allows land


Top of the copse

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Brussels aims its bow at the poor Cockney sparrow

CHARLES CLOVER


Ingham's WORLD


Boost for the black grouse

Communication and public affairs

by Tom Oliver, Director of Communication and Public Affairs

Our press coverage was widespread with frequent references in both the national and regional press.

The communication and public affairs team is responsible for our publications, our media output for England and Wales, and the management of media stories relevant to our work. We also lead the planning and management of our parliamentary engagement and provide the secretariat for the Game & Wildlife Conservation All Party Parliamentary Group. We establish and maintain dialogue with influential journalists, columnists and commentators, with the aim of achieving well-informed and constructive debate on the issues central to our research and our charitable objects.

Our press and broadcast media work achieved another year of widespread coverage reaching an audience of 346,000,000 and across 1,055 titles, national, regional and specialist. Prominent among our leading broadcast stories were several features on BBC Radio 4's *Saving Species* series, including our salmon research on the River Frome and nocturnal radio-tracking of woodcock at the Rotherfield Demonstration Project; coverage of our proposals for supplementary feeding of songbirds featured in *The Sunday Times* and on Radio 4's *Farming Today* and a broadcast on Radio 4's *Today Programme* on our black grouse conservation work. Black grouse recovery also received the attention of the prime time BBC 1 *The One Show*. The celebration of 20 years of the Allerton Project and the visit of Minister Sir Jim Paice MP to our brand new visitors' and education centre, was extensively covered by the BBC TV *East Midlands Today*.

Our press coverage included regular and frequent references in most national newspapers. Key stories included a feature article by Mike McCarthy of *The Independent* on woodcock counting; major coverage of our All Party Parliamentary Group meeting on the future for agri-environment schemes in the *Daily Express*, and our policy stance on Common Agricultural Policy reform and water policy, both in *The Sunday Times*. We highlighted the plight of the grey partridge in the run up to the shooting season and the extraordinary extent of woodcock migration tracked by satellite in the *Financial Times* and *The Daily Telegraph*. We were delighted when *The Telegraph* celebrated the fact that the winner of the RSPB's 2012 Nature of Farming Award was a longstanding GWCT member who had received advice from our advisory team.

There has been extensive coverage of our activities and events in regional and local news titles, supporting the work of our recruiters and fundraisers. Many of our key national stories also received widespread regional and local attention, examples including supplementary feeding, black grouse recovery, our Julian Gardner Memorial

BBC TV East Midlands Today covered Sir Jim Paice MP, opening our new Allerton Project visitors' centre.© Tim Scrivener

Photographic Competition, the launch of our Woodcock Watch website, and the provision of dust shelters ('private bathrooms') for grey partridges.

Gamewise, our members' magazine, continued to provide a rich mixture of expert advice, in-depth analysis of our research and celebration of the spectacular work of our volunteers and fundraisers. A new feature, *How others see us* has been introduced, which offers our members the opportunity to read the views on our work of other major conservation and rural organisations that are influential in our field. In 2012 this included the CLA, the National Trust and the Woodland Trust. We have also introduced new focus points on our volunteers' and fundraisers' remarkable achievements and admirable dedication, and on our invaluable research students.

We are fortunate to have an All Party Parliamentary Group (APPG) which met three times during 2012. Our policy of 'partnership on the platform' has involved well-attended meetings with the Salmon & Trout Association (S&TA), the only farmer-led Nature Improvement Area and the Law Commission, as well as addresses from Defra Minister, Richard Benyon MP, and Shadow Defra Minister, Huw Irranca-Davies MP.

We are very grateful indeed to Rt Hon Nicholas Soames MP and Roger Williams MP, for their generosity in supporting the APPG as its chairman and vice-chairman respectively. Meanwhile, we continue to meet MPs and peers, including newly-elected and newly-appointed members.

Shadow Agriculture Minister Huw Irranca-Davies, MP set out his vision for the support of wildlife friendly farming at our APPG group meeting in July. © Morag Walker/GWCT

Rt Hon Nicholas Soames MP, chairman of our APPG group and Paul Knight, chief executive of the S&TA. © Morag Walker/GWCT

Events of every kind

by Edward Hay,
Director of Fundraising

Our varied events this year including the Spartan Challenge (top L-R) Oliver Hurlock, Ruth Elwood, Mel Dellow, Tom Windett, Kate Chapman and Amy Jones and chef Mike Robinson's (inset) butchery and cookery demonstration evenings, helped make 2012 a successful fundraising year. © GWCT

2012 has been an interesting, challenging and ultimately very successful year for our fundraising team, despite the economic gloom across much of the world. The feedback from our array of events has been entirely positive with our audiences wanting to come back for more.

Our 40 county committees have innovative and inventive ideas such as the mouse racing event, which Martha Harley organised on behalf of the Devon committee. The evening was reported to be packed to the gunwales, seating corporate tables of 10 in a bid to make sure that the mouse they chose was the winner. Betting was fast and furious with the course bookie kept on his toes. Excellent food and drink kept every one merry to complete a great evening.

In London we had a record year, with the Savoy Ball for 350 guests exceeding all expectations and becoming the largest event in the Trust's history. We thank heartily the London ball committee and in particular, its inspiring and tireless committee chairman, Camilla Davidson.

Alongside the county events, we were pleased to offer another national sporting event, 'the Spartan Challenge'. Last year Suffolk pipped Oxfordshire at the post, to be the winning county committee raising the most sponsorship and taking the prize donated by the Trust of a day for eight guns at the Rotherfield Demonstration Project. This year the Spartan Challenge will take place again on Sunday 22 September in Birmingham.

The shoot walks are as popular as ever. They are held across the country and are intended to educate and inform. Our members come away inspired, learning something new every time they attend.

We are pleased that we have been able to offer a further programme of talks given by the Grenadier Guards recounting the compelling and first-hand accounts of the 1st Battalion's recent tour in 2012. These events have helped two charities, the GWCT and the Colonel's Fund, each of which are cherished and supported by the audiences.

This stimulating, attractive and varied menu of events keeps things interesting and gives zest to the life of the Trust. It is only possible to mention a small proportion of the different events that have been organised to raise money for the Trust by our county chairmen and their committees in 2012.

I particularly wish to thank all our supporters, for spreading our message throughout the country and for all the dedication and commitment displayed in helping to organise our events. They are so important, representing as they do a continued lifeline for our future. To all the county chairmen, committee members, donors and volunteers that support us, thank you.

Devon's innovative mouse racing evening was a huge success and thoroughly enjoyable. © GWCT

Membership and marketing

by Andrew Gilruth, Director of Membership and Marketing

Our members support is extremely important to us and enables us to carry out research and make the results accessible to people that can bring about real change. © Peter Thompson/GWCT

Support from our members is vital to our continued ability to undertake research and demonstrate the vital role of game management to the wider community. We have striven to recruit more people to our cause, while also making more of our work accessible to our members and supporters.

During the current economic downturn, we are fortunate that our existing members remain committed to our work. Finding new members in a year when quite so many rural shows had to be abandoned was particularly challenging. With our two leading recruiting opportunities, the GWCT Scottish Game Fair and the CLA Game Fair being cancelled, our recruiters had to work extremely hard on the few occasions that were available. At the end of the year, our membership stood at 20,433, a decline of 4%. This served to highlight the importance of recruiting at our existing programme of walks and talks in the future to avoid too great a dependence upon rural shows.

Our commitment to exploring additional ways in which people can support the charity financially included, for example, the development of 'Woodcock sponsorship'. Strong interest in the woodcock satellite-tracking project continued through the year with a further 97 sponsors signing up after we had built a dedicated website, **www.woodcockwatch.com**, to show people where the birds were during their migration. At times there were more people watching these website pages than those on our main charity site. Significant lessons from this experience of our online following and other web activity have contributed to the writing of a brief for a new website for the charity in 2013.

Our new website www.woodcockwatch.com enabled members and supporters to track the GWCT satellite-tagged woodcock. © GWCT

The sheer number of cancelled shows has delayed by a year our planned work to trial recruiting of those 'independent thinking' wildlife conservationists who enjoy the countryside and wish to support our research. Next year, we look forward to starting this search for those who wish to build their own understanding of the challenges facing the recovery of wildlife populations across the UK.

We also began our Campaign for Game in response to recently published reports by other well-funded organisations which appear not to support gamebird releasing. This project aims to maximise the net gain in biodiversity on released-based shoots and provide unequivocal evidence of the national beneficial effect on biodiversity. Members responded to this increasing threat to both game conservation and shooting when they sent over £64,822 to our autumn appeal for research and publication of this vital work. Your continued support, through membership, remains as important as ever. Thank you.

Director of Research's report

by Nick Sotherton

Research continued in 2012 despite the poor weather providing extra challenges and hampering counts. © William Beaumont/GWCT

Despite the unusually poor weather, we completed a full programme of work in 2012. Collecting insects in the rain is a challenge, and poor breeding makes for depressing bird counts. Thank Heavens for tough, robust species like red grouse!

Poor breeding success was a feature of our Partridge Count Scheme data (see page 26) with depressing autumn densities reported compared with last year. Given good weather and our band of dedicated landowners determined to see numbers recover in the long-term, we will make good those losses and we offer an insight in how long this will take.

Our annual *Review* allows us periodically to report on findings from our long-term datasets. This year Nicholas Aebischer presents 50-year trends in data for four species of released game species (see page 34). These species represent the majority of game management effort in the UK, so it is vital that such datasets continue to be collected, analysed and interpreted by experts.

Our work on reducing sheep ticks on grouse moors will help to improve chick survival in red grouse. © Jemma Grant/GWCT

In the uplands, we report on our progress and success with medicated grit and how we are able to reduce the impact of strongylosis on red grouse. On page 44, we report on our work to reduce sheep ticks on grouse moors to improve chick survival in red grouse. As usual, our solution to a difficult problem is simple, inexpensive but effective; all hallmarks of our research output.

We developed beetle banks in the mid-1980s. Initially working alone and then with colleagues at Southampton University, our design became popular with farmers and was adopted in England's agri-environment scheme. Since then, much more research has been undertaken to assess the value of beetle banks and on page 48 John Holland updates us on their continuing value to farming and conservation.

We introduce two new research projects, both focusing on aquatic habitats. On page 58 Chris Stoate describes his new 'Water-friendly farming' project where we will attempt, at a catchment scale, to document improvements following initiatives to implement the Water Framework Directive. On page 64 Dylan Roberts unveils our new MorFish project, funded by the European Union, whereby working with French colleagues we hope to make much more of our long-term datasets on salmon either side of the English Channel.

In a busy department there is rarely time for introspection, to sit back and review decades of activity, but on page 60 Jonathan Reynolds reviews 27 years of predator control studies. We have come a long way over this time – this is strongly recommended reading.

Finally, our research team published 42 scientific papers this year including the publication and defence of one DPhil thesis at Oxford University by Adele Powell for her work on the origins of shot woodcock in the UK. Congratulations to Adele on her doctorate and thanks to Andrew Hoodless for his role as supervisor. In 2012 we welcomed more than a dozen MSc students who conducted their research projects with us. Again, the majority gained distinctions.

The importance of controlling bracken

Alastair Leake, our director of policy, looks at why bracken needs to be controlled and the most effective way of doing it

Fossil records suggest that bracken has been around for at least 55 million years, which makes it one of the world's oldest plants still in existence. In the recent past in the UK, it has expanded its range considerably, particularly over the last century.

In England and Wales 60% of moorland is designated for the quality of vegetation or the importance of the habitat to ground-nesting birds. Heather species are a key component of these designations.

Large bracken beds have a damaging effect on the health and well-being of farm animals, wildlife and humans alike. The plant has an ability to spread rapidly under certain conditions (it can increase its area of occupation by 3% annually) and to out-compete characteristic ground cover plants such as moorland grasses, cowberry, bilberry and heather. The tall, dense fronds shade out other plants during the growing season, whereas the dead stems and foliage matt together creating an impenetrable mass in winter. When eaten in quantity by livestock, bracken contains an enzyme that destroys the animals' thiamine reserves and can prove to be fatal.

Bracken provides an ideal habitat for harbouring sheep ticks, with up to 70% of tick activity associated with bracken-dominated habitats. Ticks are parasites of humans, mammals and birds. The main diseases transmitted by ticks in the UK are Lyme Disease, Tick Borne Fever, Louping Ill and Babesia. There has been nearly a 10-fold increase in the numbers of human cases of Lyme Disease in the last decade, whereas 85% of red grouse bitten by ticks carrying the Louping Ill virus die within three weeks.

Since the 1940s bracken has been controlled by deep ploughing which disrupts and exposes its substantial network of rhizomes, along with grazing or rolling and bruising the fronds when they are young and vulnerable. However, inaccessible terrain can make physical management difficult, dangerous or impossible, can lead to soil erosion or can pose a risk to other fragile habitats, ground-nesting birds, reptiles or scheduled monuments. In this situation the most effective means of control is to use chemical herbicides. There are several approved for use in bracken control: Glyphosate (which is non-selective) and Asulox which is selective. Clearly in fragile landscapes retention of non-target flora is important as well as protecting the soil from erosion that might occur on upland slopes when all vegetation is killed. Unfortunately, our only selective means, Asulox, has been withdrawn from use within the EU, although it is still widely used across the world in sugar cane production. We have been working with other stakeholders as part of the Bracken Control Group (BCG) and Ministers have agreed to an emergency authorisation for use in 2013. Ultimately the BCG, working with the manufacturer, will seek complete re-instatement of Asulox for use within the EU.

Bracken can increase its area of occupation by 3% annually so needs to be controlled.
© Laurie Campbell

Feeding farmland birds in winter

Alastair Leake, our director of policy, charts the journey of supplementary feeding from research in the field to national policy

Wildlife seed mixes are depleted as winter draws on, leaving very little for birds to eat during the coldest months of the year.

After 25 years of encouraging farmers to conserve wildlife, the population of many birds is still diminishing. Rather than accept this state of affairs, we have sought out the reasons for it. Our research has shown how farmers can help farmland birds recover.

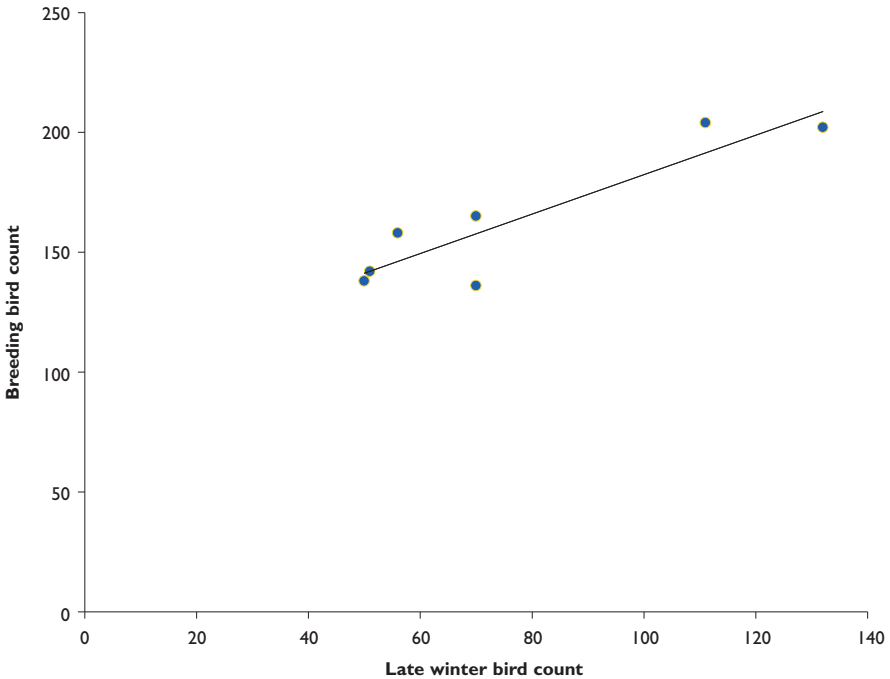
The latest population figures show that some farmland birds such as grey partridges, tree sparrows, yellowhammers, reed buntings and corn buntings are still showing a 70% decline since 1970. This is despite the widespread introduction of agri-environment schemes that have been adopted across more than 60% of the farmed land in England. These agreements with farmers involve making payments for the positive management of habitats and wildlife on their land.

One of the most significant reasons for this continuing decline, which was identified by research carried out on our Allerton Project farm at Loddington in Leicestershire, is a lack of food from late winter to early spring (January to mid-April), a period known as the 'hungry gap'. Many of the weeds that used to grow and shed seeds in the cropped areas are now eliminated by herbicides, and efficient harvesting machinery leaves little grain behind so that stubbles have limited food value in late winter. Even seeds that are produced in summer in wildlife seed mixes in the field margins are gradually depleted as the cold weather arrives, leaving very little for birds to eat during the later part of the winter and early spring. Our research has shown that late winter bird numbers more than doubled in years when additional grain seeds were provided through feed hoppers during the 'hungry gap' compared with years without (see Figure 1). The simple measure of providing additional grain during this time could provide what is needed for better winter survival as well as increasing breeding numbers and breeding success later in the season. In fact data from our Allerton Project reveal that breeding bird numbers were 30% higher in years preceded by late winter food provision than in years without.

When we ceased keepering in 2001 we continued to fill the feeders, and although the number of pheasants halved, the amount of grain dispatched through the

Figure 1

Late winter abundance of songbird species known to use hopper feeders is correlated with their breeding abundance the following spring at the Allerton Project



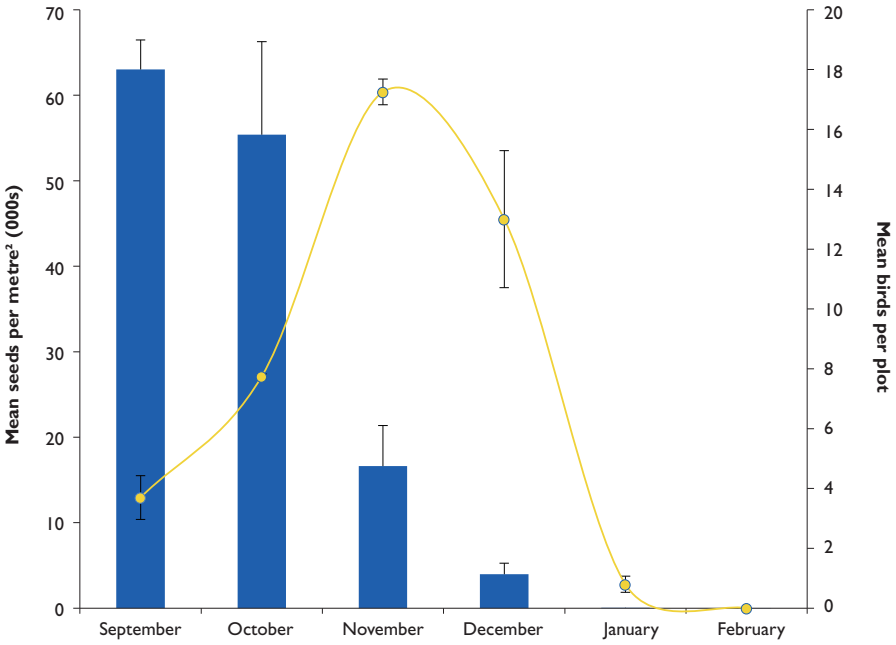


Figure 2

Yellowhammer numbers in plots of millet in relation to seed abundance

Millet seed

Yellowhammer

Yellowhammer numbers dropped in response to the continuing decline in the supply of food. © Laurie Campbell

hoppers increased. To explain this we set up a series of CCTV cameras with night vision adjacent to the hoppers and recorded the activity that took place.

In total, 27 wildlife species were filmed visiting the pheasant feeders during the study. Six of the bird species recorded were birds of conservation concern. When we added together the feeder visiting times for each species, we found that, collectively, non-game species occupied the feeders for more of the time than game species did. Furthermore, as winter advanced and food in the open countryside dwindled away with the cultivation of winter stubbles, the cameras revealed that visits to the feeders by all species increased significantly. This was most marked for songbirds, particularly yellowhammers, whose attendance increased 10-fold over the season.

Because agri-environment measures have so far failed to reverse the declines of many farmland bird species, Natural England has been persuaded by the results of our studies to include supplementary feeding as an additional option within Stewardship schemes. Since January 2013, farmers have been able to apply for payment through agri-environment schemes to provide over-winter supplementary food for farmland birds, provided they have already taken steps to provide food up to early January by participating in the over-winter stubbles or wildlife seed mix options. They also have to feed the seed mixture prescribed in the new Entry Level Stewardship (ELS) handbook. Farmers who have existing ELS agreements can apply to modify them and begin feeding straight away, without having to wait for the agreement to expire and begin a new one, as long as they meet the qualifying conditions.

This option will be particularly welcomed by farmers and landowners who plant wildlife strips for birds but know that this source of food runs out late in the winter (see Figure 2). Although we already know specifically which plant seeds different bird species eat, we also know that many of these become depleted towards the end of winter. Unfortunately, we have not yet discovered plants that will hold onto their seeds during the leanest months. Our work on the Farm4Bio Project suggests that large blocks of seed mixes could help, but we also know from other work at the Allerton Project that a wide distribution of areas of food within the landscape is important too, particularly for birds which move around seeking food during the winter months.

Most seed bearing crops have been bred to shed their seeds to enable the seed bodies to be broken open and the seed extracted during harvesting. For longevity of food supply for birds, we need the opposite quality, seed bodies that retain their contents, a trait known as 'indehiscence'. Until we can achieve this, supplementary feeding will help ensure that birds survive and thrive until the breeding season. This targeted intervention will help us reverse the long-term declines of farmland birds.

Farmland birds such as reed bunting, goldfinch, linnet and tree sparrow will all benefit from supplementary feeding through the hungry gap.

Bringing Kettelshiel grouse to the boil

© David Mason

A grouse management case study by Hugo Straker, senior advisor Scotland and Grouse Technical Services expert

In the past, we have sometimes been criticised for keeping our unbiased science and opportunities for the practical application of its findings a well kept secret. Our Advisory Service, with its nationwide team of advisors, has increasingly prided itself in disseminating the excellent work of our scientists in the uplands, lowlands, woodlands, wetlands and rivers, and providing practical management techniques for land managers. Ultimately, to coin a phrase, we want to turn words into birds.

We carefully monitored Kettelshiel clutch size, hatchability and brood survival.

The launch of our Grouse Technical Services (GTS) in 2010 provides a unique service which moorland owners and managers can engage to enhance their land assets and make the most of their investment. The service is provided by our specialist advisors and offers unique access to all our research and latest scientific developments. GTS aims to help reduce uncertainty over the productivity of shoot days by addressing the issues affecting grouse breeding success on a long-term basis. Our techniques can complement the skills of a moor's existing management team, working together to produce a harvestable surplus of red grouse.

In February 2011, the syndicate members of the 1,067 hectare Kettelshiel moor in the Lammermuir Hills of Berwickshire, contacted GTS after experiencing poor red grouse productivity over the previous two years. They commissioned a survey of the heather moorland, one which identified over-grazing, a strong infestation of purple moor grass *(Molinia caerulea)* and swathes of heather that had been subjected to heather beetle attack. The central section of the moor comprised healthy heather, and it was here that the most robust population of grouse was to be found. Although the moor was being grazed by around 900 sheep, the presence of unpalatable purple moor grass and beetled heather was encouraging the stock to congregate on other healthier sections of the hill which could not sustain the increase in grazing pressure. Together with a careful programme of chemical spraying of the moor grass, our recommendations on sheep management were accepted, with all sheep removed from the hill in the autumn of 2011 for the autumn, winter and early spring period only. This is the time when grasses die back and sheep switch their grazing efforts to heather. Heather absorbs carbohydrates

through its tips in the autumn, providing the plant with important winter energy reserves. Excessive tip removal in the autumn/winter will weaken and can eventually kill heather through the removal of the plant's 'power pack'. Winter grazing of heather can also create a more open stand, allowing grasses that start growing earlier in the spring to spread, thus speeding up loss of heather. As wintering off the moor was not a practical option, the flock was sold with the regrettable loss of the shepherd's job. With the management of the hill for a sustainable harvest of red grouse being the primary objective, the removal of sheep was rewarded by a rapid, favourable response in heather quality and other beneficial plants, such as cotton grass, during the 2012 growing season. A grazier with approximately 300 sheep was allowed to summer graze the hill and check competitive grass growth. This flock size will be reviewed on an annual basis and it is likely sheep numbers will be increased on the basis that competitive grass growth may need to be summer grazed with greater intensity to enable successful heather regeneration.

In September 2011, GTS attended a driven day on Kettelshiel. The guts were removed from 10 old and 10 young birds and analysed for strongyle worm burdens. The results revealed that worm burdens were virtually nil in both old and young birds, with no difference between beats and drives. This clearly suggested that the resident keeper's worm control programme through the careful and thorough distribution of medicated grit, was suppressing worm activity. Additionally, blood was taken from 27 birds and one hare and analysed for the presence of Louping Ill virus. Again the results returned were free of infection and while handling the birds, we found no ticks. With these results providing no obvious conclusions as to any possible cause of disappointing productivity, GTS submitted a proposal for the radio-tracking of red grouse during 2012.

We caught 15 hens in March 2012 and fitted them with radio collars. We selected three birds from each of the five distinct areas across the moor, and monitored their progress meticulously and regularly throughout the year, locating and marking nests, counting eggs, recording hatching success and monitoring chick survival. One hen shed her collar and one other 'vanished' – possibly due to a malfunctioning collar. Of the 13 remaining hens, the average brood size (in July/August) was found to be 5.7, with an average brood survival rate of 68%.

The excellent survival rate of the tagged hens and encouraging brood survival, given the unseasonally high rainfall recorded through the summer, was indicative that predation gave no cause for concern. We were grateful for the great help of the Kettelshiel headkeeper for allowing us to undertake this intensive study – one which might have revealed a predation problem.

Unhatched eggs and dead chicks found in nests were sent to the Scottish Agricultural College for detailed analysis. Nothing untoward was identified as being the cause of deaths and hatch failure, suggesting that chilling and the exceptionally wet weather were the likely reasons.

What then for the Syndicate's management strategy? We undertook July counts, in tandem with counts arranged by the headkeeper, which suggested a harvest of around 450 brace in 2012. After three days driven shooting and a season's bag of 379 brace, the syndicate and the headkeeper collectively agreed to curtail further shooting to allow a solid, healthy stock to grow. Additional worm counts showed low burdens continuing to prevail. We ensured that birds only had access to the non-medicated product throughout the pre-harvesting withdrawal period and the harvesting period. Once shooting had ceased over surrounding moors, medicated grit was once again made available to the grouse. We are able to continue the monitoring of worm burdens on moors in appropriate weather conditions throughout the winter months by counting worm eggs collected in the caecal pats of grouse.

No further radio-tracking will take place over Kettelshiel in 2013, as we are confident that current management is on the right track, but we will continue monitoring assistance. As habitats over the moor continue to improve, with reduced grazing pressure and the control of heather-suppressing purple moor grass, the productivity of grouse will, we hope, continue to be enhanced. Keen, well-equipped keepers are in place, ensuring efficient muirburn, the correct distribution of medicated grit across the moor and a diligent and responsible approach to predation control.

Anyone interested in our GTS service should contact our Scottish HQ near Perth on 01738 551511.

We located nest sites of radio-tagged hen grouse using radio-telemetry.

Reviving the management of small woods

Drawing on experience from our Allerton Project, Ian Lindsay, director of our Advisory Service, explains how to revive the management of small woods

Managing woodland helps many species such as the blackcap (top inset) and encourages structural diversity and improved habitat.

Small woods have always been an important part of our landscape, but since 1945 many have fallen into decline with little or no management. Now we are leading a revival of copse and covert management, which is proving to have a wide range of benefits for game, people and wildlife.

Over 20 years, the extent and importance of woodland management at our Allerton Project has grown. Initially spurred on by the need to improve the farm shoot, the planting, restocking and harvesting of our small farm woods is now key to both wildlife conservation and the heating of our visitors' centre.

Despite their landscape and environmental importance, over the past 40 years farm woodlands have frequently become neglected habitats, too small to justify economic management. They are often subject to sycamore invasion and squirrel damage, leading in most cases to a significant loss of species diversity and the wildlife populations they once sustained. Perhaps too, the recent high profile given to other farmland habitats and species, particularly farmland birds, has overshadowed the potential contribution of woodland habitats to farmland biodiversity. During this time, game management has provided an important incentive for woodland management: the periodic thinning, coppicing and ride management that encourage structural diversity and improved habitat.

Today, however, there may be signs of a renaissance in farm woodlands. This arises not from direct efforts to address the continuing declines of woodland birds such as blackcap and willow warblers, rather from the emergence of a number of 'drivers' that can increase the incentives for active management of even small woodlands and result in improved habitats within them. In a society preoccupied with 'protection' and 'preservation' of trees this may seem paradoxical, but it is the fundamental process of cutting trees down and their replacement by natural regeneration or replanting, which accelerates the natural process of woodland succession. This in turn delivers the rotation of age and structure that benefits the widest range of species. The problem to date and particularly with small woodlands, has been the cost of management and the limited returns from the resulting timber.

In 1992 when the Trust assumed ownership of the Allerton Project farm at Loddington, the farm woodland

cover amounted to about 18 hectares, mostly established in the 1950s and 1960s as plantations and shelterbelts. Typical of their time, these were based on hardwood crops established within a conifer nurse crop and with few or no shrub or medium height species. With minimal subsequent thinning, particularly of the nurse crop, these stands had become heavily shaded, bare, draughty covers with little or no structure, at low and medium height. During the 1990s, we started a programme of thinning and coppice management allowing regeneration of shrubs and brambles, significant improvement in pheasant holding cover and improved habitats for a range of woodland birds particularly the warblers such as blackcaps and chiffchaffs. Overall, our work has shown that woods managed in this way, for pheasants, support 50% higher breeding densities of warblers.

In addition to these existing woodlands, we established four hectares of new woodland, rich in low and medium height species in 1994. The new woods were sited to provide some of today's challenging pheasant drives on the farm.

Periodic rotational management of woodlands and the continuation of low and medium height cover is at the heart of maintaining their biodiversity value. The problem, for many years, has been the associated costs. Particularly in small woods, timber quality is rarely high owing to squirrel and deer damage, and the limited production of fine, straight veneer butts is unlikely to cover the costs. Increasingly, however, wood fuel is offering an alternative income; either as processed logs for wood burners or, as is the case at the Allerton Project, woodchip for on-farm use. Singly, or as part of local machinery 'rings', an increasing number of farmers are investing in log processors or chippers and, for the first time in a generation, small farm woodlands seem capable of providing enough income to encourage their regular management.

These woodlands are typical of those found on many farms of similar size and produce a mix of conifer thinnings, hardwood brashing, and a range of fairly poor hardwood stems thinned from established woodlands. Historically, this produce would have been of little value, but in the winter of 2011 this provided about 70 tonnes of chip – sufficient to fuel a 40kw system at Loddington House and a 35kw system at the new visitors' centre for

between three and four years. Machinery for chipping has also improved with machines now capable of producing grades of chip of sufficiently even quality for automatically fed boiler systems from the entire felling operation, including the brash which was once a waste product. This saves time as 'clearing up' operations are no longer needed and all of the felled material is used.

Trees are planted; when harvested the trees are chipped; this is then used to fuel the boiler at our visitors' centre.

At the beginning of an era of ever-rising hydrocarbon costs and with increasing social value placed on the use of carbon-neutral energy sources, particularly for farms close to the urban fringe, there are signs of a revival in small woodland management and the prospect of biodiversity benefits derived from this change.

Small farm woodlands now seem capable of providing enough income to encourage their regular management and benefit many woodland birds such as the chiffchaff.

The causes of wild pheasant mortality

Roger Draycott and his team located hens three times a week and in both years several birds died between mid-April to mid-May coinciding with the nesting season when hens are more vulnerable.
© Carlos Sanchez/GWCT

KEY FINDINGS

- Main causes of pheasant mortality were disease, parasites and predation.
- A major clinical sign in 2011 and 2012 was kidney damage; a likely cause was corona virus.
- Hen survival in 2012 was almost double the survival in 2011.

Roger Draycott
Rebecca Blamey
Silas Walton

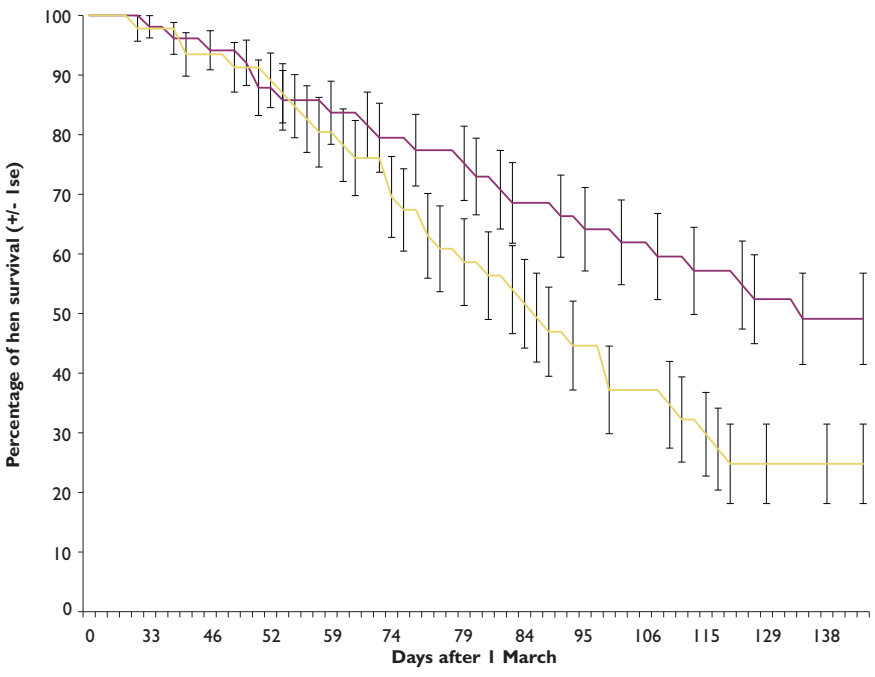
Wild pheasants are an esteemed quarry in eastern England, but concern over declining productivity and survival on some estates over the last five to 10 years led to the initiation of a research study in 2011.

In 2011 and 2012 we radio-tagged 50 wild hen pheasants in March each year on an estate in Norfolk to determine their survival and breeding success and to identify the main causes of mortality. The results of the first year's work were reported last year (*Review of 2011* page 20-21). The radio-tags had an in-built mortality switch facilitating rapid recovery of dead birds before they decomposed or were scavenged by predators, allowing us to determine the cause of death more accurately. We located hens at least three times a week between April and July and also collected detailed information on the nests of the tagged birds. With all the birds that died, if the carcass was found intact, we sent it to a specialist gamebird diagnostic veterinary practice.

At the beginning of March, in both years, all birds were in good body condition and exhibited no signs of disease or other problems. Survival was very good for the

Figure 1

Survival of wild pheasants on an estate in Norfolk from the beginning of March (day one) until the end of July



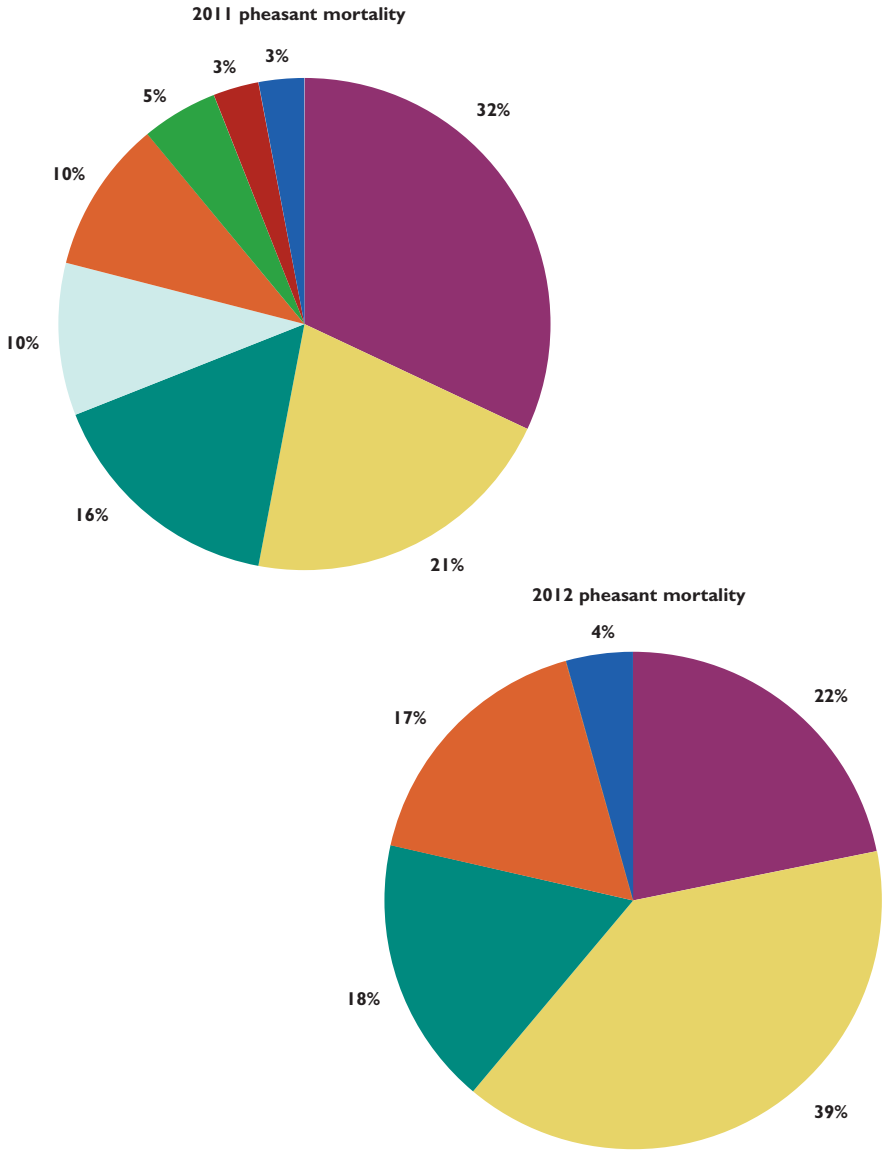


Figure 2

Causes of death of 33 wild hen pheasants in Norfolk, April-August 2011

- Fox
- Stoat
- Worm burden
- Kidney damage
- Liver damage
- Egg/yolk peritonitis
- Trauma
- No diagnosis

Causes of death of 20 wild hen pheasants in Norfolk, April-August 2012

- Fox
- Worm burden
- Kidney damage
- Trauma
- No diagnosis

first few weeks after tagging (see Figure 1). Then, in both years several birds died between mid-April and mid-May. This is when hens start nesting and are particularly vulnerable to predation. The timing also coincides with peak food demand for foxes as they have young at this time. However, in 2011 there was a high rate of mortality from mid-May until the end of June, which is unusual. Many birds were found dead in an emaciated state, with no signs of predation. There was a similar pattern in 2012, though to a lesser extent. Birds were often found in tall vegetation or were generally concealed and without the aid of radio-transmitters, would not have been easy to find. The main causes of mortality are shown in Figure 2. Kidney damage was a common clinical sign, and a likely cause of this damage was a corona virus infection. Another significant cause of mortality was infestation by parasites, particularly gape worm. High parasite levels last year could have been linked to the wet weather, but may also be due to underlying high parasite burdens on the estate. Although we identified higher than expected levels of mortality for a managed wild pheasant population, levels of predation on both birds and nests were relatively low. In previous studies we have undertaken on wild pheasants at Tendring Hall, our Allerton Project farm and Seefeld, foxes usually account for around 80% of all recorded mortality.

We need to interpret these results within the context of the unusual weather patterns over the last two years: 2011 was the driest spring for 100 years and 2012 the wettest. Dry conditions, leading to dehydration can lead to kidney damage and could have been an important factor in 2011. Also, the extremely wet weather of 2012 no doubt had a damaging effect on productivity, even though hen survival was higher. What is not clear is whether the loss of body condition is a result of disease, or whether hens in poor condition were more pre-disposed to disease, particularly a viral infection. In 2013 we are undertaking more radio-tracking research and we are sampling pheasants on other estates to determine the prevalence of various parasites and diseases to improve our understanding of their importance and epidemiology.

ACKNOWLEDGEMENTS

We are grateful to Crowshall Veterinary Practice, Oakbank Game & Conservation Ltd, Lord Romney, Sandringham Estate and the landowners who provided financial support for this study.

Unmasking migrations: tracking woodcock

Woodcock fitted with a satellite tag.
© Andrew Hoodless/GWCT

KEY FINDINGS

- Tracking by satellite has provided a fascinating insight into the speed and timing of woodcock migration.
- In spring the birds returned to breeding sites spread across their European breeding range. One of the tagged birds went twice as far as expected, eventually settling to breed in central Siberia, 6,176 kilometres from where it was tagged in Cornwall.

Andrew Hoodless

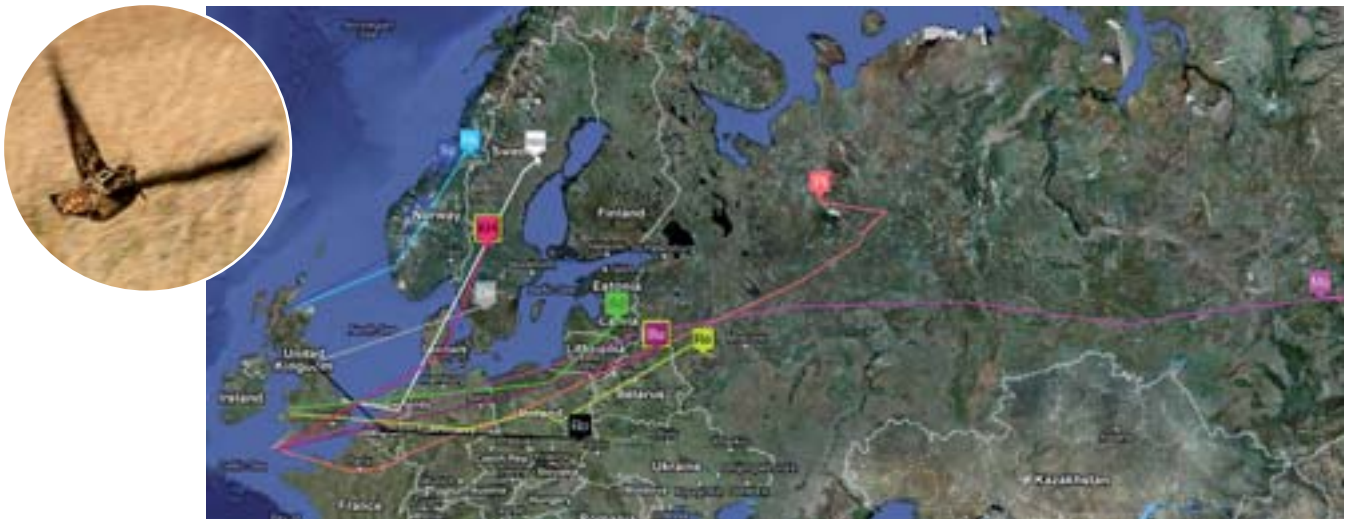
We pioneered research into the ecology of the woodcock with radio-tracking studies in the 1980s and 1990s. Following the species' amber listing in the UK in 2002, because of an apparent decline in its breeding numbers, our focus shifted to investigating population status. By developing a new approach to surveying the species, we established a more accurate estimate of British breeding numbers: 78,500 males rather than the previous estimate of 5,000-12,000 pairs. We are now studying the migration of woodcock over-wintering in this country. The objective is to determine the links between breeding and wintering sites, and the effects of changes in habitat, climate or hunting pressure.

Britain and Ireland host a significant proportion of the European population of the Eurasian woodcock during winter, probably in the order of 1-1.5 million birds. Knowledge of migratory routes and timings is essential in evaluating the importance of stop-over sites and the potential effects of altered conditions resulting from climate change, habitat destruction or hunting pressure across Europe. Originally our tracking involved the use of geolocators (loggers recording time-stamped measures of light level from which position is estimated, see *Review of 2011*, p26-27). These had to be retrieved, therefore limiting the amount of information we could gather. Now the miniaturisation of satellite-tracking devices has opened up exciting opportunities for studying woodcock movements. The tracking of individual birds complements our earlier work on the composition of the wintering population (see *Review of 2011*, p22-25). Both of these studies, in conjunction with improved population estimates, are essential if we are to ensure sustainable population management at a European scale.

In February and early March 2012, we fitted 12 satellite tags to woodcock at sites in Cornwall, Norfolk, mid-Wales, Durham and the Scottish Highlands in a trial to evaluate the data obtained and the cost-effectiveness by comparison with geolocators. Satellite tags are accurate (typically from 150 metres to one kilometre) and have the advantage that they transmit their positions at regular intervals (once every

Figure 1

Migration routes of 11 woodcock tracked from Britain to their breeding sites



three days in suitable conditions), enabling the birds to be tracked during their migrations. However, satellite tags small enough not to impair the flight of a woodcock are dependent on solar charging to replenish their batteries, which could mean receiving only intermittent transmissions owing to the woodcock's use of woodland and largely crepuscular or nocturnal activity.

In the event 11 out of the 12 satellite-tracked woodcock provided regular information during their spring migrations. We discovered that their journeys consisted of a series of long, fast flights of 600-1,100 kilometres, broken up by stops en route which typically lasted at least 10 days. We have recorded several birds flying over 1,000 kilometres non-stop over 24 hours. It was soon apparent that the majority of birds tagged at the same winter site were heading to different breeding grounds, confirming the mixing of migrants at wintering sites found during our stable isotope study (see Figure 1 and Table 1). This is best illustrated by four woodcock tagged on the Lizard Peninsula, Cornwall, all of which departed on migration between mid to late March. The first to complete its migration was a first-year bird that settled in eastern Belarus in mid-April, followed by another one-year old bird that reached central Sweden at the beginning of May. The other two woodcock (Monkey and Pilot) eventually settled in Russia, but undertook extraordinary journeys to reach their breeding sites. Monkey, an adult male, finally settled near Krasnoyarsk, central Siberia (58°N, 91°E) on 15 May having crossed the Urals and travelled an astonishing distance of 6,176 kilometres (3,838 miles). This is twice as far east as the furthest ever recovery for a woodcock ringed in Britain. What is most surprising is that this bird did not winter south of its breeding grounds. We know that some woodcock over-winter in northern India and Pakistan and this would have been a shorter migration. Given that the average lifespan for woodcock is close to three years, Monkey could travel about 38,000 kilometres during his life. Pilot, a first-year bird, headed in a similar direction to Monkey until near Moscow, but then continued north-east until 6 May when it headed west for 290 kilometres before reaching its breeding site in Arkhangel'skaya province (62°N, 45°E) on 11 May.

The satellite tags have provided some fascinating insights into woodcock migration and generated global interest in our woodcock research, but we have experienced gaps in data transmission owing to the tags losing charge when the birds were moulting in dense cover and as a result of low light levels in winter. Signals from three of the birds confirmed that they had made it back to Britain. Three others set off on their autumn migrations but we lost their signals part way. Overall, we received poor information on autumn migrations and, although some of the birds are undoubtedly dead, we are examining potential improvements to ensure delivery of data throughout the year in future. We expect the woodcock to return to the same wintering locations, but it will be good to have confirmation of this and to compare the routes taken with those flown in spring. With more data, we plan to examine how fidelity to stop-over sites and flight courses is influenced by prevailing weather conditions.

ACKNOWLEDGEMENTS

We are grateful to the *Shooting Times* Woodcock Club and several individuals for substantial donations towards the purchase of satellite tags. We also appreciate the help of everyone who has contributed to funding the on-going costs of obtaining the satellite data and managing the Woodcock Watch website. The assistance of Owen Williams and Tony Cross in fitting two satellite tags in mid-Wales is greatly appreciated. We are grateful for the enthusiasm and hospitality of all the landowners at the tagging sites, and to David Pepper for automating the mapping process on the website.

To follow the migrations of our satellite-tracked woodcock, visit the Woodcock Watch website www.woodcockwatch.com

TABLE 1

Breeding sites, times of arrival and distances flown on spring migration of 11 woodcock tracked by satellite during spring 2012

Bird	Age	Sex	Tagging location	Breeding location	Date back at breeding site	Distance to breeding site (km)
Busy (Bu)	First-year	Unknown	Cornwall	Belarus	23 April	2,392
Kit Hill (KH)	First-year	Male	Cornwall	Sweden	2 May	1,830
Pilot (Pi)	First-year	Unknown	Cornwall	Russia	11 May	4,199
Monkey (Mo)	Adult	Male	Cornwall	Russia	15 May	6,176
Aderyn (Ad)	Adult	Male	Wales	Latvia	1 April	2,185
Rebecca (Re)	First-year	Female	Wales	Russia	1 May	2,749
Woody (Wo)	Adult	Female	Norfolk	Sweden	1 May	1,872
Rose (Ro)	First-year	Female	Durham	Poland	8 April	1,876
Derwent (De)	Adult	Female	Durham	Sweden	14 April	1,028
Rocket (Rk)	Adult	Male	Scotland	Norway	17 April	946
Speedy (Sp)	First-year	Female	Scotland	Norway	24 April	1,264

Partridge Count Scheme

Last year was one of the worst breeding seasons for grey partridges since records began in 1933.
© David Mason

KEY FINDINGS

- Average spring pair density increased by 19%.
- Autumn densities decreased by 53% to an average of 13 birds per 100 hectares, following the wet summer.
- Long-term PCS sites could return to the density seen in spring 2012 around 2018-19. New sites might take until 2023-24.

Neville Kingdon
Julie Ewald

ACKNOWLEDGEMENTS

We are extremely grateful to GCUSA for their on-going support of our grey partridge work.

The extreme weather conditions, from drought in 2011 to the wettest year in a century in 2012, have been disastrous for grey partridges. Last year was one of the worst breeding seasons since records began in 1933.

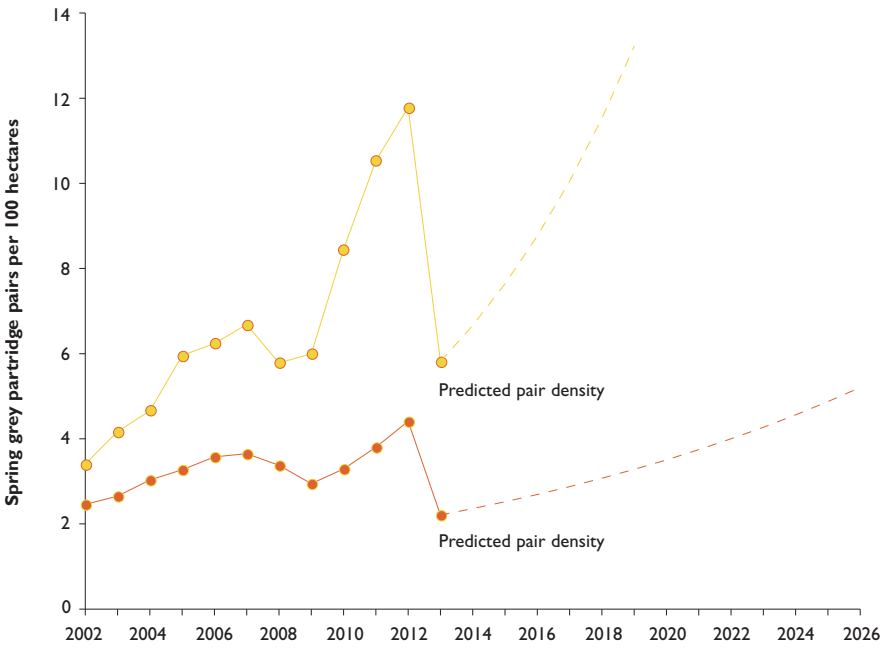
Despite the unseasonably dry beginning to the year with drought conditions being declared across many regions, followed by the wettest April-June since 1766, the Partridge Count Scheme (PCS) received 817 pair counts in the spring of 2012 (a 3% increase from the 796 received in spring 2011). PCS members counted nearly 13,200 grey partridge pairs across 245,000 hectares (604,600 acres), compared with 10,900 pairs counted across 225,000 hectares (557,000 acres) in 2011. The average pair density over all PCS sites increased by 19% (see Table 1) and all regions reported increases.

The incessant rain did not stop with April showers; it continued throughout the year. The atrocious conditions meant that the PCS received only 640 autumn counts, 17% fewer than in autumn 2011 (see Table 1). This was higher than expected and we received records until the end of November. However, the total number of grey partridges recorded nationally plummeted to nearly 23,600 birds, nearly 35,700 fewer birds (-60%) than reported in 2011. As a result national autumn densities decreased by 53% to an average of 13 birds per 100 hectares (down from 27 birds per 100 hectares in 2011).

On those PCS sites that returned counts in both autumn 2011 and 2012 and where age was determined (n=574), the density of old birds dropped from 7.7 adults

Figure 1

Potential recovery timescale of pair densities on long-term and new sites assuming conditions will be the average of the previous 10 years



per 100 hectares in 2011 to 7.2 adults per 100 hectares in 2012, a decline of only 7%. This suggests that adult grey partridges were not affected greatly by the weather, but that the recorded declines are predominantly due to lack of chick production.

The average Young-to-Old ratio (YtO) of all sites fell to just 1.2, well below the prerequisite 1.6 to ensure a stable population. This national YtO is much lower than the previous poor years of 2007 and 2008 (1.8 and 1.7 respectively), which remained above 1.6. This further demonstrated that this year's rain has been truly devastating in its effect on grey partridge broods.

Such poor chick survival will have obvious consequences for the partridge recovery seen over the past decade within the PCS. Using figures for average over-winter survival over the last 10 years, spring 2013 pair density for long-term sites (in the PCS before 1999) and new sites (which joined in 1999 or after) could be in the region of 5.8 and 2.2 pairs/per 100 hectares respectively. Assuming the average conditions of the past decade will produce a similar year-on-year increase (14.6% per year for long-term sites versus 6.8% per year for new sites), then long-term sites could return to the spring pair density seen in spring 2012 by 2018-19. New sites might take much longer until 2023-24 (see Figure 1).

There are some reasons to hope for a quicker return. The habitat that PCS members have established should be capable of producing lots of grey partridge chicks if the weather is favourable. Last spring, where conservation measures devised by our research have been put in place, the breeding density of grey partridges was back to the levels of the early 1980s. With this management in place, PCS members should have a running start at recovery to these levels sooner than we expect.

HELP EXPAND THE PCS

PCS members are demonstrating that local grey partridge recovery is achievable, but we need to expand this progress to the wider countryside and encourage more farms and shoots to get involved. Together, national recovery in partridge numbers and range expansion is possible, but we need your help. If you have grey partridges on your land or close by, please get involved and encourage your friends to do so. The future of the grey partridge rests in the hands of those who manage the countryside. Remember 'Every one counts'. Go to www.gwct.org.uk/partridge or contact Neville Kingdon on 01425 651066 or nkingdon@gwct.org.uk

TABLE 1

Grey partridge counts

a. Densities of grey partridge pairs in spring 2011 and 2012, from contributors to our Partridge Count Scheme

	Number of sites		*Spring pair density (pairs per 100ha)*		
Region	*2011*	**2012**	*2011*	**2012**	**Change (%)**
South	*126*	133	*1.4*	1.6	14%
Eastern	*219*	239	*6.3*	7.6	21%
Midlands	*146*	165	*3.4*	4.3	26%
Wales	*0*	2	*0*	0.1	100%
Northern	*186*	198	*4.9*	5.5	12%
Scotland	*121*	79	*3.1*	3.3	6%
Overall	*796*	**817**	*4.2*	**5.0**	**19%**

b. Densities and young-to-old ratios of grey partridges in autumn 2011 and 2012, from contributors to our Partridge Count Scheme

	Number of sites		*Young-to-old ratio*		*Autumn density (birds per 100ha)*		
Region	*2011*	**2012**	*2011*	**2012**	*2011*	**2012**	**Change (%)**
South	*122*	109	*2.5*	1.2	*11.8*	5.0	-58%
Eastern	*198*	182	*2.9*	1.3	*37.7*	18.8	-50%
Midlands	*145*	126	*2.9*	1.1	*22.7*	9.6	-58%
Wales	*2*	0	*0*	-	*0*	-	-
Northern	*191*	165	*3.0*	1.0	*34.6*	14.5	-58%
Scotland	*110*	58	*3.0*	1.3	*16.3*	8.3	-49%
Overall	*768*	**640**	*2.9*	**1.2**	*27.2*	**12.7**	**-53%**

The number of sites includes all those that 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

Wild bird seed mixture. © Francis Buner/GWCT

KEY FINDINGS

- Of 22 re-established grey partridge spring pairs only one brood was produced during 2012.
- Pheasant autumn numbers in 2012 were between those in 2010 and 2011.
- Farmland songbirds that are known to benefit from wild bird seed cover have increased by 114% on the Trust side and 33% on the estate side since 2010, reflecting the different amount of habitat expansion within the two areas.

Francis Buner
Malcolm Brockless
Nicholas Aebischer

The feasibility of grey partridge recovery where numbers of wild partridges are low within an open arable landscape, was previously demonstrated at Royston, Hertfordshire. The Rotherfield demonstration project began in spring 2010 with the aim of re-establishing wild grey partridges where they had previously gone extinct in farmland mingled with substantial woodlands. In contrast to Royston, this current project also aims to increase numbers of wild pheasants and other game as part of an integrated package. To achieve this goal, the Rotherfield estate in east Hampshire, which generously hosts the project, entered a comprehensive Higher Level Stewardship (HLS) agreement in spring 2012 to create optimal habitats for game and other wildlife. Two gamekeepers are managing the 3,600-acre (1,457-hectare) estate, which has been split into an estate side and a Trust side, the latter being managed by our keeper Malcolm Brockless (for more details see our *Review of 2009 and 2010*).

TABLE 1

Game recovery at Rotherfield across the whole estate, 3,600 acres (1,457ha). Reared grey partridges were either fostered or released in coveys between August and December; wild partridges were translocated in three coveys in December 2011 and five pairs in January 2012; and cock pheasants were released in groups of 50 from movable pens in early August (released on the Trust side only)

Year	Spring pairs	Autumn adults	Wild broods	Wild young	Birds released
Grey partridge					
2010	24	24	2	19	113 (all reared)
2011	20	27	5	35	81 (20 wild)
2012	22	24	1	6	72 (10 wild)
Red-legged partridge					
2010	36	48	12	53	0
2011	41	71	12	51	0
2012	58	58	1	2	0

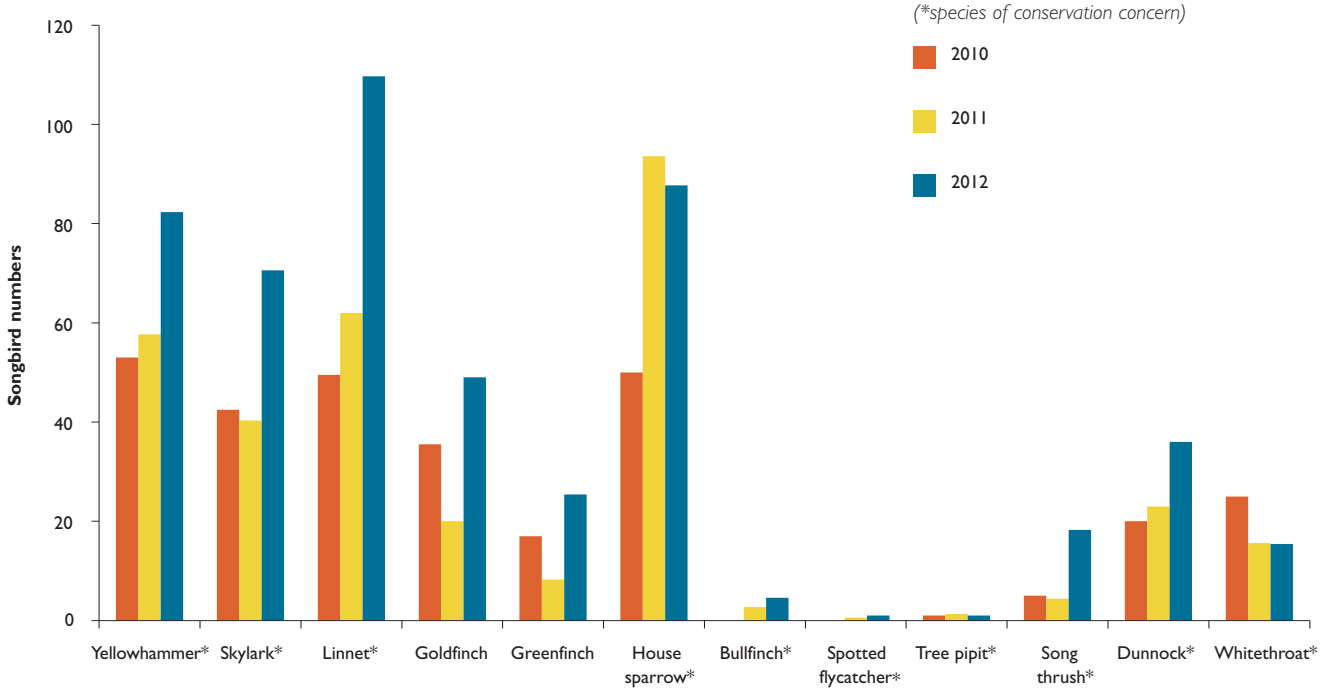
Pheasant							
Year	**Spring adults**		**Autumn adults****		**Wild broods**	**Wild young**	**Birds released**
	Cocks	**Hens**	**Cocks**	**Hens**			
2010	186	271	85	57	40	144	0
2011	282	350	118	170	113	502	600 cocks*
2012	323	410	147	141	80	201	600 cocks*

** The released reared cocks were all double wing-tagged and easily distinguishable from the resident cock pheasants owing to their much lighter colouring.*

*** Autumn adults do not include released birds in the year given.*

Figure 1

Change in farmland songbird numbers along a 20-km farmland transect during the breeding season (April-June) between 2010 and 2012
*(*species of conservation concern)*



As reported on page 26 (the Partridge Count Scheme), 2012 has been one of the worst lowland gamebird breeding seasons of the past 100 years. This has badly affected the small founder population of partridges at Rotherfield. Thirty translocated wild grey partridges were released on the Trust side and 61 parent-reared birds on the estate side in autumn-winter 2011/12, resulting in 22 spring pairs. However, only one brood of six young was confirmed on the Trust side during the autumn stubble counts (see Table 1). Hence, it is unlikely that the small 2012 autumn stock of 30 grey partridges will produce more spring pairs in 2013 than 2012.

Owing to the bad breeding success of grey partridges across the UK, no translocation is planned for winter 2012/13 on the Trust side. On the estate side, the autumn stock of re-established birds was supplemented by fostering two groups of juveniles to barren pairs in August and by releasing five coveys of parent-reared greys in October 2012. This release strategy will continue to allow us to compare the breeding success of wild and parent-reared released birds on the same estate but on two different beats.

The red-legged partridges did particularly badly in 2012 as only two juveniles were recorded across the entire estate (see Table 1). The breeding season was not good for the pheasants either, though not as bad as for the partridges. On the Trust side, autumn pheasant numbers were between those in 2010 and 2011, whereas on the estate side their numbers fell back to the level in 2010.

All farmland songbirds of conservation concern that occur in the project area, together with seed-eaters such as the greenfinch and goldfinch that are known to benefit from wild bird seed cover, showed notable increases at Rotherfield despite the bad summer weather (see Figure 1). Across the entire estate the skylark has increased by 66% since the project began, yellowhammer by 55%, linnet by 122%, greenfinch by 49%, goldfinch by 38%, house sparrow by 75%, song thrush by 266% and dunnock by 80% along a 20-kilometre farmland transect (10 kilometres on each side of the estate). This was counted three times between April and June. It seems likely that the continual increase of suitable habitat since 2010 together with intensified predation control and winter feeding is responsible for this result. On the Trust side, where the amount of wild bird seed cover increased from six hectares to a total of 14.4 hectares between 2010 and 2012, the number of these species increased by 114%, whereas on the estate side where wild bird seed cover increased from 3.0 hectares to 4.2 hectares, they increased only by 33%, despite comparable numbers at the start of the project. However, species that are not known to benefit from wild bird seed cover such as the bullfinch, spotted flycatcher and tree pipit, remained unchanged and the whitethroat even decreased, most likely owing to the bad summer weather.

Skylark numbers have increased by 66% and yellowhammers by 55% since the project began. © Markus Jenny

Strongylosis: single versus split dose treatments

Medicated grit is proven to improve red grouse health, increasing survival chances and potential breeding success. © Laurie Campbell

KEY FINDINGS

- Treatment of strongylosis using a dose of the anthelmintic drug flubendazole split over three or nine days was a third more effective than when the dose was administered all at once.
- Three dosage rates were tested: 4, 8 and 20 milligrammes (mg) per kilogramme of body weight. The lowest dose removed 51% of worms on average, compared with 75% for the highest dose.
- A red grouse visiting a medicated grit pile would accumulate the lowest dose in only two visits, which would therefore be enough to improve its health.

Nicholas Aebischer

In the past, red grouse have suffered from regular crashes in population size and breeding success due in significant part to the gut parasite *Trichostrongylus tenuis* responsible for strongylosis. Over the last few years, we have developed a way of administering medicine to grouse to reduce the effects of strongylosis using grit, impregnated with an anthelmintic drug. This is a way of harnessing natural grouse behaviour – the consumption of grit to aid digestion.

Typically, however, anthelmintic drugs are provided as a single dose and little is known about the efficiency of providing such medication in small amounts over a long period. To learn more about the efficacy of split doses of an anthelmintic drug, we conducted a laboratory experiment under Home Office licence using the grey partridge as a model. Partridges in the wild are known to suffer infection from *T. tenuis*, and in captivity they constitute a useful substitute for red grouse.

We randomly allocated a total of 110 parasite-free grey partridges aged 14 weeks to 11 experimental groups of 10 birds each. In groups two to 11, we infected the birds with 4,000 parasite larvae, retaining group one as an uninfected control. After a fortnight to allow the infection to become established, we calculated dosage rates of 4, 8 and 20 milligrams per kilogramme of the anthelmintic drug flubendazole for an average body weight per bird of 400 grammes, and administered the drug to groups three to 11 as all possible combinations of a single dose on day one of dosing, a dose split into three parts given at three-day intervals or as a dose split into nine parts given on a daily basis for nine days. Group two remained untreated to represent the infected control. During the dosing period, we treated control groups and birds that received no drug on certain days with water alone. For 14 days after the dosing period, we kept all birds as a flock and moved them to fresh ground to prevent cross-contamination. They were then killed humanely, we washed the gut contents through a 70-micron sieve and counted the number of *T. tenuis* worms under a microscope. A square-root transformation was applied to worm counts before analysis.

Only one *T. tenuis* was isolated from a single bird in the uninfected control group, confirming that cross-contamination had been negligible. The reductions in average *T. tenuis* numbers per bird following single-dose treatments at 4, 8 and 20 milligrammes per kilogramme relative to the untreated control were 38%, 52% and 59% respectively (see Figure 1). The highest dose rate was significantly more effective than the lowest dose rate. Average worm numbers per bird dropped by 56%, 67% and 78% respectively when birds were treated on the split three-dose regime, and by 58%, 55% and 88%

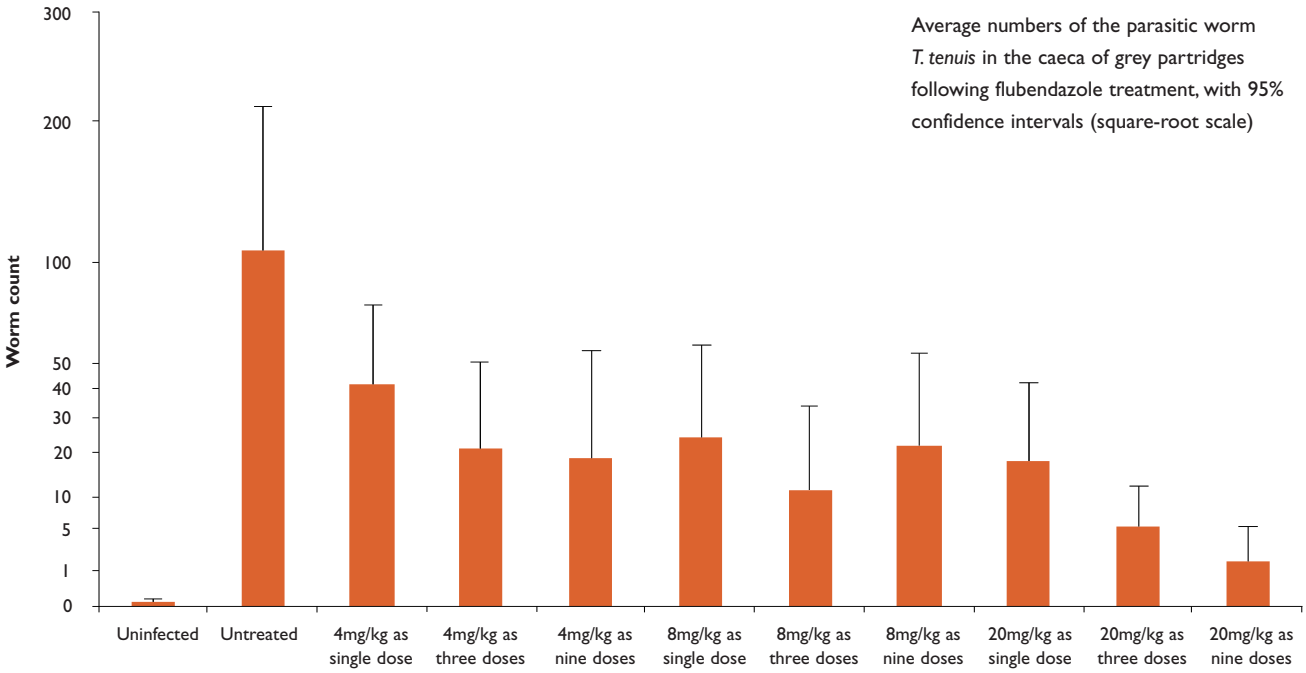


Figure 1

Average numbers of the parasitic worm *T. tenuis* in the caeca of grey partridges following flubendazole treatment, with 95% confidence intervals (square-root scale)

respectively with split-dose treatment of birds on a daily basis (see Figure 1). Overall, split-dosing was significantly more effective at reducing average parasite burdens than single-dosing, but three-way and daily split doses performed similarly.

An adult red grouse weighs around 600 grammes and its gizzard holds roughly eight grammes of grit. Of this, a fifth is lost each day and is replaced with fresh grit. If the grit is medicated, the amount of anthelmintic drug ingested corresponds to about 1.6 milligrammes of flubendazole, equivalent to a daily dose of 2.7 milligrammes per kilogramme. In relation to our experiment, this approximates to the highest dose rate that produced the largest reduction in parasite numbers. Individual variation in the use of medicated grit piles, however, will lead some birds to ingest much less drug. All our experimental concentrations of flubendazole effectively reduced numbers of *T. tenuis* – even a single dose of four milligrammes per kilogramme provided a 51% reduction on average. Such a dose could potentially be ingested by a bird in only two visits to a medicated grit pile and would therefore be enough to improve its health, increasing its survival chances and potential breeding success.

Split dosing was significantly more effective at reducing average parasite burdens than single-dosing.
© Henrietta Appleton/GWCT

The use of game feeders on lowland farmland

A pair of grey partridges visiting one of the feeders in the open (the hen is radio-tagged). © Carlos Sánchez/GWCT

KEY FINDINGS

- All feed hoppers were used by gamebirds and songbirds as intended, but the most common visitors were unwelcome pests, in particular rats and mice, corvids and pigeons.
- Apart from corvids, all species recorded preferred hoppers along hedgerows in comparison with hoppers located in open fields.
- Rats were not detected at hoppers in open fields.
- Gamebirds showed two activity periods around the hoppers: at dusk and dawn.

Carlos Sánchez
Francis Buner

Providing supplementary food for game using feed hoppers is a management tool used by many gamekeepers during the shooting season and into spring, in particular on wild bird shoots. Winter hopper feeding has been shown to keep gamebirds in good body condition throughout the 'hungry gap' and winter feeding increases seed-eating songbird densities (see *Review of 2010* and *2011*). As a result of our research, supplementary feeding has recently become an option in the Entry Level Stewardship (ELS) scheme. However, there has been no systematic study of how much of the grain is consumed by undesirable pest species from hoppers and how this can be reduced, together with the effects of hopper location on the attractiveness for game and other wildlife.

In January 2012 we started a feeding experiment using motion-sensing cameras on one farmland site in Garford, Oxfordshire (site A) and one at Rotherfield, Hampshire (site B). At both sites grey partridges were radio-tagged and colour-ringed as part of our on-going winter loss research and recovery project (see *Review of 2011* p36), which allowed us to study feeder use by individual grey partridge pairs in particular. We studied four pairs of hoppers with one feeder set in cover along a hedgerow and another in a straight line at a distance of 40 metres in the open of the adjacent field (winter wheat or rape). Each trial lasted one week, alternating between the two sites for seven weeks (February-April). The feeder locations for our trials were based on existing feeders along hedgerows, which were originally chosen by the local gamekeeper. To ensure independence between trials we targeted four different locations every week and moved the feeders 25 metres from their original location

We put one hopper out in the open field and one in the cover of a hedgerow (below the red arrow); rooks and jackdaws feeding at a hopper in the open field. © Carlos Sánchez/GWCT

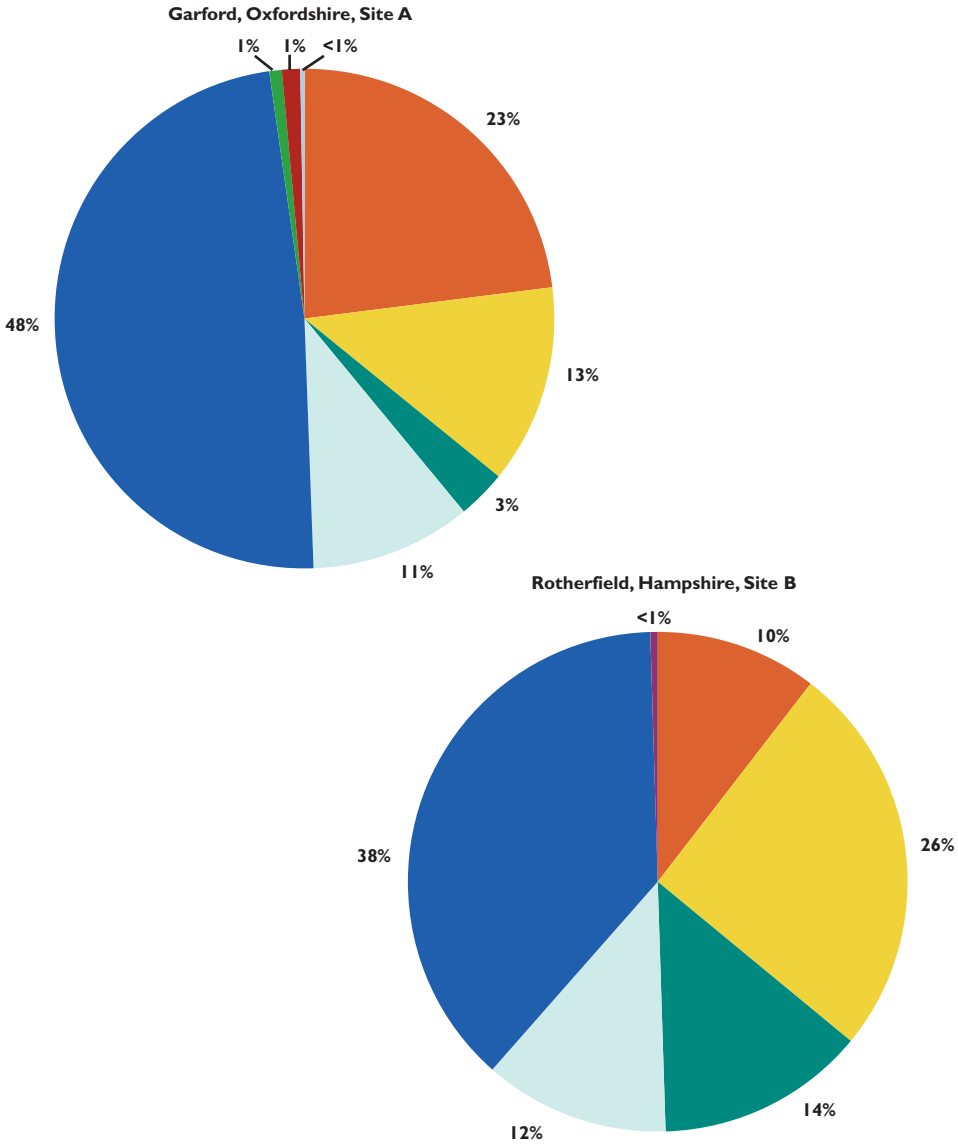


Figure 1

Overall percentage of photographs per group of species at Garford, Oxfordshire and Rotherfield, Hampshire

along the hedge. We set a camera at each of the hoppers studied, which took photographs when triggered by movement, with a time lapse of 15 seconds between consecutive photographs.

A total of 69,300 photographs resulted with considerable variation between the two sites (A: 59,991, B: 9,309). Across both sites, 57% of photographs were taken during the day and 43% during the night. During the day, 30% of photographs depicted gamebirds (48% pheasants, 29% greys, 23% redlegs), 33% songbirds, including species suffering long-term population declines (44% yellowhammers, 36% dunnocks, 6% chaffinches among a total of 10 different species identified), 19% pigeons, 14% corvids and the rest (4%) ducks, rabbits, hares and predators. However, there were some local differences (see Figure 1). The most photographed daytime species were pheasants (17%), wood pigeons (16%), dunnocks (14%), yellowhammers (13%), rooks (11%), grey partridges (7%), red-legged partridges (6%) and others (16%). During the night, rodents were the most photographed (rats 68%, mice 30%), followed by a minor proportion of other species such as badgers, roe deer and rabbits (2%). Our preliminary results suggest that 24-49% of the grain was consumed by rodents, especially rats.

The majority of photographs were taken at hoppers along hedgerows (62,777, 90%) and, except corvids, all species preferred this location compared with the open fields. Despite the weekly change of hopper location, rodents used all hoppers along hedgerows but only mice were detected in open fields.

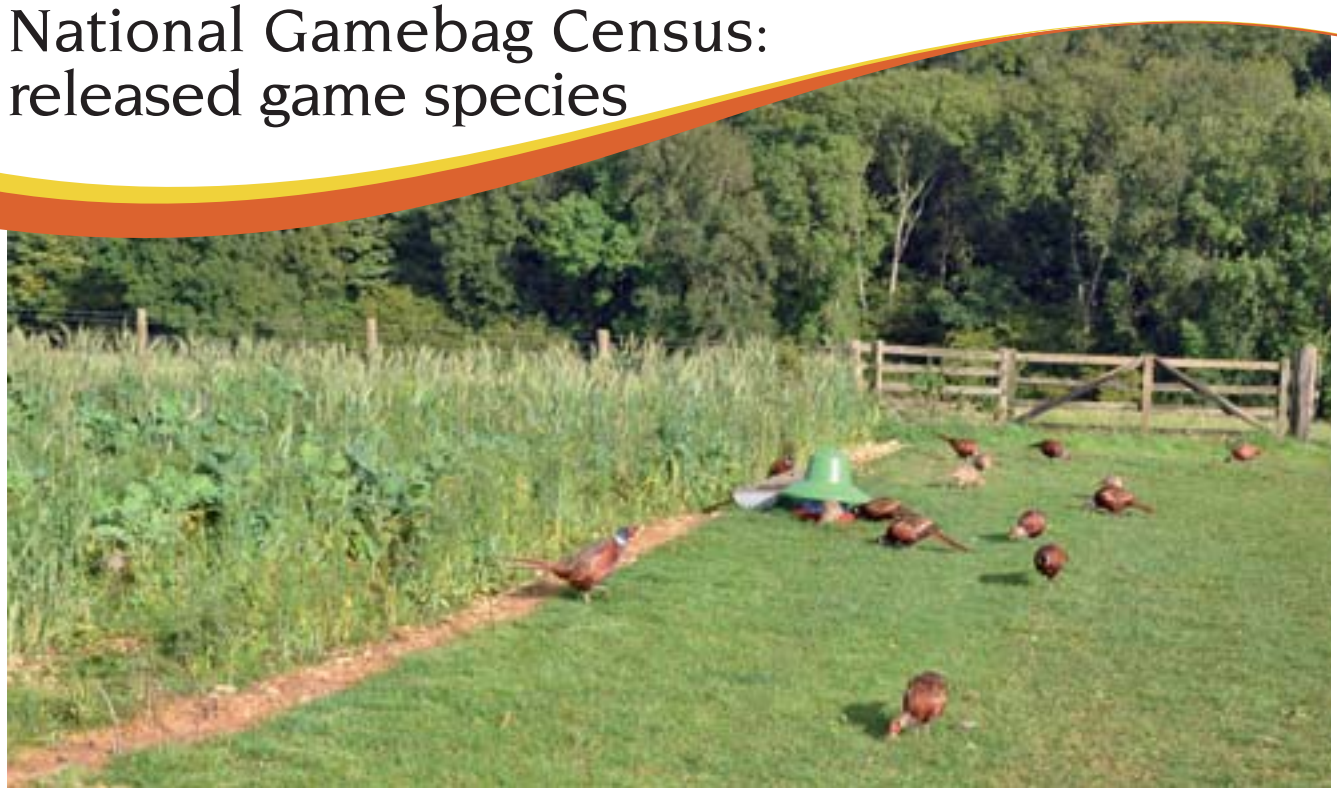
Gamebirds visited hoppers from the first or second day after they were set, showing two main activity periods around dusk and dawn. Of 23 grey partridge pairs, six used the hopper in the open only, seven only in cover and 10 used both hoppers. Three pairs visited one of the hoppers daily, although the average number of visits varied from three days per week, to four times a day. The average duration of each visit was seven minutes (se ±1.1), with no significant differences between hoppers in the open or in cover, or between the study sites.

ACKNOWLEDGEMENTS

We are extremely grateful to Fundación Caja Madrid for providing funding, David Butler for providing camera trap support and the farmers and gamekeepers in our study areas.

Beware, a family of rats can consume a high proportion of food. © Carlos Sánchez/GWCT

National Gamebag Census: released game species



Pheasant releasing has increased nine-fold since 1961. © Peter Thompson/GWCT

KEY FINDINGS

- Releases of pheasants have increased nine-fold since 1961. Pheasant bags increased correspondingly up to 1990, but have increased little since.
- Red-legged partridge releases have increased nearly 200 times since 1961, and the changes in bags have largely followed them.
- Grey partridge releasing peaked in the 1990s, but the amount is now only twice as high as in 1961. The bags mainly reflect the productivity of wild birds.
- Releases of mallards increased during the 1980s and 1990s, then fell back. Bags have broadly followed the same pattern.

Nicholas Aebischer

The Trust's National Gamebag Census (NGC) started in 1961 with a view to monitoring the abundance of game species through the use of bag records. Each year since then, we have collected information on numbers of quarry species shot and, where relevant, numbers released. Over time, this has provided an insight into major changes in the shooting world, which are illustrated here by the trends in four quarry species that are commonly released: pheasant, red-legged partridge, grey partridge and mallard. With the inclusion of data from the 2011/12 season, the NGC now covers a full 50-year span – a major milestone. It would not be possible to produce such trends without the continued supply of records from over 900 participants, and we are most grateful to all of them for their contribution and support.

For each of the four species, we base our analysis on sites that have returned bag records for at least two years. The analysis summarises the year-to-year change within sites as an index of change relative to the start year. This means that the first point of each trend series is set to 1, and subsequent index values of 2, 3, etc represent a doubling, tripling and so on in bag size since the start of the series.

Pheasant (Figure 1)

Pheasant releasing began in response to a decline in the traditional shooting of grey partridges as agricultural intensification in the 1950s and 1960s led to reduced wild stocks. Since then, demand and economics have led to continued increases in the numbers of pheasants released for shooting, which was estimated at 35 million in 2004 (PACEC 2006. *The Economic and Environmental Impact of Sporting Shooting in the UK*). The NGC index of releasing has increased nine-fold since 1961, with an average rate of increase over the last two decades of 2% per annum. The bag index has increased more slowly, as it is now only 2.5 times as high as in 1961. Most noticeably, there was a complete lack of growth during the 1990s despite the increases in releasing and it was only from 2000 that the bag index began a slow climb. The reason why higher releases do not appear to feed back into higher bags is probably that many shoots now offer shoot days in January. Because of on-going losses of released birds from August to December, disproportionately more pheasants must be released at the start of each season to achieve good late-season bags.

Red-legged partridge (Figure 2)

The releasing of red-legged partridges was uncommon practice in 1961, with only 19% of shoots in the NGC that reported bags of redlegs in that year also releasing them, and numbers released were tiny. Since then, there has been an almost exponential increase in the NGC releasing index, with some sign of slowing only in the last five years. Overall, numbers released now are almost 200 times higher than in 1961 (the

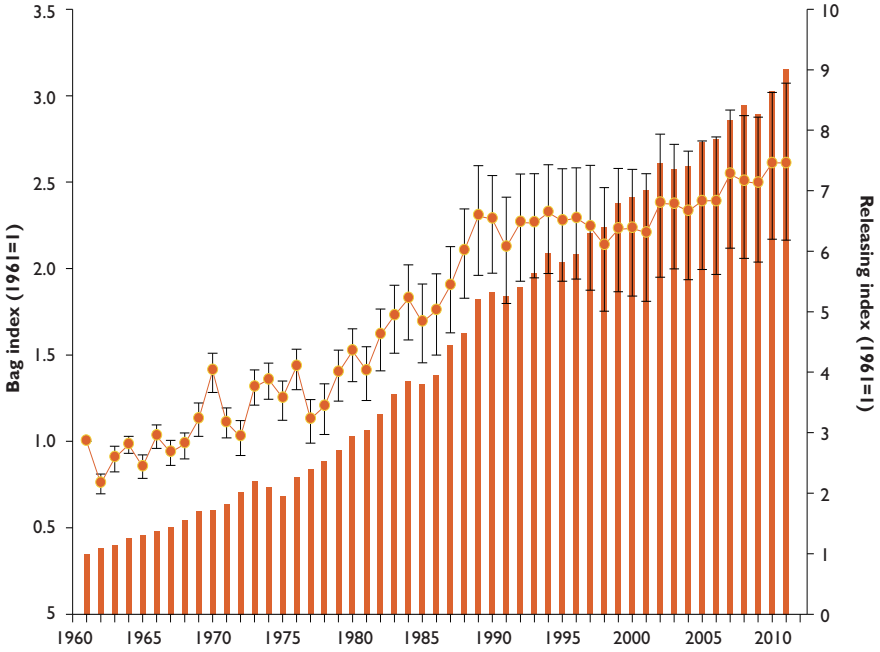


Figure 1

Pheasant: bag index (left-hand scale) and releasing index (right-hand scale)

Error bars represent 95% confidence intervals

Releasing index

Bag index

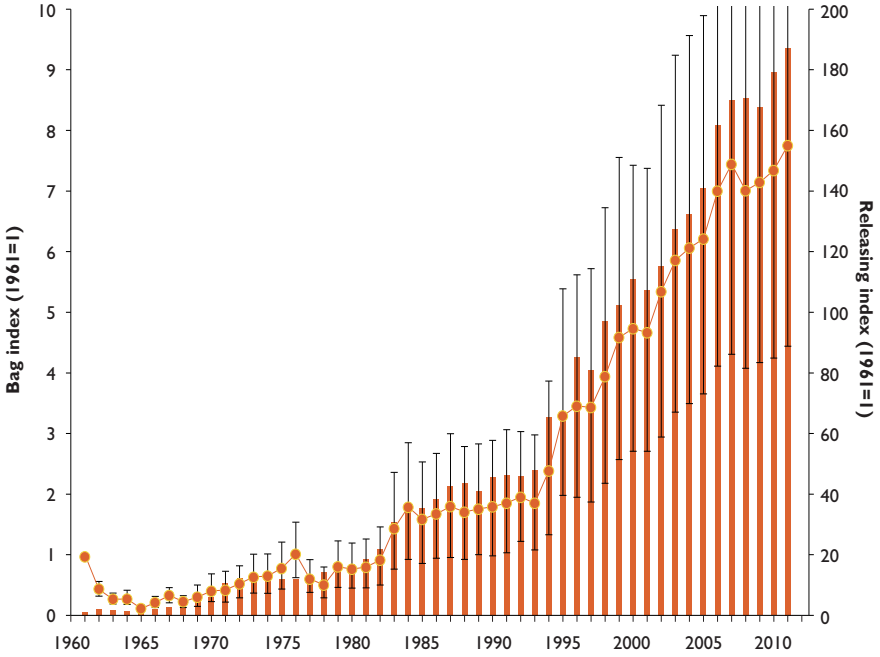


Figure 2

Red-legged partridge: bag index (left-hand scale) and releasing index (right-hand scale)

Error bars represent 95% confidence intervals

Releasing index

Bag index

The releasing of red-legged partridges was uncommon in 1961 but has since increased by nearly 200 times. © Peter Thompson/GWCT

Grey partridges are not suitable for mass releasing and it is rare for them to be released in large numbers. © Peter Thompson/GWCT

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).

UK estimate in 2004 was of 6.5 million redlegs released – PACEC). The bag originally relied on wild production, and so fell in the 1960s in the same way that the grey partridge bag fell, reflecting the impact of early agricultural intensification. Since then, the increase in releasing has fed through to the bag, which has increased eight-fold over the full 50-year span, but almost 100-fold since 1965. The redleg bag index shows no sign of the stabilisation observed for pheasant over the last 20 years, probably because most redleg shoot days are held in the first half of the season.

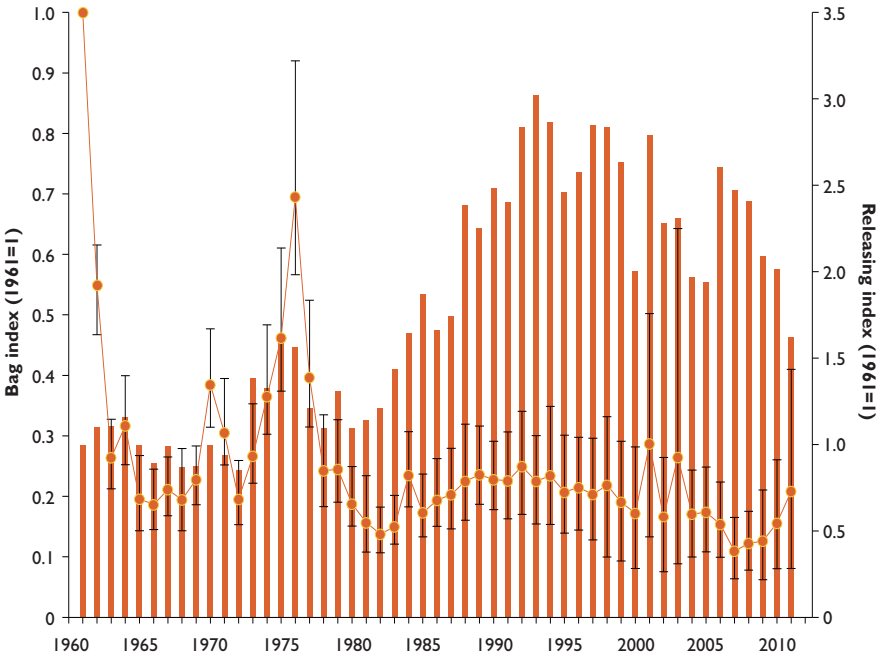
Grey partridge (Figure 3)

The grey partridge is the only one of the four species reviewed here whose bag index since 1961 is consistently less than 1. Indeed, it reached an all-time low of 0.11 in 2007, indicating that bags had dropped by almost 90% since 1961. This is the species that is least suitable for mass rearing, and it is rare for it to be released in large numbers. Accordingly, the releasing index (bars in the graph) never exceeds 3, so since 1961 numbers released have no more than tripled. The peak of releasing was in the 1990s, and releases have fallen back steadily over the last 15 years to now lie at just under twice the number released at the start of the series. These low levels

Figure 3

Grey partridge: bag index (left-hand scale) and releasing index (right-hand scale)

Error bars represent 95% confidence intervals



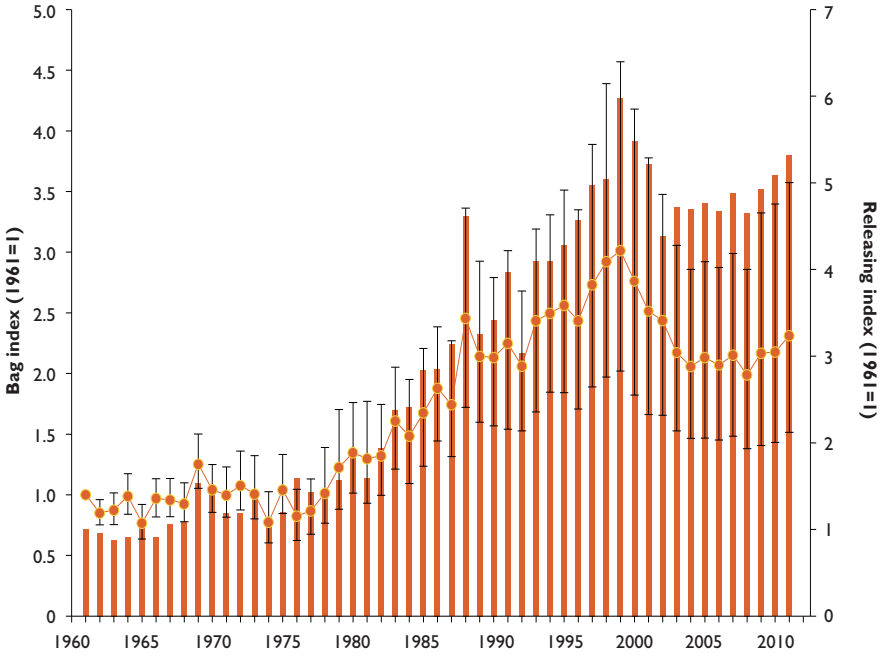


Figure 4

Mallard: bag index (left-hand scale) and releasing index (right-hand scale)

Error bars represent 95% confidence intervals

Releasing index

Bag index

of releasing mean that bags are dependent on wild production. This is most obvious in the 1975-76 spike in the bag index. But is also apparent in the most recent years, as a combination of good summer weather in 2010-11 and Entry Level and Higher Level Stewardship habitat enhancement resulted in improved breeding success. Grey partridges continue to decline nationally, so it is important to conserve them. Count them and avoid shooting them if there are fewer than 20 birds per 100 hectares (250 acres) in the autumn. Take particular care during driven redleg shooting not to shoot wild greys at the same time (see our newly revised guide *Conserving the grey partridge* at www.gwct.org.uk/gpdownloads).

Mallard (Figure 4)

The mallard is another species that was released uncommonly in 1961, with just 17% of NGC returns involving shot mallards also reporting releases. The practice started to become more popular after 1980, although it never engaged more than just over a quarter of NGC participants. Releasing peaked in 1999, with six times as many mallards released as in 1961. It has since fallen back, perhaps as a result of low game prices in the last decade. The bag index, which has doubled since 1961, reflects a combination of numbers released and numbers available in the wild. It shows a pattern very similar to the pattern of releasing: stability until 1980, a peak in 1999 followed by a decline. The decline appears stronger than expected from the releases, but this is probably because the wild population has declined over the last decade as shown by WWT/BTO/RSPB surveys.

Releasing peaked in 1999, with six times as many mallards released as in 1961.
© Peter Thompson/GWCT

Uplands monitoring in 2012

Despite the poor weather this summer, red grouse bred well with numbers only just under the record year of 2011. © Laurie Campbell

KEY FINDINGS

- Red grouse densities were maintained at similar levels to the record highs recorded in 2011.
- These high densities in northern England have often been associated with reports of sick grouse exhibiting bulgy-eye syndrome. Several such cases have been diagnosed as *Cryptosporidia* infections.
- In contrast, both black grouse and capercaillie had one of their poorest breeding years on record. Poor chick survival was associated with cool, wet weather around hatching time in June.

David Baines
Dave Newborn
David Howarth

Red grouse in northern England and Scotland

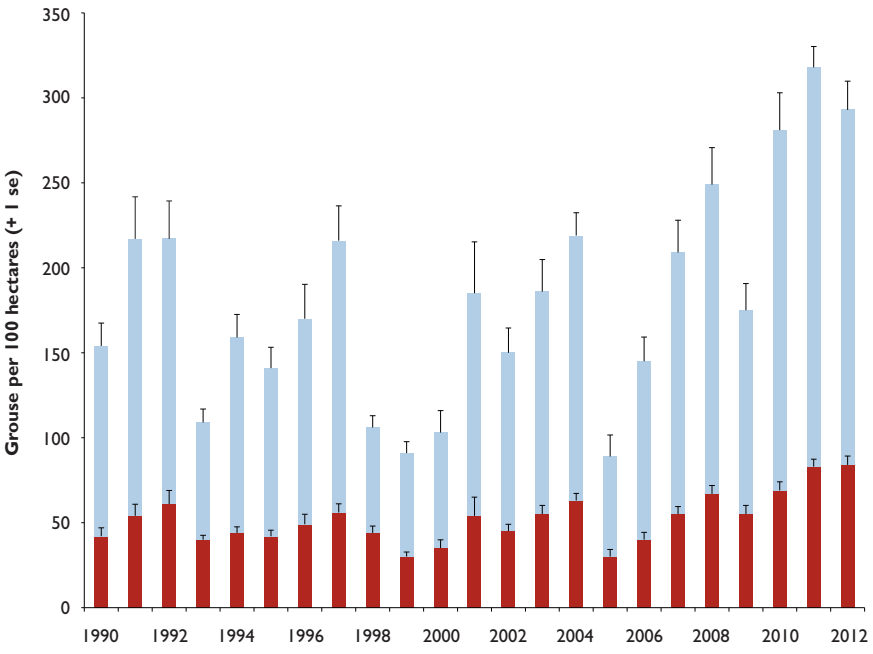
Good conservation of game species requires good quality information on how birds are faring. Wherever possible, threats to the breeding success of red grouse, black grouse and capercaillie should be anticipated and avoided. Our monitoring work is therefore vital to the recovery and expansion of all three species.

As part of our important grouse monitoring work we carry out annual spring counts using pointing dogs to determine pair densities and, in July, we use the counts to measure breeding success and pre-harvesting densities.

In northern England in 2012, we counted grouse at 25 sites, some of which have been counted for the last 30 years. Spring densities in 2012 with an average of 101 grouse per 100 hectares were very similar to levels in 2011. Despite the poor weather this summer, grouse bred well and only slightly less well than the record year in 2011. We put this recent success firmly at the door of the new form of medicated grit developed from our previous research. Since 2009, when breeding success on some moors that were not using it crashed, virtually all moors have used it. Given the previous cyclical fluctuations in grouse, 2012 without medicated grit, should have been

Figure 1

Average density of young and adult red grouse in July from 25 sites across northern England, 1990-2012



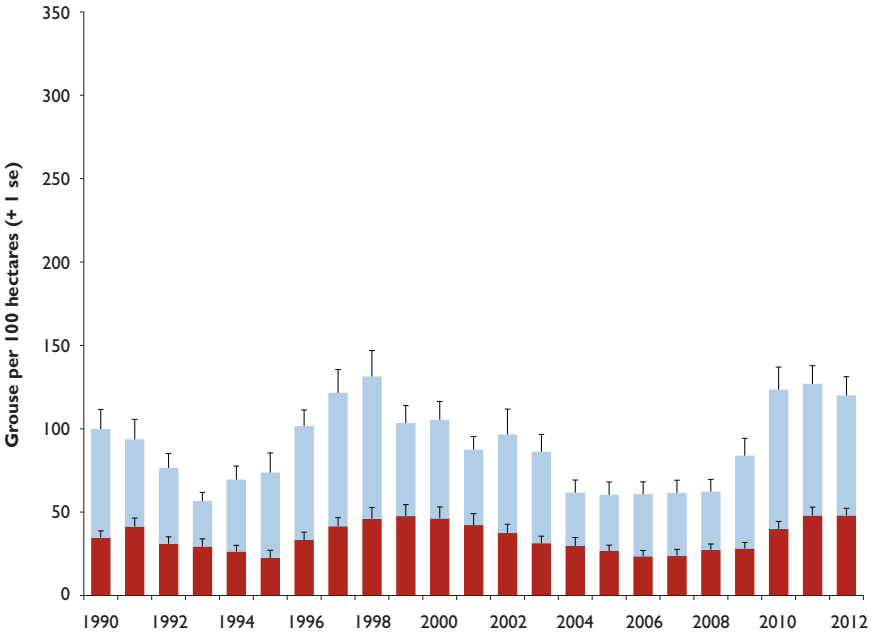


Figure 2

Average density of young and adult red grouse in July from 24 Scottish moors, 1990-2012

Young grouse

Adult grouse

a crash year for several moors, but instead, where grit has been used properly with a gritting station per pair in spring, densities have increased, often without signs of a worm build-up. If this trend continues, have we seen an end to grouse cycles, and if so, what other factors than worms will limit grouse numbers?

This year has seen increased reported cases of respiratory infections in grouse, exhibited through bulgy-eye symptoms. Those submitted for analysis have often shown infections of respiratory *Cryptosporidia*, a parasitic protozoan. This is causing considerable concern among grouse managers and can reach prevalence levels of one in every 10 grouse on some moors. This situation requires urgent research so that we can better understand its implications for grouse moor management.

In Scotland, we counted 24 long-term sites in 2012. Spring densities averaged 69 grouse per 100 hectares, again a similar level to 2011. Like their English counterparts, grouse generally bred well, again despite poor weather at key times in May and June. This resulted in average July densities of 126 grouse per 100 hectares, a decrease of 9% (see Figure 2). The prevailing mild and damp conditions may have favoured infective strongyle larvae and higher autumn worm burdens were recorded from many moors, thus highlighting the need for best practice medicated grit use.

Higher autumn worm burdens were recorded from many moors, highlighting the need for best practice medicated grit use. © Laurie Campbell

2012 was the worst breeding year for black grouse recorded in northern England due to the cold and wet weather in June. © Dave Kjaer

Black grouse

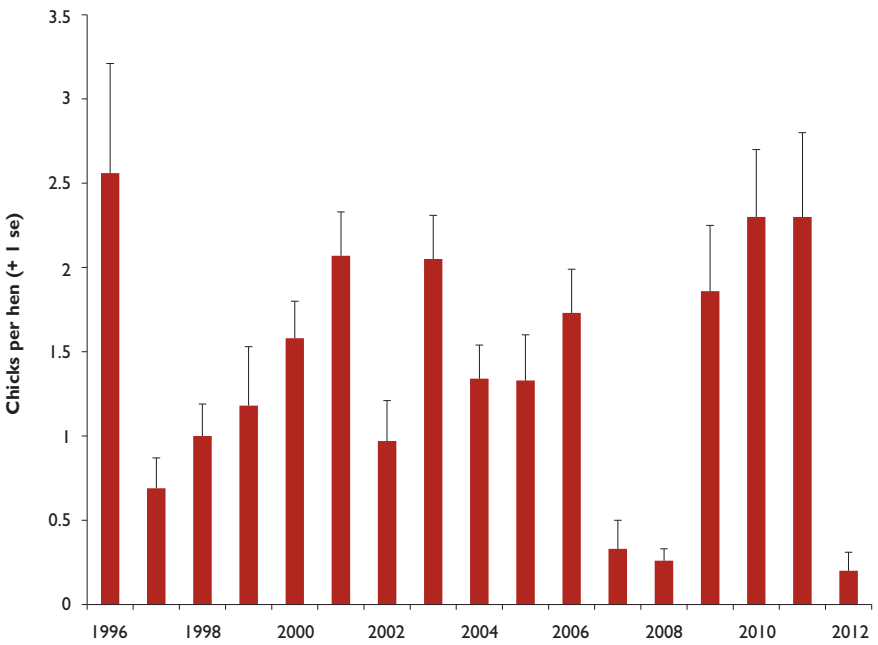
Following the severe winter of 2009/10, black grouse numbers in northern England dropped to their lowest recorded level of 495 males. In spring 2012, we surveyed black grouse at 56% of known leks and we now estimate the population at around 950 males. This recovery is attributed to two successive good breeding years in 2010 and 2011 (see Figure 3). Despite this encouraging recovery, surveys at Otterburn, once the stronghold for black grouse in Northumberland supporting 68 males in 2002 (7% of the English population), found no males. Here, despite significant investment in habitat improvements to moorland fringe habitats, these measures in the absence of predator control have failed to prevent their disappearance.

We carried out breeding surveys in northern England this summer using pointing dogs and found 35 greyhens, only four of which had broods with a total of seven chicks, an average of 0.2 chicks per hen. This was the worst breeding year for black grouse recorded in northern England and was attributed to the cold and wet weather in June.

In the Scottish Highlands, numbers of males at leks that we help count within Strathspey and Perthshire were down on 2011. In Perthshire, numbers had fallen by

Figure 3

Black grouse breeding success in northern England between 1996 and 2012



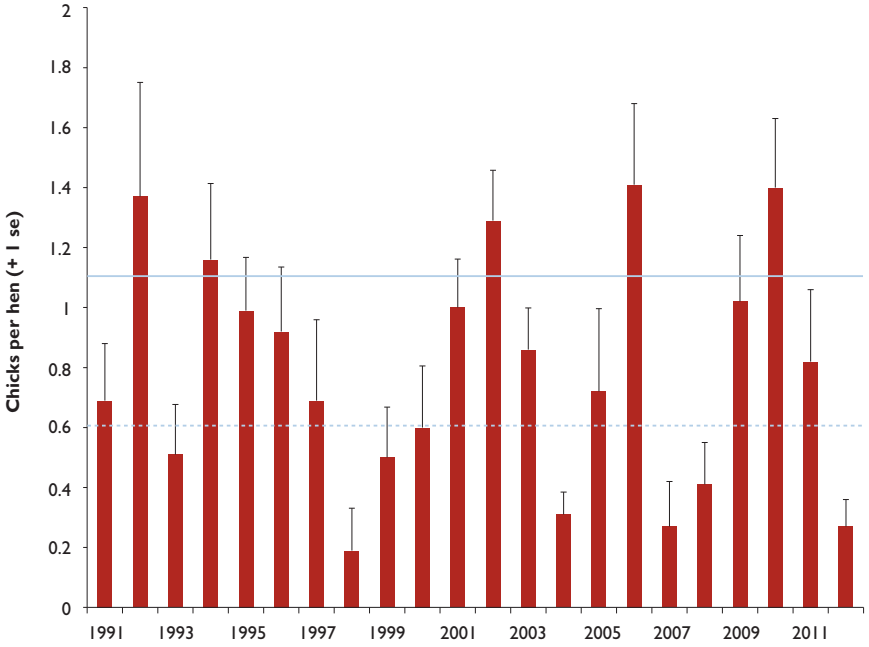


Figure 4

Capercaillie breeding success between 1991 and 2012* 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: blue solid line-with fence collision mortality; blue dashed line-without fence mortality.

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

13% and Strathspey saw a similar 10% decrease. Breeding productivity this summer was better in Scotland, where we found 27 greyhens, 15 with broods and a total of 37 chicks, giving an average of 1.4 chicks per hen.

Capercaillie

Our counts were restricted to two of our long-term study forests in Strathspey. Here, capercaillie had a reasonable breeding year and averaged about 0.9 chicks per hen (see Figure 4). To date, we are unaware how birds fared elsewhere. Almost three-quarters of the Scottish population is now restricted to Strathspey. This thinning and contraction of range is of huge concern and has been associated with poor breeding success in recent years, especially near the edges of the range in Perthshire and Morayshire.

The thinning and contraction in range of the capercaillie is of huge concern and has been associated with poor breeding success.
© Dave Kjaer

How often do grouse need medicated grit?

© Dave Kjaer

KEY FINDINGS

- On some moors, provision of medicated grit has reduced worm burdens in grouse to dramatically low levels.
- Given such low levels of worms, we ask whether annual use of medication is necessary.
- Withdrawal of medicated grit, substituting it with only plain grit, has after 18 months resulted in increased worm infestations, but not to levels associated with problems to grouse.
- Effective parasite monitoring and only medicating when necessary may reduce chances of resistance to our worming drug building up in strongyle worms.

Dave Baines

Our article in last year's *Review* described how the new medicated grit developed from our previous research, has dramatically reduced worm infections in grouse. With worm burdens now often so low, is continued annual medication appropriate or even wise? We are concerned that mis-use when not required may rapidly result in a build-up of resistance to the worming drug among worms that survive treatment. Only using medicated grit when necessary and then ensuring that grouse consume enough grit to give a virtually complete kill of worms is important in reducing the prospect of resistance. Having only one worming drug means that once worms become resistant to it, we will return to the previous 'boom and bust' of grouse cycles.

By better monitoring of parasite abundance, we think that worming can be restricted to when it is essential. How often this is will be determined through running 'gritting holidays'. In autumn 2011, we identified five moors with low worm burdens as potential sites for refraining, or 'taking a holiday' from using medicated grit and only providing plain grit. Resampling parasites on these moors in December showed continued low worm levels, which gave managers the confidence to participate in our trial (see Table 1). We withdrew medication from blocks of typically 100 hectares and compared subsequent parasite burdens with equivalent areas of the same moor where we continued to supply medicated grit from December onwards. We calculated parasite indices in early spring using worm egg counts from fresh caecal material, and again in autumn from shot grouse.

Low worm egg counts continued through March and April, but higher counts on the Teesdale site were of concern and here medication was resumed (see Table 2). Worm burdens in autumn 2012 differed between moors and between treatments, with burdens being higher in Swaledale and on non-medicated plots (see Table 3). Although non-medicated plots had statistically higher worm burdens, from a biological

TABLE 1

Geometric mean worm burdens (95% confidence intervals) in shot adult grouse on four moors in northern England in autumn 2011

	August/September			November-December		
Moor	**n**	**mean**	**(SE)**	**n**	**mean**	**(SE)**
Swaledale A	20	3	(1,6)	20	7	(3,11)
Swaledale B	20	3	(1,6)	20	5	(2,9)
Teesdale	50	2	(1,5)	23	17	(7,32)
North York Moors	20	2	(1,5)	12	2	(1,5)

TABLE 2

Geometric mean worm egg numbers (95% confidence intervals) in March and April 2012 from 20 caecal samples collected from areas where medicated grit was withdrawn in July 2011 and equivalent gritted areas on four moors in northern England and one moor in the Scottish Highlands

	March				April			
Moor	**Non-medicated**		**Medicated**		**Non-medicated**		**Medicated**	
Swaledale A	65	(31-136)	16	(8-34)	320	(154-670)	80	(38-168)
Swaledale B	137	(65-286)	34	(16-72)	675	(322-1,414)	169	(81-354)
Teesdale	149	(83-265)	37	(20-68)	737	(405-1,343)	185	(99-343)
North York Moors	9	(4-19)	2	(1-5)	45	(21-68)	11	(5-23)
Highlands	33	(12-88)	8	(3-22)	163	(72-367)	41	(18-95)

TABLE 4

Geometric mean worm burdens (95% confidence intervals) in autumn 2012 from shot adult grouse on areas where medicated grit was withdrawn in July 2011 and equivalent gritted areas on three moors in northern England and one moor in the Scottish Highlands

	Non-medicated				Medicated			
Moor	**n**	**mean**	**(SE)**	**Prop'n zero***	**n**	**mean**	**(SE)**	**Prop'n zero***
Swaledale A	10	10	(4-21)	0.40	20	5	(2-11)	0.55
Swaledale B	6	228	(89-593)	0	20	110	(52-246)	0.20
North York Moors	21	6	(4-15)	0.52	21	3	(1-7)	0.67
Highlands	24	3	(1-6)	0.83	20	1	(0-3)	0.85

** The proportion of grouse that contained no worms*

perspective, all plots, irrespective of treatment, had low worm burdens which were of little immediate concern to the moor managers, being unlikely to exhibit either sub-lethal or lethal effects in their grouse.

Our data clearly show that 18 months after grit withdrawal, worm burdens have not reached levels of concern at four of the five original sites. Subject to parasite pick-up rates in winter 2012/13, all managers have agreed not to medicate in spring 2013. Indeed, one manager has decided not to medicate over his entire moor, whereas two others will extend the size of un-medicated areas and a further four moors have opted to join our trial by not medicating. In addition to continuing our 'gritting holiday' trial in 2013, we will screen worms to look for signs of resistance. We will also measure rates of drug intake among free-living grouse to consider whether parasite kill rates are sufficiently high to minimise susceptibility to resistance. These aspects will be reported in the next *Review*.

All plots, irrespective of treatment, had low worm burdens. © Henrietta Appleton/GWCT

Acaricide-impregnated neck collars on sheep

Sheep were searched for ticks every two weeks.
© Jemma Grant/GWCT

KEY FINDINGS

- Conventional pour-on acaricides last only up to 12 weeks and repeated treatment is required within the tick questing period.
- Acaricide-impregnated neck collars designed for use on dogs look likely to provide effective cover against ticks for at least 20 weeks.
- We hope to repeat this trial in 2013 before considering commercial production and a larger field trial.

Mike Richardson
Dave Newborn

ACKNOWLEDGEMENTS

We would like to thank the owner, shepherd, agents and keepers on Westerdale & Rosedale Estate.

Grouse and sheep share much of our heather moorland. Improving their co-existence as well as the health and breeding success of both stock and birds is important for the viability of some grouse moors. The treatment of sheep for tick infestation is a case in point.

To control sheep ticks, sheep are treated with an acaricide pour-on at regular intervals between April and October when ticks are questing for a blood meal. Currently the most effective acaricide has a claimed persistency of only eight to 12 weeks. Therefore, to provide protection throughout the questing period, sheep need to be treated five times. Such repeated gathers are costly in handling time and may disturb ground-nesting birds, including grouse, at critical periods. Ideally, we need an alternative control technique without the need for repeated treatments. Accordingly, we are looking at dog neck collars and ear tags for cattle that claim effectiveness for six months. If similarly effective on sheep, repeated gathering may become unnecessary, with one collar lasting the whole tick-questing period.

We conducted our experiment within a tick-infested rough grazing paddock on Rosedale Estate in the North York Moors using the estate's sheep and shepherd. We used 66 sheep, last treated with acaricide as lambs the previous July. We counted ticks on all sheep prior to the trial starting, but found only two ticks, before each sheep was randomly assigned into one of four groups:

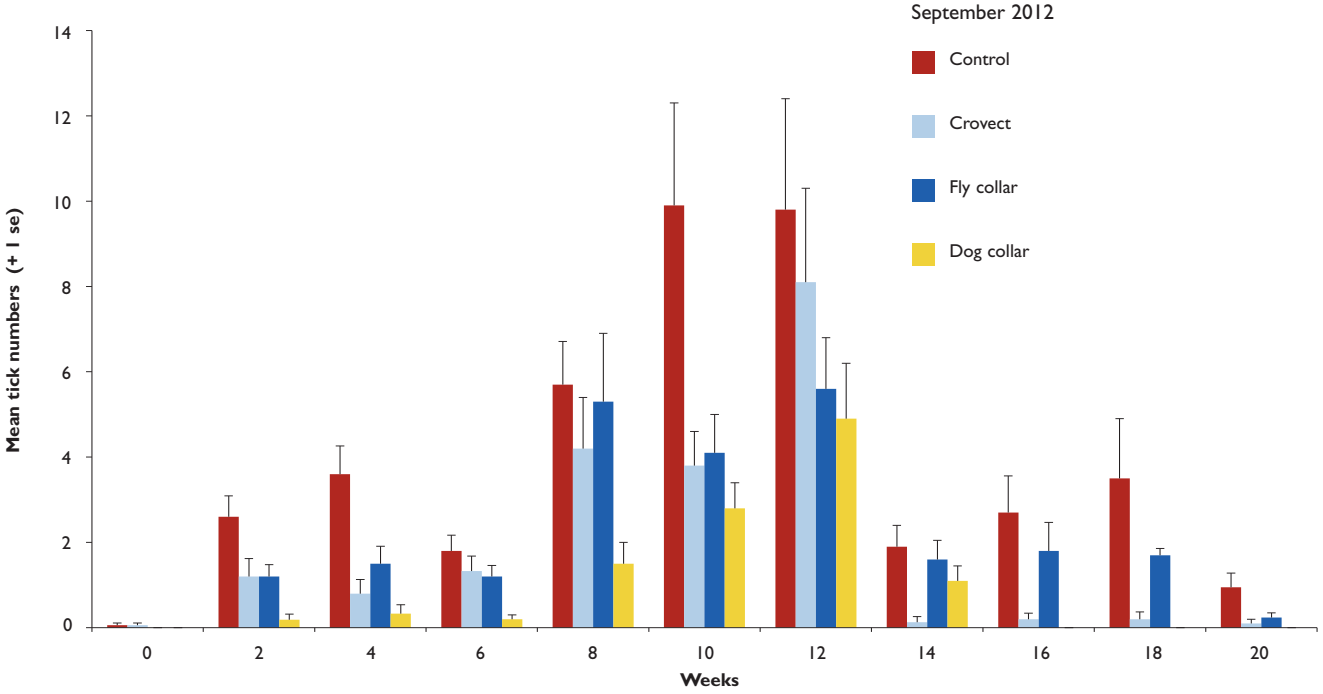
1. Fitted with a pendant made from cattle fly tags incorporating 935 milligrammes of cypermethrin and attached to plastic neck collars for sheep (n=17).
2. Fitted with a commercial tick collar for large dogs, which contained one gramme of deltamethrin (n=16).
3. Treated with Crovect, a conventional pour-on, containing 1.25% w/v cypermethrin, at an application rate of 10 millilitres per 20 kilogrammes live weight of sheep (n=17). Sheep were re-treated with Crovect after measuring tick burdens in week 12.
4. A control group with no acaricide treatment (n=16).

Sheep were subsequently gathered every two weeks from 23 April to 27 September 2012. We searched for ticks on bare areas of skin at the top of the legs and on the head. To be killed, ticks must ingest blood from treated sheep, so only live ticks of all life stages were included in our analyses.

Fortnightly variations in tick infestations for each treatment between week 0 (late April) and week 22 (late September) are given in Figure 1. Fly collars performed better

Figure 1

Mean number of ticks per sheep within three acaricide treatment groups and a control group in fortnightly periods between April and September 2012



than controls after week two, but by week four did not differ from the control group. Similarly, Crovect performed better than controls for four weeks, but thereafter was ineffective. Following a second Crovect application in week 12, better persistency was provided up to week 20, ie. an eight week period. The group fitted with dog collars showed the best persistency, with effective kill-rates relative to the control group varying from 93% after two weeks to 70% after week 10. Tick reductions of only 49% and 37% after 12 and 14 weeks respectively were statistically similar to tick infestations on control sheep, but after week 14, no further ticks were found on the dog collar group. Too few ticks in week 22 resulted in the trial ending.

Deltamethrin-impregnated dog collars fitted to sheep appear to be an effective means of killing ticks, with greater persistence than either similar collars produced from cow ear tags (cypermethrin) or a pour-on (Crovect). These data give us reasonable confidence in the effectiveness of collars and their ability to persist throughout the main tick questing period. We intend to repeat the trial next year to ensure product performance before seeking commercial tag production and expanding to a large scale trial at a farm or moorland beat scale.

Dog collars fitted to sheep (above) appear to be more effective at killing ticks than similar collars produced from cow ear tags (below).
© Melissa Dawson/GWCT

Langholm Moor Demonstration Project: year five

Hen harriers have taken substantial quantities of the diversionary food. © Damian Bubb/GWCT

KEY FINDINGS

- Hen harrier numbers did not increase despite having very good breeding success at Langholm.
- Grouse numbers increased from 2008 to 2009, but showed no significant changes in subsequent years (2010-12).
- Langholm grouse have low nesting success compared with grouse in other moors.
- More than 80% of found grouse kills can be attributed to raptor predation.

Sonja Ludwig
Dave Baines

The 10-year Langholm Moor Demonstration Project (LMDP) aims to reconcile grouse moor and raptor conservation interests with the core objective of re-establishing Langholm Moor as a driven grouse moor while maintaining a viable population of hen harriers. Since 2008 the project has employed a team of five gamekeepers to manage the 4,000 hectare moor. In addition to predator control, heather management and the provision of medicated grit to control strongyle worms, all nesting harriers are provided with diversionary food.

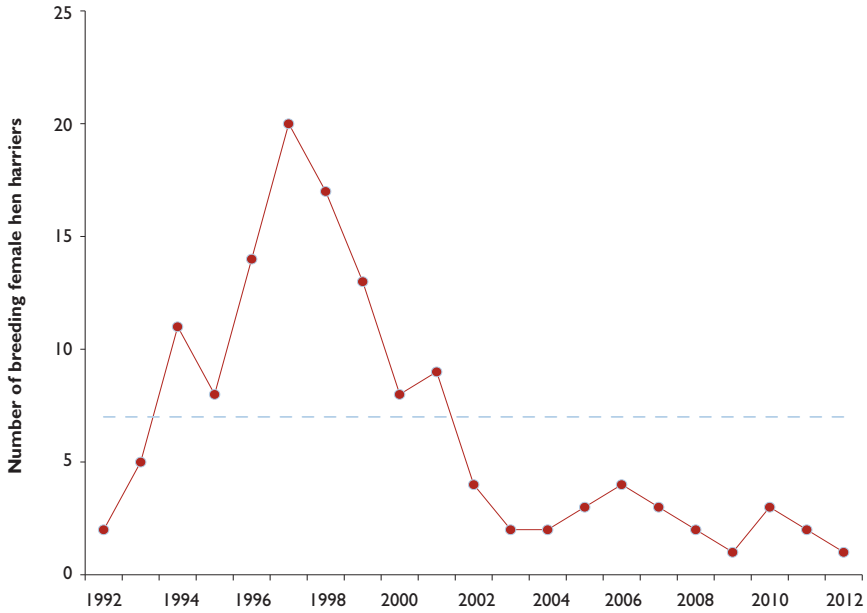
The numbers of hen harriers nesting at Langholm in the first five years of the project have been low, continuing the trend of previous years (see Figure 1). However, their breeding success has been good, with an average of 3.8 young fledged per breeding female (2008-2012). Since the start of the project, seven out of nine nests have been successful, producing 34 fledged young. We have provided all these nests at which eggs have hatched (n=7) with dead day-old cockerel chicks and rats as diversionary food, and the females have taken substantial quantities of this carrion. We have watched all harrier nests to identify prey items delivered to harrier chicks and have seen a total of 371 items (during 287 hours of observation) at the seven nests combined; of these most were passerines (47%) or diversionary food (43%). We have seen no grouse or their chicks being brought to the harrier nests.

Despite the low numbers of harriers breeding on the moor and all nests being provided with diversionary food, red grouse numbers have been disappointing (see Figure 2). Following an initial increase in density between 2008 and 2009, neither the pre-breeding (March/early April) nor post-breeding (July/early August) density of red grouse has changed significantly between 2009 and 2012. This raises concerns over the ability of red grouse numbers to increase sufficiently to meet the targets of shooting 1,000 brace.

Figure 1

Number of breeding female hen harriers at Langholm from 1992 to 2012

The dotted line represents the respective target values to maintain a viable population under Special Protection Area guidelines



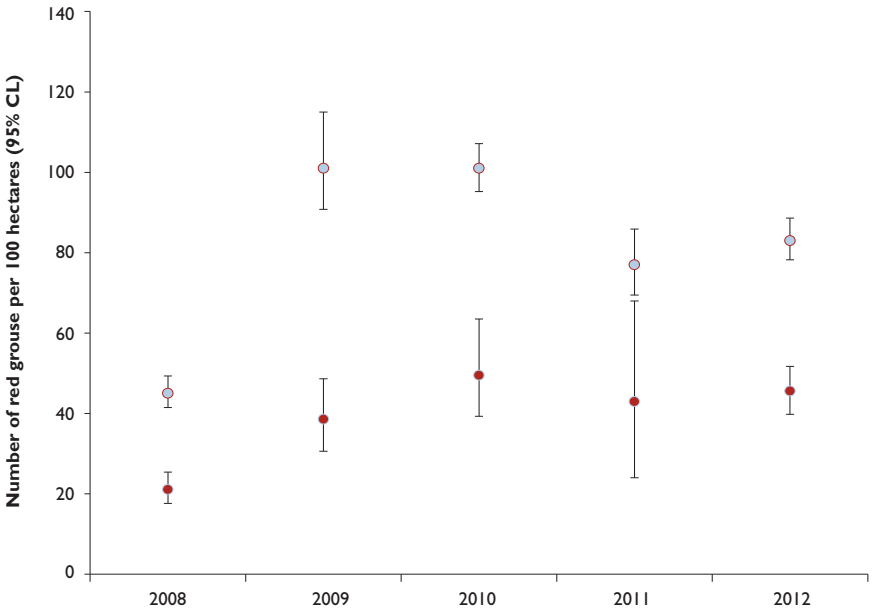


Figure 2

Density of red grouse at Langholm derived from distance sampling transects

July
Spring

Grouse at Langholm are in a good body condition when caught for radio-tagging and there is currently no problem with strongylosis or ticks. A comparison with other grouse moors in England and Scotland shows that despite laying large clutches, grouse at Langholm have comparatively low nesting success and a low percentage of hens with broods in July. Productivity (number of chicks per hen) is comparable to other Scottish moors but lower than on English grouse moors. Adult breeding mortality (difference between spring count and number of adults counted in July, relative to the spring count) and over-winter mortality (difference between July count and the count in the following spring, relative to the July count) are comparable to other moors. However, the latter does only include natural mortality at Langholm, whereas it is a combination of natural and shooting mortality in most of the English and Scottish moors (see Table 1).

We have gathered information on the likely causes of adult mortality of red grouse through finding carcasses from radio-tagged birds, systematic kill searches, and also chance found kills. Irrespective of the method, more than 80% of all dead grouse (n=288) that we have found over winter have been eaten by raptors, with only a small number showing field signs of being eaten by mammals. We are now conducting additional work to improve our understanding of the causes of mortality by repeating raptor vantage point watches that were originally carried out during the Joint Raptor Study in the 1990s. These will allow us to compare relative abundance of raptors with grouse abundance and mortality in different parts of the moor. Since 2011 we have monitored buzzards, the most abundant raptor species at Langholm, more intensely. However, nest cameras at buzzard nests have so far reported few grouse brought back as prey items.

ACKNOWLEDGEMENTS

The Langholm Moor Demonstration Project is a partnership between the Game & Wildlife Conservation Trust, Scottish Natural Heritage, Buccleuch Estates, the RSPB and Natural England. We would also like to thank the Duke of Northumberland and other moor owners.

TABLE 1

Average demographic values for red grouse at Langholm compared with other grouse moors in England (25 moors) and Scotland (21 moors) 2008-2011. Values for clutch size and nesting success are based on data from four English moors and 12 Scottish moors (*includes shooting mortality)

	LMDP	English moors (25) Mean (se)	Scottish moors (21) Mean (se)
Clutch size	9.3	9.2 (0.3)	8.7 (0.1)
Nesting success	0.70	0.88 (0.06)	0.85 (0.02)
% hens with broods	0.77	0.90 (0.02)	0.81 (0.03)
Productivity	3.4	5.1 (0.2)	3.5 (0.3)
Breeding mortality	23%	19% (2)	16% (3)
Winter mortality	42%	57% (2)*	42% (3)*

Rediscovering beetle banks

Beetle banks provide over-wintering habitat and can divide large fields. © Peter Thompson/GWCT

The European Union has approved a directive to ensure that all users of plant protection products adopt the principles of Integrated Pest Management (IPM) by 2014. Encouraging the natural enemies of pests through the use of beetle banks is one IPM approach and has the benefit that the banks are an option in English and Scottish Agri-Environment Schemes (AES) and is therefore financially supported. Beetle banks are not, however, a popular option, with only 1.4% of agreement holders in England having adopted them by 2009. Here we reflect on the body of evidence, generated from four GWCT supported PhD studies, showing their value, and look at the potential alternatives.

The idea of beetle banks was first conceived following studies in the 1980s showing that some predatory beetle species over-wintered in grassy field boundaries and dispersed into crops in spring. The banks, which are usually two metres wide and 0.6 metres high, sown with tussock-forming grasses, were originally devised as a way of restoring or encouraging beetles and other natural enemies of pests to improve crop pest control in large fields. This was to be achieved by increasing over-wintering habitat and by dividing large fields, thereby reducing the distance over which the predator species need to disperse. Results from the PhD studies enable us to assess the potential of beetle banks to increase pest natural enemies within the adjacent field based upon numbers over-wintering in them and our current recommendation of one beetle bank every 150 metres. With the average (585 per square metre) and

KEY FINDINGS

- When beetle banks are used to divide large fields they increase nesting habitat, encourage the natural enemies of pests, support endangered wildlife such as harvest mice and decrease soil erosion.
- Other key agri-environment scheme habitats can supplement the range of natural enemies of pests on farmland.

John Holland

Grey partridges can benefit from the good nesting habitat provided. © Peter Thompson/GWCT

highest (2,180 per square metre) density of pest natural enemies recorded in the banks, this amount of beetle bank would raise pest enemy numbers in the field by 3.9 per square metre or 14.5 per square metre respectively, assuming all migrated from the beetle bank during the summer. In fields without beetle banks we found between 29.3 per square metre in June declining to 11 natural enemies per square metre in July. Thus beetle banks have the ability to increase natural enemies of pests substantially within fields. However, land managers and policy makers are unlikely to be convinced about the value of beetle banks unless we can confirm that these are improvements in predator densities within fields and result in improved pest control.

Several studies assessed the spatial distribution of natural enemies of pests in fields with and without beetle banks and were able to identify a brief wave of migration from the banks in April or May, followed by a period in which there was an even spread of boundary-over-wintering natural enemies across the adjacent field. To verify whether these raised natural enemy densities have an effect on pest control, we compared the numbers of cereal aphids in enclosures with and without ground-dispersing natural enemies at 8, 33, 58 and 83 metres from a beetle bank. Overall, when we excluded ground-active natural enemies, aphid numbers were 34% higher. Looking at the effect of distance from the beetle bank on the numbers of aphids, we found that the aphid peak was reduced by at least 50% up to 58 metres from the bank, but reductions were greatest at eight metres. Moreover, the effect of the natural enemies of pests was probably lower than anticipated because in the year of the experiment the aphids invaded the crop relatively late in the season and increased rapidly making it difficult for the natural enemies to maintain control.

Besides their contribution to pest control, beetle banks have other attributes that make them a useful addition in any AES. They provide good nesting habitat for grey partridges and because a gap is left at either end for machinery access around the field, the nests are less prone to predation by mammals. The densities of chick-food insects are as high as in any field boundary and beetle banks support other wildlife

Species of conservation concern such as harvest mice can also benefit from beetle banks.
© Dave Kjaer

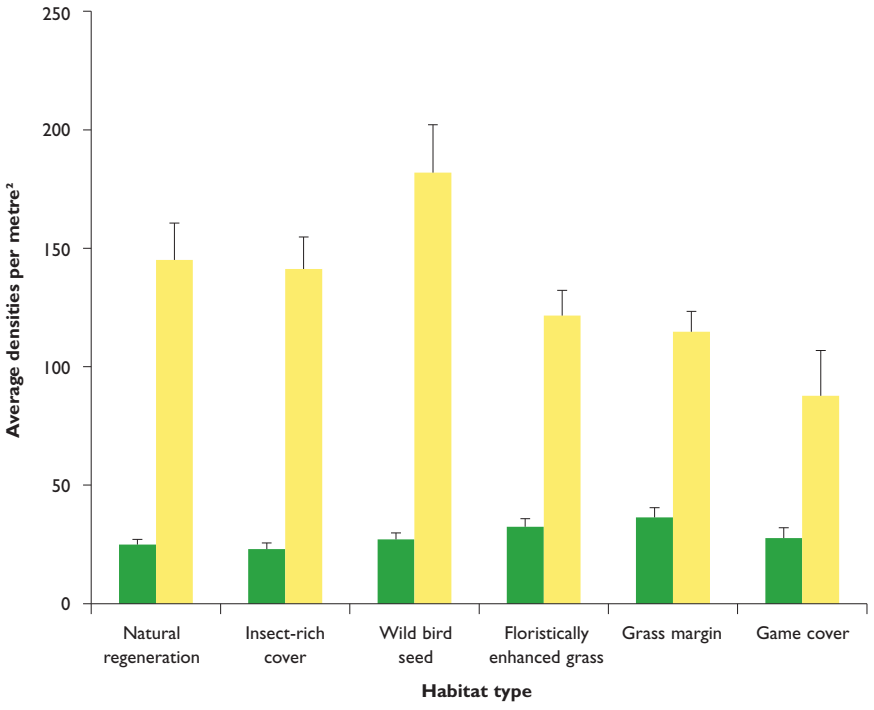
Beetle banks can halt soil erosion when located across the gradient of sloping ground. © John Holland/GWCT

of conservation concern such as harvest mice and grasshoppers. Furthermore, they can help to halt soil erosion when located across the gradient of sloping ground. In contrast, grass buffer zones, which are a very popular AES option, are less effective in providing these attributes. Since the research on beetle banks started, the threat from cereal aphids in summer has declined markedly and this may in part explain their poor uptake in AES. However, we cannot be complacent for a number of reasons. Resistance to pyrethroid insecticides has been detected in the grain aphid, *Sitobion avenae,* one of the most common aphids infesting cereal crops. There are concerns about the effect on bees of the alternative products such as the neonicotinoid insecticides and there is a new directive from Brussels stating that all EU countries must adopt the principles of Integrated Pest Management (IPM) by 2014. Finally a changing climate may bring new pests to our countryside and allow existing ones to proliferate under milder conditions.

Beetle banks alone may not be sufficient to increase densities of natural enemies of pests because for effective and robust IPM, a range of predatory and parasitic

Figure 1

Average densities (1 se) of pest predators and parasitic wasps during mid-summer in a range of wildlife habitats



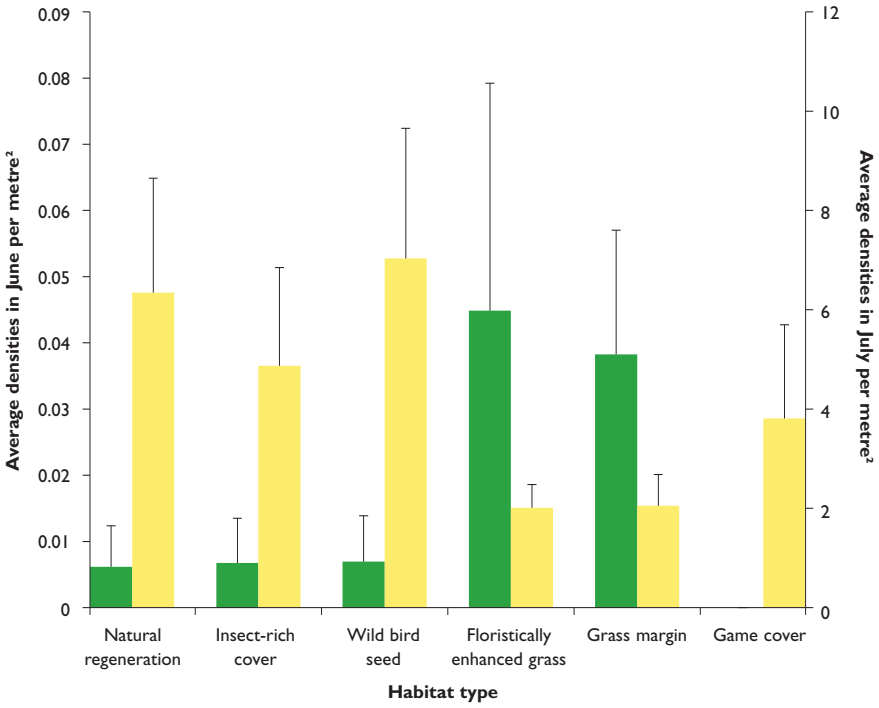


Figure 2

Average densities (1 se) of marmalade hoverfly *(Episyrphus balteatus)* during June and July in a range of wildlife habitats

June

July

species are needed, acting in different ways on all of the pests-life stages. These species also need other resources such as alternative prey for when pest-derived food is insufficient and for some species a source of nectar is necessary for their development. In the Farm4Bio project we looked at how well other wildlife habitats supported natural enemies of pests and found that the grassy habitats supported the most predators whereas the annual habitats, with the exception of game cover, supported the most parasitic wasps (see Figure 1). Overall there were between three to six times more parasitic wasps compared with predators, although not all parasitic wasp species will parasitise crop pests. The marmalade hoverfly is another important aphid predator and this species occurred primarily in the grassy habitats in June, but once the annually-sown habitats had grown they switched to these (see Figure 2). The next stage of our research will be to discover how these habitats affect natural enemy activity and pest control in the crops.

Marmalade hoverflies are important aphid predators. © Peter Thompson/GWCT

ACKNOWLEDGEMENTS

The beetle bank research was conducted by Matthew Thomas, Alan Macleod, Katy Collins and Sue Thomas for their PhDs. The Farm4Bio project was funded through the Sustainable Arable LINK programme.

Allerton Project: game and songbirds

As part of the game marking scheme we use different coloured wing tags to provide an insight into dispersal and the contribution of each pen on shoot days. © Louise Shervington/GWCT

KEY FINDINGS

- The shoot expanded in 2012 to include additional land.
- Wild gamebird numbers remained low because of poor breeding season weather conditions.
- Songbird numbers are now 42% higher than the baseline in 1992.
- Winter feeding results were used to inform a new Stewardship option.

Chris Stoate
John Szczur

Following the start of the new shoot in 2011, last year also marked an important milestone as we enlarged the shoot to take in additional land to the north of the farm. This development enables us to increase the number of shoot days we can offer, improving the economic viability of the shoot, as well as providing a superb venue for accommodation and meals for visiting guns at neighbouring Launde Abbey. The new situation also gives us access to a Site of Special Scientific Interest woodland, and first-hand experience of accommodating the nature conservation objectives of this site with running a viable shoot.

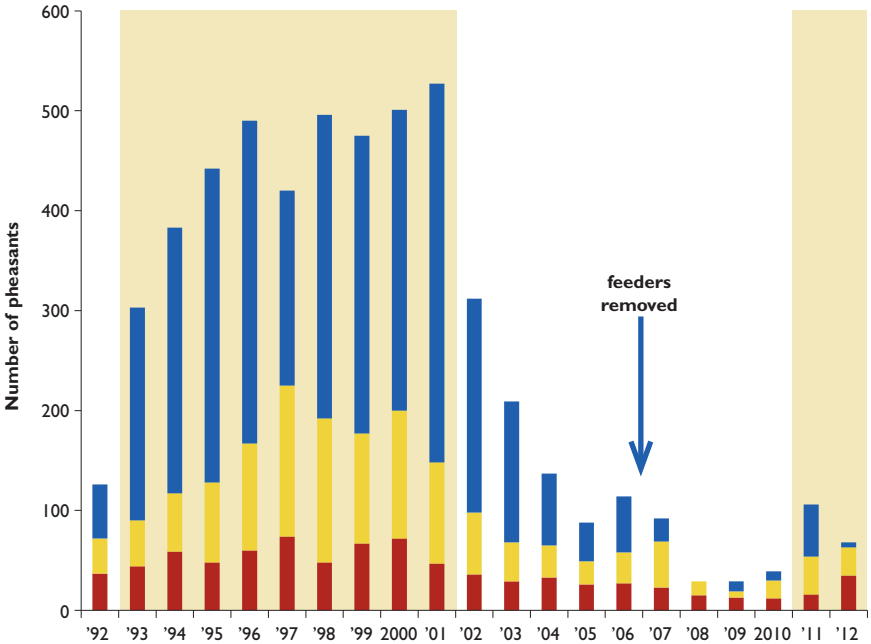
We released 3,400 pheasants across the total 1,100 acres for the 2012 season and held 11 driven shoot days, as well as four walked up days. We have five release pens across the area and a total of 12 potential drives. The return rate for the 2012 season was 48%, compared with 45% in the previous year. As part of the GWCT's Game Marking Scheme, we used different coloured wing tags for different pens to provide an insight into the dispersal of pheasants, and the contribution of each pen to a shoot day.

Our long-term monitoring of game and songbirds has continued. Autumn game counts reveal that the wet weather resulted in very poor breeding success and low numbers of wild pheasants present in the autumn, as has been the case across most of the country (see Figure 1).

Following a period in which we stopped predator control and winter feeding when songbird numbers dropped to just 5% higher than the 1992 baseline, our latest

Figure 1

Autumn wild pheasant numbers from 1992 to 2012



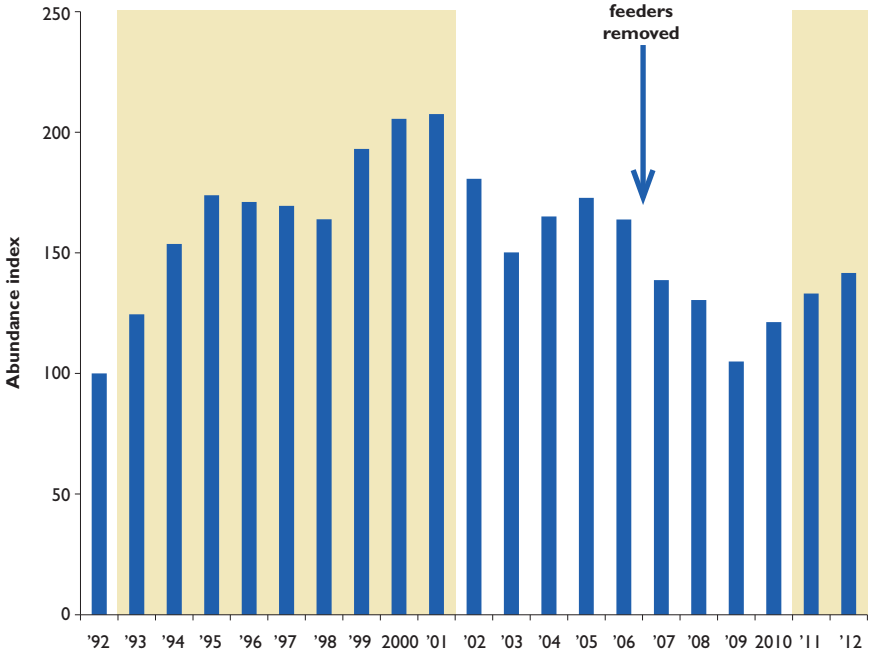


Figure 2

Songbird abundance relative to the start of the project

Keepered period

results suggest that numbers are again increasing in response to the game management system introduced in 2011. Habitat management continues, and predator control and winter feeding have been restored. Overall songbird numbers were 42% higher in 2012 than in the 1992 baseline year (see Figure 2).

Our long-term monitoring suggests that, for those species that use feed hoppers, breeding numbers were 30% higher in years with winter feeding than in years in which there was no feeding. Biodiversity Action Plan species such as stock dove, tree sparrow, yellowhammer and reed bunting, as well as more abundant species such as blackbird, dunnock, robin and chaffinch, all make regular use of feed hoppers filled with wheat and we have been continuing our investigation of this issue in 2012.

As in previous years, hoppers were used by songbirds and rodents, as well as by gamebirds and the use of hoppers varied considerably between sites. Songbirds made greater use of hoppers where pheasants were also using them than where pheasants were excluded, presumably because pheasants knocked grain onto the ground where it was more accessible for other birds. In response to the varying numbers of animals using the hoppers during January and February, grain consumption varied from just a few grammes to two kilogrammes of wheat per day.

Our data have been used to support proposals for a new Environmental Stewardship option for supplementary winter feeding which came into operation in January 2013. As with other measures developed by the Allerton Project, we hope that this will contribute to increases in songbird breeding numbers elsewhere.

Biodiversity Action Plan species such as the stock dove make regular use of feed hoppers. © Dave Kjaer

Songbirds made greater use of feeders where pheasants were also using them, as grain knocked to the ground is more accessible for small birds. © Peter Thompson/GWCT

The farming year at the Allerton Project

Unprecedented amounts of rain made harvest difficult with poor wheat yields.
© Peter Thompson/GWCT

KEY RESULTS

- High rainfall at the Allerton Project, Loddington, continues extreme weather patterns.
- There was a poor 2012 wheat harvest and difficult sowing conditions for 2013 crops.
- Concerns over slug pellet active ingredients.
- Farm joins the communication revolution.

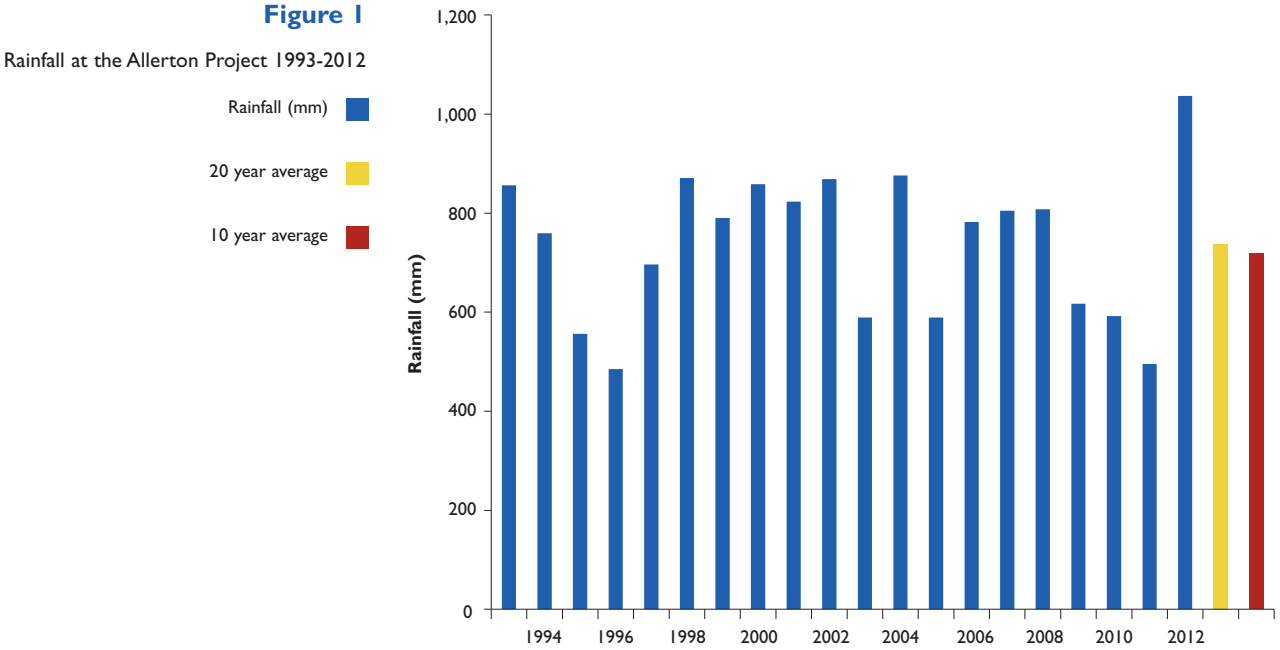
Alastair Leake
Phil Jarvis

The exact route of the North Atlantic jet stream seems to have surprised many commentators in 2012. The dry weather between January and March has been followed by unprecedented high rainfall in England. Although the UK experienced its second wettest year on record (after 2002), our local figures (see Figure 1) show a different picture. It has been the wettest year since we have been farming at Loddington and certainly wetter than 2002. Most of this rain fell during nine months between April-December.

As part of our research we collect water samples from field drains through the winter to analyse the contents for phosphate, nitrate and occasionally pesticides too. Throughout the entire 2011-12 winter, our drains never flowed. The limited rain that did fall simply went to re-wet the clays that had dried out during the previous summer. Our settlement ponds, established for removing soil particles from field ditches, were rendered redundant as no water flowed into them. Then just as hosepipe bans were

Figure 1

Rainfall at the Allerton Project 1993-2012



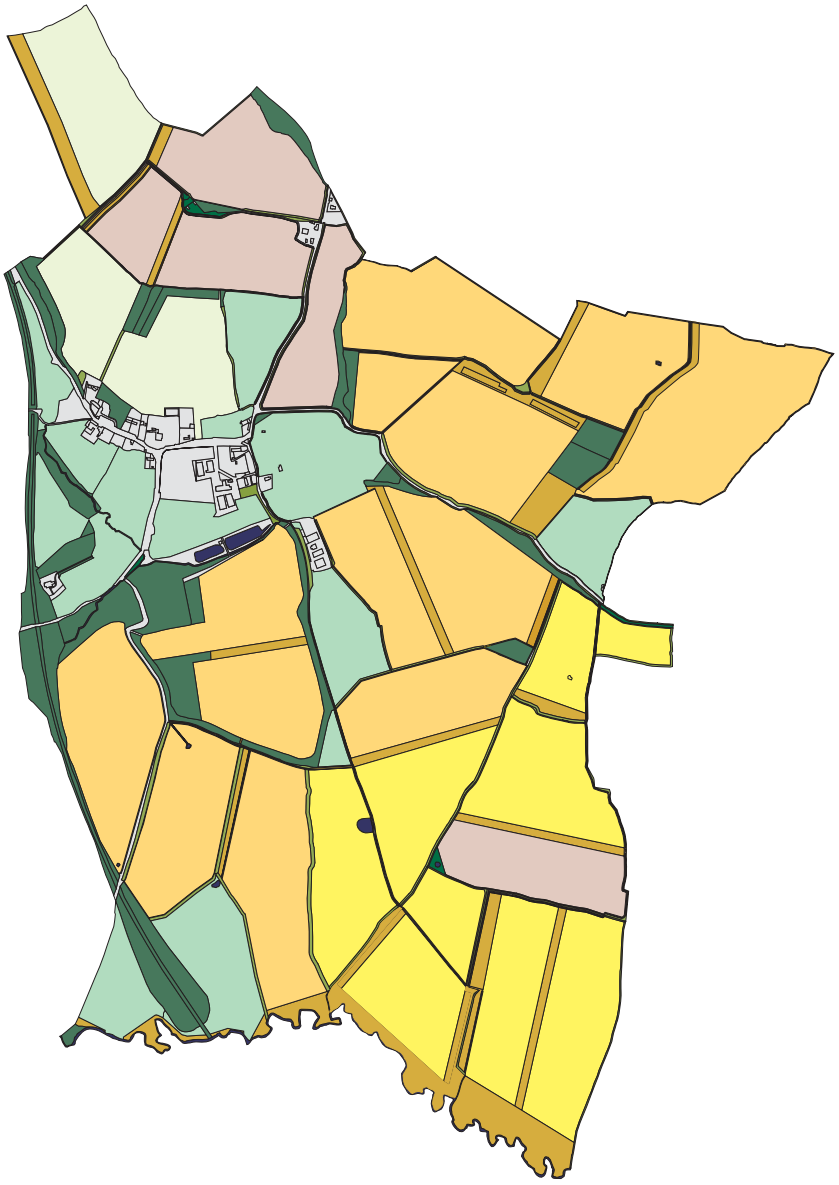


Figure 2

Allerton Project cropping 2011/12

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

about to be put in place, the rains came, giving us some of the wettest late spring and summer weather on record. Normally our drains stop flowing in April, but this year they began flowing in April and have not stopped since. The entire soil profile reached saturation point and any further rain simply ran off our land or out through the drains causing substantial flooding further down the catchment. Wet soils make spraying operations difficult and as crucial treatment opportunities were missed, disease spread quickly. Fusarium, a wheat pathogen, was particularly prevalent, and spores were washed into the soil and taken up by the roots. When the fungus enters the plant via

TABLE 1

Arable gross margins (£/hectare) at the Allerton Project 1992-2012

	Average 1992-1997	2008*	2009*	2010*	2011*	2012 (est)*
Winter wheat	702	566	496	673	783	255
Winter oilseed rape	539	862	401	799	1,082	490
Winter/spring beans	516	449§	200§	512§	507§	817§
Winter oats	601	430	387	808	873	676

**No single farm payment included*

§ spring beans

Figure 3

Gross profit and farm profit at the Allerton Project 1994-2012

this route we cannot control it effectively. The result is 'blind sites' in the wheat ears, often with the whole plant yielding no seed, characterised by 'whiteheads' or bleached looking ears in the crop.

Sunshine levels were also low and the end result was the poorest wheat yield this farm has experienced since the Trust took over 20 years ago. In 2011 our wheat averaged 9.7 tonnes per hectare (t/ha) and the 2012 wheat yield is likely to be almost half at 5t/ha. The specific weight of the grain varied from 58 kilogrammes per hectolitre (kg/hl) to 70kg/hl compared with 78kg/hl to 82kg/hl in 2011. Other crops, although below average, have fared somewhat better.

Lack of sunshine and abundant rain also led to cooler soil temperatures in autumn 2012. Measurements from our automatic weather station on the farm indicate that the air temperature was around 5°C per day cooler between mid-September and mid-October 2012 than the corresponding period in 2011. Sowing seeds for next year's crop into such cold and wet conditions means that germination and emergence are slow, and slugs have been a problem. A rapidly growing crop will grow faster than

TABLE 2

Farm conservation costs at the Allerton Project 2012 (£ total)

Higher Level Stewardship costs (including crop income foregone)	47,533
Higher Level Stewardship income	-47,747
Woodland costs	11,767
Woodland income	-11,448
Farm Shoot expenses	6,633
Farm Shoot income	-6,633
Grass strips	589
Total profit foregone	
- conservation	**£694**
- research and education	**11,891**
	£12,585

Savings on hedgelaying stakes and binders and woodchip fuel for project are not included. In future English Woodland Grant Scheme funding will cover the woodland deficit.

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

2012 was the wettest year since we have been farming at Loddington, with soil reaching saturation point. © Peter Thompson/GWCT

Slugs have caused a great deal of damage to our crops. © Omex Agriculture and Peter Thompson/GWCT

the slugs can eat it, but when the crop is not growing, slugs can cause a great deal of damage. Methaldehyde is the preferred active ingredient in the slug pellets we use because of its low impact on non-target species, but application rates are limited because of European Union rules on residue levels surrounding drinking water. Soon we had to move on to ferric phosphate pellets, which are more costly and thought to be less effective. As 2012 drew to a close, we hoped that the spring weather in 2013 would be more favourable for cropping on our heavy Leicestershire clay.

Although prices have rallied to reflect poor yields, we have been unable to take full advantage of this having 'forward sold' some of the crop to help balance out the peaks and troughs of selling across a whole season.

One of the original stated aims of the Allerton Project was: 'To disseminate the results of research for the benefit of farmers, policy makers and others'. We are always looking for ways to inform people of the work we do on the estate, so now news from the Allerton Project, at Loddington, can be found on our blog **www.loddingtonestate.blogspot.co.uk** and on Twitter **@Farmerphil1**.

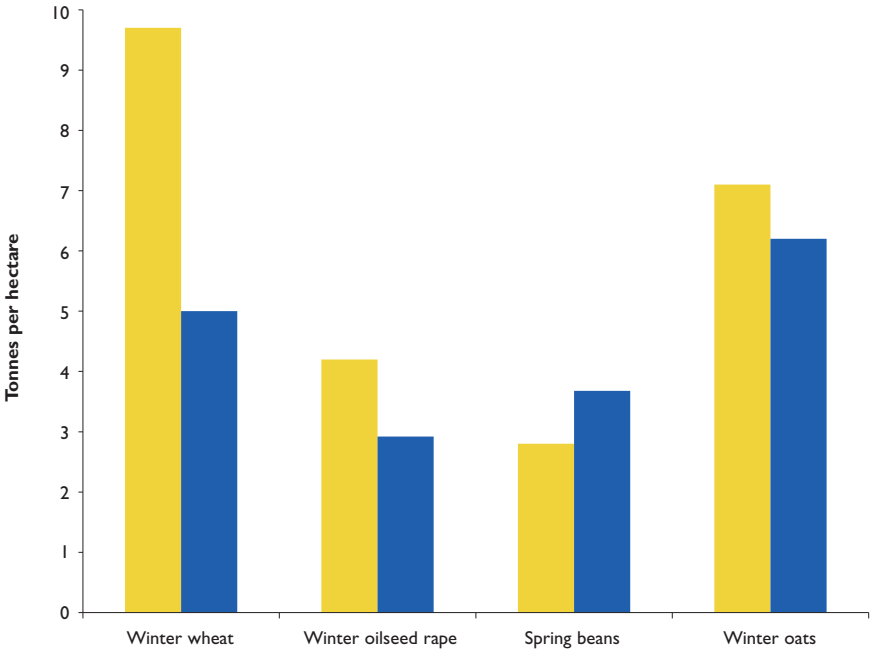


Figure 4

Crop yields at the Allerton Project in 2011 and 2012

2011

2012 (estimated)

Water friendly farming for the future

Newly created field drain interceptor pond in the Stonton Brook catchment. © Chris Stoate/GWCT

KEY FINDINGS

- Ecological surveys reveal that these catchments are representative of lowland England.
- Plant biodiversity is highest in ponds, intermediate in streams, and lowest in ditches.
- Catchment farmers are supportive of project objectives and steps to reduce agricultural effects on water.
- Sewage treatment works and domestic sources are important contributors of phosphorus to water.

Chris Stoate
John Szczur

Concern about declines in numbers of fish and other aquatic wildlife, and targets for water quality set by the EU Water Framework Directive (WFD), have been major drivers for attempts to improve rivers. The effect of farming on water, through sediment, phosphorus and pesticides from arable land, and through livestock entering watercourses, for example, is being addressed in a range of initiatives across the UK.

Although we have a reasonable understanding of how individual methods such as buffer strips, stream fencing and field corner wetlands perform, we have a remarkably poor understanding of how this suite of measures might move us towards WFD targets if applied at the catchment scale. The Water Friendly Farming project aims to assess to what extent WFD targets for water quality and wildlife can be met by applying scientifically sound and practically grounded measures to a real farmland landscape surrounding the Allerton Project farm at Loddington.

The project involves three headwater catchments, each of nearly 1,000 hectares in area, the upper Eye Brook and upper Stonton Brook in the Welland river basin and the Barkby Brook in the Soar river basin. These are all on clay soils and are typical of countless other lowland catchments in terms of their topography and farming systems.

We are interested in what happens at two scales. One is the influence of the headwaters on the river basin as a whole. For this, we are carrying out almost continuous monitoring of the quality of water 'exported' from the base of each catchment, as this is the measure that is most relevant to WFD targets and therefore to evolving Government policies. However, we are also interested in what improvements can be achieved at the landscape scale within each headwater catchment. For this we are monitoring nutrient concentrations in water and aquatic wildlife at 200 sites across the 3,000 hectare landscape.

After two years of baseline data collection in which we have assessed water quality and ecology, the project is now moving into an important phase in which we are negotiating a range of measures with the 25 farmers in the two Welland catchments to

Although surface run-off is more visible, field drains flow more consistently. © Chris Stoate/GWCT

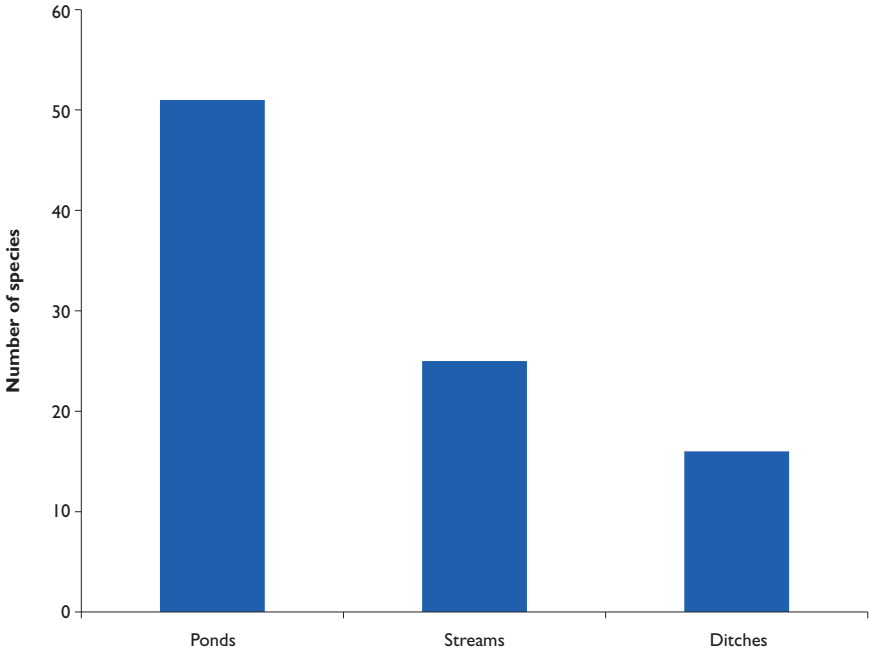


Figure 1
Number of plant species in ponds, streams and ditches

Data from Pond Conservation

be implemented on their farms. The Barkby Brook remains as a control in which there are no changes to the management of the catchment. We simply use this catchment to keep a check on background changes in water quality and ecology.

Pond Conservation collected data for aquatic invertebrates and plants, and most recently for fish. When they analysed the plant data, these show that the number of species is highest in ponds (51) and lowest in ditches (16), with streams supporting intermediate numbers of species (25) (see Figure 1). The number of species in ponds is very variable, probably because these are fed by smaller, more variable micro-catchments than ditches and streams, which are more consistently influenced by agricultural inputs. This is consistent with Pond Conservation's findings from other parts of lowland England and reassures us that the project catchments are representative of the wider agricultural landscape.

Although we have recorded elevated phosphorus concentrations at the base of the catchments associated with agricultural run-off, highest concentrations last year were in the unseasonally dry January to March period when flow was low. Monitoring within each of the three catchments reveals that tributaries with sewage treatment works have consistently much higher phosphorus concentrations than other tributaries (see Table 1). Intermediate concentrations appear to be associated with septic tanks. These findings reaffirm those from our previous work that domestic sources of phosphorus, as well as agricultural ones, need to be addressed within river catchments.

We are grateful for, and extremely encouraged by the support we are receiving from the farming community, especially as we enter the project phase in which we make changes on farms. As well as the exceptional scale of this project and the high resolution of monitoring, a major strength is the input we get from participating farmers.

Researchers from Pond Conservation measured the amount of phosphorus, aquatic invertebrates and plants in our ponds. © Chris Stoate/GWCT

TABLE 1

Mean (± SE) phosphorus concentrations in Eye Brook tributaries with and without sewage treatments works (STW) (February – April, 2012)

Phosphorus µg/L	Tributaries				Main stream
	Tributary 1 No STW	Tributary 2 STW	Tributary 3 No STW	Tributary 4 No STW	Base of Catchment
SRP	43.83 ± 30.38	864.83 ± 125.84	12.95 ± 2.47	9.47 ± 2.65	106.27 ± 18.77
TP	64.74 ± 38.7	1,015.06 ± 108.4	73.6 ± 19.85	93.35 ± 50.6	169.18 ± 26.52

SRP = Soluble reactive phosphorus, TP = Total phosphorus

ACKNOWLEDGEMENTS

Water Friendly Farming is a collaboration between the GWCT, Pond Conservation, York University, participating farmers and other research partners, with funding from the Environment Agency, Syngenta, Chemicals Regulation Directorate and Anglian Water.

Research into predation: what difference has it made?

Our earlier research looked at rural foxes and their effect on gamebirds and hares. © David Mason

KEY FINDINGS

- Predator and pest control is a hugely controversial topic in which only clear scientific evidence can help to achieve genuine progress.
- Since 1985, our research has demonstrated the significance of predation and predator control in the long-term population dynamics of gamebirds, upland waders, hares and some songbirds.
- Our research on predator control methods and strategy has aimed to create a suite of lawful practices with a documented field performance.

Jonathan Reynolds

There isn't usually much time in the research department to be introspective, but after more than quarter of a century of research on predation and how to manage it, it seems reasonable to ask what difference it has all made?

We work at many levels and for different audiences: we do exploratory research; we develop innovative management techniques; we run demonstration projects to show that our techniques are effective, and we work with Government departments and other organisations to ensure that policies are evidence-based. But our chief, fundamental output is scientific research.

Back in the 1930s, when the scientific study of wildlife was just beginning, much of the earliest work was in game management. The Eley Game Advisory Service, fore-runner of the GWCT, worked closely with Oxford University and employed one of its best graduates, Douglas Middleton, who initiated our partridge research. By degrees, though, the academic components of wildlife science drifted away from applied problems. There was a desire to get back to basics, to study wildlife in environments where the influence of man was scarcely discernible. This led to some valuable insights, but their relevance to the environment most of us live and work in could also be questioned.

By the 1980s, a clear difference of opinion about the role of predators had developed between the conservation and game management sectors. In the former camp, there was a widespread belief that predator control achieved nothing of value to conservation. Predator control also had a very bad reputation. Criticisms included disproportionate effects on predator populations; lingering use of unlawful methods; and the use of methods that were lawful but perceived to be inhumane.

So in 1985, we invested in a costly but robust experiment that would establish unambiguously how control of common predators improved the breeding density of grey partridges, year on year. This was the now-famous Salisbury Plain experiment, later matched by its upland equivalent at Otterburn, which also measured benefits for moorland waders. The Salisbury Plain experiment was the first of four long-term gamekeeping demonstrations by Malcolm Brockless, each occupying several years.

At the same time, we felt it important to address gaps in our knowledge of common predator ecology. Foxes, for instance, were well researched in and around university cities, leading to a widespread belief that the basis of their diet was small rodents, earthworms, beetles and fruit. Scarcely any evidence was available about their density and diet in rural areas. In a three-year case study in a mixed farming

Dorset landscape, we combined radio-tracking, game counts and fox scat analysis to show that predation by foxes alone was sufficient to determine the numbers of wild gamebirds and of hares. This required some very careful science, because we first had to establish that the consumption of gamebirds by foxes could be estimated from remains in their scats, and that hare fur in fox scats could be distinguished reliably from that of rabbits.

There was also scepticism from within the gamekeeper community, some of whom were killing over 100 foxes a year on beats of less than 1,000 hectares, but were now being told by us that foxes in Dorset lived at a breeding density of only one per 100 hectares. We were certain that their cull consisted largely of foxes moving in to replace those killed, but this just raised further questions: was such culling achieving its aim of protecting gamebirds; how large was the supply of replacement foxes; and did many gamekeepers have a combined effect on fox density across larger regions? To answer the latter, we undertook a three-year large-scale study which showed the effect of man on foxes in the countryside, published just in time to influence Lord Burns' Inquiry into Hunting with Dogs in 2000. We were in any case one of the chief providers of relevant scientific evidence at that Inquiry.

The earlier question about effectiveness was more difficult, and it occupies us still. Although we had shown that predator control can be effective, it isn't easy to judge how effective most predator control is, or how much effort might be required to make it effective. Assessing the effect of culling on predator numbers is difficult, even in the intensively studied context of predator removal experiments. In 2002, we realised that the control of introduced mink to conserve native water voles presented the same problem: although mink trapping was fairly easy, the supply of mink appeared endless, and it wasn't clear that trapping could have a big enough impact to benefit water voles. The mink raft which we invented to research this led to a very effective strategy for trapping mink. In a series of studies up to 2010, we refined the approach and then demonstrated how it was possible to turn back the clock by eliminating mink and reintroducing water voles. This set us the challenge of achieving equivalent advances for control of other common predators.

We demonstrated that it was possible to eliminate mink using our specially designed mink raft to successfully reinstate water voles.
© Peter Thompson/GWCT

The Larsen trap is very effective and highly selective. © Mike Swan/GWCT

Our work since the 1980s has aimed to develop methods and strategy to create a suite of lawful practices with a documented field performance showing them to be effective, selective and humane. One early issue was the lack of effective legal methods to control the numbers of corvids, tempting some keepers to resort to the illegal use of poisons. On Salisbury Plain, Malcolm Brockless had found the Danish 'Larsen' trap, with its housing for a decoy bird, to be very effective, but we needed some science to establish what difference the decoy bird made. A single summer's trial on one site showed that the decoy bird made the trap 13 times more efficient at catching the target species and much more selective. On the strength of this we were able to arrange a licensed trial among 273 gamekeepers, which showed clearly that the trap was very effective and highly selective. This dossier of evidence persuaded MAFF (as it was then) to grant a General Licence to use these traps.

The drive to improve humaneness in traps is international, as is the market in traps. Although the intentions can scarcely be criticised, realistically there are other considerations to take into account. A trap can be humane but never catch anything; or it may be so expensive to manufacture that it is not viable on the market. It is rare to make improvements on all fronts. At the moment, better humaneness costs quite a lot extra. However, the EU is a signatory to international standards, which in due course must be ratified by the UK. We know already that the established Fenn and Springer type traps are unlikely to pass these standards. To ensure that at least one effective replacement would be available for use in the UK, we submitted the DOC traps – developed in New Zealand for the Department of Conservation – to Defra for consideration, and these were duly approved. Although they are gradually filtering onto the marketplace and into normal use, price is still an issue.

Snares, too, are traps, and subject to evaluation by the same international standards. In all our radio-tracking work on foxes we have used snares to catch the fox. From this positive first-hand experience we have always been ready and qualified to engage in discussions about the use of snares. Recently, two significant research projects have taken place. As the regulator, Defra contracted work to establish the extent of snare use, the likely scale of any animal welfare problems and the influence

DOC traps are expensive but likely to survive the expected EU Directive. Older designs like Fenn traps are unlikely to meet humaneness requirements. © Juha Tiainen

of the department's earlier Code of Practice. In our own research, we were already looking beyond this, to improve the hardware and to identify which operating practices brought the highest risks of non-target capture or of death or injury. Because of the high standard of science in both studies, the results are very clear and the debate about snares can now be informed by evidence rather than prejudice.

Science is a system for working out what is most likely to be true. It's laborious and expensive, and someone will always say 'told you so' about the answer. In a controversial subject area, though, it's the only way to move things forward. We believe our work has done just that.

Our research on Larsen traps is now presented as targeted advice to help gamekeepers and landowners control corvids.
© Peter Thompson/GWCT

MorFish - stepping across the channel for salmon

Research into salmon is also undertaken on the River Scorff in France. © INRA

KEY FINDINGS

- Better alignment of data collection between rivers is key to successful management.
- The project will align data collection across three rivers in the south of England and Brittany.
- Historical data from these rivers will be aligned and interrogated for a better understanding of changes in salmon populations.

Dylan Roberts

On many rivers throughout Europe a number of public and private organisations undertake work to monitor the numbers of adult and juvenile salmon migrating to and from our rivers. However, a weak link in this work is that rarely are the same monitoring techniques used in different rivers. This reduces the usefulness of the data to river management. On some rivers different types of physical traps are used, often with unknown efficiencies. There are also many different types of automatic counting facilities, eg. resistivity or Passive Integrated Transponder (PIT) tags. This lack of compatibility makes pooling the data and comparisons between rivers difficult and fraught with the risk of statistical error. This in turn makes the subsequent management of salmon populations complex and less precise. Given this background, we decided that to improve the transferability of the detailed data we collect on salmon on the River Frome, we had to work in collaboration with other rivers across the Channel.

In early 2011 we visited fisheries scientists in Brittany who work for the Institut National de la Recherche Agronomique (INRA) to discuss the potential for collabo-

By working with scientists in France, we should gain a better understanding of changes in salmon populations. © Dylan Roberts/GWCT

rative work. INRA is a Government-funded organisation that has responsibility for undertaking research and managing rivers in France. On two rivers in Brittany, the Oir and Scorff, scientists undertake similar research on salmon to that which we do on the River Frome using PIT tags. Discussions revealed many potential areas for collaboration, but what was most apparent was the difference in the quantity of PIT tag equipment on the two French rivers. These rivers had limited PIT tagging equipment installed and had only monitored a small proportion of the population, whereas on the Frome we have more equipment and can monitor the whole population. In addition, both organisations had a wealth of under-exploited historical data on salmon numbers and environmental variables such as water temperature, flows and water quality, which had the potential to be aligned and compared together.

Soon after our meeting in France we decided, in partnership with INRA, to prepare an application to the EU for funding via their Inter-Regional (Interreg) IV Channel Programme fund. This EU funding programme aims to develop cross-border collaboration between EU regions. Following 12 months of form filling, collecting a mountain of paperwork and numerous trips to Brittany, the application was submitted to the EU in February 2012. In June we were notified that our £2.3 million Euro application had been successful. The project – Monitoring for Migratory Fish, shortened to MorFish, has two key aims:

- Increasing the instrumentation of PIT tag readers on the Rivers Oir and Scorff in Brittany. This will make the collection of data on salmon between these rivers and our River Frome more comparable so that future data collection will be aligned.
- Employing a post-doctoral scientist to interrogate and align the historical data sets held by both organisations and analyse the data to produce scientific papers and recommendations for management. We are particularly interested in the long-term changes in salmon life history strategies, especially in the context of climate change.

During the project we will also be working closely with a number of private and public bodies in the UK to ensure that policy makers are aware of the work, the data collection and analysis. The Environment Agency which has responsibility for managing salmon populations in England and Wales, is particularly keen for the project to produce recommendations on monitoring salmon in rivers. The project runs until June 2015 and we will report on its progress in future publications.

If you would like further information on the MorFish project please contact the project manager, Dylan Roberts at droberts@gwct.org.uk.

ACKNOWLEDGEMENTS

MorFish
Monitoring for Migratory Fish

The MorFish project is a partnership between

INRA SCIENCE & IMPACT

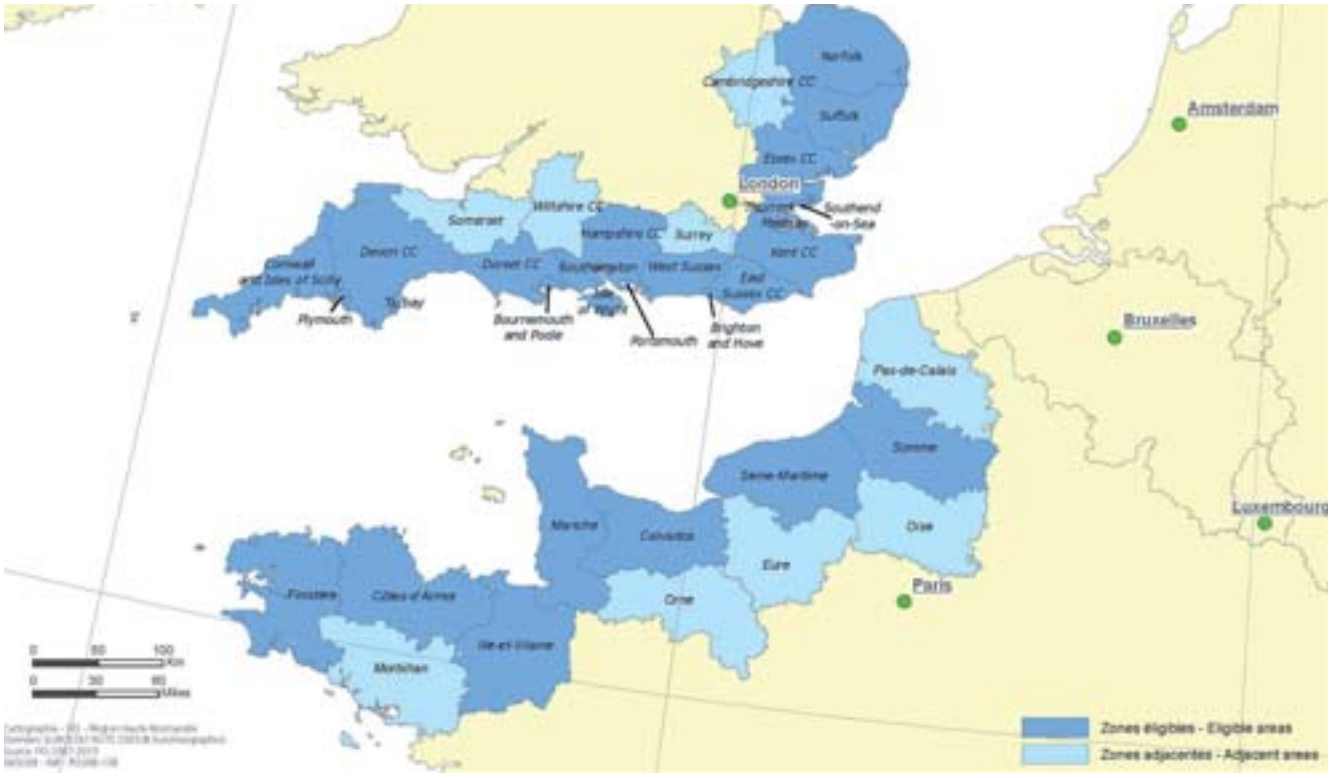
Game & Wildlife CONSERVATION TRUST

Interreg

European Union

Figure 1

The area covered by the MorFish project in southern England and northern France



River Frome salmon population

Last year saw extreme flooding on the River Frome. © Bill Beaumont/GWCT

KEY FINDINGS

- 2011 and early 2012 were characterised by unusually low flows.
- From April 2012 onwards the River Frome experienced a series of major flood events.
- The 2011 cohort of Atlantic salmon was roughly half the size of recent years, suggesting likely future declines in returns of adult salmon.

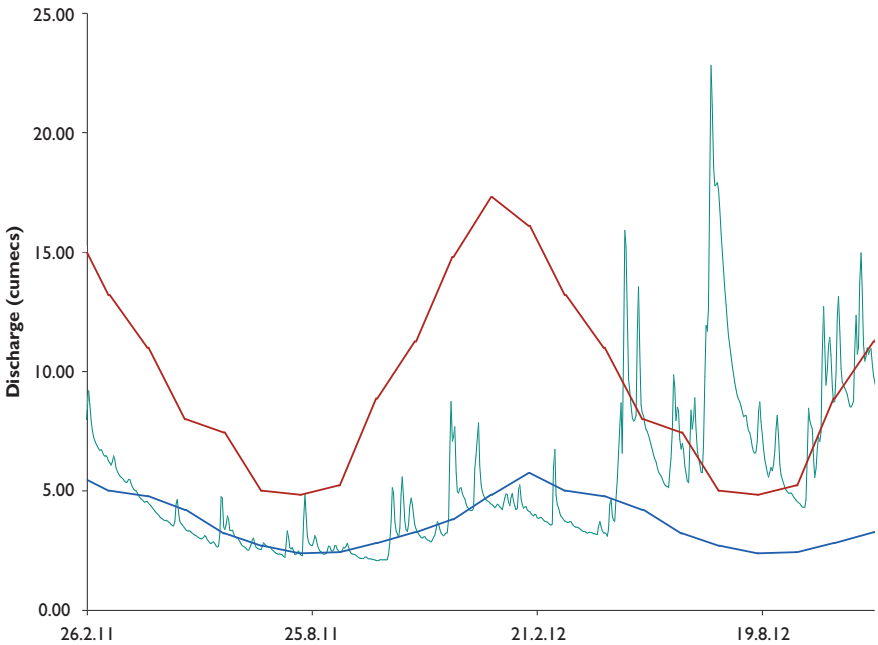
Anton Ibbotson

During the last two years, in common with many of the rivers in the UK, the River Frome has experienced extremes of flow at both ends of the spectrum. In the *Review of 2011*, we described how the flow levels on the River Frome were characterised by extremely low flow throughout that year. These continued through January, February, March and most of April in 2012. During late April we switched almost overnight to a continuous state of extraordinarily high flows, punctuated with incidences of extreme flooding events (see Figure 1). These repeated episodes have continued relentlessly throughout 2012. At the time of writing our 2011 report we issued a note of caution with regard to the likely effects of the 2011 low flows, stating that we could not expect these to be good. The effects on salmon populations that are exposed to an extended period of low flow are many. When the eggs hatch and the alevins emerge from their gravel nests in April, they head immediately for the bankside vegetated marginal areas where they spend a few weeks, feeding and seeking cover from predators. In the spring of 2011 the flow was so low that the margins had become inaccessible in many places, reducing the opportunity for salmon to reach relative safety. As the year progressed and the survivors grew, low flows resulted in lower numbers of feeding stations for the young salmon, putting further pressure on the population of young of the year.

As we predicted, the measured population sizes of the 2011 cohort demonstrated marked declines, reversing a rising trend that we had seen develop over several years from the lows reached in 2005. The total population estimate for young of the year in September 2011 fell to 63,900 from 130,000 in 2010 (see Figure 2). This was reflected

Figure 1

River Frome discharge at East Stoke (green line) between March 2011 and September 2012



The red line represents the level of flow that is exceeded 5% of the time; flows above this represent unusually high flow periods as occured throughout most of 2012.

The blue line represents the level of flow that is exceeded 95% of the time; flows below this represent unusually low flow periods as occured in early 2012 and throughout most of 2011.

Figure 2

Number of salmon parr in the River Frome each September 2002-2011

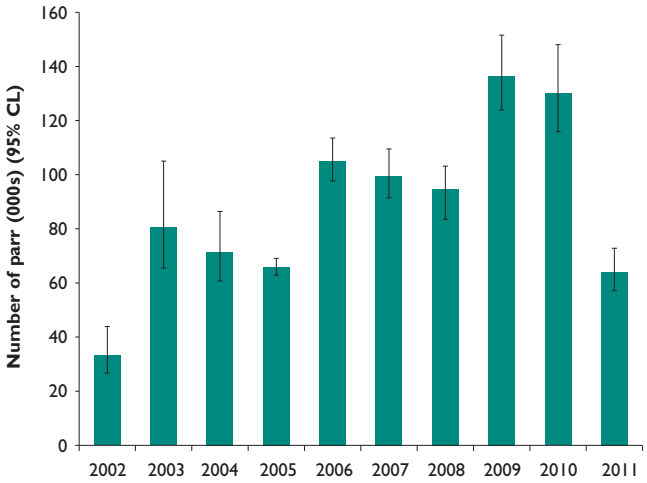
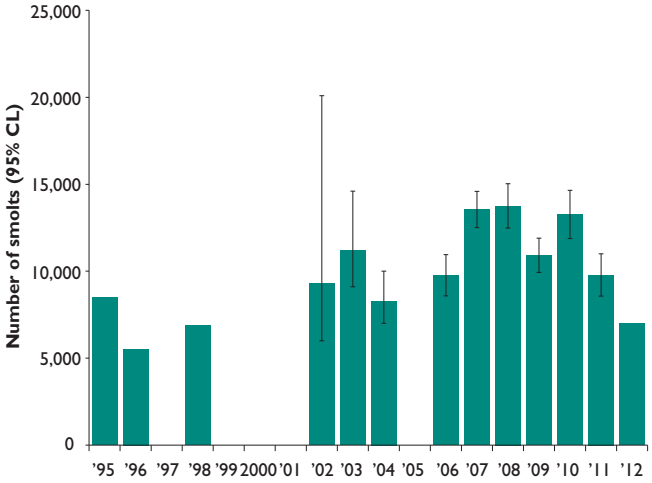


Figure 3

Spring smolt population estimate in the River Frome 1995-2012



in an estimated smolt population leaving the river in spring 2012 of under 7,000 in comparison with 9,800 in 2011 (reduced by an unusually large autumn migration) and 13,000 in 2010 (see Figure 3).

In the late autumn and winter, when the adult salmon are migrating to the spawning grounds, their progress upstream is helped by the expected normal winter flood events. In the low flows of 2011 these did not materialise and so salmon will have found it difficult to reach the upper reaches of the river, reducing the length of river over which eggs will have been deposited. Perhaps this would not have been too drastic had flows in the spring of 2012 returned to a healthy level, but they did not. They remained unusually low until the crucial point at the end of April when we would expect developed eggs and young alevins to be close to the emergent stage. At this point we experienced an almighty flood. This type of flood results in mass movement of the substratum along the bed of the river and carries with it the eggs, alevins and young salmon, which at this stage are extremely vulnerable to the mechanical shock this movement entails. We cannot be certain of the full effect of this on the 2012 cohort until we finalise the smolt run in 2013, but it will not be positive. Following on from the poor cohort of 2011, we must expect severe declines in returning adult salmon populations in 2013, 2014 and into 2015 for the River Frome and those rivers that experienced similar conditions in the 2011-2012 period, reversing recent increases in adult salmon returns (see Figure 4).

We think it is important to note that these expected declines will be independent of any changes to the survival of salmon in the marine environment. They will be a direct result of challenging conditions the fish experienced in their freshwater stages.

ACKNOWLEDGEMENTS

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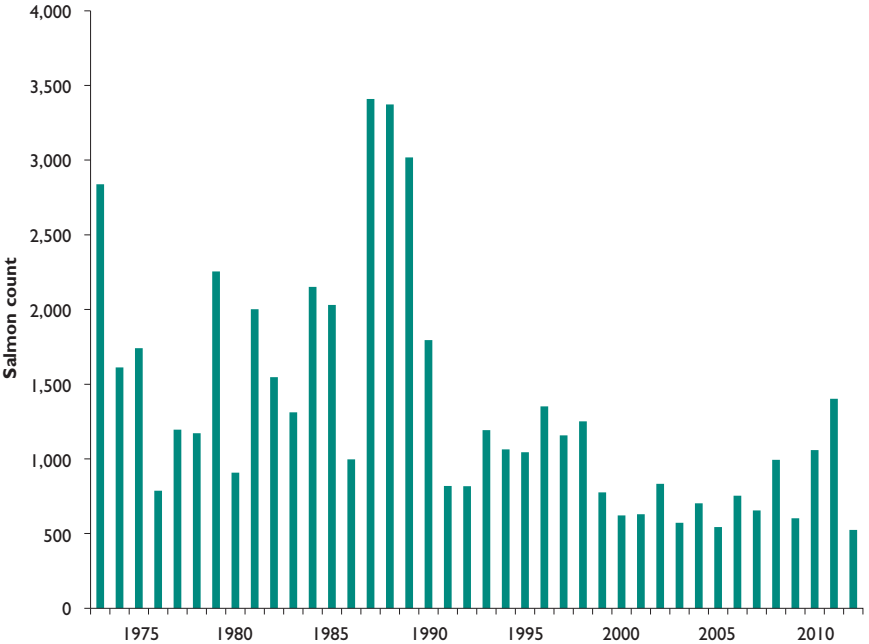

Figure 4

Numbers of returning adult salmon in the River Frome, 1973-2012

The best estimate for the total number of adults returning for 2012 was 526, but this is a minimum estimate only.

Research projects

by the Game & Wildlife Conservation Trust in 2012

WILDLIFE DISEASE AND EPIDEMIOLOGY RESEARCH IN 2012

Project title	Description	Staff	Funding source	Date
Gamebird health	*Disease prevention and control in game and wildlife*	*Chris Davis*	*Core funds*	*1998-2012*

LOWLAND GAME RESEARCH IN 2012

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*
Corvids and hedgerow birds	*Does crow and magpie control increase productivity in hedgerow birds?*	*Rufus Sage, Sue Wilson, Tony Powell, Mikel Salvador*	*Songbird Survival*	*2010- on-going*
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 Dr Davy McCracken*	*SAC, SGRPID*	*2008-2013*
Wild pheasant mortality (see page 22)	*Investigating survival and productivity of wild pheasants*	*Roger Draycott, Silas Walton*	*Gayton Estate, Private landowners Sandringham Estate, Oakbank*	*2011- on-going*
Game marking scheme	*Study of factors affecting return rates of pheasant release pens*	*Rufus Sage, Maureen Woodburn, Roger Draycott*	*Core funds, Solway Feeders, Roxan International*	*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, Roger Draycott, Louise Dean, Julie Day*	*Guns on Pegs, Core funds Private funds,*	*2010-2014*
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*	*2006-2013*
PhD: Breeding birds in biomass crops	*Breeding success of ground and hedgerow nesting birds in miscanthus and SRC*	*Henrietta Pringle Supervisors: Rufus Sage, Dr Simon Leather/Imperial College, London*	*NERC/CASE*	*2011-2014*
PhD: Pheasant behaviour and the rearing system	*Improving behavioural and physiological adaption of reared pheasants to the wild*	*Mark Whiteside Supervisors: Rufus Sage, Louise Dean Dr Joah Madden/Exeter University*	*Exeter University, Middleton Estate*	*2012-2015*

WETLAND RESEARCH IN 2012

Project title	Description	Staff	Funding source	Date
Woodcock monitoring	*Examination of annual variation in breeding woodcock abundance*	*Andrew Hoodless, Chris Heward, Collaboration with BTO*	*Shooting Times Woodcock Club*	*2003- on-going*
Woodcock migration routes (see page 24)	*Use of satellite tags and geolocators to examine woodcock migration strategies*	*Andrew Hoodless Collaboration with ONCFS*	*Shooting Times Woodcock Club, private donors*	*2010-2015*
Woodcock winter survey	*Randomised survey of abundance and modelling of habitat use*	*Andrew Hoodless, Chris Heward Jessica Chadwick, Michael Hockey*	*Core funds*	*2011-2013*
Woodcock habitat use and behaviour in cold weather	*Radio-tracking of woodcock in arable landscapes in winter*	*Andrew Hoodless, John Simper, Chris Heward*	*Core funds*	*2011-2013*
Avon Valley waders	*Monitoring lapwing breeding success in relation to the Higher Level Scheme*	*Andrew Hoodless, Jessica Chadwick*	*Core funds, Natural England*	*2007-2012*
Lapwings on fallow plots	*Assessment of lapwing breeding success on AES fallow plots*	*Andrew Hoodless, John Simper, Matt White, Samantha Ireton, Emma Cutten, Richard Vials, collaboration with RSPB*	*Defra, The Manydown Trust*	*2012-2014*
DPhil: Origins of over-winter woodcock	*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 NERC, Private funds*	*2008-2012*
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 2012

Project title	Description	Staff	Funding source	Date
Partridge Count Scheme (see page 26)	*Nationwide monitoring of grey and red-legged partridge abundance and breeding success*	*Neville Kingdon, Nicholas Aebischer, Julie Ewald, Dave Parish*	*Core funds, GCUSA*	*1933- on-going*
National Gamebag Census (see page 34)	*Monitoring game and predator numbers with annual bag records*	*Nicholas Aebischer, Gillian Gooderham, Chris Wheatley*	*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 Eleanor Brown, Ryan Burrell, Lizzie Grayshon, Holly Narey*	*Core funds, GCUSA*	*2007-2013*
Mammal population trends	*Analysis of mammalian bag and cull data from the National Gamebag Census under the Tracking Mammals Partnership*	*Nicholas Aebischer, Chris Wheatley, Julie Ewald*	*JNCC*	*2003-2012*
Wildlife monitoring at Rotherfield Park (see page 28)	*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*
BDS deer survey work	*Repeat of the 2000, 2006 deer survey*	*Julie Ewald, Neville Kingdon,Chris Wheatley, Ryan Burrell, Lizzie Grayshon*	*British Deer Society*	*2011-2012*
BDS shooting accuracy project	*Analysis of data from the BDS shooting accuracy and deer recovery research project*	*Nicholas Aebischer, Chris Wheatley*	*British Deer Society*	*2012-2012*
WES database construction	*Designing and implementing a SQL database to hold Wildlife Estate Scotland data and enable interface with NGC*	*Julie Ewald, James Long, Chris Wheatley, David Pepper*	*Wildlife Estates Scotland*	*2012-2012*
Winter hopper feeding (see page 32)	*Assessing hopper use by gamebirds and other wildlife through camera trapping*	*Carlos Sánchez, Francis Buner, Nicholas Aebischer, Max Krioutchkov*	*Fundación Caja Madrid*	*2012-2013*

UPLANDS RESEARCH IN 2012

Project title	Description	Staff	Funding source	Date
Strongylosis research (see page 42)	*Development of strongylosis control techniques in red grouse*	*David Newborn, David Baines, Mike Richardson*	*Core funds*	*2006- on-going*
Grouse Count Scheme (see page 38)	*Annual grouse and parasitic worm counts in relation to moorland management indices and biodiversity*	*David Newborn, David Baines, Mike Richardson, Kathy Fletcher, David Howarth, Graeme Neish*	*Core funds, Gunnerside Estate*	*1980- on-going*
Black grouse research	*Ecology and management of black grouse*	*Philip Warren, Frances Atterton*	*Core funds*	*1989- on-going*
Timing of breeding in red grouse	*Long-term assessment of changes in laying dates in relation to climate change*	*Kathy Fletcher, David Howarth, David Newborn*	*The Samuels Trust, Core funds*	*1995- on-going*
Black grouse range expansion	*Black grouse range restoration by translocating surplus wild males*	*Philip Warren, Frances Atterton*	*Biffa, SITA Trust Private funder*	*1996-2013*
Woodlands for black grouse project	*Implementing woodland establishment to aid black grouse winter survival*	*Philip Warren, Frances Atterton*	*Heritage Lottery Fund, Woodland Trust*	*2011-2013*
Tick research (see page 44)	*Development of tick control techniques through trialling acaricide impregnated neck collars*	*David Baines, David Newborn, Mike Richardson*	*Private donor*	*2011-2015*
Tick impacts on grouse chicks	*Tick control in a multi-host system and the effects on grouse chicks*	*Kathy Fletcher, David Howarth*	*Various Trusts*	*2000-2013*
Capercaillie brood ecology	*Surveys of capercaillie and their broods in Scottish forests in relation to habitat, predators and weather*	*David Baines, Graeme Neish David Howarth, Kathy Fletcher*	*SNH, Forest Enterprise Scotland*	*1991- ongoing*
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 46)	*Research data for moorland restoration to-achieve economically-viable driven grouse shooting and sustainable numbers of hen harriers*	*David Baines, Damian Bubb, Sonja Ludwig, Tommy Pringle, Paula Keane/RSPB, Aly McCluskie/RSPB*	*Core funds, Buccleuch Estates SNH, RSPB, NE*	*2008-2018*
Spatial habitat use by black grouse in commercial plantation forests in Scotland	*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*
Conservation of grey partridges in the upland fringes	*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*
Black grouse range expansion II	*Feasibility studies based on habitat assessment*	*Philip Warren, Frances Atterton*	*United Utilities, NE, Private funder*	*2012-2012*
Estimating pine marten abundance in Scottish forests by DNA sampling	*DNA analysis of marten hair obtained while visiting baited sticky sampling tubes*	*David Baines, Kathy Fletcher, David Howarth*	*Forest Enterprise Scotland Cairngorms National Park Authority*	*2012-2013*
Alternative grouse diseases	*Questionnaire survey of Mycoplasma and Cryptosporidia in red grouse*	*David Baines, Mike Richardson*	*Core funds*	*2012-2013*

UPLANDS RESEARCH IN 2012 (continued)

Project title	Description	Staff	Funding source	Date
Factors affecting red grouse abundance	*Effect of habitat composition, habitat quality and predator indices on grouse abundance and breeding success*	*David Baines, Sonja Ludwig*	*Natural England,Heather Trust*	*2012-2013*
Black grouse in forested landscapes	*Interpretation guidance from research projects on black grouse habitat use in forests*	*Patrick White*	*Forestry Commission Scotland*	*2012-2013*
PhD: Impacts of buzzards on red grouse	*Dietary studies of breeding buzzards and foraging patterns in relation to grouse survival*	*Richard Francksen Supervisors: David Baines, Mark Whittingham/University of Newcastle*	*Langholm Moor Demonstration Project*	*2012-2015*

FARMLAND RESEARCH IN 2012

Project title	Description	Staff	Funding source	Date
Conservation Grade	*To develop sustainable, multi-purpose, farmland*	*John Holland, Laura Kor, Amy Smith, Tom Birkett, Thomas Wood*	*Conservation Grade Ltd, Wixamtree Trust, John Oldacre Foundation*	*2010-2015*
People and pollinators in India	*To improve understanding of native Indian pollinators, their ecology and best practice management*	*Barbara Smith*	*Darwin Initiative*	*2012-2015*
New Forest heather	*A comparison of the effect of managed burning and vegetation cutting on biodiversity in the New Forest*	*Barbara Smith, Tom Birkett, David Evershed, Amy Smith, Laura Kor with Dan Carpenter (Natural History Museum)*	*New Forest National Park Authority, the Verderers and the National Trust*	*2012-2013*
Sainfoin	*To investigate the potential of sainfoin* (Onobrychis viciifolia) *as a resource for wildlife*	*Barbara Smith, Tom Birkett, David Evershed*	*Core funds*	*2011-2012*
Chick-food in perennial habitats	*Evaluating potential of uncropped habitats on farmland to provide chick-food*	*John Holland, Tom Birkett, Steve Moreby*	*Core funds*	*2010-2012*
River Avon invertebrates	*Long-term monitoring of River Avon aquatic invertebrates*	*Tom Birkett*	*Core funds*	*2011- on-going*
PhD: Farmland birds and agri-environment schemes	*The breeding success of farmland birds and the impact of agri-environment scheme habitats*	*Niamh McHugh Supervisors: John Holland, Denis Wright/ Imperial College, London*	*BBSRC/CASE studentship*	*2012-2015*

ALLERTON PROJECT RESEARCH IN 2012

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. Commencement of shooting.*	*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*
Farming and soil health	*The impacts of zero-tillage arable farming on soil health*	*Alastair Leake, Tony Reynolds, Tamma Carel (University of Newcastle)*	*Core funds*	*2010- on-going*
Metaldehyde in water	*Assessment of metaldehyde in field drain water and streams*	*Chris Stoate, John Szczur*	*Anglian Water*	*2011-2012*
School farm catchment	*Practical demonstration of ecosystem services*	*Chris Stoate, John Szczur*	*Allerton Project, Environment Agency*	*2012- on-going*
Earthworms and land use	*Landscape-scale assessment of earthworm communities in relation to land use*	*David Stella, Supervisor: Chris Stoate*	*Allerton Project/ Cranfield University*	*2012-2012*
Soil microbiology and land use	*Landscape-scale assessment of soil microbial communities in relation to land use*	*Michael Weeks, Supervisor: Chris Stoate*	*Allerton Project/ Cranfield University*	*2012-2012*
Rural communities adapting to climate change	*Interaction between national/regional policy and local perceptions and practice influencing domestic and landscape climate change adaptation and mitigation*	*Chris Stoate*	*RELU*	*2011-2012*
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	*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 (see page 58)	*A catchment-scale demonstration of diffuse pollution control project in headwater catchments*	*Chris Stoate, John Szczur, Jeremy Briggs, Penny Williams, Sian Davis and Elaine McGoff (Pond Conservation), Professor Colin Brown/University of York*	*Environment Agency, Syngenta, Chemical Regulation Directorate, Anglian Water*	*2012-2015*
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 British Deer Society*	*2007-2012*

ALLERTON PROJECT RESEARCH IN 2012 (continued)

Project title	Description	Staff	Funding source	Date
PhD: Environmental learning careers of farmers	*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 2012

Project title	Description	Staff	Funding source	Date
Fox control methods (see page 60 for overview)	*Experimental field comparison of fox capture devices*	*Jonathan Reynolds, Mike Short*	*Core funds*	*2002- on-going*
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*	*2006-2013*

FISHERIES RESEARCH IN 2012

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*	*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	*Survival of domesticated triploid farmed trout fry stocked from incubator boxes in chalk streams and their impacts on wild trout*	*Dylan Roberts*	*Core funds*	*2008-2012*
Salmon life-history strategies in freshwater (see page 66)	*Understanding the population declines in salmon*	*Anton Ibbotson, Dylan Roberts, William Beaumont, Luke Scott, Rasmus Lauridsen*	*Core funds, EA, CEFAS, Valentine Trust, Alice Ellen Cooper Dean Charitable Trust, Mr A Daniell, Iliffe Trust, Balmain Trust, AST, S&TA, Winton Capital*	*2009- on-going*
Salmon smolt rotary screw trap assessment	*Calculating the effects of rotary screw traps on salmon smolts*	*Anton Ibbotson, Dylan Roberts, Luke Scott William Beaumont, Rasmus Lauridsen*	*CEFAS*	*2009- on-going*
Avon demonstration test catchment project (DTC)	*Demonstrating the impacts of catchment management to reduce diffuse agricultural run-off pollution on fish populations*	*Dylan Roberts, Luke Scott*	*Defra*	*2010-2014*
Juvenile salmon and hydro	*The effects of a hydropower installation on salmon smolts*	*Anton Ibbotson, William Beaumont, Graeme Storey (EA)*	*EA, core funds, S&TA, Lulworth Estate*	*2012-2015*
Water temperatures and salmonids	*Micro habitat use by salmonids in relation to temperature*	*Anton Ibbotson, Dr Paul Kemp (Southampton University)*	*Southampton University, CEH, core funds*	*2009-2013*
MorFish (see page 64)	*Alignment and analysis of long-term data sets on the Rivers Frome, Oir and Scorff. Technical development of PIT equipment on these rivers*	*Dylan Roberts, Anton Ibbotson, Dr Jean-Marc Roussel and Didier Azam (INRA), Paul Stephens, William Beaumont, Luke Scott, Rasmus Lauridsen*	*Core funds, INRA, EU Interreg Channel programme*	*2012-2015*
Wessex biodiversity and ecosystem service sustainability	*Wessex biodiversity and ecosystem service sustainability*	*Anton Ibbotson, Dr Iwan Jones (Queen Mary, University of London)*	*NERC*	*2012-2013*
Macro-nutrient cycling-lateral exchange	*Macro-nutrient cycling-lateral exchange*	*Anton Ibbotson, Dr Iwan Jones (Queen Mary, University of London)*	*NERC*	*2012-2013*
DURESS	*Ecosystems services in Welsh rivers*	*Dylan Roberts, Dr Isabelle Durance, Professor Steve Ormerod (Cardiff University)*	*NERC*	*2012-2015*
Life history choice of juvenile salmon	*Over wintering ecology and migration strategy of juvenile salmon*	*Rasmus Lauridsen, Anton Ibbotson, Dr Jean-Marc Roussel*	*Core funds, INRA, EU Interreg Channel Programme*	*2012-2015*
Modelling fish population trends and uncertainties	*An international collaboration to model historical fish populations using state-of-the-art Bayesian theory*	*Dr Stephen Gregory, Anton Ibbotson, Dr Jean-Marc Roussel, Bill Beaumont, Dr Etienne Rivot*	*Core funds, INRA, EU Interreg Channel Programme*	*2012-2015*
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*	*2009-2012*
PhD: Atlantic salmon, climate change and human exploitation	*Assessing the sustainability of Atlantic salmon across the southern part of their European range in the light of climate change and human exploitation*	*Charles Ikediashi Supervisors: Anton Ibbotson, Dr Dylan Bright, Dr Jamie Stevens/Exeter University, WCRT*	*Exeter University, AST, S&TA, WCRT, Core Funds*	*2011-2014*

Key to abbreviations: AST = Atlantic Salmon Trust; BBSRC = Biotechnology and Biological Sciences Research Council; 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; JNCC = Joint Nature Conservation Committee; NE = Natural England; NERC = Natural Environment Research Council; RSPB = Royal Society for the Protection of Birds; RELU = Rural Economy & Land Use; S&TA = Salmon & Trout Association; SAC = Scottish Agricultural College; SGRPID = Scottish Government Rural Payments and Inspections Directorate; SNH = Scottish Natural Heritage; WCRT = Westcountry Rivers Trust.

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by staff of the Game & Wildlife Conservation Trust in 2012

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Note: the publications listed as 2011 did not appear in print before the Review of 2011 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 2012

KEY POINTS

- Overall funds increased by £48,936.
- The Trust broke even on its General Fund.
- Income (excluding endowment receipts) was the highest since 2006.
- Expenditure on research exceeded £3.5 million.

The summary report and financial statement for the year ended 31 December 2012, 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 GWCT Events Limited (formerly Game Conservancy Events Limited). They do not comprise the full statutory Trustees' report and accounts, which were approved by the Trustees on 15 April 2013 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's financial performance in 2012 reflects the first step in the implementation of the Trustees' plan to restore the reserves over a five year period. Excluding the endowment which the Trust received in 2011, total income increased by around 8% to £6.7 million. We are particularly grateful to our supporters and fundraisers for this result in a year when the weather adversely affected many of our sources of income such as our Allerton Project farm and the Scottish Game Fair. Expenditure remains carefully controlled, resulting in a break-even on the Trust's unrestricted General Fund. Our restricted funds showed a deficit of around £147,000, partly as we drew on donations received in previous years and partly due to the effect of the weather on the performance of the farm.

The unrestricted investments and Underwood endowment continued to meet their target of producing a total return which was double the return on cash. The endowed investment produced a stronger performance with a total return of 13.8%.

The Trustees continue to keep the Trust's financial performance under close review and to take appropriate measures to protect the Trust against the inevitable uncertainty in fundraising in the current climate. They continue to be satisfied that the Trust's overall financial position is sound. The Trust's reserves policy is that unrestricted cash and investments should exceed £1.5 million and must not fall below £1 million. The break-even for 2012 was not fully reflected in the Trust's cash flow with the result that the reserves have fallen slightly below the minimum, but the Trustees are satisfied that the Trust is on course to see them return to an acceptable level in the near future.

Plans for future periods

A new strategic plan was approved in 2012. This sets out the Trust's strategic direction: to position game conservation as part of mainstream nature conservation and to promote game conservation principles as a way of integrating agriculture and nature conservation. It also sets out the Trust's primary management aims:

1. To undertake a research programme that: (1) further quantifies the applicability of game conservation principles to species recovery more generally and; (2) bridges the gap between research and policy;
2. To use both partnership working and a more campaigning approach to ensure the Trust's reseach is put into practice;
3. To be regarded as a sophisticated partner in the reconciliation of production, wildlife conservation and natural resource protection;
4. To achieve greater financial security and stability.

I Coghill
Chairman of the Trustees

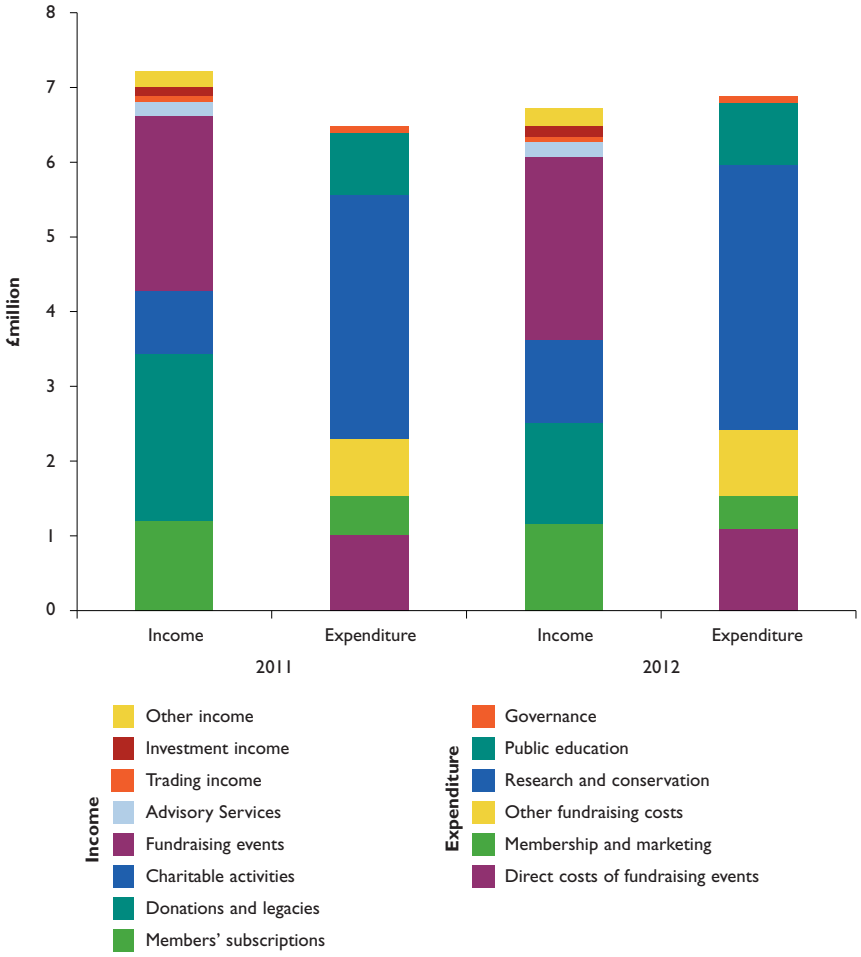

Figure 1

Total incoming and outgoing resources in 2012 (and 2011) 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 2012 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 2012 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, 30 April 2013

Consolidated

Statement of financial activities

	General Fund £	Designated Funds £	Restricted Funds £	Endowed Funds £	**Total 2012 £**	Total 2011 £
INCOME AND EXPENDITURE						
INCOMING RESOURCES						
Incoming resources from generated funds						
Voluntary income						
Members' subscriptions	1,169,596	-	-	-	**1,169,596**	1,197,874
Donations and legacies	767,886	-	570,571	-	**1,338,457**	2,246,096
	1,937,482	-	570,571	-	**2,508,053**	3,443,970
Activities for generating funds						
Fundraising events	2,435,961	-	11,582	-	**2,447,543**	2,329,446
Advisory Service	196,746	-	-	-	**196,746**	193,144
Trading income	77,501	-	-	-	**77,501**	75,625
Investment income	19,594	-	99,274	21,790	**140,658**	117,207
Incoming resources from						
Charitable activities	29,497	-	1,086,177	-	**1,115,674**	843,430
Other incoming resources	155,624	-	75,502	-	**231,126**	213,131
TOTAL INCOMING RESOURCES	4,852,405	-	1,843,106	21,790	**6,717,301**	7,215,953
RESOURCES EXPENDED						
Costs of generating funds						
Direct costs of fundraising events	1,093,172	-	-	-	**1,093,172**	1,022,815
Membership and marketing	445,245	-	-	-	**445,245**	520,854
Other fundraising costs	879,415	-	-	-	**879,415**	753,459
	2,417,832	-	-	-	**2,417,832**	2,297,128
Activities in furtherance of the charity's objects						
Research and conservation - Lowlands	953,693	-	515,415	-	**1,469,108**	1,430,275
Research and conservation - Uplands	505,119	-	249,032	-	**754,151**	800,237
Research and conservation - Allerton Project	127,137	-	782,989	4,150	**914,276**	680,338
Research and conservation - Fisheries	53,969	-	350,287	-	**404,256**	354,086
	1,639,918	-	1,897,723	4,150	**3,541,791**	3,264,936
Public education	709,395	-	92,918	38,546	**840,859**	828,657
	2,349,313	-	1,990,641	42,696	**4,382,650**	4,093,593
Governance	84,751	-	-	-	**84,751**	81,878
TOTAL RESOURCES EXPENDED	4,851,896	-	1,990,641	42,696	**6,885,233**	6,472,599
NET INCOMING/(OUTGOING) RESOURCES	509	-	(147,535)	(20,906)	**(167,932)**	743,354
OTHER RECOGNISED GAINS AND LOSSES						
Realised gains/(losses) on investments	4,131	-	-	(11,497)	**(7,366)**	(1,817)
Unrealised gains/(losses) on investments	14,808	-	-	209,426	**224,234**	(74,176)
NET MOVEMENT IN FUNDS	19,448	-	(147,535)	177,023	**48,936**	667,361
BALANCES AT 1 JANUARY 2012	2,143,367	136,492	415,811	5,283,010	**7,978,680**	7,311,319
BALANCES AT 31 DECEMBER 2012	£2,162,815	£136,492	£268,276	£5,460,033	**£8,027,616**	£7,978,680

Consolidated

Balance sheet

as at 31 December 2012

	2012		2011	
	£	£	£	£
FIXED ASSETS				
Tangible assets		3,314,145		3,350,383
Investments		3,894,535		4,266,682
		7,208,680		7,617,065
CURRENT ASSETS				
Stock	163,521		239,604	
Debtors	988,637		711,258	
Cash at bank and in hand	721,844		408,213	
	1,874,002		1,359,075	
CREDITORS:				
Amounts falling due within one year	681,749		590,327	
NET CURRENT ASSETS		1,192,253		768,748
TOTAL ASSETS LESS CURRENT LIABILITIES		8,400,933		8,385,813
CREDITORS:				
Amounts falling due after more than one year		373,317		407,133
NET ASSETS		£8,027,616		£7,978,680
Representing:				
CAPITAL FUNDS				
Endowment funds		5,460,033		5,283,010
INCOME FUNDS				
Restricted funds		268,276		415,811
Unrestricted funds:				
Designated funds	136,492		136,492	
Revaluation reserve	289,512		378,871	
General fund	1,827,560		1,718,431	
Non-charitable trading fund	45,743		46,065	
		2,299,307		2,279,859
TOTAL FUNDS		£8,027,616		£7,978,680

Approved by the Trustees on 15 April 2013 and signed on their behalf

I COGHILL

Chairman of the Trustees

Staff

of the Game & Wildlife Conservation Trust
in 2012

CHIEF EXECUTIVE	Teresa Dent BSc, FRAgS
Personal Assistant	Lindsay Watson BSc, MSc
Head of Finance	James McDonald ACMA
Finance Assistant - Limited	Lin Dance
Accounts Assistant (p/t)	Suzanne Hall
Head of Administration & Personnel (p/t)	Ian Collins MCIPD, BA
Administration & Personnel Assistant (p/t)	Jayne Cheney Assoc CIPD
Head Groundsman (p/t)	Craig Morris
Headquarters Cleaner (p/t)	Rosemary Davis
Headquarters Janitor (p/t)	Chris Johnson
Head of Information Technology	James Long BSc
DIRECTOR OF COMMUNICATION & PUBLIC AFFAIRS	Tom Oliver MA, Dip.LA, FRSA
Head of Media	Morag Walker MIPR
Head of Publications	Louise Shervington
PR Assistant (p/t)	Jane Bushnell *(until July)*; Daniel O'Mahony *(from July)*
DIRECTOR OF RESEARCH	Nick Sotherton BSc, PhD
Personal Assistant (p/t)	Lynn Field
Head of Fisheries Research	Dylan Roberts BSc
Head of Salmon & Trout Research Centre	Anton Ibbotson BSc, PhD
Senior Fisheries Scientist	Bill Beaumont MIFM
Fisheries Scientist	Rasmus Lauridsen BSc, MSc, PhD *(from September)*
Research Assistant	Luke Scott
PhD Student *(University of Bournemouth)* - pike removal and weed cutting	Sui Phang BSc, MSc
PhD Student *(University of Exeter)* - salmon genetics	Charles Ikediashi BSc
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
Bird Surveyor	Sue Wilson BA *(April-July)*
Bird Surveyor	Tony Powell *(April-July)*
Bird Surveyor	Mikel Salvador *(April-July)*
PhD Student *(Imperial College, London)* - birds and miscanthus	Henrietta Pringle BSc
PhD student *(University of Exeter)* - pheasant behaviour	Mark Whiteside MSc
MSc student *(University of Newcastle)* - wild pheasants	Silas Walton BSc
MSc Student *(Imperial College, London)* - pheasants	Julie Day BSc
Placement Student *(Bath University)*	Louise Dean *(until August)*
Placement Student *(Bath University)*	Christopher Guggari-Peel *(from September)*
Head of Wetland Research	Andrew Hoodless BSc, PhD
Ecologist	John Simper BSc, MSc
Research Assistant	Chris Heward BSc
Research Assistant	Matt White BSc *(March-August)*
DPhil Student *(University of Oxford)* - woodcock migration	Adele Powell BSc, MSc
PhD Student *(University of Reading)* - game landscapes	Jessica Neumann BSc
MSc Student *(University of East Anglia)* - lapwings on fallow plots	Samantha Ireton BSc
MSc Student *(University of Reading)* - lapwings on fallow plots	Emma Cutten BSc
MSc Student *(University College London)* - lapwings on fallow plots	Richard Vials BSc
MSc Student *(University of East Anglia)* - woodcock distribution	Laura Henderson BA
Placement Student *(University of Plymouth)*	Jessica Chadwick *(until August)*
Placement Student *(University of Southampton)*	Michael Hockey *(from October)*
Senior Scientist - Scottish Lowland Research	David Parish BSc, PhD
PhD Student *(University of Glasgow)* - yellowhammer ecology	Dawn Thomson BSc
PhD Student *(University of Dundee)* - population genetics of sawflies	Nicki Cook BSc
PhD Student *(University of St Andrews and John Hutton Institute)* - small mammal ecology on farmland	Amanda Wilson BSc
Head of Wildlife Disease & Epidemiology	Chris Davis BVM&S, MRCVS *(until February)*
Head of Predation Control Studies	Jonathan Reynolds BSc, PhD
Senior Field Ecologist	Mike Short HND
Research Assistant	Thomas Porteus BSc, MSc
MSc Student *(University of Reading)* - detection devices for small predators	Louise Brickell BSc (April-August)
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 *(seconded Plantlife)*
Ecologist	Tom Birkett BSc, PgC
PhD Student *(Imperial College London)* - stewardship and farmland birds	Niamh McHugh BSc, MSc
MSc Student *(Imperial College London)* - yellowhammer foraging	Cecily Goodwin BSc
MSc Student *(Bournemouth University)* - yellowhammer territory selection	Sophie Hughes BSc
MSc Student *(University of Plymouth)* - quarry restoration	Adam Day BSc
Placement Student *(University of Durham)*	David Evershed *(until August)*
Placement Student *(University of Plymouth)*	Amy-Jane Smith *(from September)*
Placement Student *(Imperial College London)*	Laura Kor *(from September)*
Director of Upland Research	David Baines BSc, PhD
Office Manager, Uplands	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 BSc
Research Ecologist Langholm	Damian Bubb BSc, PhD *(until May)*; Sonja Ludwig MSc, PhD *(from September)*

Research Assistant	Thomas Pringle BSc *(from November)*
PhD student *(University of Newcastle)* - buzzards and grouse	Richard Francksen BSc
Placement Student *(Harper Adams)*	Matthew Howarth *(until July)*
Placement Student *(University of Durham)*	Melissa Dawson *(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	Graeme Neish
Woodland Grouse Research Scientist	Patrick White BSc, PhD
Project Scientist - Angus Glens	Laura Taylor BSc *(until September)*
MSc Student *(University of Reading)* - black grouse habitat ecology	Pete DeBoo BSc
MSc Student *(University of Leeds)* - black grouse breeding ecology	Douglas Shapley BSc
Placement Student *(Harper Adams)*	Merlin Becker *(until August)*
Placement Student *(University of Bath)*	Gemma Jenkins *(until August)*
Placement Student *(University of Plymouth)*	Robyn Owen *(from September)*
DIRECTOR OF POLICY & THE ALLERTON PROJECT	Alastair Leake BSc (Hons), MBPR (Agric), PhD, FRAgS, MIAgM, CEnv
Secretary (p/t)	Natalie Augusztinyi
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
MSc student *(Cranfield University)* - land use and earthworms	David Stella
MSc student *(Cranfield University)* - land use and soil microbial biomass	Michael Weeks
Research Assistant	Ben Norman BSc *(from January)*
Research Assistant	Jamie Partridge BSc *(from October)*
Farm Manager	Philip Jarvis MSc
Farm Assistant	Michael Berg
Farm Assistant	Ben Jarvis *(from January)*
Game Manager	James Watchorn
DEPUTY DIRECTOR OF RESEARCH	Nicholas Aebischer Lic ès Sc Math, PhD
Secretary & Librarian	Gillian Gooderham
Senior Conservation Scientist	Francis Buner Dipl Biol, PhD
Post-Doctoral Researcher *(University of León)*	Carlos Sánchez García-Abad, PhD, BVSc *(from January)*
Scholarship from Leonardo Da Vinci Initiative *(University of Pais Vasco)*	Eukene Rueda BSc, MSc *(January-June)*
Head of Geographical Information Systems	Julie Ewald BS, MS, PhD
Partridge Count Scheme Co-ordinator	Neville Kingdon BSc
Biometrics/GIS Assistant	Chris Wheatley BSc
MSc Student *(Oxford Brookes University)* - farmland birds in Sussex	Jack Knott BSc
MSc Student *(University College London)* - insights from old farm records	Lucy Capstick BA
Placement Student IT *(University of Ulster)*	David Pepper *(until September)*
Placement Student *(University of Bath)*	Ryan Burrell *(until August)*
Placement Student *(University of Cardiff)*	Lizzie Grayshon *(until August)*
Placement Student *(University of Cardiff)*	Eleanor Brown *(from September)*
Placement Student *(University of Bath)*	Holly Narey *(from September)*
Placement Student IT *(City University London)*	Maxim Krioutchkov *(from August)*
DIRECTOR OF FUNDRAISING	Edward Hay
Personal Assistant	Adelaide Greenwood *(until February)*
Personal Assistant/Sweepstake Co-ordinator	Kathryn Solari *(from March)*
National Events Co-ordinator	Mel Dellow
London Events Manager	Lucinda Pearson
London Events Assistant	Tortie Hoare *(from April)*
Northern Regional Fundraiser (p/t)	Sophie Dingwall
Southern Regional Fundraiser	Max Kendry
Eastern Regional Fundraiser	Lizzie Herring
North West Regional Organiser (p/t)	Rebecca Fifield *(until December)*
Regional Organiser (p/t)	Claire Woodward *(January-June)*
Regional Organiser (p/t)	Gay Wilmot-Smith BSc
Regional Organiser (p/t)	Charlotte Meeson BSc
Regional Organiser (p/t)	David Thurgood *(from October)*
Fundraiser - Scotland	Andrew Dingwall-Fordyce
DIRECTOR OF MEMBERSHIP & MARKETING	Andrew Gilruth BSc
Head of Database	Corinne Duggins Lic ès Lettres
Database Assistant (p/t)	Beverley Mansbridge
Head of Membership and Marketing	Sarah Felix-Rogers HND *(until July)*
Membership Assistant	Angela Hodge
Administrator (p/t)	Suzanne Fairbairn
Head of Telesales	Joanne Hilton
DIRECTOR SCOTLAND	Adam Smith BSc, MSc, DPhil
Scottish HQ Administrator (p/t)	Irene Johnston BA
Head of PR & Education - Scotland (p/t)	Katrina Candy HND
Policy Officer Scotland	Gemma Davis MA
Senior Scottish Advisor & Scottish Game Fair Chairman	Hugo Straker NDA[1]
DIRECTOR OF ADVISORY & EDUCATION	Ian Lindsay BSc[2]
Co-ordinator Advisory Services (p/t)	Lynda Ferguson
Advisor/Development Officer	Alex Butler *(until September)*
Field Officer – Farmland Ecology	Peter Thompson DipCM, MRPPA (Agric)
Head of Education	Mike Swan BSc, PhD[3]
Regional Advisor - North East (p/t)	Henrietta Appleton BA, MSc
Regional Advisor - East (p/t)	Roger Draycott HND, MSc, PhD *(from November)*
Advisor Grouse Technical Services	Craig Jones *(until February)*
Game Manager – Rotherfield	Malcolm Brockless

[1] Hugo Straker is also Regional Advisor for Scotland and Ireland;
[2] Ian Lindsay is also Regional Advisor - Wales, Midlands; [3] Mike Swan is also Regional Advisor for the South of England.

External committees with GWCT representation

1. BASC Gamekeeping and Gameshooting	**Mike Swan**
2. BBC Scotland Rural Affairs Committee	**Adam Smith/ Katrina Candy**
3. BCPC Science and Environment Group	**Alastair Leake**
4. Bird Expert Group of the England Biodiversity Strategy	**Nicholas Aebischer**
5. Cairngorms National Park Land Management Forum	**Gemma Davis**
6. Campaign for the Farmed Environment Evidence & Monitoring Group	**Peter Thompson**
7. Campaign for the Farmed Environment Hampshire Co-ordinator	**Peter Thompson**
8. Campaign for the Farmed Environment Steering Committee	**Alastair Leake** *(Natural England-led)*
9. Campaign for the Farmed Environment National Delivery Group	**Ian Lindsay**
10. Capercaillie BAP Group	**David Baines/ Adam Smith**
11. Cold Weather Wildfowl Suspensions	**Mike Swan**
12. National Gamekeepers' Organisation Committee	**Ian Lindsay**
13. Conservation Grade	**Peter Thompson**
14. Cornish Red Squirrel Project	**Nick Sotherton**
15. Council of the World Pheasant Association	**Francis Buner**
16. Deer Initiative	**Mike Swan**
17. Deer Management Qualifications	**Mike Swan**
18. Defra Upland Stakeholder Forum & Raptor and Burning sub-groups	**Adam Smith/ Dave Newborn**
19. Environment Council Hen Harrier Dialogue Group	**Adam Smith**
20. Environmental Panel of the Advisory Committee on Pesticides	**Nick Sotherton**
21. Expert Panel of SNH's Scientific Advisory Committee	**Nicholas Aebischer**
22. Farmland Biodiversity 'Toolkit' Partnership	**Peter Thompson**
23. Fellow of the National Centre for Statistical Excellence	**Nicholas Aebischer**
24. Freshwater Fisheries CEO Meetings	**Nick Sotherton**
25. Gamekeepers' Welfare Trust	**Mike Swan**
26. Hampshire Ornithological Society	**Peter Thompson**
27. Hares Best Practice Group	**Mike Swan**
28. Honorary Scientific Advisory Panel of the Atlantic Salmon Trust	**Nick Sotherton**
29. Honorary Scientific Advisory Panel of the Salmon & Trout Association (Science, Environmental and Policy Committee)	**Nick Sotherton**
30. IUCN/SSC European Sustainable Use Specialist Group	**Nicholas Aebischer/ Julie Ewald**
31. Joint Hampshire Bird Group	**Peter Thompson**
32. Langholm Moor Demonstration Project Board & three sub-groups	**Teresa Dent/Nick Sotherton/David Baines/Adam Smith**
33. Lead Ammunition Group and the Primary Evidence and Risk Assessment Working Group	**Alastair Leake**
34. LEAF Policy and Communications Advisory Committee	**Alastair Leake**
35. Marlborough Downs Nature Improvement Area Board	**Teresa Dent**
36. Marlborough Downs Nature Improvement Area Species Delivery Group	**Peter Thompson**
37. MESME Steering Group	**Alastair Leake**
38. Natural England National Arable Systems Option Review Group	**Peter Thompson**
39. Natural England National CAP Species Workstream Review	**Peter Thompson**
40. North Wessex Farmland Bird Advisor Steering Committee	**Peter Thompson**
41. North York Moors NP's Primary Land Users Group	**Henrietta Appleton**
42. Pesticides Forum Indicators Group of the Chemicals Regulation Directorate	**Julie Ewald**
43. Purdey Awards	**Mike Swan**
44. Scotland's Peatland Working Group	**Gemma Davis**
45. Scientific Advisory Committee of the Office National de la Chasse et de la Faune Sauvage	**Nicholas Aebischer**
46. Scotland's Moorland Forum & sub-groups	**Adam Smith**
47. Scotland's Rural College Council	**Adam Smith**
48. Scottish Black Grouse BAP Group	**Phil Warren/ Adam Smith**
49. Scottish Game Industry Snare Training Group	**Hugo Straker**
50. Scottish Government Biodiversity Strategy Science Group	**Adam Smith**
51. Scottish Government Biodiversity Strategy Upland Ecosystem Group	**Adam Smith**
52. Scottish Government CAP Reform Stakeholder Group	**Gemma Davis**
53. Scottish Land & Estates Moorland Working Group	**Adam Smith**
54. Scottish PAW (Wildlife Crime) Executive & Raptor and Training sub-groups	**Adam Smith**
55. SNH Deer Management Round Table	**Adam Smith**
56. South West Farmland Bird Advisor Steering Committee	**Peter Thompson**
57. Strathspey Black Grouse Group	**Patrick White**
58. Squirrel Forum	**Mike Swan**
59. Tayside Biodiversity Partnership Farmland Ecosystem Group	**Dave Parish**
60. The ACP Environmental Panel	**Alastair Leake**
61. The ACP/COT Bystanders Risk Assessment Working Group	**Alastair Leake**
62. The Agri-Environment Stakeholder Group	**Alastair Leake**
63. The Bracken Control Group	**Alastair Leake**
64. The CAAV Agriculture and Environment Group	**Alastair Leake**
65. The Green Food Project	**Alastair Leake**
66. The UK Pesticides Forum	**Alastair Leake**
67. The UK Soil Management Initiative Executive Committee	**Alastair Leake**
68. Upland Coordination Group	**Adam Smith**
69. UK Avian Population Estimates Panel	**Nicholas Aebischer** *(JNCC-led)*
70. UK Birds of Conservation Concern Panel	**Nicholas Aebischer** *(RSPB-led)*
71. Winning Ways for Wildlife (Hampshire group)	**Peter Thompson**

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